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California Horticulture Oral History Series

Adele and Lewis Lawyer

LAWYERS INC.: PARTNERS IN PLANT PATHOLOGY, HORTICULTURE, AND MARRIAGE

With Introductions by
Olive Rice Waters
Richard G. Landis
and Robert D. Raabe

Interviews Conducted by
Suzanne B. Riess
in 1989

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Adele and Lewis Lawyer in their garden,
December, 1983.

AS A HORTICULTURIST. Lewis' mother was influential in his lifelong passion for growing flowers. His mother, Ida, grew many flowers in their Alhambra, California garden where she lived with Lewis' father, Arthur, sister, Betty, and brother, Dick. His grandparents lived nearby. His mother's peach-colored sweet peas were sold to florists in season. Within this garden, Lewis built an aquarium and raised and sold tropical fish. Waterlilies were his passion at that time. He built many pools in their yard where tropical lilies were planted. To compliment these horizontal pools, Lewis planted tall bearded Iris bordering them for vertical contrast. This cultivated a continuing interest in iris. The *Californicae*, (Pacific Coast Native Iris), became his hybridizing focus, although his fascination with flower improvement led to daubing pollen on other plants and flowers, including nerines, babianas, clivia, and deciduous azaleas.

AS A SCIENTIST. After graduating from Chaffey Junior College in Ontario, California, Lewis entered the University of California at Berkeley, where he intended to become a landscape architect. Upon observing the constant interactions and "inventiveness" of scientists at Berkeley, Lewis changed his major to Plant Pathology and became a lifetime devotee of experimental science. His minor was Genetics. Lewis was an outstanding student and was initiated into Alpha Zeta, the agricultural honor society. When a graduate student was needed to work on the control of armillaria, a fungus disease of trees, Lewis was recommended. Dr. Panos Caldis, Agricultural Research Director of Del Monte Corporation (then called the California Packing Corporation), arranged for a research grant. Lewis was enthusiastic about this research challenge and happy to have gainful employment, since it was still in the midst of the Depression. An assistant was needed for the lab work and culturing. Adele Schwartz, an 18-year-old Education major was assigned to him, which was the beginning of a life-long partnership. The relationship with Del Monte was also a continuing pleasure. Lewis and Adele, (who was eventually hired by the

contractor's blueprints, he made drawings of the structures as they would look from a specified viewing point, so that clients could better visualize the finished product. The Great Depression eliminated this profession as a source of income, and he decided it was advisable to go to college. Watercolors and wood cuts have been continuing hobbies throughout his life until recently, when failing eyesight interfered. In photography, Lewis participated in the beginnings of color slides, evaluating one of the first two rolls of "Kodachrome" film sent to the Bay Area. His cameras, lenses, and other equipment have been updated through the years, stopping short of digital developments. Landscape and horticultural subjects were his specialty, with the photos often being used in presentations to horticultural societies. His interest in lapidary techniques expanded his long-standing interest in rock collecting into the creation of earrings and pendants for Adele and his family, using agates, opals, petrified wood, and jade. Finally, the architectural design of the addition to the Lawyer home is his, as are the numerous built-in shelves, drawers and cabinets. These 'built-ins' are both practical and attractive, with color a key ingredient. Every room of the house has its own unique, and often dramatic (some would say, 'wild') color scheme.

AS A MUSICIAN AND MUSIC LOVER. Lewis' passion for music was lifelong. He enjoyed all types of music, from jazz to classical. He worked at a movie theater during high school, which had live vaudeville acts, often featuring prominent musicians. Lewis attended classical music concerts on a regular basis during the years between high school and college. At that time he started building a varied music library which continued throughout his life, from 78s to CDs. This collection included classical, musical comedy, popular, and all types of jazz. In his twenties, he taught himself the ukulele, learning the chords and complex playing styles. Within ten years, he had written down the chords and words to hundreds of popular tunes, including records of historical family songs taught to him by his father.



LEWIS OLSON LAWYER
1907 - 2001

Before dawn, on the morning of April 18, 2001, Lewis Lawyer lost his battle to stay in this wonderful world. Lewis was a warm, loving, and productive person, compacting a wide number of interests, pursuits, and talents into his life.

AS AN ARTIST. Lewis expanded his capabilities throughout his life: In elementary school, he won poster contests. After graduating from high school, he attended Otis Art Institute in Los Angeles, following which, he worked as a commercial artist for a few years. From the

company) had a school spirit pride in "our company". Lewis respected the executives, and appreciated their support and recognition of the progress they made with asparagus, peaches, peas, and spinach, and even screening bananas for the presence of virus. Lewis was Assistant Director of Agricultural Research for many years, and colleagues remained friends, even after retirement. Lewis' use of competing soil inhabitants in his research on armillaria, was recognized as one of the first successful uses of biological control.

AS A GISMOLOGIST. Lewis' interests in how things work went well beyond his formal training and activities in plant pathology and genetics. He was always interested in keeping up with technology. He was one of the first to build a crystal radio set. His Superhetrodyne radio setup in Alhambra was the first to receive broadcasts from radio stations in Australia, London, and areas in Canada. This was big news, reported in newspapers world-wide, since it was a tribute to the improved power of the radio stations as well as to those who received the signal. As another example, within the Del Monte research facility at San Leandro, he designed and/or improved the temperature-controlled chambers to duplicate temperature patterns predisposing plants to frost damage. These were also used for selecting vegetables for disease resistance. Lack of uniform greenhouse temperature control was also corrected. In his home, the stereo system was built into EVERY room, with most of the speaker systems being modified to fit the assigned room. The automatic sprinkler system he devised with varied times depending on the location and the types of plants being watered, worked so well that the family could leave home from March through July and return to find the garden thriving. Lewis was a compulsive data collector in all categories, keeping detailed records on rainfall, automobile mileage, investments, expenses, dates and comparison of seasonal bloom, and analysis and comparison of trends. He surveyed and topographically mapped out the entire yard. His love of computer technology

enabled him to produce his own software for many uses, even income tax. He found the computer endlessly fascinating, even taking it along on some family vacations.

AS A PARENT. Lewis and Adele's first child, Lori, painted or sketched along with her father on their many weekend painting trips, both in California, when they lived in Morgan Hill, and in the Midwest, where they spent their summers in Illinois doing field research. This experience and help with technique were instrumental in her eventual choice of art as her career. In later years, Lewis and Adele purchased a home in Oakland, and it was there that their two younger children were born. Although they purchased this home on close to an acre of property because the soil and climate would enable the growth of a wide variety of coveted flowers and shrubs, this eventuality was postponed so that the children would have more space for play. In the wild landscape of the backyard, Lewis carved them a hollowed-out room within the dense ten foot high honeysuckle weed, which they used as a fort. There were great hiding places and many trees to climb. There was a huge sandbox he built to play in, as well as several custom swings. First, there was a baby swing, then a two person pump-swing, and, ultimately, a giant single rope ladder. This continues to be a thrilling ride for adults, as well as children. Both Melanie and Artie have gone on to build sensational swings in their yards. Lewis and Artie, at 10 years old, built a model train setup in the basement which taught Artie mechanical and electrical skills (and several words that he had never heard before). Even in college, he brought friends home to play with the train and celebrate special occasions. Lewis was involved in countless projects for the kids: building rat mazes for Melanie's science projects, teaching the children about nature on picnic trips, helping with ANY science or math homework assignment, and resolving personal problems in a calm and understanding manner.

Lewis is preceded in death by his daughter, Lori. He is survived by two children, four grandchildren, and two great grandchildren. He is also survived by the most important element of his life, his centerpiece, and partner in all things, passionate love, and cofounder of the two member corporation they called "Lawyers Inc.", Adele.

AS A HUSBAND. Lewis and I have existed as a single unit ever since we were married on Friday, August 13, 1937. And, indeed, we were partners in love, as parents, and in our professional life, as well. We shared every interest: the music every morning at breakfast time, and in the living room where our speakers have full range. We have shared the pleasure of working together at the office, in the laboratory, in the experimental trial fields, in the garden, and painting. Together, we enjoyed the beauty of nature, sunsets, the joy of planning trips to see flowers in their natural habitats, and the pride we experienced when our first pea variety went through the cannery for the first time and was 100% fancy quality. It was similar to our recent elation of seeing flowers we had hybridized open for the first time and find that they actually fulfilled our expectations. Above all, is the love and pride we feel for having produced exceptional children and grandchildren who are achieving all that we have wished for them, - a happy and productive life, filled with love.

I am grateful to have been able to awake each morning with Lewis for almost 64 years and hear, "I love you, darling!" And this has been repeated many times during the day from both of us. When we came near to each other, we always felt a magnet in operation, and a need to touch in some way, - sometimes a full-fledged hug, sometimes just a touch of fingers as we passed by. And because we always knew that someday our relationship would come to an end, we have savored every day as precious. I know that I am fortunate to have experienced the gift of his love for a very long time, but I shall miss him terribly. I know, too, that he will always be with me. Whatever I do, I will think, "How would Lewis have done this?" And I will try to follow his always reliable directions. I love him very much! I am glad I can leave the photograph of his brilliant smile with you, as warm and glowing in his 90's as it was in his 30's.

Cataloging Information

LAWYER, Adele (b. 1918)

Plant pathologists, horticulturists

LAWYER, Lewis (b. 1907)

Lawyers Inc.: Partners in Plant Pathology, Horticulture, and Marriage, xii, 300 pp., 1991.

Lewis Lawyer: childhood in Alhambra CA, art school training, mentors in plant pathology at UC Berkeley (1934); Adele Schwartz Lawyer: childhood in San Francisco, combining a career in science with marriage and family; Calpak (Del Monte Corporation) peach crop, Wheatland CA, Armillaria problem; research on asparagus, hydroponic tomatoes; Del Monte peas: yield problem, seed treatment, diseases, selection and breeding; corporate employment vs academic career; Lawyers' garden: sweet peas, daffodils, poppies, and hybridizing Pacific Coast Native iris; California horticultural organizations.

Introductions by Olive Rice Waters, Public Relations Chairman, The American Iris Society; Richard G. Landis, President and Chief Executive Officer, Del Monte Corporation; Robert D. Raabe, Professor of Plant Pathology, UC Berkeley.

Interviewed 1989 by Suzanne B. Riess for the California Horticulture Oral History series. The Regional Oral History Office, The Bancroft Library, University of California, Berkeley.

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David and Evelyne Lennette

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American Rock Garden Society, Western Chapter

Regional Oral History Office Interviews on
Horticulture, Botany, and Landscape Design

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TABLE OF CONTENTS -- Adele and Lewis Lawyer

INTRODUCTION by Olive Rice Waters	i
INTRODUCTION by Richard D. Landis	iii
INTRODUCTION by Robert D. Raabe	v
INTERVIEW HISTORY	viii
LAWYER VITA OUTLINE	x
I LEWIS LAWYER, FAMILY AND EDUCATION	1
Olson-Lawyer, Family History	1
Childhood in Alhambra, 1907-1925	8
Gardens and Plants	22
School Years	26
The Depression and Chaffey Junior College	30
II ADELE LAWYER, FAMILY AND EDUCATION	40
Schwartz-Loewy, Family History	40
Relentlessly Enriched Childhood	43
The Thrill of Living Cells	47
Getting an Education	49
III U.C. BERKELEY--A TREASURY OF EXPERIENCES	53
Introduction to Plant Pathology at Berkeley	53
Takahashi and Problem-Solving	59
Other Subjects and Contacts	61
Hilgard Hall--Research and Funding, 1934	68
University vs. Corporate Employment	72
Marriage, Pregnancy, and Career	77
IV THE ARMILLARIA PROBLEM	82
Getting Started	82
Adele Joins the Team	85
Gathering the Facts	89
Applying the Information	93
The Big Gamble	95
Economics and Quality	100
V LIVING WITH DEL MONTE	103
Lawyer Lifestyle on the Road	103
P. D. Caldis and Agricultural Research	108

	Asparagus Research, a Difficult Crop	110
	Tomatoes and Hydroponics	115
	Other Crops to Replace Asparagus	117
	Flood!	118
VI	PEAS	122
	Low Yields in Illinois	122
	The "Lab" at Morgan Hill	124
	Rochelle, Illinois, "A Picture Perfect Postcard"	126
	The First Year at Rochelle	130
	Problems Develop	134
	Seed Field Investigations	137
	The Second Winter at Morgan Hill	139
	The Fight for Seed Treatment	143
	Del Monte's Pea Variety Collection	144
	Pea Disease Survey, Illinois, 1942	148
	Delmar 16	151
	The Del Monte Pea Team	155
	Discovery of the Super Early Pea	159
	Root Rot and Bacterial Blight Resistance Found in Variety Collection	161
	Frost Resistance	165
	Leafless Peas	167
	"Fizzle" and Pea Leaf Roll Mosaic Virus--Panic!	168
	Working with Entomologists	172
	Thoughts on Pathogens	175
	Close-up Photography	178
	Labels and Packaging	179
	Life on the Home Front	181
VII	DEL MONTE CAREER	184
	Job Opportunities and Money	184
	To Be or Not To Be	187
	Rewards	190
	Expansion and Job Opportunities	190
	Technology Replaces People	193
	Tomatoes and the Mechanical Harvester	197
	Smog and Other Pollutants	198
	Academic Freedom	201
VIII	FLOWERS	203
	Sweet Peas, Water Lilies, and Mesembryanthemums	203
	Seeing Things for the First Time	206
	Daffodils and Frank Reinelt	208
	Sunday Afternoon Excursions	210
	Clivias and Deciduous Azaleas	213
	The Garden on Oak Hill Road	216
	Pacific Coast Native Irises and Lee Lenz	222

The University and Iris Research	226
Garden Organizations and Science	230
Writing and Editing	234
Pink Poppies	237
Hybridizing Iris--Mitchell and Mendel	240
American Iris Society, Sydney B. Mitchell Iris Society	246
Top Iris Hybridizers	250
Judging Standards and the AIS Check List	254
Political Action Issues	258
Friends of the UC Botanical Garden	259
California Horticultural Society	261
Rock Garden Society	262
Ted Kipping's Programs	263
Thoughts on Life, and Life Together	265
TAPE GUIDE	274
APPENDICES	275
A. Lawyers Inc.	276
B. "A Woman in Plant Science"	288
C. Memorial Addendum	291
D. Two Love Letters	295
INDEX	297

Illustrations follow p. 102

INTRODUCTION by Olive Rice Waters

Lawyers, Inc., as Lewis and Adele are affectionately called by their many friends, are the kind of team one seldom if ever sees. Their association began early on in a university laboratory; both were academics, Lewis perhaps more so than Adele. At that time I lived nearby, and how I wish I could have become acquainted with them then!

Our friendship began at an Iris Society meeting; the society is called the Sydney B. Mitchell Iris Society, named for that great plantsman, first editor of the California Horticultural Journal, and first dean of the University of California's graduate school of librarianship.

On first meeting them, the Lawyers seemed reserved, as if trying to make up their minds about these strange irisholics. Later they decided that we were for real, and began to bid as high or higher for iris rarities as the rest of us.

Who can forget the sight of Lewis' color-banded borders at the 1978 National American Iris Society Convention? Other growers planted their iris alphabetically, for convenience, or perhaps by year of introduction. Lewis, artist that he is, planted all varieties of the same color in one bed, making comparison between varieties, both for form and vigor, easily decided.

Though the Lawyers still grow many tall bearded irises, they have settled on Iris californicae, the Pacific Coast irises, as their particular field of endeavor. They are trying to bring vigor into the elusive Iris munzii, found in the wild only in the King's Canyon area east of Fresno, by crossing it with more hardy species. Already their hybrids with the turquoise blue wash are in great demand. Perseverance is called for in such an effort, and this they have in abundance.

In the early '70s I became editor of a fledgling bulletin called the Almanac, begun by Ed Pasahow in San Diego in 1973. It was a mimeographed newsletter full of good insights into the growing of the PCI's [Pacific Coast iris]. My main contribution was to work on the format and try to keep enough circulation to pay the printer, the same job I have been doing for Pacific Horticulture since 1976.

Several editors later, after both I and the Lawyers had served terms editing the Region 14 Iris Bulletin, the Lawyers brought the Almanac into a focus that rightfully places it on library shelves of universities. Their years of teamwork in university research as well as in agricultural research for Del Monte have been applied to a different sort of problem but using the same approach.

In addition, Adele serves as scientific editor of the American Iris Society Bulletin.

The fact that these two persons are well-organized should not be allowed to detract from their appeal as friends to plantsmen in general. They are outgoing and enthusiastic; it's hard to speak of the accomplishments of one without the other--a most successful arrangement!

Olive Rice Waters, Public Relations
Chairman, The American Iris Society

November 1990
Berkeley, California

INTRODUCTION by Richard G. Landis

Reflection of forty-some years with a corporation (Del Monte Corporation, i.e., California Packing Corporation) brings to mind many experiences. Most reflections are of a thoroughly enjoyable nature and relate in large part to people with whom one has worked, or projects of a meaningful nature that were initiated. Adele and Lewis Lawyer are a part of this period and seemed to be ever present in the early and middle years of my own career with Del Monte.

I should note that Del Monte, the brand name and ultimately corporate name, succeeds the original name of California Packing Corporation, or common reference of Calpak.

1. California Packing Corporation changed its name to Del Monte Corporation in June 1967.

2. California Packing Corporation was founded in October 1916 by the amalgamation of four organizations: J. K. Armsby, Co., founded in 1865; Griffin & Skelley, founded in 1881; California Fruit Cannery Association founded in 1899; Central California Canneries founded in 1901.

I mention the distinction since the Lawyers played an important role in agricultural activities which helped establish the Del Monte label as a preeminent image of quality and nutritious canned foods.

I first became acquainted with the Lawyers in the late 1950s and followed their work more closely from 1961 through 1964 when I served as Del Monte's Midwest Division Manager, at which location much agricultural research was carried out.

During this period, and thereafter, the enthusiasm and enduring efforts of this couple in improving the quality and yield of Del Monte varietal sources was a refreshing sight. In my many trips to observe research field trials or to evaluate processed test samples of research products, the knowledge and professionalism of the Lawyers was to be appreciated. Their search for excellence in their field of endeavor was an apparent objective.

It is somewhat unusual for a food processing company to have as complete a program of vertical integration as achieved by Del Monte in seed research, variety development, production, and processing. It was apparent, however, from the start that maintaining varietal or seed stock improvements required such integration to maintain the cost edge and quality of our product line.

It was also somewhat unique to have a husband and wife share the same vocation and scientific interest as well as do these two research people who worked in consort to maintain Del Monte quality in their pea variety selections, while including such characteristics as blight resistance, early maturing, frost resistance and many other cost and quality-related factors. The Lawyers have been a part of a highly-skilled group of men and women who played a vital role in the quality and economy of the United States and world food supply.

As a former Chairman, President and Chief Executive Officer of Del Monte Corporation, I am pleased to offer this introduction to the oral history memoir of Adele and Lewis Lawyer.

Richard G. Landis, former Chairman,
President and Chief Executive Officer,
Del Monte Corporation

February 1991
Piedmont, California

INTRODUCTION by Robert D. Raabe

Imagine a young graduate student in plant pathology who, as a person extremely interested in plants, met two other plant pathologists who also were extremely interested in plants. This doesn't sound like an exciting scenario, but interestingly, while plant pathologists may be interested in plant diseases, and maybe the plants with which they work, for them to be interested in plants in general is unusual. Also unusual is the fact that those two other plant pathologists were married to each other.

I met Adele and Lewis Lawyer in the late 1940s at the University of Wisconsin, where Adele came occasionally to work on diseases of peas for the California Packing Corporation. My graduate research project was on white rust disease of spinach. Cal Pack was very much interested in this problem because in Texas, where they grew the bulk of their spinach, it was causing the company much trouble. I talked a lot about my work with the Lawyers. Although neither was assigned to spinach at the time, both were interested in it, and in the process of talking and getting to know each other we discovered a mutual interest in ornamental plants and thus a long lasting friendship started, full of coincidence of interest.

After school I moved to California, and the first disease I was assigned to was one that Lewis had worked on in his duties at Cal Pack, Armillaria. Needless to say, much time was spent discussing the disease, and the fungus which is the causal agent. Remarkably, later Adele was assigned to work on the spinach problem that I had worked on as a graduate student, so our professional paths crossed again. Of course, whenever possible in all of our busy schedules we discussed plants, and even enjoyed visits to botanical gardens when we were together for meetings and conventions.

Visits to the Lawyers' large garden in the Oakland hills are, and always were, a treat because of the wealth of plant material and the unusual plants they are growing. What a surprise to find Pelargonium echinatum, a geranium with soft spines, growing in their yard, the only ones I'd seen other than those I had grown! The Lawyers' garden covers about three-quarters of an acre. It is on sloping ground and is well traversed by paths. There is easy access to all portions of the garden.

Watering is accomplished by an elaborate system devised by Lewis long before such systems were available commercially, although our current drought is causing them to cut back on the annual flowers which they formerly planted throughout the garden for summer-long color.

When I mentioned recently in conversation with Adele and Lewis that I thought they were interested principally in bulbs or bulbous type plants, Lewis answered that he thought they were interested in most flowering plants. However, they are hybridizing native California irises and have produced some named varieties which are beautiful. Very important in the hybridizing is that the plants selected must be vigorous in addition to having beautiful flowers. The group of native iris with which they are working are difficult to grow and to hybridize, thus making what they are doing even more important. They also are collecting species irises.

Lewis also has hybridized Clivia and selected beautiful color variations. Other plants hybridized include plants in the genera Babiana and Nerine. To emphasize that their interests include not only bulbous or cormous plants, he reminds one that their hybridization program has included deciduous azaleas and California poppies. In the poppy program, they select the colors they want, plant the ones they want to cross near each other, and let bees do the hybridization. Then they again select for the colors and repeat the process.

It seems that Lewis is the hybridizer, but the two work so closely as a team that it's hard to tell what each does. Certainly one cannot help but notice how cooperatively they work on all their many projects. And because disease problems on some of their plants have been a concern, I have cooperated with them on trying to work out control measures. All of us have been involved in checking the results of the research studies, and the teamwork is very fine.

Although Adele and Lewis have retired, their interests keep them now more busy than ever, so our paths don't cross much more than they did when their professional jobs kept them busy. I never cease to be amazed at the things I hear of them doing: hosting a tour in their garden; editing the almanac for the Society for Pacific Coast Native Iris; taking on scientific editorship for the American Iris Society Bulletin.

We still get together, and of course principally it is about plants, but our interests cover other areas such as electric trains--they have a very nice layout in their house--and Christmas traditions. Lewis uses his talents as a photographer and artist, and they prepare and send out their own Christmas cards. They also are interested in Christmas trees and have very artistically decorated trees. They are very interested in

my Christmas tree efforts: I have decorated a fifteen-foot tree for many years, and although not artistically designed, the huge numbers of lights and ornaments help make up for that!

Unusual for three plant pathologists to have so many similar interests? It is, and I feel very fortunate that their paths and mine have crossed.

Robert D. Raabe
Professor of Plant Pathology
University of California, Berkeley

March 1991
Berkeley, California

INTERVIEW HISTORY

Lewis and Adele Lawyer live and garden in Oakland, California. Their home is close to the top of a hill, and the view faces west. To get to this address they both have come a long way from very different backgrounds and career interests. (Lewis Lawyer, who is a diarist of things that are important to him, has written the story of the circumstances of their courtship, and that chronicle is appended.) Lewis Lawyer met Adele Schwartz in the Department of Plant Pathology at the University of California on September 19, 1936. Adele was in her junior year, and she had a National Youth Administration-generated job in the plant pathology lab. Lewis was a graduate student working for Del Monte, then called California Packing Corporation, and his assignment was to combat *Armillaria* fungus on the peach crop at Del Monte's Wheatland Ranch.

Adele was made Lewis's assistant on the *Armillaria* campaign, and less than a year later, on August 11, 1937, they were married. Adele, captivated by the research she had been doing for Lewis, wanted to continue working at his side. However, California Packing Corporation's nepotism rules prohibited Adele Lawyer from working with Lewis Lawyer, officially. So unofficially she assisted Lewis in field observations and in the lab, and at the same time received under his tutelage the training that would take her on to breakthroughs in pea hybridizing, and earn her the National Pea Improvement Association Meritorious Service Award in 1983. (Adele Lawyer's "A Woman in Plant Science" is appended.) Lewis, Assistant Director of Agricultural Research at Del Monte, retired in 1972. Adele, for whom an exception to the rule was eventually made, retired from her research work at Del Monte in 1983.

When Lewis and Adele married, they called themselves Lawyers Inc. More than a clever appellation, it was a signal to the world that they were united. And as they worked together for Del Monte, they worked together to create their home and garden in the Oakland Hills, purchased in 1948. Because they had three children--the illustrations attest to the family life--it took another decade before they could really garden. But when they did find time, 4333 Oak Hill Road became a sort of second laboratory, and the partners were working together again. They undertook a number of hybridizing projects, mainly iris, working toward Lewis's goals of a Pacific Coast Native both "true blue and trustworthy." They also set high standards with their contributions as editors and producers of the Almanac: Society for Pacific Coast Native Iris, a publication of this section of the American Iris Society.

An article in the Bulletin of Region 14 of the American Iris Society [October 1988] was my first introduction to the Lawyers. It summarized their early life and background and education and their achievements for Del Monte Corporation, and it went into some detail in describing their garden and their work with Pacific Coast iris. Dr. David Lennette, at that time second vice-president of the Society for Pacific Coast Iris, suggested the Lawyers for a comprehensive oral history. Our intention in interviewing Lewis and Adele was to go further back into their own histories, and to go in depth into their work, and emerge with a whole picture.

The kind of thoroughness that is the hallmark of the work of Lewis and Adele, their scientific spirit of inquiry, patience, openness to new ideas, their preference for the specific to the general, facts rather than fiction, all such traits shaped this oral history. At a few points the interviewer probably did the interviewees's rigorous approach to problems a disservice. For instance, when Lewis was going through the step-by-step process required to understand and eradicate Armillaria, the interviewer tried sporadically to waylay him in search of "philosophy," as he called it. But the reader will find that facts triumphed!

For the interviewing we sat at a long table in the area between the kitchen and the study. We had a view up into the azaleas and clivias and oaks shading the front entry of the house [pl. 34]. The give and take between the Lawyers was singularly respectful and supportive. They treated me, the interviewer, as someone who had really come to learn. I found out what it was like to be a student of Lewis's, and to appreciate his exactitude, and the willingness of both of them "to take the trouble," whatever it was. And listening to them, I could almost feel the intense pleasure of understanding nature that seems to be the achievement, or by-product, of plant hybridizing.

There are many pleasant memories of the interviews and the following meetings to deal with editing and photographic illustration questions. There was the hurry-up call to come see the nerines, glistening in the morning sunlight, the quarter of an hour of listening to the sound of music on the excellent system that Lewis and Adele enjoy, a tour that took in the train room [pl. 37], and paintings by Lewis in the living room and music room. Over the months, from the first interview in August 1989, to more recent concluding arrangements, I always tried to take away a garden tip, and we all commiserated over the lack of rain, the killing freeze, and discussed how to dispose of too many persimmons. One unhappy memory is that of Lewis and Adele's announcement of their daughter Lori's death in an automobile accident in October 1990. Their tribute to Lori is included in the Appendices.

The oral history was never the only thing the Lawyers were working on. Long-retired, they have become more and more the mainstay of Region

14 of the American Iris Society, and above-mentioned Almanac editors. They absorb and disseminate new scientific literature on irises. They have also greatly enriched both publications with the interviews they conduct, ranging from short sketches of individual members of Region 14 and how they came to know and love iris, to great botanical garden directors, such as Lee Lenz. Several examples of these are deposited in The Bancroft Library.

Given such an orientation to the written word, it was natural that careful editing by the Lawyers would follow their careful interview responses. When Lewis and Adele wanted to expand on some answer, or bring material more tightly together, Lewis's skills on the word processor yielded several floppy discs of retyped transcript, a great help in the final typing for the Regional Oral History Office. Their experience in photographic and newsletter layout, from putting out the iris publications, made Adele and Lewis over-qualified volunteers in assembling and captioning the picture pages for the oral history. The readers will appreciate the complete illustration of the oral history, from Lewis's second birthday picture to his children's birthdays, and from the first experimental pond to the present successful garden, as well as the complete illustration of the two major projects discussed in the oral history, the Armillaria work and the pea breeding.

I join the three friends of the Lawyers who wrote introductions to this oral history, Richard G. Landis of Del Monte Corporation, Olive Rice Waters, of the iris and horticultural publication world, and Robert Raabe, a colleague of the Lawyers in plant pathology, as well as in iris research, in referring frequently to the unitedness of Lewis and Adele. On December 12, 1989, I received a letter from the Lawyers that I have placed in the Appendices. A letter that Lewis wrote in 1983 to Adele belongs with it. And the Appendices, as noted, include Lewis's courtship story, Adele's woman's story, and a memorial addendum on Lori.

We have taken care to make the oral history a complete history. To avoid the redundancy of appending articles on the same subjects we have discussed, The Bancroft Library's Manuscripts Division has been made the repository for printed matter that further illustrates the workings of Lawyers Inc. The reader is referred to the story of George Staheli from Under Dixie Sun; Pacific Horticulture, Summer 1986; the Bulletin of the American Rock Garden Society, Winter 1990; Bulletin of the American Iris Society, January 1990; Spring 1985 and October 1988 Bulletin of Region 14, The American Iris Society; the Almanac: Society for Pacific Coast Native Iris, Fall 1986 Monograph Issue "Diseases of the Pacific Coast Iris," and Fall 1990; Lawyers Inc. invitation to their daughter Melanie's wedding; 1972 "Sweet Peace" Lawyers Inc. greeting card; National Pea Improvement Association 1983 Awards Luncheon program; program for the 24th Annual Conference on the Control of Soil Fungi, March 1978; "Discussion of the Replant Problem," April 1963, chaired by Lewis Lawyer; "30 Years with Peas and Ascochyta: Perspectives," National Pea

Improvement Association keynote address, November 1989; and the announcement of the Compendium of Pea Diseases developed by Adele Lawyer.

Because of the Lawyer's own experience of interviewing and being interviewed they suggested, at the end of the taping in December 1989, that Owen Pearce, elder statesman of California horticulture, former editor of California Horticultural Journal, retired and living in Orinda, should be interviewed. They volunteered to do the interviews, and after editing in the Oral History Office, the resulting volume, California Garden Societies and Horticultural Publications, 1947-1990, was presented to Mr. Pearce in February 1991 at the annual meeting of the California Horticultural Society.

The next horticulturist interviewed by the Regional Oral History Office, again at the suggestion of David Lennette and with enthusiastic seconding from the Lawyers, was Wayne Roderick, nurseryman, California native plantsman, former director of the California section of the UC Botanical Garden from 1960 to 1976, and former director of the East Bay Regional Park Districts' Botanic Garden at Tilden Park, 1976 to 1982. That oral history will be completed in 1991, as well as an interview with Gerda Isenberg, founder of Yerba Buena Nursery, a native-plant and fern nursery in Woodside, California.

In other words, meeting and interviewing Adele and Lewis Lawyer has as its consequence not only the following oral history, but the beginning of the California Horticulture Oral History Series. Readers of the Lawyer oral history will also be interested in the larger group of interviews conducted by the Office in horticulture, botany, and landscape design. The Regional Oral History Office was established to tape record autobiographical interviews with persons who have contributed significantly to recent California history. The office is headed by Willa K. Baum and is under the administrative supervision of the director of The Bancroft Library.

Suzanne B. Riess, Senior Editor

February 19, 1991
Regional Oral History Office
Berkeley, California

LAWYER VITA OUTLINE

Lewis Olson Lawyer Antecedents:

- Grandmother: Maria Staheli: Swiss, Mormon, Santa Clara, Utah. Came to this country June 1861
- Grandfather: Hans Olson: Norwegian
- Mother: Ida Elizabeth Olson: Born 1877 at Jackrabbit Mine, Pioche, Nevada
- Grandmother: Nancy Jane Kelley: Born 1843 Maryland-Pennsylvania area
- Grandfather: Lewis Mathias Lawyer: Born 1828, Dutch-German stock. Came to Maryland-Pennsylvania area
- Father: Arthur Alonzo Lawyer: Born 1871, Solon, Iowa.
- Ida and Arthur married 1905.

Lewis O. Lawyer

- 1907 May 17. Born at Alhambra, CA. Oldest of three children, 5 and 8 years younger.
- 1914 Father built treehouse in pepper tree approximately 7 by 8 feet. Had a bench all around. In 1930, Lewis converted it into a bedroom by taking out the benches and building in walls, windows, and a roof. Put in a bed and a closet. Slept there until he went to UC.
- 1918 Built club house with alarm clock-activated door bell.
- 1919 Eugenia Rice disappointed Lewis enough to delay his interest in girls.
- 1922-1925 Attended Alhambra High School. Excelled in math and art.
- 1923 Radio activities: Eighty foot tower. Picked up 2LO London, 2BL Sydney.
- 1923 Started building fish ponds. First was a wash tub. Expanded this interest to water lilies, tropical fish, and some commercial application.
- 1924 Built family cabin at Mt. Baldy.
- 1925 Remodeled family home.

- 1926 Attended Otis Art School for two years. Discovered he was not an outstanding artist, but did commercial art work.
- 1926 Friendship with Gloria Widmann and her family influential.
- 1926 Started building large pools. Completed pools in 1931.
- 1932 Attended Chaffey Junior College in Ontario through 1934.

Instructors:

Botany and bacteriology: H. R. Stanford,
 English: Rosamond Norman,
 Journalism: Mabel Stanford,
 Geology: R. D. Dysart,
 Pomology and Entomology: George P. Weldon.

- 1934 Started at UC Berkeley. Roomed with Otto Widmann 1st year, Nester Ortiz 2nd year, both at Milvia St. apartment. Gill Tract as caretaker thereafter.

Professors:

Plant Pathology: James Barrett, T. E. Rawlins, William Snyder,
 Dr. Hansen, Ralph E. Smith, Harold Thomas, Harvey Thomas,
 William Takahashi
 Genetics: Dr. Ernest Babcock
 Chemistry: Dr. Blaisdale
 Organic Chemistry: C. W. Porter
 Zoology: S. F. Light

Honors: Alpha Zeta, Sigma Xi, Honors at graduation.

- 1935 December 1. Started work for UC and Calif. Packing Corp. at \$55/month half time, \$85/month full time during vacation.
- 1937 January 1. Started full time for CPC at \$160/month.

Adele Schwartz Lawyer Antecedents

- Grandmother: Celia Burns New York City. Born in Austria.
- Grandfather: Ignatz Lowey, New York City. Born in Austria.
- Mother: Nedye Lowey Schwartz. Born in New York City.
- Grandfather: Adolf Schwartz. New York City. Born in Poland.
- Grandmother: Molly Rosenthal. New York City. Born in Germany.
- Father: Rudolf Schwartz. Born in New York City.

Adele S. Lawyer

Adele Ruth Schwartz:

- 1918 Born in San Francisco, CA June 8. Oldest of two children, brother 2 years younger. Father was a cigar manufacturer, Brand name: Rudolfo Cigars. Lived in the Richmond District, 23rd Ave., between Lake and California. Went to Alamo elementary school. Conventional childhood, under strong maternal direction. Had a live-in maid and had daily lessons in something: piano, swimming, dancing, horseback riding, art, sunday school, ice skating. Went to children's symphony series, selected operas. Little time for play.
- 1932 Sent to Wilkins private school to avoid going to the newly instituted Junior High Schools. This was in order to go to Lowell High School which was then the best school for college prep in S.F. Did 7th and 8th grade work in one year here.
- 1933 Attended Lowell High School. Impressed with first sight of living cells under microscope in Biology. Poor in math and physical sciences. Active in dramatics, Blue ribbons in horsemanship. Graduated when 16 years old.
- 1936 Started UC Berkeley. Commuted by ferry at first, making up deficiencies in chemistry by taking zoology at U.C. Extension. Then moved to Hilgard Street in Berkeley with mother and brother to be closer to campus. Particularly enjoyed geology, zoology, English, literature, and public speaking. Majored in education and child development with minors in psychology and public speaking. Goal was to teach kindergarten and/or write books for children.

Because of reduced finances after my father's death, I worked for NYA and was assigned to the Plant Pathology Department where I met people and subjects unlike any I had known. My first supervisor was Dr. Cecil Yarwood, a mildew expert! Then I met and worked for graduate student, Lewis Lawyer, whose careful, scientific approach was a new experience and gradually led to a lack of confidence in psychology as a science and a switch in direction toward the biological sciences.

I LEWIS LAWYER, FAMILY AND EDUCATION

[Interview 1: August 22, 1989]###¹Olson-Lawyer, Family History

Lewis: We were talking to my cousin down in southern California on the telephone just a couple of days ago, and he said that my grandfather had come to the U.S. from Norway about twenty years before he met my grandmother. I didn't know that, but my cousin lived right next door to my grandparents, and so knew a little more about them. They had one big property. My grandfather bought an orange orchard, about twenty acres, and my cousin's family had part of that property where they built their house.

Riess: This is Alhambra?

Lewis: In Alhambra, yes.

Riess: Why did those grandparents come?

Lewis: Well, I still don't know that, for certain. I always assumed that my grandfather had come directly from Norway to the gold fields. This may have been because gold mining seemed a much more glamorous occupation than farming when I was a child, but, according to my cousin, Grandpa lived in Wisconsin for about twenty years before moving west. Of course, there were a lot of Norwegians in that area.

Riess: This is Hans Olson?

Lewis: Yes. My sister just came back from Norway where she and her husband were vacationing, and she said that there was a lot of gold mining in Norway. She also assumed that that's why he came over

¹This symbol (###) indicates that a tape or a segment of a tape has begun or ended. For a guide to the tapes see page .

here, from the gold fields in Norway, but that's apparently not true. He may have come over for agriculture, because when he left the mine at Jackrabbit, he grew crops for the miners for a long time. In fact, now that I think about it, he may never have been really interested in mining except as a handy means of making a living. Even when he posed for a picture with a gold-mining pan, he was actually posing on the bank of an irrigation ditch in his orange orchard.

The more I think about it, the more I feel that his primary interests must have been agricultural: his coming to Wisconsin, switching from mining to growing crops for the miners, both his properties in Alhambra being agricultural, and his meticulously-tended one-acre vegetable garden when he was in his seventies and eighties. My horticulture genes may be Norwegian! He grew the vegetables and Grandma grew the flowers.

Riess: Your grandmother's family on your mother's side was Swiss, and they were brought here by--

Lewis: By the Mormons, to grow grapes in St. George, Utah, for sacramental wine.

My great-grandfather, George Staheli, had been converted to Mormonism in Switzerland. He and his family, including my grandmother, Mary Staheli, who was then five-and-a-half years old, left Switzerland in mid-March, 1861, and sailed from Liverpool to New York on the Amerswile, the second-largest passenger ship at the time. The passage took seven weeks, and one of the children died about three days out of New York.

They went by train from New York to Florence (now Omaha), and they could hear the cannon and gun-fire when the train passed through the battlefields that first year of the Civil War. From Florence they traveled by wagon train pulled by oxen, which traveled so slowly that the children walked almost the entire distance to Salt Lake.

As I said, the Mormons brought the Swiss Colony over here to grow grapes. That's all in the book, Under Dixie Sun, that I told you about. They came over here to grow grapes for sacramental wine, and then, as it was told to me, the leaders of the church found out that the people were using the wine for things other than sacramental, and so eventually they pulled all the grape orchards and got out of grapes. But that was why they came over here in the first place, to grow grapes.

Adele: And music.

Lewis: Yes, my great-grandfather was a musician in Europe, and he traveled through Switzerland and Germany playing for dances and weddings. He brought his cornet with him, and used to blow it to start the wagons each day, but it fell from its moorings and was run over by the wagon wheel on the last leg of their journey between Salt Lake and St. George, and it was flattened. That was a big thing in his life, the loss of his musical instrument. He wrote several letters home, begging them to send musical instruments and music scores so that he could start a band. I think the rest of the family was not into Mormonism, and so they never even replied to his letters. We have a copy of the fourth letter he wrote home, a translation of it, and it is filled with the sadness of not hearing from his family.

Someone else in the Swiss party was owed money by somebody in Europe and this person arranged to get his money back in musical instruments. They got the money back in musical instruments from Germany. So, they did organize the band, and they played when the Mormon temple at St. George was dedicated. There's a parapet around the top of the tower, and the band was up there. That was George Staheli's band. So they did get the musical instruments.

Riess: Was the band always associated with Mormon events?

Lewis: Well, I would guess that the dedication music was religious, but, according to the letters we have, they played mostly for the enjoyment of the music, for dances and at parties.

So that was Grandma's side of the family. Then, of course, Hans Olson came into the picture. I do know that when he was coming west to go to the gold fields, or silver, whichever, he came through St. George and he and my grandmother, Mary, fell in love, and they eloped. They ran off against her family's wishes. He was always against Mormonism, and I think she didn't care one way or the other. She wasn't that religious.

Adele: Didn't he carry her on skis?

Lewis: Yes, it was in the wintertime, and he carried her at least part of the way on skis from St. George. It's quite a ways, about ninety miles from St. George to Pioche, Nevada, where they eventually settled. In 1974, Adele and I drove the route we thought they might have taken. It was mountainous all the way.

Adele: He was a strong skier, and she was a little thing.

Riess: She must have been a really little thing. And what was their age difference?

Adele: He was forty and she was sixteen, something like that--an enormous difference.

Lewis: Let's see. He was born in 1832 and she in 1855. That would make him forty-three and her twenty when they were married. I know my uncle, Frank Olson, who was the third from the last one to be born, said, "My father always seemed old to me." He was pretty old by the time Uncle Frank was born, but, actually he was fifty-three, which doesn't seem that old to me now.

Grandpa worked in the mine at Jackrabbit, ten miles north of Pioche, and my mother, Ida Elizabeth Olson, was born there in the mine camp. Then they went to Spring Valley where they grew crops for the miners. This is all right around Pioche, Nevada, which is about twenty miles west of the Utah border and one hundred-fifty miles north of Las Vegas. My Uncle Henry was born in Spring Valley in 1880.

In 1882 they moved from Nevada to Oregon, near Roseburg, where my Uncle George was born. From there they moved to California. I'm not sure why they settled in Alhambra. I know they had a fairly large place, because they had a Chinese cook for their ranch hands. The Chinese cook gave my mother a vase when she and Dad were married, and we have it now.

Riess: Did they have Mexican help also?

Lewis: No, I don't think so. I think it was mostly white help. The Mexican colony was in San Gabriel. I know that one of the Mexican people, "Nacho" [Ignacio Rangel], worked for the mill. He used to bring tamales. His wife was a great cook of Mexican food, and once a week he'd bring tamales, so we had tamales at home every week. Nacho probably had his share of problems, but my memory of him is that he was a good worker and always happy.

Riess: Did you know your grandmother and grandfather?

Lewis: Oh, yes, very well.

Riess: Did they tell these tales to you?

Lewis: Grandpa wasn't much of a talker, but Grandma was a great tale-teller, and I'm not sure how much of it was true, because she would always embellish stories. I know we were scared to death of gypsies. That was a long time ago, of course, and gypsies used to come around in their wagons, selling things, and they would have a tendency to pick up material that they could find in people's yards and that type of thing. She had great scary tales about gypsies, and I think they had gypsies in her native country, too.

Riess: You had honest-to-goodness gypsies in Alhambra?

Lewis: Oh, yeah.

Riess: Of what origin?

Lewis: I think from Central Europe. They would come through in wagons, and they would sell crockery and various things.

Riess: And you would never know the origin of the things, whether they were your neighbor's crockery or what?

Adele: That was part of their code, I guess.

Riess: You were saying that she liked to embellish the tales.

Lewis: She tells the story about the Mountain Meadow Massacre that occurred before her party came to Utah. That was when the Mormons dressed up like Indians--there were bad Mormons, too. They dressed up like Indians and slaughtered a whole, rich wagon train that was coming west. That story is also in the Bancroft Library.

My grandmother tells this story about watching a parade, and there was a little girl standing beside her, and when the parade came by the little girl said, "That's the dress my mommy used to wear"--a dress that somebody was wearing in the parade. They had killed everybody except those they called "the innocents." The innocents were the young children, young enough so that they couldn't remember anything.

Adele: I think it was six years or younger.

Lewis: Six years or younger, approximately, according to the history. This girl, evidently, could remember at least what her mother's dress looked like, and so somebody paid an Indian to take her out into the woods and get rid of her. The Indian took the girl out in the woods, but I guess he didn't want to kill her. They found out that he was bringing food to somebody, so eventually they got rid of both of them.

You see, that's the story that my grandma told,. I really don't know whether it's true or not, because she did tell a lot of stories. But it rings true, because they did find out that it was the Mormons that organized the massacre in an absolutely ruthless manner, and the Mormon church prosecuted. But all that's, again, in the history book up there in the Bancroft Library.

Riess: We've talked about your mother's family. What about your father's family?

Lewis: The Lawyer side of it was German-Dutch.

Riess: Does the name mean anything?

Lewis: I don't know what it was translated from. It obviously wasn't Lawyer when it was in Europe, but whatever the name was, it translated into Lawyer. There are a bunch of Lawyers in Maryland and Pennsylvania. It's Pennsylvania Dutch. As a matter of fact, when they lived there, it was in Pennsylvania, and now it's in Maryland. There was a border relocation there, some way. Anyway, it's right on the border between Maryland and Pennsylvania, and there are a lot of Lawyers there.

Our son, Artie, when he was coming home from Yale, went by there and got some information about the family. We know that my Grandpa Lawyer was born in this country, in Frederick County, Pennsylvania, in 1828. This is now Carroll County, Maryland. He homesteaded a farm, "Sunny Side Farm", three miles northeast of Westminster, Maryland, and was a member of the Lutheran church of Silver Run, Maryland. He was first married in 1852 to Eliza Fisher, and they had two sons and five daughters.

Two years after she died he married my grandmother, who had also had a previous marriage with two male children. She was fifteen years younger than he and bore him six more children, four sons, of which my father was one, and two daughters. So my father had fourteen siblings, two sisters, three brothers, five half-sisters, and four half-brothers. It turned out to be a big family. My grandmother's maiden name was Nancy Jane Kelly. Now, that's at least part Irish, but whether she was full Irish or whether a Kelly had married a German--because she also was living there in the Pennsylvania-Maryland area--I don't know.

Riess: I know the Pennsylvania Dutch. I come from the Allentown-Bethlehem area, and it strikes me that they're not the kind of people that come to California, or even to Iowa. Your father had more initiative.

Lewis: My grandfather was Lewis Mathias Lawyer, and my father was Arthur. Then I was named Lewis, and my middle name is Olson, for mother's side of the family. Now my son is Arthur Lewis Lawyer, and his son is Lewis Cook Lawyer--Lewis for me and Cook from his wife's maiden name. So it's kind of trading back and forth.

Anyway, my father was a banker in Iowa.

Riess: Born 1871, Solon, Iowa?

Lewis: Right. One father's day we visited Solon, Iowa--Adele and I--and called Dad from there on the telephone. He had always said what a sleepy little town Solon was. It was still a very little town, but it was halfway between the University of Iowa and a state college, and that's where they both came to party. It was just wild that night when we were telephoning him. Grandpa Lawyer had a dry goods store in Solon, and we took pictures of the dry goods store the next morning.

Riess: Then did your father go to one of these schools that were on either side?

Lewis: No. I know that he went to a business school. Same way with my mother. My mother went to normal school for teaching credentials. But neither of them had much education beyond high school. He went to business school, and he was secretary in the bank. The whole family was in the lumber business in Alhambra, and he became secretary at the lumber yard. He could add board feet faster than you could with a computer.

Adele: Or a calculator, in those days.

Lewis: As a matter of fact, it was a comptometer in those days. He could add four figures at a time. If there were more than four, he would add four and then do something with the others. And converting to board feet, which is in base twelve instead of ten, was completely natural to him. But he didn't like algebra, didn't think it was necessary.

Adele: I was just wondering if you shouldn't tell about how your father got married before in Iowa?

Lewis: Yes, he was married before he came to California, and his whole family, his wife and one or two children, died from meningitis, all at the same time.

Riess: Is that why he left?

Lewis: That probably had something to do with it, but there was another Lawyer living in Pasadena, California. It was not a brother, but they were related, maybe cousins or something like that. So Dad came out to visit him, and then he worked in a bank in South Pasadena for a while. When it started to get rainy, he thought the weather was pretty lousy in southern California, so he went back to Iowa. He stayed there two weeks. It was freezing and thawing, and all the streets were muddy, so he came right back to California.

I'm not sure how he met my mother, but Dad was working in the bank at South Pasadena, and Mother was working in a near-by store. They were married in November, 1905, and Dad started working in the lumber yard at that time. Dad would have been thirty-four at the time, and mother twenty-eight.

Riess: The lumber yard was what the rest of the family was involved in?

Lewis: Yes, my grandfather and two uncles. One uncle had the planing mill and the other had the lumber yard. It was right together as one unit--a sort of a family unit.

Riess: What were they lumbering? Trees growing in the San Gabriels?

Lewis: No, no. They bought lumber from San Pedro and trucked it up to Alhambra.

Riess: You mean it came in on ships from the Northwest?

Lewis: Yes, so it was already lumber. They didn't do anything with trees. My brother did later.

Childhood in Alhambra, 1907-1925

Lewis: I was born, on May 17, 1907, but I had a hard time proving it when I wanted to get a passport, because they didn't keep records in those days. My sister was born five years later and she had the same problem that I did getting a passport. They did eventually believe that I was born.

Riess: You were born at home rather than in a hospital?

Lewis: Yes I was born at home rather than at a hospital. I think most children were then, but that had nothing to do with the lack of records. They were keeping records in Los Angeles city at that time, but none of the outlying cities had birth certificates.

Riess: Who settled Alhambra? Do you know anything about it?

Lewis: No. There were, I think, something like four thousand people there when I was born, and it got up to about seven thousand when I was in high school. I don't know what it is now, but it's around sixty thousand or so.

It was quite different when I was going to school than it is now. There were almost no houses around. There were many vacant

lots, and also large fields where they were growing grain, in Alhambra, and orange orchards. It was about five blocks to grammar school. Going to school was mostly across lots, just going across grain fields. It's hard to realize this now, but a lot of grain was required to feed the horses. It was the gasoline of the day.

Riess: Was it the kind of place that people came for their health, sort of, or just to farm?

Lewis: Just farms, and a bedroom for people working in Los Angeles. Everything around there was typical of the small town of the day: a grocery store where they waited on you, a meat market, a barber shop, a hardware store, a dry goods store, a drug store with a soda fountain, an ice manufacturing plant--no refrigerators, and you left your house unlocked so the ice man could deliver the ice--a library, and of course, a blacksmith. There were truck farms and a lot of orange groves.

And there was some business there too. There was a felt manufacturing place there, and a steel pipe and tank manufacturing place, and one place that dealt with structural steel in some way. I think it moved to Alhambra from the Bay Area because there were no unions in Alhambra. But there wasn't much big business in Alhambra--I mean, big manufacturing business. The lumber yard was about as big as anything, I think.

Riess: Was your family associated with a local church or parish?

Lewis: Yes, of course, they were--let's see, what church would they be in from Norway? From Norway and Germany, I think, was Lutheran. I think that they probably were originally connected with the Lutheran, but there was no Lutheran church in Alhambra, and the Presbyterian church was only two blocks away. So we all became Presbyterians.

Of course, in those days distance was something, because few people at that time had automobiles. They had horses, and you walked every place. We were at 30 North Third Street, which was about a third of a block away from Main Street. We were about a half a block from our meat market and about two blocks from the grocery store. I was about five blocks from grammar school and about a half block from high school.

Riess: Did you go around barefoot? I want to picture you.

Lewis: Oh yes. I didn't wear shoes except to Sunday school--never to school, until I went into high school.

Adele: Isn't that amazing?

Riess: Yes. I mean, I expected you to say yes, but not full-time barefoot.

Lewis: Full-time barefoot, except for Sunday school. Not many people, the kids, wore shoes in those days, because it was southern California, and it was warm. Every kid went barefoot.

Riess: Your mother had gone to normal school, which usually means one plans to teach. Your father had been a banker. So we have a teacher and a banker, and their child ran around with no shoes on?

Lewis: It was cheaper, but I don't think any kid would wear shoes, even today, if he didn't have to. I hated to wear shoes. It was just terrible putting on shoes, even to go to Sunday school. I went up in the snow to Mount Wilson one time, barefoot. It didn't bother me.

Riess: Your feet must have been like leather.

Lewis: They were.

Adele: When he talks about his childhood, it is the most exciting and, I would say, innovative educationally type of childhood you could have.

Riess: With books or without books?

Lewis: Both. We had a good library, and here again, only two blocks away.

Riess: Why innovative?

Adele: [to Lewis] Tell about your clubhouse, for instance, and about the bell.

Lewis: I think everyone remembers things they did or built for themselves, better than they remember the ready-made toys that were given to them. We had a clubhouse in our backyard which I built out of corrugated sheet metal and various pieces of lumber, one of those primitive things that kids build. I decided that we had to have a doorbell, so we had an old alarm clock. The alarm clock, like all alarm clocks, had a little gadget, a lever, on it. When the alarm goes off in the morning, to shut it off, you would push this little lever over. I hooked this alarm clock up with a lever and a spring, so when you pushed a stick that stuck through the wall of the clubhouse, it would ring the doorbell. So, when you wanted to come in, instead of knocking you could ring the bell, just like on a big home. I was quite proud of this refinement!

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Lewis: On the property in back of our house was a three-story apartment house where several families lived. It was a big building, more than a hundred feet long. At one time they must have manufactured shoes there, because we always called it "the old shoe factory." I was talking about going barefoot, but here was this big shoe factory right in back of our house! It wasn't making shoes when I knew it.

Between the old shoe factory and our house was a big barn made out of corrugated iron. There were quite a few fairly large barns scattered around Alhambra, where they stored hay and grain and things for the horses. There were two big barns relatively close. They had to have a food supply for horses close enough so that they were practical. They were the "service stations" of the time.

The barn right in back of our yard, which we always called "the old tin barn," was, maybe, a hundred feet long and seventy feet wide and quite high. At the front end of the barn, where they would pull the bales of hay up, they had pulleys and a rope. This was high enough so that we could use the rope for a swing when they weren't using it for pulling up the bales of hay. The barn was very tall and it made a great swing. We were surrounded with plenty of places to play.

And a blacksmith's shop. The blacksmith's shop is one of the things that I often remember from childhood, hearing the clang when he was making horseshoes, and the red-hot iron, and the big hammer that he would hammer out the horseshoes with.

Riess: He was the blacksmith for the community, for all of the horses?

Lewis: Yes, and he was, oh, about a third of a block away.

Riess: Everything was about a block away. That's wonderful.

Lewis: Everything was in close.

Riess: What did your mother do all day long?

Lewis: Well, she was just a housewife. She was active in PTA. She was the first Honorary Life Member of the PTA in the city. That was after I was in high school. She had plenty to do, and, of course, she gardened. I think that was where I got my gardening interests. And she may have inherited it from her parents.

Riess: How many children in your family?

Lewis: There were three. I was the oldest, and a sister, and a brother, who's the youngest--all living.

Riess: When you were growing up there, did you ever travel back to any of these points of origin?

Lewis: No, I didn't pay very much attention to that until after Adele and I were married. [to Adele] I don't think you had anything to do with it. I think that it was just that when we get a little bit older, we get interested and try to get back and see where we did come from. All of that has been since we were married--the interest in that kind of thing.

Riess: You say that your grandmother used to tell great stories. Did your mother and father?

Lewis: No, I don't think so. I don't remember them telling the types of stories Grandma told.

I know, to me, we had a very happy family. I was talking to my brother-in-law, Ward Kimball, about that. Neither Ward, my sister, or my brother ever remembers my mother and father having an argument other than just arguing something--I mean, never having a fight type of an argument. Ward said, "The biggest argument I remember is when your dad would say something a little off color, and your mother would say, 'Oh, Arthur!'"

Riess: Even though there wasn't a lot of money, that was not a problem?

Lewis: I had a very happy childhood. In fact I don't remember ever wanting something I couldn't either get or make.

Adele: I think she was a very good mother, because she must have taught him how to think, and the right things to play with to develop him well.

Riess: That's your sense of it--that your mother was guiding you.

Lewis: Well, yes, in that direction, but I think I got more moral ideas from my father. The strange thing--that would be when he was making beer during Prohibition. And, of course, again, we were only about half a block from the police station. [laughter] The wind was from the west, blowing right toward the police station, and I used to worry about him making beer during Prohibition. Then one afternoon one of the cops came over and had some beer with him, so I didn't worry about it any more.

He used to make this beer down in the basement, and I used to help him bottle the beer, and we would have talks while I capped

the bottles. He talked about sex and that type of thing from the standpoint that--well, he thought that you shouldn't be too loose until you met somebody that you really loved, and I think that set with me pretty much. I can still remember him saying that one of the neighbor ladies--he mentioned her by name, "I could go to bed with her anytime. She's been after me ever since we lived here. You'll find as you go through life, you'll have plenty of opportunities. To me, I think you'll feel better about it later, if you save yourself for somebody special."

Riess: Isn't that interesting, that on his own volition he brought it up, rather than making you ask. That's very nice.

Lewis: Both of them were open, so far as answering questions. I can remember that, because I remember what to me now seems like a very embarrassing question that I asked my mother, and she came right out with the answer.

Riess: What was that?

Lewis: Well, my question was, "'Were babies born by - - - - ?" I used the four-letter word, which was the only word for it I knew. I had just learned it from some guy who said that that's the way babies were made. And she said, "Yes."

I still remember her remarks were: "You'll find out that when you grow up and fall in love, that things that you think you would never want to do at your age will become very wonderful." I remember where we were. We were standing beside a wood-stove--the house was warmed with a wood-stove--in the dining room, and just exactly where she was standing, and where I was standing. I don't know how old I was. It couldn't have been very old, because you find out about those thing when you're fairly young.

It is obvious that I never had a problem communicating with either parent. Also I know that, from both word and example, I always thought that marriage, once I found the right girl, was going to be both forever, and pretty wonderful.

Riess: Were your parents close in age.

Lewis: Well, they weren't really close, but I don't think they were as far apart as Adele and I.

Riess: [checking notes] Born 1871. No. It was six years difference.

Lewis: Yes, and see, we're eleven years.

I think that there are two interesting things I experienced and that I should talk about. One is that I went through the fourteen years of Prohibition, and the other is pre-television entertainment.

Prohibition was an interesting and very exciting thing that you don't have very often--fortunately, I guess. I remember Dad taking me to a speakeasy in Los Angeles and his knocking on the big door, the little window in the door opening, and the two of us walking into the dingy bar. And the night the rum-runners' truck overturned on the only downtown corner of the little Mojave Desert town of Littlerock--the party-line telephones ringing, and the entire population, twenty or so, rushing out to retrieve unbroken bottles. Or the roadside stand between Glendale and La Crescenta where you could buy a glass of grape juice for a nickel, or you could go out in back and buy some older, slightly spoiled juice for fifty cents. It was exciting!

One interesting form of entertainment: we had medicine men. I was thinking about that just last night. Right across Main Street from where we lived was a big vacant area where the circus came. A medicine man would come there three or four times a year. It was right on a main corner downtown. They would set up their little platform on a stage outdoors, and then they would have performers. But they would sell medicines.

Riess: The performers would attract the audience.

Lewis: And they would sell cures for all kinds of things. I can still remember one that made quite an impression on me. This guy had a tapeworm that he said had come from some person's intestines, and it was in a gallon jar. He would reach in with some tweezers or something, and he would pull it up like this [gestures] and show it to people. It was about two feet long. If you took his medicine, you wouldn't get a tapeworm. [laughter] I can still see him holding up that tapeworm.

Riess: These medicine men--would your parents have bought any of their wares?

Lewis: Not that I remember. But I remember them going down to watch the show, and there was usually quite a big crowd around. We didn't have television.

Adele: Your mother would never do that, because she was quite a nutritionist.

Riess: Did she use doctors? Did your family have doctors?

- Lewis: No, we had a homeopath. Medicine really wasn't that far along then, but it was probably farther along than our homeopathic doctor. He had pink pills, the little sugar pills, that he would dip into dilute medicines.
- Riess: Homeopathic medicine is quite a science of its own. There are still homeopathic physicians. Did your mother subscribe to the system? In homeopathic medicine, aren't you given a small amount of whatever it is that's poisoning you as cure?
- Lewis: I don't really know what it is, but I do know that he was, or called himself, a homeopath, and he would dip little sugar pills in solutions and give them to you.
- But I want to get back to the entertainment of those days before television.
- Adele: When the Chautauquas came.
- Riess: Yes, you mentioned Chautauqua. I want to hear more about that, too.
- Lewis: Well, of course, Chautauqua was a big outfit in those days. I mean that it was a very good source of entertainment. They had good speakers, and they had comedy, classical music, opera, and other stage entertainment, but they also had people talking about political and contemporary things, much like Channel 9 on television now.
- Riess: And they would stay in town for a couple of weeks?
- Lewis: They would stay, yes. Sometimes longer than that. It was a way of bringing really good entertainment to small communities.
- Riess: They were orators.
- Lewis: Orators, yes, but much more than that.
- Riess: Did the whole community go, or would just certain people be interested, as with educational TV programs?
- Lewis: Well, I presume that it was certain people, but it was very well attended. There wasn't much else of that nature.

I wanted to say one more thing about the grounds where they had the circuses, Chautauquas, and medicine men. This was a large area, maybe about ten acres, and they would come to the mill and get wood shavings by the truckload, and they would spread the

shavings out on this big piece of property. Every year, for maybe ten or fifteen years they had done that.

One day we had a big windstorm and it blew all the sawdust over against the fence, all the shavings and sawdust. The place had been covered all these years with this big layer of stuff four inches deep. Now it was all swept clean by the wind, and there was money that people had dropped and had gotten into the shavings. Two neighbor kids and I just happened to go down there during the wind storm, and there was money everywhere--quarters and nickels and dimes and pennies that had been lost in the shavings all these years. We picked up pockets full of money!

Riess: And you kept it, of course?

Lewis: Sure, it was ours. For several years I had dreams about going around, picking up money.

Riess: You know what I thought you were going to tell me? That the shavings blew away and underneath you had discovered that wonderful soil had been created after fifteen years of shavings on the ground. I thought that we were going to have a great agricultural success story. No! Money!

Lewis: That was quite an experience. Money was very precious in those days. I remember one day I must have spent three hours trying to find a dime that I had lost on the way to the meat market. There was a path that went kitty-corner across a vacant lot, right down at the corner of Third and Main Street. Somewhere on that path I lost a dime, and I just hunted and hunted and hunted. Spent hours--never did find it. But you can see how indelible the experience of finding all that money on the circus field would be.

Riess: Did you put that money away for some future project?

Lewis: In the house we had a money cup up on the shelf. When you went shopping, you would get money out of the money cup.

Riess: So that's what you did with the money? In other words it went to the family.

Lewis: Oh, yes, everything would go in the money cup, except this time there was more money than the cup would hold. I had two pockets bulging with coins!

In our home everything belonged to everybody. We didn't have any allowances, no, nothing. We didn't give allowances to our kids, either. We tried it for a while and they couldn't see any

reason for it. We didn't have any reason for it either when I was a kid, because the money cup was there.

Adele: And you always worked, too.

Lewis: Yes, I worked from the time I first went into high school. I worked summers at the lumber yard.

Adele: Then there was the theater.

Lewis: And the theater, delivering handbills and that type of thing, and helping on the stage on vaudeville nights. And I also worked part time in the local newspaper pressroom for a couple of years.

One interesting, and at the time somewhat embarrassing, thing happened in conjunction with my work on the stage on vaudeville nights. Vaudeville was every Wednesday night, and I met a lot of interesting people from that connection. The performers would come in during the afternoon to bring in their equipment and to go over their musical needs, if any, with the theater organist. I used to talk with them a lot. (I think almost all of them had this dream of retiring on a little farm in Azusa or some other outlying country town, and spending the rest of their lives lying in a hammock. They didn't have the slightest idea how much work a little farm could be, but from their point of view it looked wonderful.)

The theater was right across the street from the high school, and about a half block from where I lived. If someone really seemed interested in growing plants, I would invite them up to our garden to see the water lilies or the flowers. One Wednesday a really cute girl showed up. I had never seen her there before, but it turned out that she was a singer, and after she gave her music to the organist and explained the tempos of the various songs, I asked her if she wanted to visit our garden, and she did. Well, she came back to the theater two more times, about three or four months apart. She sang cute, popular songs and was quite good at it. Each of the two times she came up to our garden, and spent the afternoon with Mother and me.

Later, when I was at Otis, I invited a friend and fellow student, Helen Anthony, to go to the theater with me in Glendale. It happened to be vaudeville night there, and, about the middle of the show, the curtains parted and here was this girl singer. She had a brand new act, which I hadn't seen before. The whole theater was dark, but she was in a bright white spotlight. She held a mirror in her hand and would reflect the bright spotlight back and forth into the audience while she sang this song about fishing for a man to love.

Helen and I were sitting in the lodges in the front row balcony, and her bright light flashed across us momentarily-- but then it came back and shone right into our faces. She stopped singing and the theater pianist must have been confused. But she stopped, and all of a sudden she said, "Lewis!" She paused for a minute, but then she continued, "Where have you been? I thought I was your only love!" Then she wondered who the blond girl was that I was with, and she started singing one of the popular tunes of the day: "Honest and truly, I'm in love with you..." and she sang it all the way through. It took the pianist by surprise, but by the time she was half-way through he had found the key and was accompanying her.

Helen told me later that I was so red that I was reflecting red light all over the theater. It all ended OK, because I took Helen backstage and introduced her, but I think that was the most embarrassing fifteen minutes of my entire life.

Riess: Do you have any recollections of the religions that in some cases grew up in southern California, like Religious Sciences?

Lewis: Well, I remember Aimee Semple McPherson in Los Angeles, but that was after radio, of course. Our family was never very religious, and I never had to go to church, but I did have to go to Sunday school.

Adele: And your mother played the organ in the church. She was quite a musician.

Lewis: But we were never very religious.

Riess: In your outline here, you've mentioned a tree house your father built when you were seven years old.

Lewis: Yes, it was built by my dad and my uncle Henry. The tree house was about seven feet by eight feet, and it had a bench all around it for sitting on, and also so you wouldn't fall off the edge. It was pretty well built. It had a three-foot-wide stairway going up to it, and it was maybe fifteen feet up in the air in a big pepper tree.

Then, let's see, what year did I convert it? In 1930, I converted it into a bedroom. I did most of the work on it, but Dad helped some. We replaced the benches, and put walls up to about three feet, and then windows above that, and put a roof on it. It didn't have a roof at first. Then I slept there--moved a bed into it, and used it for my bedroom. It was just long enough for a bed,

and wide enough so that you had room enough to put on shoes and socks, sitting on the edge of the bed.

Riess: If you wanted to.

Lewis: By that time I was wearing shoes.

Riess: How come you slept out there?

Lewis: Well, just because it was nice. The mockingbirds used the tree, also, and on moonlight nights they would sing all night long. Mockingbirds annoy some people, but you get used to those kinds of things, you know, and don't pay too much attention to them. It was a nice place to stay, and the windows came out, and we could put screens in. So most of the year there were no windows in, just screens.

Riess: But it was roofed?

Lewis: It was roofed, and had a little closet.

Riess: That's wonderful! You're very lucky.

Lewis: Yes, it was a great place to grow up. It was a great place to be.

Adele: One of the stories I love that Lewis tells about is when you and your cousin got into the eggs.

Lewis: Oh yeah, you would like that story! Grandpa had about a ten-acre orange grove, a large fruit orchard, and a truck garden at their home place in Alhambra. I guess that you would say that he was retired by that time. My cousin, Don, and I had dug a tunnel and covered it over with boards and then put dirt over the top of that, so we could crawl down into the tunnel. Part of it was actually dug underground, where it was deeper.

Don and I--I don't know how we were going to cook the eggs, I don't remember that, but anyway, we went into Grandpa's chicken coop to "steal" some eggs. We wouldn't have had to "steal" them, because they would have given us all the eggs we wanted. I guess we just wanted to "steal" them for the excitement. We had to go through his barn in order to get into the chicken coop, and we each got a couple of eggs. I can remember, we were just coming out when Grandpa unexpectedly came in the barn door. We were still in the barn, and I stuck the eggs--I had four eggs, two in each hand--in my pockets.

My mother used to make my clothes; they were what we called rompers. They were loose-fitting and about knee-high. Anyway, I

stuck the eggs in my pockets and we came out the door just as Grandpa was going in. We were just going by him, and he said, "Well, how is everything today?" Then he said, "Well, have a nice time," and he slapped me on both pockets [laughter], and then he went on about his business as if nothing had happened. So there I was with eggs running down both legs. He had a sense of humor.

Riess: This picture that Adele has just showed me is your mother at that time. She's lovely and young-looking. And is this outfit on you what your little fellow friends were wearing, or is this a fancier sort of outfit?

Lewis: No, it's a regular outfit. In those days kids didn't wear long pants until they were about in the seventh grade. Getting long pants was one of the graduation steps that occurred.

Riess: It's like a sailor suit at the top, with a yoke across there.

Lewis: Yes, we called them rompers. For my baby book, my mother cut out little hunks of the materials that she made my clothes with, so I have samples of each of my rompers. Anyway, getting long pants was quite an event. It isn't that way now.

Riess: When we first talked, you mentioned an interest in crystal radios. When did you rig up your crystal radio? That was probably on a rainy day in Alhambra.

Lewis: I was in love with a girl named Eugenia Lee Rice from the time I met her when we were still in grammar school, and actually, all through high school. I met her in Sunday school, a pretty girl with long flowing blond hair. She had just moved to Alhambra from one of the southern states, still had her sugary southern accent, and was a beautiful singer. For her first Christmas recital at Sunday school she sang "Under The Stars," and she told me, "I am going to sing this song just for you." And she did. All through the song she looked right at me with her pretty eyes. I didn't have a chance! I was gone!

We lived about a mile apart, and she used to ride over to my place on her bicycle, and I spent as much time as possible with her. But about the time I started high school, I found out that she was sharing her affections with somebody else. Now this is a strange thing, because to this day I don't know that she really was. This kid was a neighbor of hers and he knew that I was running around with her. He probably liked her--she was a cute little girl--and so he told me this.

It never occurred to me until many years later that maybe he wasn't telling the truth. Almost every high school annual that I

have, there's a letter from her: "What ever happened to us?" Anyway, I was in love with her, but I couldn't stand sharing her with somebody else, and so I was just off women. I wasn't interested in other women because I was still interested in her. But that was the reason I got into radio.

Riess: Well, that's good. She functioned very effectively. [laughter]

Lewis: I guess so, but at the time I was pretty devastated. But before we get into radio, I want to tell a little story that happened when I was about in the eighth grade. This will also give me a chance to remind you that Halloween was a pretty destructive event back in those days. It was all trick and no treat.

Anyway, four of the neighbor kids and I were out seeing what mischief we could do, and typical of me at that time, we sort of drifted over to Eugenia's neighborhood. About two doors from her house, we spotted a sewing machine on a table on a screen porch. The screen door was unlocked and nobody was looking, so we took the sewing machine and one of the guys climbed on the fence and put it on the roof.

The next morning when we were right in the middle of breakfast, I got this telephone call from Eugenia, and about how some awful boys had broken into her neighbor's house and put her sewing machine up on the roof. And how sewing was this poor old lady's only way to make a living, and how it was just awful! I told her I would come and help; and without finishing breakfast, I jumped on my bike and headed for Eugenia's. Well, to make a wonderful story short: we got a ladder and I hauled the sewing machine down off the roof and back onto the table, and Eugenia kissed me. That was the first time, and I'm really not sure I deserved it. But, let's see, we were going to talk about radio.

Riess: Were crystal radios the rage, then?

Lewis: I started with a crystal set which I built in 1920. And they weren't the rage because that was before broadcasting. The only thing you could hear was the telephone between Catalina Island and the mainland. Broadcasting started later that same year when KDKA, the Westinghouse station in Pittsburg, broadcast the returns of the presidential election. The next year, I heard KPO in San Francisco, which was quite a feat for a crystal set.

Then in 1923 I replaced the crystal with tubes. I started out with a neutrodyne, which another guy and I built together, and then the superheterodyne, which was built by one of the radio stores in Alhambra and which I later modified to get short wave.

Riess: And you have here a letter from Sydney, Australia..

Lewis: Yes, and the newspaper clippings. That was the first time they had been heard in the United States.

Adele: And Japan and England.

Lewis: One by one, I heard almost every station in the U.S. and in all the major countries where they gave their call letters in English. I was the first person to hear London, 2LO, west of Chicago, and in September, 1924, I picked up an experimental broadcast on short wave from KDKA. Short wave was being used by amateurs, but this was the first time a short wave station had broadcast a program. Of course, I had an eighty-foot high tower in the back yard, which was quite a construction feat. Some of the neighbor guys helped me put it up. We built it on the ground, laying flat, and then raised it.

Riess: And it survived the Santa Anas?

Lewis: It survived. It was well guy-wired.

Riess: That sounds like a strong interest--the physics and the electronics and so on--and yet art school still was where you went.

Lewis: All my life I've had a lot of interests. The problem has been choosing between them.

Gardens and Plants

Riess: When I asked you what your mother was doing to occupy herself, you talked a little bit about her interest in gardening.

Lewis: Yes, the lady across the street, their name was Stransky, had a daughter who worked in Los Angeles. Her work was near a florist's outlet, and so she used to take bunches of Mother's sweet peas in to the florist shop every morning. That brought in some extra money.

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Riess: So had she made a business of this? Did she have masses and masses of them?

Lewis: Well, not really. As I remember, she would grow about a fifty-foot row of sweet peas, growing up on the trellis, and so it was not big business.

And then we sold things, other produce from the place, and we also sold eggs. It was no big business. She liked to grow flowers, and she used to pay a lot for the sweet pea seeds, I remember. It was when the Spencer sweet peas first came out.

Riess: She didn't keep her own seeds from year to year?

Lewis: No. She bought seed. I don't know why. I think that with peas-- they don't make F1 hybrids, so I don't think that could have had anything to do with them, but she bought seed.

Adele: It could have been because the colors were segregated?

Riess: Oh, so they weren't planted mixed. Do you remember seeing groups of single colors?

Lewis: Yes, groups of single colors. Maybe that was the reason. But then, see, she probably didn't know that. I certainly didn't know it at the time, but they don't get mixed--the colors--because they don't cross. Sweet peas are all selfed, almost all. Sometimes a bumblebee will get in and open them up, but by the time the flower opens, why, they're all pollinated. So she really shouldn't have had any problems saving seed.

Riess: It seems like a great expense to buy seed if you're trying to do a shoestring operation.

Lewis: I know that she did buy seed, at least for the sweet peas. I don't remember growing any other crops for sale.

Riess: Was there a vegetable garden?

Lewis: Yeah, we had a vegetable garden, but mostly flowers, mostly a flower garden. She liked to grow flowers. We had flowers of all kinds. Of course, I took--

Adele: You could have gotten vegetables from the grandparents.

Lewis: Yes, their truck garden area was the size of a football field. It was big.

Riess: Were you intrigued by these gardening activities, or was this peripheral?

Lewis: I think it was peripheral, but I always liked the flowers. I'm sure that's where I first got into it. My dad didn't do anything in the garden except the shoveling. He would do the labor-type work, but he really wasn't that interested in gardening.

Riess: Was the soil wonderful there?

Lewis: Yeah, it was good for growing. It was hard to work. You had to catch it at the right time for it to work, like most of the heavy clay adobe-type soils.

Riess: [to Adele] What are you pointing out for us?

Adele: Well, they did start fish ponds, which was for lilies, mostly.

Lewis: Yes. In 1923 I started out with some fish and some seaweed stuff that we got from Laguna Beach--I guess it was probably from a tide pool, as I remember--one time when we were down fishing. My dad and uncles used to go fishing at Laguna, and we would go down and camp out overnight. And I got some fish, and I even brought home some sea anemones, which didn't live. I found out how much salt you were supposed to add to the water, and we brought them home in a pail of sea water. I tried growing salt water fish in a tin bathtub thing, actually. It was about three feet across.

Riess: A washtub?

Lewis: Well, they actually used it for taking baths. Our family had a bathtub, but a lot of families didn't have a bathtub. My grandma and grandpa's house--they didn't have an indoor bathroom or toilet. My grandpa said he wasn't going to have one of those things in the house, so they had a back house. Anyway, this was the type of thing. It was big enough to take a bath in.

I didn't have much luck. Salt water fish are very difficult to keep in captivity, and I didn't know that when I got them.

Riess: Did you keep trying? Did you go back to the beach?

Lewis: No, just the once. They lived for a while, but it was very unsuccessful. [pointing to photo] There's me in the bathtub. [chuckles]

Riess: Oh, yes. That's not a very big bathtub. That's just about the right size for a two-year-old.

Lewis: From there, I went to goldfish and the more usual things. That would be about halfway through high school. Then I built one small

pool right along the side of the house. It would have been about four feet by seven or eight feet.

Riess: Lined with what?

Lewis: It was cement--concrete. Then a couple of years later, I built one pool in the backyard. Eventually, I took over most of my mother's growing area with pools and water lilies.

Riess: It sounds like the aesthetic part of it was important, too.

Lewis: Yes, that's how I got into iris, because I figured that these flat pools and the lily pads and the lilies was all horizontal, and you should have some vertical things growing around the pool. Iris were good vertical plants, and so I went up to Pasadena and bought a big supply of iris of various kinds--Japanese iris, Siberians, tall bearded, a lot of different species--and grew them around the pools, because they looked good growing vertically.

Riess: It almost sounds like an extravagant idea, under the circumstances, to do all this.

Lewis: By that time, I was working summers and making enough money to buy some things on my own. But the bigger pools were built after I got out of high school.

Riess: Where did you get the water lilies?

Lewis: I bought them from two places near Alhambra where you could buy water lilies, and one in North Hollywood. By that time we had a car, because I drove the car to art school when I was going to art school. There was the Miller Iris Garden in San Gabriel where I got probably most of them, and another garden--I can't remember the person's name--in Alhambra. I bought from Tricker, the tropical water lilies--Tricker in New Jersey.

Riess: Was Alhambra a place where there was a lot of commercial flower business?

Lewis: I don't think so. I think the flower business would have been a little closer to the coast, probably.

Riess: How about the Huntington Gardens? Had they been developed at all? Is that something you saw?

Lewis: I never visited the Huntington Gardens until after we were married. I guess they were there, but that wasn't one of the things that I did.

Adele: There was Coolidge Rare Plant Gardens.

Lewis: Of course, this was a nursery where you bought things. The Coolidge Rare Plant Gardens--I visited them a lot. I was interested in things that were either difficult to grow or there weren't very many of.

Snider--a person I think I told you about before--his real name was Schneidau, but he went under the name of Snider. He had a dilapidated nursery, but all kinds of real interesting things. He knew a lot of people. He was the one who took me to Armacost and Royston Orchid Gardens to see the scarlet catalpa orchid, the first time that they had had a scarlet-colored catalpa orchid. I can still remember going with him to see that.

And then near Bel-Air, near Hollywood, there was a gardener who grew all kinds of things that were difficult to get. He had terrestrial orchids and things like that. Another person was Weinberg, who was importing succulents. He would make trips down to Mexico. So I knew a lot of growers down there.

Riess: How about Japanese nurserymen? Did you meet any?

Lewis: I don't think so. I don't think that we had Japanese nurseries. I don't remember any in those days. I don't know why, but I don't remember that there were any.

Riess: I interviewed Toichi Domoto in Hayward, and he talked about his father bringing persimmons from Japan and expanding the kinds of things that we were growing here in California.¹

Lewis: Of course, Domoto was probably the best example, but there were a lot of other Japanese interested in nurseries up here in the Bay Area. I really don't remember any around Alhambra. I can't think of visiting any in that whole area.

School Years

Riess: Were any of your grade school teachers, or the librarian, or your high school teachers, very strong influences?

¹ Lurline Matson Roth, Matson and Roth Family History: A Love of Ships, Horses, and Gardens, Regional Oral History Office, The Bancroft Library, UC Berkeley, 1982.

Lewis: Yes. I think that all the way through school I have been very strongly influenced by various teachers. I know that a fifth grade teacher left. She had to move away because she got married, and I can still remember the whole class crying when she told us she was leaving. She was a real good teacher, and we liked her. That would have been during the first world war.

The first grade teacher in grammar school--I had her in first grade and second grade--Florence Irwin, she became principal of the grammar school later. After we were married, on one of our trips to Alhambra, I took Adele to visit her. We went unannounced, and I don't know how many years that was after I had her in school. I still remember: she was in the backyard, and Adele and I went around the driveway. She came up the driveway, and she looked at me, and all of a sudden she said, "Little Lewis." Then she told Adele that I had made a very fine clay pig when I was in the first grade.

Adele: She recognized him when he smiled. He has a distinctive smile.

Riess: Were they beginning to give you a feeling, which it sounds like you were also getting from your family, that you could just do or be anything? That the world for you had enormous possibilities?

Lewis: I don't ever remember having very profound ideas along this line. Usually I just did whatever needed to be done without giving it any peripheral thought, and I think that usually I was successful.

Riess: But a lot of supportive people.

Lewis: Yes, and I was always aware of what they were doing and that I could learn something from them. There were some high school teachers that had a strong influence on me: one English teacher that was very good. I don't think that, at the time I was in her class, I felt that teacher's influence, really, except looking back on it. But after I got married, I thought enough about her that I introduced her to Adele. I think that I appreciated teachers more after I got into Chaffey Junior College.

Riess: Were you a sufficiently good student that you were encouraged to go to a university rather than junior college?

Lewis: I personally don't think that a university has any advantage over a good junior college, but I don't think the family thought too much about that. I think that was prior to the days that you did too much thinking about higher education, although I know I wanted to go to Cal Tech. I took the entrance exam and passed, but we didn't have enough money.

Riess: You would have to live there?

Lewis: Well, yes, I would have had to. It was far enough away. I also took the entrance exam for the state universities and passed, but I don't remember it impressing me very much.

Adele: Tuition was high at Cal Tech.

Lewis: Yes, it was high for those days. It probably wasn't very much, but we really didn't have very much in the way of money. Art school was free, and that's why I went to art school.

Riess: I'm surprised that you went to art school.

Lewis: I went to art school right out of high school. I had some artistic talent. I did quite a bit of the art work in the high school annual, and had even won poster contests in high school. But there was no way that I could go to Cal Tech. I don't think there were scholarships. Maybe there were scholarships then, but I didn't know anything about them, so I went to Otis.

Riess: It was free--the Otis Art School?

Lewis: Yes, it was a county school, and it was free. There was another art school in Los Angeles that was not free, but Otis was free.

Riess: Chouinard?

Lewis: Chouinard was the other. Otis was free, so I went there for two years. [1926-1928] I did letterheads and posters and some newspaper ads--not very many, but a few newspaper ads.

Adele: He means commercially, he did those.

Lewis: Then, of course, the Depression came along--.

Riess: That was the training--to be a commercial artist?

Lewis: Yes, and I did make pretty good money doing it, for a short time.

Riess: What were the best things about Otis? What did you learn there?

Lewis: I really don't think I got very much out of Otis--I mean, so far as the ability to draw. Oh, I did from probably one person. There were two excellent fine-arts teachers there: Edouard Vysekal, and Roscoe Shrader. Under Shrader, I made a lot of charcoal drawings, and that probably helped. For one thing, I remember that he showed me that the darkest part of a rounded object is not the part farthest from, or opposite, the light source. This is a physical

truth which was new and fascinating to me. But I think as far as commercial art is concerned, I don't think I got that much from Otis.

Riess: Do you think you developed a sensitivity to color that you didn't have before?

Lewis: No, I don't think so. Vysekal was the color expert, but only in the fine arts.

Riess: I mean, now that you work with iris where there are a thousand shades of blue. Is that something that--?

Lewis: I don't think that came from Otis.

Adele: Well, how about techniques?

Lewis: Yes, there are some techniques, but I think I learned more about people there. At art school, there was a multitude of strange people, and straight people, too.

Riess: What do you mean by "strange people?"

Lewis: Well, a type of person I had never run into before, that were just arty people, very unconventional people. I can remember one of the parties that we had, there was some gal that came as a statue. All she had on was talcum powder, and so everybody that danced with her was white down the front.

I met some very nice people there, too. First, Wilfred Jackson, one of Disney's first directors, who for years was a best friend, and Charlene, my first girl-friend after Eugenia. And, of course, Gloria, Gloria Widmann--she was a very special and wonderful person.

Riess: Cubism was important in Europe, and known here too. Did you have any sense of modern movements?

Lewis: No, Otis was more classical than that, I think. Oh, there was one teacher there who was real hot for colors. That was, of course, Edouard Vysekal. His oil paintings, though quite representative, were wild and beautiful. But there were mostly straight painters. Roscoe Shrader was a good landscape artist, but he didn't deviate much from what you see. I liked his paintings because I'm not too hot on some modern art.

Riess: Did they give you courses in art history?

Lewis: No. They did have a course in art history, and probably a good one, but I was never interested in history of any kind, and so I didn't take it. They had an excellent course in anatomy which I enjoyed.

Riess: Did you go to museums and galleries when you were in that phase of your life?

Lewis: No, not very much--not any more than at any other time of my life.

Riess: So it really was commercial art.

Lewis: So far as I was concerned, although I like both. I think there were better teachers in fine arts than there were in commercial art there, and at that time I was looking for a means of making a living. Fine art was, and probably still is, an uncertain way of making a living.

But at the same time, and even earlier when I was in high school, I was going on sketching trips with Jakob Koch, a southern California watercolorist who lived a mile or so from our home. On these trips, which we made on bicycles, he worked entirely in watercolor, but I did mostly pencil sketches, with occasional watercolor sketches thrown in. I did learn a lot of watercolor techniques from Jake--in fact, as I look back on it, he was an excellent teacher with lots of patience. And I still go into our dining room and look at the watercolor painting which he gave to Mother and Dad when they were married in 1906, and wish that I could paint as well as he could.

The Depression and Chaffey Junior College

Adele: Tell about the man who offered you a business building fireplaces.

Lewis: Shortly after art school the Depression came along, and nobody could afford anything. I was still working in the lumber yard part-time, but then it got so bad that rather than fire people, my uncle kept everybody on half-time. So I was working for twenty-seven dollars a week, I remember, and every other week.

And as Adele said, I was offered this job by a guy who made fireplaces, and he was going to show me how to build fireplaces. He was making a good living and had plenty of money. He said if I'd work with him for a year, he'd teach me how to do the work and then, because he didn't have any children of his own, he would turn the business over to me. I used to deliver the material to him--

deliver cement and stuff like that that that the lumber yard kept --so we got to be fairly good friends.

He asked me if I wanted to take over his business, and that he would give it to me. That was when I talked with Gloria--Gloria Widmann--in Los Angeles about it. She said, "Why don't you go back to school?" I had saved up enough money so I figured that I might just as well go to school. And so I did.

Riess: Gloria Widmann. Who is she.

Lewis: Gloria is one of the three best friends I spoke about in Otis Art Institute. She was an art school student and very special to me. We still see her. She's married to a person named Norman Bilderback, who was in charge of making exhibits in the Los Angeles Museum.

Adele: She also did that type of work. She did archaeological work, and her family was extraordinary with Audubon and art.

Riess: With Audubon?

Lewis: Yes, the whole family was interested in birds, and her father had an Audubon book.

Riess: You mean one of the elephant folios?

Lewis: Yes. He was a commercial artist. He did newspaper advertising art. It was a real nice family.

Riess: You had enough money so that you could enroll at Chaffey. Chaffey was a community college?

Lewis: Yes, it was a community college. Prior to that it had been a private school, and an agricultural school. Then, of course, I could live at our cabin at Baldy [built 1924], which was just up the hill from Chaffey. Chaffey is in Ontario, and Baldy is right--you could see Mount Baldy from the Chaffey campus. So I could live there free. Then they had agriculture. It was agriculture that made me decide on Chaffey, since I was going to be a landscape architect.

I always thought that the people who had nurseries down there --they really weren't making very much money, but they were having a great life, I thought. They were able to grow things and sell them to people. I would go see this nurseryman, Scotty, who was up in Beverly Glen, near Bel Air--there were a lot of rich, very rich, people living around him, and they all had landscape gardeners and architects and so forth. I thought that there could be some money

in that. You could at least live on what you were doing. Maybe even the nurserymen weren't living very well, because they had pretty dilapidated nurseries, but that was during the Depression, you see.

Riess: So you saw that as a new career direction?

Lewis: Yes, and that is why I went to Chaffey. I didn't think plant pathology until I met that professor up in Berkeley.

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Riess: You entered Chaffey in 1932, and you were there for two years. What did Chaffey contribute to your education?

Lewis: There were three good teachers there. No, that's not right. Most of the teachers at Chaffey were good, but there were three to whom I felt very close. I took pomology and entomology from George P. Weldon, and I think he was probably the most influential. Mabel Stanford--she was journalism--and another Stanford, Howard R., who was in no way related to her and who taught botany, are the other two. Howard Stanford was the one that I got the most thrill from, and the one who gave me the letter of introduction to Dr. Barrett at Berkeley.

The first test I took with Weldon, I got a "D" on it, which wasn't a very good grade. I talked with him about it, and he looked over the paper and said, "Well, I think your biggest problem is that you're not trying to pay attention to what's important and what isn't important. There are lots of things that I talk about. In your mind, you should be thinking about the relative importance of various things. I can see by the way you answered the questions that everything was going into your brain about equal. There are some things that I talk about that are very important, and other things that just have to do with the background of the knowledge, and you should be able to sort those things out." So, he got me started thinking, and I think in that way he helped me a lot in how to study. I hadn't studied for seven years, you see, anything real. I think from that standpoint he helped me a lot.

It was interesting. Weldon was the one who bred the Babcock peach, and it was named for Ernest Babcock. Later I had genetics with Babcock up at Berkeley, and he became a good friend of ours, too. See, Weldon was working on how to make peaches do well in southern California. Peach trees require a certain amount of winter chilling, and there wasn't enough winter chilling down there to make the peaches grow well. There were certain types of peaches that would do well there, but they weren't very good peaches. So, he was making crosses between good peaches and the kind that would

bear down in the warm winter climate, and out of that came the Babcock.

Riess: Did you work with him on that?

Lewis: No, not at all.

Riess: Was there a commercial tie-in to what was going on there in Weldon's lab at Chaffey?

Lewis: No, there would be no commercial tie-in because Chaffey was a state-funded school, or at least a government-funded school.

Riess: So anything he produced, the patent would go to the junior college?

Lewis: Well, I'm not sure that they had plant patents in those days, but I know that the Babcock peach is still being sold. As a matter of fact, it's drawing a premium. I noticed at Safeway the other day that it was a dollar-something a pound, and the others were sixty-nine cents.

Riess: It still doesn't taste like much.

Lewis: No, it's a sweet, white peach. One of it's parents was called a "honey peach." Some people like sugar on their cereal in the morning. Some don't.

Adele: Oh, and tell about Mabel Stanford, because I think she was extraordinary.

Lewis: Yes, Mabel Stanford was the journalism teacher. She was excellent. As a matter of fact, at the time I went to Berkeley I was offered a scholarship that I could get into journalism at Seattle, the University of Washington.

Riess: You were offered a journalism scholarship to the University of Washington. Why?

Lewis: The journalism department at Seattle was considered to be tops at the time. I liked journalism very much, but I really wasn't that interested in it as a career.

Riess: But that had been arranged through Mabel Stanford?

Lewis: Yes.

Adele: And you learned from her--

Lewis: We learned a lot from her: how to be concise, the five necessary W's--who, what, where, when, and why--the exact connotation of a word and choosing the best word to express your exact meaning, all the finer things about writing.

Another thing that you learned from her was how to concentrate when a lot of things were going on around you. Every other test that you took--half of the class took the test one day and the other half took the test the next day. While you were taking the test, the rest of the class, they couldn't really bother you, but they could yell, they could scream, they could talk about all kinds of things. Everything was going on around you, and, always, you had to write a story about something.

Riess: So this was calculated in the teaching, in the journalism class.

Lewis: Yes, because there would be times when you were writing an article when all hell was going on around you, and you had to be able to concentrate on what you were doing. So, that was one of the things that we learned there, how to shut out things that were going on around you.

Adele: She also taught you how to spell, you said.

Lewis: Yes, I was a poor speller all through high school. My mother was a poor speller, and my dad was a very good speller.

Riess: Do you think this is genetic?

Lewis: Well, I think some people are better spellers, naturally, than other people. Yes, I think it's probably something built in.

But Mabel Stanford said that if you type--I wasn't a good typist, of course--if you type everything, don't write it, you'll learn how to spell. When you type with one finger, you're thinking about the letters, and if you don't know how to spell it, you'll have to look it up. When you're writing, you don't have to think about that kind of thing. And it worked. I bought a typewriter and took it up to the mountain cabin, and from that time on I did everything on the typewriter.

Riess: Now, this is distinct from a computer keyboard, where you would not have to learn to spell. [laughter]

Lewis: That's right. You wouldn't have to; you would just ask the computer to spell it for you.

These are the Driftwood poetry magazines that the Chaffey journalism class published. One of the girls in the class, Elsie Stevens, got the idea, and Mabel and the rest of us went with it.

Adele: That he illustrated.

Lewis: I did some of the illustrations in them. This is volume one, number one.

Riess: Oh, that's very "Japanesque," isn't it?

Lewis: It's a three-block print on silk, and then tipped in. This one of the ocotillo was not a block print, though. It's a zinc etching that I made in 1930 as a Christmas card. This was a technique that I learned at Otis two years earlier.

Riess: I'm glad we pursued what you learned at Otis. These Driftwoods are really lovely, appealing and artistic.

Adele: He did such beautiful wood cuts. These aren't his. You can always tell which ones are his, I think.

Lewis: Well, yeah, because everybody has their own style

Riess: Driftwood [reading]: "Volume Two, Number One, November, 1933, written and edited by members of the journalism department. Limited edition of two hundred." And here is a review by "Vagabond Poet, broadcasting regularly from station KNX, Wednesdays and Fridays."

Lewis: Yes, Driftwood was reviewed by a lot of poetry magazines, and mostly very favorably.

Adele: [reading] "New Books. Reviewed by James Neill Northe. DRIFTWOOD, Chaffey Junior College, Ontario California. Forty-six poems of various modes and scenes. The most outstanding contribution to the book is that of Lewis Lawyer, whose three exquisite block prints add an artistic touch that denotes an ability far ahead of the average block-print artist."

Riess: [looking at more illustrations] Yes. That's really lovely. It seems like Chaffey was an excellent small school, actually.

Lewis: Yes, it was, and I'd like to add that I think that a lot of students would be better off if they took their first two years in a junior college rather than plunging in to a big university. I did, and I graduated from Berkeley with honors, so I don't think it hurt me any.

Riess: After you left, Chaffey must have fallen on hard times.

Adele: Miss Stanford told me that he had the highest grades that they ever had in any student before him. And she let him illustrate her book.

Lewis: I think there were four little block prints.

Riess: [reading] The First Californians, by Mabel Stanford.

Lewis: It was a play.

Adele: [to Lewis] How did you learn block printing?

Lewis: I think we made a block print in high school, but I used the technique as a means of making Christmas cards.

Adele: [to Lewis] This might be a good time to tell about the art you did with your sister in the desert. [showing Riess a handful of 4" x 6" cards illustrating desert flowers, drawn scientifically, and colored]

Lewis: Yes. Shortly after I started taking botany at Chaffey, my sister and I made several trips to the Mojave Desert to make some pictures of the wildflowers.

Betty--her name is Betty Kimball now--was, as I said, five years younger than I was, but we spent a lot of time together. We were great pals. We decided to do these botanical cards because it would be fun. I would make the line drawings and she would color them, using watercolor. We would just go out in the desert and hunt around in various places. We used the old Jepson Manual of Flowering Plants of California for identification.

Riess: How did you know how to slice through them and identify them?

Lewis: By that time, I was in botany at Chaffey, you see. I never took any bio-sciences in high school, and art I just happened to be reasonably good at, at least until I got in with real competition, and then I thought I wasn't as good.

Riess: But these are really wonderful drawings. And, if you saw all these things out in your deserts, these are wonderful deserts!

Lewis: Yes, that was the Mojave near Littlerock, where my aunt and uncle lived, which was near Palmdale.

Riess: This represents, maybe, a year of going out to the desert?

Lewis: That was one spring and summer. We went up there weekends. One day we found, I think it was, forty-seven different species in a one-yard square area. A lot of these things are very tiny. See this is one. The scale is x 1 [times one]. That's how big the whole plant was. You know, desert plants have to make it [the flower] in a hurry. It freezes there in the wintertime. Then, as soon as it starts to get warm enough, the rains stop and they have to make it before it gets hot. So they're very rapid and very tiny.

Riess: Look at this one, by ten [x 10]. Did have a fine magnifying glass, ten power?

Lewis: Yes.

I didn't know that plants had cells until I was in junior college. I had grown lots of plants, but I had never thought anything about how they were constructed. I made lots of crosses, but I didn't have the slightest idea what the mechanism was. I think that's one of the reasons why I wanted Adele to get into the same thing that I was in, because I was so excited in botany. Everything was new, and I was so excited to find out that plants were made out of cells. It was just unbelievable--how they could pump water up. I think, theoretically, they can't pump water that high, as high as some of the high trees, but they do it. Everything was just so exciting--to learn all these new things about the plants that I had been fooling with all my life.

Riess: That's what you learned at Chaffey?

Lewis: Yes. It wasn't until I was at Chaffey. [1932-1934] And that was from the third teacher, Howard R. Stanford, the one who taught me botany. I also had bacteriology with him.

Riess: Botany changed your concept of drawing plants. What is the date of those desert drawings?

Lewis: That was after I had his course in botany, because that's where I learned the botanical representation in drawings.

Riess: Was that done because you loved to do it, or was that done for a class?

Lewis: No, just because the flowers were there, I guess.

Adele: Your sister was such a good friend, and it was a nice thing to do.

- Lewis: Yes, it was a nice thing to do. We just went out and sat on the ground and drew the flowers. She would color them while I was drawing them with India ink.
- Riess: It's the best way to represent a flower, and yet people struggle to take pictures--photographs. It doesn't work nearly as well. Just last week I went to a show of botanical drawings at the New York Public Library. Many old books were opened to beautiful pages of drawings. You can learn everything from the drawing, except how the cells work. [laughter]
- Lewis: Yes, that takes a microscope.
- Adele: [to Lewis] But it fits in with your mechanical abilities, too, and your orderliness. I think that that fits in with the pattern.
- Lewis: As I said, I took both botany and bacteriology from Howard Stanford. Stanford was also a county bacteriologist, and I can remember a serious problem they had. I don't know whether they still make the milk--what do they call it, the one that doesn't require pasteurization?
- Adele: Certified milk.
- Lewis: They were having a problem at this big dairy where they produced certified milk. They were finding bacteria in the milk. I went to the dairy with Stanford four or five times, and we went over everything there. It was quite a puzzle. They couldn't find out where the bacteria were coming from. We could never find bacteria anywhere. It wasn't coming from the cows, we tested that, and everything else was fine.
- What we finally found out was that there were rubber tubes used someplace in the machinery, and they had become old enough to get little, minute cracks in them. When the milk was going through the machinery, it was under pressure, and it would open the cracks, and the bacteria would get out. Then when the milk wasn't running through, the cracks would close up, but a few bacteria would be there and feed on the new milk supply that got in the cracks when they were open. That was quite a problem, to find out where the bacteria were coming from, because every time they were testing for bacteria, the machinery wasn't under pressure, so they didn't find anything.
- Riess: That's very interesting.
- Lewis: Before we leave Chaffey I should mention a fourth teacher, and my initiation into geology. R.D. Dysart, the geology professor, was an interesting person, and was interested in growing flowers, too,

at that time. Geology was new to me and also fascinating, but the most memorable experience I had in his classroom was when I had to take charge of his class. He got sick, and he was only going to be out for a day, so they asked me to take over his class. And then it turned out that he had some kind of a virus infection, and he was out for two weeks. I had to teach the class for two weeks. I was just barely keeping ahead of the class, but every day I had everyone in the class, including me, write a one-paragraph summary of what we had covered that day, so Dysart would know. It turned out quite well.

II ADELE LAWYER, FAMILY AND EDUCATION

Schwartz-Loewy. Family History

Riess: You were born Adele Schwartz.

Adele: Yes, in San Francisco, in the Stanford hospital, with records!

I was the oldest of two children, and my brother, whose name is Abbott, is two years younger. My father, Rudolph Schwartz, was a cigar manufacturer, and he came from New York City. He was one of ten children, and his father died when he was twelve. He had to quit school at that point and go to work and support the family, so he had a hard childhood. I think his father had been in the cigar business, too, so he went on with that.

Riess: Did he start his own business when he came out here?

Adele: Yes, he did.

Riess: Where did he get his cigar-making materials?

Adele: From Havana. He went every year on a buying trip to Havana and bought just the right kind of tobacco, and then he processed it in three factories. He had one in Tampa, one in Los Angeles, and one in San Francisco on Jackson Street, where they have all the interior decoration firms now.

Riess: The only thing I know about cigar-making is from "Carmen." Did women roll cigars?

Adele: No, men. He had little wooden boards there with shapes like cigars, molds, and they were mostly Cuban men that worked, even in the San Francisco factory.

Riess: So it was Cuban men; it wasn't flashing-eyed women?

Adele: No, it wasn't--with red roses in their hair. There were some Chinese, too. They made the boxes for his cigars. I could see the big tobacco eaves hanging upstairs in the loft there when I'd go to visit once in a while. But he did very well. He called his cigars "Rudolfos" after his own name.

My mother, Nedye Ethyl Loewy, came from the east side in New York City. She had two sisters and one brother. She left school earlier than my father did--quit, I think, in the fifth grade or something like that, although she always knew how to read and write and so forth. I never knew this until five years ago when her younger sister told me about it. Mother was always very upper-class. I had no idea that she hadn't gone to high school. She learned how to read and write, and she was really well-read.

Riess: Why would she have left school in the fifth grade?

Adele: Her older sister did, too. Their mother and father didn't feel that a girl should be too well-educated. A boy should be, but not the girls.

Riess: And so, presumably, they stayed home and learned to sew.

Adele: She learned some good needlework, and she did a lot of reading on her own. In New York, they had a lot of advantages. They had some kind of a community center that they would go to--the Settlement House, she would say--and there they had very fine lectures and courses on books. She did all this, and she was pretty well self-educated, but not in school.

She felt very intellectual. She said she only went with intellectuals. She would always tell me this. She dated boys who were well-educated. She would have nothing to do with boys that were tradesmen or anything like that.

Lewis: She didn't think much of my occupation, either.

Riess: But she didn't feel ashamed, in some way, that she didn't have a formal education?

Adele: She possibly did, you see, but I didn't know that. I didn't know that she hadn't even gone to high school. I knew she didn't go to college and that it was very important to her that I go to college.

Anyway, she fell in love with my father, who was unlike any of the young men that she was going with, the intellectual, the musical, and so forth. He was different from the others, a kind of a playboy, for one thing. He had lots of girlfriends, and I think that with his family, all the men had live-in girlfriends, even in

those days. And he was a business man and a very macho type of man. When he came out here to San Francisco, she decided that she would come out, and they would get married. So she came west. Her two sisters came out later, but she was the first in her family to come out here, and they got married.

We lived in the Avenues, on Twenty-third Avenue between Lake and California streets. It was a very nice neighborhood to grow up in. There was Lake Street, and then there was Seacliff, and that's where we played, you know. Bakers Beach, China Beach, and Lands End and all that. We had trails right there, and I could roller skate right down to the waterfront, take my skates off and walk down to the beaches.

Riess: Your family was Jewish. Did you go to temple?

Adele: I did, but my brother didn't go. My father was a Christian Scientist. His parents might have been Jewish, but they never went to temple. But they sent me. My mother decided that--

Riess: Was your mother Jewish?

Adele: No, she was not. She didn't practice. She practiced Ethical Culture, a philosophy in which she became involved in New York.

Riess: I bring it up because it was obviously an issue for you when you first met Lewis. [referring to "Lawyers, Inc., Lewis and Adele."]¹

Adele: That's true. It was.

Riess: Was your father a practicing Christian Scientist?

Adele: My father liked the Christian Science ethic quite a bit.

Riess: That meant that you had no medical care when you were very young?

Adele: No, no. That's not the case at all. My father didn't attend church at all, but he read Mary Baker Eddy thoroughly and often. And Ralph Waldo Emerson's Conduct of Life and Thoreau's Walden. These were his "religion."

I did start in the Christian Science Sunday School, and when they would start talking about Jesus Christ, my mother said, "She is not going to go there anymore, because I don't want her to think that there is a deity like that." Of course, Ethical Culture has to do with your behavior, not to do with who you're worshiping. So

¹See Appendices.

she took me out, and she put me in the Jewish church. So I went to Temple Emmanuel in San Francisco.

Riess: Yes, which was nice and handy.

Adele: Very handy, and they were very reform, and I was confirmed there. My brother didn't have to go at all. I don't know why. I think it was a very good religious education, because it was not biased. They gave a course in comparative religion in which they taught Confucianism and Taoism and everything, and I had a chance to compare. I decided I didn't want to be any more Jewish than anything else. I think Confucianism sounded to me like the best one, which was more like a code of ethics stressing good behavior, thinking about other people, and not having any particular deities.

Relentlessly Enriched Childhood##

[Interview 2: August 23, 1989]

Riess: You talk about your childhood "under strong maternal direction." I'm afraid that's what my children would say, but it would be rueful. [laughter]

Adele: Yes. My mother was determined that I would have full preparation for the future. We also always had a live-in maid so there was someone home with my brother and me whenever my mother was out, and she also cleaned the house and so forth.

I had lessons in everything. I had piano lessons, and then swimming lessons another day, and dancing lessons. Then I had horseback riding lessons, and every Saturday I went to the Art Institute, and I took art. And then I went to Sunday school on Sunday. I practiced piano every day, and I had homework, so I was what you would call occupied.

Incidentally, when I first took swimming lessons it was at the YWCA on Sutter Street, and later it was at the Fairmont Hotel in the pool, which was later a centerpiece of the Tonga Room restaurant. A Hawaiian band floated back and forth on my swimming pool! And there was an artificial tropical storm on the pool every fifteen minutes or so.

I had a fulfilling childhood, I would say. I was well-fed. My mother believed in good nutrition, so I came home from school every day and had a hot lunch, even though they had lunches at school, because she was a very conscientious mother.

I had a few good friends, and among them was Barbara Bine, who lived in Seacliff. I went to her birthday parties and so forth, and I met Hepzibah and Yehudi Menuhin, who were friends of theirs. The Menuhins were very important people in San Francisco at that time; Yehudi was a child prodigy, and Hepzibah was his sister, who accompanied him on the piano. I thought they had a much easier life than I did, because they only had to practice one thing. He had only the violin, and she had only the piano, whereas it seemed to me I was having to work at everything! [laughter]

Riess: Were you good at these things?

Adele: I was good in some of the things. I was very good at dancing, and I was very good at horseback riding.

My piano playing--I had a lot of expression, but I was kind of careless. At first I had a teacher who taught children. Then when I was about eight or nine my aunt thought I was promising enough, so she recommended that her piano teacher--who only taught professionals and brushed them up--should try taking a child, one time.

That was a big mistake, because this man, Noah Steinberg, who was a very fine musician, could hardly stand it when I made mistakes. He would slap my hands when he lost patience, you know, and then I would be tense and make the same mistakes over again, and he would slap my hands again. I was very fearful of him, and it didn't work out at all well.

Then I transferred to Allan Bier, who taught at Dominican College as well, and he was a wonderful man. We had a marvelous relationship. He collected Chinese jade, and we would have a nice conversation about the art and other subjects beforehand, and then he would point out my good points, which were expression and feeling rather than technique. So we had a very nice relationship. We still see his widow, Marcie Bier, and through her retain the friendship.

Riess: But this was more a kind of education in which you were being "finished," rather than being prepared for a professional career in anything?

Adele: That's right. Yes, I think my mother would have preferred I married someone who was well-to-do and I would have all these social graces, which were important to her.

Riess: Hepzibah and Yehudi Menuhin--that's a kind of rich inner circle of San Francisco life that you were in.

Adele: Oh, no, I wouldn't say so.

Riess: How about the Salzes and Arnsteins, in the musical circle?

Adele: No, I didn't know any others on a personal basis. I attended all the Young People's Symphonies, which were at the Curran Theater then, so I had a very rich background in music. And operas--I didn't go to hear Wagner, but I went to the more melodic "Hansel and Gretel" and "La Traviata." So I would say that I had a very good background in music.

Riess: You went to Wilkins School. Where was that?

Adele: Wilkins, yes. It was rather near us. All of our family had gone to Lowell High, and then they went on to Stanford--my mother's sister's children. At that time, they were just initiating the junior high system in San Francisco, and they built a junior high near us. Washington High School was also being built.

Mother didn't want me to go to any high school but Lowell. For that reason I went to Wilkins, a private school. You could go as fast as you want there, as long as you could learn the subject matter, because it was one-on-one. They had other children there who were in the entertainment field, on the radio, or performers that could not spare the time for a full day of school. They could learn their subjects much faster at Wilkins, and the school hours were flexible to fit in with their schedules of rehearsals and performances.

Riess: So it was a school for performing--

Adele: Performing arts, mostly. This way, if I got through the eighth grade a year sooner, I could get into Lowell before they restricted attendance according to neighborhoods. The city didn't want Lowell to be an elitist school. They were changing that type of thing. For that reason, I made two years in one. I had also entered school early, so that I was younger than most of my classmates when I graduated from high school.

High school was very good. I took Latin, and I took a college prep course, basically. I think the only interesting event that happened was when I was going home from school one day--this was from Denman School where we went while they were doing some reconstruction at Lowell. The sophomore class had to go to Denman, which was this school up on the top of the hill, on Fell Street.

I was coming home from school one day, and walking to get to the streetcar. It was very cold and blustery and foggy, the way it often is, and somebody in a car came by.

He opened the car door, and he said, "Do you want a ride?"

I said, "Oh, that would be nice," not knowing this man at all, and then I said, "Well, the streetcar is down two more blocks, and that would be very nice."

He said, "I'll take you wherever you want to go."

I said, "Well, I'm going to my music lesson," and he said, "I'll take you there."

He kept talking to me about, "Aren't you worried about being with me? How about going for a ride in the hills first?"

And I said, "No, I have to go to my music lesson. I have to get there within an hour, because he's waiting for me."

Finally, he started to laugh, and he said, "Okay, I'll take you to your music lesson." Then, when he let me off, he said, "Now, you'd better tell your mother about this, because you'd better not do this again. You were just lucky." [laughs]

Riess: It's a really alarming story, isn't it?

Adele: And so when I told Allan Bier, my music teacher, about it, he was really upset. So then they explained more to me about the facts of life than I had known--I mean, a little different from what Lewis had, isn't it?

Riess: Oh, such implicit trust in everyone, yes.

Adele: So I was what you call a little innocent until then. That was interesting, I thought.

Riess: It's interesting that you singled that out as the only really interesting thing--more like somewhat horrifying.

Adele: I don't mean that the way it sounds. It certainly wasn't "the only interesting" thing to me, because learning and school were so exciting to me that I could have gone on forever. This was an event that I didn't know was important until after it was over and everyone was scolding me. It was only scary in retrospect. You know, I looked back at it, and everyone frightened me so about it afterwards: "Why did you ever do that?"

Lewis: Why not?

Adele: He seemed like a really nice man, and I was cold, you know. It was nice of him.

Riess: How about Girls' High School for you?

Adele: Oh, that was on Geary Street then, but I heard that it was for bad girls that were mostly in trouble, you know, or fooling around too much with boys. They would send them there, because they would isolate them from boys. I mean, it wasn't a place to go.

Lewis: That doesn't work.

Riess: That doesn't work? What is this comment, from a boy?

Lewis: I mean, it's like I said. I knew where the hole in the fence was to the Catholic girls convent down in Alhambra. You know, all the guys did. The girls would go over to the hole in the fence and meet with their boyfriends.

Adele: If you starved them, I guess. But that was what my conception of Girls' High was--that's what I was told, anyway.

The Thrill of Living Cells

Adele: Let's see. I do remember that seeing living cells under the microscope in biology was a very exciting thing. We had onion cells, and you could see the protoplasm moving around in there, and I got just as much of a thrill out of it as Lewis did, only earlier, because Lewis said he didn't take biology in his high school, nor any other biological sciences.

Riess: Now, why was it a thrill?

Adele: Well, that life existed that was so small that you couldn't see it except with a microscope. Then, with a microscope, you can see that there were hundreds of little amoebas swimming around in just a small section of a drop of water! What you can find in a drop of water, and how marvelously complex life is! We see only the surface of our universe.

Riess: The reason I asked that is, I think I had already seen microscopic life in a movie--perhaps somewhere else--and is it possible that for both of you this was really the first time in any form?

Adele: That's right.

Lewis: Sure. The kids that grow up with television--on Channel 9, you see those things all the time, and you just don't pay much attention to them, so they don't have the impact.

Adele: That's right. And even in television, I don't think it's the same as seeing them, really.

Lewis: Yeah, but you do know that they exist--that the type of thing exists.

Adele: And then, with my mother and father, who had very little enriched education, I didn't know about a lot of things that you would have known, like my cousin, who was a doctor's child. I didn't do well, for instance, in mathematics or chemistry, because I had no one to help me at home. I wasn't naturally good in it, and I had a real struggle with that, whereas with our own children--Lewis could help them with anything mathematical they had any problems with. I did have trouble with that, and for that reason I had to go to Cal Extension at UC Berkeley for a semester after I graduated from high school, to make up my poor grade in chemistry. I had to have a science. But then, when I made that up at Extension, I did very well in zoology, because it wasn't mathematical, except for the part dealing with genetics. And I did well here, probably because the subject matter was so fascinating to me.

Dramatics were a very important part of my life in high school. Mr. Pollard, the coach, was a fine director, and I was the juvenile lead in many plays at school. Mr. Pollard had a large home with a small theater in it in Pacific Heights. We had some extra-curricular productions there, and I also belonged to a small theater group outside school sponsored by the Elks Club, for young people. This experience in acting gave me a degree of self-confidence I never had before.

Riess: When did you decide that you wanted to do sciences?

Adele: It wasn't until after I met Lewis and contacted the plant pathology department, the professors, the students, the atmosphere.

Riess: You were a psychology major?

Adele: I wanted to be a kindergarten teacher. I always loved small children, and I could draw well, and I could play the piano. I loved little children--

Lewis: Still does.

Adele: --and art, and I could draw things. I thought that I would do well in that, so I took elementary education, child development, and psychology, and minored in public speaking. I think I was more naturally talented in that, probably, than I was in science. But then, the more I got into psychology and such, I thought less of it. I didn't think it had a good basis as a science.

Riess: Was this after you had met Lewis? He questioned it? Or did you?

Adele: No, it was before then, because they would have all these mice and maze tests. If they go fast through a maze towards food, or would go faster toward their children waiting over here to be nursed, this would show that the maternal instinct was stronger than the need for food. I mean, I just thought that a lot of their conclusions were based on insufficient evidence, as far as I could see.

Riess: The experimental psychology. How about the more clinical--abnormal and so on?

Adele: Oh, I thought that was very interesting. I enjoyed that a great deal. I was trying to think of the name of the professor I took abnormal psych from, a woman.

Riess: Jean McFarland?

Adele: I think so, yes, and she was excellent. She was one of the best professors that I had had, and she was the only woman professor. I think I was especially impressed. Then, after taking that course, you see everybody--you know, you analyze what kind of a psychosis they fit into. Almost all of the people I knew of that were interested in majoring in psychology were themselves psychotic or very introverted. They weren't the kind of people I really liked. I just didn't feel comfortable in that field.

Getting an Education

Riess: Your mother and your family moved over to Berkeley?

Adele: Oh, yes, when we lived in San Francisco I had to commute. That was interesting, too, because you don't have to do that on the ferry anymore. I could get onto the streetcar right at the corner of my block and go down to the Ferry Building, but I would have to get up very early in the morning to get to eight o'clock classes. You'd go down on the streetcar, and then transfer to the ferry, and then

you would go onto the AC buses, and then you would transfer at Adeline. To get to Berkeley, it was a very long trip.

Lewis: They weren't buses then--weren't they streetcars?

Adele: Streetcars, yes. The Key System, that's what it was. Of course, I would study [on the commute]. But Mother thought it was too much work for me. She was widowed just about that time, when I was sixteen and started college. She moved over there with Abbott and me. She rented the San Francisco house, and we had a little apartment on Hilgard right off Euclid, so it was real close to school. (My brother went to Berkeley High.) And this meant that I could go to the library and study and so forth. It was very good that way. My mother was being a total mother again, you know. She was a very good mother.

I had to go to work because my father died. He had this big business, but he was always borrowing for business, so that when he died he left, I think it was ten thousand dollars, which didn't go far. My mother didn't know how to budget things.

Riess: Did your mother have to go to work also?

Adele: She had to, but she didn't know how to do anything very much. She tried real estate in Berkeley. She worked all the time, but she never sold one thing, so we ran short of money. She did eventually get a full-time job at the United States Mint in San Francisco.

The ten thousand dollars, it lasted a long time, but during those days we had to be careful of our finances, and I had to find work through the employment office there at UC. I did all sorts of little things--typed envelopes for somebody. I did a survey on what would be the impact of a bridge when it was built across the bay. So I would go interviewing people: "Would you shop more in San Francisco if there was a bridge across the bay?"

Riess: For what organization were you doing that?

Adele: I think it had to do with the East Bay in some way, because they felt that we would lose a lot of business if the bridge was built. They wouldn't be able to stop it, so I really don't know the purpose of the survey.

Lewis: Sounds like something the Chamber of Commerce would be doing.

Adele: I went from door to door asking people, and a lot of them thought they would go across the bay and shop at some of the nicer stores that we didn't have--I. Magnin, a big clothing store located in the building now occupied by Macy's, off Union Square, the City of

Paris, H. Liebes. They had quite a few nicer shops in San Francisco.

Riess: That bridge was built in 1939, wasn't it?

Adele: Well, it must have been in progress, and they were wondering about the impact.

Riess: Another job you've noted was for the--what's the NYA?

Adele: National Youth Authority. It was during Roosevelt's time, and it was to help those students earn money--that was part of a government thing. I got that job, and I worked for the library at first, the plant pathology library, typing cards. I wasn't a very good typist. Oh, and I also went to night school to try to learn shorthand, so I could take notes better. I didn't ever learn very well, though. I learned to write the shorthand symbols, but I could never learn to decipher them quickly enough afterwards to do me any good. [laughs]

Riess: [to Lewis] When you met her, did you realize what a hard-working and determined creature you had here?

Lewis: When she was assigned to me to help with my research, the first thing I ran into was that she didn't know how to use a ruler. She had never measured anything with a ruler. I had to show her what a quarter of an inch was, what an eighth of an inch was. But I did recognize her as a good worker. I don't think "determined" is the right word, but I soon learned that she had a knack for doing her part of the work in a way that would make our work as a team most productive.

Adele: But then, when I was working in the library--I did work for Dr. [Cecil] Yarwood, who was in charge of the library. He was a mildew expert. I thought that was the funniest thing. I told all my friends, "Can you imagine anybody being a mildew expert and being a professor in a university?" That was so funny then. Of course, later I worked on mildew diseases myself. At that time, it was just a laugh, because it was so out of my field.

Riess: You could have been anything, at that point, because you were very organized. You were a worker, and you were used to being disciplined and to being organized, and to being put to work at one task or another.

Adele: I loved the University, and I had a wonderful liberal education. I mean, I had California literature, and I had Slavic literature, and the psychology, and philosophy. The thing is that I loved it so

much that I went to Intersession, and I went to Summer Session, and it was over so fast. Three years and it was all over.

I'm getting ahead of myself, but I had a baby, and I had to stop. If I hadn't had that baby, I would have gone on to graduate school and everything, because I was really into doing it. That's one of the things that I feel is so important, to have the right to have an abortion when you're not ready, and you're not finished [with school]. It's really a shame to have to have a child when you don't want one. But that's the way it was, and I've had a very happy life anyway in spite of it.

Riess: You never did have a chance to do graduate work? There wasn't a way you could organize your life?

Adele: No, I didn't think it was right, you know, because you have to take care of your child.

Riess: Actually, your mother sounds like she was still a candidate for taking care of your child.

Adele: Well, no, because we moved away.

Lewis: We moved down to Morgan Hill. We were up at Rio Vista first, but we were away from her for most of the time that Lori was growing up.

Adele: And I probably wouldn't have done that, and I probably wouldn't have had an abortion, either. I would have thought it was wrong. It wouldn't have been, of course. But that's one of the things that we believe in very strongly now, the right of the woman to choose what she would like to do with her body.

III U.C. BERKELEY, A TREASURY OF EXPERIENCES

Introduction to Plant Pathology at Berkeley

Riess: [to Lewis] Would you tell now how you discovered plant pathology?
And J.D.Barrett?

Lewis: Yes. I was a kind of naive person. I had never traveled, and coming up to Berkeley was the farthest I had ever been from home. Howard Stanford, who taught me botany at Chaffey, knew Dr. Barrett, because they both taught plant pathology. I guess he had met him at meetings. He thought that I should have an introduction to somebody up at Berkeley, because I would be all by myself up there. So he wrote a letter of introduction to Dr. Barrett that I could take with me to Berkeley so that if I needed any help I could talk to him. I was pretty green at the time.

I had already enrolled in all the courses that I needed for the landscape architecture department at Berkeley, and then I had some time to spare, so I took this letter to Dr Barrett and met him in his office. He read the letter and started talking with me. He talked with me for maybe an hour or so about my interests, the University, and everything. While we were talking, two different students came in, and he spent a lot of time, excusing himself, talking with them.

I asked him why he was so interested in these students, and he said that he was their advisor and that was part of his job. So I asked him if he could be my advisor, and he said, "No, because you will be in a different department. You'll have another advisor." I felt so strongly about him that I switched majors. I canceled all the courses in landscape architecture and signed up for plant pathology. And so I did have Barrett as an advisor. This was a quick, almost instantaneous, judgement of Barrett's character, but neither it nor his importance to me has ever changed.

Adele: He was a very fine mycology specialist.

Lewis: And he was a good teacher. He was a great teacher.

Riess: When you say you were green, what do you mean? What didn't you have? After all, you were a good deal older than those other students.

Lewis: But I hadn't been out in the world at all, and pretty close to home. I was just thinking last night, that when I went over to Ontario to enroll in Chaffey, I had been out of high school for six or seven years. I was old enough to take care of myself, but my mother went over with me the first day I went to see about classes at Chaffey. I didn't ask her to come and she didn't ask--it was just a natural thing to do.

Riess: And Otis hadn't been as sophisticated?

Lewis: Well, Otis was pretty sophisticated, but not everyone who went there was, and I still felt pretty tied to home.

Riess: Actually, Berkeley was a pretty exciting place in that period, socially very active, and politically explosive. I don't know if it was that way over in the College of Agriculture.

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Lewis: No, it wasn't. It was quite different, and that's one of the things I think is the big difference about being in a small department, and being in these other departments where you hardly know the teachers. It is possible to get acquainted with these teachers, at least with some of them. Not all of them, because even in a small department you can't get acquainted with some teachers. But with the good teachers, you can always get acquainted, even in the big departments, but there it's a lot more difficult. A small department, like plant pathology, was like a family again. I know that I felt two of the professors there were like an addition to my father. It was quite different.

[to Adele] I think even you felt that way, too. She knows, and knew at that time, more of the professors in plant pathology than she knew in her own department.

Adele: Oh, yes. You just get to know the teaching assistants in the larger departments, and then only sometimes.

Lewis: When I took zoology with Dr. [Sol F.] Light, he lectured to us, but it was in the big auditorium, and hundreds of kids, and you really don't know him. The first time I met him was when he, or his T.A., marked me incorrect on an answer I gave on a genetics question.

The answer I gave actually was correct, but we hadn't been taught that in zoology.

I went to see Dr. Light. It was the first time I had ever talked with him. In my whole life I have talked with him only twice, and that was the first of the two times. I had shown my examination paper to [Ernest] Babcock who was my professor in genetics, and he said that my answer was correct. So I told Dr. Light to call Babcock. He said, "Well, of course, this isn't going to change your grade, anyway. It's just that we haven't taught that concept."

By coincidence, I had just been elected to Sigma Xi, and Dr. Light was at that time the secretary of the California chapter. Anyway, he was the one who was handing out the certificates when the new members went in, and that was the next day after our confrontation. So that was the other time that I met him. He looked at me and said "Oh, we meet again." I only met Dr. Light twice, but I have his signature on my Sigma Xi certificate.

Adele: But he gave you a B. He didn't give you an A because of that.

Lewis: No, it didn't have anything to do with that. I just wasn't as interested in zoology as I was in botany.

Riess: But the effect of knowing the professor, I guess, is that you understand their own personal passion for what it is they're doing?

Lewis: I don't know that it is any better for your studies, I don't know if you learn any more, but it's an entirely different feeling. It's more personal. I was trying to remember how many professors we ever called by their first names, and there weren't very many.

Adele: Yes, but they were good friends. I mean, we went to their homes.

Lewis: Oh yes, we were very good friends, but they were always Dr. So-and-So. Bill Snyder would be one that wasn't.

Adele: And Harold Thomas and Harvey Thomas, and Bill Takahashi.

Riess: There were a great number of people teaching plant pathology. Did everyone who studied agriculture take plant pathology? I mean, why was there such a large teaching staff?

Lewis: Of course, the beginning course in plant pathology, as were the beginning courses in zoology, entomology, botany, chemistry, and physics, was required for graduation in agriculture. For this reason, the first course in plant pathology was quite a large class. But I've had some very small classes. I had a one-to-one

class with William Chandler in pomology, a wonderful experience. And a four-to-one class with Professor [Ralph] Smith.

Smith was the first plant pathologist in the state. They had a rust disease on asparagus, and he came here because it was so bad. Then the rust left, but Professor Smith stayed. He organized the plant pathology department at Berkeley and became the first chairman of the department. I had him, as I said, when there were just four students in his class. There were no tests. We just sat around and discussed various facets of plant pathology, and he would question us orally as we went along. The final exam was in a small lab room. He served us tea or coffee and some cookies, and we discussed some of the more philosophical aspects of plant pathology. Professor Smith was a dynamic, and yet a very gentle person.

Riess: Maybe I need a little background--I'm sure I do--in plant pathology. It was a new science, you're saying?

Lewis: Yes, it was relatively new. It started in Germany and France in the mid 1850s, maybe even with soil injection. In 1853, Anton DeBary established the parasitism of the fungi associated with rusts and smuts. Of course, plant diseases had been there forever, as long as there have been plants, but the actual study of them was pretty new. Of course, animal and human diseases weren't studied very much until recently, either. Plant pathology was first taught as a subject in the United States in 1873 at the University of Illinois.

Adele: We went to the Hundredth Anniversary of Plant Pathology celebration during our married life, so it's now over a hundred years old.

Riess: Plant pathology--does that imply chemical answers to questions?

Lewis: Not necessarily, no, it's just the study of diseases, the same as animal pathology. Ordinarily, plant pathology was a part of botany, and even until recently it was still a part of the Department of Botany at Wisconsin.

Adele: But not all of it had to do with the control of diseases. The mechanics of it, how a plant is affected, and what is the means of spreading throughout, and why does it sometimes cause a spot instead of becoming systemic as with a wilt? There are lots of things to learn that just enrich your knowledge of the world. I think that the Bordeaux spray was one of the first chemical control measures. It was a copper spray, wasn't it, in France?

Lewis: Yes. Bordeaux spray was formulated by Millardet in France in the mid 1880s.

And then, of course, spectacular diseases, such as the chestnut blight, awakened people to how serious a plant disease could be. Chestnut blight was first found in the United States in 1904 in one tree in the New York Zoological Park where it had been introduced on trees imported from China. It was one of the first diseases studied by the United States Department of Agriculture after the organization of the laboratory for the study of tree diseases in 1907. By 1908, in just four years, the disease had spread to Connecticut, Massachusetts, Delaware, New Jersey, Pennsylvania, Maryland, and Virginia. Within twenty years, nearly every native chestnut tree in the United States had been wiped out.

And the potato famine in Ireland in 1845. Like chestnut blight, this was a relatively new disease, having been discovered in Europe about ten years earlier. It is interesting that in Ireland the disease was first blamed on electricity, which was also new, but they soon found out that it was a fungus disease.

Adele: It made everybody come to America--all the Irishmen. So even plant diseases can have a very great impact on social structures and so forth.

Riess: I would like to try to place plant pathology in terms of the development of land grant colleges. By that time, had the main body of the agriculture school gone to Davis?

Lewis: I don't think so, not during the time that we were active with the department.

Adele: But, as you said, they got their foothold there at Berkeley through the agriculture grant.

Lewis: I think that probably the administration, the higher-ups in the University, really used the land grant just as a means of getting money for the School of Letters and Science. The first building that was built on the campus had these agricultural carvings all around it. It's still there, I think, South Hall.

Riess: Sheaves of wheat.

Lewis: Yes, all around. But agriculture was placed down in the basement, and all the rest of the departments were upstairs. There's an interesting article in an old Hilgardia about that--I read it a long time ago when I was still going to school there--how there was kind of dirty work done so far as the agricultural department was concerned.

- Adele: Actually, the agricultural land is closer to Davis than it is to Berkeley.
- Lewis: Oh, yes, the best place for agriculture to be is up there.
- Riess: Were you working with the Gill Tract space then?
- Lewis: Yes, there were two reasonably large farms--the one, of course, right across the street from Hilgard Hall, and then the one down by Sacramento Street. That's where I lived for awhile as a caretaker and night watchman.
- Adele: Yes, there was a nice little house there.
- Lewis: It was a nice little house--we called it "The Estate"--two bedrooms and a living room. There were two of us there most of the time at night or Sunday, but it wasn't absolutely necessary. Then there was Eric, the guard dog, German shepherd--a beautiful dog, and the first dog I ever had.
- Adele: Staying there saved Lewis a lot of money, too.
- Lewis: Staying there was free. It was just that one of us was usually at home all the time.
- Adele: Did you know the man that roomed with you before you were assigned?
- Lewis: Ralph Settle? No, he was in an entirely different department. I think he got there through a sports grant. He was interested in football and baseball.
- Adele: I often wondered, because he was so unlike you.
- Lewis: Yes, he was the chamber of commerce-type person.
- Riess: How would he have described you?
- Lewis: Probably about the way I described him. We got along fine. There was no competition. We had nothing in common so far as interests were concerned, and we both made it a place to stay. We were both conscientious about our roll as watchmen, so it was a good arrangement.
- Riess: Did you enter as a junior? What was your status?
- Lewis: Yes, the first two years were at Chaffey, and then I came here as a junior.

Takahashi and Problem-Solving

Riess: [referring to a list] Barrett, and [William] Takahashi, Ralph Smith, T. E. Rawlins, and Harold Thomas were your professors. But who did you work with? Who was your major professor?

Lewis: Well, my first courses were with Barrett, and he was always my advisor. Then Rawlins taught techniques courses which were fascinating to me, and he sort of took me under his wing for awhile. Then Harold Thomas was my major professor during the Armillaria work. Takahashi was a sort of an assistant in Rawlins' technique class, but he was working separately on virus, especially tobacco mosaic virus.

I thought very highly of Takahashi. He had gotten this idea from the observation that when loose logs are floating down a stream, they have a tendency to line up with the current. Stream refraction, I think he called it. Of course, at that time they were unable to actually see anything as small as the virus. But he could show that if you had a concentration of tobacco mosaic virus in solution, every time you made the solution flow in one direction, the virus particles would line up like the logs.

To show this, he used a polarizing microscope, ordinarily used for studying crystal formation. He oriented the polarizing screen of the microscope at right angles to the flow of the virus solution. When the solution was motionless, light would pass through it and the polarizing screen. When he caused the solution to flow under the polarizing screen, the light was cut off, showing that the virus particles were polarizing the light in a direction opposite to that of the microscope screen. When he oriented the microscope polarizing screen parallel to the flow of the virus solution, the light would again pass through. From this, without ever having seen them, he deduced that the virus particles were long, thin things, like logs, which aligned themselves like the tiny lines of the polarizing screen.

I have always thought that that was a wonderful conception. It is so simple, but tying a phenomenon of giant logs to the behavior of tiny virus particles took more than luck.

Adele: He was the first one to discover that, and it was revolutionary.

Lewis: It was revolutionary. Adele and I had been privileged to share some of his enthusiasm when he conceived the idea, and had observed it under his microscope, but I remember when he presented his data at a national APS meeting, he was given a standing ovation. And

the nice thing is that when they finally were able to see the virus, they were pole-shaped--just like he said they were.

Riess: Is this kind of thinking something that you had to learn, or did it fit in with the way you had already been looking at the world, close observation and deduction?

Lewis: Well, I presume that it all fits in, but actually, the simpler the things are, the harder they are to think of sometimes. They can just escape a person.

Adele: No, Lewis, I think that's very true of you. Some of the people we hired, for instance--there are a lot of people who are good students and who learn a lot of facts, but they lack the ability to put together the facts that they have learned and apply them. I think that's something that Lewis does and that he admires in others.

Riess: Do you lie on your bed and look at the ceiling and sort of daydream your way through problems?

Lewis: Sometimes--not very often. Usually I just get down and work on it. I think that Bill's discovery was a perfect example of serendipity. I don't know for sure, but here he was thinking about these logs, and then he got this great idea that was quite different, but it's applicable. It comes from something that you might see, but not everyone would be able to connect a property of something as big as logs to something as tiny as a virus.

Riess: How ideas come is really fascinating. Some people will work very hard on a problem and then put it aside and go to sleep, and have something happen in a dream, or they'll wake up the next day, and it's clear.

Lewis: I do get some ideas, sometimes, that way, but I think more often I just like to sit down and work at it. I have a hard time dropping it when I get started on it.

Riess: Takahashi, was he a first or second generation Japanese?

Adele: He was second generation,

Riess: And what happened to him during the war? Was he relocated?

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Lewis: Yes, he was interned in Utah. We were no longer at the University at that time, we were at Morgan Hill. We had a Japanese boy, Haruto Mukai, the son of a local farmer, working for us at Morgan

Hill, and he was a great person. He went into a concentration camp, and we cried with him; so we felt it very deeply. We corresponded with him during internment, and he sent Adele a pair of beautiful birds that he made while he was there.

Adele: Yes, but Bill Takahashi changed his whole personality. When he came back to the University after that, he was very negative and very bitter.

Lewis: Our first date was with the Takahashis to hear the Don Cossack Choir, and we became very good friends. Bill and Rose always made their own Christmas cards, but for more than ten years, they didn't send a card. To us, this was a very strong indication of how severely they were affected.

Adele: On the other hand, Lewis had another friend who was a fellow student at Berkeley--Jimmy [James Arata] Karakawa. Anyway, he was a good friend of Lewis's, and he was visiting Japan when the war broke out. He was conscripted into the Japanese army.

Lewis: I got a letter from him just before Pearl Harbor, but he was killed during the war.

Adele: And he was an American-Japanese, and he didn't want to do that. That was a sad thing.

Other Subjects and Contacts

Riess: You've noted other Berkeley professors. What did you do in pomology?

Lewis: Well, that's an interesting thing. When I took chemistry at Chaffey, the chemistry teacher, Harold Merchant, was a graduate of Cal Tech. Our exams were half Cal Tech and half University of California. In those days we all took qualitative analysis, where components of a substance were identified by a series of chemical tests in a smelly laboratory. I guess it isn't done that way at all any more, now that they have refractometers and new electronic methods. But in those days, to find out what chemicals were in, say, various mixtures or in solids, there was a chemical routine you would go through.

Zinc was one of the elements that was very difficult to identify--either how much, or even if you had it at all. Cal Tech had just come up with a dye process where you put a drop of this reagent into your solution after you got it to a certain point. If

it turned green, there was zinc in it. If it didn't turn green, there wasn't any zinc in it. It was very specific for zinc, and it was a good test. I don't even remember what the test material was anymore.

I told you before that I had this one-to-one pomology class with Dr. Chandler. I would go to his office once a week for an hour or so and we would discuss my pomological studies, and occasionally some of his problems. One day he mentioned that he was working on zinc deficiency in fruit trees. He was concerned because he really didn't know where the zinc was located in the cells, or what it was doing there. I got the idea that this new reagent should be able to show you where the zinc was--wherever it turned green, that's where the zinc would be.

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Lewis: I wrote to Merchant at Chaffey, and he sent me a bottle of the zinc-determining solution along with a reminder that the color was very transient. Then, with the help of Dr. Rawlins, we made thin sections from the leaves and twigs which Chandler had taken from trees that were healthy and from some that were zinc-deficient and so forth. We made slides using these thin sections, and then I would put a drop of the material under the cover slip on one side, looking through the microscope, with a blotter on the other side that would draw the water out and make the solution move through.

As the zinc-determining reagent passed by the cells, there would be spaces in them that would turn bright green for just a moment and then fade out. It worked, and both Rawlins and Chandler could see it for themselves. So we were able to find out precisely where the zinc was in the cells, and from that, Chandler could deduce what it was doing there.

See, that's a serendipity that came out of something quite unrelated to the eventual application. We hadn't actually used the test at Chaffey--Merchant had just told us about it in chemistry class--but he was so enthusiastic about it that it made an indelible impression on me. That was where I got acquainted with Dr. Chandler. He taught a graduate course; I was the only one who applied, and so I got to sit in his office and talk with him about it. He was a wonderful person.

Adele: And, shortly after that, he became Assistant Dean of the College of Agriculture at UCLA and Riverside.

Riess: And who was Max Gardner?

- Lewis: He was the one who was brought in from outside and became chairman of the department. He was a good administrator.
- Riess: And that's because there had been so much squabbling?
- Lewis: Oh, I don't know. I haven't the slightest idea, because that type of politics has never been one of my strong interests, but I do remember that several of the professors in the department were upset that the position hadn't been filled from within the department.
- Adele: I think he was good at public relations. You have to have somebody who's not only a pathologist, but who will also have the gift of salesmanship.
- Lewis: Yes, he was a good administrator of the department. I know it certainly didn't hurt to bring him in.
- Riess: [looking at the list] Ernest Babcock--that is the peach name?
- Lewis: The Babcock Peach. Yes, he's the one it was named after, but not the one who did the work. George Weldon, my pomology professor at Chaffey, was the hybridizer, and named it after Babcock. Of course, it was probably based on Babcock's work--genetics.
- Adele: He was a very fine man.
- Lewis: Genetics, like some of my other courses, was a small class, perhaps twenty students. But Babcock was an interesting lecturer and I was an interested student, and since he made himself available, we became good friends. I think this was right from the very beginning when one day he spent about two hours in his greenhouse space with me showing me his genetic work. I enjoyed genetics. I thought it was great.
- Riess: Genetics isn't necessarily under agriculture, is it?
- Lewis: No. I graduated from the School of Agriculture, but I also took courses that were under L & S [Letters and Science]. Babcock's genetics was both plant and animal, and his office was in the agriculture complex. Now that they have discovered the helix, genetics is under the Department of Molecular and Cell Biology.
- Adele: When I took zoology, they had genetics within that. It was a different emphasis, but the principles were alike.
- Lewis: I had gotten a little acquainted with genetics in botany at Chaffey, but at Chaffey, Howard Stanford, the teacher, told us that there were some people who didn't believe in heredity. Ontario was

a very church-going community, and he didn't want to offend anybody who believed strictly in the Bible. The only other genetics I had was in zoology. Babcock's genetics was, of course, more comprehensive than those courses. We worked with *Drosophila*, and had our own little colonies. We made counts and found out that these types really did separate the way Mendel said they would. The lab course was also about half statistical analysis. It was great. It was exciting.

Riess: Why didn't you go on and concentrate on genetics?

Lewis: I did minor in genetics, and later, after we got out of the peach problems at Del Monte, our work for them was almost all genetics. The whole thing was breeding plants that were disease resistant

Adele: We'll get into that later.

Riess: In a way genetics is the other side of pathology?

Lewis: Plant pathology genetics is just the opposite from human pathology. In humans, you try to save the weak ones and the people who are sick. You wouldn't consider just finding people who can breed together that won't get that disease.

Adele: You can't do that--eugenics isn't it?

Lewis: With humans it's eugenics, but plant genetics or plant eugenics became very important in our work--the major emphasis.

Riess: Were you feeling philosophically that this would be a more productive use of your time, to build something rather than to repair something?

Lewis: I don't really believe that when I was taking those courses that I was thinking about a future use of them. I think it was just a fascinating lot of things that I was learning, rather than ever thinking about how I would apply this knowledge. I had two completely unsolicited offers of employment while still attending school. Both were complete surprises, and both required much soul-searching, but I don't think that it ever occurred to me that someday I might have to apply what I was learning.

I remember that I wrote a term paper on Phymatotrichum omnivorum, which is a disease--cotton root rot, if you want a simpler name. I never thought that there would be a time that I would have to use this information. It didn't occur here in California, but it was a very destructive and interesting disease. I was fascinated by the way they had worked on its control, and what they'd discovered about it. I wrote a term paper on it.

It turned out that Del Monte, many years later after I had retired, had property in Mexico, a peach orchard, and somebody from Dow Chemical reported that they had *Phymatotrichum* in the orchard. So Del Monte asked me to go down there to see what should be done about it. This was the only work that I had done for Del Monte since I've been retired--the only work I had done officially for money. So I boned up on the disease all that I could before I had to become an instant expert in Mexico.

I still had the term paper--I still have it--and so I looked at that. Then I found out that a Dr. H. E. Bloss and others were still working on the disease in Arizona. It's a bad disease in Arizona. I stopped by the University of Arizona on my way down to Mexico. Bloss was very cooperative--showed me the disease in the field and through a microscope, the first time I had ever actually seen it.

Then, as it turned out, I found out that Del Monte didn't have the disease on their ranch. It was just a muffed diagnosis on the part of the Dow experts. It was all around the Del Monte orchard, on other properties, but the problem on the Del Monte orchard was something entirely unrelated. So Del Monte didn't have to perform the complicated and costly chemical treatment recommended by Dow.

Adele: You saved them a lot of money.

Lewis: It saved them a lot of money, and it was an interesting trip. But here was this term paper--it was the only knowledge that I had had of the disease prior to that, but it did help, because I had really worked hard on the term paper. It had given me a lot of background on the disease. You never know. But I certainly wasn't working on that term paper thinking that I would ever be working on *Phymatotrichum* or that it might earn me some money in my retirement years.

Adele: And then genetics, too. I mean, he's storing all this stuff in his head, but he's able to pull it out and apply it when he needs it, which not everybody can do.

Lewis: Of course, originally I was thinking towards landscape architecture and landscape gardening, but when I was taking specific courses--botany, and all those subjects that were so fascinating--I think it was just the fascination of learning new things. That was primarily what I was thinking about. That's why I would explain things to Adele.

You asked her if it wasn't a tedious, monotonous thing, you know. But all these things that we were learning were so exciting

at the time that we didn't think about monotony. You do the tedious things, but in the mean time you're thinking about something else much more exciting.

Adele: He's a very good teacher, too.

Lewis: She's a very good student, too.

Adele: Everything I know in pathology I learned through him. I never took it.

Riess: Oh. Once you discovered him, you didn't start taking classes?

Lewis: It was too late.

Adele: I tried to, you see, but if I changed majors I couldn't graduate, especially when I got pregnant just before I graduated. I did take all the science courses I could, but I couldn't go on to graduate school. I would have, but since I was pregnant I couldn't. So he taught me. He shared everything with me. Some men don't; they like to be superior. Everything that he found exciting he wanted to share with me, and that's a real special thing, I think.

Riess: Yes. But aren't the two of you lucky? A team--it's just such a wonderful thing!

Did you know Chiura Obata, when you were at the University? I have been told that scientists came to him to learn to look through the microscope. He was teaching art, and he was a skilled observer. I thought it was interesting that scientists could learn those skills from a professor of art.

Adele: How to look at things.

Lewis: Well, I think that art certainly helped me in seeing things through the microscope, in sorting out what I was looking at. Also, in our lab courses we would have to make pictures of what we saw in the microscope, and art certainly helped me to understand, to look for what you wanted to see, and then to be able to put it down on a piece of paper so that it would look like what you had seen. I certainly think art helped in that way.

Riess: "To look for what you wanted to see."

Lewis: Well, I was thinking of a thing we learned from Barrett. Some guy, I think in Arizona, had just written a paper on a certain disease, and the things that he had seen under the microscope and how he interpreted them. It turned out that they weren't that at all. He had seen these things, but they weren't what he thought they were.

He had written a paper on it before he found out, and Barrett was using that as a warning to be pretty sure of yourself before you publish. So you can be a good observer, but you have to interpret what you see the right way.

Adele: Usually, when you are working on a familiar problem, you have a preconceived notion of what disease you are going to find in the microscope examination. For example, Rhizoctonia has certain quite specific field symptoms, and you use the microscope only to confirm your field diagnosis, so you look first for Rhizoctonia. Only if you don't find it do you look for something else.

Lewis: Yes, but you do have to be careful about what you say in a written report, and yet, on the other hand, if you're even writing a report for a corporation on your work, it has to be exciting enough--the way you write it--so that they'll get interested in reading it. You're torn between these two things. You can't enlarge on it too much and get beyond a certain point. Above all, a report should never be misleading, and yet you have to make it exciting, even in just a plain old report that you're writing for work.

Riess: Well, there's your journalism.

Adele: Right. And it helped him. He was very good at writing reports, I think. I was pretty good at writing reports, too, because I had my background in English and literature. But he helped me a lot to pare down the verbiage.

Riess: The rest of the names of important people at Berkeley. You've mentioned Snyder and Hansen. Some of these people were from the thirties, right? Barrett, Takahashi, Smith, Rawlins, Thomas, Snyder, Hansen.

Adele: Yes, and Yarwood, Cecil Yarwood, and Herb Gold, and Scotty. Everybody's gone except Bob Raabe. Bob Raabe's still a real good friend.

Riess: Was he a student with you?

Lewis: No.

Adele: We first met him at the University of Wisconsin, when he was still a graduate student and we were working for Del Monte. At that time he was working on spinach diseases, and he had gone down to our Del Monte place in Crystal City, Texas, to work on white rust of spinach.

Lewis: Bill Snyder was also a good teacher, and he helped Adele a lot.

Adele: He was a wonderful man.

Lewis: We worked with him quite a bit after we got into working on peas for Del Monte.

Adele: Snyder and Hansen were a team working on fusarium. They really made the reputation of the department at UC Berkeley worldwide because of their work on fusarium. We were fortunate enough to work with them, and Bill Snyder taught me an awful lot. He kind of took me under his wing, but that was later on. It wasn't while we were still in school; it was later on, when I was working on diseases of peas.

Lewis: But that was part of her learning process.

Hilgard Hall--Research and Funding, 1934-##

[Interview 3: September 20, 1989]

Riess: What was Hilgard Hall like when you were there? Were the same refrigerators sitting out in the hall with the same little beakers of green juice? [chuckles]

Lewis: I can still smell the big walk-in refrigerator where we used to store the roots.

Adele: It was downstairs in the basement.

Lewis: Downstairs. There were many things stored in there besides our roots, so there were all kinds of odors mixed together, and it was all damp and cold.

Adele: [to Lewis] And remember the store of test tubes they had there? There were so many they used to shovel them.

Lewis: That was at Davis, yes. During the war they had a big project going on that had to do with the war. When the project was finished, they had accumulated so many glass test tubes that they just dumped them in a room. When we wanted test tubes, we would go up there with a scoop shovel and shovel them into a box. Not very many of them broke, and that was the way we got test tubes for a few years.

Adele: In answer to your question, we were up visiting Hilgard Hall in Berkeley just last week, and we noticed how much change there was since we were students. The labs were much bigger at that time.

We were in room--I believe it was 111. That lab is now three little rooms. They sectioned it up in order to allow more professors to have their own little cubbyholes, because they don't have room enough anymore.

Lewis: As a matter of fact, that very sacred place where we met is now a wall. [laughs]

Adele: It was very informal. We had this big lab. There must have been --how many full-sized lab tables across there? Maybe four.

Lewis: Yes, I think there were four lab tables. It was a big room, and that was where Dr. [T. E.] Rawlins had his classes. When we were working there, for instance, at night, there would always be six or seven students in there working on their own projects. Now that room is divided into three.

Adele: And they've moved stuff out into the halls. It's just terrible.

Riess: Dr. [Robert] Raabe said that graduate students receive \$11,000 a year now for project work. This was interesting to me. They're all funded for graduate school. That was the case also for you, Mr Lawyer? Did you know as soon as you got into graduate school that you would get attached to a project?

Lewis: I don't think so, but when they chose me for the Del Monte Armillaria project as an undergraduate, all of the graduate students did have projects and I presume were getting paid. I don't think there was any specified amount. Of course, I don't remember any particulars about going into graduate school. You just went into graduate school. You didn't have to apply or anything like you do now. If you wanted to go to graduate school, you just stayed there and continued your studies. I had one year of graduate studies before being drafted by Cal Pack. [California Packing Corporation--now Del Monte]

Riess: And attached yourself to a particular professor?

Lewis: Yes.

Riess: And then would you expect that he would find some money for you?

Lewis: I don't remember a thing about money in connection with graduate school. I know that I was offered this project six months before graduation, and there was money involved: \$55 a month while school was in session, and \$85 a month during vacation periods. That would total \$750 a year, plus room and board when traveling, equivalent to about \$15,000 a year today. I don't remember anything about expecting money, but I do remember being excited

about the fact that I was being offered money for doing something so interesting, and I hadn't even asked for it.

Adele: What about people like Rex Thomas, who later became an administrator in the U.S. Department of Agriculture?

Lewis: Well, I think you expected eventually to get a job.

Adele: Were those men making any money? The other graduate students?

Lewis: I suppose, but I really don't know. I don't remember money being talked about. I think most of us were more interested in our work than we were in money.

Riess: The other thing that I was interested in along these lines is, were people at that point doing anything that you would call "pure research," or was it all research on a particular problem?

Lewis: A lot of people were doing pure research, including some of the professors.

Riess: Was there a general attitude about pure research vis-a-vis problem solving?

Lewis: I think it was more of a personality thing--that is, that there were certain people who were more inclined to do pure research. Some were more inclined to want to apply--even their own research had to be applicable to something. Other people didn't care one way or another. And I think it may still be that way quite a bit; that is, it's a matter of personality more than anything else.

Adele: I don't think they had as many big grants from, say, the cotton industry or the nursery industry in those days as they do now. But I think the most practical ones were those working in fruit orchards, the pomology emphasis. Dr. Harvey Thomas and Dr. Scott --"Scotty" we called him, I don't know what his first name was-- they were practical men, and they were out in the field, mostly.

Lewis: Yes, and that's all they did.

Adele: They would identify diseases, and they would set control measures and help farmers. These were real earth-type people, whereas Dr. Takahashi, Dr. Rawlins, and Dr. Barrett, and Dr. William Snyder and Dr. Nick Hansen, they were all basic research people.

Lewis: Yes. Snyder also applied, but some of them did only basic.

Adele: I'm thinking of Dr. Jack Oswald, also, who is now president of Penn State. Dr. Oswald did quite a bit of practical work on potatoes for the lower San Joaquin Valley.

Riess: Did you have an attitude about that yourself?

Lewis: I think so. I think I've always liked to apply research.

Adele: But you always liked learning the basics.

Lewis: Yes, it was exciting learning the basic things, maybe too exciting at the time to even consider application, but I still think that I always wanted to apply what I was learning about. I guess almost everybody that's working on basic research does hope that it is applied, but whether they really want to apply it themselves or just stick with the basics is a personal choice. I think there are some people who maybe can't apply anything. A lot of discoveries are made by one person, but it's really somebody else who really applies their discovery to something practical. I think there are probably more examples of that than there are the other way around.

Adele: Yes, we knew people who were extremely good students and had an enormous store of knowledge in their heads and could answer questions on anything they had learned, but they had no ability to implement those things.

Riess: Why have they gone into plant pathology rather than chemistry or biology?

Lewis: Because there is applied and basic research in plant pathology just the same as there is in chemistry or anything else. I think that the study of how the diseases work, how they invade the cells and all that type of thing, is all very interesting.

Adele: It's the same as medical research. Pathology is the same kind of thing. You deal with the organisms, the bacteria or the fungi, and you have to learn the life cycle, their temperature requirements, their growth habits, or why they act the way they act, in order to know how to control them.

Riess: In 1934, according to my brief lesson from Dr. Raabe on the history of plant pathology yesterday, new chemical controls were introduced. In 1936, there were some new fungicides that were introduced. That means that in the period of your graduate school career, things really made a big shift.

Lewis: Yes, the chemical side of plant pathology has had a big advance starting about that time. Prior to that it was mercury and copper, and various compounds of them, and sulfur. Then they got into all

these new organic fungicides. That's been a big step. And the same holds true in entomology. It was almost impossible to kill insects. We had tobacco--the nicotine things. Black Leaf 40 was one of them. Remember that?

Adele: Whale-oil soap that they would mix in to stick it to the plants.

Lewis: I can still remember looking at aphids which we were trying to control--this would have been in, say, 1941, just about that time when things like DDT were first coming in--seeing insects under the microscope crawling around with tons of insecticide on their backs, hardly able to walk because of the weight of the material, but it wasn't killing them. [laughter]

DDT was an eye-opener, and it made a tremendous difference in the Midwest. Prior to DDT you couldn't wear shorts, for instance, in the Midwest. You wouldn't dare because the deerflies were so bad. All of a sudden, all of these bugs that were bothering you when you were working out in the field disappeared, just from treating the corn. It was a big advance, and it did happen very rapidly. It's still going on.

University vs. Corporate Employment

Riess: Another question I had was about issues of competition and cooperation. Maybe they're no different than they are in any other field, but it seems to me that in plant pathology you could make your discovery and not share it with the next company or the next country or the next political power. Where do you develop a kind of set of ethics and philosophy about that? From whom do you take your moral guidance?

Lewis: Some people can't even share with their closest friends, but, again, I think that's personality. There are some people who can share, and some people who really can't. There are some people who really can't work with another person. Other people work together real well, and some just tolerate it. I think it's a big difference in personality.

Adele: There were jealousies there within the department. Some of the people were more prominent than others and received more publicity than others.

Riess: What would the debate be, between staying at the University and some notion of pure science, or doing something more applied? What was the dilemma, really?

Adele: [to Lewis] I remember that I thought that you should have gotten a Ph.D. and gone to work for the University. I thought that was a very prestigious thing which he surely would have qualified for. But that didn't mean as much to him.

Lewis: Well, for one thing, I think that you think of a job with the University as being absolutely permanent, where you think of a job working for a corporation, they can kick you out any time they want to. Permanency probably is a factor in accepting positions with government, say. But when you get really acquainted with a department in the school, you find out there are a lot of interdepartmental squabbles going on. We did some work with Colorado State University. The squabbles there were so bad that departments weren't even talking with each other, were keeping secrets from each other, and so forth, so that it was near impossible to get anything done.

Adele: Even at Berkeley there was a lot of politics.

Lewis: Yes, there's a lot of politics at the University.

Adele: It's very unpleasant sometimes.

Riess: Because of money?

Adele: No. Personalities and prestige.

Lewis: It's personality, yes. Publishing, being afraid that somebody else is going to publish on the same thing before you.

Adele: And they were all competing to be head of the department, and what did they do? They brought in somebody from another state. There was a lot of that all the time.

Lewis: As it turns out, I don't think that working for either a university or the government is any more secure. I think that the politics are there, and I don't think it's any worse than it is for a private corporation. I think you stand a chance of getting stepped on both places, or stepping on somebody else.

I remember talking with Harold Thomas when I was first offered the job with Del Monte, discussing the advantages of working for a university and working for a big corporation. Most of the students there, I think, thought that it was better to work for a university because once you got tenure, you weren't going to be fired. But I can still remember Harold Thomas saying, "Well, it may look like everything is very smooth in the University, but if they want to

get rid of somebody, they can make it pretty miserable for them, and he'll want to quit."

Adele: There's a prestige accompanying university employment.

Riess: You would say that that's still so?

Lewis: Yes.

Adele: I think so. People say, "Well, he works for the University." If he works for a corporation, that's viewed as self-interested. A corporation is always viewed as being self-interested. Of course, the individuals within the university are self interested, also. But that's the way I think the two are viewed.

Riess: Harold Thomas is an example of someone who left the University. He joined the Strawberry Institute in 1944. Why?

Adele: Well, that's easy. He was Lewis's major professor, and we knew Harold and his wife, Helene, very intimately at the time. He was interested in breeding strawberries, and the Strawberry Institute gave him the best opportunity to do what he liked to do.

Riess: Even though he could have continued to do strawberry research at the University?

Lewis: Yes, I think that he saw just what I saw when I first started to work for the Corporation. Del Monte was able to put larger amounts of money and resources into this specific problem when they really wanted to. I think it just opened a new door to his view of the thing. See, when I started to work on Armillaria with Harold at Niles we had these two trees.

Riess: When you were called to Niles, there were just two trees?

Adele: Yes, that was the University plot.

Lewis: That was the University plot. When I got up to Wheatland, why, I had thousands of trees and all the help I wanted. It was quite an experience. I mean, it was quite different.

Riess: Thousands of sick trees, or thousands of trees.?

Lewis: There were thousands of sick trees, but what I really mean is the willingness on the part of the company to give me all the help, everything I wanted. All I had to do was to just ask for how many people I wanted to dig, or make injections. Or higher-class help to take notes or keep things straight.

- Adele: Or equipment that he wanted, whereas with the University, you just had to fight for every little thing. Harold worked with us on Armillaria, and close to us on strawberries as well, because Del Monte gave Harold and the University some land to use up at their Wheatland ranch where our Armillaria work was centered. So we watched him working with his assistant, Dr. Earl Goldsmith. They loved their work, but they needed more space and more facilities and that sort of thing. From Del Monte, they got space, facilities, and cooperation without any hassle. I think that's why they left.
- Lewis: And here they got it from Del Monte, which wasn't even interested in strawberries, but was interested in Harold because of his work with me on Armillaria.
- Adele: We liked him. He was a wonderful man. He was a good friend of ours until he passed away last year. He had moved to Morgan Hill, and that's where we moved later, so we got to retain him as a friend
- Riess: The fact that he left the University--is that a case where the University could have extended itself further for him, or was there no point anyway? Did it make just as much sense for him to do his research off the campus in the big picture?
- Lewis: I think that he could see that there were more opportunities to work on strawberries away from the University than at the University. There were too many other things going on at the University.
- Adele: He was a modest man. He wouldn't have cared about the prestige about being from the University of California. He was just a very quiet man who was really interested in his work. The Institute gave him the best opportunity to do the best job that he could possibly do. He really improved the strawberries. Most of those that are grown now are his breeding.
- Riess: In fact, when you put it like that, it almost sounds like pure research again.
- Adele: Yes.
- Lewis: Pure research, perhaps, but you can see that with the Strawberry Institute it could be applied. The University could not apply it. Harold's interests were always focused more toward applied than toward basic research.
- Riess: Why couldn't the University apply it?

Lewis: They weren't growing strawberries.

Adele: And not only that, it was an interdisciplinary project, because he not only looked for disease resistance in the strawberry and how to control it, but he was trying to get a strawberry that was a more uniform red color, a strawberry that was a nicer shape, a strawberry that produced well. So he had to look for other attributes. Well, if you wanted to work in the plant pathology department, you should work on diseases, and he needed to combine traits other than disease resistance.

Riess: He had to have genetics--

Adele: Genetics, and entomology, and fertilization. Then he used fumigation not only for disease control, but to make a more-productive plant. He was seeing the whole picture, and I don't think that he could restrict his research to pathology alone.

Riess: If he had set his research up at the San Jose station, then it would have been under the University. In fact, he did for a while use that facility. The deciduous fruit work was in San Jose. [referring to notes] This is an experiment station, yes?

Lewis: Yes.

Riess: So are we still talking about being part of the University when you talk about experiment stations, or do they have the feeling of being removed?

Lewis: I don't think so.

Adele: They work together.

Lewis: Yes, I think that's just the same as being at the University.

Adele: At the Oxford tract, right by the Berkeley campus, the extension people are working there in the same greenhouses together with University professors.

Lewis: I don't think that would be the same as working for a company that was producing strawberries. The question of why he went with Driscoll, I think, is almost entirely what Adele said, that he saw firsthand what was going on with the Del Monte Armillaria research, and he liked the way it was going. It was quite different from what he was used to at the University: a few cultures, not very many, and a few trees. Then all of a sudden with Del Monte you have everything you want. I mean, volume was nothing, and we went so fast learning things, through just sheer volume of work that we were able to do.

We had unlimited help at the ranch, and unlimited trees. That was bad, of course, because they were dying, more than a thousand trees a year. But there it was. And the service we got from the ranch and the top management of the corporation, I think, was just an eye-opener. I think that that's the reason Harold was so anxious to go with Driscoll. Of course, it might not have worked out, but it did. As far as his work was concerned, it worked out as well for Harold as it did for me.

Marriage, Pregnancy, and Career

Riess: You've mentioned your daughter, Lori, and you've mentioned how your schooling was truncated. I have the history of your courtship and marriage. [See appendices] [to Lewis] You wrote that history?

Lewis: Yes, I wrote it, but I got the dates from her diary--that is, after we were working together.

Riess: When did you write the history?

Lewis: Well, about five years ago. I wrote it for the kids. We made three copies of it and sent it to the kids so they would know how we met.

A lot of things had to happen. Her father had to die, or she wouldn't have been working for NYA. She wouldn't have been working for anybody. They would be sending her to school. So her dad had to die. Of course, I had to transfer. If it wasn't for Barrett, I wouldn't have been in plant pathology. It was an amazing fact that we met.

Riess: That's the way it's written. It's written from a scientific point of view, you might say, might you not?

Lewis: Yes, except that, in this case, it's very sentimental. [laughter]

Riess: Yes, and so that's why [to Adele] I decided it was your writing.

Adele: Oh, no. He's much more sentimental than I, I think.

Riess: Anyway, so we have that, which I want to include properly in the oral history--some parts of it.

Lewis: I guess this is not sentimental, but we were talking earlier about Adele's pregnancy. My feelings on abortion and a woman's right to

choose date clear back to when I was a kid. My sister was then in late grammar school, and some friend of hers had become pregnant.

I can still remember, my mother and my sister and I were walking on Main Street in Alhambra, going down to visit my uncle, and my sister was talking about it with mother. This girl wasn't going to the same school that my sister was going to, but she knew her, and she was going to have this baby. I thought at the time about how unfair it was that the guy was perfectly clear, but it was going to have a very profound effect on this real young girl who had become pregnant, and how unfair it was. That's when all my thinking towards women's rights and stuff started--way back then.

Riess: Did you talk with your mother and sister about it?

Lewis: Yes, my sister had brought it up, and we were talking about it as we walked along the road.

Adele: It was quite personal to me, because I really loved school, and I wanted to go on very much. Then, when we went down south, we went to see one doctor and asked him if there was anything we could do about it, and I went into a drugstore and got some ergotrate, and tried that. It didn't work. Nothing worked. I would go for long walks, and run, and skip rope, and everything else I could think of.

Riess: But you could have gone to Mexico, or something like that.

Adele: That never even occurred to me.

Lewis: I was afraid of that, because there were too many chances of it going wrong.

Riess: [to Adele] What was your mother's attitude about it?

Adele: She thought it was terrible. She thought Lewis had deceived me and did it on purpose so that I couldn't leave him. She didn't approve of my getting married to him in the first place. I told her that he was making \$160, and she thought I meant a week. When she found out it was a month, and I had said, "Yes", she thought that was terrible. In addition to that, she said, "You may think he's working in soil, but to me, it's just dirt." [laughter]

Riess: A devastating remark.

Adele: Well, you know, she had certainly prepared me for a more elevated position in life. She was very, very disappointed. Not only that, but I was going to be tied to him, because once the child was born, you had to be responsible. So it was too bad. I don't like to

talk about it, because we had the daughter. She is a happy person as an adult, and everything is fine. I always had this guilt feeling: "Can she tell what I'm thinking inside, even though I'm doing all the right things, following Dr. Spock's book, and loving her. Can she tell that I wish I could have gone on to graduate school?"

Riess: Well, once you had her, did you become "all mother," or were you still having a lot of these feelings.

Adele: I wasn't "all mother." I didn't think she was a beautiful baby immediately, and I couldn't understand why the doctor said, "What a beautiful baby!" I said, "What's so beautiful about her? She has no hair, and she's all red?" And the doctor said, "She's healthy and well, and she has all her faculties. That's what a beautiful baby is."

But, of course, I came to love her, and I think we were good parents. I was a good mother.

Lewis: We took her with us everywhere we went.

Adele: We had her with us all the time, and we did our work. We had a little car that had a shelf in back of the seats. It was a coupe. It had this little shelf in the back, and we had a bed there. She went with us everywhere. We had a collapsible playpen. We put her out in the orchards. Wherever we were working she was with us at all times. So it didn't hold me down, either in respect to my time with her or as far as my research with Lewis--just the school part. In retrospect, I didn't need the school part, either, because Lewis taught me everything I needed to know.

Lewis: Everything that she could possibly have taken in graduate school she got either through me or through Bill Snyder, or the other pathologists with whom we worked. She became a very good plant pathologist. I think that three honors she received will confirm this. In 1972, on the recommendation of Dr. Herbert Gold, with whom she had worked in connection with virus diseases, she was admitted to Sigma Xi. She became the first woman member of the Steering Committee of the Conference on the Control of Soil Fungi, and in 1978, chaired the conference at Carmel. In 1983 she became the first woman recipient of the Meritorious Service Award of the National Pea Improvement Association at a presentation ceremony in Minneapolis.

Adele: Dr. Nick Hansen, all the professors. I really got everything I wanted. I just didn't have the degree to show for it.

Riess: Yes, and you were in a man's world there.

Adele: Yes, I was the only woman for many years.

Riess: When did you get married? And when was Lori born?

Adele: We got married in 1937--August 13, 1937.

Lewis: Friday the thirteenth.

Adele: And Lori was born the next year, in September.

Lewis: We eloped to Yuba City, because Yuba City was the only county seat that the University of California library didn't get a newspaper from. This meant that the plant path group couldn't get the county records from Yuba City. The guys in the department knew we were going to get married, and I heard through the grapevine that they were going to have a great time when we got married, so we decided to fool them and elope.

I found out by going to the University Library that there were no records from Yuba City (Sutter County). You had to apply three days in advance, you know. So we went up there, applied for the license, and made arrangements with the judge for the ceremony. Then we took her mother and brother up with us. So we eloped, but we took her mother and brother.

Adele: Mother would have liked me to have a big wedding, you know--all that stuff--and I used to think I'd like to have a wedding and look pretty and all that kind of stuff. But when it comes down to basics, it seemed like a big show, when it was an intimate thing, just between two people, really. So it was fine. The ceremony worked very well. We've been married fifty-two years, so--.

Riess: [to Lewis] And your parents--were they able to be there?

Lewis: No. They knew we were going to get married, so far as that was concerned. We just sent them a postcard.

Adele: And that was when we called ourselves "Lawyers Incorporated" on the post-card announcements we sent out. There's no reason for it except that it was a sentimental thing. That theme--it's on our stationery, Lawyers Inc., it's on our car license. Then, when our children were born, they became an addition to the corporation on the birth announcements we sent, etc. For Lori, we had our Lawyers Inc. letterhead engraved and used it to announce her as a new member of the corporation.

Riess: So can people buy stock in this corporation?

Lewis: Yes. We have issued stock in the corporation.

Adele: When our second daughter, Melanie, was born, we gave one share of stock in honor of the new issue.

Lewis: The president and vice presidents at Del Monte got a big kick out of that, because that was right up their line, of course. We got some real clever letters back from them. We still have them.

Adele: And Melanie, when she married, we issued a stock certificate as an invitation to her wedding.

Lewis: [reciting] "Lawyers Inc., Lewis and Adele, request the honor of your presence at the ceremony celebrating the merger of their subsidiary, Melanie, with James B. Davis, a division of the Aaron and LaVin Davis Conglomerate." Dr. Davis, the father of her husband, went along with it. We carried it along as a theme. So far we have neither been taken over, nor split. [laughs]

IV THE ARMILLARIA PROBLEM

Getting Started

Riess: Let's look at your outline of principal Del Monte projects.

Lewis: Well, I'd like to start with the Armillaria problem at the Del Monte Wheatland Ranch--actually it was the Calpak Ranch at that time. That was my first work as a plant pathologist, and it turned out to be the first work Adele and I would do together. Also, the work is a good example of basic scientific deduction, and how such knowledge can be applied.

Adele: Calpak was the early name of Del Monte.

Riess: Oh, was it? I didn't realize that.

Lewis: Yes. California Packing Corporation. They put out the Del Monte brand, but they were the California Packing Corporation. I didn't know that, and the first time I went up to Wheatland after I had gotten this job, I knew I was working for California Packing Corporation, and there were all these Del Monte boxes in the orchard. And so I asked the ranch superintendent if they sold their fruit to Del Monte. Of course, he thought I was kidding, and he went along with the joke. It wasn't until a while afterwards that I found out that Del Monte was California Packing Corporation's brand. When they expanded internationally, they changed the name to Del Monte Corporation.

Riess: Let me stop you for a minute. The work that you'll be talking about, have we gotten you all the way out of school when you're up there at Wheatland?

Lewis: No. What happened--Calpak had the problem on the Wheatland Ranch. They were losing thousands of trees, and they decided that they would get some help from the University. So Dr. Panos D. Caldis, who later became my boss, came over and talked with Dr. Ralph Smith, chairman of the Department of Plant Pathology. He wanted a

graduate student to work on this problem. Either fortunately or unfortunately, all the graduate students had already been assigned to some sort of a project, and so Ralph Smith suggested me. I was still an undergraduate.

Riess: You've gone back, and you've found a letter from Calpak to Professor Ralph Smith. This is December 1, 1935, I see here.

Lewis: Yes. [reading] "We approve the arrangements made by you and Dr. Caldis for the employment of Mr. Lawyer for one year beginning December 1, 1935. We shall pay Mr. Lawyer at the part-time rate of fifty-five dollars a month for the eight months that college is in session, and at the full-time rate of eighty-five dollars a month during the vacation periods."

Riess: Was that a handsome salary?

Lewis: Yes, it was. [to Adele] You were working for ten dollars?

Adele: Twelve dollars a month.

Lewis: [continuing reading letter] "Expenditure of one thousand dollars has been approved."

Adele: That was a lot of money.

Lewis: Yes, that would be equivalent to about twenty thousand dollars today, and it didn't include the cost of labor on the ranch.

So that's how I got into the Armillaria work. Harold Thomas, who I later worked with all the time--Dr. Thomas had started a project about a couple of months before I became involved, using carbon bisulfide on apricots at Niles. I think they injected two different tree spaces, so my first involvement was when I started digging roots there.

Riess: The College of Agriculture has its own Extension Division, doesn't it? If Calpak were having this problem, couldn't they call upon Extension to come and solve their problems, rather than hiring a plant pathologist of their own?

Lewis: Yes, I suppose. But, of course, they weren't hiring. They were getting the Department of Plant Pathology to do the work for them, you see. They weren't hiring me at that time. They were paying my salary, but they weren't hiring me. I wasn't working for them. It was a fellowship. I was working for the University and they were paying me at first.

Adele: But the Extension would never do the kind of extensive research that we did after he was hired. They would go out and identify problems and tell you what to do within the limits of what was known at that time. That wouldn't have been sufficient then to take care of this problem. It needed a lot of research.

Riess: Did you save those thousand trees?

Lewis: Well, the thousand trees were dead, but we did replant.

Riess: But the trees that were marginal, could you make them healthy? I mean, it sounds like if a tree was a little sick you could make it well.

Lewis: No, that won't work with Armillaria, and especially with peaches. First of all, a peach tree with Armillaria is only "a little sick" for about a month; then it is dead.

However, you can delay the death of a plant sometimes, on very valuable ornamentals. They did some work on the University campus while I was there on some trees that they wanted to save. You have to go in and cut it out with a chisel, and it's a very expensive process. If the tree is valuable enough and if the disease hasn't gotten to the trunk yet, you can cut the infected roots off. They use chisels and cut it out and get rid of it. This may save the tree, unless of course, the disease is coming in from someplace else around, which usually is the case. Eventually, unless you are lucky enough to find and cut out every infected root, it will die. But you can save the tree for a number of years by surgery. There's no other way of getting rid of it. Of course, you couldn't afford to do that on a peach tree--on a large orchard of trees.

Armillaria is unique in that it lives only in the roots, not in the soil, and that it doesn't spread by spores. But it is very persistent in the roots. We know of one case where a tree had been removed forty-two years before we were digging in that area. The Armillaria was still alive on the roots. That was an oak tree on one of the ranches. We found the invoices where they paid for digging the oak trees in that block of land forty-two years before, and yet the Armillaria was still alive in the oak tree roots down under there. It lasts for a long time if you don't kill it.

I should explain the injection process and how you determine its effectiveness. What you do, you inject the chemical material into the soil around a tree that has been killed by the disease. At that time they were drilling holes with a soil auger twelve inches apart and from eight to twenty-eight inches deep, and pouring a measured amount of the chemical (in this case carbon bisulfide), into the hole. Later, we used a hand-held injector

manufactured for that purpose by Stauffer Chemical Company. This injected the carbon bisulfide eight inches deep.

Then you dig all the roots out from the injected area to a depth of six to eight feet. At that time, they were letting it go for two months after they had injected the chemical. I was the one who went down and dug the roots. I think that I had a helper with me, somebody who was working at the greenhouse at the University. We dug the roots, and put them in a gunny sack, and brought them to the University laboratory.

Riess: You collect some roots, but the tree is still standing?

Lewis: No, we dig all the roots from the area injected. The holes were usually about four by six feet, and as deep as we found the roots. The tree is dead, so it could either be left standing, cut off, or pulled. The disease kills the tree very rapidly. From the time you see the first symptoms, its about six months, and the tree is dead.

After bringing the roots to the lab I made cultures from them in test tubes or in agar plates (petri dishes), to see whether the disease was still alive. Most of the cultures were sterile, showing that the disease had been killed; but some were not--the *Armillaria* was still alive. These we called "escapes." So that's when we started trying to figure out: why are we getting these escapes? I thought of root size. I thought of root depth--where it was in the soil. And, of course, at that time we knew nothing about where the roots came from in the soil. Did the carbon bisulfide penetrate deep? How far was the root away from the injection point? That type of thing, the questions and the scientific approach to find out why the escapes were occurring.

From that time on we measured the depth and diameter of every root cultured; but actually, we didn't find out until quite a long time later why the escapes were occurring. They were very unreasonable. They would occur on tiny roots, and they would occur on big roots, and it would be at various depths. There just seemed to be no rhyme or reason for it. But all this required a lot of recording as the cultures were made, and that is where Adele comes in.

Adele Joins the Team

Riess: The two of you weren't married yet?

Adele: No, we were just working together on the Armillaria.

Lewis: See, when we first worked together, I was still working with this arrangement for the University. We were able to inject so many trees at Wheatland, and to dig so many holes and bring so many roots down that I couldn't handle it by myself so far as the culturing was concerned. We literally made cultures by the thousands, and the records required were horrendous! I needed help on that, and so the University gave me Adele. She was handed to me by the University.

Riess: How did they decide on her?

Lewis: She was working in the library.

Adele: Oh, yes. I was typing library cards and that sort of thing.

Lewis: So then she worked full-time for me. I mean, whatever hours she was to put in, she worked for me. When she worked over the hours that she was supposed to work for NYA [National Youth Administration], she was paid by Del Monte--by Calpak. They paid the extra hours that were required. There were also two other girls who worked with me occasionally.

Adele: Yes. The work was very interesting to me. You know, it just kind of overwhelmed me after a while. It was so much more interesting to be doing something in research than just learning facts.

Riess: But wasn't it just a lot of, sort of, tedious measurement?

Adele: Yes, that's true, but he would explain what we were trying to find out, what the end was.

That's something you have to learn to accept--that there's sometimes a lot of work and unpleasant tasks when you are working towards a goal. That goes with it. But I liked the people who were working in the lab. We were in a lab with other students, and they all became good friends, and the professors became friends. We socialized with them. It was such a different thing than I had in the College of Letters and Science situation.

Riess: Armillaria is the same thing as oak root fungus?

Lewis: Yes.

Riess: I see. I had never heard of that until I came to California, and then I looked out in my backyard, and at that time there were two nearly-dead apricot trees and one dead peach tree. I still had a Santa Rosa plum, which does well, but it has some damage to it.

Lewis: Yes. It takes a long time to kill a plum tree, and some plum root stocks are almost completely resistant to it.

Riess: Well, now I have all apple trees, and they don't seem to be suffering.

Lewis: Apple is resistant, yes.

Riess: How will an orange tree do?

Lewis: That's susceptible, but it takes a long time to kill.

Adele: Yes. We've had some for a long time, and they're not dead yet. One of them is about ready to be pulled out.

Riess: Why is it called oak root fungus?

Lewis: The reason for that was that when they first discovered it in Germany, they found that after they pulled out an oak and tried to plant other trees, the other trees would die where the oak tree had been growing.

Oak is quite resistant to the fungus, despite the fact that it's named after it, but as soon as you pull the tree, the disease would spread through the dead roots underground. Then, when you plant a new tree in that spot, the roots would go down and contact the fungus. Then it would attack the new tree and kill it. Wherever you had the oak tree, then you would have a big batch of fungus. That was why it was called oak root fungus. The reason Wheatland was so bad is because the disease occurred in the trees up in the Sierras.

Riess: In what kind of trees?

Lewis: In all kinds, almost everything. There are only a few trees that it doesn't attack. It washed down in the stream in the roots of washed-out trees.

Adele: Bear Creek, its called.

Lewis: Yes, Bear Creek runs along the edge of the ranch. Disease-carrying roots would wash into the stream, especially when they were working the gold up there with the big hydraulic mining methods, they would wash out brush and trees and everything. Then the winter rains would bring it down. The silt and tree roots settled out on this area on both sides of the creek. Actually, it was a big river in the wintertime, and the whole ranch area used to be flooded.

One old rancher we talked to up there said that he had built three fences over the top of each other because of the silt washing in. Of course, that was way back before we were up there. Now they put levies on both sides of the creek and it doesn't wash onto the land.

Adele: But the ranch is all sediment.

Lewis: All of that good ranch land then was from silt and things being washed in on top of the red clay valley floor, which then had oak trees growing in it. There were wild valley oaks all over the place. Of course, this had been going on way before the miners, too. When the hydraulic mining was up there it happened a lot faster, but it had been going on for centuries, bringing in this beautiful alluvial soil.

Riess: You could get some history from the local farmers of problems with Armillaria. They didn't know what they were dealing with, but trees were just dying?

Lewis: They knew pretty well what they were dealing with by the time we started working on the disease.

Adele: Yes. Oak root fungus was a dirty word around then.

Riess: Why did Del Monte plant there?

Lewis: Well, it was the wonderful soil.

Adele: And the yields were terrific, much higher than any other area in the state--or the world, I guess.

Riess: When you went up there, were you just part of a succession of people who had been working on this?

Lewis: Well, when Del Monte first started planting in there, they didn't have any idea that the fungus was there.

Riess: How many years had they been growing peaches before you got there?

Lewis: Let's see. Maybe seven or eight years.

The reason they decided, eventually, to treat the area, which we're coming to, was because it was so productive. It was just beautiful soil. Of course, the fact that it was laid down by water and washed there, there was enough sand in it. There were some places that were too sandy to grow trees, but most of it was just ideal, just the right amount of sand and silt. It was beautiful.

Gathering the Facts

Lewis: Now I'd like to outline what we found in our work, and how that information was applied. I have told you that when I was culturing the roots we dug from the apricot orchard at Niles, I found that the Armillaria had been killed in most of the root pieces, but that it had "escaped" in others. To find out the why of these escapes would require a lot more information than we obtained at Niles--a lot more volume, and a lot more note taking. That was where Adele came in. I made the cultures and Adele took the notes.

The first thing I thought of was the size of the roots: is it the big roots where the disease is escaping because the chemical doesn't penetrate; is it the big roots where it's escaping and surviving? Maybe down the middle of a big root? Adele measured the diameter of every root cultured, some as large as four to six inches, and some as small as one-eighth inch. That theory didn't work out. The Armillaria was killed, even in the center of the largest roots.

Was it how deep they happened to be in the soil? Then we started recording the depth of every root in the soil as they were dug. We knew every place that a root came from in the soil, and found that the Armillaria could be killed as deep as six to eight feet under the surface.

Then we began to notice that kill was much more successful in certain trees than it was in others. In one site the disease would be controlled 100 percent, in another, not fifty feet away, there would be escapes. Checking our notes, we found that this correlated with the length of time between the death of the tree and the treatment. The longer the tree had been dead, the easier the fungus was to control.

Eventually--it was probably two years before we got it all straightened out--we found out that the place where it escaped the most, and was able to live through the fumigation, was in a healthy, live root where the disease was growing up towards the crown of the tree. The disease was working its way up a healthy root in the cambium layer. The fungus quickly destroys or disintegrates the bark, and the fumigant can penetrate and kill the fungus. But right where it's working its way up the healthy root, and the bark is still intact and corky, the fumigant doesn't penetrate and the fungus remains alive. Then, when the fumigant gas leaves, the fungus just goes right on growing. The root may have been killed by the gas, but you haven't killed the fungus.

Adele: In addition to carbon bisulfide, we also tested all of the other toxic chemicals which were available. Strangely enough, the ones that were the best in the laboratory tests, the most pathogenic, the most toxic in petri dishes or jars, were completely ineffective in the field tests.

Lewis: Chloropicrin (tear gas), for instance, which has been used very much in soil sterilization, was no good against Armillaria. We injected chloropicrin, and it went deep. We would dig these holes, and we had to have blowers to blow air down into the holes so we could work in them. And yet it doesn't control the disease at all. That's one of the chemicals that you can hardly measure a small enough amount in a laboratory petri dish or jar test.

Adele: That would not kill the fungus.

Lewis: Yes, we would put a single drop on a piece of filter paper and cut the soaked area into hundreds of minute pieces, and no matter how tiny the segments we used, they would kill the disease. Almost none of it would kill the disease dead. And yet, in the field tests it was no good at all. That's the type of thing that gets you curious.

Armillaria doesn't occur in the soil. It grows only in roots, and so just being able to penetrate the soil wasn't enough.

Now, why was it that chemicals that you could hardly measure a small enough quantity to kill in a petri dish, or in jars, would have no effect in the field? Why was that? All these things, the puzzling things. Why did they happen?

With Armillaria, the roots are always moist, and chloropicrin, like most of these chemicals, is an organic material that is not water soluble. If they're not water soluble, they don't get into the root very well.

It turned out that carbon bisulfide was the best material for controlling that particular root rot. It's not very water soluble, but it is a little bit more water soluble than the others. That was one of the reasons for its success. The second thing we discovered was that carbon bisulfide killed Armillaria, but didn't kill Trichoderma, another fungus which lives in soil.

Adele: And when we unscrambled the data, it made a perfect picture. The material that worked the best, carbon bisulfide, was less toxic to Trichoderma. Trichoderma, which it didn't kill, could come in and populate the soil. Chloropicrin, on the other hand, killed the Trichoderma and not the Armillaria. So that was the answer: partial sterilization.

Lewis: It turned out there were two things that were involved. One of them was the ability of the fumigant to penetrate damp roots, but probably the most important one was this partial sterilization so the good organisms can come in--the ones with the white hats can come in and destroy the ones with the black hats.

Riess: I think there's a lot of drama in this business.

Adele: Oh, yes; and it was so wonderful, the whole concept, because that was the first application of biological control.

Lewis: We found that the carbon bisulfide actually does kill the organism at most depths, say down to four feet. Below that depth, it's questionable whether the carbon bisulfide kills the *Armillaria* or whether the *Trichoderma* comes in and kills after the organism has been weakened by the carbon bisulfide.

To answer this question, we did some studies in the wintertime, where, because of the colder soil, the gas moves more slowly than it does in the summertime. So we were able to dig at intervals after application, three days, ten days, twenty days, and up to 120 days, and we did find that material was going slowly into the soil.

After three days the *Armillaria* had been killed down to a depth of fifteen inches. After ten days, the *Armillaria* had been killed down to twenty inches, but half of our cultures were bacterial. At that time there was no change in the number of cultures of *Trichoderma*, which averaged about 2 percent here and in the non-fumigated check areas.

But after twenty days, *Trichoderma* occurred in 60 percent of the cultures down to twenty inches, and 40 percent from twenty inches down to forty inches. After thirty days, *Trichoderma* was found in 80 percent of the cultures down to thirty-five inches, and 60 percent below that depth. After four months, *Trichoderma* occurred in over 85 percent of the cultures at all depths.

The *Armillaria* was actually killed by the carbon bisulfide at shallower depths down to fifty inches. Then bacteria came in, and then the *Trichoderma*, in that order. But at the lower depths the *Armillaria* was still alive, at least for a while, and then the *Trichoderma* came in and killed it. The *Trichoderma* wasn't killed by the fumigation.

Trichoderma lives in the soil, so you almost never isolate it from roots before you add the carbon bisulfide. It's in the soil,

but it hasn't gotten into the roots. Then you kill off or weaken the other organisms in the soil, and the Trichoderma invades.

How you work at these things, you just get puzzled about something, and then you try to find a way to answer or solve it. This winter test, alone, required twenty-six trees, twenty-six holes dug down to six feet deep, thousands of roots to be labeled, and [looking at notes], four thousand four hundred and eighty cultures to be made and analyzed.

Riess: Ultimately, what was the control?

Lewis: Well, we used carbon bisulfide. You can use carbon bisulfide or methyl bromide. Methyl bromide was just coming in at the time, and of course it's an extremely toxic material to work with and has no odor. Now, they put a small proportion of tear gas in so you can tell when it's present.

Our first introduction to methyl bromide was very dramatic. We were going to apply it experimentally up at the ranch at Wheatland. A representative of the manufacturer of methyl bromide was going to come up, I think it was at about nine or ten o'clock, to bring materials and equipment. We waited and waited, and he didn't show up. What had happened: he had treated a barn with methyl bromide the day before, and on the way to our ranch he had gone by the barn to see how the control was. There were some kind of varmints in the building. He unsealed the door, walked in, and he never came out. It killed him. So that was a very dramatic experience.

Riess: How is it applied?

Lewis: As a gas. They use it all the time now commercially. Big applications.

Adele: Commercial applications. But they have to have experts doing it. You can't do it yourself anymore. It's illegal.

Lewis: Big machinery puts it in: maybe a ten to fifteen foot-wide machine puts it in the soil and rolls plastic tarp along as a seal. They treat all strawberry fields before planting.

Riess: How did it get down to the roots?

Lewis: It's heavier than air.

Riess: It doesn't have to be injected? It can just filter down?

Lewis: No. Methyl bromide is injected, usually six inches deep, something like that, and it's sealed with plastic. We have never used it for Armillaria on peach roots. We just use carbon bisulfide. It is heavy and it goes deep.

Adele: It's not toxic; it smells like rotten eggs, it smells terrible, but it's not going to hurt you.

Applying the Information

Lewis: It's about time to say something about how we applied this information. I decided to map the entire orchard the first day I visited the ranch so we would know where and when each tree died. We kept these maps up to date, making a completely new set each year until the year the ranch was sold. This in itself was no small task, requiring about a hundred man hours each year.

The work on Armillaria was going on all this time that we were working on peas, clear up into 1950. We started working on peas in 1940, so this first ten years that we were working on peas, all this was going on at Wheatland. For a while, we had a house at Wheatland and a house at Rio Vista or Morgan Hill because we circulated around at different places.

Riess: Was there just one season that it was practical to be working on the peach problem?

Lewis: Yes. We would be back in Illinois working on peas all spring, so we would do our mapping and decide what trees to treat after we got back from the Midwest. We would go up to Wheatland and map the whole orchard. We would walk. Each of us took four trees.

Adele: No. We took eight trees, four on each side.

Lewis: Yes, that's right, four on each side. Adele would be eight trees away from me, four trees on that side, and her four trees. They were numbered one, two, three, four, five, six, seven, eight. She would call out the numbers. I usually carried the map. Sometimes she would carry the map. That way, we would just walk one row at a time, and then we would call off the numbers of the trees that looked like they should be removed and treated. Some of them would be sick and some of them would be dead.

Riess: And was this an experienced eyeball thing?

Adele: Well, mostly we could tell, but then if we had any doubts we would go over and look at the roots. We would scrape around the trunk of the tree to see if it had Armillaria.

Lewis: If it was a brand-new area that had never had the disease before, then we would always need to confirm it. We would need to confirm it always, otherwise it was, just as you say, eyeballing.

Adele: Sometimes we would find a virus-infected tree, and we would put that down on the map. We discovered different things about viruses that were interesting to the University, too. We always shared things with the University.

Lewis: When the yellow-roll-virus came along, it was a brand-new disease, and we had been mapping it for four or five years.

Adele: So we knew things about the spread of the virus that other people didn't know because we had the records.

Lewis: By mapping, we learned a lot of things, some of them not very pleasant. For instance, we learned the number of trees that died at the Wheatland Ranch the twelfth year after they were planted. They lost 1783 trees in one year. The total trees planted were about 48,000, so that's a lot of trees dying. In twenty-three years, they lost 270 acres of trees, and there are ninety trees to the acre; so that's how serious the disease was.

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Lewis: By studying our yearly maps we were able to tell exactly how fast the disease traveled from tree to tree through the orchard if left untreated. The trees were planted twenty-two feet apart, and it spread through to the next tree in about six years. So the rate of spread was about twenty-two feet in six years.

A lot of the growers were removing one or two rows of healthy trees where the disease was spreading from an infested into a clean area. They thought that by doing this, they were slowing down the spread of the disease.

Adele: [referring to the map] Like this. They were removing the healthy trees there.

Lewis: When one tree dies, there are eight trees around it that are healthy. There are that many trees around a single tree. So if you were to remove a row of healthy trees for each tree that died, you would have to kill up to eight trees. Some growers were not only pulling one row of trees around an area that was spreading into their orchard, but they were pulling out two rows.

We ran a test on it, pulling one row of healthy trees at the edge of a diseased area. [producing map] That was where we pulled a row of healthy trees around a block. Actually what we found was that if you don't dig all the roots and treat, the spread underground is just as fast, despite the fact that you pulled the trees out, because it is going underground through the roots. Most of the roots are still there. So unless you dig all the roots out and get rid of them, it's going to spread just as fast as if you hadn't removed the trees. The growers who did this thought that they were doing some good because they didn't get the disease again for six or seven years. But in those six or seven years, depending on how many trees you pull, you've lost all that production. So we shouldn't do that.

We did find, though, that where an individual tree started dying in a young block of trees--first deaths usually occur about two years after the block is planted--and you pull that tree, bring in backhoes and dig and screen the roots out, and then treat with carbon bisulfide, that that would slow the spread enough so that it paid to do it. I think we figured out that within two years you paid for the treatment just because adjoining trees wouldn't start to die. The treatment was expensive, but it still paid out. In addition, all those treated areas were replanted and the replants were producing peaches within three years.

Riess: What is the bearing life of a peach tree anyway?

Lewis: Oh, sixteen to twenty years.

Riess: What would be wrong with the idea of pulling out all the trees, and sifting all the land, and getting rid of all the roots?

Adele: That's what we did.

Lewis: Well, eventually that's what we did, except that we didn't sift or treat all the land, just a small part, and you couldn't do that unless you had maps and knew where the fungus was. Otherwise you would have to go through that whole acreage and sift all the roots and fumigate the entire acreage. It's very expensive, even the treatment the way we did it.

The Big Gamble

Lewis: About 1948 or 1949, the ranch management decided that the blocks of trees had gotten so old that production was starting to lag. That

was when they decided to pull large acreages and treat the whole thing, and they wanted to know whether it would work.

Fortunately, we had a lot of information, hard facts, on which to base our recommendations. We knew if it wasn't treated at all, the replants would live for approximately two years. Some would die even the first year if nothing was done. For several years we had planted trees on purpose in untreated areas and let them die, just to find out. You would expect well over 50 percent of them to be dead the second year and at least 90 percent of them, and maybe even close to 100 percent of them, to be dead in three years. It was obvious that you couldn't replant without doing something.

You will remember that we found out that the place where the fungus was most difficult to kill was under the healthy bark of a newly-diseased root. We took copious notes on treatments that we had done and could show that if a tree had been dead for two years or more and you treated that spot, you were practically sure to kill all the fungus, even without digging the roots. If the tree had died one year before, why, there were more escapes.

If the tree had just died--just started to show symptoms--and then you treated it, you'd get a lot of escapes where the fungus was still alive. This is exactly what you would expect, because the more recently a tree had been infected, the more roots you would expect to find with healthy, impenetrable bark. So it was obvious that the roots had to be removed from the soil of all recently-diseased trees before treatment.

Also, we had all the information on how long a tree lived when you had removed all the old trees and replanted following treatment with carbon bisulfide. We had literally thousands of examples where we dug a dead tree, removed all the roots immediately after they died in these younger orchards. They had been treated with carbon bisulfide and replanted. So we knew exactly what the chances were that the replant would live for six years, seven years, eight years, or more.

Adele: And also what their yield would be.

Riess: Did you have to do all the figures on this, or did you turn that over to someone else? I mean, these matters of yield, is that part of your work?

Lewis: Yes, we had all the figures on yield. Of course, we took yields on individual trees when we would treat these young blocks and replant one tree at a time. So we had all the figures on yield. We knew exactly what they would yield: nothing the first year, nothing the second year. They would start to yield the third year, and by the

fourth year they would be 100 percent in production. From that time on, the individual trees wouldn't increase in yield. Knowing this, we figured that if the trees all lived for more than seven years, why, the cost of the entire operation would be paid back. Of course, we knew from our previous experience that the trees would live much longer than that, so we recommended that they go ahead.

In preparation for the commercial operation, we made a new map of what the area looked like immediately before it was pulled. Every tree that died or was sick, we knew exactly where it was. Then they pulled each block of trees with a hundred feet of heavy anchor-chain fastened between two large track-laying tractors, four rows at a time. It was relentlessly frightening. The tractors never stopped, and one large tree after another toppled over.

Then the whole area was resurveyed. They had corporation surveyors there, and they put a stake where every tree had been. Then we went through with the last map we had made, and wherever they had a stake for the tree, we would put a certain tag on it to show whether it needed to be dug or not.

We knew exactly when each tree had died. If it had died two years previously, we wouldn't do anything, because by that time the fungus had destroyed all the corky bark. We knew that the carbon bisulfide would penetrate. But every tree that had died earlier than two years was marked for digging.

We also marked healthy border trees. Those were the difficult ones because in at least half of them the fungus had already started going up a root someplace. Of course, in the healthy trees, that's the hardest place to kill it. Those were the most important. So the trees in those two categories were the only trees we dug.

There were large acreages that never had to be clamshelled or backhoed. (Besides the clamshell, there were two or three backhoes in there.) That work was largely supervised by ranch foremen, but at first we were up there with the crews, training them. Adele had one gang and I had another gang. That was fun.

Adele: Yes, that was the first time I had done any real supervision.

Lewis: All the soil that was dug had to be sifted through giant screens to remove the roots. This equipment was all home-made.

Riess: When you say "home-made equipment," who made it?

Lewis: The screening equipment was made at the Del Monte Ranch at Union Island, which is in the delta.

Adele: They have a blacksmith.

Lewis: They have a big shop there.

This was big equipment, towed by a tractor and run by a gasoline motor. They made a screen out of cyclone fence, so it was about two-inch mesh. This rolled around big rollers, and it was about--let's see, it was about eight feet across, about eight by ten. The backhoe would dump its load--

Adele: It would shake.

Lewis: Well, it shook a little bit, but it rolled all the time. Dirt would fall through, and the roots would fall off the end. Then there was somebody to throw them aside so they wouldn't get covered with dirt. Those roots were taken away and burned. They dug all the roots that we recommended that they dig, and leveled it back again.

Then we made use of some unrelated information we had developed several years earlier when a so-called "replant problem" had occurred on the ranch. Where you replant peaches after peaches, they don't grow well. The ranch had a big block of young trees that had been replanted in an area where they had already grown peaches. There was no *Armillaria* involved in that particular area], but they lost over half the trees the first year and the remaining trees were very spindly and hardly grew at all. The previous planting had been beautiful. It was the replant problem, so we tried a lot of things.

This was all done in conjunction with Dr. Louis Proebsting and the University of California at Davis. Proebsting tried all kinds of chemicals, oxidizing agents, minor elements, fertilizers, and so forth, treating four tree spaces with each chemical. Dr. Leonard Day tested various rootstocks: plum, apricot, and several peach varieties. Of the seventeen chemicals tested, only potassium permanganate was partially successful.

All the rootstocks except peach grew beautifully, but none of the peach varieties survived. We knew that where we had treated with carbon bisulfide for *Armillaria* we didn't have any replant problems, so we also included eight trees in spaces treated with carbon bisulfide in a six by six foot area. The trees grew beautifully wherever we did this. So then the whole young block that they were replanting was treated with carbon bisulfide. It

produced a beautiful block. So we made use of this information in our big Armillaria project.

Before treating the area with carbon bisulfide, we mapped it out again. Wherever the original trees had been healthy and the roots had not been dug, they treated only a six foot by six foot area. The tractor-drawn carbon bisulfide injecting machine treated a six foot swath as it went through. We had it modified so that they could turn it on and off. As they came to these stakes marking the previously-healthy trees, the tractor driver would pull the lever, and it would inject for only six feet where these trees were. Wherever there had been Armillaria, then that area was treated solidly.

We saved a lot of money in digging because we had this information that you don't have to dig the roots if the tree has been dead for two years or more. Also, we saved a lot of money by treating only the six by six foot area where the replant problem was anticipated. Altogether, we did treat seven hundred acres. That's a lot.

Adele: There were a lot of people in on this, interested in it. We had visitors: Dennis Garrett from England, Noel Flentje from Australia, Ellis Darley from U.C. Riverside, and Bob Raabe from Berkeley. These people are all Ph.D.s, you know, from all countries that came to see this operation. They were really impressed.

Lewis: Now, I just wanted to finish up on this thing. On the area where we treated for Armillaria there were seven hundred acres, or 63,000 trees. In the original planting at the end of the fifth year, 1972 trees had died of Armillaria. And where we treated, in that same length of time, only 175 trees died, less than one-tenth the original number. So that was the difference between the original planting which was untreated and the replanting.

And this despite the fact that Armillaria was much more widespread in the treated area by the time it had gone through the original twenty-year cycle. So it did slow down the disease a lot, the trees grew beautifully, and there was not a sign of the replant problem.

Adele: That was exactly what you predicted, too, wasn't it?

Lewis: No, it was even better than I predicted. Tree deaths were about half of what I predicted. With the prediction, it would make money. So it did work, and it did pay for itself by the end of the seventh year.

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Riess: I go with friends and pick peaches every summer. I'd never thought about any problems that small ranch might be having. What about the people who weren't Del Monte? Were they dealing with it in the same way? Could people do it as a sort of home remedy?

Lewis: No, I don't think so. Of course, you can hand-dig roots. We have it in our yard here, and we just replanted a tree. I hand-dug the roots out. It's a lot easier with a backhoe, though. But you can't get a backhoe into your yard, you see.

Riess: What about small peach-growing outfits? How did they deal with it?

Lewis: They mostly replant with walnuts, which are resistant.

Riess: Well then, the surviving peach orchards, do they represent an area that has never had the infestation?

Lewis: Yes, although its fairly widespread up in the Marysville area. But that's true, many of the peach orchards don't have it as a problem.

Economics and Quality

Riess: I read somewhere in my notes on Del Monte that the LaFollette Committee testified that--well, in 1948 Del Monte was growing a quarter of the peaches that were consumed. The LaFollette Committee testified they could have bought those peaches cheaper than producing them themselves.

Lewis: Yes, but with their own ranches they knew that they had a reliable supply of raw fruit. The biggest danger where you have a national trademark, the Del Monte label, is not having your product available for grocery stores. If it drops off the store shelves for a year, why, you're in big trouble. You have to have a supply. They were so big in canned peaches that they just felt that they had to grow enough of their crop so that they knew that they would have a supply of peaches.

There's another cost factor in corporate farming that maybe the LaFollette Committee didn't consider. Del Monte charged as much of its overhead, the main office in San Francisco, the sales force, the district offices, to the ranches as it did to the canneries. When the ranches were sold, all that overhead remained the same and had to be absorbed by the canneries. The Corporate ranches would have made a lot more money if it weren't for those overhead charges.

Now they don't grow any of their own peaches anymore, and so that's all finished. It's a new policy now. Maybe they could buy them cheaper than they could grow them, and maybe they couldn't, but they knew they could get them when they wanted them, and the quality.

Adele: The quality was very important to them.

Lewis: The quality of the peaches at the Wheatland Ranch was another factor, and the size. They were big. They were good.

Riess: When Del Monte would market them, would it be a different label, or would they mix them in with all their other peaches?

Adele: No, they mix them in.

Lewis: They mix them in. You can get good-quality peaches.

Adele: Some of our problems were getting the fruit too big, and then you would have to can sliced peaches, and there wasn't as much money in sliced peaches. So we had to do a lot of experiments on that to get them just the right size, what Del Monte called the "melba" peach. They grew so well at Wheatland that you just had a hard time holding down the size, so we had sizing experiments.

Lewis: Yes, peaches are thinned to a certain number per tree, and you had to leave more on the tree in order to make them smaller, and then you had to prop trees. We practically had a whole lumberyard of props.

Adele: And we had irrigation experiments, timing of irrigation, because if you irrigated at a certain time, the fruit would swell up more, or faster.

Lewis: Yes, they wanted to know what irrigation had to do with quality.

We had a big irrigation experiment at several of the ranches at the same time, where you would withhold irrigation so many days before harvest. In the one we had at Wheatland, we irrigated one of the plots right up to the day they were picking. They actually had their ladders out there and were picking trees where the water was still flowing to the trees. They found there was no difference in quality. It was interesting. They thought there would be a difference in flavor or something from dilution--more water in the fruit--but there wasn't.

- Riess: When you started out, did you have any notion that you could lick it in a year or two? Did you think it was going to be easier than it was?
- Lewis: I don't think I thought about that. I think all that we were thinking about was what we could learn about it. We were disturbed by the fact that we weren't killing it 100 percent and why. I think that was all we thought about at the time.
- Riess: Given what I know about the history of this field, it all goes slowly. You knock something out one place and it crops up someplace else.
- Adele: Research is slow. Research is a slow process, on almost anything. I remember that we heard about Madame Curie in the movie, that it took "five long years" to find out about this radiation effect. We thought that was so funny. "Five long years" was a very short time to make such a phenomenal discovery.
- Lewis: Yes, I remember her handling the radium with her bare hands.
[chuckles]
- Adele: We've been so successful at everything we've done that it's been phenomenal when we're going through, reviewing this thing. Maybe it was a lot of years, but we've been just real fortunate.
- Riess: Well, it's interesting. It's patience, and, I guess, the set of expectations are different. Del Monte doesn't say to you, "You've got three years to get this problem solved."
- Adele: That's right.
- Riess: That's not their attitude, is it?
- Adele: It is now, probably. Things change as management changes.
- Lewis: Yes, things changed. You now have to show that things will pay out in two years or something like that. It's a shorter time.

Planting peaches--even if there's no disease at all, you can't expect it to pay out for--well, first of all, you don't get any crop for two years. You get zero for two years. It's a longtime project. I guess they had to stop growing their own.



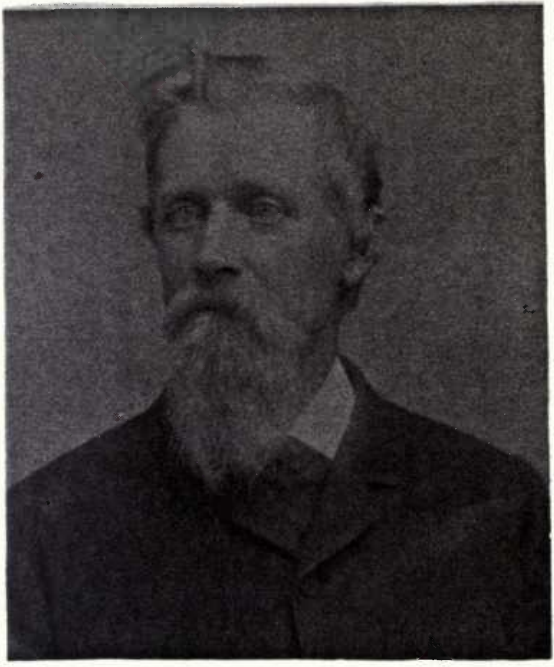
George Staheli
Band and choir leader of renown in both Switzerland and Utah's Dixie and surrounding towns.



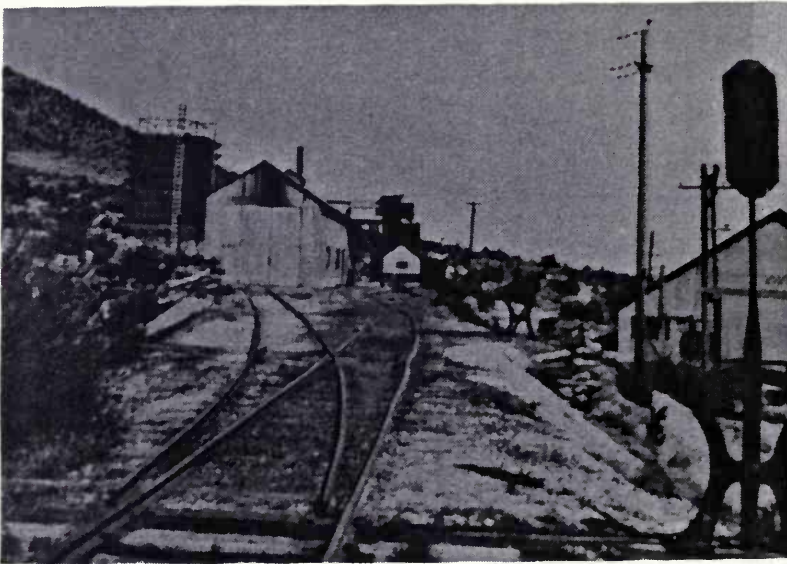
Lewis' great grandfather, George Staheli, (photo from "*Under Dixie Skies*"), and the Mormon Temple at St George, Utah, where the Staheli band played for the ground-breaking ceremony, the laying of the cornerstone, and the dedication ceremony. At the latter occasion, the band was stationed on the high balcony, near the top of the tower. Including George Staheli, there were twelve members in the band. Instruments included three trombones, two cornets, a tuba, and a tenor horn, all obtained from Germany by a fellow Swiss immigrant, John Eaton, in lieu of money owed him by an estate in his homeland. "These instruments were a veritable gift from the Gods to our people hungering to express themselves in music." All the music parts for each instrument were hand written by Staheli, in all a repertoire of 108 numbers. (From memoirs by John and Barbara Staheli)



Open barn and corral on the Staheli property at Santa Clara, Utah, where Lewis' grandmother, Mary Staheli, spent most of her childhood. The property comprised some ten acres devoted to grapes, grain, and truck crops. She tells of picking string beans here, and always carrying a long stick to make the rattlesnakes rattle before she accidentally picked one instead of a bean.



Mary Staheli Olson and Hans Olson. Photos taken in Los Angeles about 1898.

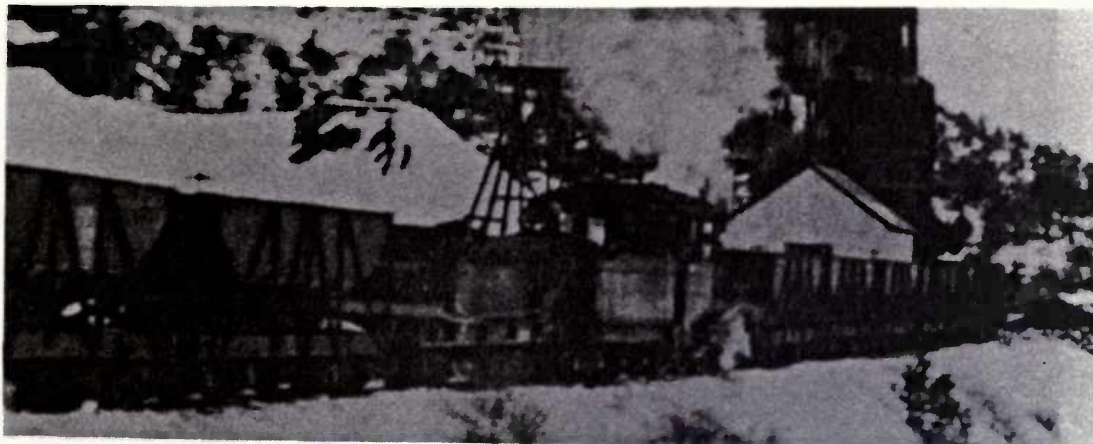


Spur of the Pioche Pacific Railroad at Jackrabbit in 1879.

(Photo courtesy Pioche Library)

Note the stub type switch used in early-day railroading. The spur line ends about 100 yards beyond the building at the left, alongside the bins at the base of the spectacular aerial tramway which conveyed the ore to the gondola cars. Housing, where Lewis' mother was born, was located on the sloping hill beyond.

The mines at Pioche were financed by a San Francisco business man, S.F. Pioche, in 1870, and operated until 1875. During this time \$16,908,000 worth of gold and silver ore was extracted. The population reached a peak of over 5000 in 1872-3, and was less than half that 3 years later. The mine at Jackrabbit, owned by the Bristol Silver Mine Company, started operations in 1876, about the same time as the Pioche mines were closing, and operated at full capacity for about ten years. Jackrabbit never had a population of more than 100, and in 1877, when Lewis' mother was born, the population was increased from 66 to 67 by her birth. She was three years old when the picture above was taken.



Ore cars being loaded at Jackrabbit, 1879. (Photo courtesy Pioche Library)



Adele and Lewis at the Jackrabbit mine in 1974.
Aerial tramway footings in the rear.



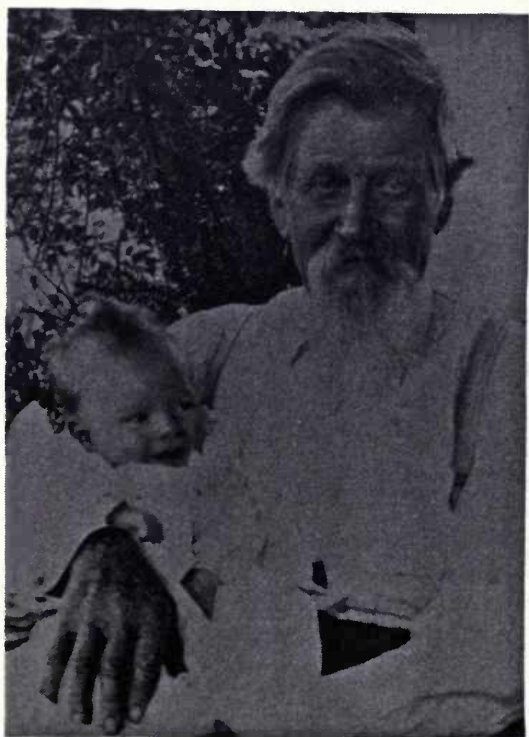
Adele in doorway of one of the few remaining
buildings at the Jackrabbit mine site.



Farm site at Spring Valley, Nevada, where Lewis' grandfather and grandmother Olson farmed
with his grandmother's sister, Elizabeth (Aunt Lizzie) and her husband, Francis Walker.



Ida Olson Lawyer and Arthur A. Lawyer, Lewis' parents.
Ida on the day she received an honorary life membership in the PTA, and Arthur
in 1906, shortly after they were married.



Above
Grandpa Hans Olson, 75,
with Lewis, 11 weeks.

August 3, 1907

Below
Lewis' childhood home, 30 North Third Street,
Alhambra. Dad, Lewis, and Aunt Minnie, seated,
with Uncle Gene Lawyer and Lewis' mother, rear.
Note wicker baby buggy.

September 1907





Hans Olson home on North Wilson Avenue,
(now Atlantic Boulevard), in Alhambra. 1908.



Lewis and "Tommy Cat",
October, 1909



Family group in front of Olson home, June 1908.
Lewis in stroller with grandmother and mother.
Cousin Donald sitting with his mother.

Mrs. A. A. Lawyer entertained on Monday afternoon with a party in honor of the third birthday anniversary of her little son, Lewis O. Lawyer. The guests included Mrs. James Bennett, Winnifred Bennett, Mrs. R. R. Behlow, Lewis Behlow, Mrs. Dura Blackburn, Barbara Blackburn, Mrs. D. D. Bronaugh, Richard Bronaugh, Mrs. Ralph Cunningham, Elizabeth and Edwin Cunningham, Mrs. M. S. Charles, Olga and Glenn Charles, Mrs. Walter Lattin and Ralph Lattin, Mrs. Henry Olson, Donald Olson, Mrs. H. O. Olson, Mrs. E. S. Lawyer and Miss Eleanor Rich.

L.A. Times, May 18, 1910, an unsophisticated world.



Above: Lewis on his second birthday in 1909. Right: With his sister, Betty, and brother, Dick, in 1914.

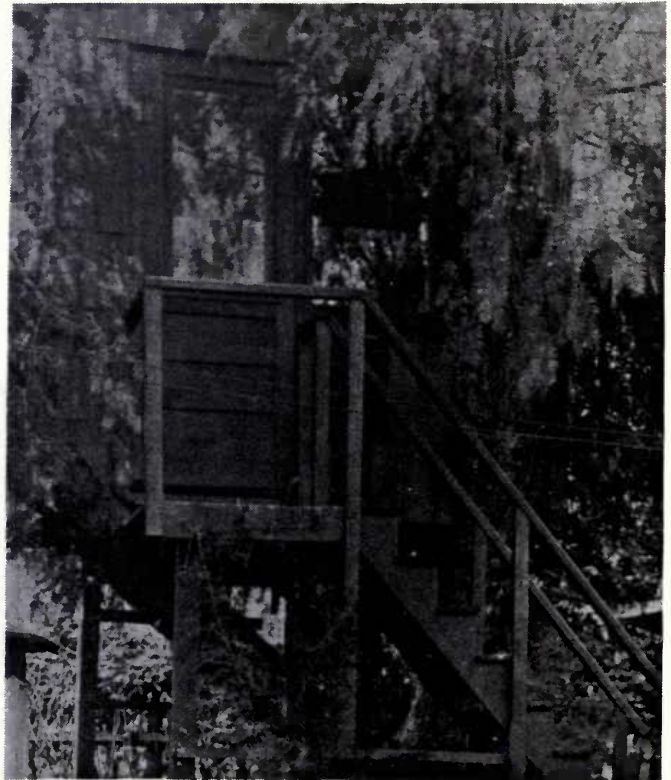




TWO MEANS OF TRANSPORTATION

Left: Grandpa Olson takes Lewis for a ride in his home-made, barrel-stave wheelbarrow. June, 1908.

Above: Lewis in the coaster built for him by his father and Uncle Henry in 1913. It had a brake which dragged on the ground when you stepped on it, and was steered by means of a rope attached to the base of the steering wheel shaft. Note the notches cut by the front wheel due to sharp turning.



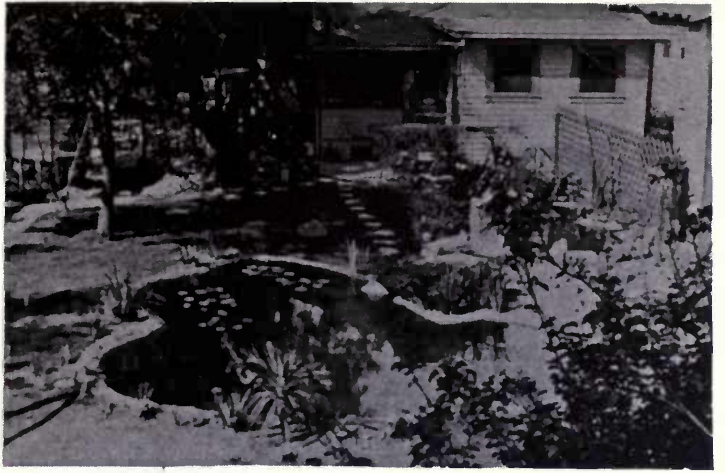
TREE HOUSE

As originally constructed in 1914 between three limbs of a pepper tree. An open platform with surrounding benches.

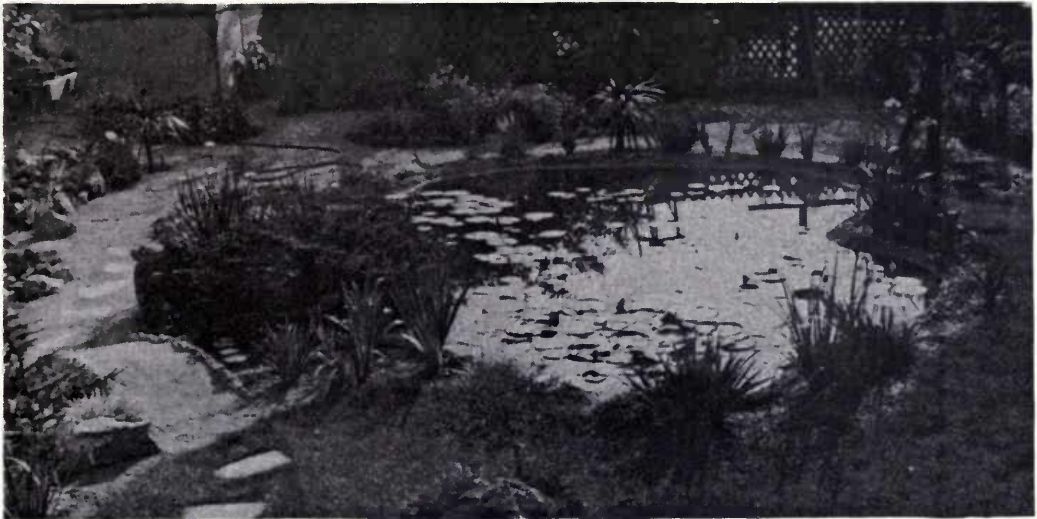
As transformed into a bedroom in 1930. The windows were completely removable on 3 sides, leaving only screens for the summer.



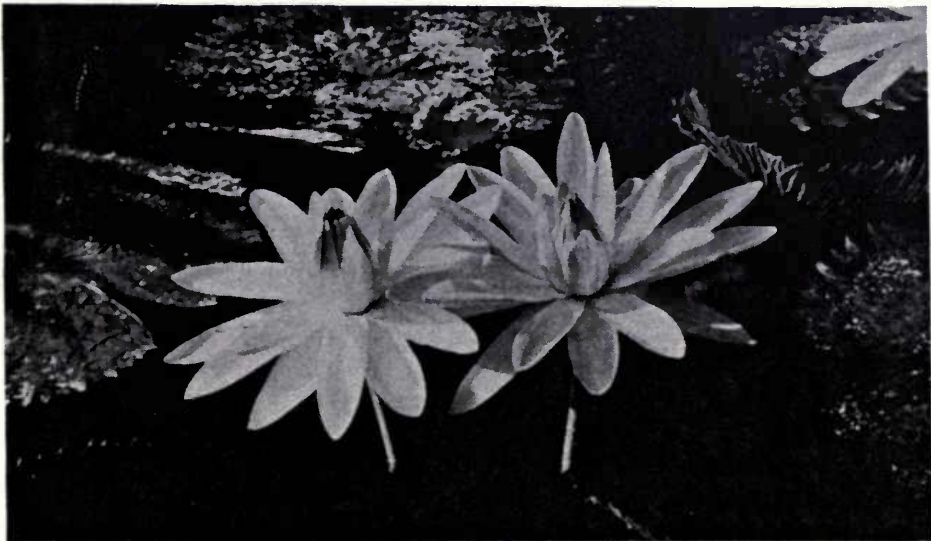
Lewis and first pool, 1924.



Two connecting pools, constructed in 1926 and 1931.



The new pool as seen out the bedroom window. The connecting pool is out of the picture to the left of the bridge, and is about half the size of the one pictured. The lattice fence in the rear hides the chicken coop and a large greenhouse for tropical fish and exotic plants.



Tropical night-blooming water lilies in the large pool.

Sydney, Australia, to Alhambra By Radio -- 8500 Miles

LOCAL RADIO FAN SETS NEW DISTANCE RECORD

Lewis Lawyer picked up Sydney, as letter stated, on an 8-Tube Superhetrodyne Radio Set a loop aerial — NO OUTSIDE AERIAL, NO BOOSTER — ON A LOUD-SPEAKER. Lawyer was the first on the coast to pick up LONDON last year.

Above: June, 1925. Article in the Alhambra Post Advocate regarding the reception of 2BL, Sydney, Australia, and, right: copy of letter received from the Sydney station, and the clipping from the Sydney newspaper which was enclosed.

Below: Newspaper article regarding the reception of 2LO, London, a year earlier.

HEARD LONDON RADIO MESSAGE IN ALHAMBRA

Said To Be First Feat of Kind
On Pacific Coast

Lewis Lawyer, an Alhambra high school boy, is enjoying the distinction of having been the first person, young or old, scientific or otherwise, to pick up London by radio here on the Pacific coast.

Lewis lives at 30 North Third street with his parents, Mr. and Mrs. Arthur A. Lawyer. Listening in on his radio about 6 o'clock on the evening of March 12, he heard messages read from Paris and snatches of musical numbers, followed by the "signing off" of the British Broadcasting Co. On the 13th, the following night, his radio set again brought the London broadcasting.

Lewis Lawyer, young radio enthusiast, holds a letter he received from Sydney, Australia, this week which verifies his belief that he heard a concert from that distant station one night last February on his eight-tube super-hetrodyne radio. This is the first time that a station over 8000 miles away has been heard in Alhambra. He heard the station call and

later got a catalog which located that station as Sydney Broadcasters Limited. He wrote them about it and this week got a verification. Lawyer startled radio fans a year ago when he picked up London on his set. He was one of the first Alhambra boys to take up radio and has perfected it in many ways. He has no outside aerial and received Sydney on the loud speaker attachment.



2 B.L.

BROADCASTERS (SYDNEY) LIMITED

SUITE 4, 1st FLOOR, FULLER'S BUILDINGS
KING AND ELIZABETH STREETS

Address Communications to Box 378 G.P.O. Sydney

Telephone B 7571, 3 Lines

Cable Address: "Broadcast," Sydney

7th April, 1925.

Lewis O. Lawyer, Esq.,
30 N. 3rd Street,
Alhambra,
CALIFORNIA.

Dear Sir:

Your letter of the 15th February received. You will be pleased to learn that we have no doubt that you were actually in touch with our Station and attached you will find a newspaper cutting in accordance therewith.

Our power is at present 500 watts, but in a couple of months' time it will be increased to 5,000.

Yours cordially,

BROADCASTERS (SYDNEY) LIMITED.

Per *[Signature]*

Encl.

HEARD IN U.S.A.

2BLS PIANO TINKLES IN
CALIFORNIA

Australian broadcasting has been heard in U.S.A.

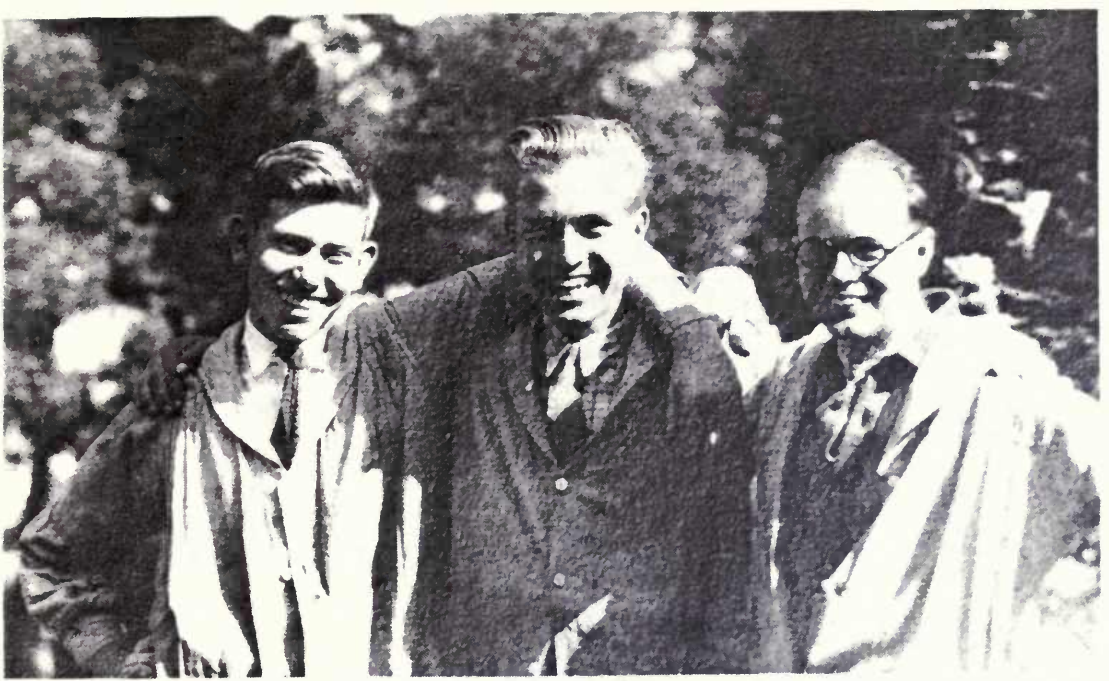
Broadcasters Ltd., 2BL, was received by an enthusiast in Alhambra, California, on February 12.

In a letter to Broadcasters Ltd. he stated that he heard piano music faintly, and then the call letters of the station.

He used an eight tube superhetrodyne set with a loud speaker.

Broadcasters have received also a number of enthusiastic letters from people in New Zealand.

The logging of long distance radio stations was the "in" thing with radiophiles of that era. 2LO, London, which Lewis logged in 1924, was picked up with a Neutrodyne and an 80-foot-high outdoor antenna. 2BL, Sydney, and, later, stations in Adelaide and Melbourne, were picked up with only an indoor loop antenna which was about two feet in diameter. The advantage of the latter type antenna, however, was that it could be rotated and thus was highly directional.



AT OTIS ART INSTITUTE, 1927

Lewis, center, with friends, Wilfred Jackson, left, and Lawrence Hinckley, right. Jackson joined Disney Studios, becoming their first Director other than Walt himself, and the first person ever to work out a method for synchronizing sound with animation. Hinckley made his home in Ojai, California, as a fine artist.



Above: Lewis with group of Otis students on a sketching trip to San Pedro harbor.



Right: Edouard Vysekal, fine arts teacher, Otis.



Above: Roscoe Shrader, landscape artist, composition and illustration teacher, Otis.



TWO CHARCOAL SKETCHES

Drawn while at Otis.

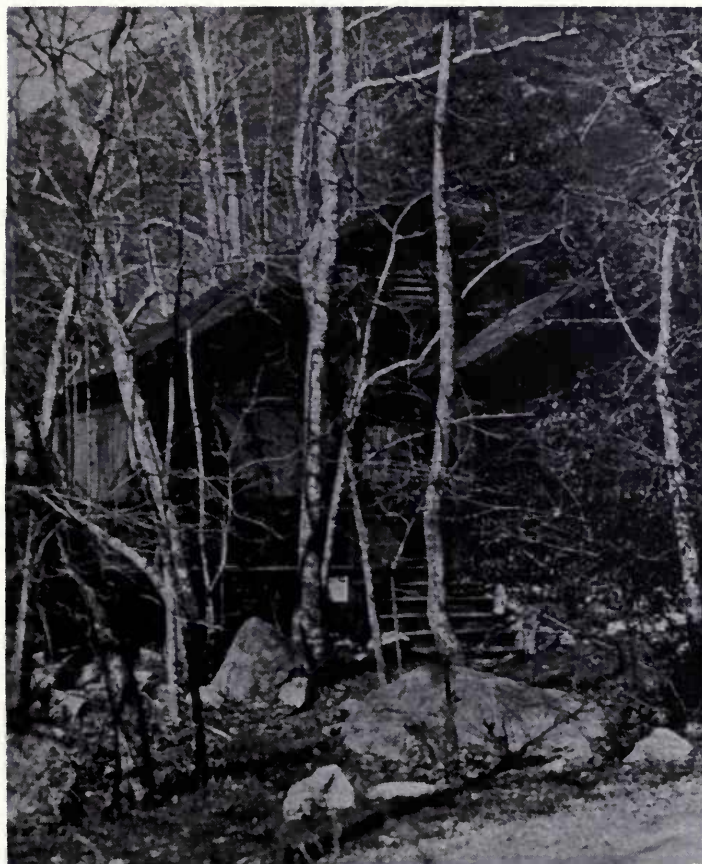
Above: Lewis' sister, Betty.
Right: Lewis' grandfather, Hans Olson. Both of these sketches were made from photographs and were submitted as part of the requirements for completion of an illustration course taught by Roscoe Shrader.

Betty was also interested in art and, after college, worked in the color department at Disney Studios. While there she met her husband, Ward Kimball, Animator, Director, and, as was Wilfred Jackson, pictured on the previous page, one of the "Nine Old Men" at Disney.

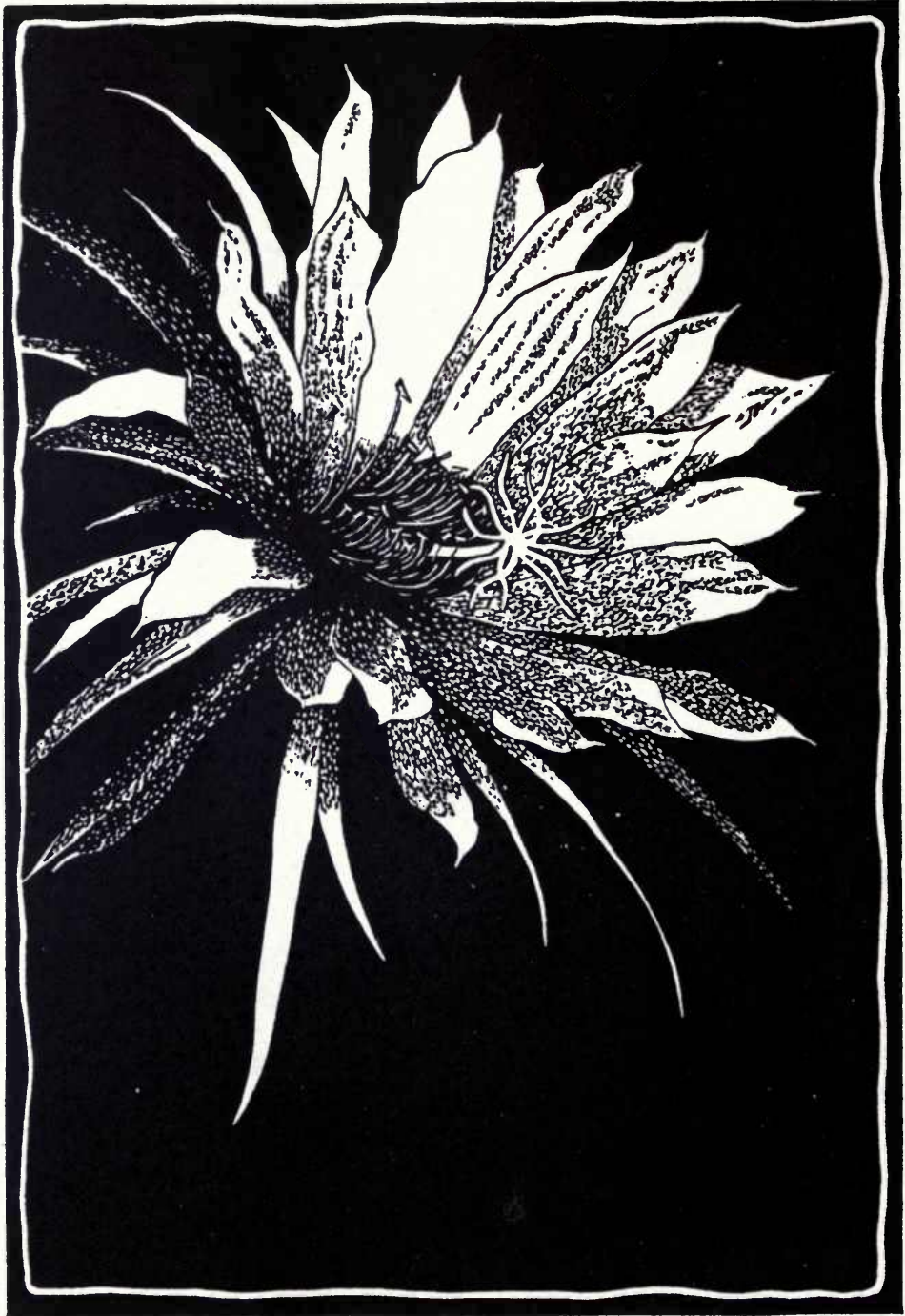




Lewis with his family on the porch at the Camp Baldy cabin, which they designed and built in 1924. With him are his sister, Betty, his mother and father, and his brother, Dick. Early spring, 1931.



The Lawyer family cabin at Camp Baldy where Lewis lived while attending Chaffey Junior College at Ontario. The cabin was about fifty minutes from their Alhambra home, and fifteen minutes from Chaffey by bus. It was a great place to study because he had that part of the canyon much to himself most of the time.



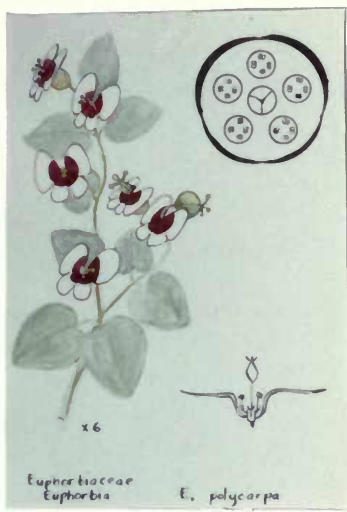
Night Blooming Cereus (*Nyctocereus serpentinus*)
Block print cut for Chaffey Junior College poetry magazine,
DRIFTWOOD, May, 1934



Two more of Lewis' block prints from DRIFTWOOD, the one above was entitled "Winter" and appeared in the March, 1934 issue. It features two trees on the divide between San Antonio and Lytle Creek canyons. The one on the right was created for Elsie Stevens' caption carved in the attached panel.



Above: One of five block prints created for THE FIRST CALIFORNIANS, a pageant by Mabel A. Stanford, Lewis' journalism teacher. The Saunders Studio Press, 1934.



FROM THE MOJAVE DESERT

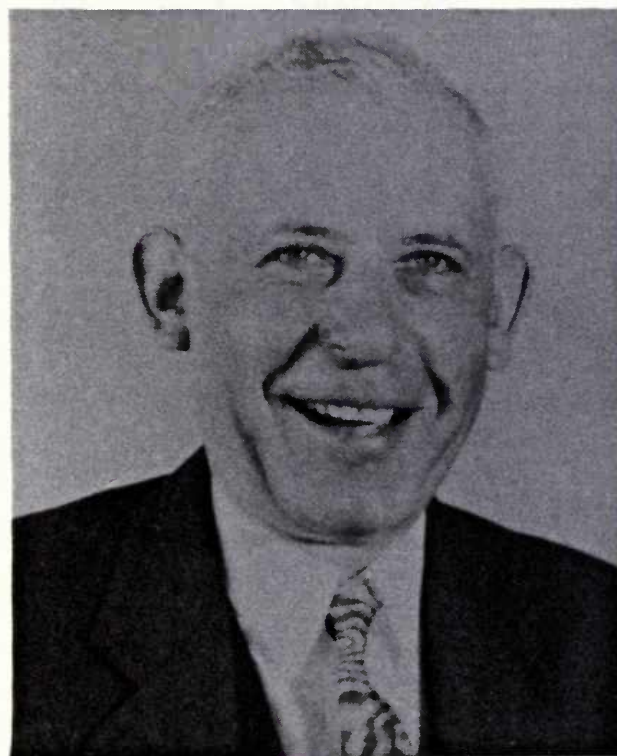
Four examples of the 84 botanical cards made by Lewis and his sister Betty in the Mojave Desert near Littlerock, and a picture of the cave dwelling in the Mojave north of Hinkley where Lewis and two friends from the geology class at Chaffey spent the night with some friendly rats on a rock-hunting trip.

The botanical drawings, shown here half size, were selected to represent four types of flowers. First a Euphorbia, where the involucre resembles a flower, but actually consists of bracts, similar to the sepals of regular flowers, enclosing several small staminate flowers and one pistillate flower. Bracts or sepals are shown in solid black, petals in outline. Second, a legume with highly irregular flowers having 5 petals: a large banner, two wings, and two joined together at the edges to form the keel. Third a Diplacus with irregular, joined-together petals. And fourth a Compositae, the "flower" of which is composed of two types of flowers, ray and disk.

On the geology trip we were searching in part for opalized petrified wood, motivated by the fact that the finest fire opal we had ever seen was found by a Barstow rock hound in the center of a large log of petrified wood which he discovered near Opal Mountain. For many years he had supported himself by selling little chunks of that log. We found some beautiful, very large, crystal-centered geodes, but no petrified wood, and I'm afraid that log was the only one of its kind in the State.



Ignatz Loewy, Adele's maternal grandfather, came from Austria as did her grandmother, Celia Birns. They met and married in New York City. Here they raised four children, three daughters, Sadye, Nedye, and Ada, and one son, Maurice.



Rudolph Schwartz



Nedye Schwartz

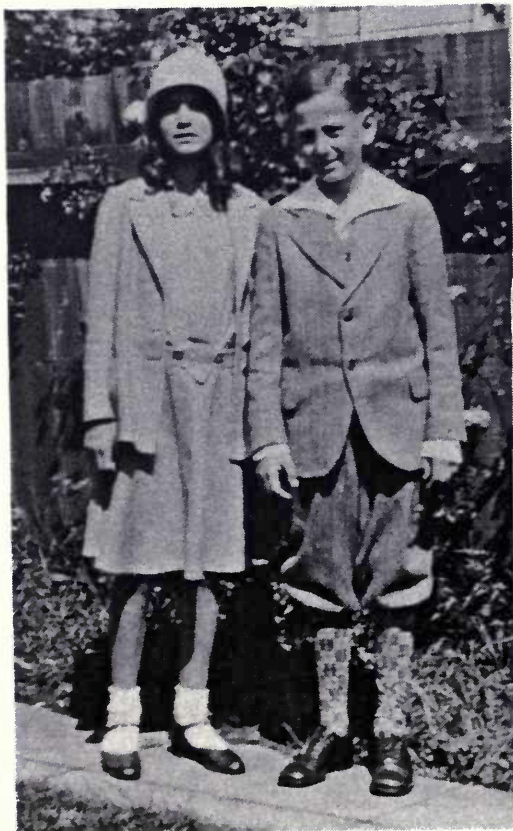
Adele's father, Rudolph Schwartz, was born in Poland and came to New York City at an early age. His father died when he was twelve, and as the oldest of 9 siblings, it was necessary that he quit school to support them. After meeting these obligations, he moved to San Francisco, and married Nedye Loewy there. Rudolph died at 55, and Nedye raised their two children, Adele and Abbott thereafter.



Adele, 4, gives her brother, Abbott, a ride on her tricycle.



Adele practicing "Expressive dancing", complete with tie-dye scarf.



Adele, 10, with her brother.



Adele, fifth grade, doing an Egyptian dance to Grieg's *Anitra's Dance*. School-made accessories, and dress by mother.



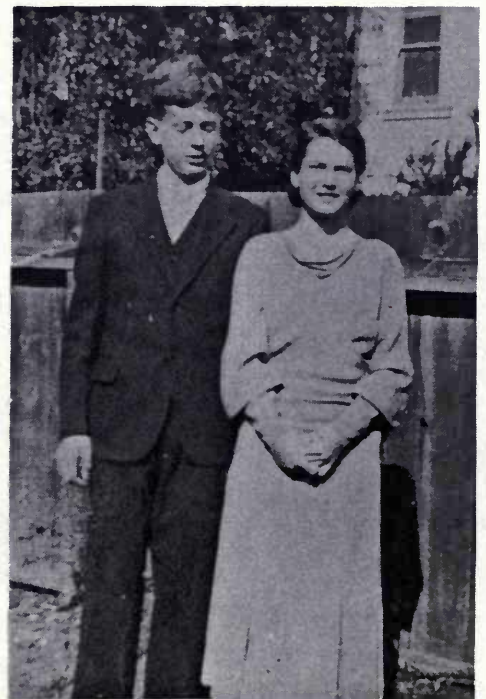
Adele in jodhpurs, ready for her riding lesson in Golden Gate Park.



Adele, Fatima, in sixth grade operata, *Ali Baba and the Forty Thieves*.



At fifteen Adele was a senior at Lowell High School.



Adele, 16, with her brother. At this time she was commuting from San Francisco to U.C. Berkeley on the streetcar, ferry, and Key system train.



Professor Ralph E. Smith

Founder and first Chairman of the Department of Plant Pathology at U.C. Berkeley. Photographed on a visit to the Del Monte Agricultural Research headquarters at San Leandro.

Photo by P. D. Caldis, 1953.



Dr. J. T. Barrett

Professor of Plant Pathology, and Lewis' inspiration to join the Department of Plant Pathology..



Above: Adele and Lewis with Max Gardner, Chairman of the Department of Plant Pathology, at the celebration of the 50th Anniversary of Plant Pathology at Berkeley, 1953.

Right: Harvey Thomas, tree disease expert. A miniature tea rose Harvey gave us is still a fixture in our garden



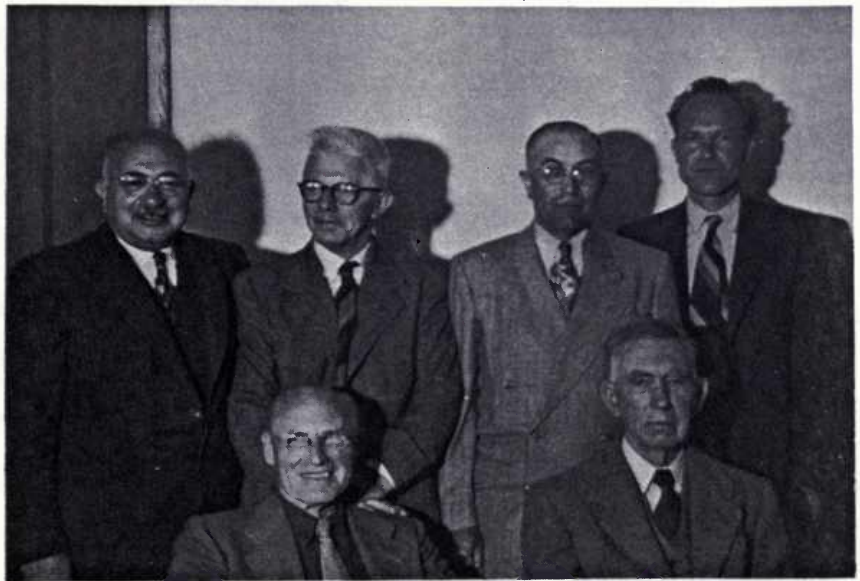
Bill Takahashi with his son, Keith, 1953. Our first date was with Bill and his wife, Rose.





Ernest Babcock, Professor of Genetics, and William Chandler, Pomologist. Both were renowned for their scientific and academic accomplishments, yet both were excellent examples of everything a good teacher should be. It is a sobering fact, however, that Babcock, despite the very timely nature of his lectures, was unable to include any mention of the yet-to-be-discovered basic machinery of genetics: the DNA, the RNA, and the helix! We felt fortunate that both of these fine gentlemen became prized friends.

Photos courtesy Plant Pathology Library, U.C. Berkeley.



Left, Harold Thomas, Lewis' major professor, and partner in the *Armillaria* research, and, right, a group of U.C. plant pathologists visit the Del Monte Corporation laboratories at San Leandro, 1953.

Harold continued his interest in our *Armillaria* work long after joining the Strawberry Institute, and he and his wife, Helene, were lifelong friends. In the group picture are Panos D. Caldis, our boss during most of our Del Monte days, Nick Hansen of "Snyder and Hansen" fame, Harold Thomas, Lewis, and, seated, Marion Goldsworthy, and Ralph Smith. Several of the U.C. professors were frequent visitors, but this was a special occasion to show Ralph Smith our facilities. Another such special occasion was when William Chandler visited us and we could show him our work on peas.



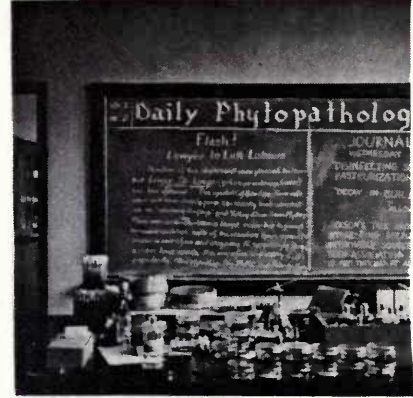
Both bridges were under construction when Lewis took these pictures of the Bay Bridge from Treasure Island. Left: looking toward San Francisco, Center: from the tunnel, and Right: toward Berkeley.



Lewis' desk in his apartment on Milvia, three blocks from the campus, 1935.



Eric, the noble dog of the Gill Tract.



The lab desk where Lewis and Adele worked, and our blackboard daily "newspaper".



THE START OF THE ARMILLARIA WORK

Left: The University plot area in an apricot orchard at Niles. Center: Lewis sitting on the bumper of the University transportation of the day. Right: Lewis is in the hole, digging roots in one of the two treated areas. At this time, no attempt was made to keep track of exactly where each root came from. Later, each root piece would be tagged as to its depth and distance from the original tree site, and when cultured, would be measured for its diameter.



Lewis showing Adele an Armillaria-infested peach root at the Wheatland Ranch in the spring of 1937. This was the second of two trips made to the ranch so that Adele could learn more about the origin of all those roots they were culturing at the University lab.



MARRIAGE

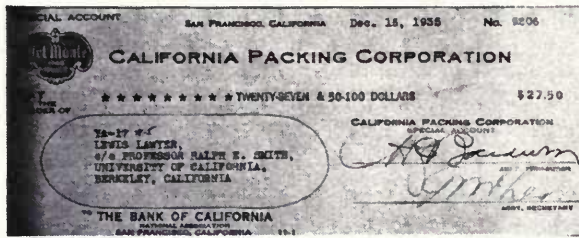
Adele and Lewis on the lawn of the Yuba City Courthouse where they were married. Friday the thirteenth of August, 1937.



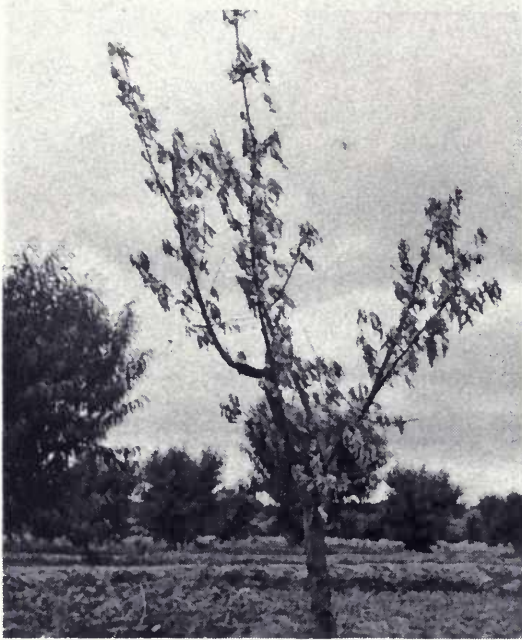
This picture was taken as they were leaving Yuba City on their honeymoon to Mt. Rainier and Seattle.



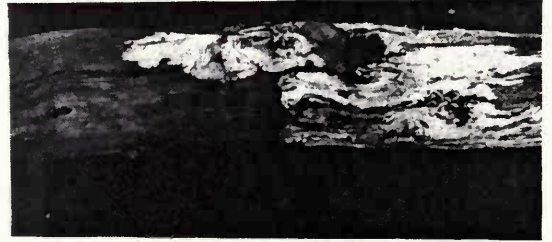
And they lived happily ever after.



Lewis' first professional check - \$27.50



"Instant death" symptoms typical of an Armillaria-infected peach tree.



Armillaria symptoms. Top: Bark peeled away to show fungal mats. Bottom: Armillaria mushrooms.



Plot ready for chloropicrin fumigation. Stakes mark spots where the injector will be inserted.



Applying chloropicrin and sealing with a plastic tarp. This treatment proved to be unsuccessful.



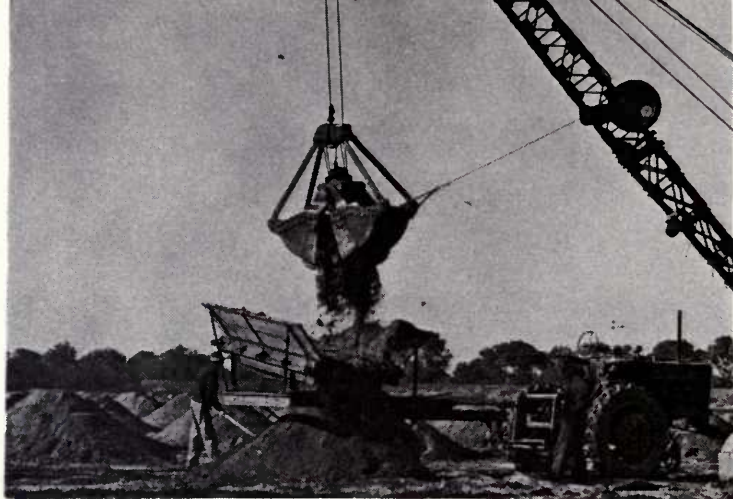
Upper left: Treating an Armillaria area at Wheatland Ranch with carbon bisulfide. Injections were made every 18 inches, and Lewis improvised the movable board markers to replace the time-consuming practice of measuring and placing stakes to mark the insertion points. Notches were cut every 18 inches along both sides of the double-board marker, and every 36 inches along one edge of the single boards which marked the ends.

Upper right: Digging roots at Wheatland. Holes were 6 feet wide by 12 feet long, and as deep as the roots were found, (up to 8 feet). Holes were dug in layers, one foot at a time, and all the roots in each layer placed in separate bags for culturing.

Above: Studying the method of spread of the Armillaria fungus. To take this picture, soil was removed from above the roots, and sheets of white paper placed beneath them. Armillaria lives only in the roots of plants, and can not exist in the soil except in the form of rhizomorphs (fungal strands) which can extend out from an infected root for distances up to about a foot, and infect a neighboring root by penetration. Here a diseased root from a tree above enters the picture from the upper right, and crosses over two roots from a healthy tree below. Rhizomorphs are penetrating both roots of the healthy tree, and infection has already spread about three feet in one of the two roots.



How bad was the disease? Ten years before this photo was taken, this was a solid planting of peach trees.

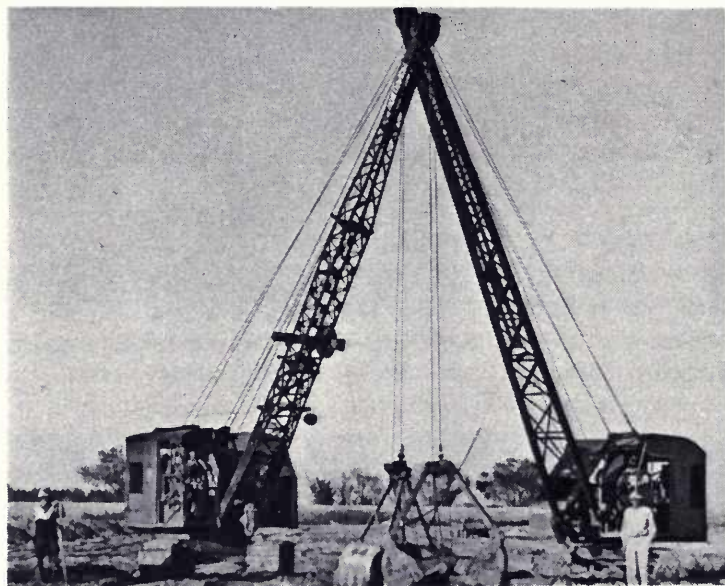


THE BIG GAMBLE

In 1948, after ten years of research, during which time only small acreages had been treated to control Armillaria, the Corporation decided to pull all the remaining old trees and treat the 700 acres with carbon bisulfide.

Upper left: A clamshell starts digging the old diseased roots.

Upper right: The clamshell drops a load of earth and roots onto the large rolling screen. Soil drops through the screen and the roots are carried to the end of the rig to be hauled away and burned. Note the large piles of soil to the left of the rig which mark areas already dug and sifted.



Left: After several months of digging, the job is completed and the two clamshells shake hands, ignoring the two backhoes which were also employed in the project. The holes were filled, the land leveled, and it was time to inject the carbon bisulfide.



Tractor-drawn machine injecting carbon bisulfide. In the rear, sprinklers are sealing the surface with "rain".



In her home-made folding crib at Wheatland.

LORI LEARNS TO COPE WITH THE LAWYER LIFE STYLE



To feed herself when her parents are busy. Rio Vista, May 1939.



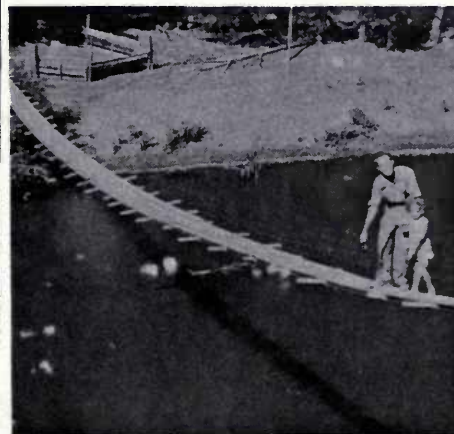
To furnish her own transportation. Montezuma, Oct. 28, '39.



To keep herself neat. Marysville Hotel bathtub, August, 1939.



To take care of herself. Sand box, Morgan Hill greenhouse, February, 1941.



To cross her bridges carefully. Yakima River bridge, August, 1946.



To enjoy life and nature. Irrigation canal, Ogden, Utah, April, 1946.



The "Blue Room" at Wheatland Ranch. Pointer and Curly read the Sunday paper. March, '38.



Adele and Lewis inspect a tomato field at Woodland. August, 1939



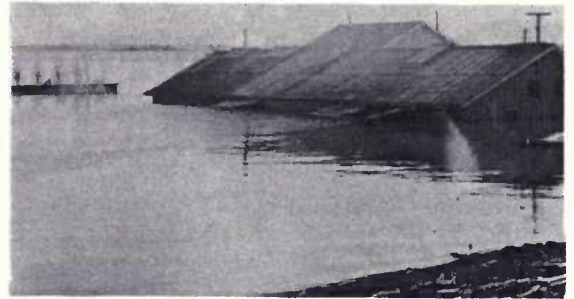
Adele and Lewis in their improvised Plymouth "camper". Lewis fitted the trunk area with an inner-spring mattress.



Lewis and Adele go back to school.



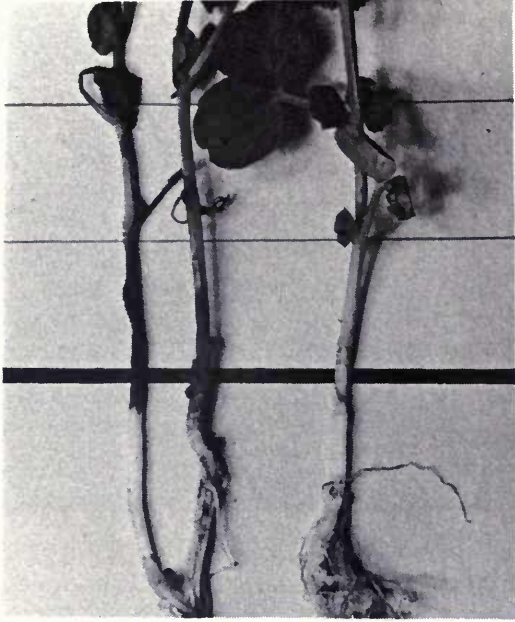
Adele at one of the Del Monte ranch research meetings. One woman, forty five men. George Nyland, stone-fruit virologist, U.C.Davis, offers Adele a cigar to make her feel at home.



FLOOD!

On the morning of February 29, 1940, Adele walked to the top of the levee in front of our Montezuma home to check out the water level with her toe. It was just six inches below the top of the levee, and was predicted to rise higher the next morning. We and the other six families living at the ranch compound were told to get all our belongings out of our houses. We hurriedly packed everything in Del Monte lug boxes. Then several moving vans and trucks took our personal things to high ground in Rio Vista, and our furniture to storage in the Bay Area. We didn't find our piano for six years.

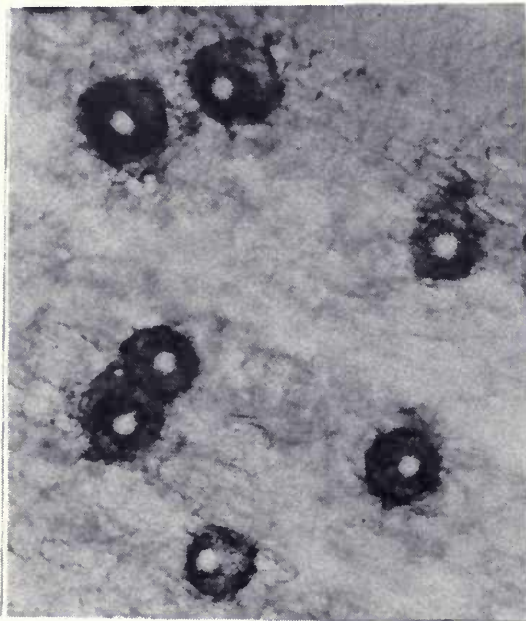
Late that afternoon and into the night, Adele and Lewis, with Lori sleeping in the backseat, patrolled five miles of the levee road with our car spotlight, searching for seepage areas. At three o'clock we were told to get away, and a half hour later, at 3:30 am, February first, the levee gave way. The last 3 pictures show the Del Monte barn, our home, and what's left of the levee road north of Rio Vista.



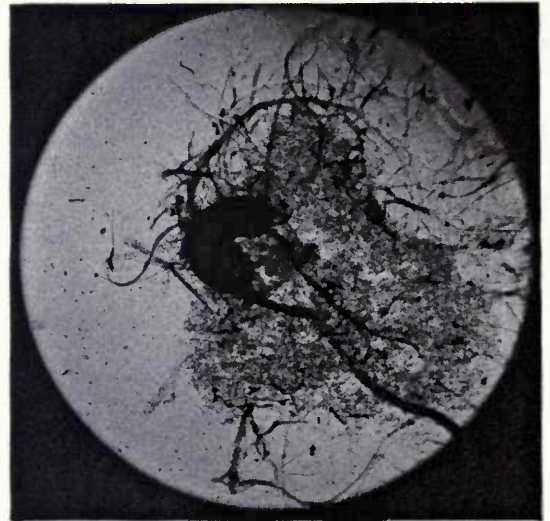
Ascochyta symptoms on pea plants: severe, medium, and slight. As graded in the 1942 Illinois pea-disease survey program.



Concentric ring pattern of Ascochyta lesions on a pea leaf. From wind-blown spores. X 1.5.



Microscope picture of Ascochyta perithecia embedded in dry pea stubble tissue. X 150.



Ruptured pycnidia of Ascochyta releasing thousands of spores. Microscope photo, X 200.

Ascochyta, as do most fungi, has two types of spores. In the case of Ascochyta, both forms develop in circular sacks embedded in the tissue of the pea plant. The sexual, wind-blown spores develop in smaller elongated sacks, asci, inside the larger circular sack, the perithecia. Asexual spores develop free in the circular sack called the pycnidia. Both erupt when wet during a rain storm. There could be twenty or more almost invisible perithecia in each lesion on the leaf at the upper right, and each perithecia could have thousands of spores. In the micro-photo in the lower left, you can clearly see the opening where the spores escape. In the one on the lower right, the pycnidia absorbed sufficient water to rupture, spewing the spores out the side. The potential for severe damage with this degree of spore production is obvious. The concentric ring lesion, pictured on the leaf in the upper right photo, and so common in the Midwest, was not found in the dry seed fields of Idaho.



We visit the seed fields of Idaho on our way home from Illinois, 1941. Left: Adele in our make-shift laboratory in a motel in Idaho Falls. Right: To everyone's surprise, we found *Ascochyta* everywhere.



Selection plots in Illinois were grown in rows on 2-inch mesh chicken wire, three feet high and 150 feet long, with six feet between rows. Steel stakes supporting the wire are painted white on top so the airplane pilots could easily see them when spraying for insect control. Several acres were devoted to plots, and in all, about a half million seedlings were available for selection each year.



Selections were shipped to California and planted in the Morgan Hill greenhouse, pictured above, right, or on Seed Department property at Gilroy. Midwest selections yielded from 10 to 20 seeds each, and after increase the seed supply for each would be between 200 and 500. These would be planted in replicated plots of 100 seeds each for evaluation in Illinois the following year. As were the plots in Illinois, the greenhouse plantings were sprayed with *Ascochyta* spores so that any selections would be tolerant to that important disease. Our first commercial introduction, Delmar 16, was selected in this greenhouse, and virtually doubled the yield and quality of early season peas.



Above: Adele in the Rochelle selection plots, June, 1954. Right: In the greenhouse at San Leandro, March, 1965, where she is selecting peas for resistance to bacterial blight. The greenhouse plots were grown in boxes 4 x 5 feet in area and 6 inches deep. Plants were sprayed with blight cultures, and those having no lesions were selected and increased.



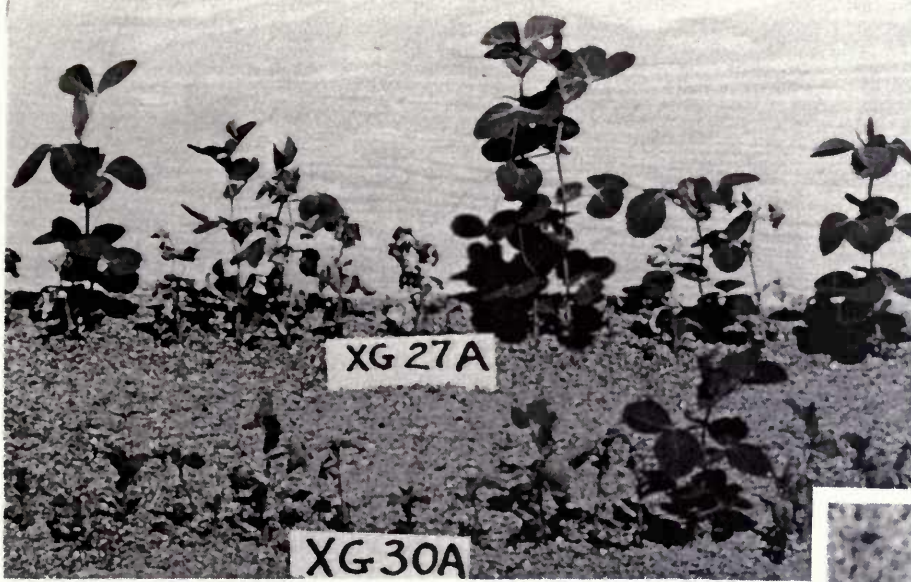
THE PEA TEAMS

Above, left: Sid Piersma of the Midwest Division, who joined the pea team in 1946, shown here with Adele and Lewis in the plots at Rochelle, July, 1967. Above, right: Pat Winter, who represented the Del Monte Seed Department from the start of the program until his death in 1952. Photo March, '51, in the San Leandro greenhouse.



Right: Bud Cruger who joined the team in 1961, standing with Lewis in the Illinois plots, July, 1961.





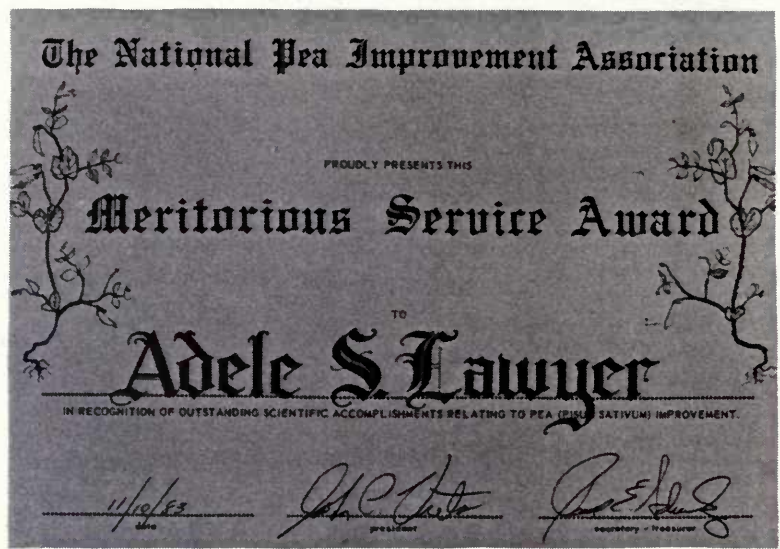
Above: XG27A, the first successful cross for resistance to *Aphanomyces* root rot. Photographed in the greenhouse at San Leandro, August, 1947. You can see the segregation for resistance and susceptibility. XG30A, in the foreground was a similar cross, but only one plant showed resistance.

Right: The first plant ever to have combined resistance to *Aphanomyces* root rot, bacterial blight, and *Fusarium* wilt races 1 and 2. April, 1964. This took 17 years of breeding, and did it pay? See below.



The root rot plots in Rochelle. Above in 1949, where only the weeds between the rows survived. Right, in 1969, where only the susceptible check plots are dead. This is only 5 years after the first plant having combined root-rot resistance, shown above, was found, but, in total, this represents 28 years of breeding, testing for resistance, and selection.





Adele accepts the Meritorious Service Award from the National Pea Improvement Association at their meeting in the Hilton Inn, Minneapolis, November 10, 1983.



Left: Adele is congratulated by Don Hagedorn, Professor of Plant Pathology and an authority on the diseases of peas, University of Wisconsin.

Above: By Bill Haglund, Plant Pathologist, Washington State University, and Dick Hampton, Virologist, U. S. Department of Agriculture, Agricultural Research Service, Corvallis, Oregon.



Adele with Jim Baggett, Professor of Horticulture, Oregon State University, and, right, flanked by Lewis and Bud Cruger, with a group of fellow workers from Del Monte.



Lewis gets his 20-year diamond pin from Vice President Jack Countryman. April, 1957.

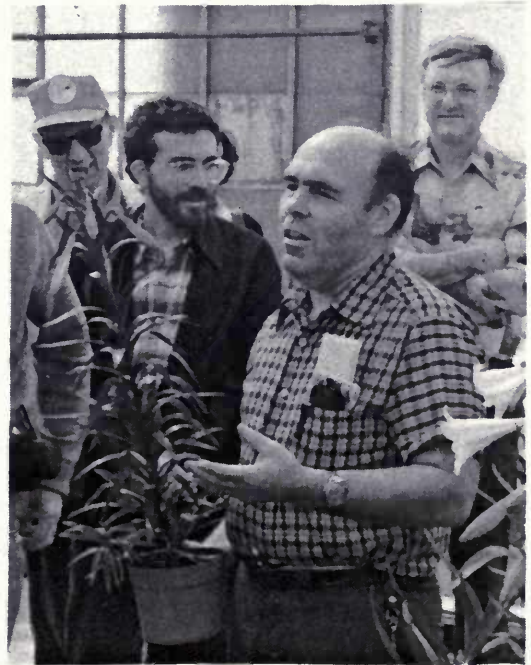


Adele gets her 20-year diamond pin from Vice President Charles Griffin. June, 1960.

Jack Countryman, Midwest Division Fieldman in 1941 when we started working on peas, became President of Del Monte in 1964. He was always a helpful friend to us and to our work. Charles Griffin and his brother Willard, were descendants of C.W.Griffin of Griffin and Skelly, one of the four companies which, in 1916, combined to form the California Packing Corporation. Willard Griffin, as Vice President in charge of western farming and agricultural research from the time Lewis was hired, was especially supportive of our work. Shortly after Willard's retirement, brother Charly was given responsibility for Research and Development, and continued Willard's enthusiastic support.



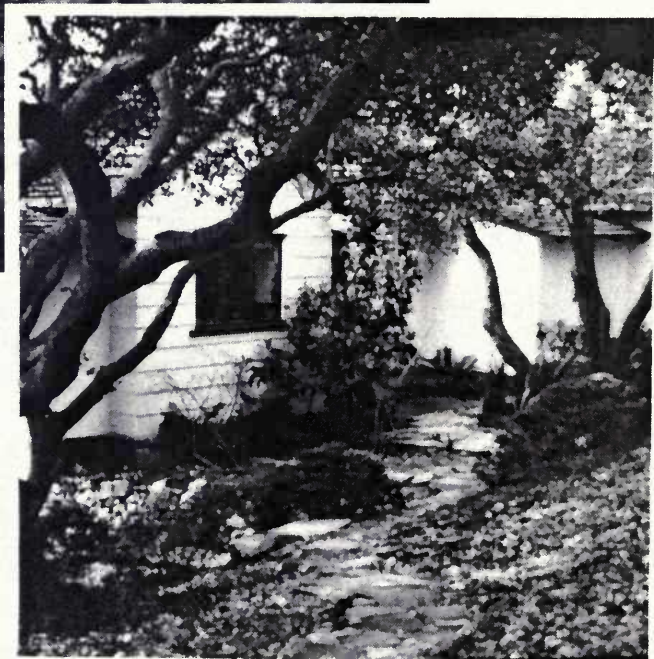
Above, left: Lewis and Adele at Adele's retirement, February, 1983. Right: Bob Raabe, Department of Plant Pathology, U.C.Berkeley explains problems with potted Easter lilies to group from the 24th Conference on the Control of Soil Fungi which Adele chaired in 1978. Bob is presently working with us on the identification and control of diseases affecting iris.



After the flood we moved to Berkeley for a year and then to Morgan Hill and Rochelle alternately. At Morgan Hill, where we spent seven winters, we lived in three different houses, one of which is shown to the right, at the foot of Murphy's Mountain. In Rochelle where we spent 25 springs, we lived in 19 different homes and one year in a corner suite in the local hotel, bringing our art materials, our photography, and our record-playing equipment wherever we went.



In 1948 we moved to our home in Oakland, and the first thing we did was to design a completely automatic sprinkling system so we could leave our garden during the four months we would be in Rochelle each year.



The two photos above show our Oakland home as it is now, left, and as it looked when we first moved in. The front yard, originally mostly ivy, was planted to camelias, rhododendrons, fuchsias, deciduous azaleas, and clivias. After 42 years, some of the ivy still persists. The photo to the left was taken one foggy morning looking toward the front entrance, and was used in one of our Christmas cards.

LORI'S HOMES

Left: Lori in her cave on a high cliff in Sycamore Canyon, Arizona, where she lived in 1970 and 1971. Photo taken during an overnight visit by Lewis and Adele, June, 1971. Below: The dugout home in lower Sycamore Canyon, where Granddaughter, Lluvia, was born. Photo by Lewis, two weeks after Lluvia's birth, February, 13, 1973. Pictured are Lori's brother, Artie, husband, Billy Platte, and Lori.



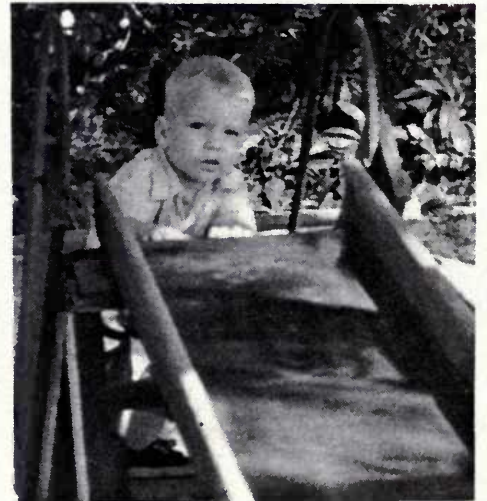
Above: Lluvia, Adele, and Lori in front of adobe home at Carson, New Mexico, designed and built by Lori in 1981. Left: Plaster relief on the outside adobe wall of Lori's last home in Dixon, New Mexico.



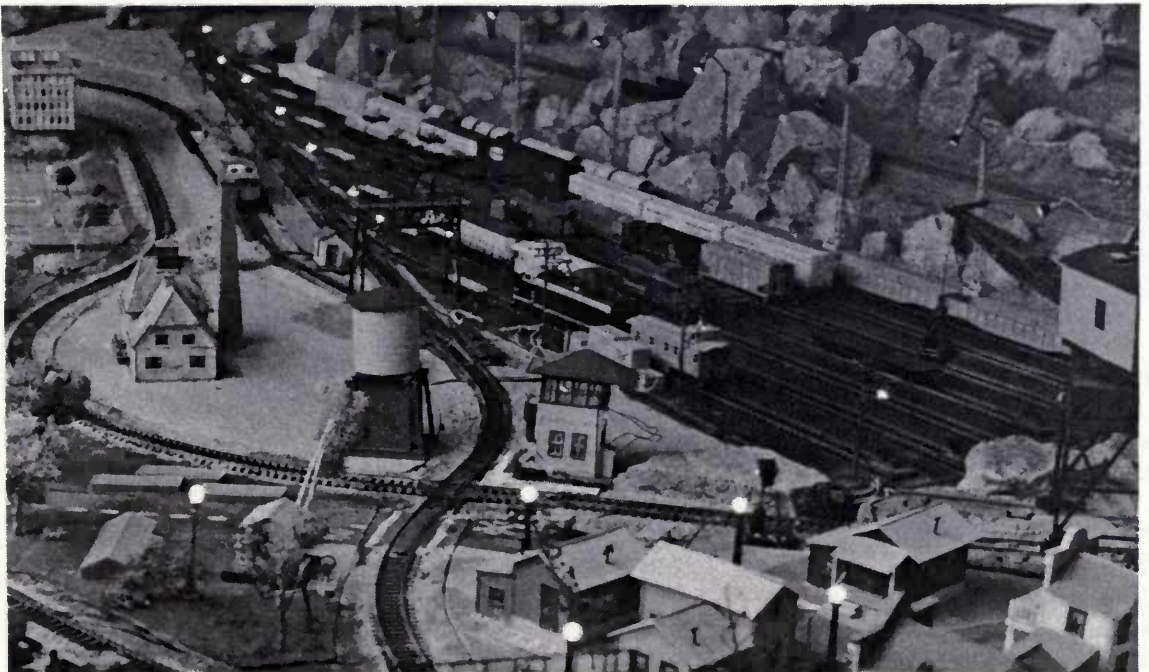
Above, left: Melanie on her first birthday, Rochelle, Illinois, June 21, 1953. Right: Artie on his first birthday, Oakland, California, March 12, 1955. Melanie preferred chocolate cake and watermelon, Artie the white frosting on his cake, but both show the results of careful training in neatness and dexterity.



During the five years between the time we moved into our Oakland hills home and the birth of Melanie, we had established a fairly reputable garden, but with the arrival of the new family we completely abandoned serious gardening and turned the back yard into a jungle. The photo above shows Artie in his foot deep, 130 square foot, sand box, constructing roads. Above, right: Artie and Melanie on their pump-up swing constructed by Lewis and hanging from a large limb on an oak tree. Right: Artie on the home-made slide. There were two other swings, one a thirty-foot single rope swing which elevated them 20 feet above the ground, a tree-house in the fig tree, a "cave" with an upstairs and a downstairs carved in a large tangle of honeysuckle, a small swimming pool, and jungle paths everywhere.



Halloween in our front yard was an event. Ghosts and spider webs hung from our oak trees. Blinking strobe lights and black lights added excitement, and a stereo sound system blaring out ominous music, weird sounds, and screams from either side of the path made it a pretty frightening place. To this day grown-ups come by and tell us how scared they were when they were little. Below are two views of the train room, constructed between January, 1965 and December, 1967 in an excavated area under our home. Top shows Artie painting the track bed in an area which will become a 4-foot high mountain with 10 tunnels and 6 bridges. Below is the central switching yard area. The layout is 12 x 22 feet, made of reinforced concrete strong enough to hold a man, with 265 feet of HO track and 19 circuits. Four trains can be run simultaneously and independently from the single control panel. It was a good place for Artie to learn construction and circuitry.





Two views of our garden when we were one of the tour gardens for the 1978 National Convention of the American Iris Society, April 29, 1978. There were 773 guests, in 4 waves of about 200 each. One, from Switzerland, said that our view of the bay reminded her of home.

The big busses couldn't negotiate our curves and hills so they parked below in the Navy Hospital parking lot and smaller busses transported the guests to our front path. Eastern guests found it difficult to believe that our evergreen coast live oaks were really oaks, the leaves were so different from theirs. All were in awe of the passion vine covering the arbor, and several wanted to pick an orange right off the tree.



Right: Shortly before the convention we had found in a local store, a half dozen plastic, pink, iris flowers mounted on wire stems. On the morning of the visit we stuck them upright in a non-blooming iris plant and labeled them "PINK PLASTIQUE". Guests would spot these gaudy flowers from across the garden and rush over only to find out that they had been fooled. Of the over 700 iris plants in the garden, this was by far the most photographed.



Adele admires a Bird-of-Paradise flower on a trip to Mexico in 1939, and, right, with Lewis on a "nostalgia trip" back to the Wheatland Ranch on their 45th anniversary, August 13, 1982. On the four-week Mexico tour we camped out all but four nights, including two nights on the beach at the sleepy little town of Acapulco. The most memorable experience was a New Years Eve dance in a little schoolhouse in Tomazunchale where the hundred or so inhabitants, only four of whom spoke any English, literally took us into their hearts and arms.



The last fling before the younger kids deserted us, a Christmas-vacation trip to Merida, Cozumel, Oaxaca, Taxco, and Mexico City, December, 1972, January, 1973. Photo shows Melanie, Artie, Adele, and Lewis with their rented Jeep on the island of Cozumel, December 23, 1972.

Adele and Lewis in the iris-hybridizing plots of Dr. Lee W. Lenz at the Rancho Santa Ana Botanic Garden. April 30, 1982. This was the first stop on our way to visit Lewis' brother, Dick, and his wife Dottie, in their resort complex at Las Cruces, Baja California. Dick had chartered a plane which took us from an airport in Arcadia to Las Cruces. In the plane with Lewis and Adele were Dick and Dottie, their daughter, Linda, her two children, and Ward and Betty Kimball.



Left: Adele and Lewis standing in front of the plane that brought them to Las Cruces. Right: On a cliff overlooking the Gulf of California, stand the three crosses from which Las Cruces gets its name. Pictured are: Ward Kimball (seated), Lewis, his sister: Betty Kimball, and Adele.



Lewis in front of the cabana where we stayed. The Las Cruces resort, about 20 miles east of La Paz, is half owned by Lewis' brother Dick. It is accessible only by plane, boat, or by a very poor dirt road from La Paz.

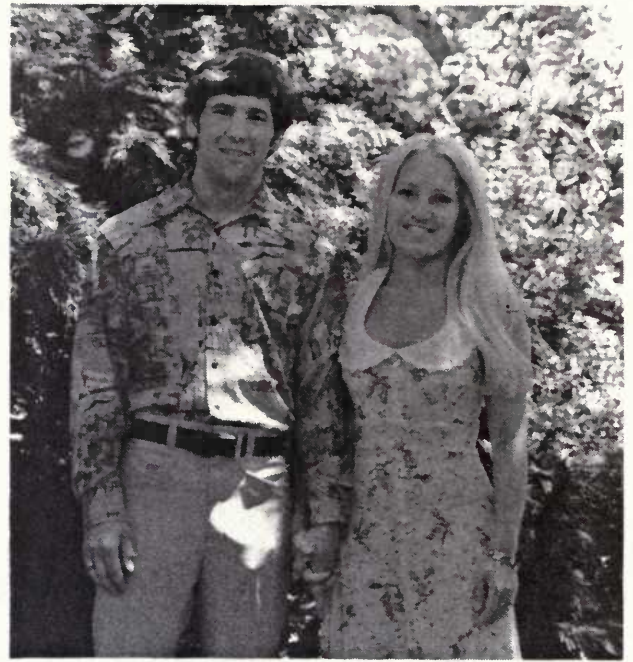


Two of our favorite vacation spots. Above: On the big island of Hawaii, and, left: at the Heritage House, Little River, California. In Hawaii, Hilo, on the island of Hawaii, and Princeville on the Na-Pali-Coast side of Kuai have proved ideal for getting away from the unrelenting demands of retirement.

We have spent several of our mid-August wedding anniversaries in the Mendocino area. At that time of year, the north coast has many advantages and most of the things we enjoy, the rocky shoreline, the foothills, the beautiful fall weather, and good accommodations for food and lodging.



A chance to introduce some members of our family in this photo taken in our living room at Kanaloa, Keauhou, on the Kona side of Hawaii. Flanking us are our son, Artie with his wife, Francie, and our youngest daughter, Melanie, with her husband, Jim Davis.



Above left: Artie on his way to Yale with Francie, August, 1974. Right: Jim Davis and Melanie shortly before they were married, September, 1977. Artie got his PhD in biophysics under Israel Zelitch, and Francie worked in the human genetics laboratory under Frank Ruddle. Jim went into the insurance business and Melanie into research, first with Cordis-Dow on artificial kidneys, and then with Dow Chemical.



Left: Four generations. Lori holds our first grandchild, Lluvia, while Adele and her mother, Nedye, watch from the rear. August, 1973.

The new generation. Our three other grandchildren, Lewis and Emily, children of Artie and Francie Lawyer, and Laura, child of Jim and Melanie Davis. Reading to them is their aunt, Melissa Coupin, daughter of Adele's brother, Abbott. Lewis is seven and in the second grade at Montclair School. Laura, six, is a champion swimmer, and in the first grade at Valley Verde School in Concord, California. Christmas, 1989.





Our fiftieth anniversary celebration was held in the garden of Jim and Melanie Davis, August 15, 1987. The theme was informal Hawaiian, and friends from Del Monte, the Iris Society, neighbors, and relatives helped make it a festive occasion. Betty Kimball, with Adele's cousin, Ruth Scholtz, at left. Next-door neighbor, Maya Aikawa, with our daughter, Lori, center. Niece, Kelly Kimball, at far right.



Adele and Lewis, dancing to a Dixieland jazz band led by Bill Hepler, friend from old Del Monte days. Hepler developed tomato varieties for Del Monte, and subsequently headed the Agronomy Department at Penn State University. His interest in jazz has continued throughout.

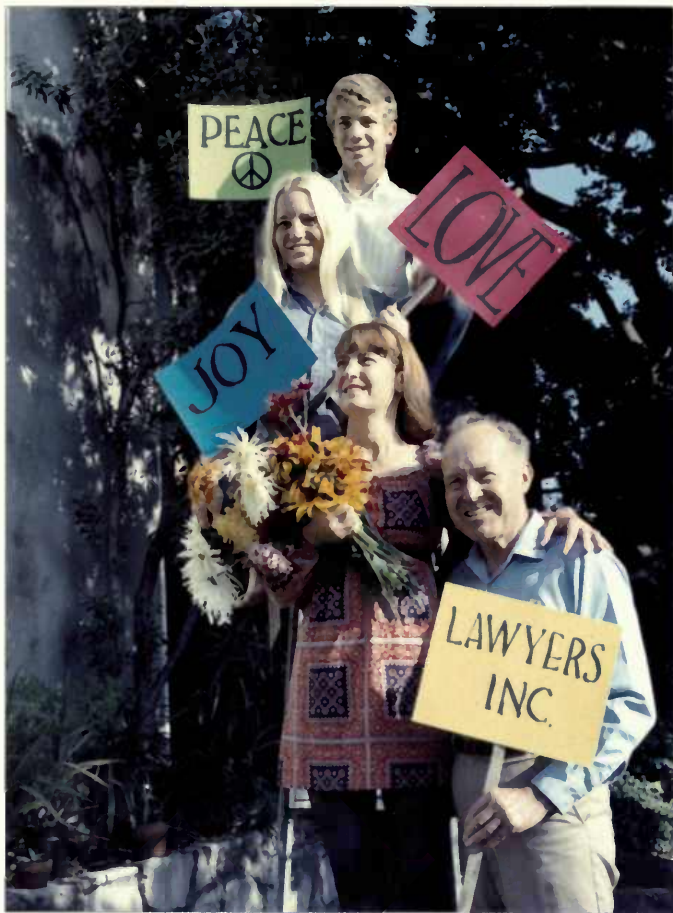


Above: Lewis stands behind the Toastmaster toaster given to us as a wedding present by Adele's Uncle Bob. Still functioning well, along with our marriage, after 50 years of wear and tear, it was ribboned, and mounted on a Grecian pedestal for display as an honored guest at our party.

CHRISTMAS CARDS

We have been making our Christmas cards ever since we were married. The one on the right was for 1976 when we were first becoming interested in the Pacific Coast native iris. The two prints on the facing page were used in our cards for 1969, when peace and love were "in", and 1987, our 50th anniversary year.






1969: Peace, love, and joy.



1987: Fifty years of Christmas cards.



ERRY
CHRISTMAS,
HAPPY
NEW YEAR,
AND A
JOYFUL,
BLOOMING
1977

LAWYERS INC
LEWIS AND ADELE



1969: Peace, love, and joy.



1987: Fifty years of Christmas cards.

V LIVING WITH DEL MONTE

Lawyer Lifestyle on the Road

Lewis: Although I was originally hired to work on the replant problem of asparagus, and to continue the Armillaria work, our first five years were divided between many crops on eight large ranches owned by the corporation. During this time, for five years in a row we averaged 33,000 miles a year in our car, and we got a new car every year.

Adele: We lived in more than one place. In fact, for a while we rented homes in Wheatland and Morgan Hill, and a room in the Rio Vista Hotel. We had our little child, Lori, along with us all the time during the first thirteen years, the first six years of which were pretty hectic. During Lori's first four years or so, we had a little bed in the car, and we had a little folding playpen for her to go into. Later, we would just put her out in the orchard, the field, or wherever we were, and she played around.

Riess: So you weren't any different from migrant workers.

Adele: No, not really. Oh, there was one place--we called it the Livingston Hotel--it was at the Wheatland Ranch, and they had a little tent there, a wooden base with a tent top. That was where we made our Wheatland Ranch headquarters for a while. It had a little sink in it with running water. Well, that was Lori's bed--with the water turned off, of course! [laughs] She couldn't fall out of that sink. We had a little burner, a hot plate, you know, for making her formula in there.

We could go over to the cookhouse, where they had the Chinese cook for all the workers, and eat over there. We would go over there after the workers left and Chung, the cook, would cook us something special, usually more than we could eat. But sometimes we would eat there in that little house. We would get out early in the morning and go to work and then come back and have breakfast with the ranch superintendent.

We loved our work, and we were just enthusiastic. We did all these things, and for me, just out of San Francisco and all of the advantages, it was a big adventure. I thought it was just so exciting.

Riess: In fact, what was your social status? You were like gypsies in some way when you were in a town.

Adele: We got to know all kinds of people that we never would have socialized with ordinarily. Chung, the cook, for instance, was especially solicitous to us. He would love to prepare special things for us. When we had breakfast there, he would have eggs, fried potatoes, pancakes, bacon, sausage, ham, toast, biscuits, and coffee. We could never eat it all, although we tried because he looked so pathetic when he would look at me and say, "Missy no like?"

After we had our baby, he had a dinner party in our honor at a fine Chinese restaurant in Sacramento. It was a banquet to which he also invited about fifteen Chinese friends of his, whom we did not know. The dinner was scrumptious, with course after course. One of the dishes was Bird's Nest soup, which we had never tasted before. At the end of the banquet Chung presented me with a beautiful silk, royal-blue, brocaded dress that he had arranged to have made for me. We were overwhelmed.

At the Wheatland Ranch, there was even a murderer there that had murdered someone in England and had come over here. He was a delightful guy and spoke the "King's English," but he had all the failings of many of the unmarried ranch workers: they did a real good job until Saturday night; then they would go off, and they would get drunk, and they may show up on Monday or they may not. They would get into brawls and everything, but they were fine people when they were sober. They worked hard and they were very valuable. We got to know these people, and we liked them. I think they liked us.

Riess: Did you deal directly with them, or did you deal with a foreman on each ranch?

Lewis: We dealt with the foreman or the superintendent. He would give us a crew, for instance, to work with, and then we would be in charge of them. Actually, starting about our second year there, we had an assistant on the ranch payroll who took charge of the crew. His name was Porter Tipton. He and his wife lived in a little home in Wheatland.

Adele: They came from Arkansas and had been married ten years, a long time, I thought, then.

And what did we see, prostitutes! There were prostitutes right there by the ranch. There was a levee along Bear Creek, and they were camped there, right on the other side of the levee.

Lewis: Yes. This would be during picking season when there would be a lot of men.

Riess: Camp followers!

Adele: But they were twenty-five cents in those days. [laughter] I remember seeing them and being so shocked when Lewis told me what they were, because they were ugly ladies, you know, very ugly --old, middle-aged hags, even.

Riess: Mexicans?

Adele: I don't think so. No, there weren't many Mexican laborers there. I can only remember one, Joe--"Mexican Joe" they called him--and Chung always served hot chilies for him. They were mostly Arkies and Okies that came. They were real nice people. But the men that were unattached were quite rounders.

Lewis: For a while, Mexican Joe was in charge of one of our digging crews and he was the one who taught me how to throw a knife underhanded so a person wouldn't know that it was coming. He had a pair of Greyhound dogs that they used to race and sic after jackrabbits.

Riess: This was still in the Depression?

Adele: In the midst of it.

Lewis: It was still in the Depression, yes, when we were doing most of this.

Riess: But these Dust Bowl people, had they settled into communities and become the available agricultural workers? Or were they in Farm Security Administration housing units that had been built?

Lewis: Most of the ones that were married, which I imagine you're talking about, would live in the town of Wheatland. They would have a house.

Riess: In a house, not in public housing?

Lewis: In a house. They either rented or owned a house. I'm quite sure there wasn't any public housing in those days, certainly not there. They had bunk houses on the ranch for the unmarried men--only men.

Wheatland Ranch, like all the other corporate ranches, had a "blue room" where unmarried foremen or even superintendents stayed or could eat. I stayed at the Wheatland Ranch blue room the first Christmas vacation and summer vacation, and had a bed there until Adele and I were married. During that time two or three ranch foremen were also using the facility. Through them, I got acquainted with all the hillbilly music of the day, and the night spots and gambling casinos at Wheatland and Marysville.

During that first two weeks of Christmas vacation, I remember how impressed I was with the difference between the men on the ranch and my student friends at the University. The men on the ranch could hardly speak a sentence without including one of the four letter expletives, yet I never heard any of them tell a dirty joke or speak coarsely about a woman. One remark I remember real well, because I wrote it down at the time, word for word. Ralph Petrie--everybody called him "Alabama"--had seen a covey of quail with a bunch of little babies, still with their protective spotted feathers, running along the edge of the levee. He had told us about seeing them, and after a moment of silence he continued, "Son of a bitch, those little bastards sure were cute."

Adele: There were some outstanding people among these Arkies and Okies, and all of them that were willing to work, and didn't get drunk, became permanently employed at whatever they did. They just did very well. For three months one year we rented a small unit in a bungalow court in Wheatland. A very young Okie couple lived right next door. They had almost nothing, but every once in awhile the wife would bring us a cake or some cookies she had baked. It was part of their code to be neighborly and sharing.

Lewis: They were real nice people.

Adele: Gyce Clayton was one who worked there. He was good at mathematics, and then he would study and learn things, and pretty soon he became the office manager and bookkeeper there. They were establishing themselves.

Riess: Were the women in the fields, too?

Adele: In the picking season they had families there.

Lewis: Yes, picking season. They were migrants, and beginning about 1942 or so, many of the families were Mexican.

Adele: These were migrants. Those were different kinds of people. They just seemed to like to move around. Well, I think they made best money that way. They could go from one crop to another. They would start at Imperial Valley with the tomatoes, and go north. They were very good working families, even the children. Were the children employed, or did they just play under the trees? I don't remember.

Lewis: I think it depended on their age. Some of them worked part of the time, but not for Del Monte. They picked fruit for their mother and father, and Del Monte paid the family by the box.

Riess: What did you do with Lori all those thirteen years while you were putting 33,000 miles on the car?

Adele: She was with us all the time, except for a while when we sent her to a private boarding school in Piedmont. That didn't work because we were too lonesome and she was too lonesome. It was too different. They were teaching her French and all kinds of things you don't have to have at that pre-school age. She liked wading in the irrigation ditches and such things, so she was with us all the time.

Riess: What about school?

Adele: By the time Lori started school, we were living in Morgan Hill, and they had good schools.

I was never employed, you know. For all those years, I never got any money. There was a rule against husband and wife working together, so I was working, but I wasn't getting paid. I could be off any time I wanted to, naturally, since I wasn't really employed.

Riess: [to both] Were you compensated in some way for the fact that she was doing all this work?

Adele: Eventually. It was, I think, 1941 before I got paid. Then I was just paid an honorarium, fifty dollars, which went on his paycheck because they had this rule against spouses.

Eventually, the executive committee took it up, because one of the vice presidents thought so highly of our partnership. They made an exception so they could put me on the payroll. I had worked unofficially a long time before 1941. From 1938, really, is when I started working practically full-time, except that I could take off whenever I wanted to do things with my daughter or with my household chores.

P. D. Caldis and Agricultural Research

- Adele: One of the reasons that I think most of the people who worked in agricultural research for Del Monte did so well is because we had such a wonderful manager. We had Dr. Panos D. Caldis [1896-1974]. He was like a god to most of us. He's the man who came here from Greece on a scholarship; he was stranded over here when the Turks took over his birthplace, Smyrna, in Asia Minor, in 1923. He went to Michigan State University, where he got his B.S. degree. Then he came out and got his M.S. and Ph.D degrees from the University of California at Berkeley. His thesis was on figs.
- Lewis: Endosepsis.
- Adele: Endosepsis, and he discovered how it was transmitted by a wasp. He just virtually eliminated the disease. Then, when he took over agricultural research and hired Lewis, they started the agricultural research for Del Monte.
- He was a really wonderful, brilliant man. He was the kind of person who had a photographic memory--if he read it in a book, fifteen, twenty years ago, he knew even what page it was on and what his reference was. He had all this internal "computer" knowledge. He was admired by everyone that worked with him.
- Riess: What was his Del Monte title? He was the director of research?
- Lewis: No. First he was in the California Division Land Department, in charge of their agricultural research. The Land Department controlled the dozen large ranches owned and operated by the corporation. His last title was Director of Agricultural Research, Del Monte Corporation.
- Riess: Was he the first person with that kind of scientific background to be in that position?
- Lewis: No. I think they first did research in Hawaii on pineapple. Of course, Caldis started on pineapple, too, in Puerto Rico and the Philippines. I think Maxwell Johnson in Hawaii was before he was.
- Riess: Was he also a plant pathologist?
- Adele: No, I think he was a horticulturist. He had a B.S., M.S., Ch.E. after his name in his publications. Maxwell was also a wonderful, brilliant man.
- Riess: I was just wondering whether Panos Caldis made a great difference in Del Monte's attitude because of his own research frame of mind.

If you were to look at the history of Del Monte, was that a pivotal position? Were the years when he was there the years that they were most research-oriented, and never before or never since, or something like that?

Lewis: That probably was true. He was a good PR person and very enthusiastic about our work. He may have exaggerated, even, sometimes when he was talking to the presidents and vice presidents.

Adele: He had an office in San Leandro and also an office in San Francisco, where the executives were. He grew flowers very well, and he helped them in their gardens. He would go out to their homes and help them if they were having trouble with their trees or anything.

Not only that, he pushed research, and he told them what his people were doing.

Lewis: And they knew who was doing it. It wasn't "I."

Adele: Yes, he didn't take credit for it. He would say, "Our department is doing this," or "Lewis Lawyer has done this," or "David Williams has done this." He gave us all credit. When he was going to show off something his department had done, he would take us over with him to the main office and let us talk about it. We haven't had that since he left. The director has been the director, and he tells about what the department did.

Riess: More pure bureaucrat.

Adele: Yes.

Riess: In that job he was the bearer of good tidings and bad tidings. That must be the hardest part of the job, to say that something is going to take longer than they thought. I think of this because of something I read in this book about strawberries, a remark that "it required courage of a certain quality to make known the test results."

Lewis: Yes, you mean when they don't work.

Riess: Yes.

Lewis: Well, yes. Though, I think that he had more successful things to report than he did unsuccessful.

Adele: That's what I was thinking. I can't think of anything that wasn't successful under his regime. I don't know whether it's because the

type of things we were tackling needed research so much, and therefore they were rewarding, whereas later on--like the cucumber work, which was not under him and was not successful, and the zucchini work, and some of those other things.

Asparagus Research. A Difficult Crop

Riess: Well, the next thing you have on the outline you've given me is spray control of leaf blight.

Lewis: Oh, yes. The reason we put that down was because that was the first work other than Armillaria that Adele was involved in: counting lesions on peach twigs to determine the effectiveness of different sprays. We were working on all sorts of diseases on the peaches at the same time as the Armillaria, and, as we said, not only peaches but other crops, as well. A lot of our time in the first two or three years, when we were living mostly at Rio Vista, was spent on corn and peas, trying to get an alternate crop for the areas where you could no longer grow asparagus.

They had large acreages up there, thousands of acres, and it was mostly asparagus. In fact, as I said earlier, that's why I started to work for Del Monte, to find out why asparagus would not grow in land where asparagus had previously been grown. Here again there was a replant problem. We did eventually find out both the cause and the cure. You could treat the soil, fumigate the soil, and grow a beautiful second crop of asparagus, but it was too costly, it didn't pay so far as the money was concerned.

Adele: The most significant thing that we found out was the reason for the problem.

Lewis: Yes. We found out that the reason for it was two different Fusarium species, Fusarium moniliformae and Fusarium oxysporum.

Adele: We were the first ones to find out the cause of the asparagus replant problem. That was one time when we didn't share our knowledge with the University. [to Lewis] And it was how many years later that they discovered it?

Lewis: Well, it was first discovered by a Washington State University pathologist named Cohen up in Washington. That was about three years after we were starting to work on it, on the Fusarium. Then, I forget who it was that announced it at Davis. Oh yes, Dr. Ray Grogan at Davis published on it, also finding a Fusarium.

Riess: When you were working for Del Monte, then, there wasn't a policy of publishing at all?

Adele: No. All of our communication with the University was on a personal basis--I mean, talking to them and telling them about things that we could tell them without hurting our research or advantage.

Lewis: They knew it. They knew that we were always honest with them.

Adele: We would always say, "We can't talk to you about that."

Riess: So you could say, "We've been working on asparagus, and we've got some good results, but we can't say anything more about it than that."

Lewis: Well, I don't think that is exactly right because I don't think we would have instigated the conversation if we couldn't tell them what we knew about it.

Riess: And that was spelled out for you by Caldis, or by whom?

Lewis: It was just general company policy. Of course, Del Monte was paying for something, and they wanted the advantage of it. That never bothered me.

Adele: But that's an ethical concern. There were some people who didn't want to work for Del Monte because they couldn't publish.

But our advantage in starting our breeding program for disease resistance on asparagus is something that hasn't paid off. We got some varieties that were excellent and are still the best, varieties that they try to clone, even now, but they didn't have the Fusarium resistance. We never got that.

Lewis: We hired a Cal graduate, Ralph Gilmer, especially to work on that, and we did develop varieties that were resistant to the disease but never that were very productive. The reason for this was because to get the genes for resistance, we had to go to a species that was not a good horticultural type asparagus. So nothing ever did come from that and that work was dropped, not because we couldn't have developed a good Fusarium-resistant variety, but because plenty of good land was available where asparagus had never been grown

Riess: But if asparagus had been a bigger and more important crop, as in the case of the strawberry, where the strawberry problem is brought to the University, and all this enormous amount of effort goes into it--was it that asparagus was an intractable problem, or was it that it was not important enough economically?

- Lewis: Well, so far they haven't run out of new asparagus soil, so they really don't have to replant old acreage. But, as you say, it isn't a major crop.
- Adele: But there was a lot of money in it though, and there still is. If you buy a can of asparagus, it's expensive. It's labor intensive. You have to pick it every day and nobody has developed a satisfactory machine harvester.
- Riess: If the kind of energy that was applied to strawberries had been applied to asparagus, in terms of a breeding program and so on, could there have been a greater success?
- Lewis: Oh, I think so, I don't think there's any question about it. There are lots of asparagus species, but that kind of a project is a long-term thing, not like strawberries.

It's very long-term even once you get a plant, to know whether it's any good. It doesn't come into production until about the fourth year. You plant the crowns of asparagus, and the first year you don't harvest anything, the second year you can harvest a little, and the third year you can harvest a little more. But not only that, you have to cut the asparagus by hand every single day over a long period of time each year. And this has to be done every year for eight to ten years before you learn anything about either yield or quality. This is quite different from strawberries.

- Adele: Experimentally, it was a terribly difficult crop.
- Lewis: Just to keep your variety plots separate.
- Adele: You had to have randomized plots, with many replications of each variety separated by stakes down the rows in the field. You would need to watch this every day and every day to get the people who would harvest them to stop at the right place (at the stakes), and not mix the varieties. That was a really hard project.
- Lewis: Especially when your cutters can't speak English. [laughing]
- Adele: It's a difficult job to lean over and cut that 'grass.
- Lewis: The best asparagus work for the corporation was done by Bill Coover. He was a very patient person, and he harvested individual plants, nine thousand of them, for a period of years. Then he intercrossed the ten best male and female plants. From these crosses he got two different varieties that were outstanding, one especially that replaced the first one. The first one was good.

The second one was much better. It really made a lot of money for the corporation, but it required years of work.

Adele: Twelve years, something like that, before he brought it out. He had almost completed that by the time Lewis went to work. He was a very patient man.

Lewis: He did a very good job of that, but it was time-consuming. That's certainly a factor if it's not going to pay back. In this case it did pay back. It's difficult to place a monetary value on quality, but in yield advantage alone, it was worth about \$200,000 a year.

Adele: But it was plodding work, and not very many people want to do that.

Riess: Did he do it for Del Monte?

Lewis: Yes.

Riess: So it does pay back, doesn't it?

Lewis: Sure, but it's not going to pay back in two years, because you can't even start harvesting it in two years.

Riess: In that case, might he have gone, as they did with strawberries, to Chili or somewhere, and found little bits of basic asparagus? How could that not be wonderfully interesting?

Lewis: Oh, it would, but it's just whether the crop will pay for it. Asparagus is not like strawberries. Most wild strawberries are good to eat. Most wild asparagus are wiry, woody, tough ferns that defy eating, even by animals. To get our Fusarium-resistant plants, we used one of the woody ferns. They're still doing quite a bit of asparagus research, especially up in Washington, but they are working only with Asparagus officinalis, the edible one.

Del Monte went out of asparagus in California. They're not packing it here at all. They moved up to Washington, and they had fresh ground that had never grown asparagus. Now, unless they use new land, they have the replant problem up there the same as down here.

Riess: Fusarium?

Adele: Oh, yes, Fusarium, and they have it on the seed. I did quite a bit of work on cleaning up the seed.

Lewis: But it was cheaper to move to new land than it was to find resistance.

Adele: Some farmers were fumigating their land in the Toppenish area and were getting satisfactory results. If the price of asparagus is high enough, this would be practical since the planting is harvestable for about fifteen years.

We did a lot of work on asparagus up at Toppenish. Toppenish was an interesting place, for one thing because of the Indians that owned the land there. Del Monte had to be especially honest, because when you're a big corporation, people are always looking for you to do something villainous. In order to rent some land up there you had to deal with the Indians.

Riess: Where is Toppenish?

Adele: It's in eastern Washington near Yakima.

Lewis: Between Yakima and Spokane. At least half the land there is still Indian Reservation, so non-Indians don't ever own the land. You rent it from the Indians, or lease it. Del Monte would offer a fair amount for the land, but somebody else would offer a lesser amount, but also a case of whiskey. See, the Indians weren't allowed to have whiskey on their own. I don't think that's the same now; but, at least at that time, a case of whiskey was worth a thousand dollars or so to the Indians. It was illegal to give whiskey to an Indian, but if you would throw in a case of whiskey--why, then you would get the land. It was difficult to deal with.

Adele: It was difficult to deal with them at all. Even if you would just give them more money, they wouldn't take it. We had competition from the hop growers. That was a very popular crop up there. They knew just how to treat the Indians, but we couldn't do that. The man that was in charge up there for Del Monte was a very religious man--he would never think of doing that, you know. I thought that was a kind of interesting thing when we were up there.

Riess: Indeed. Did you ultimately get some of that land from the Indians?

Lewis: Oh, yes. But the Indians kept a quarter mile of Interstate 82 from being built through Union Gap for more than ten years.

Riess: Did you have, then, Indians working land at all for you?

Adele: They seldom, if ever, worked on the land. They lived on the rental money.

Riess: It would have been nice if you could have given them a new economy along with everything else.

Lewis: Yes.

Riess: But not so?

Adele: Unfortunately.

Tomatoes and Hydroponics://

Adele: Another thing we did that was interesting was on tomatoes. Del Monte was really interested in having the highest quality tomatoes, so we used hydroponics.

Riess: That was a new word.

Lewis: Yes. As a matter of fact, we worked with Dr. William F. Gericke, who was then in the Plant Nutrition Department of the University at Berkeley. He invented the word "hydroponics." Gericke helped us a lot with the physical set-up of the experiment.

Adele: The thing is, we wanted to know what was the most important factor in the environment to improve the quality of tomatoes--the temperature, nutrition, or the soil type. We had hydroponic tanks up at Woodland and down at Hollister, two quite diverse environments.

Lewis: Tanks were located at Woodland, at Hollister, and at Coyote--that was the Del Monte Seed Farm--and on the roof of the cannery at Sacramento. So we had samples of different climates. Of course, the fertility was exactly the same in each one since they were growing in a nutrient solution.

We had these long tanks, about eighteen feet long and a couple of feet wide, with a chicken-wire screen over the top, and they were maybe eight inches deep. We would plant the tomatoes up above the screen in excelsior or some kind of compost material. Then the roots would grow down into the water. So they all got the same nutrition. We varied the nutrition in different tanks, but exactly the same at each location. We ran that for, I guess, three years.

Adele: We analyzed the leaves for nutrition.

Lewis: And then canned the tomatoes to see how they were. There is quite a bit of difference, especially in sugar content of the tomatoes, depending on the climate. The hotter the climate, on the whole, the more sugar we found. High nitrogen reduced the yields and made the fruit softer.

Adele: And phosphorus makes them more firm.

Riess: Do tomatoes always have to be such salty things? Aren't they very high in sodium?

Lewis: Well, the tomatoes themselves, I don't think, are. I think it would just be the salt that people add to them. They thought, for instance, that tomatoes grown in Utah were more acid than tomatoes grown in California.

Adele: More tangy.

Lewis: But they found out that they weren't. Actually, the tomatoes grown in California have a higher acidity than tomatoes grown in Utah. But they also have more sugar, quite a bit more sugar than the ones grown in Utah, so they taste sweeter.

Adele: Even with the same nutrition.

Riess: How much of your testing was taste-testing?

Lewis: Oh, lots of it.

Adele: Everything had to do with taste, too.

Riess: The two of you would slice a tomato and talk about it?

Lewis: No, most of the taste-testing was done by experts.

Adele: Expert tasters in the quality control lab, but that was after they were canned, because that was what we wanted to know--how they tasted after they were canned.

Riess: I am picturing these tomatoes, and it's delightful. Would you pick from all of them on a given day and taste them all within twenty-four hours or something?

Lewis: But they would be canned, so once we got them in the can, it didn't make any difference when they were tasted.

Riess: You couldn't tell ahead of time? It had to be canned?

Lewis: Yes. You see, so far as Del Monte is concerned--

Adele: It has to be after it's canned, how it tastes, because Del Monte was a canning company. They preserved them that way.

Other Crops to Replace Asparagus

Lewis: We did freezing, too. We had a freezer in our apartment at Rio Vista for a while when we were running the peas and corn. We froze both peas and corn. Del Monte never really went into freezing because it didn't pay. There was more profit in canned food than there was in frozen food.

Adele: Because the storage has to be under refrigeration, and then they have to be transported in refrigerated trucks, and if anything happens to the temperature control, they're wrecked. Whereas, when they're canned, they're more stable.

Lewis: Of course, there's money in frozen stuff, and it's used probably more now than canned. But every time they would run a study on freezing, they found it just couldn't pay to get into it. They did freeze some things: they had frozen packs in Canada, but never did get into it in the United States.

The reason that we were growing the peas and the corn is that they wanted to grow some crop in the acreage where they could no longer grow the asparagus, and so, among other crops, they tried peas and corn. Corn was all right there, but compared to costs in the Midwest, the land was still too valuable for growing corn. We tried flax for flax-seed oil, and the first planting of the--what is that oil plant?

Riess: Safflower.

Adele: Right.

Riess: I have seen fields of safflower. Beautiful plants.

Lewis: Beautiful plants, yes, but they are thistles, you know, and sure hard to walk through. So we grew them, and for two or three years we grew peas up there.

The only thing we knew about peas before we went to Illinois, was what we learned up there. They brought a fellow out from Illinois that did most of the work on the peas, but we were quite involved in that. We had a commercial freezer in our dining room and we were freezing peas at that time, because they were thinking of going into frozen peas.

Whether frozen or canned, the quality--Del Monte couldn't tolerate the quality of the peas here compared to what it is in the Midwest. The climate is too variable here. They had to be grown in the winter here, because it gets hot too soon in the spring.

We'd have hot days and cold days, and then you'd have a bit of frost.

Adele: So then the peas would send out side branches, and each branch would bloom at different times.

Lewis: Maturity was all different.

Adele: You would have some pods that would mature early, and then the rest of them would mature later. So when you harvested them all at the same time with a machine, you would have real hard peas in with the tender ones. And there would be a high cost added if they were separated in the cannery. It never worked out in California.

Lewis: And for the corn, the land value was too high. They thought they could get better yields here, like they do in Washington. The yields in Washington with irrigation are about double what they are in the Midwest, but the irrigation costs are so high that the cost of growing corn is about the same. Here in California, the value of the land and the cost of irrigation was way too high to compete with the Midwest, so they weren't able to grow corn. They grew sugar beets for a while. We did a lot of work on sugar beets.

Flood!

Adele: One thing that we didn't mention that I think was kind of exciting was that when we were on the asparagus land, living near Rio Vista, we went through a flood. We were flooded out of our house and all that kind of stuff, which is very interesting.

Riess: Let's hear more about your life there.

Adele: Well, we were moved to Del Monte's Montezuma Ranch near Rio Vista to stay. We were given a ranch house to live in, a fairly large two-bedroom house with a living room and a dining room, but with a kitchen that was quite primitive. We had a stove--[to Lewis] What was the fuel?

Lewis: It was diesel oil.

Adele: An oil stove, and you would turn it on and then throw a lighted match in and it would flame up. Then you would close the damper down and try to cook on that. It was really something! For a while, I burned up almost everything I tried to cook, especially in the oven.

Lewis: It was a big stove. [laughter]

Adele: A big, cast-iron stove.

Riess: This was a ranch house designed for a whole crew of people?

Lewis: No, just a single-family home.

Riess: Why was the stove so big?

Adele: I don't know. It was just a big, cast-iron stove with those burners--round plates, like man-hole covers--that you pick up with tongs.

Lewis: Yes, and it had a double oven. Each home had one.

Adele: Those were Del Monte homes for the people who lived on the ranch, the foremen and their families. That was the first place that we lived outside the Bay Area. The mosquitoes were dreadful when the wind would stop blowing; and the wind was usually just blowing continuously. So I washed diapers and put them on the line and would take them right in again. I mean, it was really windy all the time, and it was kind of tiresome. It wasn't pretty there because asparagus fields, when they are being harvested, are just bare fields. You can't see anything growing.

Lewis: Yes. Our house backed right into an asparagus field, and during picking season we could go out our back door and break off a few tender spears of asparagus for dinner. We had a lawn in front, though. They had people who took care of the lawn, a gardener. This was sort of a compound. The office was there and, let's see, there were one, two [counting]--about six homes. The superintendent lived in the house right across from ours. He was superintendent of several ranches, but he lived on Montezuma Ranch.

Adele: We had a nice little congenial group there that we got along well with. We were happy with our work, and we raised our little girl there until she was one-and-a-half, I think. She learned how to walk there, I remember.

We were living right next to the levee. When the high water came it was a little bit frightening. You would go up to the top of the levee and look down and the water was coming up, and up, and up, and up! I always remember, one day I said to Lewis, "Wouldn't it be exciting if we had a flood?" The next morning, we had to pack all of our stuff, because it was really going to be true! We had to take all of our belongings out of the house in a hurry--mostly in Del Monte picking lug boxes--and put them on the

lawn. Big trucks came and took all of our things away, and then we worked all night on the levee.

Lewis: We worked most of the night patrolling the levee. Most of the breaks occur where gophers had burrowed. The water starts running in a gopher hole and out the other side, and then it just gets bigger and bigger. We had a spotlight on the car, and we would go along looking at the inside of the levee for water signs. Wherever we would find it, why, then they would come, and they would drop a tarp down on the river side to stop the flow of water through there.

Adele: There's a little bit different reason for the floods there than just too much water in the Sacramento River.

Lewis: It was the tide. Even that far up, the river is affected by the tides that come into the bay. They back the water up, and of course it was raining constantly. They had to open the flood gates at Sacramento, so they let the water through. The combination of the water coming in and the tides coming up--we knew exactly what time of day it was going to be dangerous. They sandbagged everything, but it finally got so it went right over the top. About three o'clock in the morning we were told to get off the levee.

Riess: What an experience!

Adele: They moved us into some cannery shacks that were in Rio Vista. They were for the transient workers that came in to work in the asparagus cannery. They reminded me of the ones that the Japanese-Americans were in during those segregation years, those dreadful years. They had no bathrooms in our shack, but there was a place in the middle of the rows of attached living quarters where there were showers and toilets. We lived there for about two months. So that was quite a bad adventure.

Lewis: There were two consecutive floods, and we never went back to the house.

Adele: We never went back. And Lewis--[to Lewis] Tell Suzanne--

Lewis: We had a small boat, and I rowed through the house. I went in the front door, and--[laughter]. The water was down then, but it was still about four feet deep in the house. It had gone clear to the ceiling. We had left some stuff on high shelves and it was washed away, and there were things had floated into the chandeliers.

Adele: And Lori's blocks were up on the ridges, the molding, way up high, so the house had to be completely filled with water.

- Lewis: And silt all over everything. I had electrical equipment, and it was just filled with silt.
- Lewis: It flooded twice, so it was under water for nineteen days after the levee broke. We were still rowing around in boats there.
- Riess: That was all recovered, pumped out?
- Lewis: Oh, yes. The levee was repaired between the two breaks. I think there were two breaks about ten days apart. The tides got high again, and it broke in the same place because it was still soft dirt.
- Adele: And then we moved to Berkeley. We had a lovely house there on Portland Street, near Solano and that area. We lived there for a couple of years until our move to Morgan Hill, and we had entirely different types of friends.

VI PEAS

[Interview 4: September 21, 1989]##

Low Yields in Illinois

Riess: Was it wartime when you went to Illinois?

Lewis: It wasn't quite wartime when we moved to Morgan Hill to start the pea work. Pearl Harbor happened in December the first year we were there. We heard about it in the car driving from Morgan Hill to San Jose. Most of the time that we were in Illinois was during wartime. When we were assigned to peas, it was pre-war time.

Riess: Was there any question of your being drafted?

Lewis: I had a draft card.

Riess: Was plant pathology considered vital?

Adele: Yes, but it was the food supply, not pathology.

Lewis: I think it might be well to give an overall view of the problems and why we were put on peas. That was why I was looking up the date. In 1926, Del Monte [it was actually called the California Packing Corporation then] took over the Midwest Canning Company, headquartered at Rochelle, Illinois. Pea yields were going down and down there in Illinois, but corn yields were staying up.

They had three canneries in Illinois and were making plans to build a fourth because they were canning corn there. They could use the same four canneries for canning peas in the early season when they're not canning corn. There's a lot of overhead just letting canneries stay idle. That's one of the big costs in the canning or freezing industry. You have a big plant, and the only time it can operate is when the products are coming in from the field. Of course, corn has its time, and peas come in at a

different time. So peas could be processed there with no additional cost for canneries.

The land is beautiful around Rochelle. Soil and climate are ideal for corn. It's much better soil than in the northern parts of the United States, Minnesota or Wisconsin, where most peas are processed. They did want to grow peas there, but it's borderline so far as temperature is concerned, because it gets hot sooner. They had this problem that yields were going down so much that they were no longer profitable. And yet they had the canneries there. You can see the dilemma they were in.

So, in early 1940 they asked Dr. Caldis to go back and see what he thought was wrong. I think he found every disease of peas that you could possibly find, even one that was very rare on peas --we've only seen it once since. So he got there on a good year to find everything. [laughter]

Adele: Pathologically speaking.

Lewis: Pathologically speaking, and they picked me to go back and do some work on it.

Actually, we started our work on peas at Morgan Hill in the greenhouse on our third anniversary, August 13, 1940. There was lab work, a lot of which Adele was doing at that time, and just before we went back to the Midwest, they decided to put her [Adele] on my payroll. They gave her a fifty dollar honorarium and said she didn't have to work any particular hours if she needed to take care of personal matters.

Riess: So you had already been told by Caldis that you would be working on this in 1941?

Lewis: Yes, by that time we had been told officially by Caldis. Actually, originally I wasn't told by Caldis. That was the funny thing. The company is queer--I guess they all are--about keeping things secret until the last minute. They don't want to promise something and then have it fall through. So I found out--well, let me tell you about it.

We had already moved to Berkeley, but we were still doing work up on all the ranches. I was up on Hasting Ranch, a big ranch owned by the company, and the guy who delivers mail and groceries --. (They have this guy who drives what they called the "candy wagon." When we were living there on Montezuma, that's the way we got our groceries. We would write out an order, and he would take it into town. It was a charge account at the store. Then he would

deliver groceries and mail to everybody that was living there on the ranch.)

This fellow came in at Hastings and said, "I understand you're going to go to Illinois." That was the first time I heard about it. [laughter] I think that was almost two months before I was told officially. I never said anything about it, except to Adele. I said, "This guy said we were going to Illinois." How he found out, I don't know. Of course, he brought the mail in too. But the letters would be sealed. Maybe he emptied the trash cans, too. [chuckles] I don't know. Anyway, that's how I found out about this.

Adele: Lewis, didn't we plant at Morgan Hill a lot of varieties before we went out there? We got these varieties, many of them, from the Seed Department's pea breeder. That first year, did we do any seed testing? I'm talking about when we were still at Morgan Hill preparing to go to Rochelle.

Lewis: Yes. The first year we did some seed testing, but mostly we examined plants from the Midwest. Once they decided that we were going to go back to Rochelle they made a very late planting of peas, an off-season planting. They planted peas and then, when the plants were mature, they would send the plants to us by airmail. They did that at all the locations where they were growing peas, in DeKalb, Illinois, and around Rochelle and Mendota, Illinois, and from Sleepy Eye, Minnesota--wherever they had a cannery.

Adele did most of the culturing on these plants to see what diseases we could find. When Caldis went back there earlier that year, he identified the diseases but didn't obtain cultures. We were after cultures of the diseases so that we could use them for testing in the greenhouse. At the same time, we planted peas in the greenhouse and inoculated them with these various things.

Adele: The proof that your culture is actually the pathogen is whether you can isolate the organism from a diseased plant, inoculate a healthy plant with that organism, and the inoculated plant will get the disease. If the inoculated plant gets the disease, then you've proven that the isolated organism was indeed the cause.

The "Lab" at Morgan Hill

Adele: I thought you might want to know about our headquarters in this old greenhouse that they rented for us at Morgan Hill. The greenhouse

was quite large, about 7500 square feet, but quite old. We rented a house that was about four or five blocks away, the first year.

Lewis: The second year, the house we rented was right there on the same property.

Adele: That's the main thing I want to bring out, that we had property right there. We had our little girl, who was two, and she had a sandbox inside the greenhouse so I could see her at all times playing. Then, outside, there was another playground we had for her. So I could still watch her and work full-time, too.

We had a very primitive lab. It was an old greenhouse and the whitewash would always flake off onto things, so that wasn't a very good laboratory. But we boarded up a section of the headhouse, including the ceiling, so the whitewash and the rain wouldn't drip down on us. Then we had a little fly sprayer with water in it and we would spray the room down so the dust would settle. Then we'd culture, and, amazingly, we did very well. We got very little contamination. Later on, when we moved to San Leandro, we had all these fancy rooms with the air filters and so forth (like a hospital "clean room"), but we did very well with that shed there.

Lewis: It is easier to do in a clean room, but--[laughter]

Riess: Did you dress like scientists every day? White coats?

Adele: No, not there.

Lewis: So, at the greenhouse the first year we worked with the plants that we grew there, and inoculated them with disease organisms that we had isolated from the plants that were sent to us from the Midwest. We had a lot of help from Dr. William Snyder, for instance, at the University, in identifying the different diseases which we had never worked with before. Bill Snyder came down to Morgan Hill quite often and verified that we did have a certain form of Ascochyta, for instance.

Adele: We measured all the spores and shared the information with him, because there are three types of Ascochyta, and he was convinced that there might be a fourth one, or that two of them might be different forms of the same organism. He was always going to write a paper on this.

Lewis: I think that he still may be correct, but it's controversial.

And then we worked some on seed, trying to see whether the seed was carrying a disease, but because of our method of working

on it that first year, we didn't find what we were really looking for. We'll talk about that later.

We drove back to Illinois through two memorable snow storms in eastern Nevada and all through Wyoming.

The first year that we went back there--of course, we were very green on peas and knew almost nothing about them. The only real experience we had previously was on Montezuma Ranch, so we boned up on pea diseases all winter, at the University, from bulletins in our Del Monte library, and every place we could find anything about peas. [To Adele] Now, you can tell--

Rochelle, Illinois, "A Picture Perfect Postcard"

Adele: It was like going back to a picture postcard of the past. Women, for instance, never wore slacks or shorts the way we did out here, so I honored that. I always wore skirts in the field, even though it would have been more comfortable to have slacks on when you're crawling around on the ground. The houses were tall, and two or three stories high, rather than sprawling, because it gets cold in the wintertime.

The houses we would rent were usually from school teachers who would go on vacations or sabbaticals or something. Most of them didn't have water heaters that were automatic. When we wanted to take a bath we would have to go down into the basement and light a fire or shovel coal.

Lewis: Yes, one house we had was a beautiful home, a big home, but it had a coal water heater.

Adele: And then there were never any showers, and we never take baths. We'd rather take showers, and there were never showers. We would go to the store and get one of these little tubes--

Lewis: Things you attach to faucets and hang somewhere to make a shower.

Riess: Did you change houses every year?

Adele: Yes. Sometimes we got one for two or three years.

Riess: How much of the year were you in them?

Adele: Well, at first, you know, we were there from March until August. We got to know the people very well, and the town knew us. This is

the sort of thing we weren't used to, because when I lived in San Francisco I never did know the names of our next-door neighbors; our houses were flush, that close to one another, but you never said hello to people in the street that you didn't know.

But there, the first time we went into the bank, they said, "You're new here. Where are you from?" At first I was pretty uppity about that--"it's none of your business"-type attitude. Then, later on, I realized it was just friendliness. It was just a revelation. Everybody pretty soon knew that the Lawyers came back every year, and they would say we were like the robins in spring. [laughter]

Lewis: The thing that I remember--. We were banking with Bank of America in Berkeley, and we had been with them ever since we were married. Every time we'd go into the bank, why, we'd have to identify ourselves because there was never the same teller there. Their turnover was horrendous. They couldn't punch numbers into a computer like they do now, to see whether you have any money. So we'd have to identify ourselves.

Once we went into the bank in Rochelle and were introduced, there was no problem cashing a check. I had to cash a check for seven hundred dollars one time just before we left. Well, it would have taken a couple of weeks to do it here. Seven hundred dollars was a lot of money in those days. But no questions there. It was quite different.

Adele: Then they had a park where they had band concerts once a week. The musicians were people that lived in the town who played instruments. And they'd have ice-cream socials afterwards, usually sponsored by the various churches--events we never could have imagined. Almost everyone in town attended, and many of the neighboring farm families. The nights were warm and the children would chase fireflies while the adults sat around on the lawn or on benches. Many listened from their cars and blew their horns as applause at the conclusion of each musical number.

All the stores stayed open on Thursday night and the farmers would come into town to shop and visit. Everyone would walk around on Main Street to say hello. By the end of the year we knew everyone in town, at least by sight.

The only thing that we found a little uncomfortable was the polarization of social events according to religion. There were the Catholics, and not just the Protestants--the Methodists and the Presbyterians and the Lutherans, two types, and the Episcopalians, and the Baptists, and two different kinds of Baptists. They all stayed mostly within these groups socially.

Riess: Did they all make an attempt to proselytize you in any way?

Adele: We were pretty free of that.

Lewis: Only at Morgan Hill. It's the only place that I remember it.

Adele: Yes, but Lewis, if we had lived there, in Rochelle, I think it would have been uncomfortable for us not to have gone to any church.

One year, when we stayed with a Miss Heltness in her attic apartment, she and this man had not married but kept company for many years. They were maybe fifty-five or so. He would come over there and stay till maybe two in the morning and go home, but they couldn't get married because she was Presbyterian and he was Catholic, and there was no way.

Lewis: Neither of them would change. They were very good friends and very much in love. They couldn't live without each other.

Adele: People recognized, although they were very strict about morals and everything, that this was the only way it could be. This was quite a strange thing to us, but we accepted it, too.

Riess: Were they all involved in agriculture in some way in Rochelle?

Lewis: No.

Adele: When we first came, there was the Baldwin Locomotive Factory where they manufactured steam locomotives.

Lewis: There was a dye works and a spinning mill, a very large greenhouse where they grew roses for the Chicago market. a furniture manufacturer, and Baldwin Locomotive. The first house we lived in, William Eckert, the chief engineer for Baldwin Locomotive, owned it. They lived downstairs. We lived upstairs. We became very good friends. He had just designed and constructed a huge crane that ran the full length of the plant. The first time it picked up a locomotive, Bill walked over and stood under it. He said that if the crane buckled, he didn't want to hear about it.

Adele: Then, later on, Swift came in, and they had a big packing plant there. But now things have changed.

Riess: It sounds like it was a prosperous community.

Adele: It was a prosperous, completely middle-class and upper-class community, and the schools were excellent. All the children went

to college. It was much more homogeneous a city than we're used to here. They had one black family in town, and so they were very tolerant and liked them very much, but I have an idea that if there had been more--

Lewis: Their son was a good football player when he went to high school. Elzie Cooper was his name, and he later went to work for Del Monte as a foreman in their big distribution center.

Adele: I remember they had a controversy about whether he should be invited to the banquet at the end of the football season. Some of the parents didn't want him to come, but the students all got together and had a petition, and he was allowed to come to the banquet. But that's as much as they knew about other races.

Riess: Was California almost like another race for them? Were you considered to be exotic in that way?

Adele: That's right. We were. They would ask us all about things that happened in California. In the early years, we were even asked about having dangerous Indians in California, since some of them thought of California as the wild west. And we were questioned about the report of a Rochelle resident who had visited California and reported that, because of the constant earthquakes, she didn't even have to push her rocking chair. It just went back and forth by earthquake power! They were very prejudiced, during the war, against Japanese.

Riess: No Japanese were relocated into that town.

Adele: No, but there was one professional man who was Japanese-American.

Lewis: He sexed chickens; there were a few chicken ranches around, and they need to sex the chickens when they're very young. It's something that few people can do. It's difficult to tell the sex of a chicken until one of them starts to crow. [laughter] He would come out when they were just hatched out of the eggs and separate the males from the females. They had always accepted him before. He didn't have to be relocated because he wasn't along the coast, and he was there all during the war.

Adele: But whenever he would come, they would let the air out of his tires, and once they broke the windows of his car and that sort of thing.

Riess: How about the German-Americans in the community? Were there any?

Lewis: I imagine there were a lot of them.

Adele: I didn't notice any feelings about that.

Lewis: They had prisoners of war later. They were all good singers. They used to take them in trucks out to the fields, and they would be singing these German songs. It was beautiful to hear them go by.

Adele: They were all friendly and good workers, very nice.

Lewis: We had them helping with the experimental plots.

Adele: They seemed to be happy, too.

Lewis: Yes. Happy to get out of the war, I guess. [chuckles]

Anyway, that's the general background of what Rochelle was like, why we went there, and what Del Monte's problems were.

Adele: What our problems were.

Riess: Adele was saying that the growing season was two months--that's May, June, or something?

Adele: June, July.

Riess: June, July, and so you would arrive on the scene, when?

Adele: We arrived, at that time, in March.

The First Year at Rochelle

Lewis: The first year, we went the earliest. We were there way ahead of planting time the first year, because we knew nothing about their season. I don't know really who decided when we should go, but it wasn't us. I know that we didn't want to go back there in March. The lawns still hadn't started to grow. They were all brown.

The first year, as I remember it, we had just one farm for our research. We can't remember whether we started the root rot area planting the first year, but I think that that was the second year. Anyway, primarily the first year, we just had some row plots planted on an old farm where they had grown peas before. Every variety of peas that we could lay our hands on from other seed companies and our Seed Department was planted here.

Riess: This was before you had a chance to see them growing?

Lewis: Before we had a chance to observe, yes. This was just to try to find out if any of the varieties were resistant to any of the diseases, especially Ascochyta.

Riess: And the diseases were not visible in the seeds? I've seen your pictures of all these deformed, scarred seeds.

Adele: [to Lewis] We didn't examine the seed lots before we went out there, did we?

Lewis: We examined a few seed lots, but because of the method we used we found no disease. But they knew from Caldis's report and what they saw themselves back there, that they had a disease problem. We wanted to plant varieties back there so that we could see if there was any difference in resistance. That was primarily the thing. We had high school boys. We had lots of help from high school boys.

Riess: Just boys? [chuckles] Hmmm.

Lewis: Yes. There again--it's discrimination. But just having high school boys is bad enough. Can you imagine having both high school boys and girls!

Riess: Girls know how to shell peas.

Lewis: They weren't shelling. In this case we had them go out and select plants that were free of disease.

Adele: And tag them.

Lewis: This was done at "canning stage," just before the peas were ready for canning. They would tag them, and we would go out and grade the tagged plants. All we had to look at were the plants that they had tagged. We didn't have to look at everything. We found out that there was no rhyme nor reason to the tagging. This goes back to the high school boys ideas--they didn't seem to be selecting plants that were any more resistant than anything else, as far as I could see. So I got this idea--I had them put their names on the tags. I told them that we wanted to give them credit if we did find something that was good. After that the plants were tagged better! [laughter]

We did find visual differences in the apparent resistance of some of the plants there, but from the work that we did with them later, we actually were getting nowhere by that method. None of the plants selected that way were resistant in subsequent tests.

I don't think anything of monetary value came from that first year. But you have to get started, and we certainly added to our knowledge.

Adele: Anyway, we'll talk about other research which we did that first year.

Lewis: Yes. Other than the one big variety collection plot which we have told you about, the first year that we went back there we primarily just went from field to field to see what we could find. What was the source of all the disease? Was it coming in on the seed or was there a local source? In those days they made stacks of pea refuge. They would harvest them with a sickle-bar mower and bring them in to a viner, a big machine with revolving paddles that separated the peas from the pods and vines.

They had viner stations where there would be three or four viners. Crews of men would fork the vines into these viner machines, and the viner would thrash the peas out. The stripped vines would come out the end of the viner, and then the men would haul them and stack them in a big, tight stack. By the end of the season, each stack would be about fifteen feet wide, ten feet high, and fifty to one hundred feet long. This would make ensilage for the cattle.

Adele: It would ferment and be like sauerkraut. They would feed that to the cattle.

Lewis: In the wintertime.

Adele: So these stacks were located at all of the viner stations, big stacks of pea-vine ensilage to use on their own leased farms, and the other farmers, of course, either would sell the stacks or feed their own cattle.

Adele: They fed them corn, too.

Riess: Then Del Monte sold its cattle to somebody else?

Lewis: Yes.

Anyway, these stacks would be sitting out in the field, and we thought they might be a good source of inoculum to spread the diseases. Sometimes they would be used up before they would plant peas, but other times they wouldn't. So we went around examining and sampling the stacks, and we found on the whole that fermentation had killed all the pea disease fungi.

Adele: Everything in the middle of the stack.

Lewis: We were looking for the fungus, Ascochyta, especially, and figured that it would be killed in the middle of the stack. But on the edges, the outer surface, we found air-dried pieces of pea vines with fungus damage seemingly unaffected by the ensilage process. But even there, evidently the fumes got it, because we could see the fungus but we couldn't get it to grow.

Then we put microscope plates out with--well, we used various things, Vaseline, gelatine, various sticky things to catch spores. We had those around, and we would take them in, look at them under the microscope, and see what kind of spores had fallen on them. We found Ascochyta spores on most of the slides, so obviously organisms were getting around.

The only place where we really found live fungi, however, was on the little pieces of stubble that were left on a mowed pea field. The mowers would mow the pea vines maybe an inch and a half or two inches above ground, and then there would be this stubble left there. We found many live spores on that stubble. That's probably where field infestation was coming from.

In the springtime, they would have these terrific storms with big winds--thunderstorms and heavy winds. Bacterial blight, a leaf-spot disease, we showed that it could spread from three to four miles from a spot from these winds. You could just see a path of it across the field where it spread.

Adele: Not only the winds, but they determined how far a single drop can splash, something like eight feet.

Riess: Was that work you did?

Lewis: No, that drop thing was done at the University of Wisconsin. They found that if they'd put a drop of dye on a pea leaf and then drop another drop of pure water down on it, the dye would be replaced, and the drop that fell would be left on the leaf. So when a raindrop falls down and wets a leaf, the fungi and bacteria get absorbed in the water. When the next raindrop hits the leaf, then the bacteria and fungus spores splash all around. Also, if the raindrops are clearing material out of the air that happened to be blowing by there, why, that gets spread around. In a thunderstorm with strong winds the spores and bacteria can be spread for miles.

Riess: Well, Caldis had said that there were all sorts of problems, but you were just looking for a particular bacteria?

Adele: We looked for one thing at a time. Bacterial blight is a bad disease, but mostly we were looking for Ascochyta. The first thing

you think of when you see the pea stacks, and you know they're composed of diseased plants, is that they may be the source of diseases. So that was one of the first things we investigated. The raindrop thing and the spread from pea stubble came later.

Problems Develop

Riess: When they invited Dr. Caldis to come, surely that wasn't the first notion they had had of a problem? They knew that their yields were going down, but they also must have been able to observe something?

Lewis: Actually, there was no plant pathologist back there.

Riess: But aren't there some kind of common sense observations?

Lewis: Yes. They had a big project on corn themselves, even before Calpak bought it. But they didn't have any breeding project on peas.

Actually, that was one of the things that made part of our program at Rochelle difficult, because there was one man there, Lloyd Koritz, who should have done something about their problem sooner, that hadn't. He was in charge of their research. And here we came back there from California, and the more successful we were, the worse he liked it.

Riess: So they did have their own scientists there? This Midwest Packing Company had its own research department?

Lewis: Yes. But their work was primarily on fertilizer. They were doing work on fertilizing the peas. They hadn't done anything on rotation.

Riess: You mean leaving fields empty by "rotation," or rotating crops?

Lewis: Rotating crops. They had done nothing about that, and that was one of their problems.

Adele: Because if you have a disease, and you continuously plant the same crop, then you build it up.

Lewis: Corn is an exception to that, fortunately. Incidentally, they had done very good work on developing an exceptional hybrid corn variety.

- Riess: Isn't there something about survival of the fittest? In a way, if you keep replanting and replanting, ultimately the fittest will survive?
- Lewis: Yes, but peas are self-pollinated. There's no natural crossing in peas. Sometimes an insect may eat its way into the flower before the flower opens. That's the only way they can pollinate because the flowers self-pollinate themselves before the flower opens, ordinarily. There's no crossing, so you don't gain anything by selecting plants in the field. Each plant within a variety is the same as its neighbor. It may not have as much disease, but this is just by chance. With most other plants, in fact with any plant that you or a bee can cross, all you have to do is continuously plant seeds there, and eventually you end up with something that is better, but you can't do that with peas. You have to cross them yourselves.
- Riess: Had anybody been working on the problem? You say that they were just trying to make them healthier plants, fertilizing them.
- Lewis: Yes. They were doing good work on that, and also, of course, peas require nodulation bacteria (*Rhizobium* spp.). Illinois is one of the few places in the world, I guess, where if you plant peas where peas have never been grown before, there are no nodulation bacteria, and the peas won't grow. That's not true almost anywhere else. For instance, in California you can plant peas anywhere, and the bacteria are already there. Why they're not in the Midwest is a puzzle, because once a field has been planted to peas and you get nodules on them, the bacteria stay in the soil forever. So the cause isn't freezing and thawing or anything like that. It's just an area where they don't exist naturally.
- Riess: Prairie lands?
- Lewis: Yes, it's prairie land, and they don't exist naturally, so they've done a lot of good work on inoculation.
- Adele: They develop different strains of *Rhizobium* bacteria and try them out. Some of them are better than others to inoculate the soil with.
- Lewis: Koritz for years had been trying to blame the Calpak Seed Department for all of their problems. The Seed Department was headquartered in California, but the seeds were grown primarily in Idaho. He was trying to blame the Seed Department, saying that the Seed Department was bringing these diseases in. Of course, it was not their fault, so the Seed Department here was involved in this big controversy, also.

But I want to make one thing clear, I don't think anybody ever had better cooperation than we did with the Midwest Division management and personnel. There was only this one member of the Research Department that we had quite a fight with, and he was trying to downplay the success of our program.

Riess: What could they actually do to stand in the way of the success of your program?

Lewis: Almost every year, the vice president who was in charge of the Midwest Division, but headquartered in San Francisco, would be fed "Koritz" information from Illinois each time he visited there. Then he would come back out here, and he understood that it was this way. Every year, we would have this argument and have to show him that there really was some progress being made. Lloyd was trying to kill the program so they could get it, and because he should have started it himself five years before we did.

Riess: Oh, and they would get their own plant pathologists and start all over again?

Lewis: Yes. They did have a plant pathologist back there by then. His name was Sid Piersma. He was more interested in other things than he was, for instance, in making cultures. He did excellent work on the nodulation bacteria.

Adele: I forgot that he was a plant pathologist by training. He was a fine man and a good friend of ours, and he worked with us on many projects, but he was never involved in the pathology part except to observe what we did. He was very cooperative, a good manager, active in the trial plots of peas, corn, lima beans, and pumpkin, did the lima bean breeding, and was responsible for hybrid corn seed production.

Riess: Well, the scientists who were part of the Midwest Packing Company--were they geneticists or horticulturists, or what were they?

Adele: I think Lloyd Koritz, the head of the Midwest Research Department was a plant breeder.

Lewis: No, Don Taylor was their plant breeder, and they also had an entomologist. Lloyd was a horticulturist, but I think his main interest was getting ahead in the company. The first day he started to work for Midwest Packing Company he told a fellow worker that someday he was going to be president.

Adele: Koritz was trained at the University of Illinois, and he was a very smart man. He used the University of Wisconsin to confirm some of

the things he believed in, and the University of Wisconsin was not always right.

Lewis: Yes, despite the fact that there were two famous pathologists there.

Adele: J. C. Walker was one.

Lewis: He was a good friend of ours, too, but he made a mistake, which we will tell you about eventually. But anyway, since Lloyd blamed the Seed Department for all their pea problems, the whole thing became a three-way, inter-departmental project, including the Del Monte Seed Department.

Seed Field Investigations

Lewis: This brings up the one thing we should cover that we haven't covered, and which was the grand climax of that first year. By that time gas rationing had started, but all driving in Illinois was done with gasoline from the un-rationed Del Monte tanks, so we had saved enough ration coupons for our drive home.

As I said, the Midwest Division's Lloyd Koritz blamed the Seed Department for all his problems, and the whole thing had become a three-way interdepartmental project, or should I say, "squabble?" So, despite the fact that we were pretty well convinced that the stubble was a primary source of their disease problems, the Midwest Division insisted that we go to the seed fields and examine them as a source.

On the way home from Illinois to Idaho, we also managed a visit to Yellowstone Park and a few things like that. That was the first time either of us had been out in the wilds of the United States. [to Adele] Of course, you'd been to New York City, but you hadn't been in the country. I hadn't been anywhere.

From Yellowstone, we went to Idaho Falls, where they grow pea seed. We rented a place in a motel, a regular housekeeping room in a motel, and we converted the kitchen to a laboratory. We had our microscopes with us, and all this stuff for making cultures.

The first day, a man took us out to the fields, and I can remember--we jumped over an irrigation ditch, and there was bacterial blight. We hadn't expected to find bacterial blight in the Northwest. Actually, we hadn't expected to find any serious problems, especially since it was reported by L. K. Jones, the

person who actually named one of the Ascochytas, that Ascochyta did not exist in the western seed fields. Of course, we later found Ascochyta everywhere, and we found bacterial blight in quite a few of the fields.

It was ironic. We jumped across this irrigation ditch, and here was bacterial blight, the first plant we looked at. Our guide was the field superintendent at Idaho Falls, and he told us later that he had been told by Seed Department management, specifically, to take us to that field because there was no disease in it. They didn't want disease found in there, you see, because the Midwest Division had been saying that's where all their troubles were coming from, which wasn't true either.

Then he took us to another field which also had been very carefully selected as a field where we weren't going to find any disease. We began noticing these spots, yellow, mottled areas, on the lower leaves, and they really didn't look like Ascochyta does, either. What happens is that in that dry country, Ascochyta doesn't look like it does where there are rains in the Midwest. We found Ascochyta on--oh, I don't think there was a field up in Idaho Falls that didn't have it. It was just as universal as it was in the Midwest.

Adele: But it didn't look like Ascochyta to us, either.

Lewis: No, it didn't look at all like Ascochyta, and we can certainly understand why Jones hadn't recognized it.

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Adele: The lower leaves were just yellowed, and they didn't have any spots or anything, so you would never know that it was Ascochyta until we cultured it.

Lewis: We didn't know what it was.

Adele: We just wondered why they were yellow, and then when we put them on agar plates, the pycnidia came right out, and you could see. It was amazing, because we were familiar with what it should look like. It didn't look anything like that, so naturally no one had recognized it before.

Lewis: Anyway, at Idaho Falls, from that work we did find out that there was a lot of the same Ascochyta (Mycosphaerella pinodes), in the Northwest seed fields that was causing them the problem in the Midwest.

The Second Winter at Morgan Hill

Adele: The first thing we did when we got back home from the seed fields was to hire an assistant to work on the asparagus disease so we could work more on the peas. That was Ralph Gilmer, who was also a graduate in plant pathology at Berkeley, whom we had known there.

At Morgan Hill, our life was almost all our work. We didn't ever get into the community or have close friends, except for Dr. Harold Thomas, who had moved to Morgan Hill, also. We would see him occasionally, but he was busy with his research, too. Ralph Gilmer and his wife were very nice people, but we had very little in common with them. The research was our life. Our recreation at that time was watercolor painting, and we enjoyed painting landscapes along the country roads. Lori painted, too, right along with us.

Lewis: The thing we had in common with Ralph was our work. He and his wife were interested in judging livestock, which they learned in 4H.

Riess: You were continuing to go up to Wheatland from there, and you were checking your tomatoes from that base, too?

Lewis: Yes. The hydroponic tomato work, then, we turned over to somebody else, but we still paid some attention to it.

Riess: Once things get rolling, you have to work seven days a week?

Lewis: Oh, yes. The crops don't know it's Saturday or Sunday.

Adele: Then we had so much statistical work on everything to do that we worked nights an awful lot, too. That was kind of our life, and because we were together, we weren't hurting our home life. That's why I think we were able to be more productive than people who weren't working together. They have to have the responsibilities to their family.

Riess: There is a tradition of working in teams, it seems to me, in this profession, isn't there? Maybe I just keep running across teams.

Lewis: Snyder and Hansen? Yes.

Adele: That's true,

Riess: Buddy systems, sort of.

Adele: That's true, but they can't work as many long hours because Snyder had three daughters and a charming wife that he would want to spend time with.

Lewis: No. [added later] I've been thinking about team work in plant pathology and I really can't think of any except Snyder and Hansen. There were no real teams at Wisconsin, Illinois, or Cornell. They got along with each other, but they didn't team up, except for the relationship between major professors and graduate students.

Riess: Were husband and wife teams--did you come across any more of them?

Lewis: No.

Riess: It seems quite perfect. Now, were you just continuing to get the occasional honorarium? You weren't on the payroll?

Lewis: Four years, I think it was, she worked just for the fun of it.

Adele: Yes, and then they had this executive committee meeting and made an exception in my case.

Riess: That was in 1941.

Adele: Yes, when we went back to the Midwest.

Lewis: Anyhow, to get back to the peas: After we hired Ralph Gilmer and got rid of some of our other responsibilities, we outlined the winter work at Morgan Hill. Because of what we had seen in the seed fields, and because the Midwest Division still thought it was the seed that was carrying the disease, we started checking seed lots to see what diseases they had.

We had checked about twenty lots the previous year and had found nothing. All twenty of the seed lots were free of disease. The normal thing that you do when you're testing plant material for disease, you surface sterilize it with chlorine. Then you plate it out. You surface sterilize it because the surface is contaminated with all sorts of organisms. So we would surface sterilize the seed, place them in wet paper towels to germinate and develop the disease, but we couldn't find any disease on them.

We eventually found out that the seed was carrying the disease. It was our method of testing that was in error. When we went up to the Northwest, we had found the disease and we knew that it had to be on the seed. Seed produced in the rainy Midwest has deep lesions of Ascochyta and no amount of surface sterilization will kill it. But, we found that, instead of being internal in the seed in that dry country up there, the only disease that gets on

the seed is in the form of a dust from the leaves, stems, and pods when they're thrashing the seed and processing it. It's all over the surface, but none is internal. Any disease they have is on the surface of the seed in the form of dust. Well, of course, when you surface sterilize it, it's all cleaned up. So we stopped surface sterilizing, and then we found Ascochyta on almost every seed lot produced in the northwest.

The interesting thing, and I still don't know why it is, when we examined some seed that came from California seed fields, they all had Mycosphaerella pinodes on the seed. But when we examined the seed that comes from Idaho Falls (and we did this several years in a row), we never found Mycosphaerella pinodes. That's the form of Ascochyta that we had found on the leaves, but we found only Ascochyta pinodella, an entirely different organism, on the seed. It has even been given a different species name now (Phoma medicaginis var. pinodella), but at that time it was Ascochyta pinodella. It causes a foot rot, sort of a root rot, but never runs rampant in the Midwest like M. pinodes. So the seed was not responsible for causing the main problem in Illinois. That, we decided, was coming from the stubble.

- Adele: Ascochyta pinodes has two forms, and the Mycosphaerella pinodes form is the perfect stage and has airborne spores.
- Lewis: It's the sexual stage.
- Adele: So they're two stages of the same thing. The airborne stage can go for great distances.
- Lewis: Adele measured spores, and this was the thing that Bill Snyder was interested in at Cal. On many Idaho plants she found this intermediate spore size that was neither pinodella nor Mycosphaerella pinodes. Once you cultured it, however, it usually turned out to be the pinodes, and almost never the pinodella. Snyder thought that pinodella might be still another form of the same fungus, but he was never able to prove that. Taxonomists now think that it's not even an Ascochyta. I think the taxonomists are wrong, and that Bill might even be right, but that's a taxonomy problem. We don't need to worry about it.

But the really interesting and still puzzling thing was that Ascochyta pinodes, the fungus that we found on the leaves, was never found on the seed. And yet we know that the leaves are where the seed inoculum comes from. It is deposited on the surface of the seed as a dust during the thrashing process, and you can clean it up easily with surface sterilization. So we know that it's in the dust, and yet the Ascochyta that we found the most prevalent on the plants is not the one that gets on the seed. Why that is, I

don't know to this day, but we've never found A. pinodes on the seed--only pinodella. Maybe that intermediate spore that Adele found so often means that Bill Snyder was correct and that pinodella and pinodes are different forms of the same fungus.

Now this is where J. C. Walker comes in, and his error that I was telling you about before. We were working in part with the University and I think Lloyd Koritz told him that we had found Ascochyta on the seed. As soon as he found out that we were doing this work on the seed, and that we had found Ascochyta, he tested some seed himself, using our method. Of course, he found Ascochyta, just as we had. So he published an article in one of the seed journals saying that he was going to have all the seed examined and certified before it came into Wisconsin because of bringing disease into Wisconsin.

I can still remember, he was visiting us in Rochelle, and I said, "Well, you know that pinodes isn't carried on the seed, don't you?" And I can still remember his face. I said, "You know, we've only found pinodella on the seed." He had found Ascochyta, but he had never bothered to identify it--just assumed it was pinodes. They look alike in culture, and until you look at the spores under the microscope, you can't tell them apart. He never bothered to look at it, and so that whole thing then was hushed. That's the only time I ever saw J. C. embarrassed.

Now, I want to make things clear. To me, as to all his peers, J. C. Walker was one of, if not the leading plant pathologist of all time. He just made this one little slip and published before he was absolutely sure. He was a fine person and soon became a friend of ours. But he could be quite devastating and even rude at times.

I remember the first time we met (or almost met) him. Shortly after we first arrived at Rochelle, Lloyd Koritz took us up to the University at Madison. He talked with J.C.'s secretary and she told J.C. we were there. We waited in the hall for twenty minutes or so, and finally his secretary looked in his office. He was gone! He had slipped out a back door and down a fire escape. This was a route he often took to see his plots. Did he just forget? I often wondered. But, as I say, we became good friends and visited him at his home, and he and his wife visited us when Adele asked him to come out here and give the keynote address at the Soil Fungus Conference she chaired in 1978.

The Fight for Seed Treatment

- Adele: We developed the seed treatment for the peas, too. So that was a big thing in itself. It raised the yields.
- Lewis: Seed treatment chemicals other than mercuries and copper were just being introduced. We figured that if surface sterilization with chlorine would clean up the Ascochyta, so would a good seed treatment chemical. Spergon had just been introduced and it turned out to be ideal. I think the first five years that we used and tested it, it made a difference of someplace between five hundred and six hundred pounds per acre of peas.
- Adele: That was another thing we had to fight for, because Koritz said they didn't need seed treatment. He felt it was a personal affront for us to recommend seed treatment. And that's not a research approach.
- Lewis: It was years before they used it on any seed lot that we hadn't found to be badly infested with Ascochyta, and this cost the company thousands of dollars.
- Riess: So you're saying he didn't use it?
- Adele: No, and he refused to use it even though we recommended it.
- Lewis: We could use it on seed lots that we had proved had disease, but just to clean up the disease, and that's all. We recommended that treated seed be planted on all but first-year land. You couldn't use it on first-year land, on any soil that hadn't grown peas, because seed treatment also killed the nodulation bacteria.

The seed treatment chemical would be put on the seed before planting, of course, so when you mixed the nodulation bacteria with the seed, why the rhizobium bacteria were killed. This was very easy to prove, and we planted test plots in land where peas had never been grown before. Whenever you used treated seed, you'd have a plot of spindly, yellow peas with no nodules growing on the roots, and a green plot right beside it with many nodules where you hadn't used seed treatment. So at that time we didn't recommend its use on any seed used on first-year pea land. Lloyd thought that seed treatment would also affect the nodulation on old pea land. We proved that this wasn't true, but he was a very stubborn man.

- Riess: I was imagining that the bacteria would have been added to the soil, but it was added to the seed?

Lewis: It's added to the seed, yes.

Adele: It was at that time added to the seed, sprayed on the seed as it was added to the hopper on the planter.

Lewis: Now, Del Monte has developed machinery to put the rhizobium inoculum in the row--

Adele: --so we could use seed treatment even on first-year land. The interesting thing was that in the years where they refused to use seed treatment on first-year land and we only used it on diseased seed, those fields planted with treated seed outyielded the ones planted with untreated seed, even on first-year land.

Lewis: Yes, they outyielded first-year land by five hundred pounds to the acre. We kept notes for five years, and the poorest yields were on old pea land, using untreated, non-diseased seed. Next was first-year land planted to untreated, non-diseased seed, and the highest yielding fields by 500 to 700 pounds per acre were those planted with disease-infested, but treated, seed.

We knew that using treated seed everywhere, even on first-year land, would boost the yields. So, with Lloyd Koritz protesting every inch of the way, we started trials on what we called "indirect inoculation." That worked fine. We worked that out by hand-planting the treated seed and then pouring bacteria, or dusting bacteria alongside them in the soil.

It can be done several ways, and we soon found out that the "indirect" method was actually better than the old method. We told the Del Monte shop foreman what we wanted, and they developed the machinery to plant. At the same time we worked with Urbana Laboratories, where the company was buying their inoculum. They furnished us with rhizobium inoculum impregnated on finely-ground limestone. It was expensive, but it increased their yields tremendously.

It's interesting, Koritz fought this until Midwest management overruled him, but now it's used everywhere. Now, because of improved varieties and the use of treated seed, the ten-year average yields on first-year land are more than double the highest yield ever recorded on a Del Monte farm in Illinois prior to 1940.

Del Monte's Pea Variety Collection

Lewis: Everything that we've talked about so far involves what we discovered in our first year-and-a-half of work: winter 1940 at

Morgan Hill, summer 1941 in Rochelle and Idaho, and winter 1941 back at Morgan Hill. As I said, by then it was a three-way venture involving us, the California Division Agricultural Research Department, the Midwest Division Agricultural Research, and the Seed Department.

Riess: The Seed Department?

Adele: The Del Monte Seed Department. We had some competition from that source also.

Lewis: Yes, but in this case it was interdepartmental competition, it wasn't personal. In the Midwest it was personal, an individual, and we got along fine with the division. With the Seed Department, we got along fine with the members of the department, but Ag Research and the Seed Department were competing with one another. The Seed Department really hadn't done much work on developing pea varieties and they hated to see another department come in and take over the work they should have been doing.

Riess: What kind of scientists work in the Seed Department?

Lewis: Geneticists, plant breeders. But they had never selected for disease resistance. They had selected for type and that sort of thing, out of commercial varieties, but had never developed a variety of their own.

Actually, where Del Monte got its start on superior quality peas came from a selection that the head of the Seed Department, Tom Booye, had found in Utah. In a field of late maturity peas he found an early rogue. Now, whether it was a genetic rogue or whether it was a seed mixture, it was never decided, but we never found another variety like it. That pea, called Delmar, they were already using commercially in Utah. This Utah selection, though disease susceptible, was superior to anything else for quality, and we used it extensively to get good quality into our crosses for disease resistance.

Riess: Could you call on the USDA to send you whatever they had?

Adele: We did. That was a very great part of our success.

Riess: How about from other--

Adele: Besides the plant introductions from the USDA, we got everything that we could get from all seed companies and agricultural colleges. We had the biggest collection of pea varieties in the world.

Riess: By "we" you mean Del Monte.

Lewis: Yes.

Adele: Del Monte, and it has been accessible to anybody.

Lewis: Yes, we got the collection from a lot of sources, but we also made it available to others. One time, by chance, I was seated next to the director of research for Campbell Soups, on a flight home from Chicago, and after we found out who each other was, he said he had heard that we had a good pea collection. He needed a pea for their split-pea soup and gave me the specifications including dark-green cotyledons. We had five accessions with his desired characteristics. He later wrote and told me that one suited his needs exactly.

Adele: We did a lot of work on the variety collection. The USDA, at that time, didn't increase them often enough, so that sometimes they weren't even viable by the time we received them.

Lewis: They lost the entire Wade collection of peas of some 700 pea varieties by letting them sit on a shelf in glass jars at room temperature for twenty-five years.

Riess: Every year they would have to be increased?

Adele: Well, not every year.

Lewis: At least every ten years they have to be increased. Five if you don't have good storage. We have a good storage facility. The temperature is kept at 55 degrees Fahrenheit and the humidity very low.

Anyway, our policy at first was to increase one-fifth of the collection every five years, and that's a big planting considering we had 4000 plus accessions. Of course everything had to be kept separate when they're harvested.

Adele: The reason we had to do so much work with it is that when they come in to the USDA Plant Introduction Station they are usually a very mixed lot. For instance, a plant collector might go to Afghanistan and go to a marketplace and get some peas. When you plant those out, you may have tall ones, and short ones, and yellow-seeded ones, and green-seeded ones--they're all mixed up, they're rarely pure (consisting of one type only). But that seed lot is given a Plant Introduction accession number, whether it's mixed or not. We would plant them out and tag each type separately and harvest them separately, so that we would have, for example, USDA Number 12567A,

B, C, D, E, F, and so forth; so we were able to test each of these types separately for disease resistance.

Lewis: They were all different genetically.

Adele: Every one was different, and so we had a tremendous job. Even now, they increase, say, every ten years. But we have so many that they'll plant, maybe, four or five hundred a year. There's still ten years between them because--[to Lewis] oh, how many thousand do we have? I don't remember. Something like five thousand now, I guess.

Riess: What if one of those peas from Afghanistan was just the pea of all peas, and you only have a couple of plants--how do you multiply them?

Lewis: You increase it.

Adele: The minimum increase would be ten-fold, you know, and so we'd get ten seeds from each plant. When you get enough seed, you plant them in a root-rot spot to see what happens. Or maybe some of the plants would be inoculated with leaf diseases to see how they react to the disease. We've discovered a lot of useable traits through that procedure. It's a wonderful thing to have this germ plasm available for that kind of a program.

Riess: The only way you can get enough seeds is the tenfold thing?

Lewis: Yes, but you really don't need much seed of most P.I. accessions. They are absolutely useless as they are, except perhaps for a single useful gene.

Adele: No, it is only useful as a parent after you cross it with a suitable variety. It would be a "dog" by itself. Almost always they're just absolutely worthless as a commercial variety. Some of them would be six to eight feet tall, spindly things with little, teeny pods that aren't worth anything. And the seeds have anthocyanin (the colored seeds), and they can taste terrible. So you have to start by crossing a good variety with the disease-resistant accession, and then keep reselecting. It takes a lot of years and patience.

Lewis: The genetic stuff is a package deal, and everything else, every undesirable character, comes along with it. You select away from the characteristics you don't want. There's just the one gene, perhaps disease resistance, in there that you want to incorporate into yours. Of course, you can do it eventually. There are linkage problems sometimes, but not always.

Adele: I always remember the first time we saw mildew resistance. Peas always got mildew in the Midwest in the late season, and their leaves are all white and powdery with mildew. So there were our variety collection plots, you know, rows and rows of them for increase, and here's this one shiny, bright-green plant! We started a breeding program for resistance to mildew (powdery mildew), and all of our peas are resistant now. They are just completely green from that one shiny parent there. [to Lewis] It was a recessive, wasn't it?

Lewis: Yes, resistance was controlled by a single recessive gene, and it was easy to work with, because once you get it, why, it stays there.

Adele: It was wonderful.

Lewis: We have a picture of the plot showing the segregation of the first cross.

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Lewis: When I first saw the mildew resistant plant in the increase plots I thought it was lack of aphids. I thought, "My Gosh! The aphids must not be eating it." Mildew is so universal that you don't pay attention to it. During the late season it came onto everything, and here was this green plot, and I went over to see about the aphids. But lack of aphids was not the cause. There it was with no mildew! That plot was from a selection we originally made for seed type from a mixed-up P.I. number.

Pea Disease Survey, Illinois, 1942

Lewis: But we're getting a little ahead of our story. Before we made any crosses for disease resistance we decided we should gather some exact information on which diseases were the most important economically. We had tried to find out which disease was the most important the first year, but we could see that we weren't getting very far because it was too complicated.

So the second year we were there, we set up this plan. It's probably the most comprehensive study ever made on pea diseases. We had the field men bring in peas from every field of his they were harvesting that day. Each field man had charge of harvesting on about five or six farms. Plants were to be pulled or dug so as to include the roots, and were to be taken from the area being harvested. There was also a certain way the field men had to

gather them so that he couldn't choose plants. He had to take twenty plants in a row regardless of where it was. We had a system that insured random selection. This continued for the entire pea season.

Each day we got twenty plants from each field, and then we had a group of high school kids--

Adele: How many fields did we have approximately?

Lewis: Oh, I would guess up to fifty fields that they were harvesting in any one day.

Adele: We operated over thirty thousand acres.

Lewis: So it was a big project. But anyway, each plant was graded. Adele would grade them for one group of diseases, and I would grade them for another type of disease. We had a microscope so that we could verify our diagnosis.

Riess: What would the high school boys do?

Lewis: They were shelling each plant and getting yields on each plant. All the data for each plant was recorded separately so that yield and disease grade for each plant could be correlated. Each one would record these things as they went through, like an assembly line. Then we could go back and we could pick up which plants were diseased, what their yield was, what kind of disease they had, how severe the disease was--from that we amassed a tremendous amount of information.

Riess: It sounds like a tremendous space-consuming project. I can't imagine fifty times twenty piles of peas.

Adele: Every day.

Lewis: The samples came in every day, and they had gram scales there. So we had yields and disease information on individual plants from thousands of locations by the time we finished that year. This went on every day during canning season.

From that we made a statistical analysis of the whole thing, and we found out approximately how important each disease was--how often it occurred, what percentage of the plants had it, and all of that type of thing, so we knew what losses were for each disease.

Adele: What our priorities should be.

Lewis: What our priorities should be in a breeding project.

What did we find out by looking at all these plants, these twenty plants that came in from each field? We haven't talked about root rots, but root rots are very spectacular because they may kill off half of a field, just everything, and I think we were pretty sure that they were going to be the most important. You get no yields from that part of the field at all. But we found out that root rot wasn't common enough. It cost money and reduced yields, but the big thing was Ascochyta because it is everywhere. It was reducing the yield of every field and almost every plant.

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Lewis: Also, bacterial blight is quite spectacular. It does cause losses because it disfigures the pea pods in addition to the leaves and stems. In some cases, if it's bad enough, they have to abandon the field. It makes black spots on the berries if it works its way through the pod, and these disfigured berries are near impossible to handle in the cannery. If it isn't that bad, it doesn't affect the berries at all and it may just lower the yield a little bit.

What we found out was that Ascochyta was everywhere and it was nicking on the main body of the plant. It develops on the leaves, but it also can spread down the stems and cut off the circulation. They go on and yield, but it cuts the yield. We found out that Ascochyta was by far the most important disease so far as monetary loss was concerned. So that, then would be our number one thing to work on.

Riess: You couldn't spray for this?

Adele: At that time there were no such controls.

Lewis: Even if there were, spraying is very expensive.

Adele: Peas are a low value crop. The farmer can't afford to spend much money on them

Lewis: Not only that, but unlike insecticide sprays, which break down and leave, sometimes within hours, on the whole, fungicide sprays don't break down and leave the plant as rapidly, and in some cases, not at all. Since all of the pea plants run through the viners that pound the pods open, everything that's on the outside of the plants gets on the peas. Then the shelled peas are washed and all that. But the company would prefer not to use fungicide sprays, and has never used them on peas, even in later days when effective fungicides were available. This was not only from the cost standpoint,

So Ascochyta, then, would be number one. We also wanted to work on root rot because that was important, and bacterial blight was important. Those were probably the three most important things we had. We hadn't considered mildew. Mildew, of course, was very widespread. But, on the whole, it came in later in the season and didn't affect the early peas very much. So, right to begin with, we weren't working on that at all.

Adele: But the root rot, too, was complex.

Lewis: Yes, especially if you include the wilts, caused by Fusarium oxysporum, with Aphanomyces, which is the most commonly occurring root rot.

Adele: And Fusarium solani, which causes another root rot.

Delmar 16

Lewis: And there is also one of the Ascochytas that's a root rot. When we decided where our priorities were so far as the breeding project, we started our search for resistance. By that time, though, the breeding project actually had already started, because we had already crossed Delmar, which is susceptible to common wilt, with two different wilt-resistant varieties, and both of those crosses turned out to be very important later. We haven't talked much about wilt. There are several races of wilt, all caused by Fusarium oxysporum, but without resistance to Race 1 (common wilt), you can not grow peas in Illinois, Wisconsin, or Minnesota.

Seeds from these two Delmar crosses were planted the third winter, 1941-1943, in the Morgan Hill greenhouse. We had sprayed Ascochyta spores on everything in the greenhouse and the disease was widespread. From one of the Delmar crosses Adele selected SC16, which later became our first commercial variety, Delmar 16.

Delmar was the pea variety we spoke of earlier, which Tom Booye, the head of the Seed Department, had found in Utah. It was an excellent quality pea, but it was susceptible to common wilt. Wilt wasn't important in Utah, it doesn't even exist in Utah, but it was in the Midwest, so we couldn't grow it there. We needed the Delmar quality in the Midwest, so the crosses were made to get a "wilt-resistant Delmar." SC16 turned out to be resistant to wilt, and more importantly, we found it in a plot that had been sprayed with Ascochyta.

Riess: And "SC" stands for what?

Lewis: "S" means Morgan Hill, and "C" is the third year, 1943.

Riess: Is this a traditional designating system? Would this be internationally understood?

Lewis: No. Everybody has their own pedigree system. We used A, B, C, etc. for the year. It was handy. Since we started in 1941, the "1" would be "A," 1942 would be "B," and so forth.

Riess: The year they were selected?

Lewis: Yes, that part of the pedigree, we developed. The designation of where seed lots came from had been started by the Seed Department, and "A" was, I think, Sunnyvale, their Sunnyvale warehouse. I forget what they all were.

Adele: They're not universal. They're our particular pedigree system.

Lewis: "R" and "S" were still available--that is, they were not already in use by the Seed Department--and we used "R" for Rochelle and "S" for Morgan Hill. I know "M" was no longer available at the time.

Riess: [to Adele] Your name was associated with this? Lewis said that you discovered it--you picked it.

Adele: He always gives me credit for that.

Lewis: She did, and we have a copy of the page of the book where she selected it for the record.

But what we wanted now was resistance to Ascochyta pinodes, and the irony of it is that we never found any resistance to that Ascochyta. To this day, the primary Ascochyta form that's back in Illinois, Mycosphaerella pinodes, we never did find even the slightest resistance to it. But we did find something possibly more interesting and certainly just as important and useful.

We ran some quite complicated tests in a field where peas had never been grown before, using relatively small plots of a hundred seeds each. We had ten replications, ten different varieties, and ten different Ascochyta levels. We did not inoculate one set of plots at all, we inoculated another set of plots once, another set of plots twice, clear up to ten times during the season, so that we had various amounts of Ascochyta sprayed on the plots.

Riess: Inoculation was by spraying?

- Lewis: By spraying, yes. We would grow the spores in petri dishes and then put them in water and spray them on the pea plants with a three-gallon garden sprayer.
- Adele: Spray them preferably on rainy days because the spores had to stay moist long enough to cause an infection.
- Lewis: Actually, we had designed these plots to verify our yield data in the previous year's big survey, and we ran them for three successive years. As we expected, the plants were more diseased and the yields were markedly reduced with each additional spray.

The second year, we included SC16 in the trials. As in the previous year, the disease increased in intensity in direct proportion to the number of disease sprays, and when you got to ten sprays, most varieties, including SC16, looked pretty miserable. The yields also went way down with each additional Ascochyta spray, all except SC16, that is, and it stayed almost even in yield despite the fact you couldn't see one single bit of difference in the amount of disease on the plants. The SC16 plants looked just as diseased as the others. There was absolutely no Ascochyta resistance, but despite this, the yields were only slightly reduced, there was tolerance! So that's what we based our whole program on.

- Adele: It was a practical control.
- Lewis: Up until this time we had two sets of selection plots in Rochelle, one for the Seed Department and one which was sprayed with Ascochyta once or twice for us. We were working with Pat Winter from the Seed Department. As I said, inter-personally we got along fine. Pat would come back from his headquarters in Sunnyvale. He was great to work with. He taught Adele all she knows about how to select commercially acceptable peas.
- Adele: Yes, a careful man.
- Lewis: He was Irish, right out of Ireland. He was educated at U.C. Davis. He was a heavy drinker (after working hours), but a very--
- Adele: Delightful man.
- Lewis: We all worked together. Pat didn't care too much for the disease work, but we all worked together, and we looked at each other's plots. He was there to select for type, and we were there to select for disease. But he immediately recognized SC16 as a winner, even where it was planted in his uninoculated plots, but especially in our Ascochyta-sprayed plots.

And it became quite obvious that the best selections were coming from our diseased plots, not his type plots. We both made selections, and then we would increase the seed from his and our selections on the seed farm at San Jose. Then we would plant them back in the trial grounds at Rochelle the next year. Even in Pat's plots, the selections that came from our diseased plots were better than his selections. Even when he would make selections in our plots, they were better than the selections he was getting from his non-diseased plots.

From that time on, we sprayed everything. We didn't have two sets of plots anymore. We had one set of plots and we sprayed everything that we were growing with Ascochyta. That's the way we got such increased yields. We would choose whatever looked good. We paid no attention to disease resistance, only which ones yielded best.

- Riess: This idea of resistance rather than tolerance--how do you define that?
- Lewis: There are three terms involved: "immune," "resistant," and "tolerant." "Immune" means that the plants don't get the disease at all. "Resistance" is quantitative, from near immune to slightly resistant, and is visual or can be measured. "Tolerant" implies that the plants are diseased, but despite the disease, the yield and quality are not affected.
- Adele: You can't tell the difference in symptoms between productive or non-productive plants, but the disease doesn't hurt their yields. Our "tolerant" pea selections have black spots on the leaves, pods, and stems.
- Riess: But nice, green peas inside?
- Adele: Yes, and they have full pods and everything, whereas some other varieties that have this disease are very much adversely affected. Tolerance is fine, but mostly we worked for genetic resistance, if we could get it.
- Lewis: But we never found resistance to Ascochyta, and that's what we're going to say at Toronto where we have been invited to give the "keynote" address at the National Pea Improvement Association Meeting on November 5, 1989. We're going to say we've not found resistance.
- Adele: Yes, I think it's time to tell them how we're doing.

Lewis: Oh, yes. Yes, sure. Of course, it really increased the yields. The ten-year average when we went back there, as I said, was 1700 pounds to the acre, and now it's 4000 plus.

Adele: Yes, but that's not all due to Ascochyta.

Lewis: No, it's not all due to Ascochyta, because we found resistance to other diseases, and there were type improvements, too. But Delmar 16 had tolerance only to Ascochyta, and the first year it was planted commercially on two farms in Rochelle it outyielded all other farms by 79 percent, was the first-ever 5000-plus pounds per acre yield recorded at Rochelle, and it packed out 100 percent fancy quality compared to 64 percent for the rest of the pack.

The Del Monte Pea Team

Riess: Were the two of you still working on the same things?

Adele: Yes, after we consolidated and had only one set of plots, Lewis, Pat, and I always went through the same varieties. Each variety was planted in three different plots (replications), and each of us would evaluate them by plot number without knowing the pedigree, and not knowing what the other one thought of them. We would give each plot a grade. If there was a big discrepancy in the grades, we would all go back and look at the plots. Finally we would decide which plots to keep and which to discard.

Lewis: Sometimes, somebody from the Midwest would help.

Adele: So that they would be involved in it and know our procedures. But actually we did most of the selection work, and we coordinated the whole program. Both Lewis and I selected in those days.

Riess: Would you have wished to have had more help out there? Did you ask for help?

Adele: No, we never needed--. They gave us all the help we could ever need.

Riess: In the form of high school boys?

Adele: They always had at least one high school boy working in our plots. The community tried to have jobs for their boys so that they were responsible. That's why we always had high school boys. Girls were used in corn and beans. But there were other workers who were

hired year round. They would usually be the supervisor of whatever boy we had.

We usually had a full-time helper and then a boy, and they would help tie up the pea vines onto the wires, and harvest them, and put them in bags, and thrash them, and keep them separate, and count the seeds, and that sort of thing. Weeding, cultivation, and insect control was done by another group. We would ask for what we wanted, and a supervisor and crew would be dispatched. There was car radio communication, so results could be immediate, if necessary. We had no responsibility for that crew. All we had to do was ask. We'd do all the selecting and evaluation. They never did that.

When we'd find a variety like SC16, we would increase it or send it to the Seed Department. They would increase it and send it back as large plots. [to Lewis] How many acre plots did we call it--a quarter acre?

Lewis: Let's start from the beginning. Our selection plots were 100 seeds each, replicated usually three times. If we saved the whole plot, this would give us 3000 seeds or more. From this we would increase enough seed in California for our use in Rochelle the next year. The rest would go to the Seed Department for increase at La Grande, Oregon. When they had sufficient seed, they would ship seed to Rochelle for canning tests.

Adele: The plots were one drill width wide, and one hundred feet long, replicated three times with three planting dates. Midwest Division Research did all of this. They had a small harvester, and they would harvest them mechanically, exactly the way larger acreages were handled.

Lewis: We wouldn't do anything about that except to observe the plots. The Midwest Division research staff and crew made the decision on when to harvest and all that. Yields change quite a bit each day, and harvest date decisions are very important. Each day you hold off harvest, the yields are increasing and the peas are getting tougher. So they had what they call a tenderometer that measures how tender the peas are.

Riess: Tenderometer? [laughs]

Adele: Tenderometer.

Lewis: Yes, that's the name of it, and it's universally used. You put a measured amount of peas in the hopper and the tenderometer determines how difficult it is to cut through them with a fork.

The older the peas, the harder they are and the higher the tenderometer reading.

Adele: That's not just a Del Monte thing.

Lewis: As a matter of fact, that's what packers based their payment on to the farmer, is the tenderometer reading. The higher the tenderometer reading, the less he gets paid.

Adele: Because they're more starchy.

Lewis: Older peas are more starchy, and they don't taste as good. So approximately 100 to 110 tenderometer gives you the best flavored peas.

Adele: It's no joke about getting them at the "fleeting moment of perfection," because one day can make a lot of difference.

Lewis: So the research staff would be in charge of harvesting and canning. They had their own little cannery.

Riess: Did you find it hard to give up control of these peas? You're their parents, but they're brought up by someone else.

Adele: No, no. That is our ultimate goal, developing a superior variety which will leave the "nursery" and go out on its own. And the support staff are the experts on how to harvest and how to handle them. We got all of the information from them on what the yields were in each plot. We were also told how they mowed and thrashed. We were responsible for the statistical analysis of the results, but the clerical staff did the calculations under our direction. We received all the tenderometer readings, and then we had to correct from that. If they harvested them too old, well, then we had to interpolate.

Riess: Did you go to tastings?

Adele: Oh, yes, we went to the tastings, so we were in on the whole thing. The cannery personnel were professionals provided to process these things, and do it right, because we can't be experts at everything.

Lewis: They also had to add the right amount of salt. It's interesting how the right amount of salt will affect your idea of how good something tastes.

Riess: They could add that in the irrigation?

Lewis: No, it's hard for a Californian to realize that there's no irrigation back there. They depend entirely on summer rainfall.

Salt was added at the time it was canned. It is very difficult to get the correct amount of salt in these experimental quantities. The smaller the lot of peas you have, the more critical it becomes. Of course, if you have a ton of peas it doesn't make much difference whether you add a teaspoon or a teaspoon-and-a-quarter. So control of the proportion of salt was a very important part of tasting.

Adele: And there were another group of experts, too.

Lewis And there were the tasters, too in the Quality Control Department. We would do the preliminary tasting, and then the executives would come.

Adele: Color was important, too. They would say, sometimes, "That's a little bit too gray-green. I think this has a kind of grayish tone. We can't handle that. It has to be Del Monte quality. It has to be just right."

And then they'd taste it. They have these little cans. They spit out everything they have in their mouth so that their palate will be clean. They don't really eat them. They know exactly what they want.

Lewis: That's the final product. That's what they sell.

Adele: That's what they want. It's not just the yields. It's not just that they look good, but they do have to look exactly right. The size of the berries have to be right. If they're a little too big, even if they're tender and taste marvelous--.

The public has this conception that small peas taste better, because when they get them in the market, the littlest ones taste best. Well, that's not really true. If you have a variety where they're all big, they can be delicious and big. But that is not the Del Monte image. We've had some heartbreaking experiences with varieties that were, oh, wonderful in every way but one.

Riess: But public relations couldn't handle them.

Adele: They have to be just what the public will accept. And we realized that. If we weren't working for a company that wasn't so fussy, we wouldn't be as proud to be working for them. We all had this team spirit about Del Monte--that we were going to be superior, that we were really going to do a good job. When the public bought Del Monte goods they would know that they were the best.

Discovery of the Super Early Pea

Lewis: I'd like to conclude what we learned about Ascochyta and how this led indirectly to the discovery of the Super Early pea. Adele's done a lot of work on checking varieties for resistance. In the case of Ascochyta resistance, we had an unlimited opportunity, because we grew our variety collection back there in Rochelle every year, and they all got Ascochyta. If any one of them hadn't gotten it, just like we discovered the mildew resistance, it would have stood out. We never found it.

We soon discovered that the disease develops very rapidly as the plant approaches harvest maturity. Mildew does, too, but Ascochyta probably even more so. So we found out that we had to grade every plant for disease at the same maturity, what we call "canning stage." We found that as soon as you select a plant that's a little bit more resistant than a neighboring plant, you'll find that it's also a little bit later in maturity. That's the only difference we ever found.

Riess: Do you plant a day apart? A week apart?

Lewis: They plant according to rain. When it's raining, they can't plant; but the idea is to plant a certain amount of their acreage every day. If they could do it exactly the way they wanted to, it would be every day.

Adele: They do it on heat units.

Lewis: They harvest on heat units, but you don't know what the weather's going to be like in the future, so they plant so many acres a day, however many acres they figure they're going to be able to harvest. If it rains the first day they can get in, they plant more, to make up for it so they can keep to their schedule. They even have to shut down a cannery for a day or so if the weather's wrong. But they don't like to do that, of course, so they plant in a way to avoid that.

We found out, as I said, that whenever a plant looked resistant, the only difference we could find was that it was a little bit later than its neighbors in maturity. So we began to take blossom dates. When ten percent of the plants in the plot were in bloom, why then we would record that date, and twenty-one days later, we would grade that plot for Ascochyta.

Twenty-one days later is approximately canning stage. Commercially, the fieldmen go through the fields, and approximately twenty-one days after ten percent of the plants in the field are in

bloom, it should be ready for harvest. But then they also go by heat units. A heat unit is so many degrees above a base unit. There are various heat units for various crops, but that seems to work the best: when you accumulate so many heat units after ten percent bloom, they're ready for harvest. That's approximately twenty-one days.

So we graded for Ascochyta twenty-one days after ten percent bloom. Since we did know the maturity, and we were taking blossom dates, we discovered that some plants were blooming a little bit earlier than the rest of the plot. Especially in early-generation segregating material, some of these plants were blooming as much as two or more days earlier. So we started selecting them, tagging them, and recording the bloom date on the tag. We weren't selecting to get earlier maturity. We were selecting them because we wanted to grade them at the proper time for Ascochyta.

An early maturing plant in a late plot is always more spindly than the rest of the plants, because the late plants grow taller and smother it. It starts to bloom, and it starts to make pods, and then it stops growing. In the meantime, these other plants grow up around it, and by the time the early plant reaches maturity, they've shaded and crowded it out. It's a spindly little plant, its pods are not well-filled, and it looks like nothing. But if you select that plant, and grow nothing but that in a plot, then they can look their best because all the plants in the plot are the same maturity.

We were growing some of these plots out in the field there, and here was this plot that was three days earlier than any of the others, and it was looking pretty good. We invited people from the Midwest Division to see it. Nobody paid too much attention to it because it wasn't quite as good as our early variety, SC16, and I guess everyone was kind of spoiled.

But not Ralph Brown! He was then senior vice president of the corporation. He had owned the Midwest Cannery, and he was the one who sold it to Del Monte. As senior vice president, he had moved to San Francisco, but had come back to Rochelle to visit. We showed him this plot of early plants. He was part computer. He had this mind, you know, and he says, "Well, we have six canneries here. This pea is three days earlier than the earliest pea you've got, so if you have six canneries, that's three days times six canneries or eighteen days of peas, and that's worth approximately the same as about six million dollars worth of cannery." So it was Ralph Brown that thought of the real value of the Super Early Pea.

Adele: Also, the Super Earlies come on in the cool early season when the weather's best for peas, They're more tender and succulent. I don't think even Ralph Brown thought of that.

So we went ahead and developed those, and, as a matter of fact, in about three years the Super Earlies jumped from one plot to 80 percent of our selection plots, and they were really successful.

Lewis: But I think that's the only variety that we ever developed that a vice president helped to select, and it has been worth millions to Del Monte.

Adele: That's right. He was a very practical man. So that was one of our big success stories.

Lewis: But we didn't really think of the idea. It was serendipity. This was something very simple--how to get earliness. Unless we had tagged them for Ascochyta, they never would have been selected.

Adele: We're doing the same thing now with our iris. We have some little runts in the rows of larger plants, and we're taking them out and putting them separately so they won't get shaded out. Maybe they'll be good for rock gardens.

Root Rot and Bacterial Blight Resistance Found in Variety Collection

Adele: Now we should tell about how we finally found a root rot resistant plant.

As we mentioned before, in those days we planted our variety collection each year on "clean land," that is disease-free land, and also on diseased, or root-rot infested land. Seed from Dr. J. L. Weimer of the USDA Station at Experiment, Georgia was among the acquisitions in our variety collection.

Lewis: Yes. This letter from Weimer, who was then senior pathologist at the Georgia station, was dated April, 1942. So I would guess that it was in the winter of 1942 that we were growing some of his seeds in the greenhouse at Morgan Hill.

We told you that we segregated every lot that had more than one type of seed, plant, or flower, and we kept each type separate. As I remember it, there was only one, although there may have been two, white-flowered plants in one of the Weimer plots. All the

rest had colored flowers. We selected everything out of it that we could, including the one or two white-flowered plants, and segregated them. Seeds from the white-flowered plants were given the pedigree, VW511A7. They were increased two more times before any were tested.

Anyway, one of the fields in Illinois developed root rot. So far as we know, it had never grown peas before, but possibly could have before they started mapping things. (We had maps that showed every plot of land in Illinois where they had grown peas.) In any case, the whole field died out, almost uniformly from root rot. Everybody went out to see it! It was so bad that they couldn't harvest a thing out of the field.

We figured that was a good place to try the next year's planting for root rot resistance. So every variety that we had in our collection at that time was planted there. As I remember it, there were four hundred varieties. We planted three replications, and I believe it was twenty-five seeds each. By that time we had enough of this white-flowered Weimer thing, and there were three plots of it. All three of them survived, and that's the only thing that lived through the test.

The next year we planted all our varieties, including VW511A7, in another field where our primary root rot plots were, and it died quicker than almost anything else we had in there, in fact it died before any of the plants were four inches tall. This was an unexpected blow, and it took us a while to figure it out, because we weren't quite as experienced as we are now. Actually, the symptoms were typical of common wilt, and when we put it through a series of tests in the greenhouse, we found out that it was susceptible to both of the wilts, Race one and Race two, endemic to Illinois.

Adele: Susceptible to the Fusarium wilts and resistant to Aphanomyces.

Lewis: Actually, we hadn't tested it for Aphanomyces quite yet. But anyway, we did find it was wilt-susceptible.

We started developing tests for individual diseases, and Adele did almost all of that work. She developed a real good test method for Aphanomyces, and we found that this plant was resistant to Aphanomyces, the primary root rot in Illinois. Then we did a lot of crossing to our wilt-resistant lines. Of course, we wanted to get lines resistant to wilt (Race one), and near-wilt (Race two), the two Fusarium diseases as well as Aphanomyces. So we made crosses, and ordinarily that would be very simple, but there was a linkage between resistance to Aphanomyces and susceptibility to near wilt. As I remember it, only one plant out of every 126 would

come out OK, i.e., resistant to both Aphanomyces and near wilt. All the rest of them would still be susceptible to near wilt. There was no problem with Race one.

Riess: Is that a discouraging number?

Lewis: Well, yes, it's discouraging. But it also has its good points, because once you get the two diseases combined, they'll never separate. They'll only separate one out of every 126 times. It's the same ratio. That showed that the genes for resistance to the two diseases were very close together on the same chromosome, so close together that there was almost no crossing over to separate them.

So then, instead of having every second plant with the kind of resistance we wanted, we only had one out of every 126. So that slowed down the program a little bit. But then, as I said, once you get the linkage broken, then it's easy to handle because you don't have to test for both diseases any more. They're linked together. So we did get resistance to both diseases and introduced it into all of our varieties.

Adele: And then we got bacterial blight resistance as well.

Lewis: Yes, we found bacterial blight resistance in several varieties in our collection. Adele did most of this work in the greenhouse. The bacteria were suspended in water with a wetting agent added, and sprayed on the plants at fifteen pounds pressure when the pea plants were about three inches tall. Susceptible plants would be killed by this method.

Adele: We got good resistance by this method, but then we isolated a bacteria from one of the resistant plants that had become diseased, and when we tested it, none of our plants were resistant. So we went back to the variety collection and eventually found resistance to that race of bacteria. In all, we identified three races of bacteria that infected peas, and obtained combined resistance to all three.

That program was of great benefit to the cannery, because blighted berries are so difficult to handle, and often entire fields have to be skipped. It was also of great benefit in seed production, since the disease is readily spread by the overhead irrigation systems which are increasingly used in the previously dry-farmed seed growing areas of the west.

Lewis: Gradually we combined all of these resistance factors, and I want to show you this historically important picture--historically important pea-wise. [looking at photograph] Here is the first pea

in the world to have combined resistance to Aphanomyces root rot, three bacterial blights, and the two wilts.

Riess: It looks like a little graveyard, but in fact it's a white marker that says, "ABN193A1."

Adele: Yes, so it's "A," Aphanomyces, "B," bacterial blight, and "N," near wilt-resistant.

Lewis: And it's also wilt-resistant. That's the first pea in the world to have combined resistance to those four diseases. And incidentally [to Riess], you aren't the first person to use that term "graveyard." Our disease plots in the Midwest had thousands of those little white stakes, and we always referred to the area as "the graveyard."

I wanted to say one more thing about this, philosophically. [to Riess] This discussion will interest you. [laughter] There's a lot of criticism of plant breeders because they have a tendency to ignore everything except the thing they're interested in. People who think about these kinds of things worry because the plant breeders throw away everything that they don't find useful. We're losing all this genetic stuff that was available in the wild species. All the rest of that big gene bank is gone.

But there's a real good example of just exactly the opposite. Take Aphanomyces, for example: we've tested every plant we could lay our hands on from some four thousand accessions, up until the time I left there (and it's probably more now). Every single plant was tested for resistance to Aphanomyces, thousands of them. The only plant that ever had resistance was that one white-flowered plant that came from Weimer. Now we've incorporated that gene into all--every pea variety that Del Monte grows has that resistance in it.

So here's an example of just exactly the opposite thing. There was only one plant in the wild that had it, and now we've put it into millions of plants. The same way with bacterial blight.

Adele: Yes, but the rest of the seed from that Weimer accession, the portion that was not selected, should be retained, too. When resistance is needed for some future disease, they might find it again in that seed lot. It shouldn't be thrown away.

Lewis: Yes. That's why we keep the pea collection and why we take the time to increase it. You never know which of those plants is going to give you what you want someday.

Riess: But you're not maintaining four thousand different plants?

Lewis: Yes.

Riess: Really? Four thousand?

Adele: Yes, it's more than that. I think it's more like five thousand.

Lewis: Yes, I guess it is now. They have to be increased. We have a good storage facility. But that's something that should be done, and I mean done as carefully as we did it, by the USDA or, better still, by an international organization.

Adele: I think we talked about that.

Lewis: Yes, we talked about that. But we do maintain them and don't throw them away.

Frost Resistance

Adele: The frost resistance was a discovery that you could tell about, Lewis.

Lewis: Yes. We were growing peas in Utah, for canning. Fortunately, in the Midwest--maybe Illinois more than Wisconsin and Minnesota--once the nice spring days start, it's seldom that they come back to having a heavy frost. In the mountain states, and in Washington around the Toppenish area, I guess partially because of the higher elevation, they do have maybe a month of nice weather and then all of a sudden this cold wind comes in and everything freezes. So frost resistance is more important in Utah, Idaho, and Washington than it is in the Midwest.

We were growing plots at Morgan, Utah, at an elevation of just over 5000 feet for possible resistance to frost. The planting would consist of about four hundred varieties, mostly our own hybrids, but also including varieties from other seed companies, and a few from our variety collection. For three years we grew them, three years in a row, and we didn't have a frost there. I think it was unheard of for the district. [chuckles] Of course, that's typical. And then, the fourth year, there was a severe frost.

That year when I went back there, again, just like with the root rot, there was this one plot, and fortunately (unlike the root rot plot), this was not a field pea. It was the only plot in the whole planting that wasn't frost-killed. It was replicated only

two times, but it was one of our own hybrids, and a fairly decent type. Everything was perfect on it. The vines weren't touched and the peas weren't frozen. There wasn't a single unfrozen pea on any other vine in the whole planting. We started our breeding program for frost resistance from that, and we had to work out a method for testing that was more reliable than the field at Morgan.

The worst scenario for frost damage is when you've had some warm weather ahead of a frost. Everything is growing lush, and then it freezes one night, and the plants are not hardened up. If it gradually gets cold, why, they harden, and they can withstand freezing temperatures quite well--four or five degrees below freezing, Fahrenheit. So we set our environmental chambers to duplicate the temperature pattern of a very damaging frost that had occurred at Toppenish, and also the weather that they had for the week ahead of the frost. We duplicated not only how the temperature went down and exactly how cold it got, but also how it warmed back up. Speed of warming after the frost is important, too.

Riess: You duplicated the temperatures?

Lewis: Yes, in our four big walk-in environmental rooms in the greenhouse.

Developing the equipment for the frost tests was an interesting task. The pre-conditioning room was easy, but getting the freezing temperatures to be as accurate as I desired was a problem. Ordinarily, temperature in a freezer is controlled by a thermostat which turns the compressor on when it needs cooling, and off when it is cold enough. This causes a rapid up and down fluctuation in the temperature which was very pronounced when we reached the lower temperatures. I got the idea of keeping the compressor running continuously, and varying the back pressure to control the temperature of the freezer coils. I told our refrigerator engineer what I wanted, he had the valve modified, and the temperature varied less than a quarter of a degree.

For ten days before we subjected the plants to the frost test, we put them in this conditioning room. Temperatures fluctuated between 76 degrees during daytime, and 57 degrees at night. After ten days at that regime, the plants were moved to the cold room. Temperature in the cold room started exactly where it left off in the preconditioning room. And then the controller just gradually lowered the temperature down to something below freezing and back up again. Ever since then, they've been running frost tests by that method. We have developed very good resistance in peas. I don't think it's something very many people think about.

Adele: Lloyd (Bud) Cruger, our partner, and eventually successor as pea breeder for the corporation, has been responsible for carrying on and further refining the frost resistance tests, and he has also had the major role in development of the leafless pea.

Leafless Peas

Riess: You were going to discuss horticultural improvements? More pods per plant? More peas per pod?

Adele: Not only that, we had a whole new type of pea that was leafless. That has turned out to be a very economically important asset.

Riess: Describe that.

Adele: [referring to illustration] This is a leaf, you see. But there's a stipule right here at the base. In our commercial development, we leave that on, but the leaves are gone, all these leaflets are gone, and the tendrils are thicker and stronger than in a normal pea plant.

Riess: So you said you "found" it. This was accidental?

Adele: Yes. It occurred all of a sudden, this mutation. But our find wasn't useful, it was a single gene that left nothing but the stem and a few tiny pods. Then Dr. Jerry Marx at the Geneva, New York Agricultural Experiment Station, discovered a similar gene, or more accurately, a pair of genes that had a similar effect. He recognized the potential, because with peas--not as much in the Midwest as in the Northwest--they grow so well that their leaves are too plentiful and the lower pods are shaded.

When the lower pods are shaded, the berries don't develop as green a color. The peas inside the pods are less green than they are in the pods at the top of the plant. If you had less foliage, the sunlight could reach the lower pods and you would have peas that were all the same color up and down the vine. We wouldn't have to worry about the variation of color in the canned product. That's the way it turned out.

When the peas had fewer leaves and consequently more light, they also became stronger vines because of the stiffer tendrils. So they stand up well, and they can be harvested easily. They don't get quite the yield that they do when they have all their leaves, because less chlorophyll is manufactured.

Bud Cruger solved the yield problem after we retired, by blending the seed-- mixing part, about a quarter, regular pea seed, and three-quarters leafless seed in their plantings. This brings the yields up and the leafless plants help support the leafy plants.

Riess: I see. They act like little posts.

Adele: They do that, and also the other peas yield a little bit better. So it brings them up to as high a yield as we had before, with the advantage of better color and better harvestability--the time that they spend mowing them is dollars and cents, you know, when you go through the fields.

"Fizzle" and Pea Leaf Roll Mosaic Virus--Panic!##

Riess: One of the things I found interesting in your report was that you could see fizzle virus advancing into America. It had been reported in Japan and Holland. How did it get here? [reading] "It was seen for the first time in 1968 in the United States. Dr. D.J. Hagedorn at Wisconsin and Dr. J.E. Mink at Prosser were both informed of its presence."

Adele: That virus--its real name is pea seedborne mosaic virus (PSbMV)--came in all of a sudden, but Lewis always thought that we just hadn't recognized it before, because for years we had seen seed coming in to us from the Seed Department field men. "What is this?" In wrinkled seeded varieties, a few of these round ones would show up with a little brown line around them. They would pick them out and send them to us to see if it was a seed mixture. We would plant them, and then they would turn out to be normal for the variety.

Lewis: And then we saw it occasionally in our plots in Illinois, too. I still think that it was probably the same thing. It just hadn't been recognized as a disease. I don't think it's ever become important, either. They thought that it was going to spread and wipe out the pea industry, but I don't think that it has ever become very bad.

Riess: What I was wondering about was traveling pathogens.

Lewis: Of course, that's one of the reasons we have quarantines. The bad thing about that type of pathogen is that it is spread by the seed, whereas most virus diseases are not spread in the seeds. They don't get into the seed at all. That one was, and it is, one that could be carried by seed. That's an easy way of spreading it around.

Adele: And they are still watching it because Dr. Roger Schmitt, who replaced me as pathologist, said that they use the manual I wrote on identifying and handling "fizzle" virus regularly. They test the seed that's going to be used for increase and if a large amount of PSbMV is in it, they won't use it for seed stock. They'll maybe plant it out, but they won't harvest any of that seed for further use. So they're very careful about it.

Then we had another virus disease that was thrilling to us pathologists. I was so excited. We got a call from Burley, Idaho, that there was some kind of disease they had never seen before. They thought it was a near wilt. They sent me a sample and I recognized it immediately as a virus. And so they sent me up there.

Here were all these pea experts from all over the area--field men for the cannery, representatives of field men and pea breeders from the big seed companies--Associated Seed Growers, Gallatin Valley, farmers, experiment station personnel, and so forth. They all thought it was near wilt. Because I recognized it as a virus disease, and one that I had never seen before, I called Dr. Richard Hampton of Oregon State University, an expert on legume viruses, and asked him to come there, and he identified it as bean (pea) leaf roll virus (BLRV). Dr. James Baggett, also from Oregon State, was also up there at the time, and you should have seen how excited all these pathologists were about having an epidemic.

The plants turned yellow, and whole fields were lost. The vector is the aphid, but there weren't any unusual amount of aphids in the fields, and they had been taking care of things just as usual, --counting aphid populations. BLRV has remained there in the Idaho fields, and it causes a certain amount of damage every year, but it's never been quite as bad as it was that year.

We started a breeding program on that, and other institutions and seed companies did, too. This program is not going to be very difficult, because there was some resistant germ plasm available for use. They stood out in the seed companies' trials in that epidemic year. We didn't have to start with a field pea. Not only us, but all the big seed companies, since this was right in the heart of the pea seed industry, in Idaho and eastern Washington. So we were able to make immediate progress on that one.

Lewis: Yes. We sort of thought at the time, since one of the seed companies found that quite a few of their varieties were resistant to it, that the disease had been there for years and that they had been automatically selecting for resistance to it, since their plots were right there.

Adele: They apparently never noticed it.

Lewis: No, never noticed it, but it must have been there in sufficient amounts to influence their selections.

Adele: It was never again as serious as it was that year. But it was funny, because here's a disaster for farmers and all, and these pathologists all excited because it's an epidemic. [laughs]

Riess: So who gathers together? Are the farmers and the pathologists all in the same room?

Adele: The gatherings I have been talking about have been here and there, outdoors in various fields and trial grounds. But, yes, we had a special meeting at Idaho Falls on the subject after we had surveyed the fields. The farmers came in to hear about it, both pea and bean seed farmers, and alfalfa farmers. Alfalfa is an alternate crop with the peas and harbors the aphid vector which transmits the disease.

Riess: Who comes? Do county extension agents turn up? What other administrative entities come in? Who gets called in at moments like that?

Adele: Well, I can only talk about Idaho and Washington, because that's where these things occurred. They have their farm advisors, and there were entomologists, horticulturists, and pathologists among them. They have lots of interested farmers who want to know everything about what to do. And they inform them. They go around and tell them, and they send out notices.

Riess: So the farm advisors, then, are the liaisons.

Adele: I would say so. And the university extension people. But the experts from the university are the ones that authenticate the fact that this is a serious disease, and usually tell them what to do. And then the extension people do the experimenting on it. The next year, when I went up, the extension entomologist had applied lots of different kinds of insecticides, some of which were systemic and some weren't, to see whether they would control the aphids, and which were the best.

Riess: So their results are very important to you as a plant pathologist?

Adele: Oh, yes, and on something unusual and important like this, they usually run the seed companies' trials. They're happy to do the work for them, you know. Usually the extension people provide the materials, but the seed companies--not just our seed company, but up there there's the Asgrow Seed Company, Rogers Brothers Seed Company, Gallatin Valley--we were all working together to control a potentially dangerous disease like this.

It was very bad for Gallatin Valley because they had just come out with a new sugarsnap pea. The tall variety of sugarsnap was almost completely wiped out in their seed increase plantings from this virus disease. I think that things have been better since then.

Riess: The state departments of agriculture and the U.S. Department of Agriculture--are they on the scene in any way?

Lewis: Not usually, I don't think.

Riess: They're just regulatory agencies?

Adele: They're regulatory agencies on the whole.

Lewis: We've worked with the USDA on spinach, for instance, and on both peas and beans with Dr. William Zaumeyer.

Adele: Oh, yes.

Riess: They send scientists out?

Lewis: That was when we first started. They were doing breeding work, but I don't know whether they are now. I haven't the slightest idea about that.

Adele: They had a center in Maryland, in Washington D.C.

Riess: Beltsville.

Adele: Beltsville, yes. They went out from there and looked at things every year. They had a specialist in each crop. The bean man was Dr. Zaumeyer. He would go everywhere in the country and look over beans, observe variety performance and disease incidence. They would spread information also. They would coordinate things, and they were able to say for instance, "Oh, I've seen this variety in Maryland," or "I've seen this disease in Utah. I wonder if it's the same thing." Then they would coordinate things. That was a good program. I don't know whether they are doing that any more. I don't think so.

Riess: But the state departments of agriculture?

Lewis: [to Adele] Well, now you worked with Sacramento, I think it was on the seedborne--.

Adele: Pea seedborne mosaic virus. That was a similar situation. It was a newly recognized disease and there was much concern and immediate research on it. When that was first recognized, I had greenhouse tests, and Dr. Ralph Williams, a virologist in the California State

Department of Agriculture at Sacramento also had greenhouse tests. We would visit each other's test plots and get to learn the symptoms, developing the basic concepts of what the symptoms were on this new disease that came in.

Lewis: Of course, they were interested from the quarantine standpoint, not from breeding.

Adele: That's right, because there wasn't any of that virus disease in the state. They didn't want to get it in either. They have to know all these things because--for instance, when we send our Del Monte seed to New Zealand to be increased, New Zealand wants to know that it's free of disease. So we have to certify it through the state, and the state has to be sure, that's their responsibility.

Riess: You send it to New Zealand because you gain a season or something?

Adele: Yes, down under.

Riess: How about Chile or a South American country?

Adele: They used that for tomatoes once that I know of.

Lewis: I think they're less reliable.

Adele: Oh, their labor is unreliable, but in New Zealand they are very dependable.

Riess: You cast your seed upon the waters, and it comes back--

Adele: [laughs] doublefold.

Lewis: Well, we always send somebody with it, too.

Working with Entomologists

Riess: We were talking about spraying way back there. Were there entomologists working in the field at the same time that you were?

Adele: Yes.

Riess: How did you coordinate your activities?

Lewis: Well, we would go around with Jim Paulus, the Midwest Division entomologist, and look at his plots just from interest. The only thing that the entomologist did for us was when our plots started

getting some insects in them, they would come through and spray by airplane, and we'd have to stay out for half a day.

Adele: Depending on which insecticide they were using.

Lewis: Yes. They usually used Parathion. That disappeared in half a day.

Riess: But whatever they were doing was just a given?

Lewis: Yes. We would say that our plots needed spraying, and then they would get in touch with the spray crew. If they were going to be working in that area, they might even spray them that same day or the next day--whenever the spray crews were working around in that area. This was a little, piddling job for them. We had acres of plots. It was a big operation so far as we're concerned, but so far as they're concerned, it wasn't very big. If we had done it by hand, it would have taken days, but the planes would make a few passes over our field in a matter of minutes.

Riess: What were they spraying for?

Lewis: Aphids.

Riess: The aphids are carriers of some bacteria?

Lewis: Virus.

Adele: But when there were many aphids, even if they were free of virus, they would distort the plants and reduce the yields. They didn't spray any more than they had to. There are natural predators, and also a fungus that attacks the aphids when it gets hot, so if the entomologists knew that the weather was going to be hot, then they would hold off a while to see if the problem would take care of itself.

Lewis: Entomologists, or university graduate students who were majoring in entomology, would go through and what they call "sweep" the peas with butterfly nets, except they were finely netted. Then they would count the aphids, and when they got up to a certain count, why, then it was time to get in with the airplanes.

Riess: So you were never looking for virus diseases?

Adele: Not there.

Lewis: We didn't have a problem with virus there. But in the Northwest we did.

Adele: We had quite a breeding program for viruses earlier in Toppenish. We had a lot of interest in the viruses that were just newly identified--but all in Idaho and in the West, not in the Midwest. There were occasional virus-infected plants, mostly streak viruses. They weren't ever of economic importance.

Riess: When you start working on something like that, you and the entomologists at the same time, was it something that could have been dealt with equally successfully from both directions? I mean, if it was virus, could it have been sprayed out of existence as effectively as bred out?

Lewis: No, because by the time you discover the aphids are there, the virus has already been inoculated into the plant. It only takes one aphid. Even systemic insecticides don't work because they have to feed and infect before they die.

Adele: And one of the worst yield losses we had in the Toppenish area was in a year when there were very few aphids. Still, those few were able to inoculate and kill off complete fields.

Lewis: Then we spent thousands of dollars building an aphid greenhouse here in San Leandro, where we could work with the disease--in this case enation virus--and it never occurred again. That's the history of virus diseases.

Same way on tomatoes. One year, all the circumstances are right, and you get a terrific virus infection. It may wipe out half of your tomato fields, in Utah especially, where the leaf hoppers or aphids come in from desert plants that are carrying a virus disease. One year, they're wiped out, and the next year you don't get any.

Adele: We worked on the enation virus disease in the greenhouse, and we raised aphids and put them in little cages and attached them to pea leaves to infect the plants. I did all that work myself. That was really interesting. I enjoyed it, and we were making good progress, but then we never needed the resistance. That was strange. I went up to Salem, Oregon every year to evaluate plots together with Dr. James Baggett of Oregon State University. That was a fun project.

Lewis: If we had been growing peas in Oregon, we would have had to have resistance, because the peas get it more or less every year around Corvallis and Salem.

Thoughts on Pathogens

Riess: When you were doing your work with bacteria and virus diseases, did you read all the scientific literature that was coming out?

Adele: Oh, yes.

Riess: Where was the best work coming from?

Adele: At Washington State University's Prosser Station, Dr. John Kraft and Dr. Gaylord Mink did a lot of work on peas, and at the University of Wisconsin, Dr. Don Hagedorn and his staff. Wisconsin's research applied more directly to Midwest conditions, although their climate, being cooler, was more favorable for peas than ours in Illinois.

Lewis: Minnesota also worked a little on peas, and Michigan State, and Cornell. On the whole we were ahead of anything we could read.

Riess: Is there anything that you would learn from developments in bacteriology and virology?

Adele: I don't think so. But Del Monte Agricultural Research subscribed to all the leading scientific journals dealing with agricultural science. This covered both individual disciplines and general science publications, such as the Journal of Economic Biology and Science, the journal of the American Association for the Advancement of Science. We also had an extensive library. Also, all the current journals were circulated to all staff members, and we had to initial them to indicate that we had seen them. We certainly benefited from perusal of these publications, but not necessarily in a direct way.

I know that we learned some then new things about genetics, like heterosis, that were common to both medical and plant life. I know that we went over to Iowa State University at Ames, Iowa to talk to the man who had described heterosis, the increase in vigor that happens in the first generation--the F1 generation.

Lewis: Even today, they're not sure what it is that causes that increased vigor, but it's common in both plants and animals.

Adele: Well, we just took the plant pathology journal, Phytopathology, and contacted universities.

Riess: It sounds like you didn't have time to mull things over, the way that looking at a different discipline would allow you to do.

Adele: That's right. They had a wonderful interdisciplinary meeting at Cal in Berkeley. However, I don't think it was in the sense that you

mean. It included many disciplines within plant science. I wonder what year that was? It was the same year that you [Lewis] had that session on the replant problem.

Riess: [looking at notes] That was 1963.

Adele: That was the first time they had an interdisciplinary meeting that had geneticists and entomologists and plant nutritionists and cell biologists, and many other such fields. It was a wonderful meeting because it told the means by which the diseases were taken up through the plant, or disbursed in the cells. I think I learned a great deal from that. We had people from all over the world. It was invitational, and we were fortunate to be included.

I remember that at that meeting it was the first time they had heard the concept of phytoalexins. Dr. Cruikshank from Perth, West Australia, came over, and that was the first time the concept came out, and that's that each plant produces a chemical which protects them from certain diseases.

Lewis: There are all kinds of bacteria and fungi floating around that don't cause disease--millions of them that float in the air and land all over the plants. Even the common bacterial blight of beans doesn't infect peas.

Adele: Those protective chemicals that one plant species produces might be utilized in other plants to protect them from the diseases they get.

Lewis: It's the same way with us. Look what happens to us after we die. Unless you put some preservative into us, why, we rot.

Adele: Well--! [laughs] But this was a new discovery, and Cruikshank had isolated the pea phytoalexin, which he named, "pisatin." So that was a very interesting idea, and there has been a lot of development on that concept since.

Riess: I have been reading about Cecil Yarwood at Berkeley. He believed that pathogens could best be thought of as "organisms out of place." Philosophically, it's a whole different way of looking at what you're doing.

Adele: Does it sound as though he thinks that everything should be free of diseases? That there should be natural organisms, but they shouldn't be attacking plants? I just don't see that.

Lewis: I don't know. I think that we have to live, and in order to live, we have to be fed. Of course, plants feed on non-organic material. But everything else has to feed on something organic, some living or previously living thing.

Adele: Even human beings destroy one another. There seems to be a violence in nature as well as in human beings.

Lewis: I think that diseases are natural. These organisms live, and they live on plants. You have to look at it from their standpoint. The normal place for the pathogen is right where it is. Being pathogenic, it may destroy something else. Fish eat other fish, and we eat cow meat.

Riess: Could you think of it that way? Could you think of us as pathogens in that way?

Lewis: I don't see why not. Well, sure.

Adele: I can.

Lewis: Just think of the poor fish that we eat--from their standpoint. The plants--we destroy plants all the time, we go out and cut them down and bring them in and eat them. The lettuce and the sprouts that we eat in our salads are still alive when we swallow them. That's all that plant pathogens are doing as far as I can see. They're living their normal life.

Adele: I think Cecil Yarwood may have meant when he said "man made," that when we plant a large field of a crop, then we're encouraging the proliferation of a disease because there is a larger population to feed on.

Lewis: Yes. If you have a little plot in your yard, why, it's quite different from having a thousand acres of the same thing.

Adele: They're much less prone to be attacked.

Lewis: If a few organisms attack your plots, which they do, it's not nearly the same as if they have this tremendous field of things. Then, the following year, some more is planted around for them, and so they have a tendency to build up as you increase acreage. But I still think they're doing their natural thing.

Riess: I'm beginning to wonder how you would account for food poisoning.
[laughter]

Lewis: Well, we eat the wrong mushroom, for instance. But we are able to eat certain mushrooms.

Riess: Yes, but when mayonnaise sits around with chicken too long?
[laughter]

Lewis: Yes. But it's an organism. Some of the poisons are organisms. Some of them are not. Some are things that organisms give off as a toxin. But still everything has to exist, and in order to exist, it has to eat something. Not very many plants devour each other, but of course they compete.

Close-up Photography

Riess: When did you start taking pictures, Adele, recording everything in color?

Adele: Right away. We just happened to be photography bugs, and Lewis--

Lewis: I set up so we could take stereo pictures through a stereomicroscope. The first year we were at Morgan Hill I made that set-up, so that with a regular thirty-five millimeter camera you got stereo pictures through the microscope. Then you could look at them through a viewer, and they would be in 3-D, just exactly the way they were. You could see the sporophores sticking up like they were going to poke you in the eye.

Riess: That's very ingenious.

Adele: Yes, he was very wonderful in photography. A certain kind of extension ring was not made for the cameras in those days, so he had them made and tooled especially, so we took exceptionally good pictures for those times.

Lewis: Yes, and we had gotten a lens through Disney Studios. Disney went over to Germany and hand-picked some lenses, and we got one through my brother-in-law, Ward Kimball, who works for Disney. It was an excellent lens. We still have it. Of course, now, the lenses are made with computers, and almost all lenses are better than any lens you could get in that day. Zeiss made good lenses, and some of the others in Germany, but this was an excellent lens. It had been carefully tested by Disney's agent.

That lens was not used in the stereo close-ups. We were using the microscope lenses to get the stereo pictures.

Riess: Did you use the color photographs a lot in making your point at various headquarters?

Lewis: At meetings, yes.

Riess: Were they slides?

Adele: Yes. They were transparencies, because the projected pictures are more suitable for meetings. Also, they didn't have color prints then.

Lewis: It's interesting. The negative film that they use for color prints had been developed even before Kodachrome, because they needed them in movies. You can't do just one film in a movie. You have to have copies. So Eastman was working on that, and they developed it for movies before, but it didn't become generally available until later.

Adele: We used to have research meetings every year, the Del Monte research people. We used them a lot.

Labels and Packaging

Riess: When people buy packets of seed from Burpee or whatever to grow their own peas, what are they buying? And does anything interesting ever come out of someone's backyard?

Adele: Most of the varieties that are in these catalogs are very old varieties that are not nearly as productive as the ones we produce or can be purchased. But people have an image that their grandmothers used to buy such-and-such variety, and they still carry those. It's just unbelievable. The pods always have blanks in them, on most of those. There are some good ones.

Riess: Was there a conspiracy to keep [chuckles] Americans from growing their own great peas, would you say?

Lewis: No.

Adele: No, I think it's just that people demand what they've always grown and what they're accustomed to.

Lewis: It's the same way in flowers. As a member of the iris society, most of the varieties you see advertised in magazines are no longer grown by anyone in the iris society because they're old varieties. But they are still available. I think it's the same way with seed.

Of course, so far as Del Monte is concerned, those were our own exclusive varieties, and we just used those. We never sold seed to the general public. They are not suitable for the general public anyway, because the peas that you harvest by machine are not suitable for harvesting at home. What you want at home is something that you can go out and pick a few peas today, and then a few days later you

go out and pick some more. The same way with beans. Whereas, with canning peas or beans, you want them all ready on the same day. It's a one-time harvest.

Adele: I shouldn't have distorted the facts that much, because seed catalogs are offering some of the newer varieties now, but they also retain the older ones. I've noticed that they have the sugarsnap peas, which are new, and they have Green Arrow, or something of that nature, which has very long, well-filled pods and is a good variety. Some of older ones which they retain, like Little Marvel, are really "dogs."

Riess: Del Monte has hired Landor Associates to design their new packaging. Del Monte has decided that canned vegetable products have got to look a lot more attractive to be competitive, and they are going to be on the cutting edge.

I saw an ad recently on television that you may have seen, Del Monte canned peaches dropped from a great height and smashing a chocolate chip cookie, as if to show that the can of peaches is far better and more desirable. [laughter] It's really a startling ad. I was thinking one of the things you might suggest to them is that on the back of a newly-designed can of peas they might include facts on pea breeding.

Adele: We've often felt they should exploit the research that goes into their products, because they've done a lot more than any other company.

Riess: A child could collect Del Monte can labels like trading cards. [laughs]

Adele: That's true. But the thing is that we have to put so much stuff on there now. We have to put all the vitamin content and all of that, and all the calories. That's the law, and it takes a lot of space. They keep having to redesign the label all the time because they keep adding information. [chuckles]

Lewis: They've done the same thing before. I know of two times before, and probably more than that--the so-called modernization of the labels. We went through all of that and had to take photographs of the ideal pea for a new design. That was probably twenty years ago.

Adele: I know, but it always needs modernization.

Lewis: Even our logo, the shield, was redesigned. Originally it was a lot fancier.

Adele: But they didn't advertise the research that goes into them. That would be interesting.

Life on the Home Front

Riess: [Lewis leaves the room] You weren't always working as a team, were you, because you [Adele] continued with work on the peas, and Lewis was worrying about peas and other things?

Adele: Sure, I went back to the Midwest by myself and did the selecting, because he had to go all over the country looking at all the crop trials for a while. Later, Lewis hired Bud Cruger, a plant breeder from the University of Wisconsin to work with us. He fit into the work like he was part of us and we had a wonderful relationship.

Riess: How did Lewis divide up his day between peas and the rest?

Adele: During those years, he really wasn't working on peas any more than anything else. He was just supervising the peas. He was in charge.

Riess: So you were just one of the pathologists who was working for him?

Adele: I was, at that time, the only pathologist working on peas. But Lewis also had plant breeders and horticulturists working with him. And I worked on spinach, and asparagus diseases, and so forth.

Then I stopped coming back to the Midwest because of all the disease tests that had to be run here in the greenhouse. That was really important. And I wanted to stay here somewhat because of my children. I thought they should have a little more stable environment. We had two other children after we had Lori.

Riess: And they were born, when?

Adele: They were born after we moved here, to Oakland, in 1952 and 1954. We stayed at Morgan Hill for eight years, and then we moved here. Then we had a more stable life, because before then we had moved, on the average, maybe five times a year from one place to another.

Riess: Had you thought maybe you wouldn't have any more children, but once you settled down, you decided to?

Adele: We really enjoyed having these two children. I guess I wasn't really ready for it when I had Lori, but, of course, we had a lot of fun with Lori later on.

Lewis: [returning with a sheaf of papers] I've just been thinking about the whole pea program and what made it so successful. In the entire Del Monte organization, from the president on down, there were only three persons involved that weren't completely cooperative.

From the the first year we were back in Rochelle, we talked with the mower men, asking them what was good or bad about the way various pea varieties mowed. We talked with the viner bosses about the way the peas threshed, what was the ideal vine. Pat Winter of the Seed Department showed us how pod shape effected the ease in which the pods would split open and release the berries in the viner.

And we have a warm memory of the first spring we were back there. Adele and I were way out in a field measuring an area where permanent rotation plots would be established, when we saw the head fieldman for the Midwest, Jack Countryman, driving across the field toward us. He stopped the car, and who should step out but Willard Griffin, the vice president to whom our Western Ag Research reported. He had found himself with a six-hour layover in Chicago, rented a car, and drove the sixty miles to Rochelle just so Adele and I could "see a familiar face and hear a familiar voice" from California.

We've told you how Ralph Brown, vice president for the Midwest Division, helped select the Super Early pea. Here's a letter to our boss, Dr. Caldis, from Alfred Eames Sr., president of Del Monte, dated December, 1947. This would have been about the sixth year of our work. It says in part: [reading] "I have found this report very interesting and encouraging. It seems to fully substantiate the enthusiastic report to the Executive Committee Mr. Brown made on the results these two were approaching. It certainly looks as though this work is going to be even more productive, if this is possible, than the work the Midwest organization has done on corn breeding."

We got invaluable information from the field men for the Seed Department, who had to grow our varieties in the Northwest. After all, they had to produce seed before they could be planted for canning. We knew every detail of how they handled in the seed fields and in processing.

Jack Countryman, who as fieldman had driven Willard Griffin out to see Adele and me, and who later became president of Del Monte, he knew the details of our work almost as well as we did. Jack altered our program directly only once. The first year we had plots of SCL6 for canning, we had harvested three of the nine plots and were in the sample room tasting them when Jack said, "I've watched the SCL6 plots all season, I've seen the data, and now I've tasted them. I'm satisfied. I suggest that you save the other six plots for seed." We did, and it about doubled our seed supply.

After he had become manager of the Midwest Division, and we were about to replace Delmar 16 with a root-rot resistant Delmar 16, he said to me, "Be absolutely sure before you do this. You know Delmar 16 has been worth well over a million dollars a year to us."

Finally, when he was senior vice presiden, Jack wrote: [reading] "Dear Adele and Lewis, Mr. Elworthy has just sent me a copy of your report of July 17th summarizing the Pea Breeding Program for 1953. In Mr. Elworthy's letter of transmittal he also is complimentary of the cooperation of you both with all the interested parties in the Midwest Division in this work. Of course, this is not news to me, but I wish to express again my appreciation to both of you for the fine work you have done in every respect on this and other programs in which you have been engaged."

Adele: It was really wonderful to be a part of such a team, and I hope you can understand what it was like to be part of Del Monte in those Golden Years. No wonder we were so successful.

VII DEL MONTE CAREER

[Interview 5: September 25, 1989]

Job Opportunities and Money##

Riess: Were you ever courted by any other companies?

Lewis: Yes, but other than the chance to go with Disney, or to build fireplaces, only one where I had a real firm offer. I think that most people who are courted by another company have let that company know that they would be willing to move. I never felt that way about Del Monte. Actually that one offer I did have eventually got me a salary increase.

Shortly after we arrived home after our second year in Rochelle, I was offered the job of research director for the California Fig Institute in Fresno. By that time, the work that we were doing on peas was so interesting and things were happening so fast that I just couldn't see leaving it. It was just too exciting to leave, no matter what another offer would be.

Adele: We also had the offer to go to Hawaii and be head of research for the Philippines and the Hawaiian Islands, which Lewis turned down also.

Lewis: I never was as much interested in money as I was in having a really interesting job. I've never asked for a raise, and I've never had to look for a job. Of course, the lumberyard was available to me as a kid, and I worked in the lumberyard. This Del Monte job came to me. I never asked for it. Those are the only two jobs I've had other than what I was doing myself in commercial art. As I say, I never asked for a salary increase.

This one offer from the Fig Institute offered me an increase to take over their research in Fresno. I talked it over with Adele and we decided against it. I told them I didn't want it, and I

told Dr. Caldis that they had offered me the job and that I had turned it down.

Riess: Was that something that he was behind?

Lewis: No.

Riess: That was his research, too, wasn't it?

Lewis: Yes, his research at the University was on figs, but no, he had nothing to do with the offer.

Riess: Did he counsel you at all about your career?

Lewis: No, not really. But anyway, I told him about the offer, and he wanted to know how much money they had offered me. I told him, so then I got an immediate raise--something over what they had offered me, which was almost double what I was making at the time. So it worked out fine.

I'm not the only person that didn't think about the money part of it. We hired Roger Schmitt from UC Riverside. His major professor, Dr. Robert (Bob) Endo, had told me about him at a meeting in Fresno, and then I went down to Riverside to interview him. I talked both to Bob and to Roger, and was very impressed by him. We went over what he was going to do, and he thought he'd like it.

A while later, Bob Endo called me at work from Riverside. And he said, "Roger says he's accepted that job with you, and he doesn't know how much he's going to be paid." (And I didn't know either. I didn't pay attention to it. I knew it would be comparable to what other people were getting. We were in competition, of course, with other businesses for help, so the pay would be all right.) I wasn't worried about it. Roger wasn't worried about it, but Bob did call.

Roger was working for us before he found out how much he was making, and I don't think he's ever been dissatisfied--still working. So I'm not the only one that didn't think about money. I think that somebody who's really interested in the work--that's more important than the money. Money is necessary, there's no question about it, but--.

Adele: If anyone was interested in money, they wouldn't go into agricultural research, because it's one of the poorest paying fields that you can get into because there's a limit on how much people want to pay for food.

Riess: Did you consider for a minute going to Hawaii or the Philippines?

Lewis: Yes, we considered it. I think it was largely because of Adele that we decided against it, because one of the criticisms of living in the Philippines and any tropical country is that women age rapidly.

Adele: Their periods get closer together and that sort of thing.

Riess: Why? How extraordinary.

Adele: Mr. Merck Phillips, who was stationed in the Philippines, was invited to Dr. Caldis' for dinner with his wife, and we were also there. I thought that his wife was his mother, and I said something about his mother to Mrs. Caldis (Maria), and I was given this "shush" sound. Mrs. Phillips was all gray and really shriveled-up looking. Then they told us that most of the wives that stayed there all the time aged like that.

Lewis: That was one of the things that decided it.

Riess: Do you think there's really something in it?

Lewis: I don't know, but at the time I know it was one of the--even possibly the main thing.

Riess: [to Adele] Did you realize that that was what kept him here?

Adele: I did, oh yes, we had a lot of discussions about it at that time. Also we were told there would be a lot of entertaining to do, dressing for dinner, entertaining.

Riess: That's what ages them. [laughter]

Adele: Right, maybe! And also, I would be a helpmate, but not in the research work, which I had come to really enjoy.

Lewis: In the Philippines, they had their clubhouse, you know, and servants to do everything.

Adele: It's very discriminatory, and we aren't used to that.

Lewis: Somebody who visited in the Philippines said that the first thing he noticed was that when this person had dropped a golf ball that he had his servant pick it up for him. That was the first thing he noticed about the Del Monte compound in the Philippines.

Adele: They all have a cook and a maid. It's a strange thing. And then, some of the husbands run around, too. Anyway, it didn't fit in with our lifestyle.

To Be or Not To Be

Riess: When did you become the Assistant Director of Agricultural Research? When you first went in you were considered to be a plant pathologist?

Adele: I don't know when it was, but it was certainly when we were in the Midwestern part of our research.

Lewis: Yes. I started as a plant pathologist. Panos was sick for a long time after a trip to the Philippines, and they thought he needed an assistant. We can find the date here. [looking at notes] It was September 1950. I was happy with that title, and it was a good place to be, except for the five years under Koritz. That was five years of difficulty. But I still think it was the best choice.

Riess: The choice, which we don't really have on tape, was to remain as assistant director, thereby allowing Adele to continue working in the Research Department.

Adele: And he didn't tell me that until many years later.

Lewis: Yes, it was with Jack Countryman that I had the discussion. He was at that time a senior vice president, about four years before he became president of the corporation.

Jack had gone to the Mayo Clinic and I was in the main office, so I went in to his office to see how he was feeling. I remember he said, "I just smoked my last pack of cigarettes. They told me I could have a drink every night, but I had to quit smoking." And then he told me that there was something we had to discuss. He said that the executive committee had agreed that if I was to become director of Agricultural Research, Adele couldn't continue in the same department.

I remember thinking that things couldn't be better than they were right then, and I told him I thought it would be best if we kept it just the way it was. Jack was head fieldman at Rochelle when we first went there, and he knew our work and how we worked together almost as well as we did. He said, "I think you've made the right decision."

Adele: He was sentimental about our relationship.

Lewis: Jack may have been seeing it from a monetary angle, and actually the two of us working together probably were making more money than I would make alone. But I wasn't thinking of it from that angle, and from what he told me that day, I don't think he was either. I do know that he thought we worked together well, because he told us so on several occasions.

Riess: So why didn't you tell Adele? What would she have done?

Lewis: Well, I didn't see any sense in it.

Adele: I would have liked him to be director. I may have quit. I may well have quit. I was very surprised when I found out about it.

Lewis: Yes. I still don't feel that way, though. So, it's just a difference of opinion. So far as the really important interests of mine are concerned, I could pretty well influence what was going on from where I was, as assistant director. Of course, during the five years that Lloyd Koritz was director, I was assistant director in title only.

Adele: You regretted the fact that if you had been, really, director, you would have combined research on peas and beans, for instance, you would have organized it in a different way.

Lewis: Oh, yes, there are certain things like that, which would have affected Bud Cruger and Art Sprague, but eventually it was reorganized exactly the way I wanted it. And also I would have carried it on more like Caldis had done and have people working together more.

You see, when Koritz became director he had everyone working on assigned projects, and he didn't think anyone should know what the other ones were doing. For example, we saw some plots of beans in the Midwest, and one of the plots was completely free of a bacterial disease that was clobbering all the rest of the plots. Nobody else was back there with the plots at the time, so I told Lloyd about it. He said that that wasn't my work, it was none of my business, and that I should stay out of beans. Then--I don't know whether he forgot about it or whether he did it purposely--but that lot was lost. It was spectacularly resistant, but they never did anything about it.

Adele: The thing is that this was a bad situation. We had told you how when we first went back to the Midwest we were opposed on our research by Lloyd Koritz, the man who was in charge. Well, when Lewis didn't take the job as director, this man who was formerly

our enemy in the Midwest, became our boss. He never gave Lewis a decent raise during the whole time he was there. Everyone else got, at least, cost of living raises every year, so Lewis had a difficult time during those years under Koritz.

Lewis: Yes, but when Charles Geise came in as director, he caught me up to where I would have been, monetarily.

Adele: Those were difficult years.

And, you know, as director, you go to Washington D.C. and represent the industry in research. There's a lot of prestige involved with being the director of research. But that never has meant anything to Lewis.

Lewis: That still, to me, is not as much fun as discovering something exciting in research.

Riess: The directors are withdrawn from the research? Was Caldis?

Lewis: Yes and no. There's an awful lot of your time taken up by things that are really not interesting. That part of it where you're directing and coordinating work--that would be fun, and it would be very productive. But all the piddling stuff that goes along with it--. There's an awful lot of time wasted in just being an executive.

Riess: Now what you should do then is appoint an assistant who does the piddling stuff. [laughter]

Adele: Well, that's what Lewis did--a lot of it. [to Lewis] You did all the budget work, all the monetary stuff for Dr. Caldis, who had no mind for figures.

Lewis: And also, all the way through, I was in charge of the budget.

Adele: And Dr. Caldis would say, "Oh, let's just guess," and Lewis said, "No, we have to have it exact. We should really know what's going to happen."

Riess: You think that if you're inexact in your budget then it sort of implies a kind of sloppiness all the way through?

Lewis: Not necessarily, but Caldis' idea was that you put in a lower figure and then they'll accept it, and then you overrun the budget. [chuckles] That's done, too, but I never believed in it and we never did it. Some people figure that it's a way to get money for projects.

Rewards

- Riess: I notice in the back of the Del Monte Shield magazine that awards were given to employees for suggestions, thirty-five dollars, forty-five dollars, sometimes the occasional fourteen hundred dollars. Yet you both--every single day you were making improvements.
- Lewis: Yes, but that was what we were getting paid for.
- Riess: I wondered if there was ever a time when you really got a bonus or a tremendous award for your developments.
- Adele: No, because that was our business. Our awards came in the form of recognition by the executives and Division management. But within our department there were technicians that would make some improvements in the way we do things, and they would get awards.
- Lewis: If we had gone into a cannery and seen something that we thought could be improved and would make a suggestion there, then we would get paid for it. It's a certain percentage of what the earnings are a year. It's based on the monetary value of your suggestion. But bonuses aren't so desirable anyway, they're a one-time thing, whereas a salary increase goes on for the life of the job.
- Riess: It's interesting that it's so easily calculated. They can tell the difference between a thirty dollar suggestion and a thirty-five dollar suggestion.
- Lewis: Yes.
- Adele: There were some stupid suggestions like putting "ladies" on the ladies room door. [laughter] They had two unlabeled rooms, one on each side of the potting shed wall. They gave that woman a five dollar award for that, something like that.
- Lewis: When they had only very, very, very, few people working there, it was all right. Everybody knew where they were. I think that could be classified as one of the "piddling" decisions the executives would have to make. [laughter]

Expansion and Job Opportunities

- Riess: The Western Agricultural Research Center was dedicated in 1950--it was started in 1948. What was behind getting settled down in one place?

Lewis: Well, the department was growing in size, and it just had to have a place.

Adele: We just had three or four people at first. It was mostly Dr. Caldis and Lewis and I and one helper. Gradually, we built up. You saw the picture--[producing photo]--here's a few years later. You can see how the staff has grown.

Riess: And there you are, front and center and the single female. Why didn't a few more women come along?

Adele: There weren't any women who applied. We had one biochemist for a while there. She had a baby and left.

Riess: Back then, probably there were no policies about affirmative action about hiring minorities.

Lewis: No. But it had nothing to do with that. They just weren't available. In botany, yes, but in agriculture, no.

Adele: At that time, the blacks were not interested in getting into agricultural work. They ventured into something to get out of being associated with agricultural work, so that wasn't anything that interested them. Now, it's entirely different. We have a nematologist who is black on the staff, and a woman plant breeder. She is working on tomatoes now and she is going to take over both the pea and bean breeding work.

Riess: Did Del Monte make an effort to hire from Berkeley particularly? Did they recruit?

Lewis: No, not particularly from Berkeley.

Adele: When they were interested in hiring for the Midwest, they went to the Midwest for people. They got people from the University of Illinois and the University of Wisconsin.

Riess: Is that because scientists there were working on local problems and were better versed?

Adele: Not only that, but they have their families out there, their parents and so forth. They're much happier when they don't have to move as far away from home.

Lewis: It's very difficult to move somebody from California to the Midwest--easier to move somebody from the Midwest to California.

Adele: We've had people from the Midwest transferred out here later, but usually they started there. You make more money working here, but it costs a lot more to live here than the Midwest.

Riess: And yet, if anyone were going to be making money at agricultural research, people working for Del Monte would be.

Adele: You would think so.

Lewis: Yes, Del Monte has to be competitive with other industry, and I know that they used to pay more than the USDA for example. But there isn't as much money in food as there is in other things. Somebody like Nabisco, who took over Del Monte and is now trying to get rid of it, they make a bigger profit because they're not growing the food. They're taking flour and making it into something else. They're a manufacturer.

Adele: We made--how much? An average of five percent profit, and they wanted fifteen to twenty percent minimum. So they were very disappointed when they got Del Monte.

Riess: Del Monte was only making five percent profit?

Adele: Yes.

Riess: That seems like they're really right on the edge of loss then.

Adele: They have a large volume, but that's what their profit was on canned fruits and vegetables.

Lewis: Actually, the laborers, whoever they are--white, Mexican, whatever they are--are subsidizing our food prices by working for very poor wages. They're subsidizing the food, so the whole thing isn't fair, but that's the way it is.

Adele: And they should be making more.

Riess: If you'd become director of Agricultural Research, you'd be forced, maybe, to think more about these issues.

Lewis: Well, I've thought about them quite a bit ever since I first went to Wheatland. At the Wheatland Ranch, for instance, the tractor driver who was working up on the levee for the state was making twelve dollars an hour, and the tractor driver who was working right down below him among the peach trees was making a dollar and a quarter an hour. That's quite a difference, you see.

Adele: But then when people's food price goes up, everybody complains. Other prices can go up, but not food. Prices would have to be at

least double for vegetables if farm labor was paid a decent wage. Consumers would be up in arms. It's always been taboo to raise the price of food in stores. Maybe it's changing now a little bit, but not very much--not relatively.

Lewis: Not very much. The agricultural workers still aren't making very much money.

Technology Replaces People

Adele: Not just Del Monte, but all farmers had to go to farm machinery a lot more for harvesting because the government took the braceros away. They used to have them, the people who came up from Mexico, and they were willing workers, and good workers, too. But then they decided that the braceros were taking jobs away from Americans, so they stopped bringing them in. Nobody around here wants to work in the fields and do that kind of backbreaking labor. So farm machinery was introduced, and then farmers were criticized for not having as good quality food, because it was harvested by machine.

Riess: Yes. Now, a case in point, the one that I read a little bit about, was the bush beans. Could you run through that story? I think what was interesting to me was that the impetus for developing the bean was the fact that the machine existed. I don't know whether this is unique. Maybe it isn't. In other words, that the technology is out there waiting for the plant to catch up with it.

Lewis: The plants are not always suitable for mechanical harvest. The tomato had to be changed. It had to have a heavier skin to keep it from splitting open because it would not be handled carefully by somebody's fingers. And the bushes had to be more compact.

Actually a bean already existed that could be harvested by the machines, it just wasn't good enough in quality for Del Monte's image. Peas had been harvested mechanically for years, but the beans were more difficult, and, of course, you had to have the bush. They did try to make a mechanical harvester for the tall pole-beans. That harvester never worked, and the only thing Del Monte was canning was the tall, pole, Blue Lake bean which had to be hand-picked. The quality of the Blue Lake bean is quite different from the ordinary bush type.

When Tom Booye, who was the manager of the Seed Department, saw this machine in New York, he realized that the competition was going to be very tough. There's no way we were going to compete if

we didn't have a Blue Lake bean that could grow on a bush instead of a pole. Well, that sounds easy, because there's probably only one gene difference between a tall bean and a short bean, just like peas. That's a single gene. But in order to get it, you have to cross with a bush bean. Then you get all the qualities of the bush bean that you don't want right along with it.

The genes come in a package. You get this package deal no matter what. When our technology improves and we can insert a gene into a chromosome right where we want it, just that single gene, then we will be rid of that package deal and we can just do what we want. We can't do that yet, and we couldn't do it, certainly, then. DNA and RNA hadn't even been invented. So they started to work right then to develop the bush Blue Lake. That's how the company got in ahead.

There were a lot of bush beans that will machine harvest, but none of them were suitable for Del Monte. Del Monte had built up a tremendous sale of beans based on the fact that they were canning Blue Lakes. It is a good bean and it's very different from other beans.

- Adele: It's stringless, low fiber. It's very tender, white-seeded, and straight.
- Lewis: They didn't want to drop all that advertising that they'd done for years, building on the superior quality of the Blue Lake, and still they knew that eventually they were going to have to mechanically harvest beans. So, we did get ahead of everyone else. We weren't the only ones that were working on it. The best Blue Lakes were grown in Oregon, so they were working on it at Oregon State. They did a lot of work, and eventually got a bean close to what we had developed.
- Riess: For some company?
- Lewis: For anybody that wanted it. They were developing beans for anybody in Oregon who wanted to grow bush beans.
- Adele: They gave their varieties to the canners and packers that were in Oregon--the university varieties.
- Lewis: I don't know whether Art Sprague, our bean breeder, ever used any of their stuff. I think he was so far ahead of them, all the way through, that their program didn't help him much, but he worked well with everybody at the university up there at Oregon State. He also worked well with Pat Winter, the Seed Department plant breeder who worked with us on peas.

Adele: Art was stationed at that time in Salem.

Riess: That's where the two people did their work--Art and Pat--Salem? Not down here at San Leandro?

Lewis: Pat was stationed down here, and Art was stationed up there. All the selection work was done up there. Increasing could have been done down here in the greenhouses or even in the field, but all the selection work was done up there.

Adele: Selection has to be done in the area where you're going to grow the crop.

Lewis: And then when they started growing the bush beans in Wisconsin, then of course, they switched their trials to Wisconsin. Then another person entered the picture there.

Riess: As the assistant director, did you go to oversee this at periodic intervals? What would you look for then? You already had your geneticist and horticulturist there.

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Lewis: It was primarily that they showed either me or other people who were interested--there were the research managers of the Northwest and Midwest Divisions who were involved, and the people in the canneries that were interested, too--they would show what they were doing, how far they had gotten with their efforts. You could see how they were growing in the fields. If you had any ideas, you'd suggest them. But on the whole, if you have the right people working for you, they don't require much supervision.

Adele: Sometimes you could see whether duplication was taking place, suggest that more or fewer selections be made, and coordinate things. Lewis had to go to Texas and Wisconsin as well as Oregon, and they were all working on things that were suitable for their particular area.

Lewis: Do they still grow beans in Texas? I don't know. It's been fifteen years since I was there. I think they still do, but, by and large, they couldn't compete in land values with Wisconsin.

Riess: Did it get to where you had people growing beans day and night because you knew that the competition was going to come in with a selection soon?

Lewis: It was pretty close, but I don't think it was that close. The problem was that bush shape was very difficult to get--the right

type of bush so that the harvester could pull off the pods. The beans have to be pulled, whole, off the bush.

Adele: Yes, and they had the clustering problem, too. If you get a whole bunch of beans and they come off connected in a bunch by their stems, then that was another expense in the cannery--to break up the clusters.

Lewis: There were a lot of genes had to be connected.

Adele: All of them had to be tested for fiber. Sometimes they would be perfect for yield, but they would have a little too much fiber, and the shape had to be just right, too.

Lewis: Anyway, it did come out. Of course, every bean that they can now is from a bush.

Riess: I must say, canned green beans have never had a good reputation, no matter what.

Adele: But now, I think, they're better.

Lewis: They're better than frozen beans. Frozen beans are like rubber.

Adele: I think they're better than frozen, and they are used a lot in salads. I think they're good in salads.

Riess: [laughs] You're saying that with your nose wrinkled, I must say.

Lewis: Ever loyal.

Riess: Tell me how often you have a canned green bean.

Lewis: We probably have a can of beans every two weeks or so, which is as frequent as any other vegetable.

Adele: It's too bad, in a way, because with all the work that Del Monte and other canners put into it--you have to get out there on just the right day, and they're beautiful and they taste wonderful, and we're preserving them, and we're not hurting anybody. They don't taste like fresh beans at all, but neither do very many canned products--peaches, apricots,, and even peas among them. But many people like them.

Lewis: The beans sell well. As a matter of fact [looking at document] we figured that the added value of the bush Blue Lake to Del Monte was just over six million dollars a year. This is added value, not total value, so they must have sold well.

Tomatoes and the Mechanical Harvester

Adele: The same thing that happened for beans also went on for tomatoes, except that I don't think the machine came before the tomato. It was being developed, but there wasn't one in place before they had started breeding.

Lewis: The first time I ever saw a tomato vine that was ideal for mechanical harvests and had all the fruit ripe at the same time was in New York, in the plant introduction increases at Geneva. There was already talk about the possibility of machine harvest, and Blackwelder at Rio Vista was working on one. Desmond Dolan, the manager of the USDA Plant Introduction Station there in New York, selected this vine the year before. It was from one of three or four vines that showed up in the plot that were quite different from all the other vines. There were three plots, but one, especially, where everything was ripening at once.

I remember it very distinctly. It seemed like there was just a whole big pile of ripe tomatoes there on those small vines. Dolan showed it to me. That was the second year that he would have seen it, and he said that the USDA had raised hell with him because he had made a selection, and that he was going to have to mix the seed back in with the rest of the accession. As a matter of fact, he gave me some seed of it at that time. But for some reason or other, Del Monte didn't exploit it. I don't know who was in charge at that time. I remember that they grew it in the greenhouse at San Leandro, but the tomato breeder didn't like the small vine and I don't know what happened to it. But anyway, Del Monte did not exploit it and a guy up at Davis did.

Adele: Dr. Jack Hanna.

Lewis: Yes, and within five years, 99 percent of the tomatoes grown in California were his. Even today, almost every tomato used for processing is either a selection from Jack's line, or related directly to it.

Lewis: He saw the possibilities.

Adele: He recognized its potential and went with it. Even after he retired, he was hired by the Peto Seed Company and continued to breed tomatoes that were superior for them.

Riess: After all your years in the business, do you have a lot of sympathy for American farmers?

Lewis: Probably the biggest gamble in the world is farming, because you're so dependent on weather and the whims of people, neither of which are very trustworthy.

Adele: And the price fluctuates.

Lewis: The price is based on other things, and you really don't have much say in how it comes out. I can remember one time when we were down in Imperial Valley at the hotel where there was a bar. Some guy came in and ordered drinks for everybody in the room. I heard somebody say, "He made a pile of money on carrots. Remember last year? He went broke on carrots." [chuckles]

Adele: I would have as much sympathy for the farmers themselves as I would for the farm workers, because they really can go broke in a hurry and lose their homes and farms that have been in their families for years. Most of it isn't anyone's fault but the weather.

Smog and Other Pollutants

Riess: Speaking of the weather, in 1970--and here we are twenty years later--you wrote in one issue of the Del Monte Shield that air pollution damage in the field was not a problem yet. I wondered whether it is now a problem.

Lewis: I'd say we're living with it.

Riess: It's not a problem yet?

Lewis: Oh, no, it is a problem.

Riess: But in 1970 you said it wasn't a problem.

Lewis: Well, not to the extent that it is now. And then, of course, they have done something about air pollution, too, putting converters on cars and all that type of thing.

Riess: How soon after 1970 did it become visible?

Lewis: It just was a gradual thing, but it started long before 1970. I can remember the first time I noticed it, and I really didn't know what I was noticing. I was growing water lilies in Alhambra in southern California, and I must have been a scientist, even then, because I took notes on when they started to grow and bloom. All of a sudden, in the summers, you couldn't see the mountains anymore. Also, fog stayed later in the spring. The summer didn't

start as soon, and then the water lilies didn't start growing as soon. That was the first time I noticed it, but that was the beginning of it. That was about 1927, about the time automobiles were becoming numerous.

Riess: But then, out in the fields in the seventies, didn't it get confused with other diseases?

Lewis: Yes. We filtered all our greenhouses at San Leandro with charcoal filters because of smog. After you'd been in the greenhouse for awhile and went outdoors, you could smell the difference.

Riess: But when people were bringing things in from the fields, maybe for a while you were looking at evidence of pollution and you would have been thinking that you were seeing a disease?

Lewis: Yes, and that was why we filtered the greenhouse. Smog doesn't necessarily cause much harm to the plants, but it masks symptoms of the other diseases we were studying.

Riess: So it isn't really pathological.

Lewis: Yes, strictly speaking, anything that alters the plant is a disease--is pathologic--and smog, or certain elements of smog, affect all leafy crops to a certain extent. You just accept it.

Adele: There's less chlorophyll action. They're not quite as green.

Lewis: It just barely discolors the underside of leaves or something like that.

Adele: Sometimes, as with peas in the greenhouse, it curls the leaves upward a little bit so that they aren't able to expand as much. So it would be insidious in that way.

Riess: What about lead? Is lead something that gets into plant tissue?

Lewis: I don't know. I've not seen that effect. I understand it affects plants growing close to the highways, but I have not seen that.

Adele: I know there's an awful lot of natural toxins--not man-caused--that get into plants. We saw that in some spinach growing near Salinas. The toxin comes out of the water that comes from the mountains and the hills because the soil carries this particular element. They didn't publicize this because they didn't want to alarm people because it's just something that happens around the rivers.

Lewis: But it's natural occurring, like boron toxicity in Woodland, and boron toxicity in a few other places in the state. There isn't

anything you can do about it. This element causes leaf damage to tomatoes, but no problem to the fruit.

Adele: They just avoid growing crops in these areas if they can. In Salinas, they were able to avoid that problem area.

Riess: Bob Raabe said that the spinach that he was working on down in Texas had some white fungus on it, and it might well have been of nutritional value, but of course it was aesthetically negative.

Adele: That's it.

Lewis: Professor Essig, entomologist at UC Berkeley, said it would be better for us to eat the aphids and caterpillars than to eat the spray, but I don't know of anyone who bought that idea.

Riess: Can you think of any cases where you've been able to, or Del Monte or anyone has been able to sell the public on a product that was not pleasing to look at?

Lewis: The oranges in Hawaiian markets look awful, but people buy them if they can't get mainland oranges. Of course, oranges are peeled and then they look okay.

Riess: Organic farmers now sell us all--

Adele: --all this stuff, and they charge more for it, too. I know that they feel that everybody wants to have everything natural. In Europe, for instance, with peas and other kinds of vegetables they put artificial coloring in to make the canned products look bright and pretty. That doesn't hurt you at all. But here we can't do that, and we've thrown out lots of things in both beans and peas, and in tomatoes, too.

Lewis: And peaches.

Adele: They weren't just exactly the right color; nothing wrong with them otherwise, but the public won't accept them if they see something that has a blotchy color. Like when you buy tomatoes in the store and you cut them open and they have a small white core at the stem end, well, we can't have that.

Lewis: When you go to the food market, don't you pick out the fruit? You wouldn't pick up a fruit that had a spot on it if you could get one without a spot.

Academic Freedom

Riess: You have suggested that one of the attractions of being involved with iris hybridizing is that you got results quickly. It makes me wonder whether there were ways in which your work at Del Monte was enormously frustrating, that you were limited in the avenues that you could explore there.

Lewis: I don't think that we were curtailed any at Del Monte. I think we could do almost anything we wanted.

Adele: Except publish.

Riess: So that was one frustration?

Lewis: I don't know that it was a frustration. It was for some people. For me, it wasn't at all a frustration. Actually I thought it was kind of nice to be able to develop some knowledge and keep ahead of the competition by using it rather than publishing about it. Certainly, when Del Monte was Del Monte--I don't know what they are now, but when they were a corporation by themselves--the executives knew what was going on and certainly knew what we were doing.

Adele: Encouraged us in every way to do whatever we wanted to do.

Lewis: That book on the genetics of peas we gave out to universities. Everybody that was working on peas we gave it to, including other seed companies and so forth. It really didn't add anything. It helped our knowledge of the genetics of peas, but it certainly was not a commercial venture. There was no hesitation about compiling it and publishing it.

Adele: And as far as changing to ornamental plants was concerned, there are some things we can't do now because we don't have a nice laboratory or a big greenhouse facility, or a lot of land, or technicians and labor. We're limited in what we can do compared to what we could do then. Here, we have two microscopes in a tiny room, and I use my four-quart household pressure cooker for an autoclave. [laughs] It's really a lot more difficult for us to do the scientific part of it.

Riess: When you were with Del Monte, and interested in flowers, you were able to use their equipment--that was not a problem?

Adele: No, not a problem. And even after we were retired they said we could use the lab when it was at San Leandro. But now they've sold that. They moved and are consolidated in a small, cramped space in the Scientific Research Department's headquarters at Walnut Creek.

We can't get over there real easy, and security restrictions there make it a problem, too. So there are some limitations since we have retired.

Lewis: Being retired has many good points, I don't have to take sedatives to deal with stress any more, for instance, but having a fancy laboratory isn't one of them.

VIII FLOWERS

[Interview 6: December 6, 1989]###

Sweet Peas, Water Lilies, and Mesembryanthemums

Riess: [to Lewis] When did you begin your work on flowers?

Lewis: The first thing of that nature that I can remember is making some selections for sweet pea color when my mother was growing sweet peas. I'm pretty sure she stopped doing that about the time I graduated from high school, so that was someplace in mid-high school years. It was for a pretty salmon color that had come from pinks. She bought seed by color so that she could have a whole lot of one color, because that's the way they wanted them in the florist shops.

I found these salmon-pink flowers among the pinks, so I started selecting. We eventually got enough seed so that Mother had solid plantings of that color. That's the first thing that I can remember that I did in the way of selecting. There's no crossing there but just selecting for color.

Riess: Is there a sweet pea association or a society?

Lewis: I presume so.

Adele: I don't know, I've never heard about one. I've never heard of it, and we have a book of reference on plant societies.

Lewis: Anyway, we haven't come across the color, haven't been able to find it in seed packets. I remember what it looked like, and thought it would be interesting to see it again.

The next project that I worked on was the tropical water lilies. I did quite a bit of the crossing on them.

Riess: Did you consult a book to figure out how to do that?

Lewis: I got books out of the library on both goldfish and water lilies because I was selecting goldfish, too, at the same time, for the long veil-tail type of goldfish.

Also, I tried to make crosses of the non-tropical hardy water lilies, which is very difficult. I never got any seed from that. From the tropicals, I was crossing night bloomers and day bloomers and all kinds of different types of things. I got quite a few good ones. Of course, I just kept them for myself. They're relatively easy to cross.

Riess: You were working for a nurseryman also?

Lewis: Yes, but that had nothing to do with water lilies. His name was Snyder. Mostly I was a chauffeur for him. He had a truck, but he didn't have a car. So when he would want to go visit other nurseries, why, rather than take his truck, he would call me. It worked out fine, because that was what I wanted to do anyway.

Riess: But you didn't learn any propagating or hybridizing practices from him?

Lewis: No, not from Snyder. One of the experiences that I had with him had to do with Mesembryanthemum speciosum, and I was just trying to find it listed here.

Riess: What is that?

Lewis: This is a book of the Mesembryanthemums, and there are a lot of them. All of the Mesembryanthemums have been renamed, and I find it difficult to look up the species I knew under the old names. Everything, then, was under Mesembryanthemum, and now they're divided into five tribes, several sub-tribes, and over 150 genera. That whole book is nothing but what used to be Mesembryanthemum. There are lots of species, 750 pages of them. I don't know whether Orchidaceae has more in it than Mesembryanthemum. It probably does, and probably the composites, the daisy family.

Riess: What are Mesembryanthemum?

Lewis: Well, it's like iceplant--you know, the one that they grow along the freeway. That's a Mesembryanthemum. They're the bright-colored things that you see on the hills around San Diego. They're not wild there. They're from Africa.

Mesembryanthemum speciosum was very rare and hard to come by. I had gotten a plant of it from Snyder, and I grew it about five years. It got big enough so I could make cuttings from it, and not

one of the cuttings grew. I found out that it's one of the few--possibly the only one of the Mesembryanthemums that's difficult, if not impossible, to get to grow from cuttings. They usually grow it from seed, but that was a sad, sad experience. [chuckles]

Adele: Humbling.

Lewis: All the Mesembryanthemums were just one big genus at that time. There's a controversy on the spelling of it, too, whether it should be spelled with a "y" or an "i." It was originally an "i," from two Greek words: mesembria (mid-day) and anthemium (flower). It refers to the fact that they bloom in midday, and that's why it was spelled Mesembrianthemum to begin with. But they found some night bloomers. (It couldn't be done, now--the name couldn't be changed --but that was before the botanical rules went into effect.) Because they were night flowers, too, somebody [Dillenius] changed it from the "i" to a "y." It was originally spelled "b-r-i."

Adele: What was so unusual about this one that you wanted it?

Lewis: Oh, it was a beautiful flower. I don't think there's anything more beautiful than it is. It's an orange-red, very brilliant, and has just a little bit of green in the center. I haven't seen it for years.

Riess: I'm tempted to ask you what your favorite color is. [laughter]

Lewis: Magenta. [laughter] Magenta and turquoise.

Riess: I'm not sure whether you're kidding. But I keep thinking of your lifelong interest in genetics, and in art. Some of your answers make it clear that the two really work quite well together.

Lewis: Yes. Larry Gaulter, an iris breeder--he was a house painter, he can remember color going from one garden to another. For instance, the difference in blues or violets or some color: "This one was a little more red than the one that I saw in that other garden." That's very difficult for me, but he's very good at it. He had worked mixing paints for so many years that he just sees the color, and he knows what another color looked like that he had seen previously.

I can't do that. If the two flowers are close together, I can tell that one of them is a little bit warmer violet than the other, but if they're on the opposite side of the garden, why, I'd have to pick a flower and bring it over. But he doesn't have to. It's like people that have a natural tone. There was an organist that played in the theater where I worked. If you'd ring a nail--hang a

nail on a string and ring it--he could push the right button on the organ and make the same tone. He had just absolute pitch.

Riess: It's nice that we have that admiration for each other's skills, because they are practically motor skills after a while, and almost not to be admired, they're so easy for the person who has them.

Lewis: For the person who has them, yes, where it's so difficult for somebody else.

Riess: I remember in one of the articles by you that I read, you thought that you had an iris that was blue, and then when you put one of the color scales on it, you had to face the fact that it was another shade of violet.

When you're working with flowers, does it feel recreational, like it's not work?

Lewis: I think it's always not work. Maybe when you're pulling weeds, eventually it gets to be work, but sometimes even pulling weeds isn't work. Shoveling is work. There are aspects of gardening that are work, but--.

Adele: Some things in the garden have to be scheduled. In that sense, you have to allow time for them, they're something you have to do at a certain time, and that's work.

Lewis: Yes, but I don't think you'd think of it as something you wouldn't want to do.

Riess: I was thinking about a day at Del Monte where you were doing a careful selection of one thing and another and making decisions, and then you come home to a night in the garden where, in a way, you're doing the same thing.

Adele: It's relaxing. It's much more relaxing. Like when we just came home from Toronto, where we were giving this talk on the pea work, we were so happy to get out in the garden and--well, I'll say "get to work," but it doesn't feel like work.

Seeing Things for the First Time

Lewis: Getting back to my early garden experiences, another interesting experience that I remember about was the yellow tropical water lily. Up to that time there had been no yellows in tropical lilies, although they were easy to come by in the hardy lilies.

It had been reported, I think it was in the literature, that there was a yellow tropical water lily, and somebody from the Missouri Botanical Garden was sent on a trip to find it. I don't know whether it was an expedition or whether they went out specifically to find it, but anyway, they did find it, as I remember, in one of the tributaries of the Amazon. They brought it back to the Missouri Botanical Garden.

I had written to George H. Pring at the Missouri Botanical Garden about a method I discovered to multiply tropical water lilies very rapidly. I think we had only written about three letters back and forth. When they got this yellow lily, they divided it into three or four plants, and sent one of them out to me. This was done to divide the risk, the possibility that something could happen in their greenhouse and they could lose it. They also sent it to two other people.

I grew it for about a year and a half. It didn't belong to me, and I couldn't make crosses with it because that wasn't allowed, but I did get to see it bloom. But it was an interesting experience to see the yellow water lily bloom for the first time. It was a kind of a scraggly flower, but now they've improved it a lot through interbreeding.

Riess: And then what happened after the year and a half?

Lewis: I just sent it back. I didn't try to increase it.

Riess: In what form can you send it back?

Lewis: When dormant, they're little bulbs about the size of a walnut.

Adele: You put them in a plastic bag?

Lewis: You couldn't use plastic bags in those days. I forget what we did wrap them in to keep them from getting hurt, but there was no problem shipping it. I guess it was in excelsior, or damp peat moss.

Adele: Nowadays, they send them in water in a plastic bag.

Lewis: Well, that's for the hardy water lilies. The tropical ones are shipped dormant, little round bulbs, like walnuts.

That was just an interesting experience--just the excitement of seeing something new. Like the first scarlet cattleya orchid that was in bloom at Armacost and Royston in Hollywood, in their greenhouse. That was one time when I had furnished transportation

for this nurseryman. Someone from Armacost and Royston had called him about it, and he wanted to know if I wanted to see it, too. It's an interesting thing, seeing something for the first time.

Riess: That's why you can't work in isolation, I guess, and that's why people get into groups who have a passion for these things. It's hard to sustain that interest all by yourself, don't you think? You want to talk to people who know something about it.

Adele: Yes.

Lewis: Of course, now, if you're publishing on some new work, and you wanted it to be a surprise, I don't know. It is an ego trip to be first, so if you were going to make a publication on something, you probably wouldn't want to show it to anybody until you had got the thing in writing and to the publisher. But yes, on the whole you want to share. It's one of the reasons why we like to have visitors in the garden, because you have something that's pretty, and you want somebody else to see it. You want somebody to say, "Oh, that's beautiful." That certainly is true.

Adele: And it is nice. You get suggestions from other people also.

Daffodils and Frank Reinelt

Adele: We became interested in daffodils and breeding daffodils when we were still living in Morgan Hill, because it was the only flower we could grow and see blooming before we had to go back to the Midwest.

They bloomed so early. We got a collection of daffodils from the Vetterle and Reinelt nursery in Capitola. Everyone in the Bay Area used to go down there to see the tuberous begonias. At that time, Frank Reinelt did the hybridizing of large, beautiful tuberous begonias. He also created superior delphiniums, polyanthus primroses, and was also working on new types of daffodils.

Lewis: Vetterle and Reinelt was real close to Morgan Hill, so we used to drive over there quite often. We got to talking to Frank about all kinds of plant breeding and he told us about his problem with the daffodils. It was the bulb fly.

Adele: The lesser bulb fly or--

Lewis: Yes, the fly maggots that get into the bulbs. I forget which one it was that he was having trouble with, probably the narcissus bulb fly, but it was so bad that he couldn't keep up with them. They destroyed his bulbs faster than he could produce them. Nowadays, you can treat them with a chemical, but in those days they didn't have such a thing. So one day he said, "Well, do you want my seedlings?" He gave us everything he had, and beautiful stuff. That was in 1942.

Adele: With red and pink trumpets that had never been seen before.

Lewis: We probably had four or five hundred beautiful blooms that first spring, so we made crosses with them, but I don't think we ever saw one of our crosses bloom. Of course, we got the maggot along with the bulbs. We had a lot of space at Morgan Hill, acres, so we were planting them around in different places to try to get away from the bulb maggot. But we had the same problem that he did.

Adele: The big disadvantage about breeding daffodils is that you have to wait seven years before you see a bloom. And then, if you make a further cross, it is another seven years before you can see whether you made an advancement. So the breeding took just too long. But that was our first interest in breeding flowers since our marriage. Then we left Morgan Hill before the seven years were up.

Lewis: Yes, we brought them here to Oakland.

Riess: So, do you have some daffodils here that are nowhere else?

Adele: No, we haven't any longer. We had a bad experience. We planted them here all in one bed because it was the only space we had available, and the maggots came in and destroyed almost all of them. We have daffodils now, but they are purchased daffodils of lots of pretty kinds. And we don't plant them in a big single bed anymore, because that encourages trouble. Frank Reinelt's daffodils were the finest we have ever seen.

Riess: And yet the ordinary person goes out and buys daffodils with 100 percent expectation of no problem.

Lewis: Yes. Of course, now you can drench the soil.

Riess: The ordinary person doesn't do anything.

Lewis: Somebody else had drenched them before you got them.

Riess: Drenched the bulbs?

Lewis: Yes, with an insecticide. There are several insecticides that kill the maggots now and that are very good. In those days, there wasn't anything that you could use to control them. I guess DDT was out by that time, but not at the time he gave them to us. By the time we moved up here, I think DDT was already available.

Riess: Did Reinelt go on to make these fancy daffodils commercially available?

Lewis: I talked with two people in the daffodil society recently, and as far as they know, there are no Reinelt daffodils left, but he was very free giving stuff out. I'm sure that other people got pollen from him.

Adele: I'm sure they were used for crossing and are the basis of some of these very lovely new ones.

Riess: The people who do nothing but fill orders for bulbs, like Breck's, are they also developing the bulb or the flower?

Lewis: Not necessarily. I would guess the larger ones probably are not developing. They only buy and distribute other people's.

Adele: One of our iris breeders, Ben Hager, has a partner named Sid Dubose who is breeding daffodils. The two of them work together at the same nursery, the Melrose Nursery in Stockton. Sid has some marvelous ones that are exhibited all over.

Lewis: He's working on pinks.

Adele: They sell through their nursery.

Sunday Afternoon Excursions:##

Riess: I'm asking you what place flowers filled in people's lives back then. I feel that sort of interest was more common then.

Adele: I think it was very important. They used to have big pilgrimages to go see those tuberous begonias at Vetterle and Reinelt. The parking lot was full, and they were mostly people from the cities that went out. They were so fantastically beautiful. The same thing is true for visiting Salbach's iris gardens in the Berkeley hills. Everyone went to see the Salbach and the Mitchell iris gardens. I went there before I was married, with my mother. They were both on Woodmont Avenue, next door to each other.

Riess: In your interviews for the Bulletin you've elicited over the years stories of how people have become intrigued with iris, and in so many cases it's that when they were young children they were taken with their parents to see these flowers. It's a kind of Sunday afternoon outing, and it's terrific. I just don't think it happens anymore.

Adele: I don't think as much. When we went to Australia, the children-- whenever we went to botanical gardens, there were classes of children going through looking at the flowers, from a very early age, whereas I don't believe we stress that over here at all.

Lewis: A lot more of the taxpayers' money goes to gardens in Australia than it does here.

Adele: Twenty-five percent of Adelaide's city budget goes towards botanic gardens, and this is approximately the amount in other major Australian cities as well.

Riess: How wonderful! Landscaping, or is it botanical gardens, that the money goes to?

Lewis: Both.

Adele: Botanical gardens and landscaping. It's really wonderful. But we don't have that here. Of course, we have so many big problems, I guess, to spend our money on.

Riess: In Region 14 of the Iris Society you have members in Shasta County and around Fresno. I suppose they have bigger gardens, more acreage to fill with something or other. And I suppose garden clubs were a more important social activity for women then.

Adele: That's true. There weren't as many women working. Some of them were like tea party things. They weren't all that serious, some of them.

Riess: Were flowers part of your childhood at all, Adele?

Adele: Not really. We did have a backyard in San Francisco, you know, and we grew sweet peas. I remember that. There were roses. We planted the sweet peas every year, but the roses were there, and the blackberry bushes, and the lawn in the middle, and three fruit trees, but they weren't choice or unusual things.

I went to the park a lot. Going to San Francisco's Golden Gate Park was an almost-every-Sunday thing. We played on the lawns, rolled down the hilly grass in front of the conservatory, and went to the playgrounds. But the flowers were not important.

Riess: And your mother didn't garden?

Adele: No, my mother and father weren't into gardening. My father liked it when he had pruning shears in his hand, and he'd go out there and cut everything to pieces. [laughter] There are some men that love doing that. My brother has inherited that.

Riess: Nothing can grow fast enough for people like that. [laughter]

Adele: My father would use the same technique on cars. If they were broken, he'd kick them.

But no, I didn't have any background. It was not until I met Lewis that I really noticed flowers, but I had the artistic background and I had a feeling for beauty. I had no opportunity, I guess, when I was a youngster. I had so many lessons and so much responsibility--it was just a lot of work growing up.

Riess: I gathered that. You were being pruned and shaped constantly, too.

This is such a different experience that Lewis had, that he knew from very early that he could make a flower. The rest of us could maybe buy a flower or put a flower in a jar.

Lewis: But still, I really didn't have any knowledge at that time. I really didn't know very much about plants, I just liked to grow them.

Riess: But when you went to the library to get the book out about goldfish, that was the beginning of it?

Lewis: Yes, and I can still remember that it was fascinating to me, and probably I was still in high school, when I read about this Frenchman who had done all of the work breeding the hardy water lilies. N. LaTour-Marliac, of Temple-sur-Lot, France, was able to get them to grow for him and make seed, and nobody else could do it. I can still remember that that was a fascinating thing.

Adele: It still hasn't been done.

Lewis: It still hasn't been done to any extent, and yet he got thousands of crosses. But he didn't share how he did it. Although it may not have been that he wasn't willing to share. It may have been something else; I mean, he may not have known why he got them, either. Anyway, he had no problem getting crosses, and to this day, half the hardy water lilies that are for sale are Marliac things.

I can remember that that was a fascinating thing to me, that this guy was able to do it, and nobody else could do it. That's one of the reasons why I tried crossing them. But I never got any seed to form at all. It was a curious thing.

Another thing--I think I'm a collector, too. I think I like collecting things that are rare, just to have. There are a lot of people that are just collectors.

Adele: You like them to be exceptional for other reasons, don't you?

Lewis: Yes. But I think I was always a collector, because I was looking back through the maps that I made of the collection that I had of succulents, for instance. I think I liked collecting them. I liked having all of the water lilies, not just one or two.

I think that this desire to grow the unusual has something to do with my breeding interests, too, because when you want to grow something that won't grow in your area, you have to breed to get it. That was the case here with the deciduous azaleas. We didn't have enough cold up here where we're living, at this altitude, to make the flower buds form in the wintertime. We had to make crosses to get them to bloom here.

Clivias and Deciduous Azaleas

Lewis: I think the next thing we worked on was clivia, Clivia miniata. The original species had a salmon-colored flower, but now they have bright red-orange, orange and yellow colors. I worked toward deeper reds and got some really nice things.

I had a chance to get the yellow clivia that they're working on so hard now. It's the "in" thing in clivias at the moment. J. N. Giridlian's Oakhurst Gardens in Arcadia had yellow clivias in 1951 when I picked up the English and Belgian hybrids from which I started my hybrids. I remember I was there with Caldis, and the yellow flowers were so scrawny that we didn't buy one. Other people have now improved on the flower, but I haven't seen a real good one yet. I understand there are some good yellows available at Nevin Smith's Wintergreen Nursery near Watsonville.

Riess: Is it also from a bulb?

Lewis: Yes, the plant is similar to amaryllis.

Riess: And so the bulbous rhizome plants have been the most interesting?

Lewis: No, I don't think so. I think that the work on the deciduous azaleas was real interesting. We've seen this type of azalea up in Oregon where it is ideally suited. They have beautiful orange and yellow flowers not seen in our evergreen types.

Riess: There's a handsome bronze-leafed one up there.

Lewis: Yes, now that's also blooming a little. They're kind of confused this year. A lot of the azaleas are very confused this year. Here it is December! They don't know what time of year it is because of the drought combination, and then we had a lot of rain, and now it's warm like spring was coming. So they're blooming out of season, and they really don't look good. Several of them are blooming out in the backyard.

Adele: They usually don't have leaves at the time the flowers come out, and they're much more brilliant.

Lewis: We first saw that type of azalea at the Gomez Nursery, which is located just down the hill from here. We bought a plant covered with beautiful orange flowers and of course it didn't bloom for us here. We had it two years, so I went down and asked Gomez how come, and he said that he gets them from Oregon, where they are preconditioned by the colder winter, so they bloom for him. That was when he was doing Macy's flower show.

Adele: He does Macy's flower show every year, the spring flower show. At that time, he was also doing the Oakland flower show where they used to have this marvelous display.

Lewis: But he said that he got them from Oregon. They were conditioned for bloom, and then they would bloom here. But then when we bought it--I don't think that plant ever bloomed for us at all.

About that same time, we met Howard Kerrigan just through visiting his nursery. He was hybridizing both rhododendrons and azaleas, but mostly the other type of azalea.

Adele: The Japonicas.

Lewis: I talked to Kerrigan about our problem and he offered to order a hundred seeds of Knap Hill hybrids for me. So I grew a flat of seedlings from Knap Hill in England. Howard also had some Exbury hybrids growing in his nursery, and I bought two of them to have here. But the plant that I used the most of the Exbury type was one that was in his nursery--quite a large bush that was blooming well for him. Of course, it's a little colder down there where Kerrigan had his nursery than it is here.

Of the hundred Knap Hills, as I remember it, I think there were only twenty-seven that bloomed for me during the seven years that I had them. I started intercrossing. Anything that would bloom here, I started intercrossing and just selecting for the best bloomers. Now we have seventy-four plants here which bloom well for us every spring.

Adele: They're beautiful. They're all colors. We have those in pinks, creamy yellow, oranges, and even scarlet. We have azalea varieties that bloom here that are just as pretty as those that bloom up in the colder climates.

Riess: And have you ever bought any from the Carolinas, the native azaleas, the wild ones?

Lewis: Of course, those had already been incorporated in both the Knap Hill and the Exbury hybrids. They're largely things, though, from China rather than the eastern United States, but all of that type of azalea of any value had already been incorporated into this stuff from England.

Adele: We also grow some of the sun azaleas, and they're very nice.

Riess: When you talk about breeding them, does that mean that you had a kind of a lab here all the time, or is it not like that?

Lewis: No, we just grew them in various places in the yard, and anytime they would bloom, why, you would take the pollen from that flower and put it on another one, and from the other one, and put it on that. From seed, they take four years to bloom.

As I said, we kept the Knap Hill stuff for seven years, and only twenty-seven plants out of the hundred bloomed at all. There was a big genetic difference between the plants though, and we were able to capitalize on it and get them to bloom here. There are still two of the original Knap Hills in the garden, but I don't have either of the Exburys, because they weren't quite as good as the one I used at Kerrigan's nursery. So they are the only two that are left of the originals, because after intercrossing and selecting, the new hybrids bloomed so much better. I think I only went three generations, but that was enough. So that would be twelve years we worked on it.

Riess: I have a sun azalea that I've had for years, and the thing that was always interesting to me about it is that it would have a nice pink bloom but there would always be a patch of the plant where the bloom would be darker pink, a whole other pink entirely.

Lewis: Yes, we had one down right along the driveway here that--

Adele: Sectored.

Lewis: Yes, they sector out. Ordinarily, it's a single-gene chimera, and it's a mutation--just one gene that makes that difference.

Riess: Chimera is the term?

Adele: It's a mutation. Chimera is a mutation.

Lewis: I probably shouldn't have said "chimera" because the term "chimera" denotes a specific mutation, usually undesirable. The difference between peaches and nectarines is a single-gene mutation for fuzz on the skin. A nectarine can form on the limb of a peach tree, and--

Adele: Then you can make cuttings and have a new type of fruit.

Lewis: Nectarines will revert back to peaches occasionally.

Riess: I read about someone who threw some seeds of something, I think it was an apple, out into her backyard,--I mean, this must be some kind of urban folklore--and lo, a tree grew that was a kind of a pear. Or it was a tree that had something that was like an apple in the beginning of the season, but then when it ripened, it softened and was a kind of a pear. Now I wonder what kind of a story that was. Did she have the only one of its kind, or is it possible?

Lewis: I don't know how the new Chinese apple-pears--I don't know how they originated, but they are descendants of Asiatic pears. They're called apple-pears because of their crispness, but they're not related to apples.

Adele: Those apple-pears are marvelous!

The Garden on Oak Hill Road

Riess: When you bought this place, you intended to turn it into a sort of a flower showplace?

Lewis: I think the first time we saw it when we came down here, my first thought was, "This is like our cabin up at Camp Baldy." It's wild, with all the oak trees around, and yet we're not in the mountains, we're almost in the city!

- Adele: It was all ivy under the trees, and there were a few bushes. But it looked like just what we had dreamed about. We never thought we could afford it.
- Lewis: I don't think we thought about the possibilities of the backyard as much then. I think we both thought, "This is it!"
- Adele: The first thing I thought of is we could have cinerarias all under the trees, those lavender-blues, and wouldn't that look pretty? And our daffodils could grow again. But we were never interested in a vegetable garden because we've always been able to get all the vegetables we wanted through Del Monte. We would just go pick them or get a boxful of asparagus, or anything.
- Riess: I know that you're a great mapmaker and notetaker. When did your first garden map take form?
- Lewis: That was back in Alhambra.
- Riess: [chuckles] Well, on this garden.
- Lewis: On this garden. Well, here's an example. This is the deciduous azaleas.
- Adele: Oh, he has everything mapped.
- Riess: Have you put it on your computer yet?
- Lewis: We're just starting to do that. [producing map] This is probably the first map that I made. It was about the time I graduated from high school in Alhambra. These are rocks, and these are all numbers of plants that were growing among the rocks.
- Riess: So you've watercolored the rock shapes true to size. Were these rocks in place, or did you move these rocks in?
- Lewis: No, these were all moved in, because all we had in Alhambra was adobe.
- Riess: Did you pace between them, or did you tape measure between them? Is this accurate?
- Lewis: The easiest way to do this--I lay boards down.
- Riess: You make a grid.
- Adele: [producing map] See, here's the new one. This is our rock garden now.

Lewis: In this case, I laid steel wires down every foot, and then you just stand over the top of it and draw it right on your map.

Riess: So you're like an archaeologist in your approach to this. Is this a standard technique, or was this your own solution?

Lewis: Oh, this was my own solution. The easiest way to map is probably aerial photography. That's, I think, the way they do most of it now.

Riess: You could actually have a photographer fly over and do something, and you'd work it up to scale?

Lewis: Yes.

Adele: [to Lewis] You just devised this, didn't you?

Lewis: Yes, we have a bunch of steel wires that are four feet long, and I just laid them out a foot apart in a grid across the rock garden and mapped it to scale. The smaller rocks, of course, get moved around, but the big ones don't. They stay pretty much put, so I map only the larger rocks. Once you get your primary rocks in, then you can easily map the location of each plant. There are a couple of hundred rocks, and over seven hundred species of plants on this map.

We mapped the whole garden, but these maps are much simpler than the rock gardens--all you need is a long tape measure. When you're planting seedlings, you're going to have to keep track of where they go. I mean, if you want to know where they came from originally, you have to keep track of where they are.

Adele: Yes, we have a standard map, a master map, of the whole garden, and we just make tracings from it.

Riess: Did you test the soil in all areas?

Lewis: Most soil tests are not very reliable, so here we only take readings on pH. Here it's a gravelly soil, and we mostly add compost and that type of stuff to it.

Riess: But you have oak trees and oak root fungus, don't you, all around here?

Lewis: Yes, we have oak fungus here, but it doesn't have any effect on the flowers, only the trees and shrubs.

I have the front yard mapped, too, because when we had fuschias--we had over two hundred different varieties--I had them mapped. And the clivia are mapped, too, so I know where each plant came from.

Adele: [gesturing] For instance, this is a map of the annuals that we planted one year, in the red pencil. There's probably, maybe, iris in between, or perennials on this side, but this bed would be nemesias, or iceland poppies, ranunculus, brachyome, anemones, all the different annuals. You go down the steps here, and this is Bed B, which has another group of annuals listed.

Lewis: We have all the beds coded, so that whenever we take notes, we know what bed it's in.

Adele: One map is just for annuals. Then there is one for chrysanthemums, and we have one for iris. They were each traced from our master map.

Riess: Is every year a different garden?

Adele: Yes, a different pattern. What makes it a little more complex in our case, is because of the fact that we're doing this hybridizing. We have to reserve the beds because we have new seedlings coming on each year. So we can't have as many perennials as we would like to have because we have to save those beds for the new seedlings.

Lewis: Each year we move our seedlings into a different bed. But you can't have perennials in those beds because they don't dig up and move very easily. Well, we have several beds of perennials, too, but a lot of beds, we just have to keep them open with nothing but annuals planted. It's easier to keep track of things when they're planted in rows. There's always a fight inside me: I like things to look natural, but at the same time, in order to keep track of things, you almost have to plant in rows.

Adele: This is where the chrysanthemums are.

Lewis: This map tells how many chrysanthemums you could grow. You can grow forty in that bed and ninety-one in this bed, and so forth. We move, year after year, down the garden with our chrysanthemums and come out the bottom and start out up at the top again. It takes about, oh, a dozen years to get down to the bottom of the garden.

Adele: We don't have a monoculture of any one type of flower, because they don't grow well.

- Riess: Has this always been known? Monoculture would seem to be a problem for big growers of wheat and corn and so on.
- Lewis: Well, you may have picked poor examples, because corn is one crop that doesn't deteriorate in a monoculture. I'm not sure about wheat. I don't know any other crop, however, that doesn't show a replant problem.
- Adele: Wheat behaves like corn in some areas. They find that if they leave it in long enough, it compensates, and they can grow wheat after wheat.
- Lewis: Corn--it can grow in the same field year after year after year, and it doesn't seem to bother it.
- Adele: That wasn't always known, because a lot of the things that they thought were problems of disease were actually toxicity from the roots.
- Riess: Well, integrated pest management systems and so on, whatever the systems are, find that one of the first ways to reduce the need for pesticides by huge amounts is to abandon monocultures and start shifting things around.
- Lewis: But I think that's been known for a long time.
- Riess: It hasn't been followed.
- Lewis: It hasn't necessarily been followed, any more than it is now, Sometimes it is difficult for a farmer because each crop requires different machinery and equipment, all of which are expensive, but it's been known.
- Riess: It sounds like the two of you had a huge pent-up need to get your hands into your own land as soon as you moved here.
- Adele: That's right. Lewis didn't help much in the gardens of all these rented places that we were in, because we moved, I think, twelve times or something like that. But as soon as we got here, and it was our own home, he really dug in--literally.
- Lewis: We had the greenhouse at Morgan Hill, and that land we had year after year. But our homes were different each year, because we would move back to the Midwest for four months. When we came back to Morgan Hill, we would look for a new place. Our homes were varied, but the greenhouse stayed the same, so we were able to plant. We planted the daffodils, for instance, around the greenhouse.

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- Adele: The builder who built this house, and most of the houses up here, lived in this house up to the time we moved in. He liked to play golf. That was his thing, but he had a gardener that we inherited at that time. He liked everything in straight rows. Evidently at the same time they built the house, he had bulldozed the garden, which is on a slope in the backyard, in straight rows and planted fruit trees. So everything in the back garden was right straight across, just terraced. We didn't like that, so we changed all the paths and everything so that it would flow a little bit better in design. The biggest job we had, was undoing the straight terraces.
- Lewis: When he moved out of here, he built himself a place down on the golf course right down below here. He said, "Let them take care of the lawn." [laughter]
- Adele: We had no watering system when we moved in. Everything had to be watered with a hose, you know.
- Lewis: That was one of the first things we did, was to put in the sprinkling system. Of course, that was necessary because we had to leave it for three or four months of the year and move back to Rochelle. Everything would have been dead by the time we got back if it was not watered.
- Adele: And Lewis did all that--all the digging, all the plumbing.
- Riess: After work every day? Work was nine to five?
- Adele: Yes. Right.
- Lewis: I also built the box that controls it, and I can remember, I was still working on it the night before we left for Rochelle. At two o'clock in the morning the night before we were leaving for Illinois was the first time it was tested. I had figured it all out, but you're never sure of anything. I plugged it in, and we ran it through one complete cycle, and it worked! Everything worked fine. The next morning we left it, and it took care of our garden for the four months that we were gone the first year.
- Riess: That's a story that must warm a lot of people's hearts. That's wonderful! So you didn't have to depend on the neighborhood boy.
- Adele: That's right. We let our gardener go, and we haven't had one since.
- Lewis: All the front and the periphery sprinklers of the garden would go on every night, and then the big sprinklers in the backyard went on

once a week. That was the way we left it. When we got back, everything was watered, and everything looked--matter of fact, there were weeds everywhere. It watered the weeds, too. That was the only thing we couldn't figure out how to do--to water the plants and not water the weeds.

Riess: So that means that you haven't built natives into this, I mean the kind of drought-tolerant natives.

Adele: No, we started out doing that. We left the lower part of our lot unwatered, and we collected all kinds of native plants, several types of *Arctostaphylos* (manzanita), for one. It was really nice, lots of *ceanothus*, *Fremontodendron*, *Romneya couteri* (Matilija poppy), and some different things like that. Then we needed more and more room for water-loving plants and the natives died out after a while.

Lewis: Yes, as soon as we started watering the whole backyard, they rotted out. Our problem is that we like too many plants that require water.

Adele: We still have a few *ceanothus*. But the natives were not our primary interest, although we loved them, too. You can't have everything.

Pacific Coast Native Irises and Lee Lenz

Riess: How would you describe your primary interest?

Lewis: Well, I guess that our primary interest right now is our work with the Pacific Coast native irises. I got interested in the breeding that we're doing on the Pacific Coast natives when we went to a convention in San Diego, and somebody down there was giving out seed of the Pacific Coast natives. His name was August Phillips, and he had a small garden in Inglewood where he had harvested this seed. I planted the seeds up here, I think we had a couple of hundred seeds, something like that.

Riess: Did you plant them directly?

Lewis: I planted them directly out in the soil, in rows in one of the beds down there in our garden, and then, when they were a year old, moved them. That was the regular technique for iris. I had done some hybridizing work on the tall bearded a couple of years earlier, so I knew how to plant the iris seed--or I would have

found out anyway. They were just planted as you would any iris seedling.

Among Phillips' collection was one plant that he had gotten from a fellow by the name of Thornton Abell, of Santa Monica, California, who was working with Lee Lenz material. It was a munzii type, a blue. Some of the seed I planted must have come from that plant, because a few of them turned out to be this pretty blue color. That traced back to that one plant that Phillips had growing in his garden. That was the only thing that he had that it could have come from, as we found out later. Eventually, we traced that plant back to Lee Lenz's work on Iris munzii, an iris species native to the foothills of the Sierra east of Porterville, California.

Riess: Yes, you've done a very good job of tracking that, I know.

Lewis: The reason that I was so interested in tracking it down is because, among the other things that we got from those seedlings was branching, where instead of having a single branch with a single flower or a double flower or even a triple flower on a single stalk, it branched, and so we got nine or more flowers on a single, branched stalk. In fact, we've had as many as eighteen flowers on a single, branched stalk of Sierra Butterflies which we introduced in 1983.

I was curious as to where that came from genetically. So I looked up the parentage of the plant I had gotten the pollen from to make Sierra Butterflies. Not it, nor one single ancestor had ever branched. So the branching must have come from the Phillips seed. Phillips had given me a start of the plant (Abell 66-44-30), from which he had obtained the seed he gave me. The plant that those seeds had come from didn't branch either, although when I called Phillips, he thought that it did branch occasionally in his garden. This was in the Los Angeles area. But it has never branched for me. I still grow it in the garden. I still have the plant that I got from him, and it has never had more than three flowers on a stalk. To this day, I don't know where the branching came from.

Anyway, it was that blue color that got me interested. I found out that the color came from Iris munzii up in the Sierras, and I started just working on that, just for the blues. That was the way we got into Pacific Coast natives.

Adele: It was challenging because no one else had blues. There were no blues.

Lewis: Well, of course, Lenz had it, and Thornton Abell had it. August Phillips actually had not done any work on it--he just had this plant that he had gotten from Thornton Abell in his garden.

Riess: They had it accidentally?

Lewis: No. It came from Iris munzii, and Lenz did the first work on it. I still think that, since munzii itself is not blue, the real blue color came from a cross. Lee Lenz was working on the PCI at the Rancho Santa Ana Botanic Garden in Claremont when he made the original crosses. Lenz used three other iris species that he crossed munzii with, and I think it was the combination of the genes from the three species that gave the really true blue.

Riess: By the time you had Sierra Butterflies and Sierra Stars, was that the totally satisfying moment? Was that your goal, or have you not reached your goal?

Lewis: No, I haven't reached the goal. Munzii may have brought in the blue color, but it also brought in some bad things. The flower shape is not very good on munzii as compared to other wild iris, and it doesn't grow well. It hardly increases at all. I grow a true 100 percent munzii selection here that's called Sierra Sapphire. I think I've had it nine years now, and this is the first year that I've gotten enough plants on it so that I would dare try to divide it. So, for the first time now, we have two plants of it, one still in the garden and one in a pot out here.

That's its big problem. It doesn't increase fast enough so you can sell it. That is the problem with the Lenz material. It's the problem with the Abell material. Abell named four or five different clones that came from munzii, and Lenz has named maybe fifteen or twenty. But they're very difficult to grow, and I've lost--let's see, I still have two of Lenz's things growing here. All the rest--they just don't increase enough.

You know, if an iris plant blooms, it dies, like a century plant. Almost any plant that blooms right out of the center--after it blooms, that part of the plant dies. So if you have, say, five iris fronds or fans (plants), and all five of them bloom, why, then it's gone. If the plant doesn't save at least one of the fronds that hasn't bloomed, it's gone. It's called "bloom out." I've had a plant that had seven fans in the second year, it was increasing fine, but all seven of them bloomed, and it was gone. Anyway, Iris munzii hardly multiplies at all, so that was the big difficulty.

Let's see, is this--yes. [referring to photograph] This is the false Claremont Bluebird. I made crosses with that. I got it as Lenz's Claremont Bluebird, and it turned out to be a Lenz

seedling. I had shown Lenz this picture, and he didn't recognize it. But it has given me a lot of hybrids with some Lenz-type flowers on them.

Adele: We like the Lenz type because they have these lines, and it looks like a stained-glass window or something.

Riess: And yet someone else might find them to be flaws in the flower?

Adele: That's right. Some people hate those lines, but on the whole, most breeders like the lines in the Pacificas. We have nice, smooth, blue ones, as well.

Lewis: Here, again, is the blue in the center. [producing photo] Yes. This is the true Claremont Bluebird. The thing that I don't like about this is that the petals curl back. These pictures were taken in our garden of the Bluebird, but it bloomed out last year. So now I don't have it anymore. But I do have flowers that are almost identical to this that are growing well, because I've crossed it with other munzii stuff.

My original flowers, on the whole--the things that I crossed Lenz's material onto--were not lined at all. They were all selfs. Lee had beautiful things. And then he sent me--this was the bad experience--he sent me twenty or so plants of his Claremont Bluebird. He sent it special handling so that it should have arrived here the next day. It was twenty-seven days getting here. That's the U.S. postal service! You know, he sent that special handling. [gesturing] It was a package this big of plants, and they were all rotten by the time they got here. I planted them out and tried to get them to grow.

Riess: And so this is a picture of dead Claremont Bluebirds. What a poignant name! When was this? Is Lenz still alive?

Adele: He's still alive and kicking. He's a wonderful man. Every time we go down south, we visit him. He is doing the botany of Baja California now, and he spends half his time down in Cabo San Lucas. He has a condominium there or something, and he goes down every other month. He goes by muleback way up in the mountains there--he's classifying all the plants of that area.

Riess: What a major undertaking.

Adele: He just finished a book on some plant explorer and what he has done. I don't remember his name. He still has an office there at the Santa Ana Botanic Garden where he does all his writing. He just continues his work. He's retired, but he isn't retired.

Riess: Would it be possible to call in all of his most successful plants? Does he know where they went?

Lewis: There's still one source, I guess. Or at least there was one source. I haven't actually heard this year how successful he's been in keeping them in his nursery. The nurseryman's name is Bob Hubley. He's in a poor location, actually, to grow them, because he's in Yucaipa, about halfway between Los Angeles and the desert. He had, I think, about five different varieties that came from Lenz.

The University and Iris Research

Riess: To go off on a different track, in 1984 when you were selling the Sierra Butterfly and Sierra Stars, the two Iris munzii-derived Pacificas, I saw that the proceeds were going to Berkeley for Pacifica research. This brings up Bob Raabe and, in fact, how available the University of California is as a resource for a person or a group. How does this work, exactly? Did Region 14 fund research on Pacific Coast natives?

Lewis: No, Region 14 funded research on iris in general.

Adele: I happened to have been scientific chairman of the group, and so that was our recommendation, that they give money to the University for research on iris diseases and problems. When we don't have much money, we give two hundred dollars a year, which isn't very much. When we had our big convention and made more money, we gave a thousand dollars, which is the most we have given in any one year. We supplement that with whatever we get from our sales. But that doesn't go very far compared to the money available for poinsettia research and Easter lilies research--that sort of thing. So that's the trouble. But they have been really helpful, and they sent out Dr. Joe Hurliman, in Bob Raabe's department, to put on sprays of different fungicides to find out which are the best controls for leaf spot and rust of the tall bearded iris.

Riess: Who would they take this spray to? To your garden, or to anyone in the region? In other words, what's the mechanism for using all of this research knowledge?

Lewis: It started at Joe Ghio's garden in Santa Cruz. They did a lot of work down there. The big problem is that Ghio didn't have very many of any one variety.

Adele: One cultivar.

Lewis: Each cultivar is more resistant or less resistant than another one. Some of them are almost immune to the fungus, and so getting an idea of how good the control was was a lot more difficult than if you had a lot of plants of one general type. We made a collection of varieties that were very highly susceptible to both rust and leaf spot. Raabe planted them at San Jose, but down there they didn't develop leaf spot or the rust. [chuckles] They were moved back up to Berkeley, and they're now in the lath house up at Berkeley.

In fact, they are serving a purpose right at the moment, because we had observed some evidence in our garden that the rust that was on the Pacific Coast native iris is a different race from the rust that's on the tall bearded iris. That hasn't been proved. Just this last month, we gave UC rust spores from our Pacific Coast natives here, and Raabe is spraying it on those tall bearded plants which we know are very highly susceptible.

Lewis: The University has also made isolations from diseased Pacificas and run tests in their greenhouses to try to identify the organisms that were responsible for the diseases. Most of the work that they've done for us, however, is spraying with fungicides.

Adele: Yes, or drenching. That sort of thing is what they mostly do, because that's what people want. Everyone, if they thought about it, would prefer that you develop resistant varieties, so they wouldn't have to spray. Flower hybridizers, however, don't usually do that though, because they are in too much of a hurry. They want to develop things that are the most beautiful, or the biggest, or the most ruffled, and they ignore disease susceptibility. So we continue to spray.

Lewis: That's especially true if the hybridizer is in a location where the disease is relatively unimportant. Then, when they send the plants all over the United States, where there are different conditions, that variety may not survive because it's too susceptible to disease.

The best way to control a disease is through genetic resistance. It's better than chemical. We can control rust on Pacific Coast natives just by breeding. You can get plants that just don't get rust at all. There's no chemical that we've used that can wipe out rust on a susceptible plant. Whatever it is that the genes are doing is much better than anything you can do chemically--so far.

Adele: But it's probably a chemical within the plant itself.

- Lewis: Yes, it's a chemical within a plant. There's no question about that.
- Riess: Is the philosophy at the University, "better planting through chemistry" rather than through breeding?
- Lewis: Well, no, there is considerable breeding for resistance done at universities on other plants. At Berkeley, Bob Raabe is selecting anigozanthos (Kangaroo paw) and other plants for resistance, so they do do that, too. But the short-term answer to controlling a disease has to be chemical. And there are plenty of disease-susceptible plants on the market because not very many breeders are paying any attention to disease. Plant breeders just seem to ignore it.
- Adele: They need money there at the University to do things, and the money comes from the big growers who need a good fungicide to control diseases--that's the only way they can do it.
- Riess: So they want to be able to sell a product that--getting back to daffodils--that can go anywhere in the United States, and the bulb itself has already been treated so that it can be dropped into any kind of soil?
- Lewis: It's one of the things that has been criticized. I remember at the Soil Fungi Conference, when we visited the nurseries in Salinas, Bob Raabe showed us how they took care of the plants in some of the big commercial greenhouses.
- Adele: Thirty acres under glass.
- Lewis: The plants growing in the greenhouse largely were surviving because of the chemical treatments that they were giving them. Then they sell the potted plants to people, and the people don't treat them the way they do in the nursery. Whether that's a wise or ethical thing to do--I remember there was quite a discussion about it.
- Adele: Yes, the ethical question. Bob has since, I know--he says he's trying to control some diseases by the type of soil they use. A lot of things are contributing to the problem. They changed from clay pots to plastic pots because you don't have to water as often. Plastic pots hold the water, therefore you get more excess water problems. Their problems changed when they changed from clay to plastic.
- Lewis: There are almost no clay pots anymore. Of course, the water would evaporate right through the pot, and that would help cool the roots. So there are two problems there. You have both hotter and wetter pots now because of the plastic.

Adele: I think Raabe was saying that if they went back to clay pots, and used the drip lines that they put into each pot, that they could get away from some of those problems. Labor, you see, in a big operation is very costly, so they don't want to hand-water too much.

I think it's wonderful that they have these chemicals. They're tested, and they're safe. People criticize them. They say, "Well, people abuse it. They use it at a higher rate than they're supposed to." Well, what about the medicines that people take? We wouldn't give up medicines for our colds and so forth just because sometimes a person could get into them and eat a whole bottleful. I mean, we're grateful to be able to get some relief and cures from drugs.

Lewis: Yes, what would we do without aspirin? [chuckles]

Adele: I don't think it's wicked to use fungicides, but it would be a lot cheaper and easier if you didn't have to do anything.

Lewis: Of course, there's human resistance to diseases, too, you know, like measles. Certain ethnic groups get measles a lot worse than they do in other cultures. We could do breeding for resistance to diseases on people, too, but you'd have to throw away the ones that were susceptible. With people, actually, you're doing almost the opposite to what we think we should be doing in plant breeding. In plant breeding, we think we should try to get resistance to the diseases and throw out the ones that are susceptible.

Riess: But it probably also occurs to you that the ones that are susceptible are also carrying some genetic material that's desirable in some as yet unforeseen situation.

Adele: That's right.

Lewis: They're getting closer and closer, though, to being able to put in single genes. At this meeting in Toronto, they were talking about injecting genes, even into higher plants.

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Lewis: They shoot microscopically small gold beads, containing specific genes on their surface, right into the plants, and they actually have gotten single genes to go into the plants. They have found, however, that even a single gene sometimes has very diverse effects on the plants. Say you wanted to get that gene for blue color into a plant, and only that. They found that other things in addition to the blue color go along with it, even the single gene.

When you're breeding the old, Mendelian way, it's far worse, because there you have a package deal of several chromosomes, each containing hundreds of genes. You select a plant that has a pretty flower color. It might have a lot of other adverse characteristics, and yet to get the pretty color you make the cross, and you get every character that the plant with the pretty flower has. It's a package deal. Of course, it's much less a package deal when you can shoot a single gene into a group of chromosomes.

Garden Organizations and Science

Riess: We're talking about real science. In Region 14 of the American Iris Society--and I think we might talk about that organization now--in Region 14 you were the science member of the board. Did that constitute a subcommittee, or was that just you by yourself?

Lewis: That was just myself.

Riess: Was that a new addition when you became involved with this group? Had science always been part of it?

Lewis: Science has always been part of Region 14, and also in the parent organization, the American Iris Society (AIS).

Adele: The AIS hadn't had a science editor before. They've had a science chairman.

Lewis: I think you're the first science editor for the national magazine, but there has always been a scientific committee and somebody in charge of it.

Most of the work recently has been done on a disease called scorch, and that occurs more in the Midwest than it does here--it does occur in California occasionally, but it's relatively unimportant here.

Adele: The question was on organization.

Lewis: Historically, I don't know about Region 14, but there was a scientific chairman ahead of me. There were two ahead of me that I know of, so it was nothing new.

Riess: Is that science editor or science chairman a person who identifies what the research money goes to?

Adele: They report on any findings that we or others discover, or that we hear about. These are published in the Region 14 Bulletin, the American Iris Society Bulletin, or in the Almanac. They also report on developments at our meetings. We have several meetings a year, and we usually report on some findings. And the scientific chairmen are influential on where the funds go.

Lewis Dr. Alleah Haley, a graduate of the UC Berkeley Plant Pathology Department and a student of Dr. Steve Wilhelm, was the scientific chairman right ahead of me.

Adele: She was too busy with her work on Dutch Elm disease to do anything.

Riess: Is there a limited interest in the group in the scientific findings, would you say?

Lewis: No, no.

Adele: No. I think it's very great. We get a lot of response.

Adele: I'm scientific editor now of the national AIS Bulletin, which has a circulation of eight thousand. That's what I'm writing for now. We've sent in several articles so far, and we get quite a few questions.

The AIS has a scientific chairman as well. They have a foundation where their money goes to research. The foundation's grants are more generous than our modest Region 14 contributions. Grants could be on breeding, or genetics, or disease. The chairman is Dr. Currier McEwen. He's the scientific chairman for AIS.

Riess: Yes. You've seen this article about McEwen? ["Love in Blooms," Modern Maturity, October-November 1989]

Adele: Isn't that wonderful? It's a lovely article. I just got a letter from him, because of a letter I wrote to Dr. Richard Sjolund, who's doing research on scorch at the University of Iowa. This work was funded by the AIS Foundation, so I sent a copy to Currier. He is quite interested in the work, too, but Sjolund isn't publishing yet.

Lewis: We don't know what's going on. We're trying to find out.

Adele: I want to get a good article on the scorch disease progress.

Anyway, there is good coordination between the scientific chairman of AIS and the scientific editor. As editor, among other subjects, we've put out an article on Vapan treatment, and I wrote

one on Vitamin B1. They don't need to use B1 on transplants. It doesn't do any good.

Riess: When you cover something as scientifically as you do in your articles, doesn't this in some way separate out the people who are really just happy iris lovers and garden trip-takers, and some others? I would be interested in a description of who the Region 14 members are. You must be at one end of the pole in terms of scientific orientation.

Lewis: Yes, we take more notes.

Adele: There may be fewer people, proportionately, in the iris society who are as scientifically oriented in horticulture and genetics as we are. But, on the other hand, there are a much larger proportion who are knowledgeable on iris varieties and their attributes, both on the show bench and in the garden.

By far the largest portion of the articles in both the Region 14 and the American Iris Society bulletins are devoted to comments on varieties--their color, growing habits, and form. Most of the active members of the region and AIS are accredited AIS judges, who are trained through various stages over many years to learn their craft. They are as much scientists in their field of specialty as we are in ours.

A third category of iris society members simply enjoy growing them, and are attracted by their ease of cultivation, attractive flowers, and broad choice of colors, and they aren't interested in a greater depth of study.

Lewis: But those people do call us for information.

Adele: I think there's a lot of interest in how to do things in these articles we write, because I think they're pretty simplified the way we write them. We know to whom they're directed.

For instance, a lot of people have been trying to sterilize their soil with Vapan; they can't grow things well any more, and they find that it rejuvenates their soil. They've been really following the directions that Lewis has written in the Bulletins. It does have in the article the actual chemical that is formed and the fact that it breaks down in the soil, and all those kinds of things, too. Three-quarters of them would ignore that part, but they'd follow the directions, and we've had a lot of people that have written to say how it has helped them.

Lewis: Yes. Vapan is an interesting material. Once it's mixed with water, a chemical reaction starts to take place.

Vapan itself is not toxic to the organisms in the soil. Once you mix it with water and get it into the soil, however, it changes into another material. It's that second material that's toxic. That, in turn, changes to something else which is nontoxic. Actually, it becomes a sulfur fertilizer in the soil. It's quite a rapid reaction. The whole thing takes place over a matter of maybe two days or so. Once you mix it with water--it's a completely water-soluble material--then you have to work fast. In other words, if you just hold the mixture, by the next day, it would do nothing, because the chemical reaction would already have gone through the whole process.

Riess: Do you encourage people to write about their results? Is that important, the feedback?

Adele: We don't get the feedback that we'd like.

Lewis: We get almost no feedback. I've been trying for three years to get some information on branching of flower stalks. We got feedback from one person, I think, so far. But on almost nothing do you get any response.

Riess: Your writings, both of you, and your editorial statements, have a very personal feeling, like you're talking to people you know.

Adele: It's true. We do know a lot of people now.

Riess: You would think, given that, that there would be a sort of a fellow feeling. Why aren't they giving you feedback?

Adele: It's true. I feel like they're all our friends, and they should go out in their garden and take notes.

Lewis: Yes, it really wouldn't take very long, you know.

Riess: Have you considered including a piece of paper that's just a blank, and all they need to do is fill in the blanks?

Lewis: I've done that. Yes. That didn't work. I didn't get anything back from that.

Adele: We had a request from a member in Fresno who said he would like to be part of the research group. So we devised a relatively simple experiment and sent it out and we got, I think, four answers to that. It wasn't enough to make a statistical sample.

Lewis: Not only that, but we've never gotten anything back from him, the one that wanted to do it.

Adele: We thought we'd print the results in the next Bulletin, and we didn't get enough to make any statistical analysis--you know, it wouldn't have meant anything. One of the responses was from some lady that doesn't belong to any society. Her neighbor had shown the article to her. She lives in Carmel Valley, and I've always wanted to go see her. She said flowers are very important to her because she does paintings of the iris flowers, and still she isn't growing them very well. She gave notes on whatever we asked for--and she was a total amateur. She said, "Please come see me sometime. I need to have these iris--they're so beautiful to paint." [laughter]

Writing and Editing

Lewis: For the first time, we've gotten some representatives for the Society for Pacific Coast Native Iris Almanac in southern California and northern California, Oregon, Washington, central United States, and eastern United States. So there's all those representatives that are supposed to gather articles from people in their districts and to let us know what's going on.

We gave each representative a list of all the members that were in their district, and the one in the central states sent letters to everybody on his list. He's heard nothing from anybody. The representative in southern California got a promise from this nurseryman who's growing the Lenz--possibly still has the Lenz material. "Yes, he would like to write an article about his experiences growing the plants for the nursery." That was before the last issue came out. I was to have it a week after that, and now it is six months and I still haven't gotten it. I have an idea that Hubley may eventually write the article, but it's very difficult to get anything from anybody.

Adele: I think it's easier--like when we had the big convention and I wrote articles on each of the garden owners and what their lives were like, I did it over the telephone, and that was great. I think that's a good way to do it, because you get them, and you talk to them, and then I could write it.

Lewis: They were willing to talk, but they're not willing to write.

Adele: That was much easier. I think we'll have to do something like that again.

Riess: It makes you despair, it seems to me, of turning over any of the editorial work. Who's going to have the kind of energy for doing this that the two of you have had?

Is the Almanac a spinoff of Region 14?

Adele: No, the Society for Pacific Coast Native Iris is a section of the American Iris Society. It's more international, too, and "Region 14" is only northern California, Nevada, and Hawaii. The Almanac has lots of foreign subscribers, too. We seem to have no trouble finding material to write about. But other people do. I don't know why.

Riess: When you were writing up an experiment for Del Monte, or writing up a problem for Del Monte, it was in a very straight, reportorial style, based on notes that you'd been making all along, and so it didn't require a huge amount of creative input, I'm assuming? But I wonder if that's really true.

Adele: That's right. That's true, because you have materials, the methods, and details, but the creative part comes in how you write it up.

Lewis: Yes, but I still think--for instance, when we first started writing reports for Del Monte, we were under the original boss, Dr. Caldis, and we wrote the reports more like we do now in the Bulletins. Later, when he stopped being director, the reports were standardized, and I presume that that's good in one way, but in another way it wasn't as interesting reading, and a research lost contact with the executives.

Executives are very busy people, and they don't have time to read very much, but we got lots of input from executives when we were writing our reports the way we were originally.

Riess: Because you would capture their attention.

Lewis: Yes, we always tried to make our pea report exciting--exactly the way we saw the work--and they would read them. They knew what we were doing, and we have letters here from lots of executives in the company commenting about various things. That all stopped once we had to write the standardized reports.

Riess: So there is definitely creative input, yes.

Lewis: I think that there's a creative input in making them sufficiently exciting so that people really would like to read them and think that they're interesting.

- Adele: I think that it is deliberate, the way we wrote the introductions in the Bulletin, like a personal thing, something warm and interesting, like they were our friends.
- Lewis: Yes, we've gotten letters about that. You don't get very much back, but we get a lot more back from Almanac writings than we ever did for the Region 14 Bulletin.
- Adele: Well, we've gotten a lot of comments: "We loved your issue," "I read it from beginning to end," a lot of that, all the way through, with the Bulletin, too. We didn't get response from asking for articles, but we did get lots of compliments. We saved them all because it's nice to have them.
- Lewis: We're collectors. [laughter]
- Adele: We're writing now--we have a major article out for the Bulletin of the American Rock Garden Society, which is a real slick magazine, you know, real fine paper. They're putting in at least twelve color pictures, all big, to go along with the article. So you may want to see that when it comes out.
- Riess: It hardly seems to me that the cost of membership, for instance the cost to subscribe to the Almanac, can begin to cover the cost of putting it out with the color prints tipped in.
- Lewis: We just barely keep our heads above water.
- Adele: We sell seed and the publications listed inside the front cover. Those are the only things that make us extra money. The Almanac costs us two dollars each, and we charge them four dollars a year, so that just exactly covers the cost of the Almanac itself. If it wasn't for selling the publications and the few seeds, we couldn't do it.
- Now, we've gained so many more members since we've been editors, that our balance is \$3000, which is more than they've ever had, although we are still the smallest AIS section in terms of membership or financial status. Previously our balance has always been in the neighborhood of \$300, so I guess we are doing something right. I don't know what.
- Riess: Well, maybe you could make receiving seeds contingent on a certain amount of feedback, too.
- Lewis: Well, yes, we've done that, but I'm not sure how that's going to work. That's in process now. Two years ago, we gave out lots of seed, for the specific purpose of finding out things about the different species, and trying to find freeze-resistance and various

disease resistances and all that. All that seed was sent out with the understanding that everybody that got the seed would share their information with everybody else.

This will be the first year that anything will have bloomed from that seed so we'll see if we get any input back from the recipients. The seeds went out to France, Japan, Australia, New Zealand, and all over the United States. So maybe we will get some response from that. But it's not time quite yet.

Riess: I read that the Pacific coast natives were discovered by botanists, sent home to Scotland and England where they were grown for study, then later distributed to Europe, Australia, New Zealand, and South Africa, and they're known abroad better than here. Is that still true?

Lewis: That's been true of almost everything botanical, especially the English and Dutch. But I think more in England than anyplace. They've gathered native plants from all over the world and made garden plants out of them.

The first iris plants were brought to England by Douglas in 1825, when about the only California agriculture was centered around the Missions. But, of course, to say that the Pacific Coast iris are better known abroad than they are here is nonsense. In the 1800s that was possibly true. [looking in folder] Prior to 1940, there were 35 PCI's introduced, 22 from England and 13 from here. Since then there have been 657 introductions, of which 64 came from England, 21 from Australia, one from New Zealand, two from Germany, and 569 from here.

Adele: That's interesting. The Scottish--I didn't know that. We have no members from there.

Riess: Well, my comment came from a book by a woman named Wilma L. Vallette. [Iris Culture and Hybridizing for Everyone, Adams Press, Chicago, 1961]

Pink Poppies

Riess: Where does your work on poppies fit in?

Lewis: We did work on both babianas, that we haven't mentioned, and poppies. Babianas are a member of the iris family, but they're not iris. We've gotten a lot of very pretty plants from that work.

The poppies came from a collection of mixed-colored poppies, Eschscholzia Californica (California poppies), from Park Seed Company.

Riess: They sent them to you, or you ordered them?

Lewis: No, I just ordered mixed, and there were certain of them that were interesting to me for one reason or another. One of the things that we started working on was working towards pinks. There was no really good pink in poppies, then. I'm not sure that we're going to be able to get it, I mean the delicate pink that I want. It's like iris. There's no good red in iris. But we've gotten a rose-pink now that's quite nice, and it's almost a true pink. But when you compare it with the pink of Shirley poppies, I don't think we've quite reached that yet.

Adele: Oh, they're so beautiful, and more refined-looking than the orange.

Riess: I've seen the red ones--the fire poppies [Papavar californicum], which are always exciting to me.

Adele: Those are not the same species, either. But the pink California poppies are so beautiful. We've been spreading them around.

Lewis: [producing photos]

Riess: Oh, they're lovely! And some are double. Does the bloom hold longer?

Adele: They do bloom for a long time.

Lewis: Yes. This was another thing that occurred. See, this is quite a different thing, variegated and very wrinkled--fringed and wrinkled.

Adele: He's getting towards red, too.

Lewis: Yes, I think this picture shows the rose color best.

Adele: Those pure colors come from isolating them. We would select a plant we liked and plant the seed out of the way, apart from the others, and we would weed out everything that wasn't the right color, and then let the others intercross. We've been distributing the seed to friends, and everyone really loves them. [after the final interview, the Lawyers give the interviewer a packet of seeds]

- Riess: How much further could you go on this? Could you take the California poppy, and say, "I'd like this to be a nice cut flower that's about twenty-four inches tall with dark green foliage and--"
- Lewis: Well, the big problem with California poppies is that the plant becomes very unsightly. What you really should do is, when it starts to get to that stage, pull it out.
- Adele: But Suzanne's asking, could you work at it and eliminate all the faults? You could.
- Lewis: Yes. I would like to get a smaller, more compact bush, with a larger flower. They just keep growing out and out, and up and up and up, and then they fall over. Then they get very scraggly. We should also have mildew resistance, which some plants have. But I really think that a true bush-type California poppy would be a great advantage.
- Riess: In other words, it's feasible?
- Lewis: I'm not sure.
- Adele: Can you cross the Eschscholzia lobbii with this California kind?
- Lewis: I haven't tried that. I think lobbii might make a smaller plant, but it is not a bush.
- Adele: This lobbii we have is just a tiny California poppy from the Sierras, and it grows about that high [gesturing], about three or four inches. It's just a darling little thing. Maybe, since it's in the same genus--.
- Lewis: There's another one in the Mojave desert that's a very pretty thing that only grows about that tall. So the smaller plants are available. Whether they would cross, I'm not sure. We ought to try lobbii. But I wouldn't want to go that small.
- Adele: Well, I know, but I imagine if you crossed the tall ones with the teeny, teeny ones, you'd get an in-between one.
- Riess: Is there a poppy organization?
- Adele: [laughs] I don't know! I doubt it. It's probably part of the California Native Plant Society. But I don't think they would want to make interspecific crosses. They're purists.
- Lewis: This type of thing, to me, is a very pretty thing, this frilly flower. I've had it three years. It just showed up as a mutation in a bed of cream-yellow poppies. One plant had that peculiar

flower shape, and I saved seed from that and then started making crosses for color. It was very poor in color, but now I have it in bright orange and yellow.

Adele: And we have a double yellow one that's very bright and pretty--pure yellow, not orange.

Riess: So when Park sent you that package of seeds, it was just randomly mixed?

Lewis: Yes, they had mixed colors. They also have--

Adele: Oh, that was at Thompson and Morgan. They had a purple one that they advertised as pink. We ordered it, but it wasn't pretty at all.

Lewis: As a matter of fact, as each plant bloomed, we pulled it out, because I was afraid it was going to get crossed with ours.

Adele: It was just a dirty color. It was unusual. Anyway, we have a lot of seed of the rose pink one.

Lewis: You would probably have to make hand crosses if you wanted to get the ultimate pink. I just haven't spent the time with it. All I do is plant the plants out there, let the bees do the crossing, and then rogue out everything that isn't what I want.

Hybridizing Iris--Mitchell and Mendel##

[Interview 7: December 8, 1989]

Riess: You say that you had visited the Sydney B. Mitchell gardens with Professor Essig long ago when you were in school. What was the class that you were taking where you would have been doing that?

Lewis: Essig, Stanley Freeborn, and Edwin Voorhies, were faculty advisors of the agriculture fraternity, Alpha Zeta. It's an honorary society, and I was taken into Alpha Zeta. He would take various members of Alpha Zeta on trips.

Adele: He was an entomology professor.

Lewis: Of course, he was an iris breeder, too. He's most famous, I guess, for his entomology, but he did have a Dykes Medal winner, Sierra Blue, which he introduced in 1932. He was a very good iris breeder at the time. I think there were three or four of us that went on

that trip--however many that would fit in his car. We went to his garden--this is when iris were in bloom--and then he took us on up to Mitchell's garden and [Carl] Salbach's garden.

Riess: That made me wonder whether there were other noteworthy gardens and whether the Blake garden figured at all.

Lewis: No. I don't know why, but I never knew of the Blake garden until a couple of years ago.

Adele: I thought that they didn't put those native iris in the Blake garden until later--that someone else did that. There was an article on that in Pacific Horticulture. I think that it was changed later. Now it includes a great many iris.

Riess: So he was just showing you iris? It wasn't that you were going and seeing all sorts of gardens.

Lewis: No, that particular trip, we just went for the iris, because they were in bloom at his place, and they were in bloom up there.

Adele: Sydney Mitchell's garden--he was also a Berkeley professor. He was the one who established children's libraries all over the United States, the one who originated that idea. He was an outstanding person, and was very influential in getting Pacific Coast natives popularized.

Riess: Was he doing his writing while he was still a librarian, or was that a retirement activity for him?

Lewis: No, I think he was doing his writing before he retired. I'm not sure about that, but I think so. I know I saw him on campus a few times. I forget when his first book came out.

Adele: But in the University, they don't have to retire, really. Seventy is their retirement age, and then they usually go right on with their work. I think he's that sort of a person.

Riess: I was going to try to make some distinction between amateurs and professionals in talking about him, but it sounds like it's not--is it a meaningful distinction in hybridizing, to talk about someone as a professional?

Lewis: Yes, there are professional hybridizers, for example Goldsmith that hybridizes for Park Seed Company. Park has credited several hybridizers in their catalog, like Jim Alston, the Park hybridizer who developed the Candy lily, Pardancanda, for them.

Adele: But not iris.

Lewis: No.

Adele: I don't know anyone that hasn't had a job on the side of some kind. People like Ben Hager and Richard Ernst hybridize iris, but they also distribute them through their own nurseries, Melrose and Cooley's.

I think one of the interesting things is that there are more scientists and geneticists and that sort of thing that go in for iris hybridizing as a hobby, because you get rather instant results compared to hybridizing other things. It's almost like the Drosophila with geneticists, because within two years--one year, sometimes--you can see what you're getting.

Lewis: Well, yes, with iris. With Drosophila, it's a lot quicker than that.

Riess: And it was like peas, too.

Adele: Well, peas took longer.

Lewis: Peas took a long time. Peas don't stabilize until about the eighth generation. That takes about five years from the time you make the cross. Then it takes ten more years from the time you make the selection until you have enough seed for commercial fields.

Riess: Did they? I thought Mendel got started on them because they were quick.

Lewis: Yes, he could make his segregation counts the first year, but the reason he succeeded was because there are relatively few chromosomes in peas. Of course, he didn't know that, but there are only seven, whereas there are forty-something in some iris, and there are hundreds in some things.

He lucked out also because he happened to pick characters that were strictly dominant and recessive, and all on separate chromosomes. A lot of things are additive, and a lot are linked together on the same chromosome. He wouldn't have found out these things if he hadn't picked the right genes. So he lucked out. Of course, he also observed. Somebody else could have looked at exactly the same thing and never seen what he found, so, again, it's just like that helix thing that we were talking about.

Riess: You said that you went to the library when you were interested in selecting for the characteristics of the goldfish that you wanted. Did you read a life of Mendel?

Lewis: I would guess that I had heard of Mendel before I started working on peas, but it's because I don't think you could exist without hearing about him. But I really don't remember anything about his theories until genetics class. At least, I don't remember thinking about them. I know that I wasn't thinking about it when I was breeding water lilies or selecting goldfish.

And then, of course, the strangest thing, when I edited the publication on the genetics of Pisum sativum and made an exhaustive, 16-page bibliography, I left out Mendel in the first issue that got out. Of course, he was the one that started the whole thing! I had Lamprecht from Germany, Stig Blixt, Wellensiek, and everybody else that had done genetics on peas, and all their publications, and here I completely ignored the first one. [chuckles]

Riess: Talking about the number of chromosomes in iris, in the book by Vallette she refers to all these chromosomes and says, in 1961, about Pacific Coast natives, that "the whole field is open." What did she mean by that idea, that "the whole field was open?"

Lewis: She must have meant for introduction of new things.

Adele: It's just--nothing had been done very much.

Lewis: Until the early 1920s, just the bees had been working on the native iris.

Adele: And it has been miraculous, the things that have been done. They never had reds or browns. They did have yellows, but they didn't have the two-tones, and purples, and deep violets, and certainly there were no true blues. All of this was opened up, and everybody was excited--the breeders--and they still are.

Lewis: Primarily, when the bees work on it, they were not trying to change the flower. The only change that they accomplish are those changes affected by climate, how much water they'll take, and that type of thing. There's probably selection for flower color in that certain insects are attracted more to certain colors, and that might make that color dominant.

But until man got started at it, there was no selection for ruffled flowers, or the size of flowers, or the shape of petals. It was just how well it was adapted to wherever it was living. The bees would bring the pollen in, but all the selection was just done on the basis of how well it was adapted to the circumstances, not what it looked like. So I think that's the difference that occurred when man got started at it.

Riess: It's a funny notion, isn't it, "when man got started at it." Don't you sometimes kind of wonder what it is that you're doing?
[chuckles]

Lewis: You're playing God. [chuckles]

Adele: I don't think we're destroying anything. I think that we're always careful, and we never dig plants growing in the wild. However, we know people who have criticized us just for bringing pollen back or a flower back from the wild to cross. It doesn't hurt anything in nature as far as we can see, but they say, "You're taking something away from the wild."

Lewis: "You've changed it." Of course, animals eat the flowers, too. Deer eat flowers and leaves. I don't think they touch iris, but they certainly eat things. Insects work on them, too.

I remember an interesting comment when we were working on the disease of native iris, this root rot disease that gets them when they are grown in cultivation--maybe it's too much irrigation, but whatever the cause, it's a definite disease. Anyway, I was talking with Lee Lenz about it, and I thought his philosophy about it was interesting. He said, "You know, this disease is relatively unimportant in nature, because the wild iris seed so readily that they don't care how many plants are destroyed by disease. They just seed out and make new ones."

All of a sudden it dawned on me that the disease was only important to man. It isn't until man wants to save a certain thing--like we have our variety, Sierra Dell, and we want to save that particular plant, yet the seeds from it are not Sierra Dell. They come out entirely different. So unless you want to save a particular clone because of its unique characteristics, why, the disease is unimportant. But as soon as the disease destroys that clone, then it's gone.

Riess: The disease isn't doing something in terms of selection?

Lewis: Well, of course it does. If there is resistance to it, then the susceptible plants eventually will die out.

Adele: That was one of the hints that Lee Lenz gave us. He said that he had seen a spot where there was a bog, and some Pacific Coast natives were growing there in spite of the fact that it was wet. That might be a very good place to go and see if you could find some that were resistant to excess water conditions.

Lewis: Yes, we're going to try and do that this year.

- Adele: So nature would have done our selecting for us.
- Lewis: Yes. On the whole, you never find the PCNs growing anyplace where there is very much water. We found I. munzii growing right along a stream bank. Of course, in the wintertime, they can have lots of water when it's cool. But as soon as it starts to warm up, and they get water, then they get diseased. This plant was right, I would say, six inches from the edge of the stream when we were there, but those creeks up in the Sierras dry out in the summertime and there's no water in them at all.
- Riess: This idea of the whole field being "open," does that suggest that nature is there to be exploited, or to be domesticated, or something like that?
- Lewis: Yes, of course, and not only iris. All of our flowers came from something wild, and most of them have been worked over in England by the botanist and selectors there. They're handmade now, but they all date back to something in the wild. Nobody's made something new; they've redone the old things.
- Adele: They aren't necessarily better; they're just domesticated, as you say. They will have brighter colors or broader petals so that they're more showy, or they often make them shorter so they won't be so rangy.
- Riess: Well, do you think, then, that gene manipulation is in the same spirit? Is it in the same philosophy or have we made a quantum leap?
- Lewis: Well, I think it depends on the way people look at things, and each person looks at things from their own viewpoint. I think that Joe Ghio, for instance, when selecting his plants, looks at them a different way than I do. He's selecting for something a little bit different than I am, not too much, but enough to measure. Someone else would make still another choice. I think it largely depends on the--well, maybe it's the artistic taste of the person that's doing the selecting. Or, if you were a plant pathologist, you could be just selecting for disease resistance.
- Adele: I know that there are people who are in native plant societies who believe you should only have plants that are the same as in nature. You have to collect seeds from those plants and plant them in the garden, and not alter them in any way.
- Lewis: Yes. But then we wouldn't have the roses we have now, or the daffodils, or the lilies. There's an awful lot of things that have been changed by man, and I think mostly for the good.

Adele: You wouldn't have a lot of beautiful things that we do have.

American Iris Society, Sydney B. Mitchell Iris Society

Riess: When did you join the American Iris Society? Can you give a brief chronology of how you became not just members but, in fact, extremely active members?

Adele: We joined through Frank Hutchings. The agricultural research director's daughter was going with a young man whose father grew iris. The director knew that we liked flowers and had iris at the time, so he introduced us to Frank Hutchings. We went over to see Hutch's garden, and he asked us to come to one of the meetings of the Sydney B. Mitchell Iris Society, which we did.

Riess: How many people belonged at that time?

Adele: About one hundred. That's about what it is now when you count family memberships.

Riess: When was this?

Adele: It must have been about twenty years ago, something like that. We weren't anything like founding members, but we always feel as though we should participate when we join an organization. We did the same thing in school with PTA. I offered to be the newsletter editor because I could write. That way we learned to know the Gaulters. Mrs. Frances Gaulter, Larry's wife, was secretary, and I was newsletter editor, and I reported to her.

Lewis: Larry Gaulter is still alive, but he's not doing any breeding anymore. He was a great iris breeder, tall bearded iris. He was also a painting contractor, and he painted the Del Monte building where we were working. This was before we knew him, and we had a collection of iris growing by the office that I had taken from our garden. He told us later that he was wondering who was so interested in iris, because they were pretty new iris. He said, "Usually, you find nothing but the old varieties growing around in some garden unless somebody's really interested in keeping up."

Adele: The reason we had those iris is because when we were still living at Morgan Hill we went to Mrs. Roe's garden on White Avenue in San Jose and bought from her.

Lewis: That would have been about 1946. Bernice Roe was an iris breeder.

Adele: So then when we joined the American Iris Society in the early 1970s and knew there was such a thing as a society just for iris, we saw that she was a member, too. She belonged to a different society in San Jose.

Lewis: Yes, the Clara B. Rees Society. Clara Rees was one of the early breeders of tall bearded iris.

Riess: What is the difference between calling someone a breeder and a hybridizer?

Lewis: None. Choice of words, I guess.

Adele: Hybridizer sounds more fitting

Lewis: Yes, usually I use hybridizer if I'm writing an article, and usually I use breeder if I'm talking.

Riess: Was the group a lot younger then?

Lewis: No.

Adele: Actually, I had a negative feeling about the group at first because they all seemed like old people, and we didn't feel like old people.

Lewis: There's always a mixture of old and young in the group, in all the iris groups.

Adele: Yes, they have a lot of young people, too. I would say there are maybe a quarter who are young people and the rest are older.

Lewis: Most of the work usually is done by the older members that have been there for some time. There are certain members that never help with functions at all, despite the fact that they come to meetings. I think that's the same in all groups.

Riess: But you seem to be very active core people.

Adele: No, we really aren't core people at all.

Lewis: Not like some of the others. We contribute rhizomes for plant sales and help sell them, and Adele is historian. She has prepared two books with clippings and pictures which have been well received.

Adele: We are involved in quite a few areas of the iris organization. The Sydney B. Mitchell Iris Society is but one of seventeen societies within Region 14 of the American Iris Society--that's northern

California, Hawaii, and Nevada. The American Iris Society (AIS) has more than eight thousand members, and within the AIS there are twenty-four regions and eleven specialty sub-sections, of which the Society for Pacific Coast Native Iris, whose publication we edit, is one. So you can see that our local society is but a small unit in a large, well-organized plant society.

I am scientific editor of the AIS Bulletin, secretary of Region 14 of AIS and a member of their executive board, and historian of the Sydney B. Mitchell Iris Society. In the past we have been editors of the Region 14 Bulletin, and scientific chairmen of the region. We have opened our garden on numerous occasions for tours, most notably in 1978, when eight hundred AIS members visited our garden, two hundred at a time on a single day.

The Sydney B. Mitchell Iris Society, organized in 1953, has been a strong, influential group, especially in the early years. There were fifteen outstanding hybridizers among our members, three of whom were Dykes Medal winners, and there were eight commercial iris nurseries in the East Bay. Among early members were Edward Essig, Rose Mitchell, Clara Rees, Carl Salbach, Larry Gaulter, Ben Hager, and Walt Luihn. Now there are only six hybridizers in the society and no nurseries. The center of iris activity in Region 14 has shifted to Sacramento-Stockton, which has five large nurseries, and to San Jose-Santa Cruz, which has three.

Riess: But what you brought to the group, apparently, was the scientific emphasis. Has the group retained that, do you think?

Adele: They have someone, Vernon Wood, who gives a little talk at each meeting about what to do at this time of year in the way of taking care of the iris.

Lewis: But I don't think we had anything to do with that.

Adele: No.

Lewis: But we get calls. It's mostly--if they have a problem in their garden, why, they call us by telephone.

Lewis: Yes.

Riess: That's not considered an invasion by you?

Adele: No. I think that's very flattering that they would think we're capable.

Riess: Have people asked you to design their gardens?

Lewis: No. They ask--not about the design of the garden, but about how to plant things.

Adele: The suitability: "Will this do well here?" and that sort of thing. We've always given out plants and seed whenever people come over. We have things we give to people.

Riess: That's a tradition in the botanical and horticultural circles, the circulation of seed from other gardens? Have you been a test garden?

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Adele: No, not a test garden.

Lewis: A test garden is wonderful to contemplate, but difficult to sustain. It's a difficult thing to keep a collection of seeds. It's a difficult thing to have a test garden. There was a test garden at the UC Botanical Garden, and that's gone. Joe Ghio's garden was to be a test garden, and it was a test garden for a while, but not very long. Now he's closed to the public.

Adele: It's because he can't spare the time to have it open.

Riess: A test garden means that it's open to people?

Lewis: They're open to people, and everybody is supposed to send their varieties to each of the test gardens so that they're all growing in the different areas. There was one at Laurie's garden in Oregon, one at Jean Witt's garden in Washington, at the UC Botanical Garden, at Joe Ghio's garden at Santa Cruz, and at the Santa Barbara Botanic Garden, but none of them are test gardens any more. I think that they all grow some iris, but they don't have that same concept that you would say is a test garden.

Adele: It's in the SPCNI bylaws to have test gardens, and now that we have a new president, Gigi Hall, I think perhaps we'll do it again. We were thinking of asking the Lennettes, who have a marvelous planting of PCNs, to open their garden. But we would only do it for a certain day. We would set a day and do it that way, and then ours could be open, and then find out whether we could open some gardens in the Northwest and in southern California. But that's just a concept. I think that's the only way it would work, practically, because people just cannot say, "Come on, drop in, anytime."

Lewis: But that wouldn't be a test garden. A test garden is someplace where you have almost everything that's available, or you're testing out the new things that come out. The word "test garden"

implies that you are testing things, and there is still such a garden in the East for all iris species.

Riess: And the owner's responsibility is to keep these plants under reasonably ideal conditions?

Lewis: Yes, and you can't let them go to seed, because the seeds drop, and then the seedlings come up, and they're no longer that same variety.

Riess: It's a lot of work.

Lewis: Yes. It's a lot of work, and then, also, people have to send--you really should have one each of everything that's introduced as fast as it's introduced and then keep it as long as possible.

Adele: You have to have the space.

Lewis: You have to have space and spend a lot of time on it. So, I think, so far as a test garden is concerned, I think it would have to be done under government supervision rather than some other way.

Adele: I think that the one garden that's in the East was sponsored by the American Iris Society. It has all these things. It's in New Jersey.

Top Iris Hybridizers

Riess: Everything that I've seen of what you do, the note-taking, the map-making, the whole rigorousness of it, is idiosyncratic to you, but it's exactly what would be essential to doing this. Flattering as it might be to have everyone's iris in your backyard, why, it's a major commitment.

Adele: Yes, and Joe Ghio, who is the most famous and prolific breeder of Pacific Coast iris, is a busy man. He's in politics as well. He's the one that should be doing it, because he's the top man. He can't do it and won't do it.

Lewis: Yes. It's impossible.

Adele: He's quit his job. He's not working anymore as a teacher. He still can't do it.

Riess: What makes him the top man? What is he willing to do that other people aren't willing to do that makes him the top man?

- Adele: He has such enthusiasm and energy, and he loves making changes and doing things that are new and have never been done before.
- Lewis: I don't think it's so much what he's "willing" to do as it is what he's "able" or "capable" of doing. Joe is an excellent selector. I think that he knows what's good.
- Adele: He's able to be ruthless and throw out things. People say, "Oh, no, don't throw that out! It's absolutely beautiful!" and he says, "No, that's not what I'm looking for. Look at this one." So even when you just talk to him, you know that he's an extraordinary person. He's so enthusiastic.
- Riess: Are there others who immediately come to mind over the years--maybe not even in iris--who have had extraordinary qualities as hybridizers so that you could begin to construct the personality that is required?
- Adele: Sydney Mitchell and Salbach were.
- Riess: Well, this Currier McEwen, for instance--is he one who is extraordinary?
- Adele: I would think so, yes.
- Riess: He has a medical background. Do you think it's the scientific background?
- Adele: I think that there's nothing better than a scientific background and an artistic feeling that he has.
- Lewis: Yes, because you have to have beautiful flowers, but they also have to be able to grow. So I think that it's a combination of the two things. But I don't think that this necessarily means that you have to have a scientific background. You have to be artistic and perhaps be scientific, but I think you could have had a musical or engineering background, or some other background, and be just as successful.
- Adele: But he should understand the genetic field.
- Lewis: Yes, it sure helps. Any hybridizer who is working on something which is genetically difficult will waste a lot of time if he doesn't know what he is doing.
- Adele: Some people try to do things all their lives and never get them. This Frank Hutchings that we were speaking of, who was our first contact with the iris society, has been working all his life to get

a pink amoena, which is white on top and pink on the bottom, and he hasn't achieved it, because it's such a difficult thing.

Lewis: Frank is a good hybridizer, and he has introduced some worthwhile varieties. We still grow his Goldie Ann. He's working almost entirely with recessives. To do this you have to have inbreds, and inbreds don't grow well. Like your inbreds on corn, the inbreds-- you can hardly keep them alive. And yet when you cross two unrelated inbreds, together, you get hybrid corn, with hybrid vigor.

But Frank can't cross his inbred pink and white flowers to anything unrelated because none of the progeny would be pink and white. As soon as you outcross, you lose everything. Still, each year he is coming closer to what he wants.

Adele: Another extraordinary person, I think, is Manley Osborne, now retired, who was a captain in the navy. He worked at Sunnyvale with space research. So he's a scientist as well, physics and that sort of thing. He started breeding, and he has a very limited space, in spite of which he's come up with some marvelous varieties. They're of the space-age type--the ones that have the hooks that I was showing you yesterday. They're new, and there's been a lot of resistance to them with people who like only traditional things. In spite of that, because they've grown so well, and they look very nice, they're becoming more and more popular, because he stuck with this and did an amazing job.

Lewis: What's the name of the lady at Taft?

Adele: Oh, yes, [pause] Neva Sexton.

Lewis: She's neither scientific nor well educated--she just loved flowers, and she was a very successful iris breeder.

Adele: She won two Dykes Medals.

This is a lady who was a cotton picker at Taft, in that area. She used her cotton picking money to buy iris. [laughter] She was a very talented person and very enthusiastic. She was another one of those very outstanding people, without any scientific background. She did it with instinct.

Lewis: She just loved it.

Riess: You really can do something with instinct?

Lewis: Yes. You might be able to do it better if you have a scientific background, but she had a reasonably large amount of space, more

than a city lot, but not much more. She just loved flowers, and had a supportive husband, and I think that that's really all it takes. All she wanted was beautiful iris flowers, something different.

Lewis: Well, of course, I would guess that she took plenty of notes. She certainly knew her iris.

Neva was a very small person, and intense, and she saw iris flowers for the first time in a show. She lived at Wasco, near Bakersfield. Anyway, she told us that seeing them in a show was how she got interested in them. Larry Gaulter told us how he met Neva for the first time. He was down in southern California for some reason, and coming back up, there was an iris show in Bakersfield. He said here were these beautiful iris, and all of them were by this same person. He said, "I just felt I just had to go see her," so he found out where she lived and called to see if she was home. She was just that type of person.

Riess: It must be a great joy--the meeting of two devotees.

Is the Dykes Medal a national award for iris breeders?

Lewis: Yes, that's the top award each year. Neva won it twice, in 1973 for New Moon, and in 1965 for Pacific Panorama.

Adele: To win the Dykes, the variety has to win awards previously: the HM, (honorable mention), and the AM (award of merit), before they can get a Dykes Medal. They have to be proven all over the country to see how they grow for a period of years. They really deserve it when they get to be a Dykes Medal winner.

Riess: And then are they introduced through the Iris Society? When are they taken up by something like White Flower Farm or somebody else?

Lewis: They're pretty old by the time a nursery like that gets ahold of them. [looking at catalogs] Most of these in the White Flower Farm catalog are so old that they wouldn't be listed in iris catalogs. Oh, here's one, Victoria Falls, that was introduced by Schreiners in 1977. It lists for \$7.90, and in this iris catalog it's \$2.50. Here's Beverly Sills, introduced by Ben Hager in 1979. It lists for \$7.90 also and for \$4.50 in the iris catalog.

Mary Frances also lists for \$7.90. It, along with the others we mentioned, are beautiful irises, and we still grow them. Mary Frances, however, was introduced by Larry Gaulter way back in 1973 and an iris nursery would ask \$2.00 for it. Iris people get pretty snooty, and nobody in the iris society would buy any of the rest of

them. Commercial iris growers like Schreiners sell them by the millions of plants to those big mail-order nurseries.

Adele: By the time they develop as many plants as they need for huge nurseries like that, they're well outdated. They're still nice, but they're not as improved as the newer ones.

Riess: So that's certainly a major motivation for joining flower groups.

Adele: That's true.

Judging Standards and the AIS Check List

Riess: The group was also formulating judging standards. That has been very important, I take it, and your garden has been used a lot. You've trained judges.

Adele: No, we haven't trained judges. But there have been training sessions in our garden and we have expressed our opinions on PCN standards. They're continually trying to upgrade judging standards.

Lewis: I've always had mixed emotions about judging, I think, for the same reason I didn't want to join the Boy Scouts when I was a kid--I liked to do everything that they did, but I don't like things regimented. Judging, to me, has always been a little bit too regimented.

Riess: It's in the definition of the word.

Lewis: Yes, maybe, but in my case, I fully agree with almost everything in the Handbook and I judge everything myself. There's no question about it, I have certain standards. They're not necessarily the same standards as the blue book says, but they are pretty close. It's just the regimentation, the feeling of being tied down, that I don't like.

Adele: But I think, on the whole, that standards that they're setting now for Pacific Coast natives are very good standards for garden judging.

Riess: You say they're still in the process of formulating these?

Adele: That's true.

Lewis: I'll get the book, the Handbook for Judges and Show Officials.

Adele: They do have this manual, and it's only been rather recently that the guidelines for Pacific Coast natives have been included.

Riess: Is there a committee, then, that is responsible for developing these standards? How does it evolve?

Adele: Well, it does evolve through these judges training sessions, and then whoever is the chairman of the judges training of each region reports to the national chairman who sets the standards. They get together and write them up.

The garden judging-- . For seedlings being considered for introduction, they have to conform to certain standards and show improvement in shape, color, or some other quality. Then the judges recommend that they be introduced if they're of the suitable type.

However, varieties already introduced have to be judged by the characteristics of that variety. If they were introduced as floppy, that's its characteristic. The judges are supposed to know the characteristics of all varieties. So they have these two standards. One is for the varieties that have been introduced, and one is for recommendations as to what is suitable for introduction.

Riess: It sounds full of thorny problems right away. [chuckles]

Lewis: I think that the big worry of people who have been in the Pacific Coast natives for a long time is that the judging would be towards larger flowers and more ruffled flowers and forgetting all these cute little things that occur in nature, like the innominatas, or this little iris species that you brought to show us.

Lewis: I think that was the biggest worry of PCI lovers, for instance, Jean Witt, in Washington, and then it was also expressed by the people in southern California when they first started forming the SPCNI.

Most members wanted to have judging standards, but their concern was that they would forget what the species look like in the wild, and just want to have broad petals and that type of thing. That also worries me. Of course, most of Joe Ghio's things, which are certainly the most beautiful on the market, are what you might call a modern shape. They're very wide-petaled. He doesn't like to be able to see down through them. He likes to have the petals wide enough so that they overlap. I prefer mine to be more star-shaped.

That's what they were concerned about, however, getting standards set for judging so that the PCI would become more like the tall beardededs have become, and unless they were pretty ruffled and pretty fancy, why, they're no good.

Riess: Yes. It's like making them come up to snuff, but you decide what snuff is.

Adele: Although Pacifica fans are concerned that larger, modern types will replace the simpler types, in all fairness, the Judges Handbook isn't that restrictive. [reading] "Large flowers have their appeal as do the slender and more graceful shapes. The dainty and subtle can be as treasured as the larger and more flamboyant specimens. Shape and color contribute to aesthetic value more than size alone...." "Ruffling and the more tailored forms are both acceptable, but neither should alter the flower's basic form."

I think that the taste of individual judges is more cause for worry than the Handbook rules. And, as far as purchases are concerned, people don't have to buy the types they don't like.

Lewis: No, but people do buy them. Of course, that's the whole thing. The bigger they are, and the more showy they are in a garden, the better they sell. I think that that's what we want, but whether that's the way things should be judged, I don't know.

Riess: Well, how much is economics entering into this?

Lewis: It has to enter into it, if you have a nursery or you're selling. That's all that the Schreiners do, for instance. They sell their own introductions, and the best introductions of the other hybridizers. Not that they're doing badly on it, they do wonderfully well on it, and they keep increasing their acreage. They sell plants by the millions.

Adele: They have hundreds of acres.

Lewis: They certainly don't make money on the less showy plants, either. I just don't believe that judges can put everything in a book and decide that that's what the plant should look like in order to be good.

Adele: We see examples of that when our society sponsored flower shows that have been held in malls, where we get a wide sampling of public opinion. In several of these shows we had all the old Dykes Medal winners, the "Golden Oldies," in one spot. This would date from 1929 on. You'd be surprised how many of the people like the 1929, 1930s varieties. They say, "Oh, those are lovely!"

Lewis: "They're like my grandmother used to grow."

Adele: That's right, and they haven't been brainwashed by a society telling them, "This is a good thing. This is what you should like." They're uninitiated. They have a natural feeling for what they like that is not influenced by that sort of thing, and they like the old things. So, philosophically, there's--

Riess: Well, there is an old roses movement, and there may need to be an old iris group.

Adele: There is now a section of the AIS, the Historic Iris Preservation Society, that has recently been organized. Also, each year we put offers for seed in the Almanac, and we've had many more requests for the species than for open-pollinated commercial types. It shows that there is still a great deal of interest in getting the species.

Riess: "Compiling the updated check list"--what does that mean?

Lewis: Well, we had nothing to do with that, somebody else does it.

Adele: The check list is just the varieties that were introduced.

Lewis: All the iris worldwide are registered by the American Iris Society. You register a name. They see if the name has been used before. If not, it's yours.

Adele: The AIS then issues an annual publication called Registrations and Introductions, listing the varieties and their description, when they were introduced, and who introduced them, that sort of thing.

Lewis: Yes, that's an ongoing thing, and that's taken care of by the American Iris Society.

Adele: It also gives the names of the hybridizers and their address in each annual issue. Every ten years it's put into hardback, the check list. The current one would be titled, "Iris Check List, 1989."

Lewis: [showing document] See, this is just one year's introductions. And they're starting to run out of names.

Riess: Of course! [chuckles] "Untitled," how about that?

Adele: Oh, I got a kick out of a note we got from Joe Ghio, whose home is in Santa Cruz, and he said, "Well, one good thing about the earthquake, it gave me some ideas for new names."

Lewis: "Temblor", "Epicenter"--

Riess: [laughs] Or "7.1," "7.2"--

Lewis: Of course, they've already used "10."

Adele: "Smashing"--you could use that one.

Political Action Issues

Riess: Has the group been a political body and made concerted efforts on behalf of the wilderness?

Adele: No, we have not done that politically.

Lewis: Not the iris group.

Riess: In 1987, there was a proposed Siskiyou National Park that would have disturbed PCI habitat.

Adele: Yes, but we haven't written about that as a group. That was George Gessert's research. He's at the University of Oregon, and he's very much interested in conservation.

Lewis: He did want us to publish the article, and we did, but I think that he would work more effectively with another organization rather than the iris society.

Riess: Like the Nature Conservancy or something like that.

Lewis: Yes, and we're members of that. We are interested in the work of the Nature Conservancy, but we don't work on it through the iris society.

Adele: Not officially.

Riess: Would this not go well, do you think, with this group?

Lewis: No. I think it's just that--

Riess: Too many conflicting interests.

Lewis: Yes, but not in the sense that our members are not in favor of it. The purpose of our organization is to promote the PCI, and that's what I think we should stick to.

Adele: We could very well recommend conservation, and we have put a few articles in the Almanac about not collecting wild iris plants, that sort of thing.

Riess: Yes, and you've really been clear about that. But saving whole environments is what I'm talking about.

Lewis: Well, I wouldn't be in favor of it. We're a flower organization, not a political one. I still think that there are other groups which are more effective.

I think, for instance, in the abortion thing, there are too many groups working on it. I think it would be better if we had one or two good groups like NARAL and Planned Parenthood with a lot of members working on that. I think it's the same way here, that there are groups that--Sierra Club is a good example of it. Personally, I don't like the Sierra Club, but I do like the Nature Conservancy group.

I think that Sierra Club dabbles in politics that they shouldn't be in, in some cases where they don't know anything about it. I think if they stuck to wilderness and what the Sierra Club really was for, they'd be better off. I think that's what the Conservancy does. I think there are political groups that you could work through as a member of the Pacific Coast Native Iris Society, and probably most of the members do.

Friends of the UC Botanical Garden##

Riess: Are other plant pathologists that you know also gardeners by hobby? Is this a natural extension?

Lewis: Yes and no. I don't think there's any more chance that they would be a gardener than if they were in any other field.

Adele: No, I don't know of any that are, actually, except Dr. Raabe.

Lewis: Dr. Raabe is.

Our next-door neighbor is a nurseryman, and he's not interested in having a home garden. He has a nice place, and he is interested in plants, but he doesn't bring it home.

Adele: His whole back yard is just a mess, absolutely. He doesn't do much of anything with it. He doesn't want to do gardening at home when he has it all day at work.

- Riess: You say that you like to be active in every group that you're in. So what have you done with the Friends of the UC Botanical Garden?
- Lewis: The way I got into that was that Roy Oliphant, a friend, mentioned it. I didn't even know it existed. Adele and I had visited the garden so many times and I felt that we owed them something, so we just contributed monetarily for a while. We started contributing larger amounts, and--
- Adele: We had matching funds through Del Monte. We always did matching funds. We still give to the Botanical Garden, but without matching funds since our retirement.
- Lewis: Yes. We also gave to the Rancho Santa Ana Botanic Garden at Claremont in southern California, too, because we were interested in their iris breeding down there. That was with matching funds. Then the Berkeley Friends asked me if I would be a member of their committee for membership and I said yes, but that was probably because we had contributed more than just the membership amount.
- Adele: And they get to know you. We're good friends with Wayne Roderick, who was their former native plants expert.
- Riess: Have you been docents there? Is that the kind of thing that would interest you?
- Adele: No.
- Riess: Have you given them plant material?
- Lewis: Yes, and we've gotten plant material from them. I don't remember whether we were a member that long ago, but when our garden was on tour for the American Iris Society's national convention, I wanted to get all the members of the iris family that I could to plant in our garden. I went up there, and they cooperated real well in giving me plants that you couldn't get otherwise.

As a matter of fact, they gave me some bulbs of Homeria elegans that we have in our garden that they have since gotten rid of because it didn't fit their criteria. They want to know exactly where the plants come from. They're used for study, of course, since the primary purpose of the garden is for study by the botany and agricultural department members, and students. So there are certain criteria.

These particular bulbs, Homeria elegans, that had come through Kew Gardens, England, and had been brought to the garden by Wayne Roderick, they couldn't trace back to where they came from, so they

didn't fit their criteria. So they eventually got rid of them. They're quite rare, and we still have them in our garden.

- Adele: And we're sharing them now with members of the California Horticulture Society and other friends.
- Lewis: That was only one of the things that we got that was in bloom for the convention. I don't remember whether I knew about the Friends at that time, but as soon as I found out that there was such an organization, I joined.
- Adele: We go there very often just to see things and how they grow, but we wouldn't have time to be docents. We have our own garden to maintain, which is more than we can do.
- Riess: I know. I don't really know why I asked that question at all. It made no sense. [laughs]

California Horticultural Society

- Riess: The California Horticultural Society, then--do you attend their meetings and do you show iris there?
- Adele: We haven't brought things very often, but it is wonderful. You go over there, and they have people bringing plants that are blooming in their garden that are of interest. They show them, and then they have a very good talk. It's at the Academy of Sciences, and it's a very wonderful group. They have a dinner beforehand, which is optional. You can go to this Chinese restaurant and meet the speakers and get to know them. We do that.
- Riess: Have you been what you would call "active" in that group?
- Adele: No. We just enjoy it, and we see so many people we know, now. We've become a part of the horticultural community. It's quite close-knit. You get to know quite a few people, and they're extremely nice people.
- Riess: Do you think it's a community that welcomes newcomers easily, or does close-knittedness preclude a lot of new people?
- Lewis: I think that all organizations want and welcome new people.
- Adele: It takes a while to get acquainted, but I think most of them go out of their way to see that new people are welcomed. It doesn't take long. We were surprised at how many people we really knew.

Lewis: The first experience I had with the organization was before we were married. Dr. Caldis was a member, and he wanted me to give a talk on Armillaria. The Horticultural Society sounded like a scientific group to me, which it really isn't. It's a group of gardeners. I don't think that the talk that I prepared and the slides that I gave were of as much interest to them as they could have been had I known what kind of a group it was. I was talking science, and what we had learned about the disease, and how to control it. I did mention why it couldn't be controlled in home gardens, because you have to destroy plants in order to control it. But it's quite a different organization than I pictured it as a student, thinking that it was a group of scientists that were horticultural.

Adele: But it's still more sophisticated than a garden club, for instance, because once in a while they have somebody that brings in a bunch of very common plants, geraniums or something, and the members are kind of condescending about them. So I think that there is a certain amount of snobbishness, not people-oriented, only plantwise.

Riess: In fact, if you were just a student when you were giving that talk, I think that organization didn't get going until sometime in the very early thirties anyway. They began because, I believe, there had been a freeze the year before and people who cared about gardens were in a crisis as to how to nurture their plants after that freeze.

Lewis: Yes, that was the year that the eucalyptus froze in the Berkeley hills, and even water pipes froze and ruptured and made a beautiful ice statue outside Hilgard Hall.

Riess: Not the recent freeze, so it was in the very early thirties, I think.

Lewis: Yes, about '34 or '35. We were still students.

Rock Garden Society

Riess: How about the Rock Garden Society?

Adele: We like that very much. We joined that even more recently than Cal Hort.

Lewis: I think that fits in with our--well, maybe not. It's quite different from the iris society, the type of plants that they're interested in.

Riess: Is the Rock Garden Society a national group?

Lewis: It is both national and international. We went to the last international meeting at Boulder, Colorado in 1987, and five years later, in 1991, the International Plant Conference will be at Warwick University in England. Inbetween, they have annual meetings somewhere in the United States in the spring or summer. There are many other small meetings all over, too.

Adele: They specialize in compact plants. They don't have to be in a rock garden, but the plants shouldn't be rangy in habit, so that they're a very suitable plant for small gardens or a rock garden. We like those kinds of plants. And then there are lots of alpine plants that they specialize in. They are delightful, small plants. And the field trips are especially interesting.

Lewis: And interesting people.

Adele: Oh, I think so. The people in both Cal Hort and in the Rock Garden Society, I think, are more diversified on the whole than the iris society people. [chuckles]

The iris people are more narrow-minded as far as confining themselves to one flower is concerned. They'll grow plants all in rows of every variety that you can think of in iris, whereas the Rock Garden members have more diverse interests. In that way it's more interesting--it's broader, I should say. They have half as many members as the AIS, but they put out a superior bulletin four times a year with many color pictures. The AIS Bulletin only has one color picture on the cover and some in the advertisements.

Ted Kipping's Programs

Adele: There's one other group, organized by Ted Kipping, which gives monthly talks or slide programs. Ted's an arborist, and he's very active in the Rock Garden Society and Cal Hort. He takes beautiful pictures. Most of the pictures in Pacific Horticulture are either taken by Ted or George Waters. Ted has a program at a Strybing Arboretum clubroom on the second Thursday of every month, which he pays for. It's a potluck, and he sponsors very wonderful talks there.

Riess: And he is just himself?

Adele: He's just himself, and he does it by himself. All of the people that we know from the other places--he invites certain people that he especially likes, and they're all these people that are either in the Rock Garden Society, or Cal Hort, Strybing, or something. It's a very nice occasion, and he does this all on his own. He likes to organize the meeting and plan the thing. He has a system of two projectors that he always uses, two slides going at one time.

Lewis: Usually a close-up and a picture of the whole plant at the same time so that you see what the flower looks like and what the plant looks like. Then he may have two pictures of the flower, so he'll show two on this side and leave the plant there.

Adele: He is very knowledgeable. He's a young man. He has a little child about four years old.

Lewis: [softly] He has a cute wife.

Adele: He's known all over the country already, and I'm sure he'll be a giant in horticultural fields.

Riess: That makes me wonder, are there any real loners in this? It is such a wonderful thing to share your pictures of your plants, so it would be hard to be a loner.

Lewis: It's hard to know loners, because--[laughter]

Adele: They wouldn't be with us.

Lewis: They probably wouldn't be with us in a group.

Adele: [to Lewis] Well, I think you're kind of a loner. I mean, you're not as interested in the people as you are in the plants, or the photography, or the writing, or the concepts.

Lewis: That's possibly true. In fact, when we got back from the trip that Adele organized last year to see the native iris, I think I ended up with two pictures of people. When we wanted to publish the article in the Almanac, it would have been nice to have more and better pictures of people, but I had roll after roll of flowers.

Adele: And he doesn't remember whether people are married or what their children are like or anything like that.

Riess: He just said that Ted Kipping has a cute wife. I don't think you heard that.

Adele: Oh, that's right. [laughter]

Lewis: I remember that.

Adele: But I'm the one that's interested in people. In the Region 14 Bulletin, I always interviewed the people, and I was interested in the people, whereas Lewis is really more a pure scientist, I would say. It doesn't make him a loner, but it's similar. I think he'd be very happy just doing research, painting, listening to music, whatever, with me and his family as his social life.

Riess: Well, could you imagine breeding iris without sharing what you have learned?

Lewis: No, I like to talk about it with other people. But that's not talking about their children. [laughter]

Thoughts on Life, and Life Together

Riess: Everything I've read about the two of you mentions the twosomeness of you, and the wonderfulness of that. I wholly confirm it, and I'm sure that the interview will, too. How do the two of you resolve differences, or do you ever have differences?

Adele: I think Lewis is the leader.

Lewis: That's what you always say, but I'm not.

Adele: I'm not so sure, either.

Lewis: We've just never had any problems.

Adele: We seem to have roles, I think.

Lewis: We have this "family joke" about me not knowing where the linen closet is, and, in some cases, she sews buttons on.

Adele: That's about the extent of my domesticity. [laughter]

Adele: What are our differences?

Lewis: We usually just work together naturally, I think. That was the way we were introduced at the meeting in Toronto. Richard Hampton from Oregon State University introduced us. He really doesn't know us as well personally as professionally, but I can remember, he said,

"They're going to give this talk together, and that's just natural. It's the way it should be."

Riess: This has to have evolved. There has to have been something that you've learned.

Adele: Well, I did impose on him to buy a suit. He didn't have a suit, and he had to meet my family at the reception Mother had for us after we were married. He had to get a jacket with a tie, things like that. That was a difference, and he's learned how to conform to that extent. It's very hard for me to think of our difficulties, because there must be some.

Lewis: I don't think we've ever had any real difficulties.

Adele: We have had differences of opinion.

Riess: Well, differences of opinion--how do you resolve differences of opinion?

Adele: Well, in regard to our Christmas cards, we've put out a home-made Christmas card ever since we were married. That always brings out some differences, because I'm better at novel ideas, I would say, than Lewis is. He's more for beauty.

Lewis: She's more for the cute cards.

Adele: I like cute cards, different cards.

Lewis: So what we do, we do them alternately.

Adele: We pretty well alternate, and you can see that in our cards. We do differ in that regard. He would always have something just really beautiful in there, without much of a holiday saying, whereas I would think of a message or something funny or something in tune with the times. Like when there were protestors, I think we carried signs for world peace, and we dressed like hippies, and things like that.

Lewis: But, you see, even that was cooperative, because when it came to taking the final picture, I got this idea of lining people up on a stepladder. So, I don't know--it just seems to work out.

Adele: I think in the beginning--. He was quite a bit older than I was. He taught me a lot. He was really my teacher, and [to Lewis] I think you have always been my teacher.

Lewis: Well, I think we covered that before--that I was so interested in all these new things that I was learning, and I just felt that she

should be interested, too. Of course, there was another girl that was working with me at the University at the same time as Adele. I knew that she could never have become interested in that type of thing, so I never discussed the work with her. I know a lot of other women that could never have become interested in that type of thing. Adele was different.

Adele: He opened a whole new world to me, and it was not only pathology. I learned to appreciate popular music, which I had hardly contacted before, and he expanded my appreciation of all phases of classical music. I guess the classical phase of it was a mutual learning experience.

Lewis: Yes, it wasn't that she was brought up that way and just fell into it naturally, because she had never even heard of most of these things.

Riess: But maybe she was brought up to be good and agreeable, and, in a way, what she was doing initially was conforming.

Adele: I really think that was the main thing, that he was my teacher, and I admired him, and he had all the qualities that I always wanted. He liked music, and he liked art, and dancing--.

Lewis: Yes, one of our first dates was music.

Adele: He's also mechanical. I mean, I think he's like a Renaissance man, you know, because he does everything well.

Lewis: Yes, even my love of music has something to do with the fact that I am mechanically-minded. I got my first Victrola phonograph in 1925. It had a spring wind-up motor and an acoustic tone arm that weighed seven ounces. That's roughly 200 grams! (Now my tone-arm tracks at one half gram, and because of the new compact disks, we hardly use it.) I still have the original Victrola, but I've gutted it and replaced components so many times that you'd never recognize it. We have now, and have always had, the finest sound system available.

Adele: Yes, we both love music, and we have the best.

He also takes care of me, almost too much. As he was telling me yesterday, "You'll never be a careful person. You're careless." He wouldn't let me use the grinder for the compost because he says I'll hurt myself. And I said, "Honey, I'm a big girl now." [chuckles] And he says, "Do you really think you could be careful at all times and not have your mind wander?" So I don't use the composter. That's a compromise there, sort of, but I'd just as soon he'd do it. I am not as methodical as he is about things.

Lewis: Except that you have--

Adele: I've learned to do a lot of these things.

Riess: Have you been able to pass these qualities on to your children?

Adele: Oh, yes, I think so. We have extraordinary children, I think. Lori, our oldest daughter, is an artist, and she's not a responsible person at all, but she's very happy doing what she's doing. So I would say she's a successful person.

Riess: But the son who was down there under the house with you, excavating for the train room, did all those lessons take? [refers to conversation with the Lawyers on a garden tour]

Lewis: Yes. See, he learned how to solder down there, and he learned about electrical wiring and that type of thing. He's really good at that, but no better than our youngest daughter is, and she didn't have any train room experience nor interest in mechanics when she lived here.

Adele: Artie became a biophysicist and got his Ph.D. at Yale, and he's working at Chevron. First he was in biocontrol for plants. Now, he's a public relations man for them on pesticides.

Lewis: Yes, I don't think I could ever be a PR man.

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Adele: Artie has a great personality. All the time in school, he was in school politics and so forth. He's a very outgoing, bright, sharp guy, and he likes people. He relates well to people. He's working on an initiative up at Sacramento now on the use of pesticides and so forth. And he's musical--plays the clarinet, and enjoys both classical and modern jazz. His wife, Francie, works for Cetus in Emeryville. She is a graduate in genetics and works in biotechnology, on the cutting edge of the newest developments.

Lewis: Well, gene splicing.

Adele: Francie also shares Artie's musical interests, and plays the flute. They have two children who are also very bright, nice children. Little Lewis is seven years old, and Emily is three, and we have much pleasure through them, too.

Adele: Our daughter, Melanie, graduated from Cal in zoology, and initially worked as a toxicologist for Cordis-Dow where she did artificial kidney research. When Cordis-Dow moved to Miami, she transferred

to Dow Chemical at Concord, and has been working on fiber optic research. She was recently promoted with the title of Hygiene Coordinator of Research and Development. Melanie is married to the "boy next door," Jim Davis, the son of our doctor, who lived one house away. He is in the insurance business. They have a little six-year old daughter, Laura. We're lucky to have them close.

Riess: Do people ever come to you seeking the answers to their own life problems, because the two of you are this harmonious entity?

Adele: Often people say, "How do you ever get along so well?" We heard that lots of times, but I wouldn't know how to answer. I think that people just do or don't. But I have had that question raised a lot of times.

Riess: Have you ever practiced a religion or felt that that was something that you needed to think about in your lives?

Lewis: No. Well, of course, I had to go to Sunday school all the time when I was a kid. We were in the Presbyterian church, but I don't think that it was ever necessarily because of real strong religious beliefs. I think Mother thought that it was good for me. Maybe it was.

I don't know whether we covered this or not, but the first problem that I had at Sunday school was that we had to donate a certain amount of money for the missionaries who would take the Christian religion to the heathens in China. This was when I was still with my first grade Sunday school teacher, Lucy Stone, so I must have been not farther than the first or second grade. I questioned whether we should donate money to missionaries for that purpose, and why shouldn't the Chinese have equal rights to come over here and tell us about what their religious beliefs were?

Riess: In the first or second grade?

Lewis: Lucy Stone didn't like that, and she complained. She was worried about it. She talked to my mother about it. I questioned the religion right from the very beginning. Of course, my ideas now are that all religions are man-made. God never made any of our religions. They all were invented by man, and I think anybody who thinks that their one religion is the only one is crazy, because you can't all be right. The Indians have their ideas about man coming out of the mountain there in Arizona.

I used to go hear Rabbi Magnin talk in Los Angeles, because I liked to listen to him. First of all, he was like Franklin Roosevelt. You just liked to hear him talk. Dad used to listen to him on the radio, and so I went in one time, and then we went in

quite a lot. There was a group of us from high school. Then, also later, when I was going to art school, I was interested, but it was primarily Magnin and not the religion. He had some good ideas, I thought.

Adele: I always felt a little guilty about religion in reference to our children. I have a book about the various major religions, How the Great Religions Began, by Joseph Gaer, which I read to them. I tried to teach them a little bit about each religion rather than saying, "You are such-and-such because you are our child, and you've inherited this belief." But I don't think I did it well enough.

Riess: How would you have known whether you had done it well enough?

Adele: I especially hoped that they would be tolerant of people who were religious, even if they chose not to be. I thought maybe our children would adopt one of the religions to be their own, but none of them are religious except Lori. Lori's very religious. She believes in the Indian religions from India, and she believes in Christian religions--

Lewis: --and the American Indian--

Adele: --and the American Indian religions, and she believes in supernatural-type things--astrology, multiple lives. She believes in all those things, so I guess I was very successful with her.
[laughs]

Lewis: Well, she has altars. She has an altar in her home. She burns incense. Also, on occasion, Lori and our granddaughter, if they're out in the woods someplace, they build a little altar of stones and twigs.

Adele: And when she came out here to visit us one time we went to the beach, and she took some wet sand from the edge of the ocean, brought it back to the Arizona mesa, and put it near the base of the mesa. That will make water come from the springs there at the base.

Lewis: In the old days the Indians would send runners to the ocean and bring back sand. That's how they got water for their corn to grow. Lori was living at that time with the Banyakayas, a Hopi family in New Oraibi on the Hopi reservation in Arizona, and she was quite into Indian lore.

It's interesting, though, one time Adele and I talked with Fermina Banyakaya, the mother of the family Lori was staying with, and she said that Lori was much more into Indian culture than she

was. Fermina had mixed emotions. One of her sons was letting his hair grow in the traditional manner, another son was studying to be a computer programmer.

One very warm experience we had in connection with the Hopis was our visit to the home of David, the chief of the Third Mesa, which includes the villages of Oraibi, New Oraibi, and Hotevilla. Lori took us to meet him. I was surprised when she just opened the door and walked in with us, but she told us later that Hopi doors are never locked, and that if you are a friend, there is no sense in knocking.

The three of us walked right in, without any previous warning, to a cordial welcome. David asked us to stay for dinner, which turned out to be a traditional Hopi meal. All of us--his family and guests--ate with our fingers from the single very large bowl of stew in the middle of the table. We also had tortillas made with the sacred blue corn. It truly demonstrated the Hopi's philosophy of sharing.

Adele: I remember after dinner David asked if I would write a couple of letters for him. He had glaucoma, which was prevalent among the Hopis, and he was practically blind. I remember that one of the letters was to their U.S. senator about power plants being built on sacred land in the Four Corners area, and when I didn't know how to spell an unfamiliar legal expression, David promptly spelled it for me. We thoroughly enjoyed our visit and could see why Lori admired the Hopis so much.

Lori believes in the universality of all religions. She's very spiritual, and people come to her for advice--especially women. If they have any kind of problem with their husbands or anything, they come to her and she's very understanding.

Lewis: I don't think they come to us as much as they go to her. She's got much better ideas.

Riess: That sounds like because she's willing to offer answers, and the two of you wouldn't be inclined to.

Adele: We wouldn't know what the answers are, but Lori is a very positive person, and she knows a lot of things.

Riess: That conviction is important.

Adele: She's a nurse-mother type, a very interesting person. Her daughter's name is Lluvia. She is seventeen years old and going into her senior year of high school. She has always been a joy to her mother. Since she lives far away, we have not been able to

watch her develop as we have been able, so far, with our other grandchildren.

We like religious music very much--both the Jewish religious music, which is the minor keys, lovely sounds, and we love Christmas very much. We will be decorated to the hilt pretty soon. I like it artistically, too, you know. We just really like decorating. It's a nice spirit; I like the spirit of Christmas, of giving to people that you love. We have a little creche that we picked up in Mexico. So I don't know--.

Lewis: But it still isn't religion.

Adele: No, it's a festival, isn't it? But I like festivals, like Easter.

Lewis: I wouldn't say that any of the religions are incorrect, because actually nobody knows. But blind, fanatic belief in them has caused a lot of problems in the world.

Adele: I like the feeling of peacefulness when you go into a church and you hear hymns. There's something wonderful about it. I've always enjoyed that. I don't know whether that's religion, or what it is.

Riess: How is that feeling like, or different from, the feeling when you are in a garden?

Adele: It isn't like a church, being in our own garden, because it is difficult to bask in its beauty when we have the responsibility along with the pleasure and the labor of creating it. I don't want to imply that we never see beauty in our garden, because I doubt that there is ever a time when we walk along its paths that we don't stop a minute to appreciate some blooming plant or shrub or scene.

Azalea time is wonderful, and the brilliant clivias along our front path, or just the many shades and shapes of green we see from our breakfast table window each morning. And in the springtime, when we go out together in the morning to see our hybrids bloom for the first time, it is very emotional--as often disappointing as it is exhilarating. But when we see a flower that opens with a beautiful shade of blue, and a lovely form; and the foliage is green and clean and upright, we feel fulfilled, but filled with awe.

When we go to a wilderness area, however, in nature's garden, there's where the peacefulness, like that of a church, overcomes me. And I feel humble before whatever it is that has made the world so beautiful. The landscaping cannot be matched by any trained architect. There has been a master here. And I wouldn't

feel this way if I couldn't reach out and know that Lewis is with me. I am never really wholly appreciative of anything without being able to share the experience with him.

Lewis: Maybe that's why we've stayed together this long. It's been an absolute necessity, this need to be near enough at all times to share each new experience.

TAPE GUIDE -- Adele and Lewis Lawyer

Interview 1: August 22, 1989	1
tape 1, side A	1
tape 1, side B	11
tape 2, side A	22
tape 2, side B	32
Interview 2: August 23, 1989	43
tape 3, side A	43
tape 3, side B	54
tape 4, side A	60
tape 4, side B	62
Interview 3: September 20, 1989	68
tape 5, side A	68
tape 5, side B	94
tape 6, side A	99
tape 6, side B	115
Interview 4: September 21, 1989	122
tape 7, side A	122
insert from tape 8, side B	138
tape 7, side B	148
tape 8, side A	150
insert from tape 10, side A [9/25/89; side B not recorded]	168
Interview 5: September 25, 1989	184
tape 9, side A	184
tape 9, side B	195
Interview 6: December 6, 1989	203
tape 11, side A	203
tape 11, side B	210
tape 12, side A	221
tape 12, side B	229
Interview 7: December 8, 1989	240
tape 13, side A	240
tape 13, side B	249
tape 14, side A	259
tape 14, side B	268

APPENDICES

A. Laywers Inc.	276
B. "A Woman in Plant Science"	288
C. Memorial Addendum	291
D. Two Love Letters	295

Appendix A



HOW ADELE AND LEWIS BECAME INCORPORATED

That Adele and Lewis ever met is in itself a minor miracle. Lewis grew up in Southern California, Adele in the Bay Area. She was raised in a relatively affluent family. Her father owned two cigar manufacturing plants, one in San Francisco and one in Tampa, with wholesale and retail outlets in these two cities and in Los Angeles. He traveled often, and made annual trips to Cuba to purchase top quality tobacco suitable for his exclusive "Rudolfo" cigars. They had a live-in maid. Adele had daily lessons in almost everything, including piano, horseback riding, swimming, art, and dancing. She was familiar with the arts, the theater, and opera, but had also become well acquainted with the night clubs, the restaurants, and the hotel dance floors of urban San Francisco. Lewis lived mostly out of doors in rural Alhambra, slept in a tree-house, and rarely ate a meal anywhere but in his own home. How could it be that these two people with such diverse backgrounds would ever manage to find each other!

In the summer of 1932 Lewis had terminated his education. was working in a lumber yard, and had just been offered a partnership with an elderly man who had no children of his own, and who made an excellent living building fire-places that really worked. Strangely enough it was the night he was discussing this fantastic offer with a girl friend in Los Angeles that she persuaded him to go back to school and continue his education.

Because one of his primary interests was growing plants, he enrolled at Chaffey Junior College, an agriculturally oriented school in Ontario, California, where he took two years of plant and science related courses. He was fascinated by the fabulous things he was learning. He had taken only physical science courses in high school and wasn't even aware that plants were composed of cells. He decided to continue his education, and, since his main interest still was gardening, to major in landscape architecture at the University of California at Berkeley. Because he knew no one in the Bay Area, his botany teacher gave him a letter of introduction to a close friend, Dr. James T. Barrett, professor of plant pathology at Berkeley. So it was that in August, 1934, Lewis took this letter, drove to Berkeley in his slow-moving Pontiac (the one with the rumble seat), and moved into an apartment at 1738 Milvia, about three blocks from the University.

Adele, in the mean time, was living in her family home at 146 23rd avenue and was attending Lowell High School in San Francisco.

Then two unexpected events took place which eventually led to their meeting face to face in the same room at the same time.

First, Lewis took his letter of introduction to Hilgard Hall and to the office of Dr. Barrett where he was very cordially greeted. Dr. Barrett spent some time with Lewis going over first semester classes which Lewis would be taking. They were interrupted on two occasions by students who had come to Dr Barrett for advice, and Lewis was so impressed by the care taken by Dr. Barrett while answering their questions that he asked Dr. Barrett how they happened to be coming to him for help. When Dr. Barrett told Lewis that he was their advisor, and when he told Lewis that no, he couldn't be his advisor because Lewis would be in a different department, Lewis left his office, switched most of his classes, and without any hesitation changed his major to plant pathology. (This was on August 22, 1934)

The second event was the unexpected death of Adele's father on March 18, 1935. His business had been the sole source of income for the family, and his death caused a traumatic change in their style of living. Adele had graduated from high school and was attending classes at the University of California Extension in Berkeley to make up for a deficiency in high school chemistry. During this session she took a class in zoology, her first introduction to biological sciences. She must have liked the introduction because she got an "A" in the course, a much better grade than the one she got in chemistry.

Commuting from San Francisco took over an hour each way. She boarded a Muni street car on Clement street and was taken to the Ferry Building at the foot of Market. She took the ferry across the bay and the Key System train (with one transfer) to Shattuck, in Berkeley. This commute was such an obvious waste of time that when Adele finished her extension courses and enrolled as a full time student at the University, her mother rented their San Francisco home and moved the family to an apartment at 2466 Hilgard avenue in Berkeley. Money was short, however, and Adele took whatever work she could get. She baby sat, took inventory at Montgomery Ward's, typed letters and addressed envelopes, and eventually applied to N. Y. A., the National Youth Administration established by Franklin D. Roosevelt to help needy youth through the depression. Then, on September 10, 1936, the N. Y. A. informed her that they had found a job for her in, of all places, the Plant Pathology Department. There, as you can surmise from the paragraphs above, Lewis would be waiting for her.

Even then, however, they might never have met if it had not been for the fact that a series of unusual circumstances happened at just that critical moment in time. Sometime in late November, 1935, when Lewis was starting his second year at Berkeley, Dr. Caldis had come to the University looking for a graduate student in plant pathology to work on *Armillaria* root rot, a disease which was devastating one of the California Packing Corporation's peach orchards. Unfortunately for Dr. Caldis, but fortunately for Lewis and Adele, all the graduate students in the department had been assigned projects, and none was available for the *Armillaria* assignment. Thus began the inevitable events which are chronicled in the paragraphs which follow.

December 1, 1935. Lewis accepted an offer by Professor Ralph E. Smith, chairman of the Department of Plant Pathology, and Dr. Caldis of the California Packing Corporation to work on *Armillaria* Root Rot. The work was to be directed by Dr. Harold Thomas, Professor of Plant Pathology at U. C. Berkeley, and funded by a grant of \$1000 from California Packing Corporation to the University. Lewis was put on the payroll of Cal Pack at \$55 per month during school months, and \$85 per month during the approximately four months of summer vacation. This was the first "project" of the newly-organized Agricultural Research unit of the California Packing Corporation Land Department.

The first two weekends in December were spent in an apricot orchard near Niles, California, digging the roots of a diseased tree which had previously been fumigated with carbon bisulfide by Dr. Thomas. The roots were tagged as to their location in the soil, both vertically and horizontally. During the week, Lewis made cultures from the roots to determine if the disease had been killed. Later he mapped the results and determined exactly where the treatment had been effective and where it had not. This routine would be followed as long as Lewis worked on the disease. In addition the diameter of each root would be measured because he surmised that the thickness of the roots could well have been a factor leading to some otherwise unexplained inconsistencies in the data obtained at Niles.

December 15 to December 23, 1935. Lewis spent the first half of Christmas vacation at the C.P.C. Wheatland Ranch where over 3100 peach trees had been killed by Armillaria root rot. He ate at the ranch cook house and slept in the so-called "Blue Room" where four of the ranch straw bosses lived. He started the extensive mapping of the spread of the disease across certain areas of the ranch, estimating the tree deaths back some five or six years by determining the age of replants which had been planted to replace dead trees. He dug and exposed roots to determine how the disease spread from tree to tree. He also applied carbon bisulfide at two rates and at two depths in the soil around dead trees, using the information obtained at Niles to choose the variables.

WHEATLAND

Those first nine days spent at the Wheatland Ranch were eye-openers for Lewis who had heretofore spent a fairly traditional sheltered life. First, the four men with whom he roomed, the office manager, and even the ranch superintendant were all either "Okies" or "Arkies" who had been forced out of their native states by the circumstances of the times. The ranch hands were mostly derelicts picked up off the streets of Sacramento or Marysville, although some regulars lived in Wheatland and supported families. Others would work just long enough to get money for a bottle of wine or two and would disappear until they sobered up enough to return. But none of these workers would ever steal anything! Tools, cameras, anything, could be left out in the open and nothing would ever be taken. In this all-male community everyone spoke almost entirely in four-letter expletives. But they had an inborn respect for women, and on the rare occasions when a woman was present, some found it quite difficult to express themselves at all.

Wheatland was a little town, so small that it hardly made a visible dot on the map, but it boasted two hotels, three saloons, a whorehouse, a high-stake poker parlor, and a dance floor where dances to the music of a live band were held twice each month.

Marysville was a wide open gambling town, with all the gaming devices then available in Nevada. The gambling houses were all alike: they were all illegal, they were all down stairs (down a very narrow flight of stairs, each of which had a little square window above, from which protruded a 30-gauge rifle), they were all run by Chinese, and all had direct wires to a central Keno station which flashed the winning numbers on a screen. There were few if any slot machines (they could be found in many hotel lobbies, barber shops, and bars), but there were usually several black jack and roulette tables. Several stores, both in Marysville and Wheatland still accepted gold as a means of payment, and each of these had a small but elaborate scale for weighing-in this commodity.

Bloody fights were common, and every bar boasted a huge bouncer who threw many a tough customer out on the sidewalk. Lewis spent each night of his vacation in a different place (all but one, of course) in order to get as much education as possible in the short time available, and without getting killed.

December 25 to 29. Lewis drove down to Southern California to visit his folks in Alhambra, taking with him a borrowed Contax camera and one of the first two test rolls of Kodachrome film sent to the Bay Area by Eastman Kodak.

January to July, 1936. Lewis tested chemicals in the lab in Hilgard Hall for their ability to kill Armillaria. He cultured roots from the Wheatland plots and made plans for further applications at Wheatland.

July and August, 1936. Lewis spent most of his summer vacation at Wheatland Ranch directing several experimental applications of carbon bisulfide and of some other chemicals he had found to be effective against the fungus in the laboratory at Berkeley. He also directed two commercial applications of "carbon" using a tractor-drawn injector developed by Stauffer Chemical Company. It was the volume of cultures which arose from these massive applications that prompted the University to find someone who could give him some help with the culturing. And who do you suppose that someone would be?

August 24, 1936. School started again, and Lewis moved out of his Milvia street apartment and into his "Estate" with another student, Ralph Settle, and a big, beautiful German Shepherd named Eric. His "Estate" was a small but completely furnished cottage on the University Gill Tract, an experimental agricultural unit on Sacramento street at what was then the foot of Cedar street. It had a living room, two bedrooms, and a kitchen. All of this was furnished rent free to Lewis and Ralph who acted as night watchmen with the help of Eric. One or the other was supposed to be there with Eric whenever possible at night. Actually they were seldom there together because Lewis worked most nights at the University and Ralph was deeply involved with student politics.

September 10, 1936. As stated previously, this was the day that Adele was offered an N.Y.A. job in the Department of Plant Pathology and started working for Miss Davis. She was paid \$10 every half month. Adele worked mostly in the library for Miss Davis, but also for Mrs. Freitag and for Dr. Cecil Yarwood.

Saturday, September 19, 1936. Adele Schwartz and Lewis Lawyer were introduced to each other by Mrs. Freitag in the Plant Pathology laboratory in Hilgard Hall, University of California, Berkeley. Neither of them remembers being particularly excited about the other except for the natural curiosity aroused by the realization that Miss Schwartz would be working for Mr. Lawyer on his Armillaria project. It is a fact, however, that each remembers the exact spot where the other stood when the introduction was taking place.

Monday, September 21, 1936. Adele worked for Lewis from 8 to 12 in the morning and again from 7 pm to 1 am that night. Little did they realize that this was to be the beginning of a lifetime of working together. It might also have been a small beginning of a lifetime of having fun together, for Lewis had brought a quart of ice cream to the lab, and with the help of Rex Thomas, the ice cream was consumed. It was surely the beginning of a lifetime of learning together, because Lewis had to teach Adele how to measure the diameter of the root pieces with a ruler, an instrument Adele had never needed to use in her sheltered childhood.

Saturday, September 26, 1936. Adele and Lewis worked until 3:30 pm and then, their work being completed for the day, walked up to the stadium to see the last half of a football game. This was in no way a "date" because the rooting sections are segregated and they saw no more of each other either during or after the game.

Sunday, October 4, 1936. Lewis' brother, Dick, and his wife, Dotty, came up to the Bay Area from San Gabriel on their honeymoon. They wanted Lewis to go out to dinner with them in San Francisco. The occasion seemed too festive for just the three of them, but much to their dismay, Lewis' usually reliable girl friend, Elsie, was not at home. There really wasn't anyone else he thought appropriate for the occasion and he was a little concerned about the propriety of asking Adele, who was working for him and thus might feel obligated even though she didn't really want to go. Furthermore, even though they had been working together only for thirteen days, he could tell from her conversations

that she was not lacking in either social activities or in boy friends, a few of whom had even come into the lab to ask her for dates. Lewis was pretty sure that she would already have a date or, worse yet, she wouldn't have a date but wouldn't really want to go with him. But Dick and Dotty were persistent and finally convinced him that he should explain the circumstances to this girl and ask her if she could go.

Sure enough, as Lewis had suspected, Adele had spent the latter half of this Sunday morning with a boy friend, Bob Rawlins, mostly listening to his problems and trying to console him while sipping a Coke at Jules. But by the time Lewis got up nerve enough to ask her, she had arrived back home, was free of encumbrances, and agreed to go with them. They went to San Francisco and had dinner at La Favorite.



They held hands while walking through China Town and felt just enough electricity so they would never forget it, danced at the Brass Rail, and both had a very good time together.

October 7, 1936. Lewis wrote a note to "Adelle" (he eventually learned how to spell her name) thanking her for the pleasant date. He also suggested that they might go together to the November 4 football game between California and U.S.C. in Los Angeles. He was probably already in love with her but neither of them suspected it at the time.

October 12, 1936. Lewis asked Adele to go to the Don Cossack concert with him and she agreed.

October 14, 1936. All this time Lewis and Adele had been working together almost every day, but this was the first time they went to the lab and studied together.

October 17, 1936. Adele and Lewis went to the scrimmage dance at the U.C. gymnasium and had a good time.

October 20, 1936. Adele and Lewis went to the Don Cossack concert with Bill and Rose Takahashi. After the concert they were invited to the Takahashi home for refreshments. They had a good time.

October 25, 1936. Lewis went to Adele's home for dinner, after which they drove to Lewis' Estate for cocktails. Later they went to see "Green Pastures" at the Oaks Theater in Albany. During the tender parts of the picture they held each other's fingers and both felt a subtly different kind of electricity than they

had felt in Chinatown 21 days earlier.

October 26, 1936. While they were working together in the lab, Adele told Lewis that she was Jewish. Neither of them remembers if there was any further discussion of the subject, but there must have been because Lewis had always been interested in his own mongrel background, and certainly would have been just as interested in learning all he could about hers. He does remember, however, that it was sufficiently important to be among the various things he told his family about her ten days later in Alhambra. It didn't have a real impact on him, however, until four months later when she told him that she had been concerned that he might not want to date her any more if he knew, and she wanted everything to be honest and above board. He remembers looking at the pretty little girl sitting beside him in his new Plymouth, and feeling the tears start to run down his cheeks from the thought that anyone would ever have to feel that way. Had she ever told any other boy that she was Jewish? "No", she says. But her family had cautioned her that if she let herself become involved with someone who was not Jewish, someday he would get mad at her and call her a "dirty Jew".

Why did she tell Lewis? She really doesn't know, but it must have been something that occurred to her while she was sitting so close beside him the night before, watching "Green Pastures". One more sobering thought to close this paragraph: Actually, to this day they really don't know for certain that her mother wasn't right, and they both anxiously await their first fight.

October 28, 1936. They had been discussing the possibility ever since he had suggested it earlier in the month, but this was the day that Adele said that she would go with Lewis to see the California - U.S.C. football game in Los Angeles, the day they both started making definite plans for the trip.

Wednesday, November 4, 1936. Adele and Lewis worked at the lab until 11 pm, climbed into their already-packed Pontiac (the same slow, powerless Pontiac that had brought Lewis to Berkeley two years earlier), and were off for Los Angeles. Adele wrote in her diary: "Whee!"

Thursday, November 5, 1936. The Pontiac broke down in Madera at 3 am with a broken piston ring. Fortunately they found an overnight garage, and their car was fixed by 7:30. But in those days you had to drive at 25 miles per hour for the next 500 miles following such a repair so they didn't arrive at Alhambra until about 5 pm. They visited with Lewis' folks for a short time, showered, and then drove to Disney Studios where they met Ward and Betty, and Willie and Jane Jackson, Lewis' best friends from art school. They had dinner, and danced until 2 am. Bed at Lewis' home about three.

Friday, November 6, 1936. Adele and Lewis drove to Santa Ana to see the Agricultural Commissioner and were shown some of his work on plant diseases. They spent the afternoon at Chaffey Junior College and got more information. Also, Adele had a chance to meet most of the Chaffey teachers Lewis was particularly fond of. They went from there up to Baldy where they were just in time to see a beautiful sunset from the divide between San Antonio and San Gabriel canyons. Lewis had spent many an evening here, since it was just a short hike from his cabin, and he enjoyed sharing his "view" with Adele. They drove back down, said hello to Roy Bucknell in Claremont, and then back to Alhambra for dinner at eight. They spent the evening at Dick and Dot's house dancing.

Saturday, November 7, 1936. In the morning they drove to Pasadena to visit Ruth and Jud and their baby, Judith. They were back in Alhambra at 11 am, from

where they drove in Dick's car to Disney Studios. There they picked up Betty, Ward, Jane, and Jackson, and the eight of them went to the football game. It was a good game: Cal beat U.S.C. 13 to 6. They all had dinner at a Chinese restaurant Jackson knew about, drove back to Alhambra where they visited for a while, and then on up to Lewis' cabin at Baldy where the four couples had a great time. Adele, child that she was, especially liked Willie Jackson, who had never grown up, and the two of them crawled under a table to discuss items of worldly import. Adele and Lewis went for a walk down by the stream, held hands on a little foot bridge, and played on the famous Baldy swing in Don Olson's yard.

Sunday, November 8, 1936. They had tamales at midnight and then drove up to Icehouse Canyon to dance. Adele and Lewis drove further up the canyon to look at the stars. They got to bed at three and were up again at 5:30 to drive up to the San Antonio - Lytle Creek divide (8000 feet) to see the sunrise. They took pictures of the snow and then drove down to Alhambra where they had breakfast with Lewis' folks. They spent the morning with the folks, had lunch, took a cat nap on the lawn, and left for Berkeley at three that afternoon.

Monday, November 9, 1936. They arrived in Berkeley at four in the morning, got up for eight o'clock classes, worked from 5 to 6 and again from 7 to 11, and then Adele went home to write in her diary, "Lewis and I were not very efficient today."

November 10, 1936. Lewis wrote a letter to Adele telling her how much he enjoyed having her with him on the trip. He didn't tell her until much later that his mother and dad had made a special effort to tell him how much they liked her, and that his sister, Betty, had gotten him aside the night before up at Baldy and had told him, "Lewis, if you let her get away from you, you're crazy." Nor did he tell her until much later how much he respected his sister's evaluations of his girl friends.

November 11, 1936. Adele read Lewis' letter, wondered "is Lewis sincere?" in her diary, accepted a date for Big Game night with someone else, and then spent the afternoon on a boat ride around the bay with still another boy.

EDITORIAL NOTE: Until March, 1937, both Adele and Lewis dated anyone they could lay their charms on. Also, it should be noted that Adele's boy friends were taking her to places Lewis could ill afford to go. In the short time since they had met, Paul had showered her with love poems but had tried to kiss her and was kissed off. Bob had taken her to the Mark, another Bob to a semi-formal at the Officer's Club at the Presidio, Gunther was cutting in, Al had taken her to a Masonic dance and to the Deauville, Lt. Bruce escorted her to the Navy Ball at the Fairmont, and Lt. Rouge to the Army - Navy ball.

November 19, 1936. This was Big Game bonfire night. Lewis and Adele went to the big bonfire rally, and then spent the rest of the night flitting from little bonfire to little bonfire all around the campus, waiting until the fire department came to put each one out, and having a great time.

November 20, 1936. Lewis and Adele met accidentally on Wheeler steps and from there went to the Berkeley Library where they listened to phonograph records until six. That evening they studied together at the lab and from there went to the Estate where Lewis made toasted almonds, cocktails, and a little love. Incredible as it may seem in the day and age that this is being written, this

was the first time they had kissed each other. All the wonderful feelings each was experiencing had resulted from the very simple fact that they enjoyed being together.

November 21, 1936. Big Game Day. Cal 20, Stanford 0. They both went their own way and both had wonderful, soul satisfying experiences with someone else. Well, maybe not "soul satisfying", but at least "unforgettable".

November 26, 1936. Lewis had thanksgiving dinner at Adele's. Her brother, Abbott, said, "I'm glad we're having company for dinner today even if it is only Lewis."

November 27, 1936. Adele got a permanent and a new hairdo that almost ended this story then and there. Since they survived that, they feel that they could survive anything.

November 29, 1936. Lewis overlooked the hairdo, wrote a love letter to Adele, and scared her out of her wits. She walked up to her "view" in the cold November air to be alone and to think. That night while they were working she told Lewis that she was afraid to go down south with him after Christmas.

November 30, 1936. Despite her fears, Adele went with Lewis to his Estate for cocktails "and a little love". Later that evening she showed Lewis her "view" from the hills above her home. Adele was a little near-sighted, so wore her glasses for this occasion, but Lewis took them off when they no longer seemed to be serving any practical purpose.

December 1 to 29, 1936. Lewis spent much of this time at Wheatland Ranch, but got back to Berkeley to take a couple of exams and to visit with Adele. On December 12, he took Adele to Wheatland so she could see the trees from whence all those cultures had come. He introduced her to the men on the ranch and showed her all he had learned about how the disease worked. As it had been for Lewis a year earlier, this was a totally new experience for Adele. But it was also a very interesting experience and probably the real beginning of her career as a plant pathologist.

During the last week in December, Lewis was offered a permanent position in California Packing Corporation's Agricultural Research Department working partially on Armillaria and partially on the asparagus replant problem. The beginning salary of 160 dollars a month seems quite insignificant as this is being written, but in those days of deep depression it seemed like a fortune. Lewis welcomed the opportunity to earn money while doing something he loved to do; furthermore, it seemed like a good omen to be offered an unsolicited job in the midst of a depression, so he accepted.

In the mean time, both Lewis and Adele were still dating other people, but Adele found herself ordering Bacardi Daiquiris (which Lewis had taught her to appreciate), and Lewis accidentally called one of his girl friends "darling", a word he had just learned from Adele, which he had never used before, and which antagonized the other girl no end.

December 30, 1936 - January 2, 1937. Lewis drove to Alhambra (alone) to visit his folks and to tell them about his new job. Adele stayed home, fairly certain that they would forget about each other while he was gone.

January - February, 1937. Lewis moved out of his Estate in Berkeley and into a C.P.C. ranch house on Hastings island, north of Rio Vista. He shared the house with Roy Riegles, famous University of California football player. Although

Lewis did spend most of his time working on asparagus, he also kept up with the Wheatland problem. Thus it was necessary for him to go to Berkeley quite frequently to make cultures and, incidently, to visit with his assistant. This was no small task, however, because Hastings was, after all, an island, and the ferry was closed from 8 pm to 6 am. Lewis spent many a cold morning sleeping in his car on the levee waiting for the 6 o'clock ferry.

On one of those nights after working together for a few hours in the lab, they drove up to Grizzly Peak in Lewis' new Plymouth and parked on a little dirt road just off the boulevard. They talked for some time and then Lewis noticed something bright in a bush alongside the car. It was a wild rose. What it was doing blooming so early in the spring they'll never know, but Lewis picked it and gave it to Adele. He never knew for certain what thoughts were running through her mind as she took the rose, but he did know that from that moment on he would never touch anyone but the beautiful little girl who looked up and kissed him.

They saw each other at most about three times a week, and even Adele was starting to realize that Lewis somehow wasn't forgetting her, that even the busy days at school were lacking something, and that more and more she was living for those hours when they were together.

Wednesday, March 3, 1937. Lewis took Adele to the Cocanut Grove, a large dance hall just out of Manteca, California, where they listened to the Phil Harris band and had a great time dancing on the spacious floor. It was in a Standard Service Station in Tracy on the way home from the dance that Lewis asked Adele to marry him and she agreed.

One are guests at the home of Mr. J. E. Sanders of Ceres has rented

COCOANUT GROVE

TOMORROW NIGHT

Wednesday March 3rd

DANCE

AMERICA'S
SWINGING,
SINGING
FAVORITE!

IN PERSON

**PHIL
HARRIS**
AND HIS
ORCHESTRA

Featured On
**JACK BENNY'S
JELLO PROGRAM**

With
AMERICA'S SWINGING,
SINGING FAVORITE

FEATURING
JUDY JANIS
Ninety Pounds of Heaven

ADMISSION
Ladies, 40c; Gentlemen, \$1.10

Located Four Miles West of
Manteca on Manteca-Tracy
Highway

Prior to this, Adele had been making plans to spend a year at U.C.L.A. where there was a recognized department for kindergarten teaching. On the way home the two of them discussed this option, and also the possibility that Adele might be interested in plant pathology. To this day she occasionally wonders if she made the right decision because she probably would have made a great kindergarten teacher. But Lewis and a lot of her associates in plant pathology are in agreement that she also makes a great plant pathologist, and certainly she and Lewis made a great team in their years of association for Del Monte. Possibly the best confirmation that she made a good decision came in 1972 when she was nominated to Sigma Xi by her peers in the Department of Plant Pathology at Berkeley, and again in 1978 when she became the first woman ever to be selected to chair the Conference on the Control of Soil Fungi. But whatever the outcome, the decision was made, and Adele took as many plant science and statistics courses as possible, consistent with her graduation requirements. Perhaps this disclosure would best remain a secret, but Adele now confesses that her decision was really not based on some profound academic reasoning, but on the simple fact that she could not face being separated from Lewis for that long time.

April and May, 1937. Because of the circumstances, Lewis got little sleep, but it all seemed worthwhile when on May 17 he received a birthday present from Adele: an album of Porgy and Bess with Lawrence Tibbett and Helen Jepson.

June, 1937. Lewis moved across Cache Slough from Hastings Island to Montezuma Ranch which, since Montezuma is on the mainland, was a great boon to his health.

July, 1937. Lewis had an emerald and platinum ring made for Adele and gave it to her in her Berkeley apartment. Actually he threw it to her in its little box while she was sitting on the couch in her living room. As she opened it he said to her, "I thought you might like to have this."

Adele and Lewis started planning a quiet little wedding for mid August, but hadn't yet set a date.

August 1 - 9, 1937. In early August, Lewis discovered from a friend in the Plant Pathology Department office that their many "friends" in the department were also making plans for their wedding, a not-so-quiet wedding, and were, in fact, checking all the daily newspapers in the U.C. library for their marriage license application which had to be made at least three days prior to the wedding. After some careful checking, Lewis learned that there was one county, Sutter, which was not covered by any of the daily papers in the library. Then he and Adele discussed the matter and decided that it would be fun to thwart their would-be tormentors by eloping in Sutter County. They also discovered that there was a Friday the 13th coming up, and chose that as a suitable date.

August 10, 1937. Adele and Lewis drove to Yuba City, county seat of Sutter County, signed their marriage license application, and made arrangements with a local judge to perform the ceremony the following Friday.

August 11, 1937. Adele wrote a beautiful letter to Lewis, the last sentence of which is quoted here because it so well expresses what both of them have known throughout their married life, and still feel as this is being written some 44 years later: "I know that I am happier now than I have ever been in all my life, and I am certain that if I ever realize more happiness it will surely be through you."

Friday, August 13, 1937. At 9:00 am this morning Adele Schwartz and Lewis Lawyer became Lawyers Inc in the old courthouse at Yuba City, California. Adele's mother and brother were there and acted as witnesses. The four had lunch at Chico, and from there Lewis and Adele drove leisurely through the mountains to Klamath Falls, Oregon, taking pictures and enjoying each others company. They stayed at an auto camp and cooked their first meal together.

The next day they drove through Oregon, crossed the Columbia river at Biggs ferry, and camped out on a ridge in Rattlesnake Hills between Sunnyside and Toppenish, looking up at the bright stars and listening to the coyotes.

August 15, 1937. August 15 was a Sunday. They drove to Yakima for breakfast, visited with Dorothy Danskin, an old friend of Lewis', and continued on up to the Sunrise area of Mount Rainier where they camped among the tall pine trees and the "spring" wildflowers. The temperature dropped to 31° that morning but they were warm as toast in their sleeping bag.

They had breakfast at the lodge and then hiked around the little lakes, big mosquitoes, and the beautiful flower-covered meadows until about 3 pm when they left for Seattle. They visited with Roy Bucknell on a houseboat in the harbor, and then went up to the roof of Harborview Hospital where they took night pictures of the city. They slept in an unoccupied 5-room apartment which Roy had somehow scrounged for them.

August 17, 1937. They toured Seattle all morning, and then left for home, arriving at the Marysville Hotel late the following day. Their honeymoon, and so, also, this part of their story, ended abruptly when Lewis had to get up at 3 am to take care of some spray plots at Wheatland.

A WOMAN IN PLANT SCIENCE

Adele Lawyer

In my mother's day, most ladies did not work. They were, at best, supported by husbands, who took pride in them as helpmates. The wives managed the household, raised the children, entertained guests, engaged in social activities with other wives, and performed marital responsibilities when necessary. Farm wives had more chores to perform, and little time for socializing; but they had no paid job outside the home.

In my day, this rigid pattern broke down. Some of us could be wives and still work outside the home without ruining their husband's standing in the community.

I always wanted to have what seemed to me to be the opportunities that were exclusively the province of men. I wanted to have a job outside the home that was interesting and challenging; and I also wanted to be married.

Everything came my way, - almost everything. I married a man I met at the University who shared all my interests: art, music, the beauty of nature, studiousness. And he understood and sympathized with my ambitions. He was eager to share all his enthusiasms with me totally, on an equal basis. We were married between my junior and senior years. Unfortunately, I had a baby two months after I graduated. Because of this I could not go on and get an advanced degree and was discontent for a time.

We moved from San Francisco to an asparagus ranch where my husband conducted research on that crop, and on tomatoes and peaches, as well. He took me and the baby with him wherever he went up and down the state of California, and I helped him and learned from him, and shared all the excitement inherent in research activities. We worked until late at night because of our enthusiasm.

We added peas to our research crops in 1940, and by then I was a full partner. When our daughter was 2 years old we moved to the Santa Clara Valley where we had a greenhouse and a minimal laboratory. We had a play area inside and out for our little girl, and could watch her while we worked. I did the laboratory work, the secretarial work, the statistical analysis, and much of the research evaluation of our many experiments. My husband and I shared

housework duties and we had time to paint watercolors and pursue our interest in photography and in playing and listening to music in off hours.

I came to know and be known by farm managers, corporate management, and everyone with whom I worked. I was comfortable and confident in what I did, perhaps only because Lewis, my husband, was always at hand to encourage, instruct, or hug me, whichever was appropriate.

Although I worked full time, there were rules prohibiting spouses from working for each other, so an honorarium of \$50 was paid to Lewis as an acknowledgement of my help. It took the recommendation of two vice presidents and an Executive Committee meeting to make me an exception, and I was put on the payroll after a time.

We went back to Illinois to work on the peas every year in March and returned to California in August. When we first went back to the Midwest, women did not wear shorts or slacks, even for casual occasions. I honored this practice and wore skirts in the field. They were always full enough so I could even climb fences with modesty. I was glad, however, when the practice of wearing trousers was eventually accepted in the Midwest.

Being a woman was never a handicap, since I went about my business quietly. I was obviously a devoted wife, and being feminine and attractive also made it easier. I don't know how it would have been for me if I had gone out to Illinois on my own without the reassuring presence of my husband. As it was, being a woman made me stand out. Everyone remembered my name and knew me, whereas I couldn't remember all the 100 or so men I met and associated with throughout the Midwest.

We always had a baby-sitter during the Illinois periods and worked full time. When my husband went into management, I went to Illinois independently and was so well known that there was no difficulty in the transition. We had two more children 13 years after the first one and they went back with me each year.

After 1962, I remained in California. My husband went back and forth to the various Divisions of our corporation in his management job. My mother lived with us and was home for the children after school. I continued to work full time.

I have had very few problems connected with being female in a man's field. There have been a few instances of attention from males based on their interest in me as a woman, but this could be handled diplomatically.

I did have a serious problem with a staff member with whom I was supposed to collaborate on a research project on a continuing basis. He did not want to work with a woman on an equal level and was uncooperative and abusive. The Director of Research was told of the situation and did not discipline the offender for his behavior. I considered this not only unfair, but undermining to the research project. This Director did not allow me to attend meetings of the National Pea Improvement Association, even in the years when the subject matter dealt almost exclusively with diseases of peas. That is why I felt especially honored to receive the Meritorious Service Award from this organization at the end of my career.

My youngest daughter is also a scientist. She is married, too; but her husband is in a different line of work. She uses her maiden name professionally, and women are no longer unique in the work place. It is necessary that couples both work in order to maintain their standard of living. Almost all the women in my daughter's age group work.

My son took a course in "Women's studies" at the University. He is a scientist also, and an advocate of equality for women. His wife, a molecular biologist, works, and he shares equally in household duties and in caring for the children.

What a change from my mother's day to the present!

[Author's note,]1989: This article was written in response to a request from a Midwest newspaper. They had read of my award in a Minnesota paper and wanted to know what it was like to be a woman in my field of work. It was an agricultural newspaper, "The Back Forty," published in North Dakota. The article (much changed) appeared in May 1984.]

ADDENDUM
LORI

On November 6, 1990, at 7:20 in the evening, our oldest daughter, Lori, was killed instantly in an automobile accident while driving home from work in Taos, New Mexico. She had just completed designing and plastering an adobe wall in back of a large hand-carved wooden crucifix in the Taos home of a friend, Terry Ohlinger. Embedded in the plaster were large flakes of sparkling mica which she had arranged in an amorphous halo around the head of Christ. When Adele and I saw the work two days later, we could understand the admiration expressed by Terry, and could imagine how pleased Lori must have been as she left for home.

As she left Taos on the winding highway south, it was starting to snow, and when she was only about five miles from her home in Dixon she lost control. Her pick-up truck slid over the edge of an embankment, hit a large boulder head on, and then plunged into the Rio Grande river some 30 feet below.

There were no funeral services, but three days later, on a Saturday, more than a hundred of her friends, mostly from New Mexico, but some from as far away as northern and southern California, gathered at her home for a final neighborhood pot luck party. They all seemed to know what Lori would have wanted. Each person brought something for the altar set up on a long table against her house: a flower, a pomegranate, a persimmon, multi-colored spices from India, poems they had written, beautiful stones, incense, statues, a tiny flask of water from the Ganges. There were letters of comfort, and praise of Lori, addressed to Lori's 17-year-old daughter, Lluvia, many other offerings, and even a mug full of cash to help Lluvia complete her high school education.

Then, at about two o'clock on that warm, sunny afternoon one of her Taos friends, Nbili Masala, a seven-foot, England-educated, black man from Uganda, started to play his drum. He led the group out into a large pepper field adjoining her home at the edge of an apple orchard. The peppers were recently frozen by the 16-degree mornings of the canyon, and their browned foliage and bright red peppers made a beautiful carpet for the occasion.

Nothing was planned ahead of time, but the group spontaneously held hands and expanded until a huge circle was formed. Nbili stepped out a few feet into the pepper carpet and sang a native African song, the words of which he translated into "Something of Value". The song, which he said was a favorite of Lori's, ended with a chant, the drum beats getting softer and softer, until they were inaudible. Marta Chilton, a nearby neighbor and close friend, read a few words of Indian scripture, and, intermittently, others spoke briefly of the contributions Lori had made to their lives and how much she meant to them. Lluvia and her father, Bill Platte, along with Bill's wife (also named Lori) walked into the circle and recited a mantra, a chant which had been a daily ritual in Lori's life. Then the two of us, hand in hand, walked into the circle with our other two children, Melanie and Artie, close by, and Adele spoke, "We brought Lori into the world and loved and guided her for a little while; but she dedicated herself to an independent spiritual goal in life. She knew where she was going, and we are certain now that she has arrived!" Then, as a group, everyone released Lori's spirit so that it could soar free in the hereafter.

The circle slowly dispersed, as friends wandered back to Lori's home; but still out in the pepper field a girl started singing, accompanying herself on the guitar, tears streaming down her face, singing of love, of sadness, the beauty of nature, the immortality of the spirit. As we listened to her song, Lori's friends began coming up

to us telling how Lori had affected their lives, and how much they were going to miss her counseling. The outpouring of love as expressed to us defies description, in fact the day seemed to be full of love, and it was a half hour or more before the pepper field was finally vacant.

Tables were set up in the yard, and spread with large dishes of food, but people were milling around in the house and in the little garden which Lori and Lluvia had built together. There was a tiny combination vegetable and flower garden, complete with a little stream flowing through it. The stream came from a hose, the water, borrowed from a near-by irrigation ditch, flowing across pretty rocks and into a little pool, still partly covered with ice from the morning's cold. As it was in the garden, Lori's presence was everywhere: in the adobe walls of her home decorated with bas-relief figures of deities, in the rooms, festooned to the hilt with her altars, paintings, family photographs, potted plants, and the smell of incense.

In the house we played a tape of Lori singing all the favorite songs she sang to Lluvia as lullabys from the time she was a baby to the present. There wasn't a dry eye among the many people who crowded into the room to hear her lovely voice. Lluvia joined in on many of the songs, and so did her parents, her brother and sister when we heard the songs which originated in our home. And at the end of the tape came, "I love you, Lluvia. Goodnight, sleep tight, don't let the bed bugs bite!", just the way we always said it to our children, and how Melanie and Artie say to their little ones, too.

As dusk fell, one by one Lori's friends came to embrace us and to say goodbye and thank you. It was hard to realize that we would never see our daughter again, but it was wonderful to be shown how full of love her life had been and how much

influence she had on bringing peace and comfort to others. We came away thinking that during our lifetime, the most important contribution we have made to the world may well be the production of our daughter, Lori.

Appendix D

LAWYERS INC
LEWIS AND ADELE

December 12, 1989

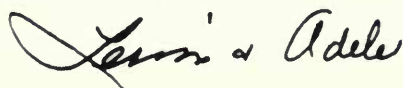
Dear Suzanne:

Enclosed are the releases and the biographical material which you requested.

We have enjoyed "working" with you and coming to know you through the style of your questioning and to respect you for the studiousness of your preparation on a subject which was initially foreign to you.

If there is a deficiency in our transcripts we think it would be the inability to express the importance of our love life together. Love, in all its forms of expression, have been, and still are more important than anything else we do; and without it, all the other things lose their spark. Despite the thrill of discovery of all the hitherto unknown aspects of the diseases in the Idaho pea fields and the excitement of identifying pathogens in our makeshift laboratory in the Idaho Falls motel, the first thing we always remember about those two weeks is the tingle of love when the laboratory work was finished, or perhaps even a little, while it was going on. It is very difficult to explain the sudden need to hold hands or touch fingers in a pea field when one of us discovers something so pathologically exciting that it has to be shared. And now this same glow of love accompanies the sight of a beautiful flower which we have hybridized opening for the first time in our garden. Love and work, for us, were, and are, inseparable, and each enhances the other. We hope that the happiness and fulfillment that have characterized our loving partnership will be reflected in the completed document.

Sincerely,

A handwritten signature in cursive script, appearing to read "Lewis & Adele".

LAWYERS INC
LEWIS AND ADELE

January 31, 1983

Adele

I like "Adele". I like to hear it. I like to say it. It means MY specific Adele, the Adele I love. My Darling.

I am proud of you today. You have done a fabulous job. And today you are wrapping up that part of your life and can look back with pride on your accomplishments, the discoveries, the joys that are unique to science. I am proud to have been your major professor - it is always especially wonderful to have a gifted and skillful student.

I am happy about the part I played in preparing you for the life you are now giving up, but I am even happier about my part in preparing you for the life you are about to begin. At least you will never want for love and understanding. Come home.

Lewis

INDEX--Adele and Lewis Lawyer

- Abell, Thornton, 223, 224
 abortion rights, 52, 77-79
 agricultural labor, 104-107
 Alhambra, California, 8ff-26
 Alpha Zeta, agriculture fraternity, 240
 Alston, Jim, 241
 American Iris Society, Region 14, 226, 230-236, 246ff-265
 American Rock Garden Society, 236, 262-264
Aphanomyces, 162-165
 aphids, 173, 174
 Armacost and Royston Nursery, Hollywood CA, 26, 207, 208
Armillaria, 69, 75, 76, 82-102
Ascochyta, 125, 131, 133, 138-144, 150-155, 159-161
 azaleas, deciduous, 213-215
- Babcock, Ernest, 32, 33, 55, 63, 64
 babilia, 237
 Baggett, James, 169, 174
 Banyakaya, Fermina, 270
 Barrett, J. D., 53, 54, 59, 66, 70
 bean leaf roll virus, 169
 Bier, Allan, 44, 46
 Bier, Marcie, 44
 Bilderback, Norman, 31
 Bine, Barbara, 44
 Blackwelder [at Rio Vista], 197
 Blake Garden, Kensington CA, 241
 Bloss, H. E., 65
 Booye, Tom, 145, 193
 Brown, Ralph, 160, 161, 182
- Caldis, Panos, 82, 83, 108, 109, 123, 124, 131, 133, 134, 182, 185, 186, 188, 191, 213, 235, 262
 California Fig Institute, Fresno CA, 184, 185
 California Horticultural Society, 261, 262
 California Native Plant Society, 239
 California Packing Corporation. See Del Monte Corporation.
- California State Department of Agriculture, 171, 172
 Calpak. See Del Monte Corporation.
 Campbell Soups, 146
 Chaffey Junior College, 30-39, 61-63
 Chandler, William, 56, 62,
 Chautauqua, 15, 16
 Christian Science, 42
 Clara B. Rees Iris Society, 247
 Clayton, Gyce, 106
Clivia, 213
 Cooley's Rare Plant Gardens, Oregon, 26
 Coover, Bill, 112
 Countryman, Jack, 182, 183, 187, 188
 Cruger, Lloyd "Bud," 167, 168, 181, 188
 Cruikshank, Dr. [from Perth], 176
 crystal radio, 21, 22
- daffodils, 208-210
 Darley, Ellis, 99
 Davis, James B., 81, 269
 Davis, Laura, 269
 Davis, Melanie Lawyer, 81, 181, 268, 269
 DDT, 71, 72
 Del Monte Corporation (Calpak), 65, 68, 73-76, 82ff-183
 Del Monte:
 Agricultural Research, 82ff-202;
 asparagus, 110-115, 119, 120;
 beans, 193-197; California
 Division, Agricultural Research
 Department, 145, 182. See Del
 Monte, Morgan Hill; camp life,
 104, 105; corn, 117, 118; flax,
 117; Hastings Ranch, 123, 124;
 Midwest Canning Co., Rochelle IL,
 122-124, 126-130, 151, 182;
 Midwest Division, Research
 Department, 136-145, 188, 189;
 Montezuma Ranch, Rio Vista CA,
 118; Morgan Hill CA, 103, 107,
 124-126, 139; Morgan UT, 165;

- packaging, 179-181; peaches, 82-101; peas, 117, 118, 122ff-161, 182ff-202; Philippines, 184-187; safflower, 117; Seed Department, 124, 130, 135-138, 145, 152, 153, 156, 168, 182, 193-197; sugar beets, 118; tomatoes [hydroponic], 115, 116, 139, 197; Western Agricultural Research Center, 1948, 190, 191; Wheatland CA Ranch, 82-100
- Dolan, Desmond, 197
Domoto, Toichi, 26
Dubose, Sid, 210
Dysart, R. D., 38, 39
- Eames, Alfred, Sr. 182
Endo, Bob, 185
entomology, 172, 173
Ernst, Richard, 242
Essig, Edward, 200, 240, 248
Ethical Culture, 42
- fizzle virus, 168
Flentje, Noel, 99
Freeborn, Stanley, 240
Fusarium, 110-114, 162
- Gardner, Max, 62, 63
Garrett, Dennis, 99
Gaulter, Frances, 246
Gaulter, Larry, 205, 246, 248, 253
Geise, Charles, 189
genetics, 63, 64
Gessert, George, 259
Ghio, Joe, 226, 245, 249-251, 255, 257, 258
Gilmer, Ralph, 111, 139, 140
Giridlian's Oakhurst Gardens, Arcadia CA, 213
Gold, Herbert, 79
Goldsmith, Earl, 75
Gomez Nursery, Oakland CA, 214
Griffin, Willard, 182
- Hagar, Ben, 210, 242, 248, 253
Hagedorn, D. J., 168
Haley, Alleah, 231
Hall, Gigi, 249
- Hampton, Richard, 169, 265, 266
Hanna, Jack, 1978
Hansen, Nick, 68, 70, 79
Hopi Indians, 270, 271
Hubley, Bob, 226, 234
Huntington Gardens, Pasadena CA, 25
Hurliman, Joe, 226
Hutchings, Frank, 246, 251, 252
- iris. Pacific Coast native iris, 222-227, 231-237, 240ff-259
Irwin, Florence, 27
- Jackson, Wilfred, 29
Japanese relocation, 60, 61
Johnson, Maxwell, 108
Jones, L. K., 137, 138
Judaism, 42, 43
- Karakawa, Jimmy [James Arata], 61
Kerrigan, Howard, 214, 215
Kimball, Betty Lawyer, 36-38
Kimball, Ward, 12, 178
Kipping, Ted, 263-265
Koch, Jakob, 30
Koritz, Lloyd, 134-137, 142, 144, 187-189
- LaFollette Committee, 100
Lawyer, Arthur, 6, 7
Lawyer, Arthur Lewis, 6, 20, 181, 268
Lawyer, Emily, 268
Lawyer, Francie, 268
Lawyer, Ida Elizabeth Olson, 4, 7, 8, 11, 12, 13, 22, 23
Lawyer, Lewis Cook, 6, 268
Lawyer, Lewis Mathias, 6, 7, 8, 12, 13
Lawyer, Lluvia, 271, 172
Lawyer, Lori, 52, 77-80, 103, 107, 139, 181, 268, 270, 271. See Appendices.
Lawyers Incorporated, 80, 81
leafless peas, 167
Lennette, David and Evelyne, 249
Lenz, Lee, 223-226, 244
Light, Sol F., 54, 55

- Lowell High School, San Francisco
CA, 45
Luihn, Walt, 248
- mapping a garden, 217-219
Marx, Jerry, 167
McEwen, Currier, 231, 251
McFarland, Jean, 49
Melrose Nursery, Stockton CA, 210,
242
Menuhin, Yehudi and Hepzibah, 44
Merchant, Harold, 61, 62
Mesembryanthemum, 204, 205
Midwest Canning Company, Rochelle
IL, 122-124, 126-130, 182
mildew resistance, 148
Miller Iris Garden, San Gabriel CA,
25
Mink, J. E., 168
Missouri Botanical Garden, 207
Mitchell, Sydney B., 251
Mitchell, Sydney B., iris gardens,
Berkeley CA, 210, 240, 241
Mitchell, Rose, 248
Mormonism, 2-5
Mukai, Haruto, 60, 61
Mycosphaerella pinodes, 141
- Nabisco, Del Monte takeover, 192
National Pea Improvement
Association, 154
National Youth Authority [NYA], 51
Nature Conservancy, 258, 259
- Oliphant, Roy, 260
Olson, Frank, 4
Olson, George, 4
Olson, Hans, 1, 3
Olson, Henry, 4
Olson, Mary Staheli, 2-5
Osborne, Manley, 252
Oswald, Jack, 71
Otis Art Institute, 28-31
- Park Seed Company, 238, 240, 241
Paulus, Jim, 172
Petrie, Ralph, 106
Phillips, August, 222, 223, 224
Phillips, Merck, 186
- Phymatotricum, 64, 65
poppies, pink, 237-240
Pring, George H., 207
Proebsting, Louis, 98
Prohibition, 14
Raabe, Bob, 67, 69, 99, 200, 226-
229, 259
Rancho Santa Ana Botanic Garden,
Claremont CA, 224, 225, 260
Rawlins, T. E., 59, 69 70
Rees, Clara, 248
Reinelt, Frank, 208-210
Rhizoctonia, 67
Rice, Eugenia Lee, 20, 21
Rio Vista CA, flooding, 118-121
Roderick, Wayne, 260
Roe, Bernice, 246, 247
root rot, 161
- Salbach, Carl, 248, 251
Salbach, Carl, iris gardens,
Berkeley CA, 210, 241
Schmitt, Roger, 169, 185
Schreiners Nursery, 254, 256
Schwartz, Abbott, 40
Schwartz, Adele. [Adele Lawyer]
Schwartz, Nedye Loewy, 41, 42
Schwartz, Rudolph, 40-42
Settle, Ralph, 58
Sexton, Neva, 252, 253
Shrader, Roscoe, 28, 29
Sierra Club, 259
Sjolund, Richard, 231
Smith, Nevin, 213
Smith, Ralph, 56, 59, 82, 83
smog, 198, 199
Snyder, William, 55, 67, 68, 70,
124, 139, 140
Snyder [nurseryman, Alhambra CA],
204, 205
Society for Pacific Coast Native
Iris, 234-236, 246ff-259
Soil Fungi Conference, 228
Sprague, Art, 188, 194, 195
Staheli, George, 2
Stanford, Howard R., 32, 37, 38, 63
Stanford, Mabel, 32-36
Stone, Lucy, 269
Strawberry Institute, 74-77

- super-early peas, 159-161
 sweet peas, 203
 Sydney B. Mitchell Iris Society,
 246-248
- Takahashi, Bill [William], 55, 59-
 61, 70
 Taylor, Don, 136
 tenderometer, 156-158
 Thomas, Harold, 55, 59, 73-77, 139
 Thomas, Harvey, 55, 70
 Thomas, Rex, 70
 Thompson and Morgan Nursery, 240
 Tipton, Porter, 104, 105
 tobacco mosaic virus, 59, 60
 Toppenish, Washington, 114, 174
Trichoderma, 90-92
 Tricker [water lilies], 25
- University of California, Berkeley,
 Botanical Garden, 249, 260, 261
 University of California, Berkeley,
 Department of Plant Pathology,
 1934, 51ff-71, 82, 83
 Urbana Laboratories, 144
 United States Department of
 Agriculture, Beltsville MD, 171
 United States Department of
 Agriculture, Plant Introduction,
 145-147, 161, 162, 164, 197
- Vetterle and Reinelt Nursery,
 Capitola CA, 208-210
 Voorhies, Edwin, 240
 Vysekal, Edouard, 28, 29
- Walker, J. C., 137, 142
 water lilies, 25, 203, 204, 206,
 207, 212
 Waters, George, 263
 Weimer, J. L., 161
 Weldon, George P., 32, 33, 63
 White Flower Farm Nursery,
 Litchfield CT, 253
 Widmann, Gloria, 29, 31
 Wilhelm, Steve, 231
 Williams, Ralph, 171
 Winter, Pat, 153-155, 182, 194, 195
 Wintergreen Nursery, Watsonville CA,
- 213
 Witt, Jean, 249, 255
 Wood, Vernon, 248
- Yarwood, Cecil, 51, 67, 176, 177
- Zaumeyer, William, 171
 zinc deficiency, 61, 62

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