ATLAS

OF

CLINICAL SURGERY

WITH SPECIAL REFERENCE TO

DIAGNOSIS AND TREATMENT

FOR

PRACTITIONERS AND STUDENTS

BY

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ENGLISH ADAPTATION

BY

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With 150 Colored Figures

From Models by F. Kolbow in the Pathoplastic Institute of Berlin.

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Preface

Those who are acquainted with the history of medicine know that, even in ancient times, it was sought to represent pictures of diseases by the aid of plastic art. No wonder then that, at the present day, when medicine has made such great progress in all domains, we take advantage of all measures which may facilitate the study of morbid conditions. The rich material of *von Bergmann's* clinic, which has been placed at my disposal, renders it possible to give plastic representations of all surgical diseases which are suitable for reproduction in this way. The models were executed with the greatest skill by *F. Kolbow* in the pathoplastic institute at Berlin, and have proved of much value in the teaching of clinical surgery.

The models have been reproduced by the four-color process, which gives a more natural appearance than can be obtained in reproduction by water colors.

In this work clinical pictures have been represented with a view to assist the practitioner in diagnosis, and to give the student a survey of the more important surgical diseases. For this purpose, the malignant and benign tumors, a number of pyogenic, tuberculous and syphilitic conditions which are common in surgical practice have been figured and described, along with numerous other cases which belong to the domain of surgery.

In the text, which represents the teaching of *von Bergmann's* school, all cases described have been

under the author's observation. Diagnosis, differential diagnosis, prognosis and treatment are dealt with from the modern standpoint.

The author begs to acknowledge his indebtedness to his master, the late Professor *von Bergmann*, and thinks this can be expressed in no better way than by an endeavor to give a true exposition of his teaching, which will always remain a landmark in the science of surgery.

PH. BOCKENHEIMER.

Berlin.

Translator's Preface

With the exception of *Lister*, few surgeons have had more influence on the progress of surgical science than the late Professor *von Bergmann*. We are, therefore, much indebted to Professor *Bockenheimer* for placing before us the teaching of *von Bergmann's* school in a concise and practical form. The reproductions of *Kolbow's* models have been executed with remarkable skill, and give a most faithful and life-like representation of the various diseases.

In this English adaptation I have followed the original text pretty closely. I have added a few paragraphs in brackets where they appeared to be useful.

C. F. Marshall.

27 New Cavendish Street, London, W.

Complete

Index of Plates

	Plate	Figure	Page
Abscess, gummatous	XCV	121	299, 314
Abscess, subcutaneous	LXVII	85	189
Acne rosacea—Rhinophyma	LIV	70	140
Acromegaly—Macromelia—Macroglossia	CXX	150	381, 410
Actinomycosis, incipient	XCII	115	293
Actinomycosis, progressive	XCIII	116	293
Amputations, amniotic	CXIX	149	381, 408
Aneurism, arterial	LXIV	82	169
Angiosarcoma of skin	XIX	26	34, 46
Anthrax—Malignant pustule	XC	112	287
Anthrax, necrosis	XCI	113	287
Arthritis, gonorrheal phlegmonous	LXXXIX	111	282
Arthritis, gouty	CXIII	141	377
Arthritis, tuberculous fibrous—osseous anchylosis	C	127	317, 338
Arthritis, tuberculous fibrous—white tumor	CI	128	317, 339
Arthritis, tuberculous fungous—fibrous anchylosis	XCIX	125	317, 335
Arthritis, tuberculous purulent	C	126	317, 337
Atheromatous cyst—carcinoma of skin	XII	18	24
Bronchocele	XXXIII	44	85
Burns	CVIII	136	355
Burn, X-ray	CX	138	365
Bursitis, prepatellar	XXXI	42	82
Carbuncle	LXX	89	202
Carcinoma of breast—cancer en cuirasse	X	15	16
Carcinoma of breast—carcinomatous lymphangitis	XI	16	16
Carcinoma of breast—carcinomatous lymphoma	V	10	16
Carcinoma of breast—disseminations	IX	14	16
Carcinoma of breast—Paget's disease	VIII	13	16
Carcinoma of breast, ulcerated	VI	11	16
Carcinoma of face	I	1	1
Carcinoma of forehead	I	2	1
Carcinoma of leg after burn	XIV	20	30
Carcinoma of lip	II	3	6
Carcinoma of lip—lupus	III	5	6
Carcinoma of nipple	VII	12	16
Carcinoma of nose	II	4	1
Carcinoma of penis—leukoplakia	XIII	19	27
Carcinoma of skin in cicatrix	XV	22	30
Carcinoma of skin after wart	XV	21	30

	Plate	Figure	Page
Carcinoma of tongue, incipient	IV	8	6
Carcinoma of tongue, ulcerated—leukoplakia	IV	9	6
Carcinoma and papilloma of tongue	IV	7	6
Chancre of tongue, syphilitic	XCIV	118	299, 311
Chondromyxosarcoma—malignant exostosis	XXVI	34	34, 62
Clavus—purulent arthritis	LXXIX	100	232
Contracture, aponeurotic (Dupuytren)	XLVI	60	115
Contracture, ischaemic	XLVIII	63	122
Contracture, tendinous (after whitlow)	XLVII	61	118
Dactylitis tuberculous—spina ventosa	CIV	131	317, 343
Dermoid	XXXVI	48	92
Dermoid—phimosis	XXXV	47	92
Dermoid, recurrent	XXXV	46	92
Detachment of skin	LVII	73	148
Dislocation with fracture of leg—Pseudarthrosis	LI	66	132
Duct, persistent omphalo mesenteric	CXVIII	147	381, 404
Elephantiasis nervorum—Fibromata mollusca	LIV	69	139
Elephantiasis of penis, lymphangiectatic	LV	71	142
Encephalocele, occipital—Rhachischisis	CXIV	142	381, 383
Enchondroma of hand	XXXVII	50	99
Endothelioma of parotid—Mixed tumour	XXX	40	77
Endothelioma of skin	XXIX	39	74
Erysipelas, erythematous	LXXI	90	204
Erysipelas, hemorrhagic bullous	LXXII	91	208
Erysipeloid	LXXIII	92	211
Fibro-adenoma of mamma, cystic	XXVIII	37	69
Fibrolipoma, pendulous subcutaneous	XXXIX	52	104
Fibroma of tendon sheath	XXXVII	49	96
Fistula, median of neck	XLIV	57	110
Fistula, from foreign body	XLIII	56	109
Frost-bite	CIX	137	360
Furunculosis	LXIX	88	196
Furunculus—Lymphangitis	LXIX	87	196
Ganglion, carpal	XXXI	41	80
Gangrene, carbolic	CVII	135	354
Gangrene, diabetic—Arteriosclerosis	CXII	140	370
Gangrene, dry—Mummification	CV	133	345
Gangrene, moist—Decubital ulcer	CVI	134	350
Gangrene moist, of foot	CIV	132	317, 344
Gumma of the lip and nose	XCV	120	299, 313
Gumma of the tongue	XCIV	119	299, 312
Hallux valgus — hammer-toe — Arthrogenous contracture	XLIX	64	126
Hemangioma	LVIII	75	152
Hemangioma, cavernous, of tongue	XXVII	36	66
Hemangioma, cavernous subcutaneous	LXII	80	166
Hemangioma, cutaneous and subcutaneous telangiectases	LXIII	81	168
Hemarthrosis — compression of ulnar nerve—neurogenous contracture	XLVII	62	120
Hematoma, diffuse—Hemophilia	LIX	77	156
Hemorrhoids—Fibromata ani	XXXVIII	51	102
Hernia, congenital umbilical	CXVIII	148	381, 406

	Plate	Figure	Page
Horn, cutaneous—Sebaceous adenoma	XXIX	38	72
Hygroma, multilocular	XXXII	43	84
Infection, generalized	LXXXVI	108	261
Keloid, after laparotomy	XLV	59	113
Keloid, after vaccination	XLV	58	113
Lipoma, diffuse subcutaneous	XL	53	104
Lipoma, symmetrical subcutaneous	XLI	54	104
Lymphadenitis, circumscribed suppurative	XCII	114	292
Lymphadenitis, diffuse (Bubo)	LXXXVIII	110	278
Lymphangioma, congenital multiple	CXVII	145	381, 397
Lymphoma, tuberculous, of neck	XCVIII	124	317, 334
Lymphosarcoma of neck	XVII	24	34
Mastitis, purulent puerpural	LXVIII	86	192
Melanocarcinoma of skin, after wart	XVI	23	32, 39
Melanosarcoma of skin—Sarcomatous lymphoma	XX	28	34, 48
Myelocele—Pes varus	CXV	143	381, 388
Myelocystocele—Myxolipoma	CXVI	144	381, 388
Nævus, neuromatous—Neurofibroma of skin	LIII	68	136
Nævus, pigmented hairy	LII	67	134
Nævus, vascular	LIX	76	155
Nævus, warty—Carcinoma of skin	XII	17	24
Œdema, malignant—Gangrenous emphysematous phlegmon	LXXXVII	109	274
Osteomyelitis, chronic, of humerus	LXXXIV	106	244, 259
Osteomyelitis of lower maxilla	LXXXII	104	244, 255
Osteomyelitis, acute	LXXXIII	105	244, 257
Osteomyelitis of tibia—Necrosis	LXXXV	107	244, 260
Ostitis, gummatous	XCVI	122	299, 315
Othematoma	LVIII	74	150
Papilloma of skin, inflammatory	XXXIV	45	90
Papilloma of tongue	IV	6	6
Paronychia	LXXVIII	98	228
Perforating ulcer of foot—Raynaud's gangrene	CXI	139	367
Periostitis, purulent alveolar—Parulis	LXXXI	103	241
Petechiæ and hemorrhage, by compression	LXI	79	164
Phlegmon of neck—Wooden phlegmon	LXXX	102	237
Phlegmon, progressive putrefactive	LXXIX	101	234
Rickets—Greenstick fracture	L	65	128
Sarcoma, epipharyngeal — malignant nasal polypus	XVIII	25	34, 42
Sarcoma of fascia, ulcerated	XXV	33	34, 60
Sarcoma, fungoid, of orbit	XIX	27	34, 46
Sarcoma, giant celled—Epulis	XXVII	35	34, 64
Sarcoma of humerus, peripheral	XXIV	32	34, 55
Sarcoma of mamma, cystic	XXII	30	34, 49
Sarcoma of mamma, ulcerated	XXI	29	34, 49
Sarcoma of skin, multiple	XXIII	31	34, 52
Skin-grafting	XLII	55	108
Suggillations and Suffusions—Subcutaneous and Hematoma	LX	78	160
Teratoma, monogerminal	CXVII	146	381, 401
Thrombophlebitis, acute purulent	LXVI	84	186
Tongue, geographical (Marginate glossitis)	XCIV	117	298

	Plate	Figure	Page
Tuberculosis of hand	CIII	130	317, 342
Tuberculosis of testicle	CII	129	317, 341
Ulcer, gummatous	XCVII	123	299
Ulcer, varicose—Elephantiasis—Pachydermia	LVI	72	145
Unguis incarnatus (Ingrowing toe-nail)	LXXVIII	99	230
Varix, cirsoid—Pes valgus	LXV	83	174
Whitlow, interdigital	LXXVII	97	213, 227
Whitlow, osteal and articular	LXXVI	95	213, 224
Whitlow, subcutaneous—Lymphangitis	LXXV	94	213, 223
Whitlow, subepidermal	LXXIV	93	213, 222
Whitlow, tendinous	LXXVII	96	213, 226

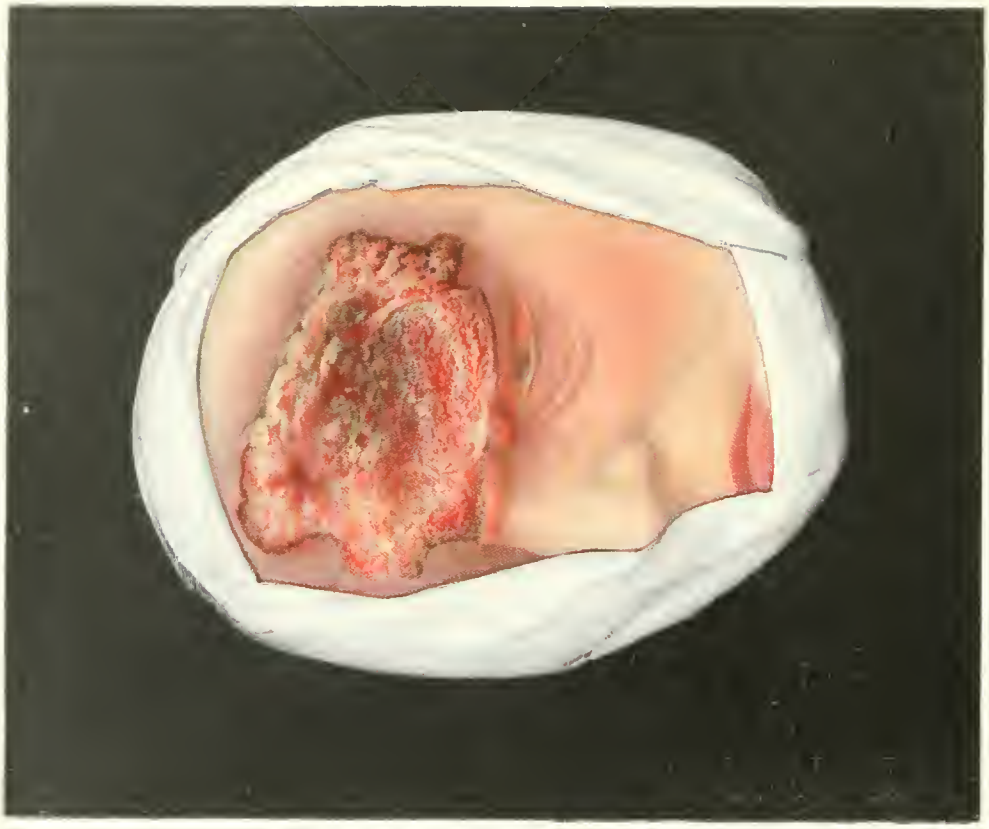

Fig. 2. Carcinoma frontis.

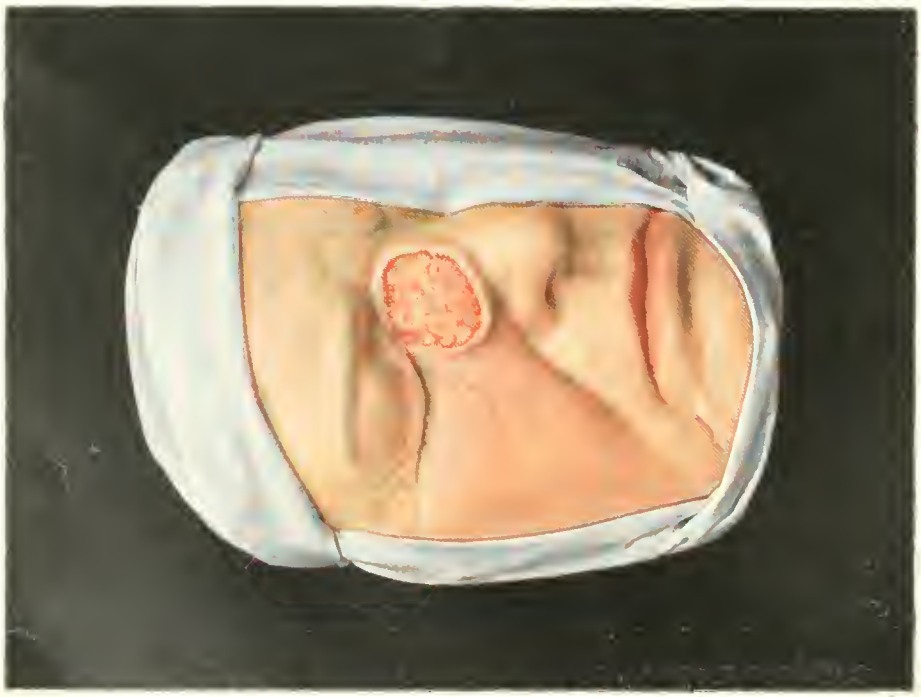

Fig. 1. Carcinoma planum faciei.

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Cutaneous Carcinoma

CARCINOMA PLANUM FACIEI (*of the Face*)
Plate I, Fig. 1.
CARCINOMA FRONTIS (*of the Forehead*)
Plate I, Fig. 2.
CARCINOMA NASI (*of the Nose*)
Plate II, Fig. 4.

Cutaneous cancers of the face are of great importance because they constitute almost a tenth part of all cases of cancer (*Gurlt, Heimann*). The nose, eyelids, cheeks, temples and forehead come in the first line, while the chin and ears are least affected. In youth, these tumors very seldom occur, and then originate in various ways from the basis of a Xeroderma pigmentosum (*Kaposi*). From the fortieth to the seventieth year the disease is common and develops from pre-existing warts, cutaneous horns, adenomata, dermoid or atheromatous cysts (*H. Wolff*), as well as from diseases which cause chronic irritation of the skin (erysipelas, eczema, tuberculous and syphilitic ulceration).

In old country people the flat cutaneous carcinoma (Figs. 1 and 2) occurs very frequently, and can be traced to early wrinkling of the skin, uncleanliness and senile seborrhea, causing an accumulation of dirty scales on the skin. By scratching this epidermic accumulation, superficial easily bleeding sores are formed, which, however, heal quickly so long as they are not cancerous.

The Carcinoma planum faciei (*von Schuh's* "ulcus rodens") presents itself at first as a hard, flat, reddish nodule, which, when scratched or broken,

forms a flat ulcer with little tendency to heal. Of slow growth, and only attaining a conspicuous size after some years, it generally remains a long time unnoticed by the patient, especially as it causes no inconvenience. When it presents itself as a growing superficial ulceration, this generally has a circular form with hard, raised edges of overlapping thinned epidermis; while the floor of the ulcer is, for the most part, soft at first, and the whole growth is movable over the deeper structures.

In the region of the chin especially there is a resemblance to the syphilitic chancre or gumma, but the base of the cancerous ulcer is distinguished by manifold irregularities and fissures. Easily bleeding granulations alternate with more yellowish, fatty looking parts (Fig. 1). It is characteristic of these cutaneous carcinomata that plugs the size of a pin's head can be pressed from the yellow surface of the ulcer; microscopic examination shows that these consist of broken-down, fatty, cancer cells. The ulcer is often covered by a scab so that the diagnosis is only possible after its removal. As the tumor extends there appear radiating contractions of the surrounding skin and consequent deformity (of the eyelids, for example). The original circular shape is then often wanting, and the outline becomes irregular (Fig. 2). At first superficial, the tumor may after some years extend to the deeper parts and cause extensive destruction; for instance, of the bones of the face (Fig. 4). This deep extension is especially seen in parts where the subcutaneous fatty tissue is not developed (the temples, bridge of the nose and zygomatic arch, Figs. 2 and 4). The deep growth is evident at the commencement in the slight mobility of the tumor over the subjacent structures.

On account of the spontaneous cicatrization, which may take place at different parts of the ulcer or over its whole surface, although it is not perma-

nent, these growths were formerly wrongly placed in the group of benign tumors (cancroid). Their microscopic structure is in most cases that of squamous-celled, epithelial cancer, which by extension into the deep glandular regions may later on cause metastatic growths in the organs (*Virchow*).

Differential Diagnosis. Carcinoma is distinguished from papilloma or adenoma by its hard edges and the characters mentioned above.

Treatment. Transient epidermization can generally be quickly obtained in small flat cutaneous carcinomas by aseptic and antiseptic dressings. A permanent healing is, however, not to be obtained in carcinoma by this means, nor by caustic pastes (Vienna paste, etc.), nor by treatment with X-rays or radium. Such healing is only deceptive, for the cancer extends deeply and gives rise to metastases; hence the only rational treatment of cancerous ulcers is early excision about one centimeter beyond the edge of the ulcer in the healthy tissue, and of sufficient depth. Infiltration anæsthesia should not be employed, for it obscures the limits of the tumor. Diseased glands, which can be recognized as small hard lumps, should always be removed.

In excision no regard must be paid to adjacent parts (*e.g.* eyelids). The defect can be remedied by plastic surgery, especially by *Dieffenbach's* methods. Recurrence seldom takes place in carcinoma planum after early excision.

Fig. 1. Shows a flat cutaneous cancer in a typical situation on the face; still clear of the subjacent tissues. Cured by excision, and repair of the defect by a pedunculated flap from the left part of the forehead. The defect in the forehead was repaired by *Thiersch's* grafts.

Fig. 2. Advanced carcinoma of the skin with

irregular borders. The growth has already extended to the bones. The upper eyelid and the ocular conjunctiva are also involved. This is a case of the rare form of cancer of the skin first described by *von Bergmann*, which in its early stages appears in the form of small multiple nodules and may therefore be mistaken and treated for tuberculosis cutis (lupus). The raised, irregular, hard edges of the ulcer point to the correct diagnosis, which in doubtful cases should be cleared up by removal of a piece for examination. Previous treatment by the X-rays had caused a rapid extension of the carcinoma, so that the patient, on account of the very advanced local disease and the severe cachexia from organic metastases, came to the clinic in an inoperable condition. Treatment of inoperable carcinoma: Antiseptic dressings with potassium permanganate and peroxide of hydrogen; later on, cauterization.

Fig. 4. Cutaneous cancer with extensive deep growth. Destruction of the nose, both of the bony framework and of the ethmoid cells. This form of cancer in its early stage consists of subcutaneous nodules covered by unaltered skin. The skin gives way when the nodules break down and a very extensive and deep cancerous ulcer results. This may be mistaken for a gumma, but the latter is not so ragged and has a yellow core. (Cf. Fig. 120.) The presence of epithelial plugs is also characteristic of this form of carcinoma. Microscopical examination and antisyphilitic treatment with iodide of potassium will decide the diagnosis in doubtful cases. The papillomatous forms (Fig. 4) which often give rise to deep cutaneous cancer, through their rapid growth and metastatic formations, must be regarded as extremely malignant tumors.

The permanent results are generally favorable after extensive operations, which often involve removal of diseased bones (*v. Bramann*, *Grosse*). When carcinoma of the face extends through the

dura mater, operation is not indicated, and the case must be treated according to the rules for inoperable cancer. In all extensive carcinomas of the face the patients may die from septic pneumonia when the destructive process reaches the buccal cavity.

A special form of cancer arising in the deep parts of the corium as cancerous nodules constitutes what *Krompecher* described as basal-celled cancers. According to *Coenen* these are not to be classed with endotheliomas, as formerly, for they arise from the basal cells of the sweat and sebaceous gland epithelium, or from the epithelium of the hair follicles. In distinction to the other cutaneous cancers they do not become cornified, and were, therefore, classed by *Borst* among the endotheliomas.

Multiple carcinomas of the face have been noted by several observers (*v. Bergmann*, *Coenen*, *Sehimmelbusch*). *Von Bergmann*, in a case of carcinoma of the forehead, which after some years was followed by another in the floor of the mouth, was of opinion that these were separate, independent carcinomas, because metastases in the tongue and floor of the mouth are very rare, and there was a long time between the development of the two carcinomas.

Carcinoma of the Mucous Membranes

CARCINOMA LABII INFERIORIS (*of lower Lip*)
Plate II, Fig. 3.
TUBERCULOSIS CUTIS (*of the Skin*)
Plate III, Fig. 5.
PAPILLOMA LINGUAE (*of Tongue*)
Plate IV, Fig. 6.
CARCINOMA ET PAPILLOMA LINGUAE (*of Tongue*)
Plate IV, Fig. 7.
CARCINOMA LINGUAE INCIPIENS
(*Incipient Carcinoma of Tongue*)
Plate IV, Fig. 8.
CARCINOMA LINGUAE EXULCERATUM
(*Ulcerating Carcinoma of Tongue*)
LEUKOPLAKIA (*Leukoplakia*)
Plate IV, Fig. 9.

Cancers of the lips resemble cancers of the skin in their form and structure, for they are squamous-celled epitheliomas, and tend to cornification. They arise in the form of cauliflower-shaped, polypoid tumors on the mucous membrane of the lips, cheeks, and glans penis, or as deep ragged ulcers (lips and tongue), and appear in these principal forms in all mucous membranes covered with squamous epithelium. Carcinoma of the upper lip is very rare, but *v. Bergmann* has observed a case where a carcinoma of the upper lip developed within a few weeks after a cancer of the lower lip, in a symmetrical position. Carcinomas of the lower lip form 45.6 per cent. of all cancers of the face, nearly all occurring in the male sex. The action of tobacco must play a special rôle in the origin of cancer of the lip,

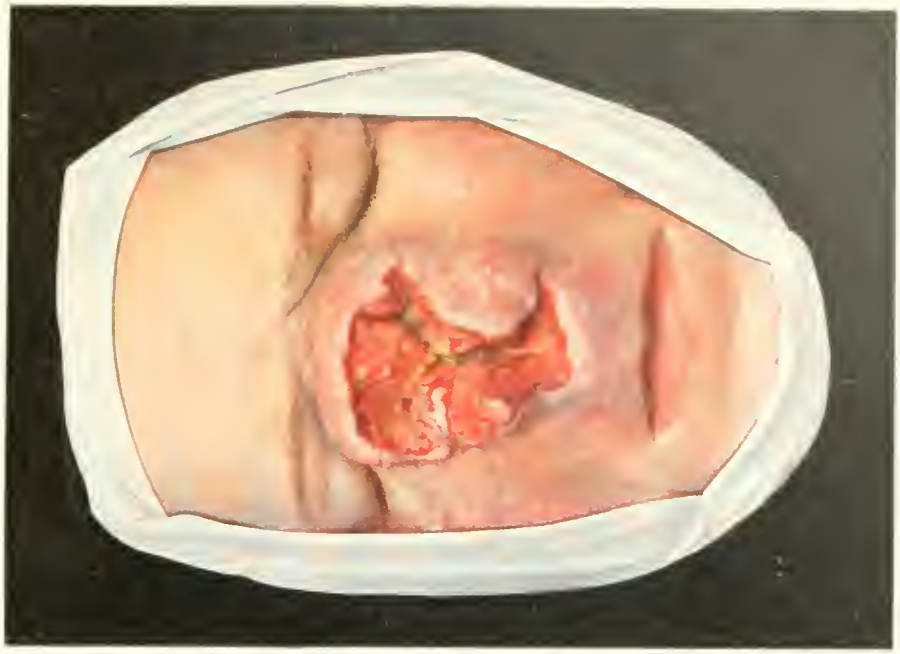

Fig. 4. Carcinoma nasi.

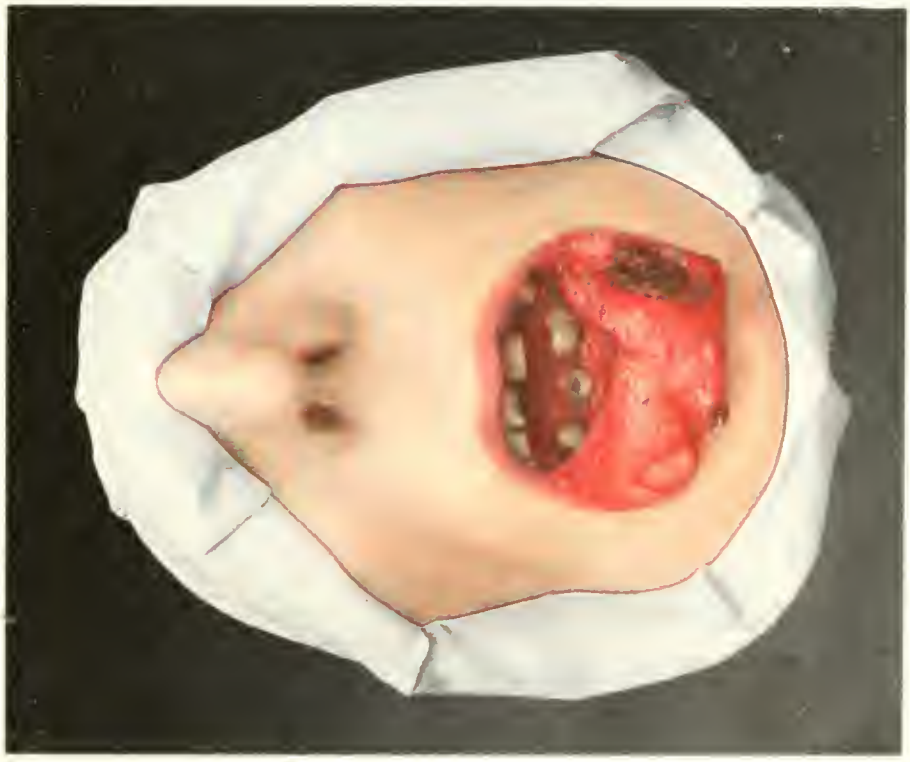

Fig. 3. Carcinoma labii inferioris.

for the patients, of both sexes, are mostly great smokers.

Cancer of the lower lip often begins at the junction of the skin with the red part of the lip, generally between the center of the lip and the angle of the mouth, as a small, hard nodule at first covered by mucous membrane. The mucous membrane soon becomes broken and the nodule grows, infiltrating the surrounding tissues rapidly, while the mucous membrane breaks down more and more and forms an ulcer. Antecedent diseases of the mucous membrane, such as tuberculosis and psoriasis (*leukoplakia*) appear to predispose to carcinoma. The whole of the lower lip may be gradually destroyed (Fig. 3). Scabs and crusts form at several places on the ulcer, and when separated give rise to bleeding. While in its early stages the cancerous ulcer is recognized by its hard, raised edges and crateriform floor, the advanced cancer of the lip shows papillomatous proliferations springing from the floor of the ulcer (Fig. 3). The more the carcinoma extends, the more it implicates the underlying bones and the mucous membrane of the cheeks and floor of the mouth, so that the bones and the buccal mucous membrane may be completely destroyed. The exudation of growing cancer of the lip gives rise to much cachexia, gastritis and enteritis, and the secretion may reach the lungs and cause death from septic pneumonia. In such inoperable forms the submaxillary and submental regions are usually filled with hard, fixed glands.

Differential Diagnosis. Although these advanced forms, which are often neglected, especially in country people, are unmistakable, there may be difficulty in the diagnosis of the early stage of the cancerous ulcer. The irregular, ragged surface of the carcinoma is in marked contrast to the smooth surface of primary syphilis, and the comedo-like

epithelial plugs which are characteristic of all squamous-celled epitheliomas can be extruded from it by pressure. The glands are affected very early in carcinoma, first in the submental region, and are usually, small, very hard and isolated, in contrast to the multiple glands in primary syphilis, which are not so hard and mostly situated at the bifurcation of the carotid.

Isolated tuberculosis, or an ulcer extending from tuberculosis of the buccal mucous membrane or tongue, is very rare on the lip. It has irregular edges which are not so raised and hard as those of cancer. The surface of the ulcer, which results from the breaking down of small tubercles, is of a reddish-gray color and bleeds very easily. It is usually covered with a single large scab. No plugs can be expressed from it. Glandular enlargement is soft and isolated.

Ulcerated cavernoma (cavernous angioma) of the lip may have a cancerous appearance, but it usually occurs in children and is generally associated with other anomalies of the blood-vessels.

The induration of fissures of the lips resulting from chronic eczema heals quickly under rational treatment, and is thus distinguished from carcinomatous induration.

It is important to note that cancer of the lip occurs not only in old people but also soon after the thirtieth year.

Treatment. All depends on early diagnosis, for the cuneiform excision of small tumors gives the best chance of a radical cure. In doubtful cases excision is to be preferred to antisyphilitic or antituberculous treatment, so as to lose no time. In extensive growths, from one and one half to two centimeters of healthy tissue should be removed round the tumors, and the neighboring parts suspected of disease, such as bones and buccal mucous membrane, should also

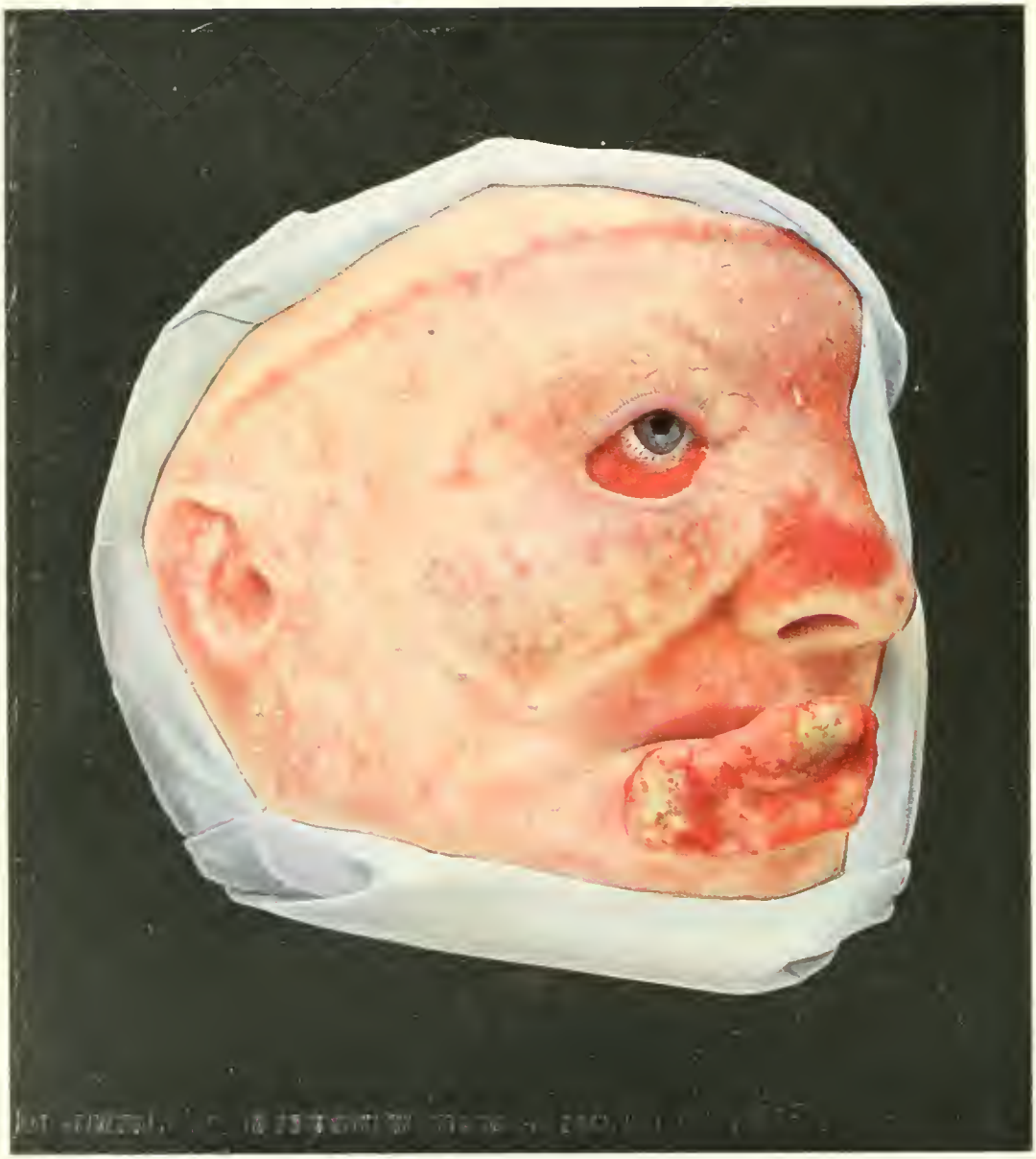

Fig. 5. Carcinoma labii inferioris — Tuberculosis cutis.

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be removed. The defect can be repaired by plastic operations, the best of which are *Dieffenbach's* or *Jaesche's*.

Palpable glands should always be removed by separate incisions in the submental and submaxillary regions. The submaxillary gland which is often affected is best removed at the same time. By radical operation a permanent cure is possible even in extensive carcinomas.

Fig. 3 shows a carcinoma involving the whole lower lip. Deep ulcerations alternate with papillomatous outgrowths. In some parts there are scabs on the surface of the ulcers, in others isolated yellow epithelial plugs. The growth is hardly movable over the lower jaw, and is on the point of extending to the buccal mucous membrane. After free excision of the tumor, removal of the enlarged glands in the submental and submaxillary regions, the extensive defect was repaired by double cheiloplasty (*Dieffenbach's* operation) and a cure was obtained.

Fig. 5 represents a large cancerous ulcer, originating from tuberculosis of the skin, involving half the lower lip. The hard, raised edges of the ulcer divested of mucous membrane are characteristic. The floor of the ulcer is irregular and ragged and beset with yellowish epithelial plugs. Cancerous ulcers arising on the basis of tuberculosis of the skin have a great tendency to bleed. In contrast to the forms of hypertrophic lupus, which gives rise to soft, fungoid, slow-growing tumors, the hardness and rapid growth of the lupus-carcinoma is characteristic. Excision of the carcinoma, removal of the glands, and repair of the defect by *Dieffenbach's* cheiloplasty led to a cure.

Fig. 5 also shows a characteristic picture of different forms of cutaneous tuberculosis; lupus of the face. The disease appears most frequently in this situation and usually begins on the nose (tuberculosis

of the nasal mucosa), and extends over the face in the form of a butterfly. The sharp, irregular outline on the forehead, neck, and behind the ears is characteristic. The disease begins with small reddish-brown nodules situated in the cutis giving rise to exfoliation of the epidermis (lupus exfoliativa); these become confluent and form flat, reddish-gray, easily bleeding ulcers (lupus exulcerans, which after healing leave radiating cicatrices, often after considerable destruction of tissue. (Fig. 5, ear.) After a time papillomatous proliferations may arise of soft and spongy consistence, especially about the ear (lupus hypertrophicus). These three forms are usually present in the same patient (*v. Bergmann*).

Treatment. In circumscribed forms excision of the skin with the diseased subcutaneous tissue is indicated, with repair of the defect by skin flaps. The diffuse forms are treated in *v. Bergmann's* clinic by the sharp spoon (*Volkmann*). The diseased parts are scraped and the bleeding surface treated with *Pacquelin's* cautery or with hot air. Many sittings are often necessary in order to arrest the disease, and the patients often succumb from tuberculous disease of the internal organs, or relapsing facial erysipelas.

Cancer of the buccal cavity occurs on the tongue, the floor of the mouth and the cheek. Cancer of the tongue (Figs. 7, 8 and 9) occurs almost exclusively in man (after the fortieth year), owing to the action of tobacco and alcohol. Antecedent lingual or buccal leucoplakia predisposes to buccal carcinoma; *v. Bergmann* finds it present in fifty per cent. of his cases of cancer of the tongue. Leucoplakia forms hard, white, opaline patches raised above the surface of the mucous membrane of the tongue, consisting of horny epithelium (hyperkeratosis). The surface, at first smooth, after a time becomes fissured, especially after excessive smoking, and the patches of leuco-

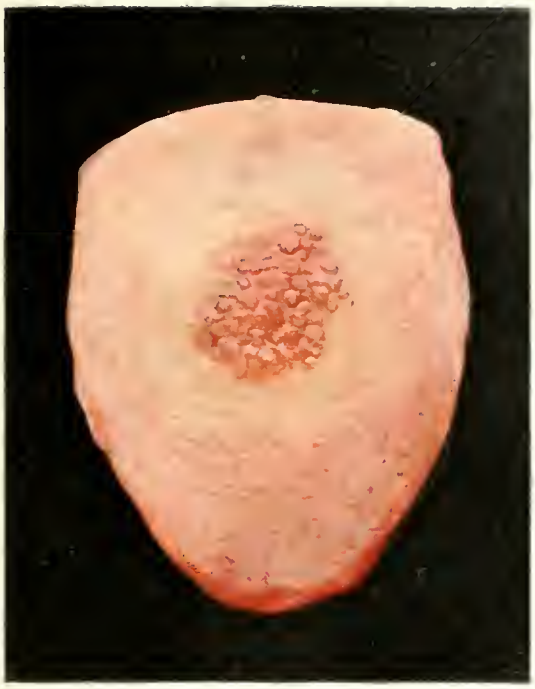

Fig. 6. Papilloma linguae.

Fig. 7. Carcinoma et Papilloma linguae.

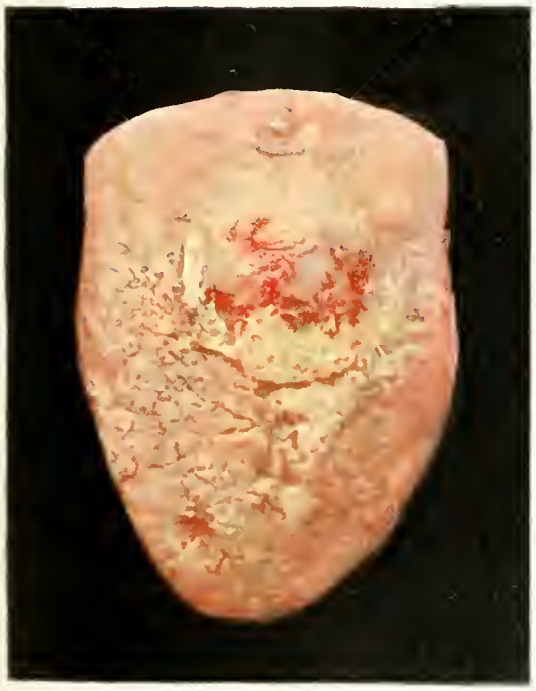

Fig. 8. Carcinoma linguae incipiens.

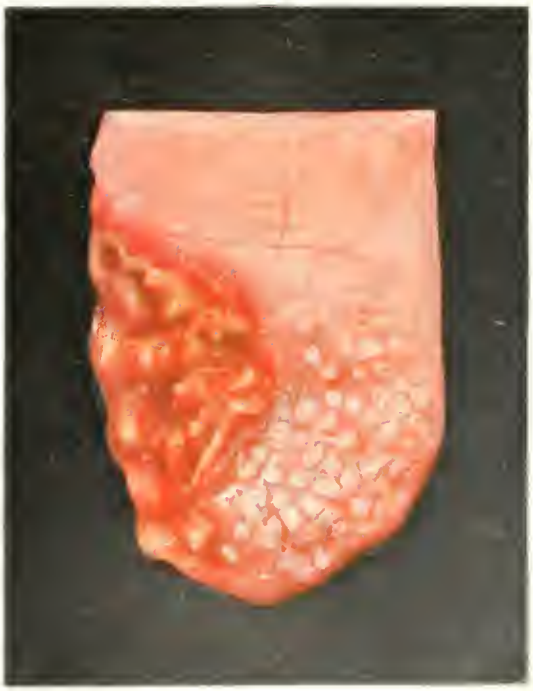

Fig. 9. Carcinoma linguae exulceratum Leukoplakie.

plakia become clearly visible and at the same time take on deeper growth. Since carcinoma arises directly from these fissured patches of leucoplakia, which have absolutely nothing to do with syphilis,* removal of such large and fissured nodules should always be performed, especially as multiple carcinomas of the buccal cavity have been observed under them. Microscopically, the direct transition from hyperkeratosis to carcinoma has not yet been conclusively demonstrated.

Besides leucoplakia, jagged carious molar teeth also act as exciting causes of cancer of the tongue, which explains the almost exclusive occurrence of cancer in the posterior part of the side of the tongue.

The carcinoma appears in two forms, according as it arises from the superficial mucous membrane or from the glandular epithelium.

The first form resembles the flat cutaneous carcinoma and soon gives rise to a small ulcer with hard, raised edges (Fig. 7, right half) the fissured surface of which has a yellowish or dirty-brown appearance. Although the carcinoma is only superficial, the submaxillary glands are soon affected, owing to the abundant lymphatics of the tongue (*Kuttner*).

The deep carcinomas form hard nodules over which the mucous membrane remains intact for a long time. After breaking down of the nodules and destruction of the mucous membrane, an extensive crateriform ulcer is formed with hard, irregular edges and deep fissures in the center. This often extends as far back as the epiglottis. Numerous epithelial plugs can be expressed from the floor of the ulcer, and often from the papillomatous proliferations.

*Translator's Note—This statement is not in accordance with the teaching of Fournier and the majority of syphilologists, who regard buccal leucoplakia as almost exclusively of syphilitic origin. According to Fournier, cancer of the tongue is due to the combined effect of syphilis and tobacco. (See Fournier's Treatment and Prophylaxis of Syphilis, Rebman Company, New York.)

The patients suffer great pain from the irritation of free nerve-endings in the floor of the ichorous ulcer, and, in untreated cases, succumb usually within a year from glandular metastases extending along the carotid to the supra-clavicular region (Fig. 9). Early diagnosis is, therefore, of the greatest possible importance.

Differential Diagnosis. The superficial carcinoma (Fig. 7) is recognized by the characteristic features of flat cutaneous carcinoma and differs from syphilitic chancre by its sharp, hard edges, the irregular floor of the ulcer with epithelial plugs, and the small, hard glands. As long as the flat carcinoma of the tongue is covered with mucous membrane it may in its earliest stages be confounded with papilloma (Fig. 6), especially in the rare cases where it lies more in the center of the dorsal surface of the tongue. Papillomas, however, generally appear as multiple, soft elevations the size of a pin's head, so that the surface of the tongue may appear furnished with small points, or may assume a lobulated form; or there may be fungiform sessile tumors, like stalactites, which often form high projections and have a warty appearance (Fig. 7). That a flat carcinoma and a papilloma of this kind may occur independently without microscopic transition into each other is shown by *v. Bergmann's* case ("Handbook of Practical Surgery, III edition: Text-book of Surgery, II edition"). Small papillomata cause the patient hardly any inconvenience and can be removed with the sharp spoon or *Pacquelin's* cautery. Larger papillomata should be excised (Fig. 7, left half).

The diagnosis is difficult when, as in Fig. 8, a hard, carcinomatous nodule develops under a patch of leucoplakia. The irregular, deep, hard infiltration and the rapid growth point to a commencing new growth, which should always be removed before it

breaks through, especially when there is leucoplakia over the nodule.

Abscesses of the tongue, which result from injury by foreign bodies (steel pens, etc.), and form hard nodules in the substance of the tongue, are characterized by the early painfulness on pressure. Actinomycosis causes a more diffuse, wooden infiltration of the whole tongue and very soon interferes with its motion. (Abscess is treated by incision and actinomycosis by incision and scraping).

The small carcinomatous ulcer of the edge of the tongue is liable to be confounded with ulcerations caused by the irritation of broken teeth (dental ulcers), especially when it is situated opposite a sharp tooth; however, the cancerous ulcer continues to grow after removal of the offending tooth. Larger ulcerations which result from the breaking down of deep carcinoma may be confounded with gumma on superficial examination. The latter, however, is almost always situated in the center of the tongue or in its anterior part, and has the characteristic dirty-yellow, gummatous core, which can be removed without bleeding (Fig. 119), in distinction to the easily bleeding reddish-brown proliferations of carcinoma. Moreover, the pain radiating to the ear which is constantly present in large carcinomas, is absent in gumma; also the glandular metastases and the leucoplakia.

The clinical picture of carcinoma is, therefore, so clear that antisyphilitic treatment for the purpose of diagnosis is not necessary. Excision for diagnosis, which is often inconclusive, is also to be disregarded (*v. Bergmann*). In cases where the diagnosis hesitates between carcinoma and the rarely occurring isolated tuberculosis, or between the still rarer sarcoma which is observed in young people at the tip of the tongue, complete excision should always be performed.

Treatment. Small carcinomas can be excised and the wound closed, after compression of the tongue by a ligature. Excision by *Pacquelin's* cautery and subsequent plugging may also be done.

For large carcinoma a radical operation by section of the lower jaw is necessary (according to *Sédillot* and *Koeher* in the middle line; according to *v. Bergmann* and *Langenbeck*, laterally) with subsequent ligation of the lingual artery (cf. *Bockenheimer & Frohse's* "Atlas of Typical Operations").* By this means not only can the tumor of the tongue be excised through healthy tissues as far as the epiglottis, but also the masses of glands which extend from the submaxillary region to the ear can be removed. Even after extirpation of extensive portions of the tongue the patients, after a few months, can make themselves well understood. Permanent cures, are however, unfortunately rare, even after radical operations, in progressive cases of cancer of the tongue, especially when the lower jaw is involved and the glands have become fixed, so that some surgeons content themselves with the local treatment of carcinoma by caustics and cauterization.

The treatment of cancer of the buccal cavity, which often arises on the basis of leucoplakia, in the same form and with the same symptoms, is carried out on the same principles.

Fig. 6 represents a flat papilloma of the tongue which was removed with the sharp spoon.

Fig. 7 shows on the right half of the tongue a superficially ulcerated carcinoma, while on the left half of the tongue there is an extensive papilloma. Both growths were removed by excision.

Fig. 8 shows a deep carcinoma developing under a patch of leucoplakia; it is not yet ulcerated and is characterized by its hardness and irregular outline. This is exceptional in the center of the tongue. The

*Rebman Company, New York.

growth was removed by excision and subsequent suture.

Fig. 9 represents the most common form of cancer of the tongue; a carcinomatous ulcer of the side of the tongue with extensive destruction, leucoplakia and glandular metastases. After section of the lower jaw the growth was widely removed, the stump of the tongue sutured and the glands removed from the neck.

Glandular Carcinoma

CARCINOMA MAMMAE (*of Breast*)
LYMPHOMATA CARCINOMATOSA (*Carcinomatous*)
Plate V, Fig. 10.

CARCINOMA MAMMAE EXULCERATUM
(*Ulcerating Carcinoma of Breast*)
Plate VI, Fig. 11.

CARCINOMA MAMMILLAE (*of Nipple*)
Plate VII, Fig. 12.

CARCINOMA MAMMAE (*of Breast*)—PAGET'S DISEASE—ECZEMA CHRONICUM MAMMILLAE
(*Chronic Eczema of Nipple*)
Plate VIII, Fig. 13.

CARCINOMA MAMMAE—DISSEMINATIONES
(*Disseminated Carcinoma of Breast*)
Plate IX, Fig. 14.

CARCINOMA MAMMAE UTRIUSQUE(*of both Breasts*)
—"CANCER EN CUIRASSE"
Plate X, Fig. 15.

CARCINOMA MAMMAE (*of Breast*)—LYMPHANGITIS CARCINOMATOSA (*Carcinomatous Lymphangitis*)
Plate XI, Fig. 16.

Of the carcinomas of glandular organs those of the female mammary gland are among the most common (they take the third place). They show a typical unrestricted epithelial proliferation in their origin and development. Observations made on cancer of the breast, therefore, have manifold bearings on carcinoma of other organs. A division into soft, many-celled, rapidly growing tumors of which the medullary cancers represent the most malignant, and slow-growing scirrhous forms with few cells, is of clinical importance.

The exciting causes include inflammatory irritation, puerperal interstitial mastitis, eczema of the nipple, antecedent benign tumors (fibro-adenoma,

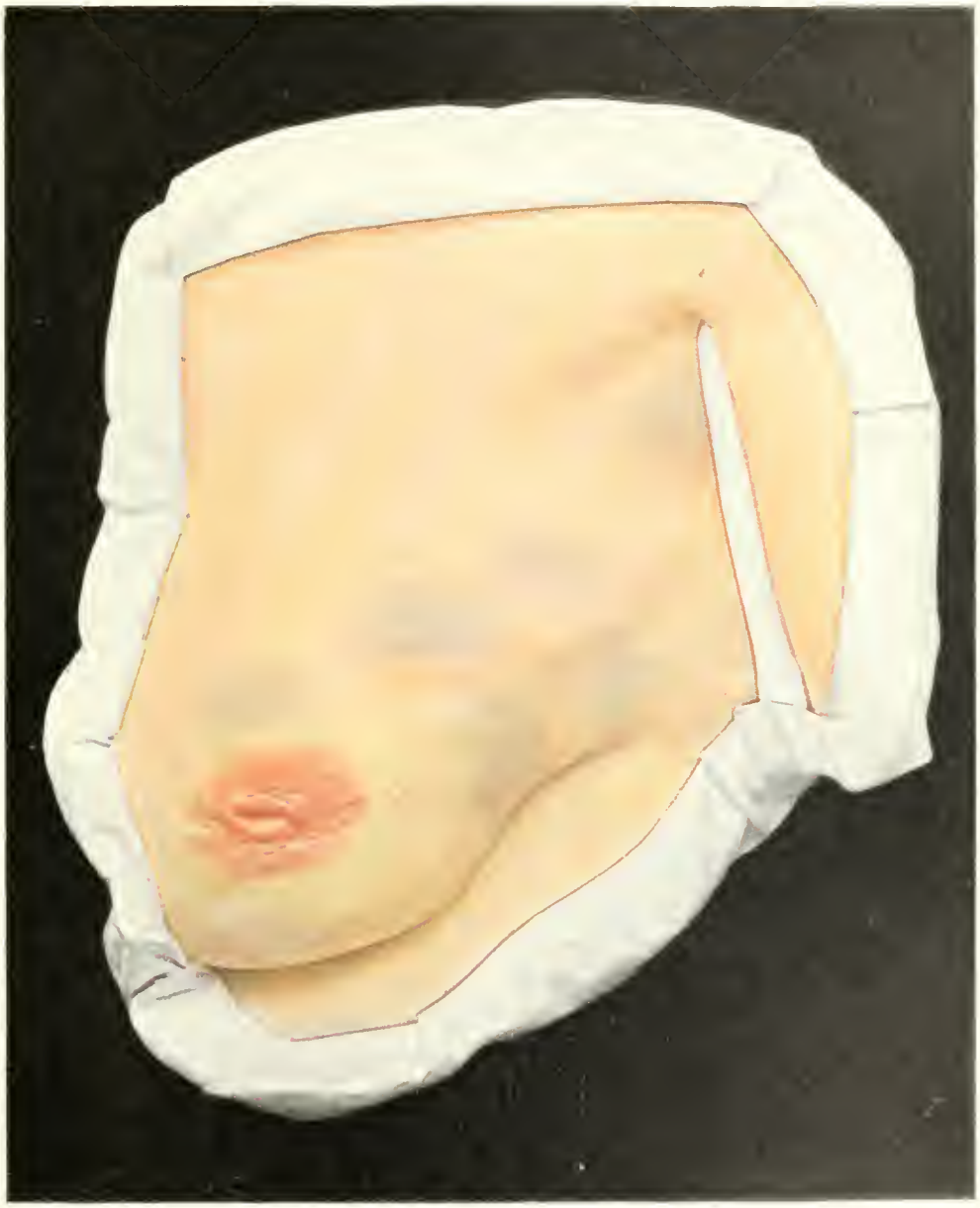

Fig. 10. Carcinoma mammae Lymphomata carcinomatosa.

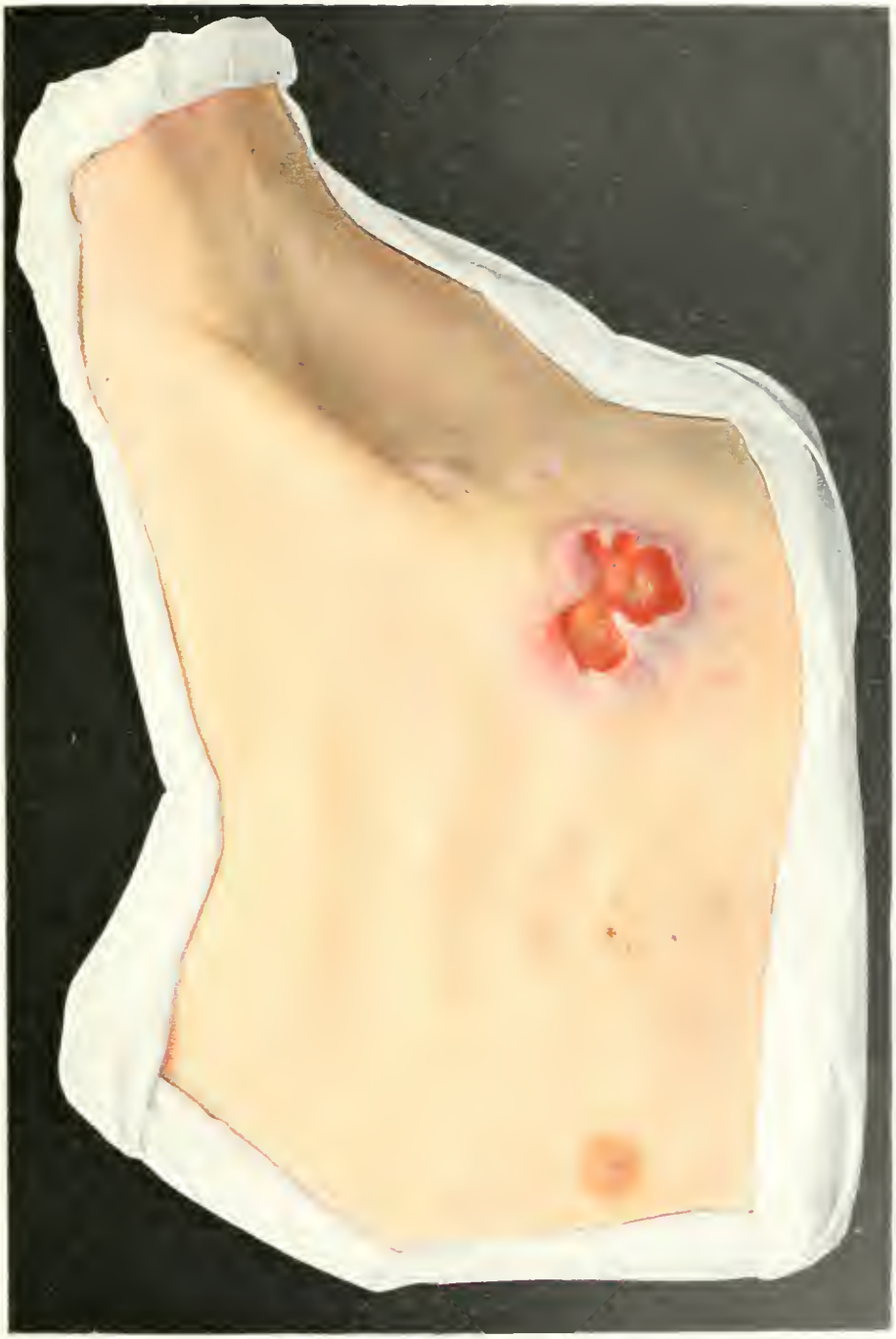

Fig. 11. Carcinoma mammae exulceratum.

Rebman Company, New-York.

cysts) injuries, mechanical irritation, frequent parturition with prolonged suckling of infants. Cancer of the breast is attributed by the public to injuries (blows), but these are often too recent to be accepted as an etiological factor, considering the slow growth of the carcinoma.

It is a remarkable fact that of sterile women only 10 per cent. have cancer of the breast. In 10 per cent. of the cases there is said to be a hereditary tendency.

Women are most often affected at the menopause (fortieth to fifty-fifth years), and come to the surgeon with nodules in the breast which have been hitherto painless and are only accidentally observed. These nodules very soon form a malignant growth of hard consistency and irregular surface. The most important sign of a malignant new growth is the absence of any demarcation or encapsulation. The tumor cannot, like all benign tumors, be separated from the mammary tissue and moved freely, but is fixed immovably in the glandular tissue, with ill-defined boundaries, and is anchored in the meshes of the mammary tissue by numerous offshoots. The nodules, which at first appear harmless, thus soon show their malignity. Accompanied by lancinating pains in the thorax, upper arm and shoulder, the tumor sends its destructive offshoots in all directions into the neighboring tissues, without limit or restraint, and reaching the surface adheres to the skin and causes retraction and fixation of the nipple. Finally, it gives rise to a hard inflammatory infiltration of the whole of the overlying skin. At the same time the tumor extends deeply and soon infiltrates the lymphatics beneath the pectoralis major muscle and also the regional lymphatic vessels and glands of the axilla (Fig. 10), which are usually affected about a year after the formation of the nodules in the breast, and take the form of hard, solid, painless nodules, which are often difficult to

feel in corpulent women. Extensive glandular affection gives rise to radiating pain and œdema of the arm (supra-clavicular glands). Although the cancer usually arises as a single nodule, there are cases in which several nodules develop simultaneously (Fig. 10) and extend through the whole breast to the axilla (Fig. 10). The prognosis is unfavorable in these cases, and in disease of both breasts (Fig. 15).

The disease is very frequently situated in the upper and outer quadrant of the breast, especially on the left side. The tumors situated in the outer half of the mamma towards the axilla, wrongly called paramammary carcinomas, are really glandular cancers, for they originate in the offshoots of the mamma which extend towards the clavicle, sternum, axilla and twelfth rib in the form of long, thin cords.

Cancer of the breast, like all cancers rich in cells (acinous, tubular), grows rapidly, especially during pregnancy, and causes destruction of the skin. A cancerous ulcer results, characterized like cutaneous carcinoma by its hard, raised, fixed borders, crateriform base and sanious discharge. A hard infiltration develops round the tumor which is usually fixed to the thorax. Small nodular thickenings of the adjacent unbroken skin sometimes constitute the first sign of commencing general cutaneous dissemination (Fig. 11). In this way the whole mamma may be transformed into a large ulcer (Fig. 15).

In other cases a tumor is gradually developed involving the whole breast without breaking through externally. The skin, however, may be infiltrated and the redress may be mistaken for inflammatory infiltration (Figs. 14 and 16). These leathery infiltrating forms of breast cancer finally envelop the whole mammary region like a cuirass (Fig. 15).

In the infiltrated skin these often appear small, pin-point disseminations of the carcinoma (Fig. 15, right side), which by confluence give rise to a nodular infiltration of the whole thorax (Fig. 14).

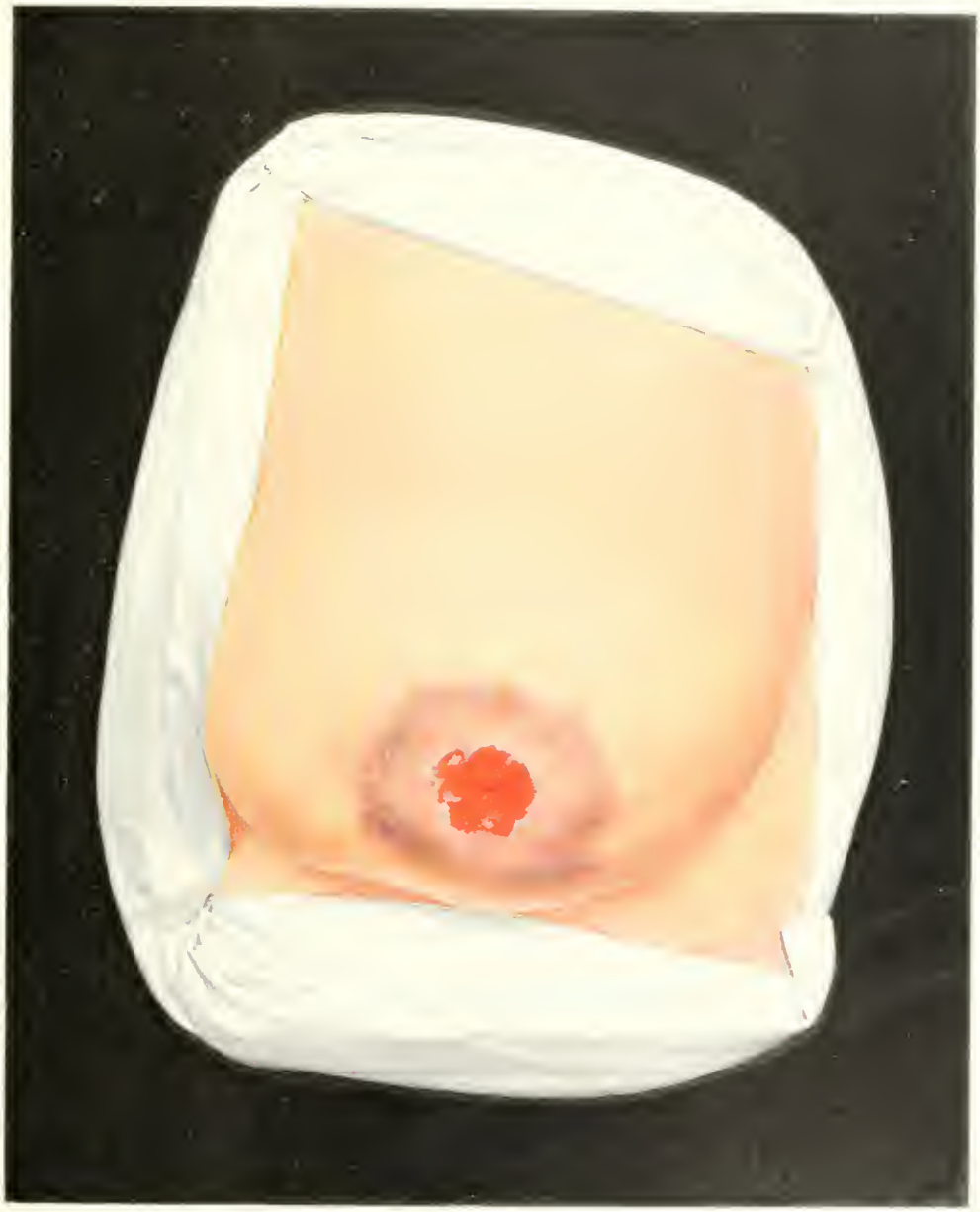

Fig. 12. Carcinoma mammillae

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In cancers which are poor in cells (scirrhous) the mammary gland is often diminished in size by shrinking, and the skin becomes puckered over the tumor by cicatricial contraction (Fig. 10).

Differential Diagnosis. Ulcerated cancers of the breast and those with hard, raised infiltration are difficult to mistake, but small tumors in the substance of the breast have to be diagnosed from interstitial mastitis, benign tumors (fibro-adenomas, cysts and mixed tumors) and abscesses, in which there is frequently deceptive induration. The age of the patient, the continuous growth of the nodules, the appearance of hard, lymphatic glands in the axilla, and the frequent occurrence of emaciation and cachexia even in small cancers assist in the diagnosis, which in doubtful cases can be established by excision of a piece for examination. Sarcoma occurs at an earlier age in the form of soft tumors extending to the skin, and presents a fairly typical clinical picture which should not be confounded with carcinoma (Figs. 29 and 30). The glands are generally unaffected in sarcoma.

Treatment. Radical excision of the whole breast and its processes as early as possible, with removal of the pectoralis major and in some cases also the pectoralis minor, and complete removal of the axillary glands is necessary for a permanent cure. In *v. Bergmann's* clinic there were 29.79 per cent. permanent cures out of 1,000 cases, *i.e.* free from recurrence three years after the operation. Recurrence is much less common in the axillary glands than locally. If of small extent they can be treated by excision, if larger by the X-rays (Fig. 15).

All cases with extensive dissemination in the skin (Fig. 14), diffuse infiltrating cancer, "cancer en cuirasse" (Figs. 15 and 16) are unsuitable for opera-

tion. In cases where the supra-clavicular glands are extensively affected, permanent cures are hardly ever obtained, even after radical operations including section of the clavicle and ligation of the axillary vein; so that it is best to abandon the operation. Also tumors which are adherent to the ribs, and fixed glandular tumors extending to the axilla are unsuitable for operation, for the recurrence generally takes place before the patient has recovered from the operation. Operation is also contra-indicated in cases of severe cachexia, in the atrophic slow-growing forms met with in old people, in cases with metastatic growths in the lung, liver and bones (often leading to spontaneous fracture of the neck of the femur.)

In the region of the head metastatic carcinomas are sometimes inoperable. Owing to their circumscribed encapsuled formation with soft contents they may be confounded with atheromatous cysts. According to *Schimmelbusch* they arise in this form through embolism of cancer cells, and thus form encapsuled freely movable nodules.

[The first brain tumor operated upon was an encapsulated metastatic carcinoma resulting from a mammary cancer.]

In cases of inoperable carcinoma the X-rays may lead to epidermization, especially in the ulcerated forms, after previous removal of the ulcerated parts. In discharging cancers powdered charcoal or chloride of zinc may be used locally, and high doses of morphia internally.

Cases hitherto reported as cured by X-rays are fallacious. No doubt a carcinomatous nodule may disintegrate and disappear under the action of the X-rays, but there is always a further growth in other parts—glands and internal organs. As regards castration for advanced mammary carcinoma in women, further experience is required.

Doyen's serum treatment of cancer has so far given no results.

Fig. 10 shows an acinous carcinoma forming several nodules in the breast, already infiltrating the skin. The axillary glands form hard, fixed, indolent nodular swellings, and nodules can be easily traced in the form of a rosary from the mammary gland to the axilla. The nipple is retracted and fixed, and the whole breast is diminished in size. Operation was performed in the usual way. The patient was already emaciated.

Fig. 11. A single cancerous nodule in a male breast. The skin has broken down and shows a cancerous ulcer with hard, raised, jagged edges, which has destroyed the nipple. The floor of the ulcer is irregular and the whole tumor is fixed to the pectoral muscle. At the edge of the ulcer the skin is radially contracted and shows isolated cancerous nodules. The axillary glands are hard, visible and hardly movable. In spite of the small size of the tumor there was already cachexia. After removal of the mamma with the pectoralis major and the axillary glands the wound, which could not be completely closed by suture, was repaired by *Thiersch's* grafts.

Cancer of the male breast (about 1 per cent. of all mammary carcinomas according to *Schuchardt*) generally arises as a small, hard nodule (scirrhous) in the neighborhood of the nipple and gives rise to a typical cancerous ulcer. The tumor occurs between the fortieth and seventieth years. Heredity appears to be frequent. Occasionally cancer of the breast is seen in husband and wife.

Fig. 12 shows a very rare case of carcinoma arising from the nipple (squamous-celled epithelioma). This is more common in men than in women. It commences as a hard infiltration of the nipple, in the same way as commencing carcinoma of the navel. The nipple is much retracted and the whole areola is transformed into a rigid wall. A cancerous ulcer soon develops which destroys the nipple and the

whole areola. At first there is no connection between this cutaneous cancer and the mammary gland.

The treatment consists in early extirpation of the mammilla with the subjacent mammary tissue, by means of an oval incision with subsequent suture. Recurrence is rare after early treatment. In doubtful cases with induration of the mammilla excision should always be performed.

Fig. 13. Paget's disease, or chronic eczema of the nipple, which is refractory to all treatment. The eczema begins on the nipple, gradually extends to the areola and surrounding skin and assumes the form of eczema madidans pustulosum. Retraction of the nipple and dragging pains are caused by the presence of carcinoma under the nipple (cylinder-epithelioma), which at first has no connection with the nipple but later on may become attached to it. The mammary gland in this case shows hard infiltration round a nodule. In the normal parts of the skin there are small dimples. Obstinate eczema of the nipple accompanied by a tumor in the breast, with infiltration of the axillary glands and early cachexia, make the diagnosis clear and indicate removal of the whole mammary gland with the axillary glands. In cases of chronic eczema of the nipple resisting all treatment, excision of the mammilla is advisable. Out of 884 cases of mammary carcinoma in *v. Bergmann's* clinic there were only seven typical cases of Paget's disease. Two of the author's cases showed cancer of the mammary gland without connection with the eczematous nipple.

According to *Schambacher* and *Ribbert* this affection is an intra-epidermoidal carcinoma which gives rise to secondary chronic eczema, an hypothesis which does not explain all cases, and is yet to be proved by microscopic examination.

Fig. 14. This is a case of tubular carcinoma (Billroth) with cutaneous dissemination which has

Fig. 13. Carcinoma mammae — Paget Disease — Eczema chronicum mammillae.

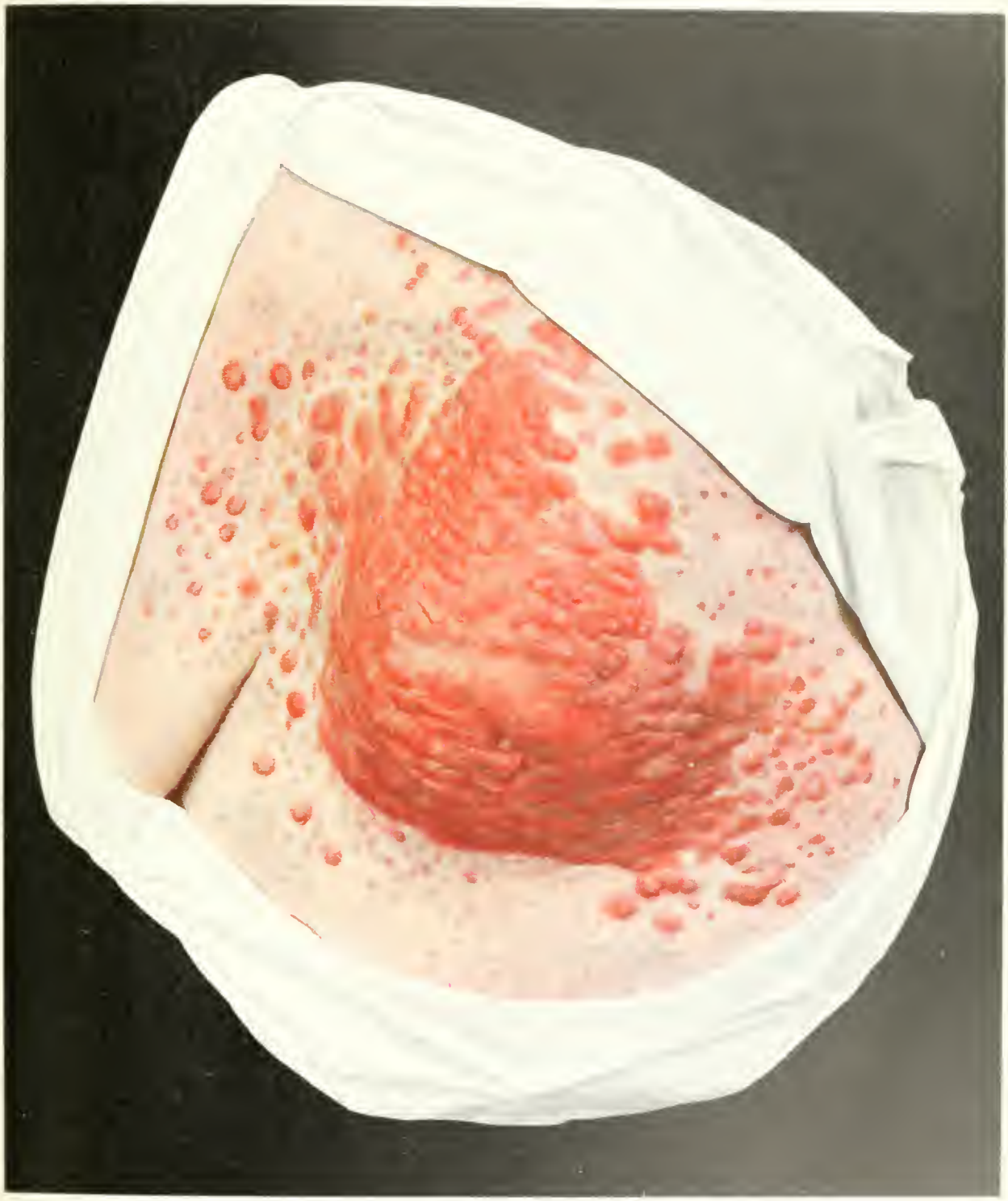

Fig. 14. Carcinoma mammae Disseminationes.

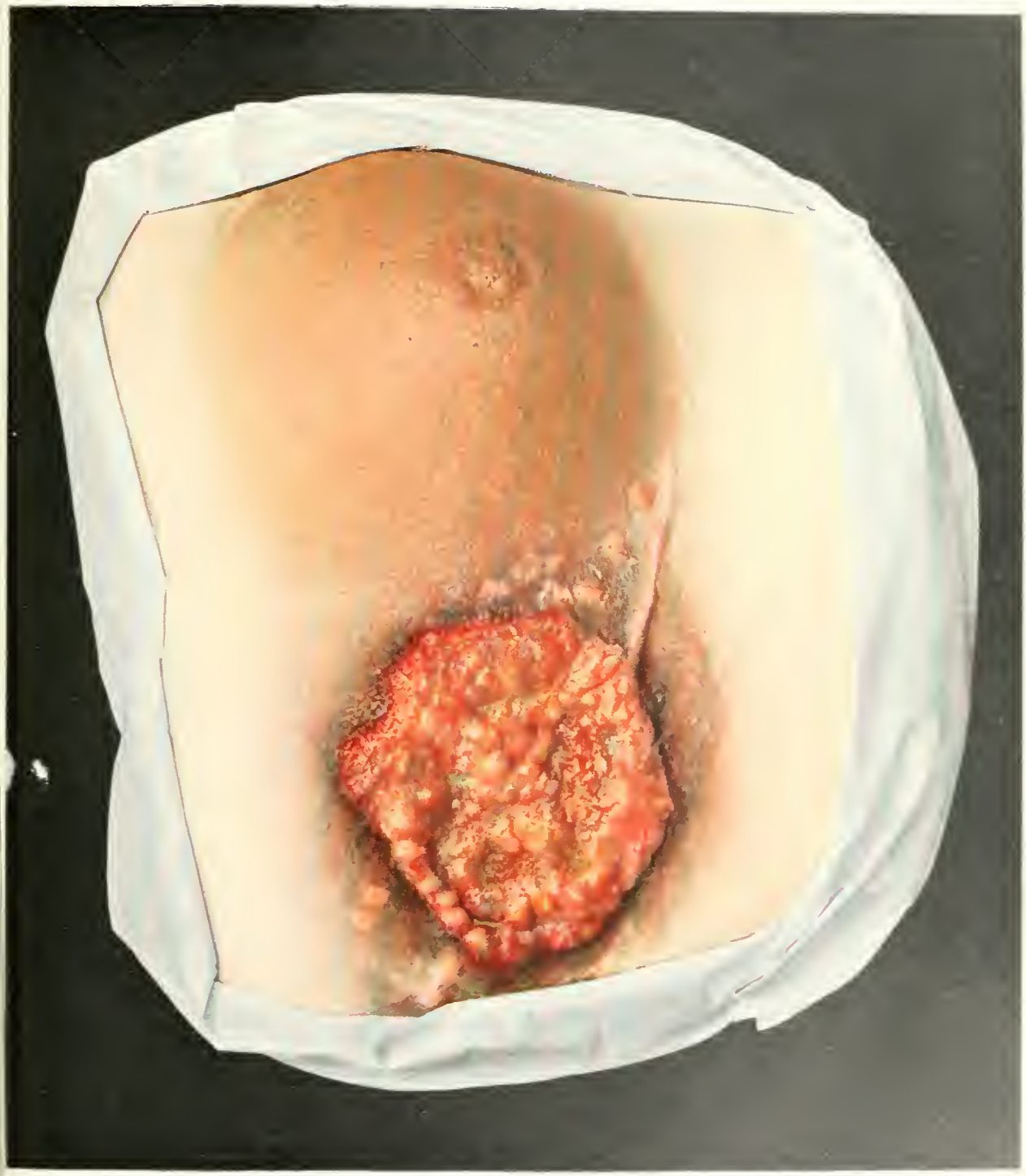

Fig. 15. Carcinoma mammae ultimum. — Cancer en cuirasse.

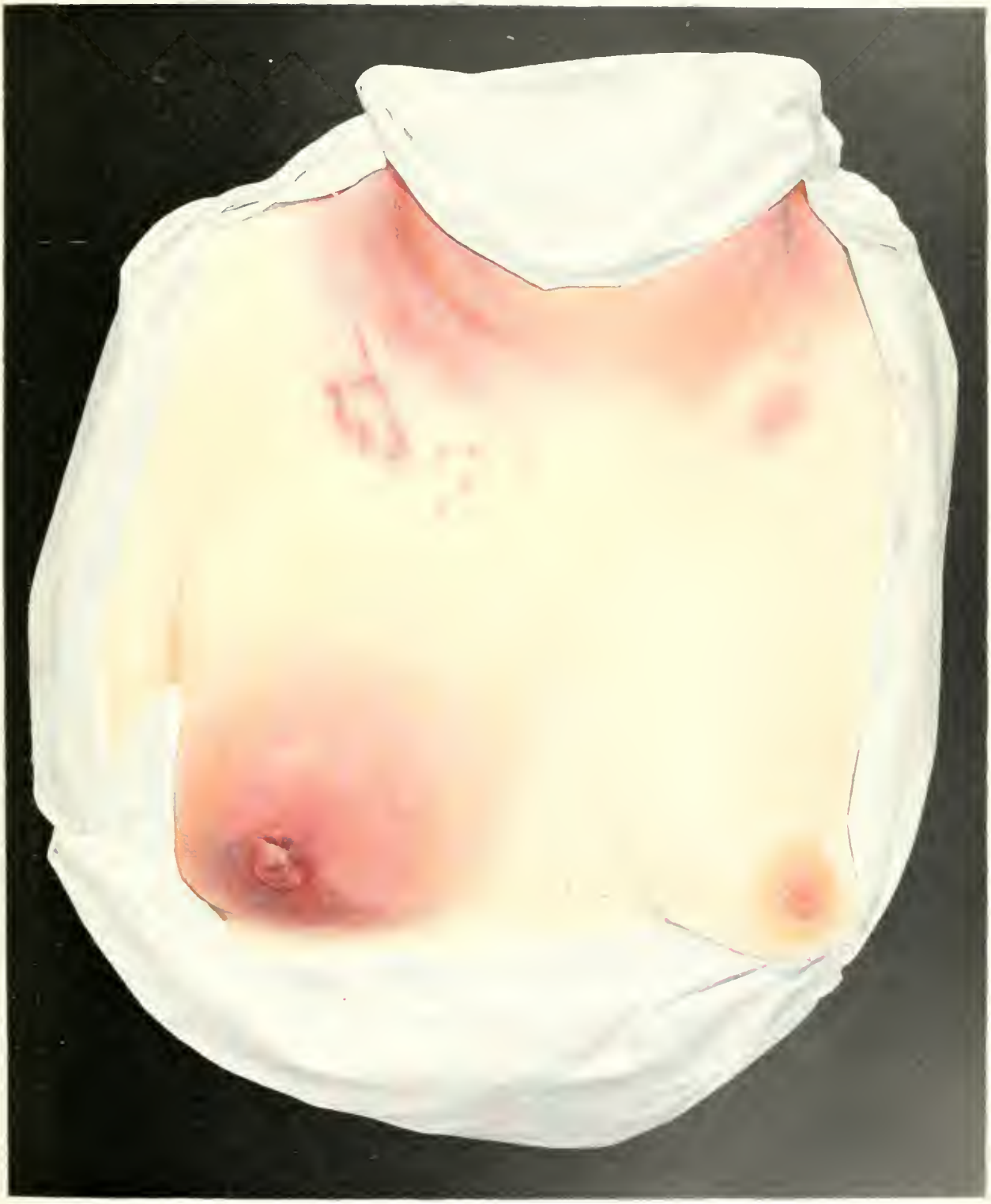

Fig. 16. Carcinoma mammae. — Lymphangitis carcinomatosa.

extended in all directions and spread over the thorax. The development of nodules in the skin occurs early. These appear at first as punctiform, bluish, glistening elevations, which increase in number and size and coalesce, forming a kind of cuirass inclosing the thorax in a rigid mass. (Cancer en cuirasse, *Panzerkrebs*). These cases are inoperable.

Fig. 15. This is a case of inoperable cancer, en cuirasse, in which both mammæ are affected with carcinoma. On the one side there has been a recurrence of the growth in the scar soon after operation, where a soft, fungous, easily bleeding ulcer presents itself. In the surrounding skin there are several isolated nodules. The left mammary gland is involved in a hard, immovable, carcinomatous infiltration. The transmigration of a carcinoma from one side to the other is possibly explained by the persistence of congenital lymphatics.

Fig. 16. At first sight this appears to be a pyogenic inflammation. However, the bluish color, the retraction of the nipple, the hard, immovable breast forming a large tumor, and the extensive metastases in the axillary and supra-clavicular glands lead to a diagnosis of carcinoma. *Volkmann* has named this very rare form of cancer—mastitis carcinomatosa. That we have here to deal with an affection of the lymphatics (lymphangitis carcinomatosa) is shown by the punctiform red spots between the two breasts, the larger punctiform or circular spots below the clavicle and the changes in the region of the neck. The latter is of a blue color and the seat of hard infiltration which is not inflammatory but due to plugging of the lymphatics with cancer cells, and consecutive œdema.

The three last plates (Figs. 14, 15 and 16) show the terrible effects of advanced cancer of the breast, so that the necessity for the earliest possible diagnosis and radical removal by operation must once more be urged.

Naevus Carcinoma

Plate XII, Fig. 17.

ATHEROMA—CARCINOMA (*Sebaceous*)
Plate XIII, Fig. 18.

Fig. 17. Carcinoma of the scalp is very rare and usually arises on the basis of old scars, ulcers, warts, atheroma (sebaceous cysts) and moles. Pigmentary nævi, which are congenital or appear soon after birth, when they appear as warty formations, belong to the class of benign tumors. Occurring over the whole body, they were included by *v. Recklinghausen* among diseases of nerves. While the growth of the nævus ceases with the growth of the body, changes occur in later years which may take the form of papilloma, sarcoma, carcinoma or malignant melanoma. In the case represented in Fig. 17, a rapidly growing tumor arose from a congenital nævus in the thirty-seventh year; the cutaneous covering soon disappeared and the tumor was separated by deep fissures into cauliflower growths. The ulcerated surface is covered with sanious secretion, so that macroscopic examination often does not decide whether it is a case of ulcerated carcinoma or sarcoma. That it is a malignant growth is shown by the rapid growth of the tumor, which in a short time extends over and destroys the whole nævus; the early adhesion to the bones; the regional glandular metastases in the form of hard, slightly movable nodules behind the ear, and the cachexia of the patient. On account of the glandular metastases which soon extend along the large vessels from the neck to the supra-clavicular

Fig. 17. Naevus verrucosus — Carcinoma cutis.

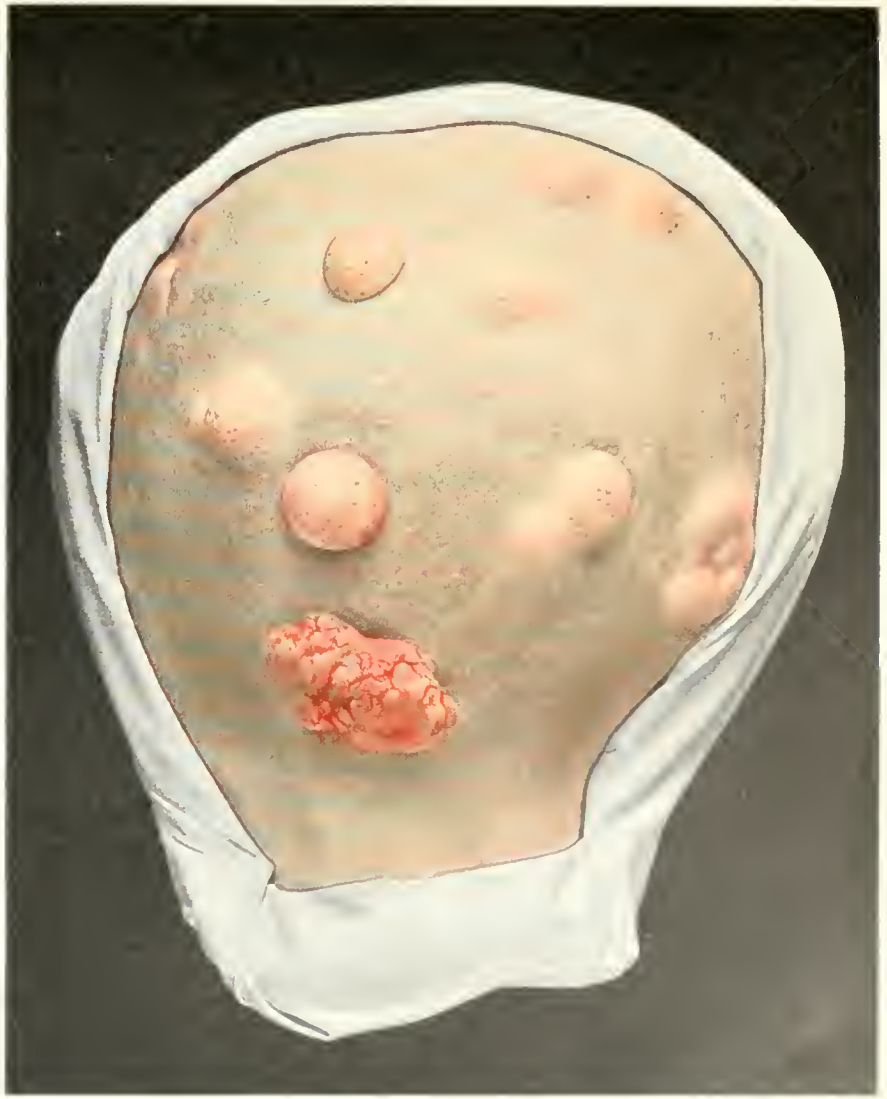

Fig. 18. Atheromata — Carcinoma cutis.

region, the case is presumed to be a carcinoma of the scalp on the basis of a nævus (pigmentary carcinoma), but there remains the possibility that microscopic examination may show it to be a pigmentary sarcoma.

Treatment. This consists in extirpation of the tumor and the rest of the nævus, repair by a plastic operation, and removal of the diseased glands. In large nævi of the head and face a portion of the nævus can, in some situations, be removed by an elliptical incision and subsequent suture (*Dieffenbach*). Owing to the elasticity of the skin of the head large nævi can often be removed without repair by plastic operation. As soon as changes of any kind appear in a nævus, especially in advanced age, it is important to remove it as soon as possible. It is best to remove all pigmentary nævi because fatal malignant melanomatous growths so often develop even from the smallest pigmentary spots.

Fig. 18. Along with multiple sebaceous cysts scattered over the whole scalp, is a carcinoma originating from one of the cysts. The sebaceous cysts, commencing as small yellowish nodules in the skin, slowly grow into large tumors with a broad base and smooth surface. The cysts are fixed to the skin but easily movable over the subjacent bone, and have a doughy consistence often resembling fluctuation. If this mobility of the cyst over the subjacent tissues ceases and the originally soft tumor becomes a hard nodule with an irregular rough surface, malignant degeneration is to be suspected; apart from the occurrence of calcification in its walls, in which, moreover, the spherical smooth surface is generally preserved. This suspicion becomes a certainty when the skin gives way and there appears a rapidly growing nodular tumor characterized by multiple lobulation and secreting a fetid discharge. These carcinomas resemble in many ways the formation

of a discharging sarcoma (Fig. 33), and often cause severe pain owing to inflammation round the tumor. Cachexia occurs early, and the patients are usually of advanced age.

The diagnosis of carcinoma depends on the hard multiple glandular enlargement, which affects the whole nape of the neck. This usually occurs later and is not so hard in sarcoma.

Treatment. This consists in extirpation of the carcinoma, and involves removal of part of the external table of the skull on account of the tumor being fixed to it. The extensive space left by removal of the tumor can be sutured after making two long lateral incisions over both ears and undermining of the scalp. The spaces left by the lateral incisions can be repaired by *Thiersch's* grafts. The glands in the nape of the neck must also be removed.

On account of the early appearance of glandular metastases the excision of especially indurated sebaceous cysts is indicated. Moreover, as there is always a possibility of malignant degeneration, it is advisable to remove every sebaceous cyst by dissecting it out, so as to avoid recurrence.

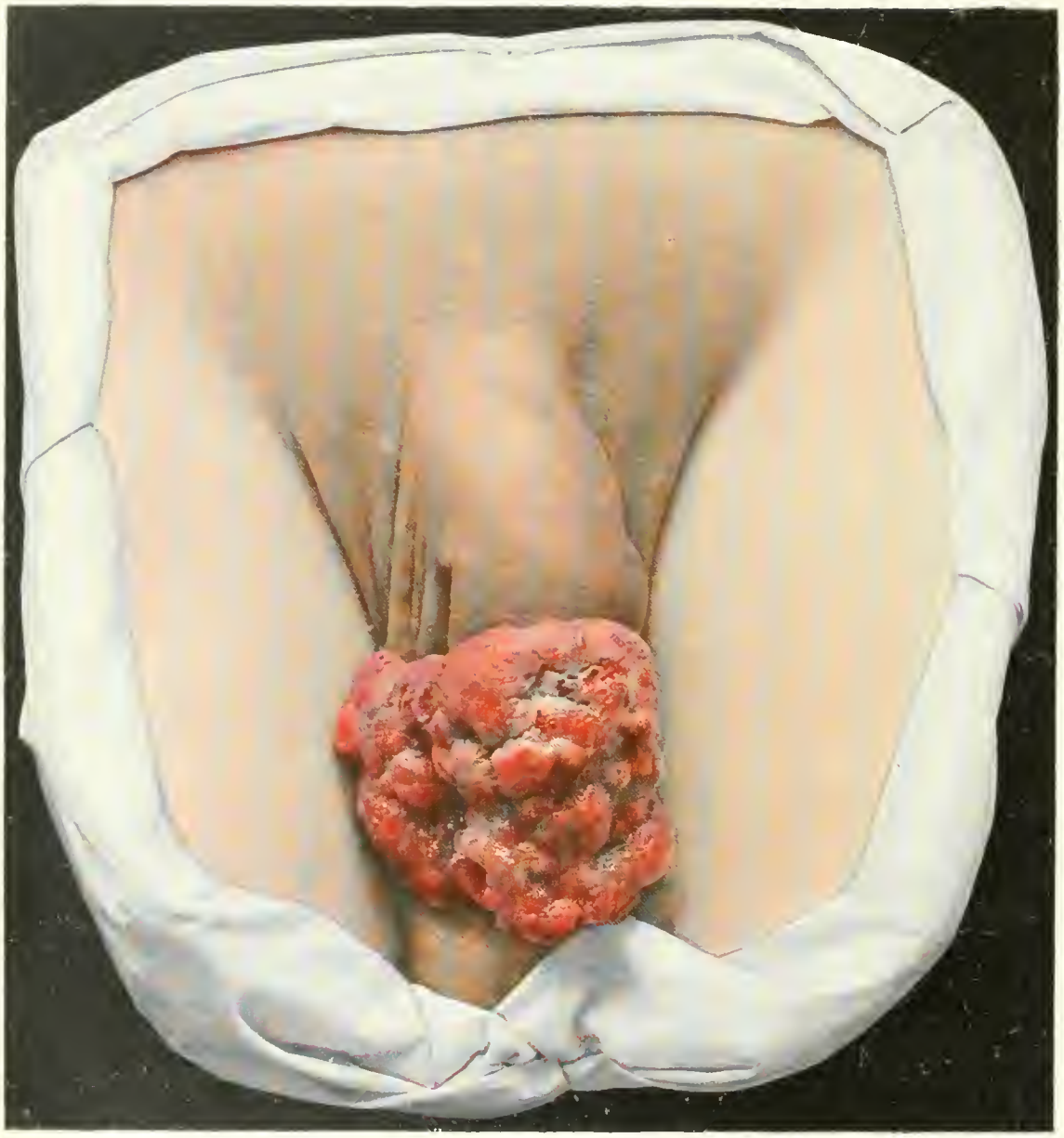

Fig. 19. Carcinoma penis — Leukoplakia.

Carcinoma Penis

Plate XIII, Fig. 19.

Carcinoma of the penis begins on the glans or in the coronary sulcus as a squamous-celled epithelioma, generally between the fiftieth and seventieth year. Predisposing causes are congenital phimosis with preputial concretions, leucoplakia præputialis (white glistening patches similar to leucoplakia of the tongue and cheek), warts, long-standing tuberculous and syphilitic ulcerations. Old fistulæ, which occur especially in eunuchs after removal of the scrotum, testicles and pendulous part of the penis, near the symphysis or perineum, also predispose to carcinoma.

The usual form is that represented in the figure, a warty carcinoma which destroys the prepuce and soon forms a cauliflower growth. Between the individual hard nodules destitute of skin appear crateriform excavations which are characteristic. Epithelial plugs can be expressed from the growth, and in other parts the surface is cornified. Thus, continuous growth alternates with permanent disintegration. The rapidly developing nodules often cause exhausting hemorrhage, while the breaking down of the carcinoma gives rise to a fetid sanious discharge. The borders of the growth are hard, raised and prominent. The whole penis may be transformed into a large growth which may extend to the scrotum, testicles and pelvis. The growth may destroy the urethra and cause much pain on micturition.

A more rare form of carcinoma arises as a small ulcer, generally on the corona glandis. It is hidden by the resulting phimosis, but its characteristic hard borders can be felt distinctly and there is a sanious secretion. The inguinal glands are affected early and point to the diagnosis of carcinoma. The growth at first causes the patient little inconvenience, but quickly leads to severe cachexia, so that the patients often present themselves with extensive metastases of the inguinal and retro-peritoneal glands, and are in an inoperable condition. A saying of *Kauffmann's*, "In old men with phimosis and offensive discharge the possibility of cancer is always to be borne in mind," merits special consideration.

Differential Diagnosis. Both forms of carcinoma are so characteristic that they can hardly be confounded with other affections. The papillomatous form at first sight suggest condylomata acuminata when these have coalesced into soft tumors, but in these the borders are as soft as the rest of the growth. A phagedenic ulcer may cause destruction of the glans penis, but the necrosis resulting from the rapid destruction differs from the proliferation of the carcinoma, and the phagedenic ulcer soon heals after cauterization. Syphilitic chancre also has hard borders like the cancerous ulcer, but its surface is smooth in distinction to the ragged surface which is always present even in small cancerous ulcers. Search may also be made for the Spirochæta pallida of syphilis.

Sarcoma affecting the corpus cavernosum are soft rapidly growing tumors, and for a long time have no glandular metastases.

Treatment. Amputation of the penis and removal of the glands from both inguinal regions. The prognosis is favorable if the glands are not affected before operation. In cases where the car-

cinoma has already affected the whole penis, testicles and prostate, a radical operation may be attempted by temporary section of the pubis on both sides (*Bramann*, *Lexer*, *Manz*), unless extensive glandular or organic metastases contra-indicate any intervention. Recurrence is frequent at the seat of amputation. In inoperable cases the cancerous ulcer can be destroyed with *Pacquelin's* cautery and afterwards treated by X-rays.

CARCINOMA CUTIS EX COMBUSTIONE (*of Skin after Burn*)
Plate XIV, Fig. 20.

CARCINOMA CUTIS EX VERRUCA (*of Skin after Wart*)
Plate XV, Fig. 21.

CARCINOMA CUTIS EX CICATRICE (*of Skin after Cicatrix*)
Plate XV, Fig. 22.

Cutaneous carcinomas of the extremities are comparatively rare and always follow preceding changes or morbid conditions in the skin. Most frequently they arise on the basis of old scars of various origins, especially from hypertrophic keloidal scars left after extensive burns. *Hawkins*, in 1835, described carcinomas arising from scars left after severe flogging, mostly in sailors. *Dietrich* described a carcinoma originating in the scar from osteomyelitis, which was for a long time regarded as primary carcinoma of bone. The scar generally becomes fissured, forming a small wound which afterwards becomes a carcinomatous ulcer (Fig. 21) with all its characteristic features, hard borders, papillomatous proliferations, ragged surface and epithelial plugs. A cauliflower tumor grows which soon becomes fixed to the fascia (Figs. 20 and 22).

Warts, old-standing ulcers of the leg and lupoid changes in the skin also lead to carcinoma of the extremities. Eczema of the skin occurring in chimney-sweeps and workers in paraffin has often led to multiple carcinoma of the extremities.

Fig. 20 shows a papillary carcinoma of the skin of the leg arising from the scar of a burn. The smooth, partly white and partly brownish, shiny scars of the burn are seen over the whole leg. The carcinoma has extended above and below and has

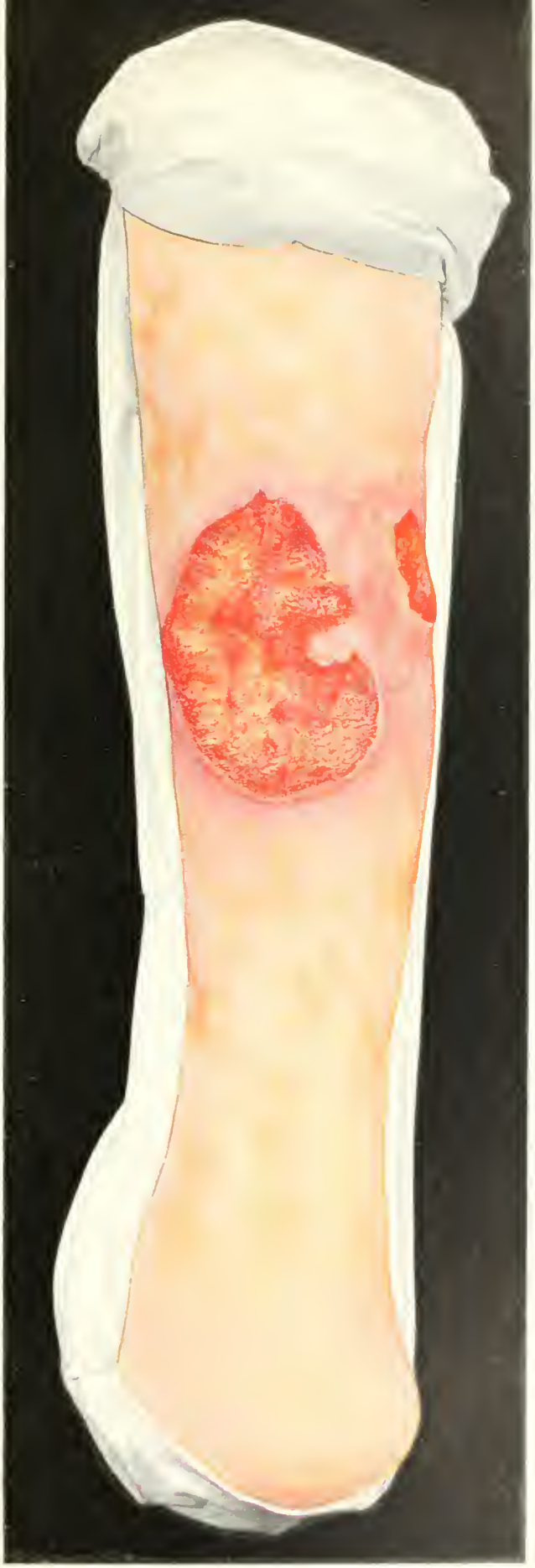

Fig. 20. Carcinoma cruris ex combustione.

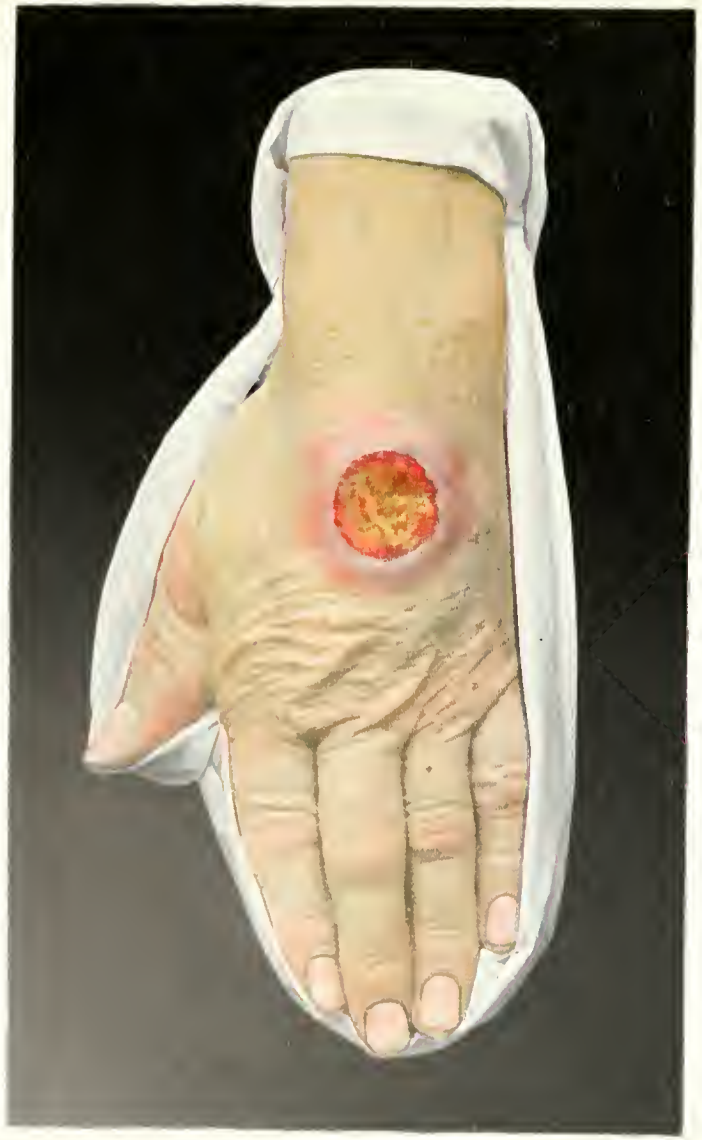

Fig. 21. Carcinoma cutis ex verruca.

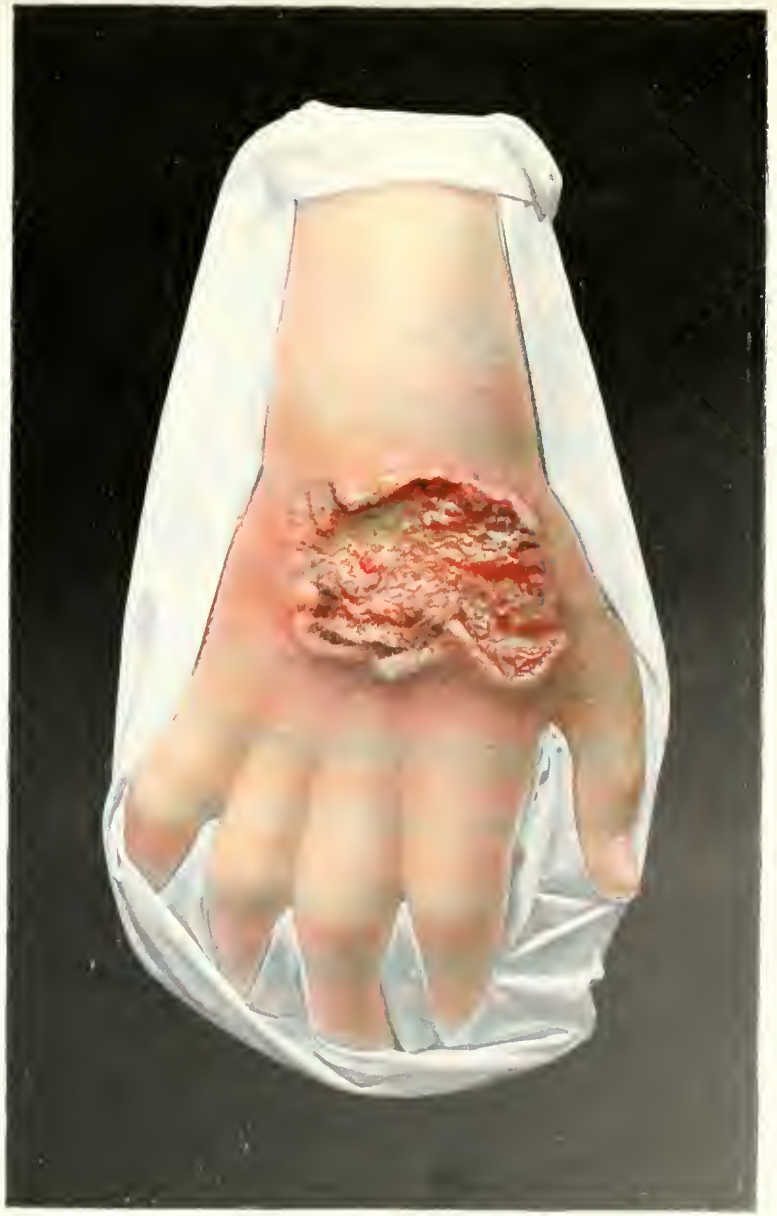

Fig. 22. Carcinoma cutis ex cicatrice.

extended round the whole circumference of the leg. The soft, cauliflower proliferations have given rise to severe hemorrhages. From the depth of the growth there is a sanious discharge. The borders of the tumor are very hard and raised, and are immovable over the fascia. The inguinal glands were already involved.

Treatment. Amputation through the thigh with removal of the inguinal glands. In cases of chronic ulcer of the leg with commencing carcinoma in the form of hard, prominent tumors in the soft granulations, it is best to remove the whole ulcer as early as possible.

Fig. 21 shows a carcinoma in a common situation, the back of the hand, arising from a wart and forming a characteristic carcinomatous ulcer. As the growth was still movable over the fascia, and there were no glandular enlargements, it was excised and the gap repaired by a pedunculated flap from the forearm. The rapid growth of these small tumors with hard borders makes early diagnosis and removal necessary, so as to avoid recurrence.

Fig. 22 shows a very extensive carcinoma arising from the scar of an injury two years before. In this case the irregular, wall-like, hard, irregular borders are very marked. The floor of the ulcer is in some places cornified and is covered with crusts and sanious secretion. The carcinoma has already extended through the fascia to the bones, interfering with the function of the hand. The glands of the elbow and axilla are hard and nodular. The rapid growth of the tumor has led to severe cachexia.

Treatment. Amputation through the arm and removal of glands.

Melanocarcinoma

Plate XVI, Fig. 23.

The malignant melanomas (melanosarcoma, melanoendothelioma and the rarely occurring melanocarcinoma) occur most often in the skin, also in the adjacent mucous membrane, and in the choroid and iris. In the skin they arise from benign melanomas, especially from flat pigmentary nævi, and from warts which become continually irritated. Warts on the sole of the foot and on the fingers often give rise to these growths. A sessile or pedunculated tumor develops, which is characterized by black, bluish-black or brownish-yellow coloration (Fig. 23). The skin soon becomes ulcerated, and by the breaking down of the tumor a deep ragged ulcer is produced. Melanocarcinomas are characterized by the hardness of the base of the tumor, thus differing from the soft, easily bleeding melanosarcomas which rapidly disintegrate into a brownish-black watery mass, and form the soft, bleeding angiosarcomas.

Melanocarcinoma of the skin not only grows deeply towards the fascia, but also forms early disseminations in the skin, in the form of small black nodules in the neighborhood of the mother tumor, which form a large growth by confluence.

The great malignity of these tumors is shown by the early appearance of metastases in the regional lymphatic glands, which generally form larger tumors than the primary one; also by the early infection of the lungs, liver, heart, brain, and other organs by metastatic deposits.

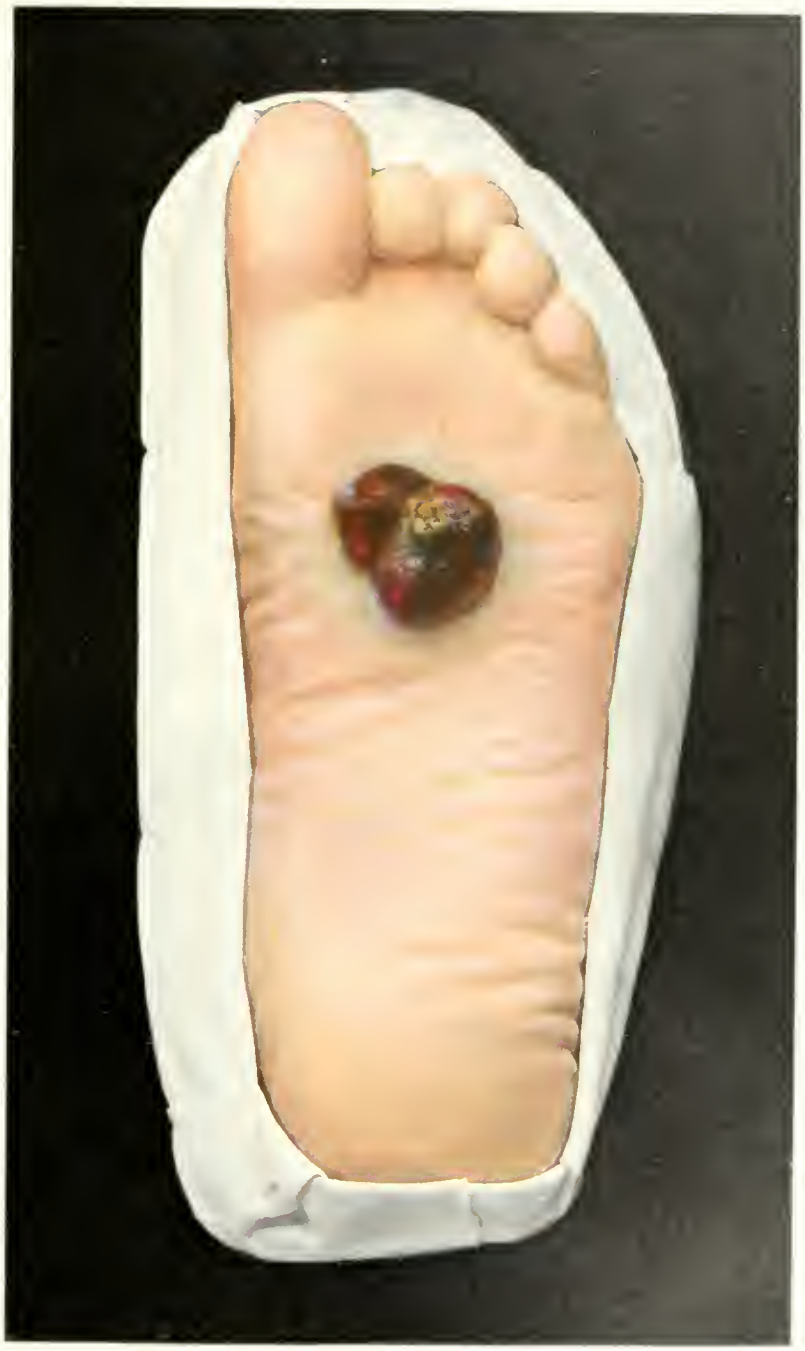

Fig. 23. Melanocarcinoma cutis ex verruca

Owing to the rapid development of these metastases pigmentation is usually absent in them.

Melanocarcinomas may be seen in children as multiple growths in the skin in connection with xeroderma pigmentosum. The rapid growth and frequent hemorrhages lead to severe anæmia.

Treatment. Small tumors of the skin can be widely removed with the fascia. In the extremities the best and most radical method is amputation and removal of the regional glands. In spite of early and extensive operation recurrence is very frequent, and in *v. Bergmann's* clinic only one case is known to be free from recurrence after a year. It is, therefore, urgent to take prophylactic measures by excising all pigmentary nævi, especially in advanced age, and all warts which become continually irritated or inflamed. The gap left by removal of extensive pigmentary nævi of the face must be filled by skin flaps. Cauterization of nævi and warts is to be condemned, as the irritation may be an exciting cause of tumor formation.

Fig. 23 shows a tumor arising from a pigmentary wart; the alveolar structure on microscopic examination showed it to be a melanotic carcinoma. In spite of amputation of the leg and removal of the inguinal glands, death resulted from organic metastases.

Sarcoma

Plates XVII—XXVI.

LYMPHOSARCOMA COLLI (*of Neck*)
Plate XVII, Fig. 24.
SARCOMA EPIPHARYNGEALE (*Epipharyngeal Sarcoma*)
POLYPOSIS NASI MALIGNA (*Malignant Nasal Polypus*)
Plate XVIII, Fig. 25.
ANGIOSARCOMA CUTIS (*of Skin*)
BOTRIOMYCOSIS
Plate XIX, Fig. 26.
SARCOMA FUNGOIDES ORBITAE
(*Fungating Sarcoma of Orbit*)
Plate XIX, Fig. 27.
MELANOSARCOMA CUTIS (*of Skin*)
LYMPHOMATA SARCOMATOSA COLLI
(*Sarcomatous Lymphoma of Neck*)
Plate XX, Fig. 28.
SARCOMA MAMMAE EXULCERATUM
(*Ulcerating Sarcoma of Breast*)
Plate XXI, Fig. 29.
SARCOMA MAMMAE CYSTICUM (*Cystic Sarcoma of Breast*)
Plate XXII, Fig. 30.
SARCOMA CUTIS MULTIPLEX (*Multiple Sarcoma of Skin*)
Plate XXIII, Fig. 31.
SARCOMA HUMERI PERIPHERICUM
(*Peripheral Sarcoma of Humerus*)
Plate XXIV, Fig. 32.
SARCOMA FASCIAE BRACHII EXULCERATUM
(*Ulcerating Sarcoma of Brachial fascia*)
Plate XXV, Fig. 33.
CHONDROMYXOSARCOMA GENUS (*of Knee*)
EXOSTOSES MALIGNAE (*Malignant Exostosis*)
Plate XXVI, Fig. 34.
SARCOMA GIGANTOCELLULARE (*Giant-celled*)—EPULIS
Plate XXVII, Fig. 35.

The tumors formerly called Sarcoceles owe their name to the fact that they have the appearance of fleshy masses on section. In distinction to carci-

nomas the sarcomas develop from the various connective tissue elements, with the exception of endothelium, and may, therefore, arise in the skin, subcutaneous tissue, fascia, periosteum, bone, nerves, and in the connective tissue of all other organs. Owing to the often very rapid growth the newly formed cells do not attain complete maturity, so that the sarcoma consists of imperfectly developed connective tissue. In its early stages it often resembles, microscopically, inflammatory granulation tissue, but by its rapid growth it soon assumes the appearance of a malignant tumor. The bulk of the sarcoma is formed of various connective tissue cells, while the interstitial fibrous tissue is scanty. The abundant formation of new blood-vessels is characteristic of sarcoma.

The transition of fibromas, especially those which arise from the connective tissue of fascia, and of other connective tissue tumors *e.g.* chondroma, into sarcoma has been demonstrated.

Patients often attribute these growths to various injuries, but there is no direct proof of this.

The pure sarcomas are classified according to their microscopic structure into round-celled, spindle-celled and giant-celled sarcoma. Those formed of various tissues are known as lympho-, myxo-, fibro-, chondro-, angio-, and glio-sarcoma. The pigmentary or melanosarcomas are placed in a special group.

Clinically, sarcomas are best divided into soft, many-celled, quickly growing, very malignant, easily recurring (medullary sarcoma, usually small round-celled sarcoma), and the hard, few-celled, slow-growing, less malignant forms (spindle-celled and giant-celled sarcoma). In the first form the soft consistence is due to the richness in cells and the scanty development of interstitial tissue. Compared with carcinomas, sarcomas are more circumscribed and at first almost completely encapsuled tumors, with borders as soft as the rest of the tumor.

Owing to frequent hemorrhages and softening in the interior of the sarcoma cystic cavities are formed which can be recognized by the presence of fluctuation (Figs. 25 and 30). Sarcomas situated under the skin gradually destroy and break through it and proliferate on the surface in a variety of forms. Fleshy reddish-brown parts alternate with yellowish-white, pulpy parts in these tumors. There are usually blood extravasations, both old and recent. The whole tumor has the appearance of a fungoid mass (Figs. 26, 27, 29 and 33). After a time these superficially proliferating growths break down and set up inflammation, so that the characteristic appearance of the sarcoma is lost, and, on the scalp and extremities, for example, it cannot be distinguished from a discharging soft carcinoma. As the sarcoma usually breaks through the skin and proliferates on the surface, so may it extend into all the deeper tissues, so that finally an enormous tumor is formed which may destroy the bones (Figs. 25, 27 and 33).

The second form, the slow-growing, few-celled tumors, resemble fibromas and often represent transitional forms (fibro-sarcoma). The latter sometimes occur as multiple nodules in the skin.

These tumors often occur in robust people in middle life (thirty to fifty). Very often sarcoma is congenital or appears in infancy (kidneys and testicles), also soon after puberty (mammary gland). The earlier the tumors appear, the more malignant they are as a rule. Multiple sarcomas are seen in the skin as pigmentary sarcomas (Fig. 31) and in the bones.

The soft sarcomas lead to metastases much more often than the hard forms. Metastatic deposits are formed by growth of the tumor into the large veins and the formation of emboli, which are carried to the lung, spleen, liver and brain. Dissemination by way of the lymphatics is almost completely absent. The latter are certainly often involved, especially in ulcer-

ated sarcoma and melanotic forms; also in sarcoma of bone.

By the entrance of the tumor cells into the blood stream and by the setting up of inflammatory processes a condition of fever is produced.

In many cases the body is so quickly affected by metastases that the patients soon succumb from severe anæmia. Unfortunately patients often come for treatment when there are already metastases in the lung causing pleural effusion and hemoptysis.

Differential Diagnosis. Sarcoma differs from carcinoma in the softer consistence of the tumor and its regular surface, and from benign tumors by its rapid growth. The distinction from syphilitic products is often difficult and sometimes not settled by microscopic examination, and according to *Esmarch* many growths were formerly extirpated as sarcoma which might have been cured by anti-syphilitic treatment.

Treatment. All tumors in which there is a suspicion of sarcoma should be removed as early and as radically as possible. As the tumors are sometimes encapsuled, operation has been unfortunately limited to enucleation in these cases; but, as in carcinoma, the tissue surrounding the tumor, which is already infiltrated by tumor cells, must be removed. In cases of soft, rapidly growing sarcoma of the extremities, the question of amputation and even disarticulation arises. In spite of operation recurrence is frequent; either locally or in the form of disseminated nodules, less commonly in the form of lymphangitis sarcomatosa. In the hard forms of sarcoma recurrence may also occur, in the form of soft growth, which is a most unfavorable sign.

Inoperable cases have been treated with the X-rays, but the action is only superficial (*Unger, Schlesinger*). By this treatment the superficial nodules are

destroyed, just as in intercurrent erysipelas, but the tumor continues to grow in the deeper tissues and in other places. Subcutaneous injections of arsenic and atoxyl are worth a trial, and iodide of potassium in large doses may be administered. Serum therapy has so far given no results.

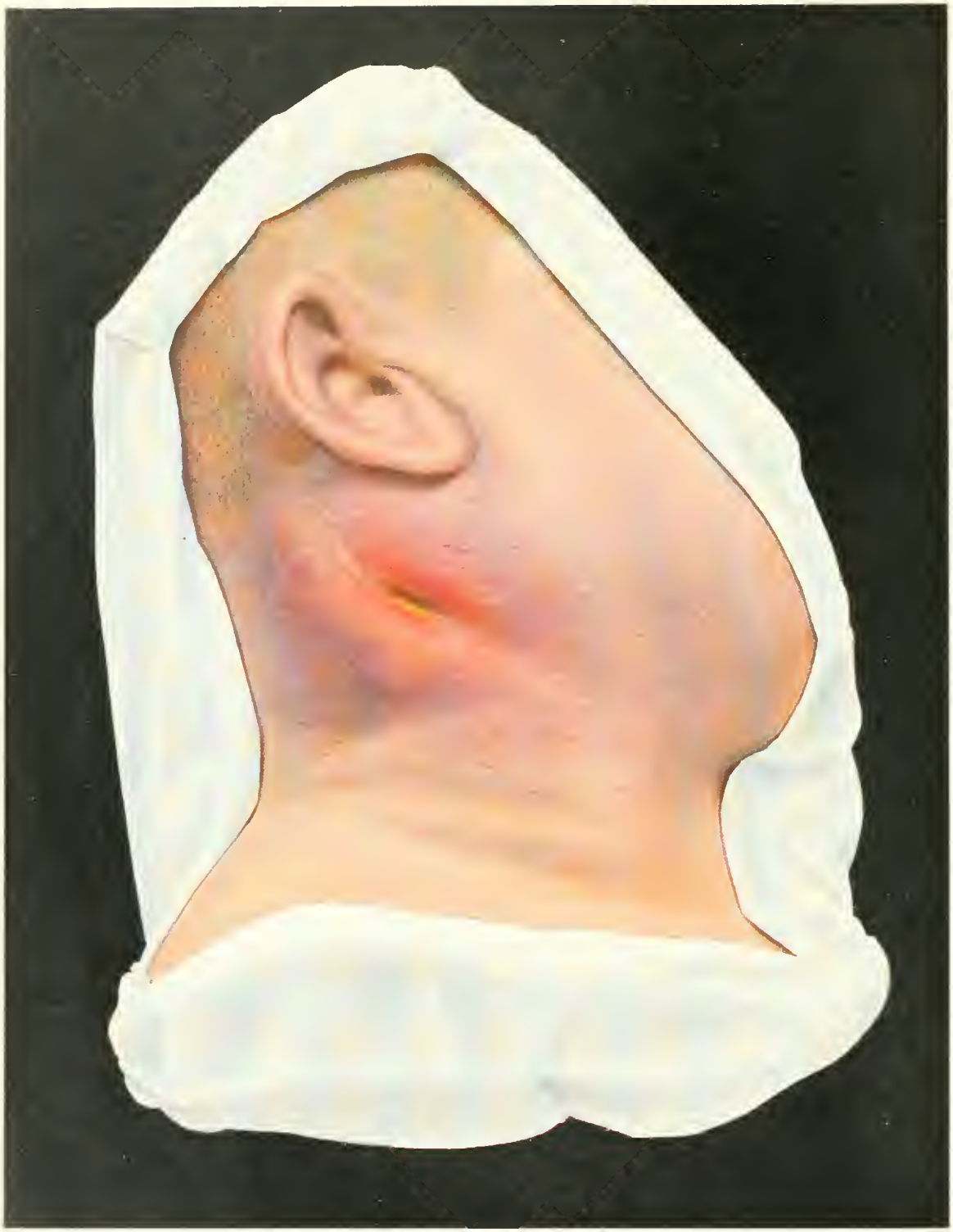

Fig. 24. Lymphosarcoma colli.

LYMPHOSARCOMA COLLI (*of Neck*)

Plate XVII, Fig. 24.

Clinically, the name lymphosarcoma is best applied to those sarcomas which originate in lymphatic glands, whether their cells have the character of lymph cells or arise from the stroma of the glands. This is all the more indicated as both forms of sarcoma can only seldom be distinguished from one another, clinically or microscopically. The seat of predilection of these tumors is the region of the neck, where the lymphatics are abundant. A diffuse nodular tumor quickly develops from a group of small, hard, movable glands.

The malignancy of these tumors is shown, especially in young individuals, by the continual formation of fresh nodules at the periphery, which coalesce with the main tumor and cause it to attain a considerable size. The unlimited growth into the neighboring tissues is characteristic. The capsule of the glands is quickly broken through, thus differing from lymphoma. The cervical fascia is destroyed and the sterno-mastoid muscle invaded. The skin is at first reddish, then bluish red or livid; it then becomes thin and gives way over the tumor. The exposed parts of the tumor rapidly break down from inflammation. The sarcoma grows into the deeper parts, especially into the internal jugular vein, giving rise to fatal organic metastases. The vagus nerve and the common carotid also become enveloped and destroyed by the tumor. Dyspnœa and dysphagia may be caused by pressure on the larynx and esophagus. The tumor extends downwards into the mediastinum and may even destroy the vertebræ.

Lymphosarcoma is distinguished from other tumors of the neck by its rapid growth in all directions, its breaking through to the exterior, and its sanious disintegration.

The diagnosis is usually not established in the early stages as the growth is hard and limited to the glands; microscopic examination is also inconclusive.

Differential Diagnosis. Malignant lymphoma (*Hodgkin's* disease, pseudoleukæmia) which usually begins in the neck, consists of small, multiple, encapsuled nodules which do not break down nor extend to the neighboring organs. There are generally also glandular enlargements in the axillæ, groins and mediastinum, and changes in the spleen and bone-marrow.

Leukæmic lymphoma can be diagnosed by the blood changes.

Tuberculous glands are characterized by the isolated groups of glands of different consistence—hard, soft, or fluctuating.

Syphilitic glands are at first hard, later on soft; but are not so extensive.

Branchiogenous carcinoma (*v. Volkmann*), arising from the remains of the epithelium of the branchial clefts, is very rare and appears as very hard, spherical tumors in the carotid fossa.

Metastatic carcinoma and sarcoma can be diagnosed by the presence of the primary tumors (scalp, esophagus, parotid, maxilla).

Actinomycosis may also cause hard infiltration of the neck, but the infiltration is diffuse and uniform, not nodular, and extends over the whole region of the neck.

The tumors affecting the sheaths of the blood-vessels, first described by *Langenbeck*, are to be regarded as lymphosarcomas which have involved the vascular sheaths at an early period.

Treatment. Extirpation of lymphosarcoma has only a chance of success by early diagnosis, and even then recurrence is frequent. For the removal of such extensive non-encapsuled tumors much intervention is necessary, in some cases including temporary ligature of the common carotid. As the internal jugular vein and vagus nerve are usually removed with the common carotid, with consequent disturbances (encephalomalacia, pneumonia), many prefer internal treatment with high doses of arsenic, or by the X-rays, by which means transient improvement may be obtained.

Fig. 24 shows an extensive lymphosarcoma of the neck. The tumor extends diffusely over the whole of the right side of the neck and is constituted by several nodular, irregular formations. The skin is broken in one place, in others it is thin and of a bluish-red color. There is a sanious discharge from the fistula. Pressure of the tumor on the large vessels has caused severe cyanosis, and pressure on the recurrent nerve hoarseness and asphyxia. In spite of treatment by arsenic and the X-rays the patient continued in a state of cachexia.

SARCOMA EPIPHARYNGEALE (*Epipharyngeal*)
POLYPOSIS NASI MALIGNA (*Malignant Nasal Polypus*)

Plate XVIII, Fig. 25.

In the naso-pharynx two kinds of growths claim special attention—fibromas, usually occurring in males between the twenty-fifth and thirtieth years, also called naso-pharyngeal polypi, arising from the basilar process—and sarcomas, which appear between the thirtieth and fiftieth years. *Langenbeck* separates tumors arising in the spheno-palatine fossa as retro-maxillary tumors, but after further extension they cannot be distinguished from the two mentioned above.

The fibromas, occurring at the earlier age, generally arise from the connective-tissue cells of the periosteum as pedunculated or sessile encapsuled tumors, which by extensive growth fill up all the spaces and apertures of the naso-pharynx, especially the posterior nares, cause atrophy of the bones by pressure, and break through into the nasal cavity, maxillary antrum and cranial cavity. On account of their great vascularity these growths, which in some places often take the form of cavernous tumors, are of much softer consistence than other fibromas. The tumors may ulcerate on the surface and give rise to exhausting hemorrhage. On account of their tendency to increase and the frequent occurrence of sarcomatous tissue in them, they are to be treated as malignant growths.

In older individuals, in the majority of cases, we have to do with true sarcomas arising from the periosteum or fascia (malignant naso-pharyngeal polypi), which extend to the posterior nares, the

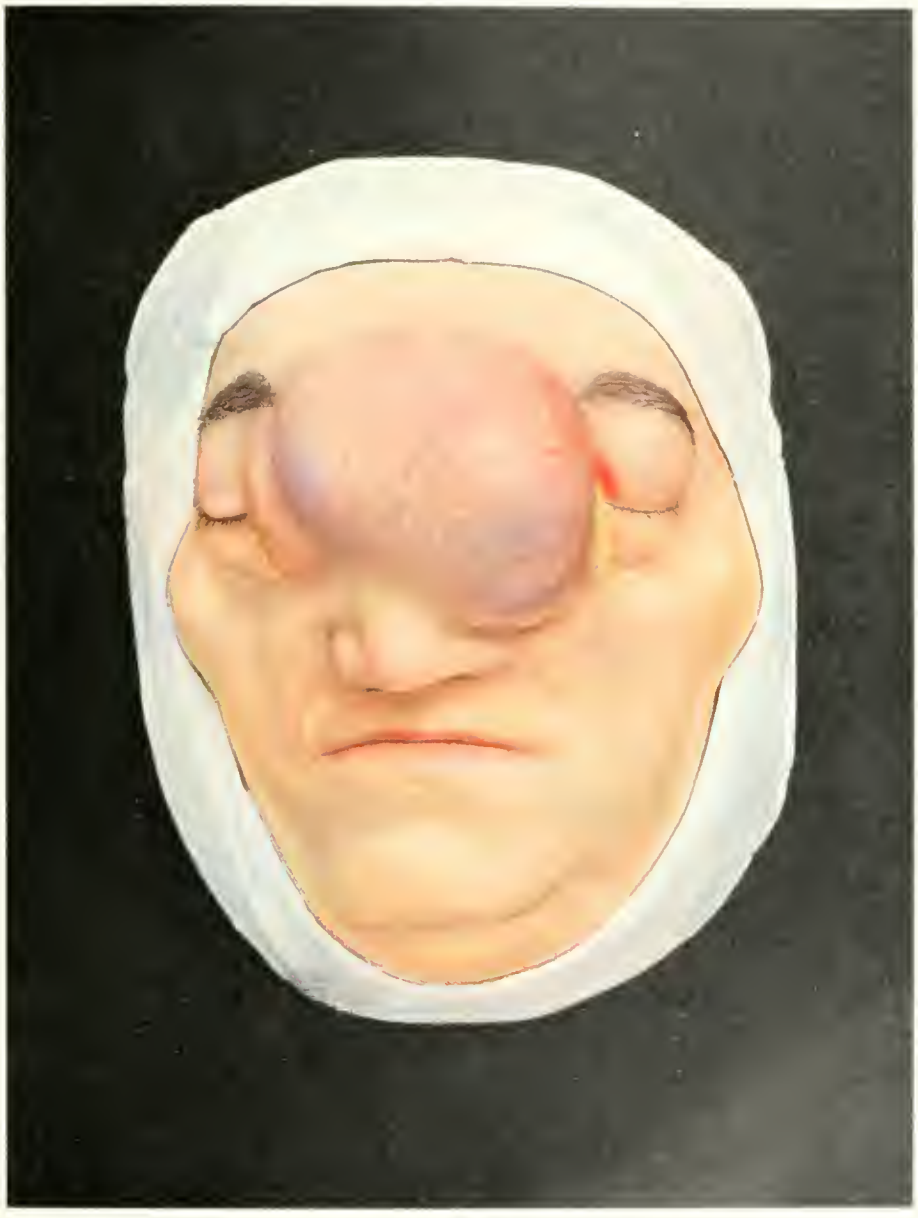

Fig. 25. Sarcoma epipharyngeale — Polyposis nasi maligna.

spheno-maxillary fossa, Eustachian tubes and larynx; not, however, as encapsuled tumors like the fibromas, but as soft, fungoid, sessile, firmly attached growths with irregular boundaries. Later on they grow very rapidly, causing destruction of the neighboring bones, and extend to the surface through the frontal sinus, nasal cavity and orbit, and internally to the brain. (Figs. 25 and 27).

Disintegration of the growth goes hand in hand with the advancing growth and the patient succumbs from the results of hemorrhage, septic infection, anæmia and organic metastases.

The clinical symptoms in fibroma and in commencing sarcoma arise from obstruction of the naso-pharynx. Continually keeping the mouth open suggests disease of the naso-pharynx. Owing to obstruction of the posterior nares the patients snore during sleep; they acquire nasal catarrh (often atrophic rhinitis) and have a nasal voice. As the tumor extends, obstruction of the Eustachian tubes causes deafness and pain in the ear; extension to the cranial cavity causes headache, somnolence and choked optic disk; extension to the orbit causes disturbance of vision, *e.g.* diplopia. Pressure on the facial nerve and trigeminal causes paralysis and severe neuralgia.

The diagnosis of these advanced sarcomas presents no difficulty. The soft, fungoid consistence of the whole tumor, the tendency to bleeding and the rapid growth are characteristic. In extensive sarcomas with commencing disintegration and discharge soft glandular metastases are found. The commencing sarcomas can be recognized by digital and rhinoscopic examination as irregular, rough, infiltrating tumors, which differ from the nodular encapsuled fibromas.

Differential Diagnosis. It is only in young individuals that other lesions can be confounded with true tumors of the naso-pharynx. Hypertrophied

tonsils and extensive adenoids cause similar symptoms, but digital examination and rhinoscopy will make the diagnosis clear. In very young children teratomas are seen (Fig. 146), which may be mistaken for sarcoma arising from the basilar process and extending to the face. However, teratomas are usually more or less encapsuled and only appear on one half of the face.

Retro-maxillary tumors manifest themselves at first by unilateral pain in the face, swelling of the cheek and fixation of the corresponding maxillary joint, but on further extension they cannot be distinguished from advanced tumors of the naso-pharynx, or from large tumors of the upper maxilla or orbit.

Treatment. The removal of adenoid vegetations is best effected by *Gottstein's* curette. Even extensive adenoid growths may disappear spontaneously at the age of puberty. Hypertrophied tonsils are to be removed by the tonsillotome. For small fibromas an oral method may be employed, by means of division of the soft palate and part of the hard palate (*Nélaton*, *Gussenbauer*) or by temporary division of the lower maxilla. The tumors should always be removed by incision into healthy tissues with the knife. In extensive fibromas and all tumors suspected of sarcoma, the naso-pharynx must be freely laid open, by temporary resection of the hard palate together with the alveolar process (*Partsch*), or by temporary resection of both upper maxillæ and raising up the nose (*v. Bergmann*). Previous tracheotomy and ligation of the external carotid on one or both sides (*Kocher*, *König*), is expedient in these sanguinary operations. That very large tumors can be removed by extensive operations with good results is shown by the experience of *v. Bergmann's* clinic. Even tumors which had extended through the base of the skull and caused symptoms of cerebral pressure were successfully

removed. Naturally, the earlier diagnosis is made by digital examination and rhinoscopy (excision for examination is dangerous on account of severe hemorrhage, and also useless) the more can these complicated operations be avoided, and the more frequent are radical cures. Inoperable tumors (Fig. 27) may be treated by the X-rays or by the administration of arsenic and morphia. When the tumors fungate externally the ulcerated parts must be cauterized and treated with moist disinfectant dressings. In the last stages tracheotomy must be performed, to save the patient from death by asphyxia.

Fig. 25 shows a malignant naso-pharyngeal polypus which arose from the basilar process and was at first covered by the mucous membrane of the epipharynx. The disease was of ten years' duration. Various polypi were removed, and also a larger tumor, after partial resection of the upper maxilla, without success. The sarcoma then grew almost exclusively forwards through the posterior nares and destroyed the whole bony framework of the nose. The fairly symmetrical growth on both sides of the middle line shows the origin from the basilar process. in distinction to the more lateral swelling of retro-maxillary tumors. It forms a soft, partly fluctuating growth with fungating borders which has begun to extend over both eyes. In some places the skin is so thin that it appears livid and transparent; in other parts it shows the great vascularity of the skin characteristic of sarcoma. The tumor, already disintegrating, is on the point of breaking through. The whole nasal cavity and the whole naso-pharynx on digital examination were found to be filled with soft, infiltrating tumor masses, which had displaced the soft palate downwards and forwards, so that the growth could only have been removed by very extensive interference. The tumor had also extended through the base of the skull.

ANGIO-SARCOMA CUTIS (*of Skin*)
Plate XIX, Fig. 26.

SARCOMA FUNGOIDES ORBITAE (*Fungating Sarcoma of Orbit*)
Plate XIX, Fig. 27.

Fig. 26. Round-celled and spindle-celled sarcomas of the face are rare; angio-sarcoma is more common. In this case the tumor is pedunculated and is characterized by its concentric, spherical formation. The base of the tumor is surrounded by a ring of epidermic scales. The surface of the tumor is of a red color and resembles exuberant granulations. It is slightly uneven and somewhat resembles a strawberry. The tumor is of very soft consistence, easily bleeding at the slightest touch. The malignancy is shown by its rapid growth. It is distinguished from carcinoma by the absence of glandular enlargement.

Differential Diagnosis. The tumor resembles in appearance two diseases—frambœsia tropica (or yaws) and botriomycosis. The initial lesion in yaws is, however, soon followed by a general eruption of similar frambœsiform growths. The granular growths in both yaws and botriomycosis remain superficial, while the sarcoma extends into the deeper tissues.

In mycosis fungoides multiple growths occur which may develop into tumors resembling sarcoma.

Treatment. Early and free excision. In the face the defect may be repaired by a plastic operation.

Fig. 27. A very extensive sarcoma involving the left half of the face and already extending to the right

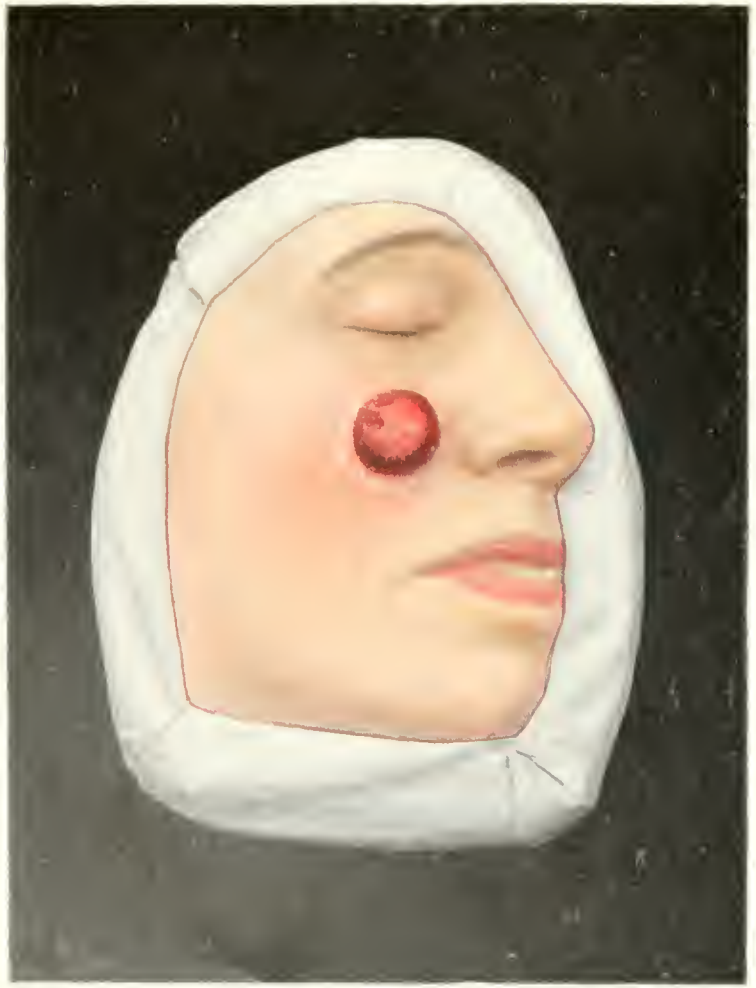

Fig. 26. Alveolarsarcoma cutis.

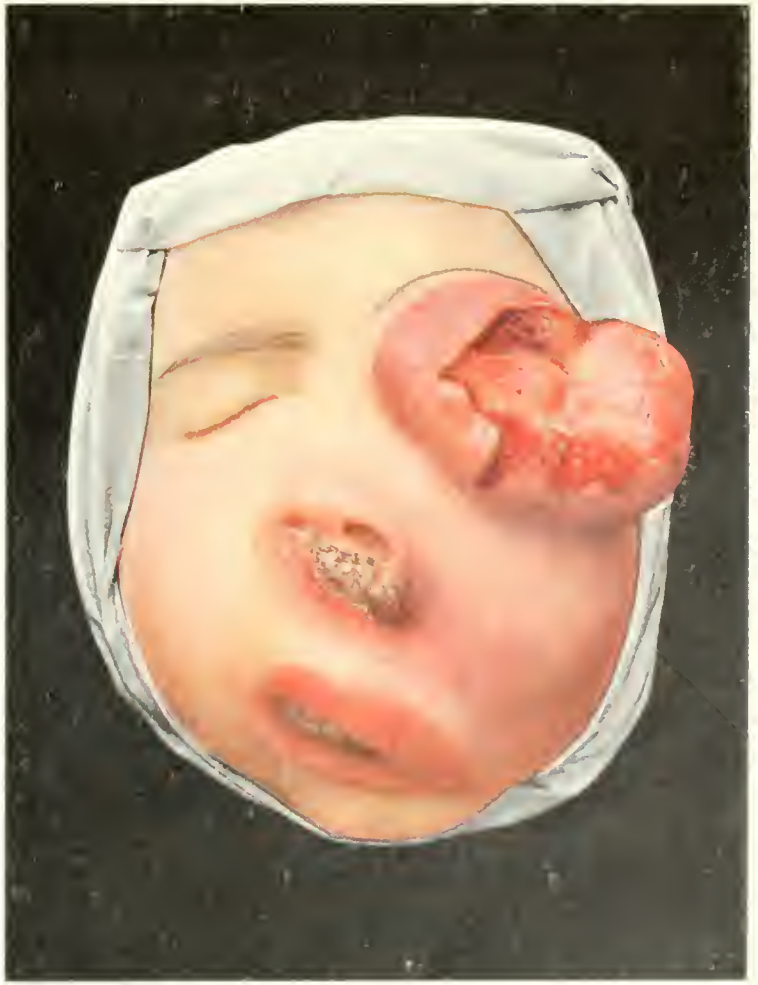

Fig. 27. Sarcoma fungoides orbitae.

half. Protruding from the orbit as a fungoid mass the tumor is characteristic of sarcoma (sarcoma fungoides). The soft edges have the typical reddish-brown color of sarcoma. In the places where the skin is destroyed soft masses with a fairly regular surface protrude, which differ from the ragged irregular ulcer of carcinoma. The whole of the tumor situated in the orbit is of soft, almost fluctuating consistence. In some parts the fungoid masses are breaking down and covered with sanious discharge. Blood crusts form on the ulcerations owing to the frequent hemorrhages in the tumor. The brown-colored skin is almost atrophied from pressure of the tumor. Sarcomatous masses protrude from both nostrils, and the whole buccal cavity and naso-pharynx is full of tumor masses, which have caused complete destruction of the bones of the face. The tumor has also extended through the base of the skull, causing extreme somnolence. It is no longer possible to decide whether it is a case of malignant naso-pharyngeal polypus, a retro-maxillary tumor, a maxillary tumor, or a periosteal sarcoma of the orbit. The last is the most probable, as the tumor was first observed in the orbit.

Treatment. Cf. Plate XVII.

MELANO-SARCOMA CUTIS (*of Skin*)
LYMPHOMATA SARCOMATOSA COLLI
(*Sarcomatous Lymphoma of Neck*)
Plate XX, Fig. 28.

This figure shows a hard, rough, movable, brownish-black tumor of the scalp, which rapidly developed from a pigmentary nævus in a man of nineteen. (Cf. Plate XVI, Fig. 23.) The hardness and rapid growth reveal a malignant tumor the nature of which (melano-carcinoma or melano-sarcoma) can only be decided by microscopic examination, for carcinoma and sarcoma of the scalp are very similar. The tumor has remained small and is covered by unbroken, pigmented skin.

The malignancy of the tumor is strikingly shown by the enormous enlargement of the regional lymphatic glands. Not only the glands of the nape of the neck, but also all the glands on the right side of the neck to the supra-clavicular fossa are transformed into soft nodular tumors. The consistence of these glandular tumors is so soft as to give the sensation of fluctuation (pseudo-fluctuation), which is characteristic of rapidly growing sarcomatous metastases. The patient rapidly succumbed after the appearance of metastases in the lungs (pleuritis exudativa).

The glandular metastases and innumerable nodules in the lungs and heart were white in color, the pigmentation of the mother tumor often being absent in the rapidly developing metastases of melanotic tumors.

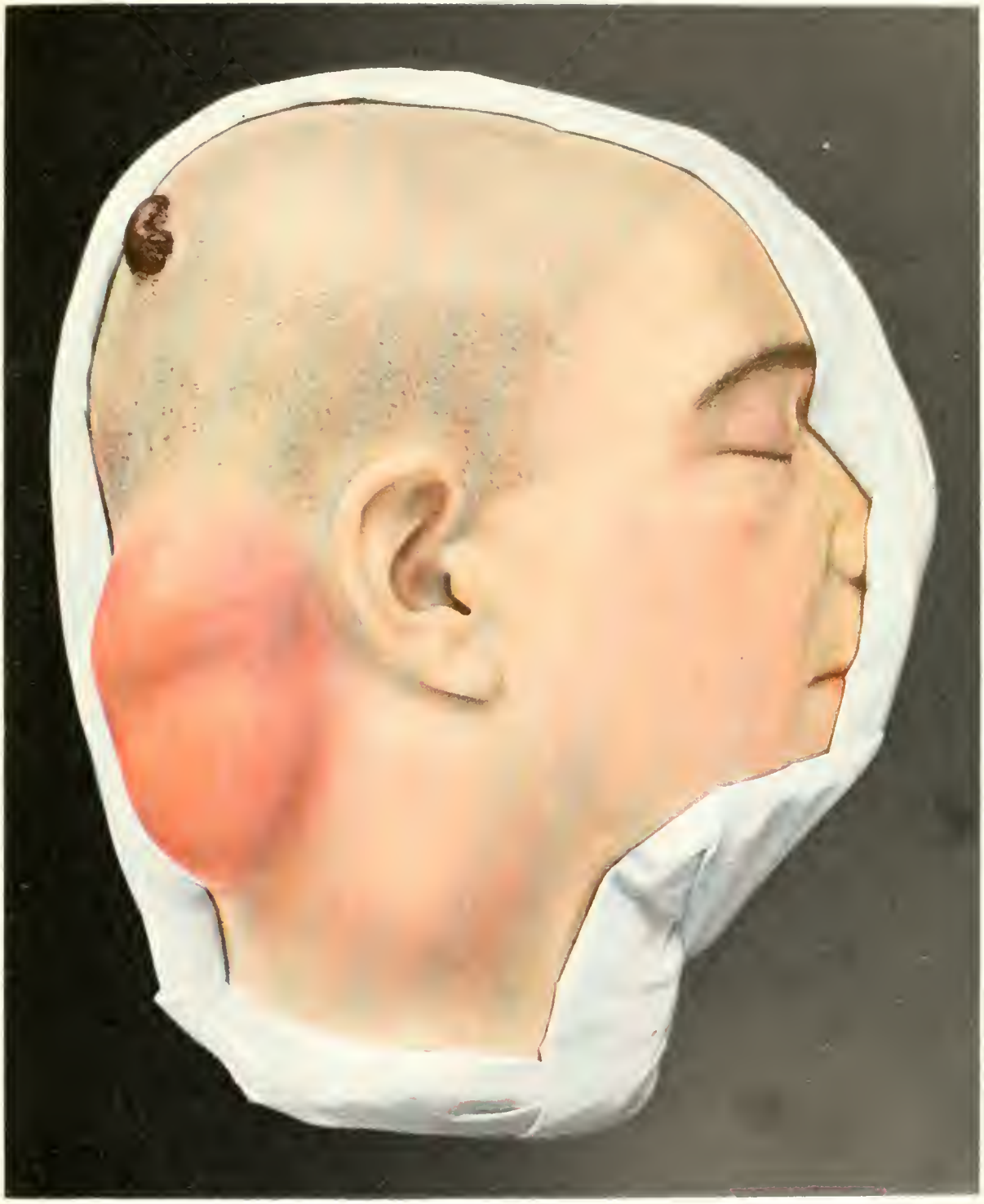

Fig. 28. Melanosarcoma cutis — Lymphomata sarcomatosa colli.

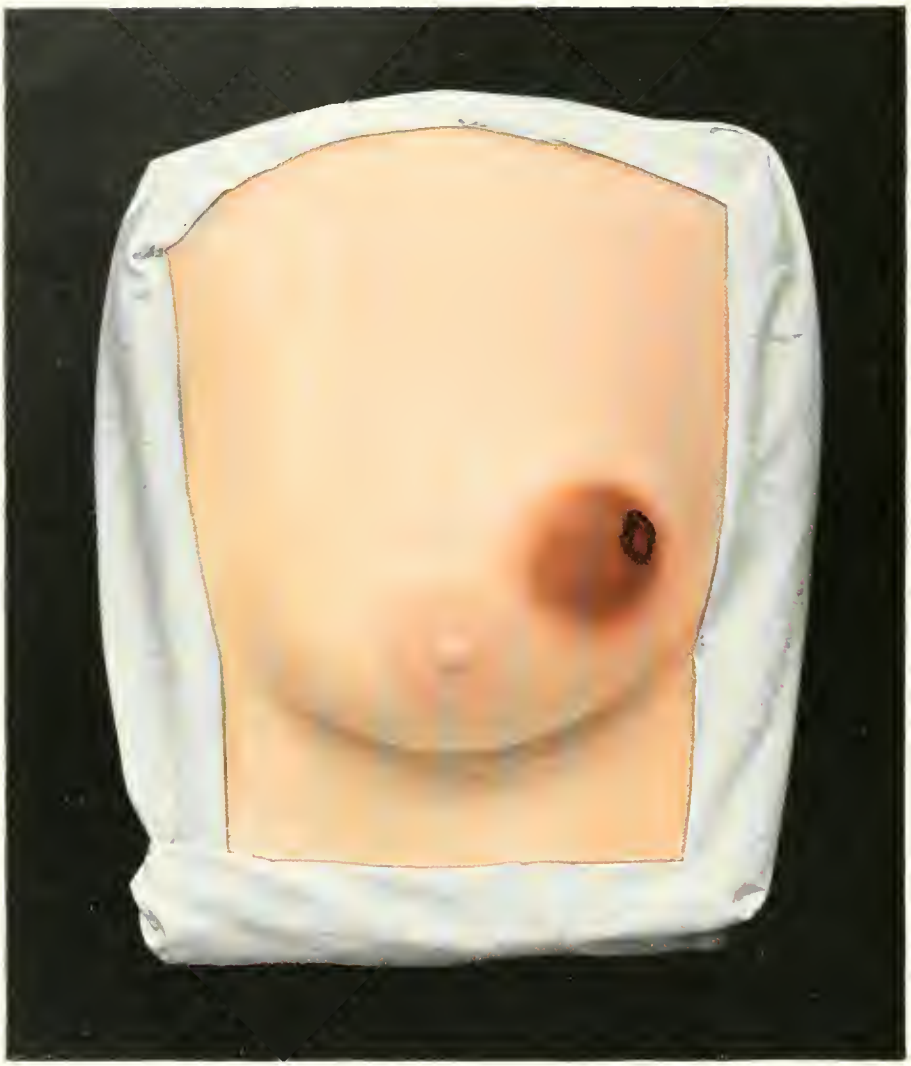

Fig. 29. Sarcoma mammae exulceratum.

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SARCOMA MAMMAE EXULCERATUM

(*Ulcerating Sarcoma of Breast*)

Plate XXI, Fig. 29.

SARCOMA MAMMAE CYSTICUM (*Cystic Sarcoma of Breast*)

Plate XXII, Fig. 30.

Sarcoma is much less common in the mammary gland than carcinoma (one hundred carcinomas to ten sarcomas, and half of these cysto-sarcomas, *v. Angerer*). All cell forms of sarcoma may be represented as well as mixed forms, such as myxo-, angio-, and melano-sarcoma.

They occur most often in young women. According to their composition they have different clinical signs. Spindle-celled sarcomas are of firm consistence and of slower growth than the soft, malignant, round-celled sarcomas and melanosarcomas. Cysto-sarcomas soon lead to extensive tumors which transform the breast into a large sac with fluid contents. The typical characteristics of sarcoma are generally present in the mammary tumors (Fig. 29).

Differential Diagnosis. Carcinoma is distinguished by the absence of any demarcation from the mammary tissue, while sarcoma is often encapsuled. Moreover, the clinical signs of carcinoma are so characteristic (cf. Plates V–XI) that confusion is hardly possible. Cysts of the mamma are usually situated behind the mammilla, multiple (in one or both mammæ), and not so large as true cysto-sarcoma. Fibroadenoma (to which the tumors incorrectly designated by *J. Müller* as cystosarcoma papilliferum phyllodes, rightly belong), which originate from the glandular tissue and show an abundant

development of connective-tissue cells, are slow growing, movable tumors, and are always encapsuled (cf. Plate XXVIII).

Treatment. Extirpation of the whole mamma as early as possible, with free exposure of the axilla. After early and extensive operations local recurrence is rare, and permanent cures more frequent than in carcinoma.

Fig. 29 shows a rapidly growing, round-celled sarcoma in a young girl. The tumor forms a soft, fairly circumscribed nodule in the mammary gland. That the part of the tumor lying in the mamma is considerably larger than the external appearance indicates is shown by the prominent veins. The tumor is near the mammilla but has caused no retraction of the nipple. It is freely movable over the pectoralis fascia. Externally it has involved the skin, which has the usual brownish-red color of sarcoma, has become very thin and is already ulcerated in one spot, from which repeated hemorrhage has taken place. The fungoid tumors, in distinction to carcinoma, have a smooth, uniform surface and resemble exuberant granulation tissue. There were no glands to be felt in the axilla. Treated by extirpation of the mamma and free exposure of the axilla.

Plate XXII, Fig. 30.

A cystic tumor occurring in a young woman, which has begun to displace the whole breast. There is no alteration in the nipple. The tumor is movable over the pectoral fascia, and in several places distinctly separate from the mammary tissue. The veins are enlarged from pressure of the tumor. The tumor has already invaded the skin, which has become very thin, and in some places fluctuating. The skin is colored brownish red and bluish green, and shows a network of vessels. As long as the skin is

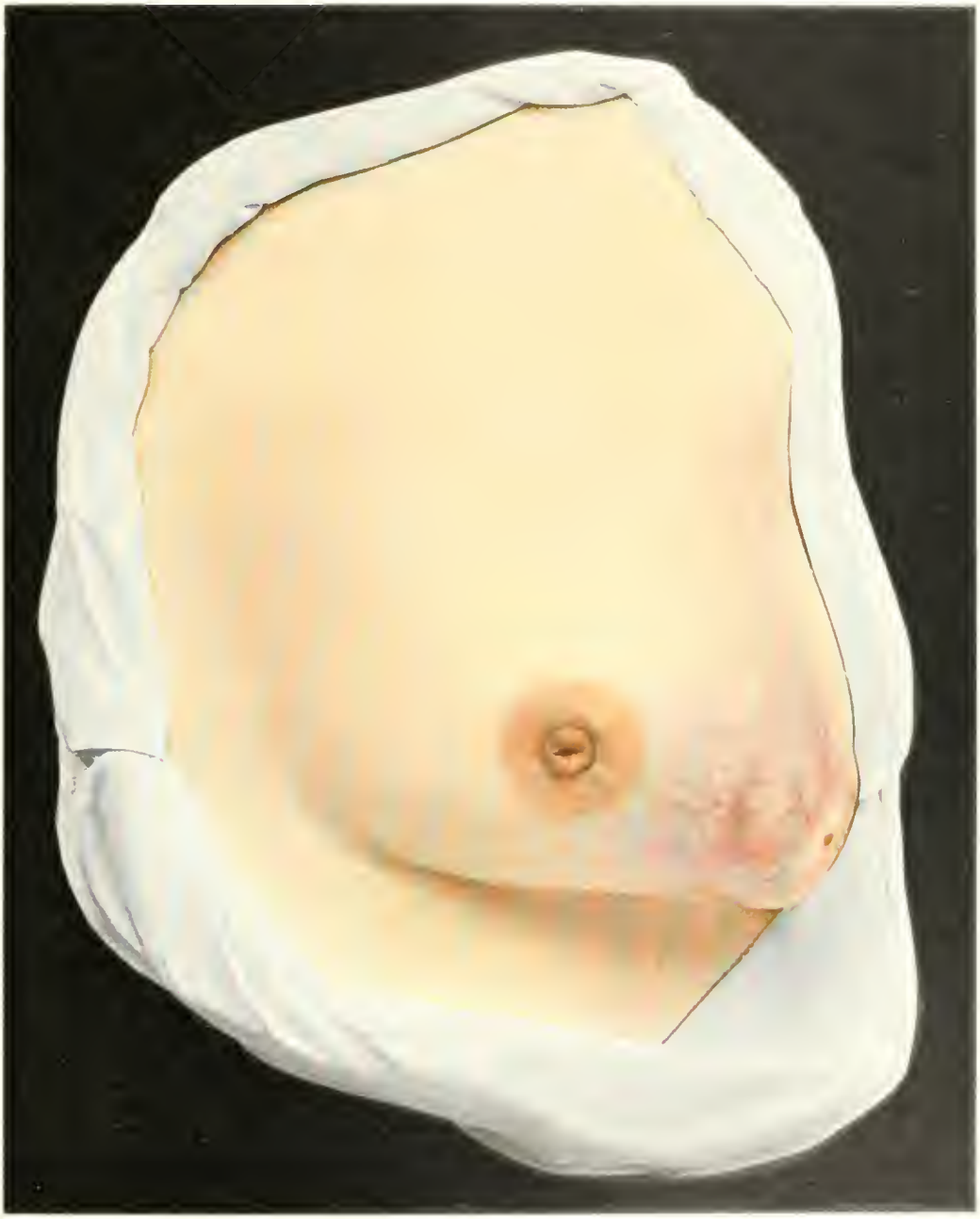

Fig. 30. Sarcoma mammae cysticum.

intact it can never be definitely ascertained whether it is a case of actual cavities filled with fluid, or the pseudofluctuation of gelatinous or mucoid sarcoma. Rapid growth and commencing soft glandular swellings in the axilla point to the diagnosis of a cystosarcoma.

Treatment. Extirpation of the mamma and removal of the axillary glands.

SARCOMA CUTIS MULTIPLEX (*Multiple Sarcoma of Skin*)

Plate XXIII, Fig. 31.

Multiple sarcomas of the skin, pigmented or colorless, may be congenital and then usually cause death after spreading over the whole body. Melanotic sarcomas arising from nævi and warts and the forms appearing in the skin as multiple nodules occur in middle life. In old people the multiple pigmentary sarcoma first described by *Kaposi* is found (hemorrhagic sarcoma of *Köbner*). Multiple sarcomas of the skin always appear in a characteristic form, as red spots which soon become nodules. The nodules increase in size and become confluent, thus forming a tumor which is at first movable over the underlying tissues. Later on the skin desquamates and becomes red, bluish or livid, then browner after repeated hemorrhages, and may finally ulcerate. The skin over pigmentary sarcomas is bluish black.

Besides the ulceration of the nodules, spontaneous resolution is possible, complete or partial, leaving a cicatrix. The nodular tumors may in some cases remain the same size for years. The tumors are always circumscribed, and are of soft or firm consistence according to their composition. Soft nodules tend to disintegration, hard nodules to atrophy and cicatrization. The former are very malignant and soon lead to death from glandular and organic metastases; the latter, by their multiplicity, after some years cause cachexia, which with metastases leads to a fatal issue. The skin of the whole body between the nodules is often of a dirty sallow color (Fig. 31). Small spots and elevations on the skin point to the development of fresh sarcomatous nodules.

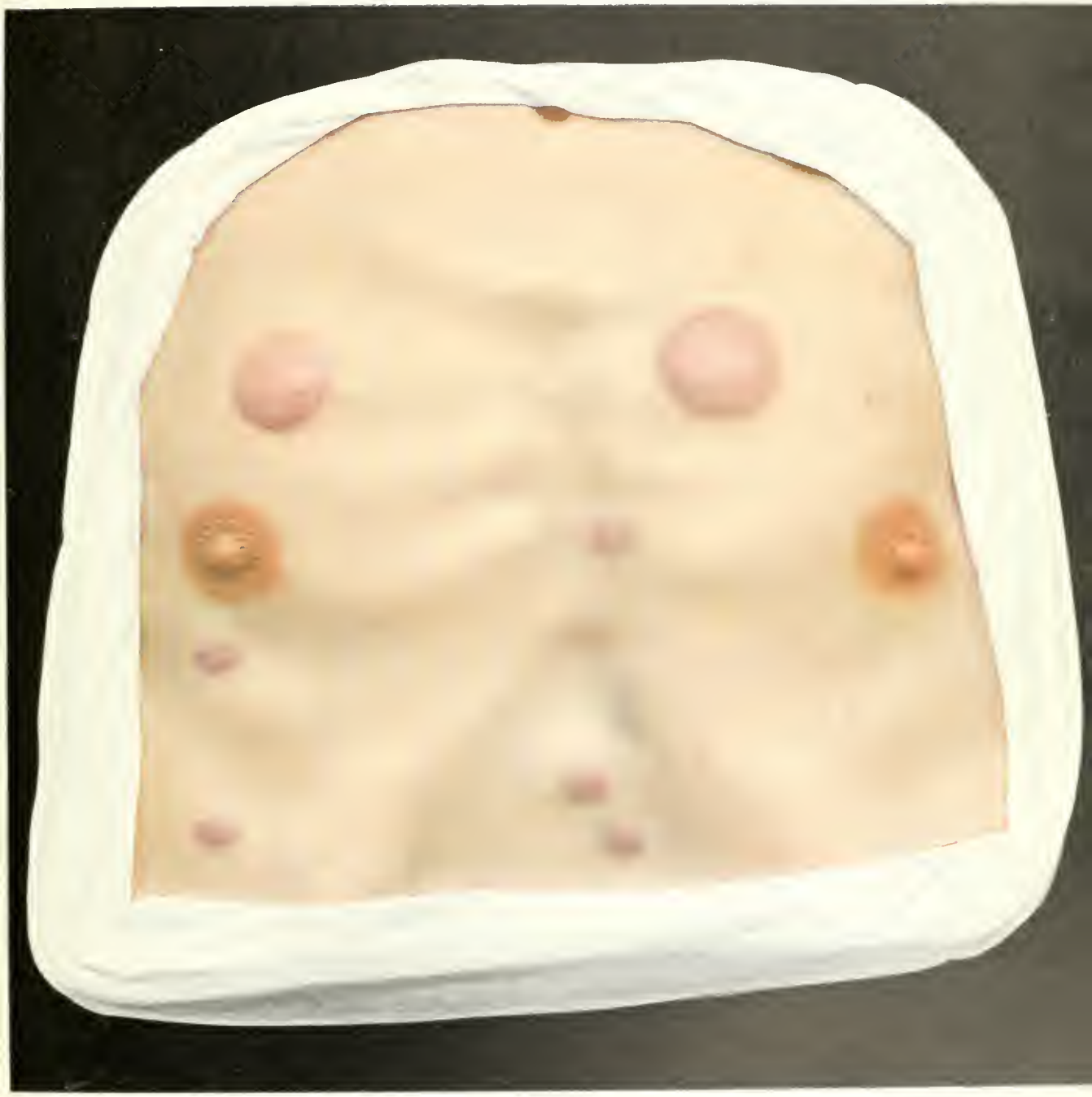

Fig. 31. Sarcoma cutis multiplex.

Sarcoma multiplex hemorrhagicum pigmentosum appears in the form described above, but first of all on the lower extremities, in the form of reddish nodules which often cause much itching. Tumor formation goes hand in hand with œdematous infiltration which extends over the whole leg and prevents the patient from walking. Desquamation of the skin on the surface of the nodules occurs along with cornification of the epidermis. Cicatrices form in the skin from atrophy of the nodules. Other regions of the body are unaffected, except the peripheral parts of the upper extremity. There is no enlargement of the lymphatic glands. The disease runs a progressive course, and in spite of the spontaneous resolution of some of the tumors, finally causes death by marasmus.

Microscopic examination shows a pure sarcoma with abundant blood-vessels, which often gives rise to organic metastases. As this form occurs exclusively in old people, arteriosclerosis may, perhaps, account for the origin and course of the disease. (*Köbner, Schlesinger*).

Differential Diagnosis. Primary multiple sarcomas must not be confounded with secondary sarcomatous growths in connection with a primary cutaneous sarcoma or a sarcoma of the internal organs. The tumors of mycosis fungoides are more likely to be mistaken for sarcoma, as they also develop from red, uneven spots, and form granulation tumors of a brownish-red color which in the later stages tend to ulceration and cachexia; but mycosis fungoides is of much slower growth than sarcoma. Syphilitic and tuberculous granulomas can hardly be confounded with sarcoma on careful examination.

Treatment. Preventive treatment of multiple sarcoma consists in the removal of all nævi which begin to take on rapid growth. In already existing

multiple pigmentary sarcomas excision is generally useless, and should only be performed when the tumors are few in number and the blood-vessels free from melanin. After excision of multiple sarcomas, especially melanosarcomas, death often follows from rapid dissemination and organic metastases. Hence the X-rays, large doses of arsenic (internally or subcutaneously) have been employed for multiple cutaneous sarcomas, in the same way as for mycosis fungoides. A permanent cure, however, is not to be expected as the prognosis of these multiple sarcomas is always bad.

Fig. 31 shows a case of multiple sarcoma of the skin affecting the whole of the thorax, abdomen and back. Some of the nodules have already atrophied leaving cicatrices. The new growth of nodules, however, exceeds the atrophy so that the patient became more and more cachectic in spite of treatment.

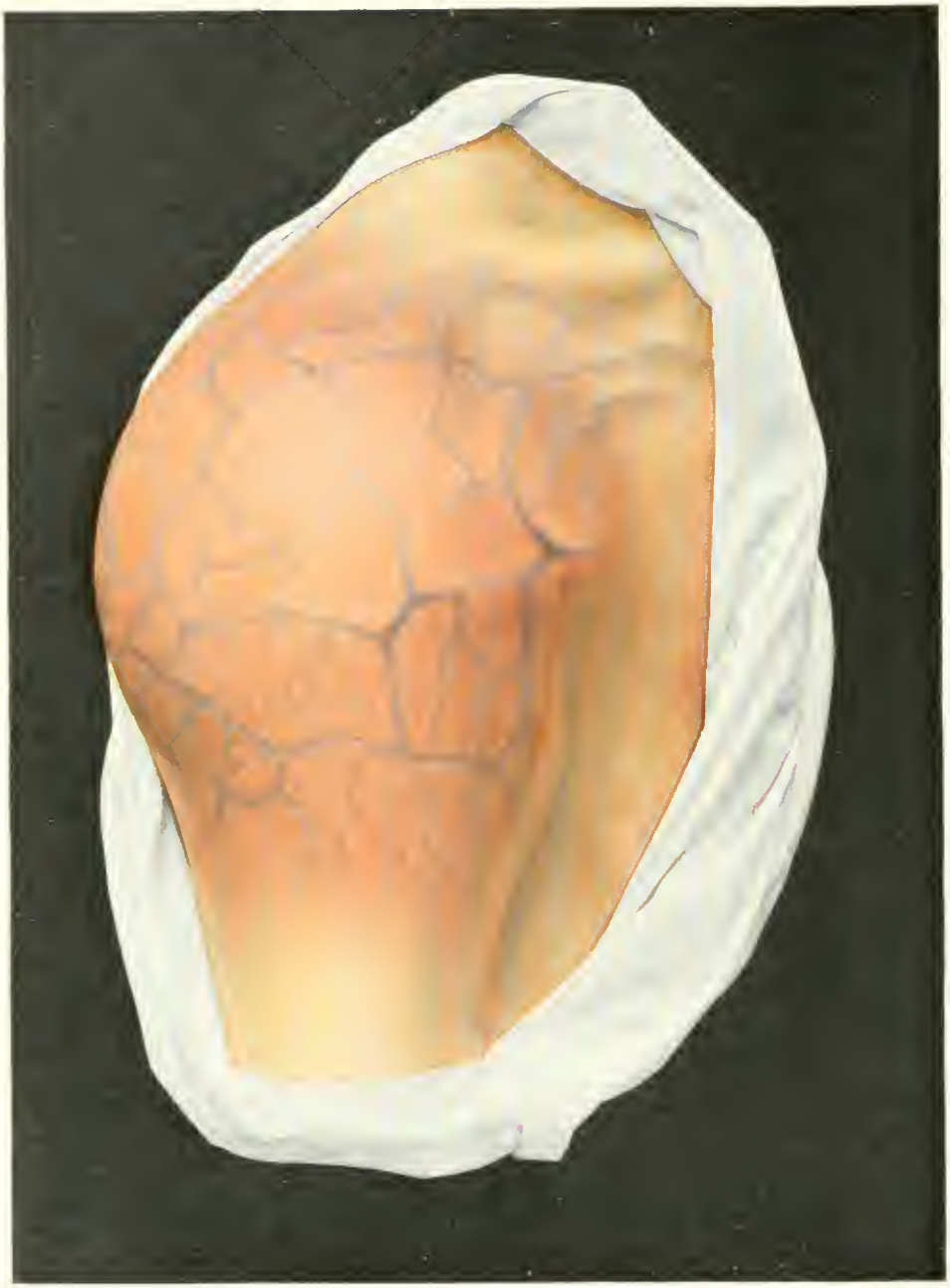

Fig. 32. Sarcoma humeri periphericum.

SARCOMA HUMERI PERIPHERICUM

(*Peripheral Sarcoma of Humerus*)

Plate XXIV, Fig. 32.

Sarcomas arising from the bones are of special interest on account of their frequency.

Osteo-sarcomas are best divided into peripheral and central; the latter may arise from the cortical, spongy or medullary portions. Division into periosteal and myelogenous tumors is clinically impossible, and the word myelogenous may be replaced by osteal. Tumors which appear clinically to be periosteal often arise from the superficial layers of the cortex. By the use of the X-rays it is more easy to divide them into peripheral and central tumors; this leaves open the possible origin of the sarcoma from any part of the bone, and this can only be conclusively settled by section of the bone after removal. This classification is all the more rational because sections of preparations which were clinically regarded as periosteal sarcomas show that these arose from small foci in the medullary cavity. Periosteal tumors may extend into the medullary cavity and so simulate osteal tumors. In extensive tumors the origin of the tumor from any definite part of the bone cannot as a rule be established.

Both forms have special seats of predilection: in the long bones, the neighborhood of the epiphyses *e.g.* the upper end of the humerus (Fig. 32), the lower end of the femur, especially the internal condyle, the head of the tibia, the lower end of the radius; the flat bones, especially the scapula and bones of the skull. Both forms also grow in a globular form involving the whole circumference of the bone and

finally its whole thickness. They appear at puberty and during the whole period of growth, generally in young and robust individuals.

Both forms are distinguished by the fact that they soon break through their own capsule and that of the bones and then extend into the neighboring joints and muscles, especially the muscular insertions into the bones, and into the veins, forming eventually enormous tumors which break through the skin and appear as fungoid masses. The superficially situated tumors have a tendency to frequent hemorrhage and destructive inflammation. Primary sarcomas of bone are very rare and are sometimes confounded with sarcoma-like changes in the bones which result from ostitis fibrosa; also with formations which do not belong to tumors in the strict sense, but are known as myelomas (especially in the blood-forming vertebral bodies).

Microscopically, spindle cells are often found in peripheral sarcoma, and giant cells in central sarcoma. The other forms of sarcoma cells are also present.

The X-rays, in peripheral sarcoma, show little change in the cortex. In central tumors, especially those arising from the medullary cavity, they often show spherical transparent spaces in the interior, while the cortex is very thin and excavated—forming a shell—in the same way as in bony cysts, osteomyelitic abscesses, isolated tuberculosis and gumma.

In the early stages the diagnosis of osteo-sarcoma is difficult. The peripheral tumors are naturally more easy to diagnose, as they present a rapidly growing tumor firmly attached to the bone, with irregular boundaries towards the muscles. Rheumatic pains and effusion into the joints frequently occur when the tumors are situated near the joints. The nearer the sarcoma approaches the skin the easier it is to recognize the superficial tumor masses, which infiltrate the soft tissues, and consist of cells

only without bony infiltration. Swelling of the cutaneous veins occurs early from pressure of the tumor on the vessels (Fig. 32), while the skin becomes reddish brown, thin and almost transparent, especially when the tumor is attached to it.

Slow-growing central sarcomas can only at first be diagnosed by the X-rays, later on they present themselves as hard spheroidal swellings like billiard balls. The more they extend and approach the skin, the thinner becomes their bony shell, which finally gives the sensation of parchment crepitation, first described by *Dupuytren*. Central tumors are often first diagnosed by the occurrence of spontaneous fracture. Extensive forms, which assume a more spindle-celled formation are easy to recognize. Through growth of the tumor into the joints and muscles, typical functional derangements are produced, and separation of the epiphyses. Metastases in the lungs develop early. Disintegration of the tumor cells gives rise to fever, especially in rapidly growing, small, round-celled sarcomas.

Differential Diagnosis. Parosteal sarcomas are easily mistaken for peripheral sarcoma, and are often impossible to distinguish by the X-rays. They are often of very soft consistence, and were formerly called encephaloid.

Chondrosarcoma only occurs in the neighborhood of the joints and forms irregular nodular tumors (Fig. 34).

Sarcomas situated near the large vessels and pulsating with them, may be mistaken for aneurism, but the X-rays will assist the diagnosis. Central sarcomas have been wrongly considered as aneurism of the bone, owing to their vascularity and their reddish-brown color on section, which is due to frequent hemorrhages.

Myelomas are multiple and occur chiefly in the vertebræ.

Metastatic carcinomas, which occur especially in the neck of the femur after mammary carcinoma in women, and in the head of the humerus after carcinoma of the thyroid gland (*v. Eiselsberg*), must be diagnosed by the primary growth.

Osteo-sarcomas may possibly be confounded with inflammation of joints, rheumatism, osteo-myelitis, syphilitic and tuberculous processes; but in most cases the diagnosis can be made by the history of the case, by the X-rays, by anti-syphilitic treatment, and in osteomyelitis by search for hemolysin (*Bruck*, *Michaelis*, *Schultze*). The uninterrupted diffuse growth should always raise the suspicion of malignant tumor. In doubtful cases an exploratory incision may be made.

In all cases the prognosis is very bad. The harder forms of sarcoma (spindle-celled and giant-celled) sometimes have a better prognosis. The soft, round-celled sarcomas are the most malignant on account of their rapid growth and early metastasis.

Treatment. The earlier operative treatment is undertaken, the more likely is a radical cure.

Small, central sarcomas can be removed by the chisel, and the medullary cavity scraped. Larger circumscribed tumors still confined to the bone can be removed by free resection of bone. The defect can be repaired by bone grafting (auto- or heteroplastic).

If the sarcoma has already invaded the muscles amputation must be performed. When the tumor is near the joint of one of the bones of the extremities, disarticulation is necessary; when in a flat bone total extirpation.

Inoperable sarcomas are to be treated according to the rules for inoperable tumors (cf. Plate XVII).

Fig. 32 shows a peripheral sarcoma of the upper end of the humerus in a young individual. The

soft tumor has extended under the skin, in which the brown coloring and extensive network of dilated veins are very marked. The lower borders of the fusiform tumor are irregular and send processes here and there into the muscles. The tumor has destroyed the head of the humerus and has broken through into the joint, in which there is effusion. The function of the joint and upper arm is destroyed. The supra-clavicular glands are enlarged. Posteriorly the tumor has extended to the scapula region. The X-rays showed complete destruction of the upper part of the humerus. As there was no evidence of organic metastases, the arm and shoulder girdle (scapula and outer half of the clavicle) were removed after section through the middle third of the clavicle and ligation of the subclavian artery and vein. The axillary and supra-clavicular glands were also removed.

On section, the whole of the upper portion of the humerus was found to be transformed into a large tumor, the central parts of which were hard from bony infiltration, while the periphery was soft and fungoid. The tumor was a round-celled sarcoma, but it was too extensive to decide from which part of the bone it originated.

SARCOMA FASCIAE EXULCERATUM

(*Ulcerating Sarcoma of Brachial Fascia*)

Plate XXV, Fig. 33.

Fascia and the sheaths of blood-vessels are often the starting point of sarcomas; not only of pure round-celled and spindle-celled sarcomas, but more often of mixed forms—myxosarcoma and fibrosarcoma. Fibrosarcomas are characterized by their firm consistence and slow growth; they are frequently circumscribed and partly encapsuled. Myxosarcomas are characterized by their softness and rapid growth without encapsulation. The pure sarcomas appear as soft, many-celled, rapidly growing tumors, or in a harder form which is of slower growth and not so malignant.

In the early stages of fascial sarcomas (fascia of the arm, fascia lata, abdominal fascia) we find small tumors fixed to the fascia, but movable over subjacent tissues and under the skin. The skin is soon involved and becomes tightly stretched over the tumor and pigmented, and finally the tumor breaks through it. At the same time the muscles and eventually the whole section of the body are infiltrated with tumor substance (bones, joints, peritoneal cavity). The chief growth, however, takes place on the external surface in the form of nodular fungoid tumors which exhibit all the characteristics of sarcoma. They are of soft consistence, both in the center and at the periphery; the surface is much smoother than in carcinoma, bleeds easily on account of its numerous blood-vessels, and is covered with sanious discharge. Nodules succeed one another till an enormous cauliflower growth is formed (Fig. 33).

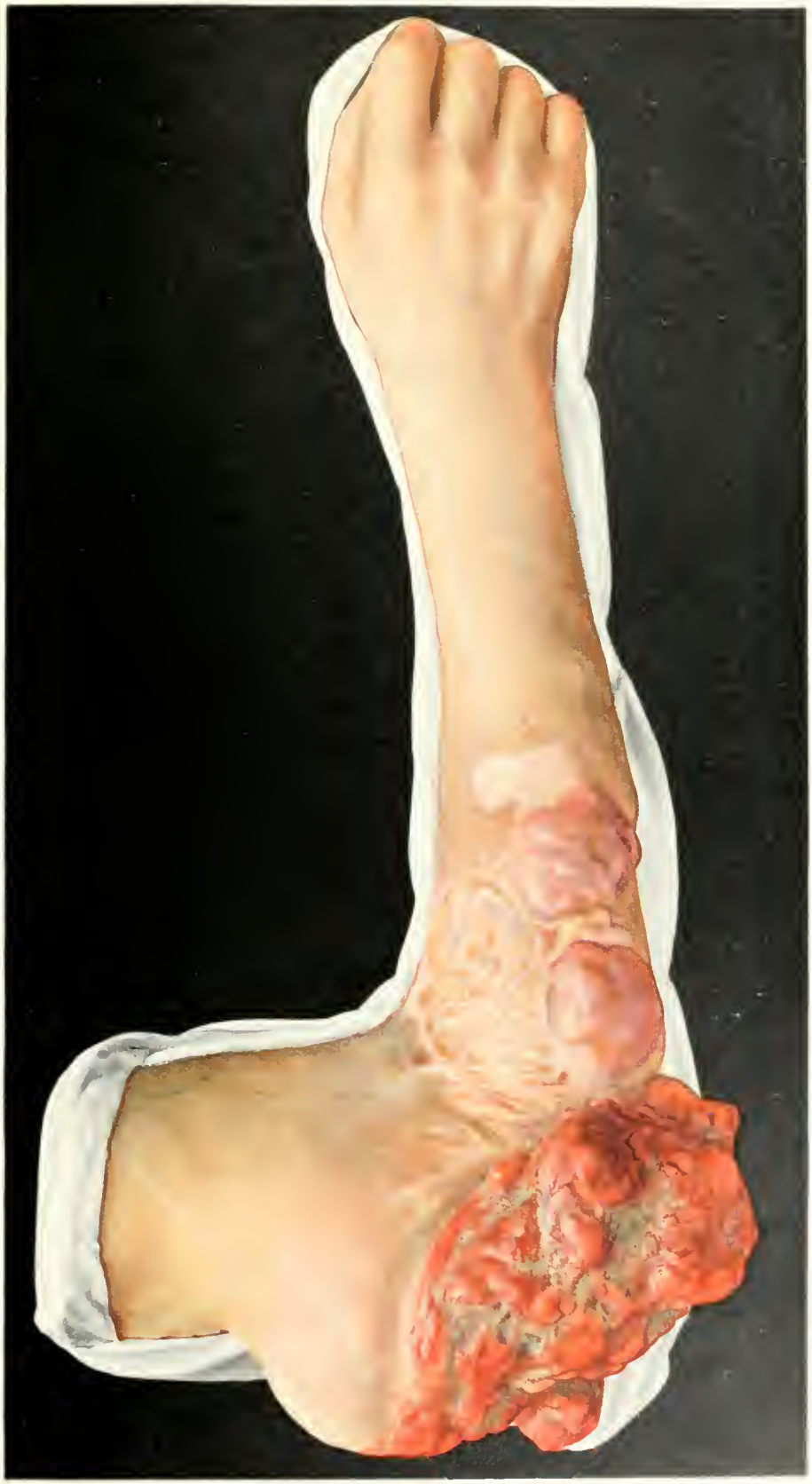

Fig. 33. Sarcoma fasciae brachii exulceratum.

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Ulceration of the tumor is followed by regional glandular metastases, organic metastases, fever and severe anæmia.

Differential Diagnosis. These rapidly growing malignant tumors are so typical in their situation and development that it is only on the scalp that they can be mistaken for ulcerating carcinoma. Sarcomas of the scalp often have hard borders with deep fissures as in carcinoma, and also give rise to early glandular enlargement.

Treatment. Small, slow-growing sarcomas can be removed by free excision, but local recurrence is frequent. In extensive, and especially in ulcerated, tumors of the extremities amputation is indicated. Tumors which arise in the abdominal fascia often become inoperable owing to extension to the peritoneal cavity.

Fig. 33 shows a rapidly growing, recurrent, ulcerated sarcoma of the fascia of the arm. The younger nodules are covered by livid skin, which is intact in some parts and thin in others. In other parts there are white cicatrices left by former operations. The X-rays showed that the sarcoma had extended to the bone. Owing to the growth having broken into the elbow joint, this was fixed in the rectangular position. There were some small, soft, enlarged glands in the axilla. Amputation through the arm was performed, with removal of the axillary glands.

CHONDROMYXOSARCOMA—EXOSTOSES MALIGNAE

(*Malignant*)

Plate XXVI, Fig. 34.

Chondrosarcomas are situated on or near the joints. Most frequently they arise from the head of the tibia or the upper end of the humerus, also from the lower end of the radius. They may also originate from previous chondromas of the phalanges, metacarpal and metatarsal bones. They generally form large, nodular, hard tumors consisting of hyaline cartilage, osseous, mucoid and sarcomatous tissue and contain cystic cavities due to softening and hemorrhage. They then resemble in appearance benign, cystic chondrofibromas.

They often form rapidly growing tumors which destroy the bones and joints and give rise to sarcomatous metastases containing no cartilage. Their prognosis is, therefore, very bad. In young individuals they cause disturbance in growth (shortening, etc.). Spontaneous fractures are frequent in the forms which show an abundant development of sarcomatous tissue and much cystic degeneration. In chondromas arising from cartilaginous exostoses, which, like the chondromas of *Virchow*, are due to arrested development of the skeleton and disturbances in growth, chondrosarcomas may also develop. The tumors are so typical that they cannot be mistaken for other growths.

Fig. 34 shows a nodular tumor of almost bony hardness arising from the tibia. Some portions of the tumor are soft. The tumor has pushed forward under the skin, which has become thin and livid, and

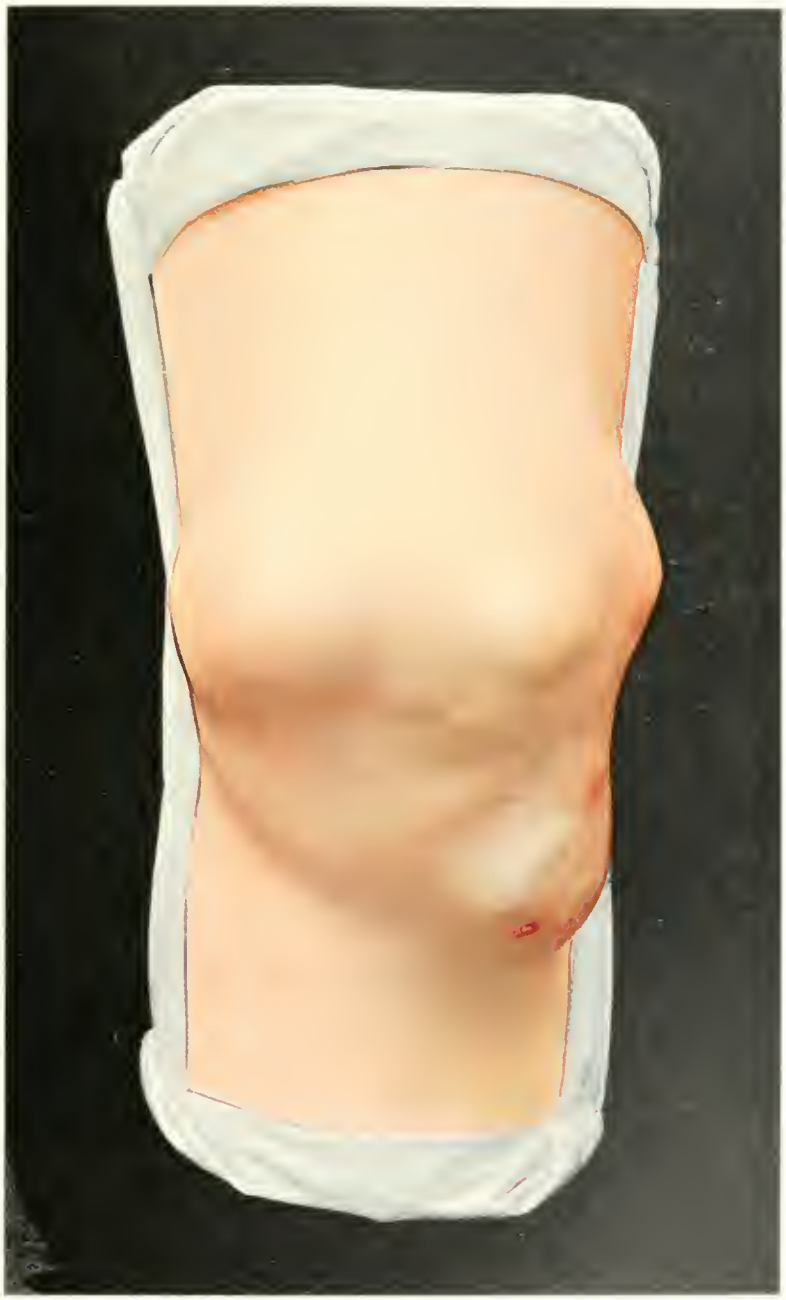

Fig. 34. Chondromyxosarcoma — Exostoses malignae.

is broken through in some places through which the tumor is beginning to discharge. The movements of the knee joint are very limited. No glandular or organic metastases were found.

Treatment. Removal of the sarcomatous exostoses, and resection of the joint, if necessary. In large tumors, amputation and disarticulation. Prophylactic treatment consists in the removal of rapidly growing exostoses and chondromas.

SARCOMA GIGANTO CELLULARE (*Giant-celled*)—EPULIS

Plate XXVII, Fig. 35.

The name epulis has been given to sessile or pedunculated fibrosarcomas with numerous spindle and giant cells, arising from the periosteum or alveolar connective tissue of the upper and lower jaw. They are hard or soft tumors according to the nature of the cells, with a smooth surface covered by mucous membrane, of rounded form and the size of a walnut. They grow rapidly in women during pregnancy. In rare cases they are ulcerated. In children and young people they occur equally in both sexes. They often arise in the spaces between the teeth, and then have the impressions of the neighboring teeth on their surface. Sometimes they develop from the lateral surface of the alveolus and then grow over the teeth, usually the molars, which they may loosen. They are very vascular and bleed easily, but cause no other trouble.

The tumors, although they are sarcomas, have usually a good prognosis, for their growth remains circumscribed, rarely involves the bone and gives rise to no glandular or organic metastases. They only assume a malignant character by their frequent recurrence after incomplete operations.

Differential Diagnosis. Polypi of the gums arising from alveolar fistula and bad teeth do not attain the size of epulis. The flaccid fibromas of the gum seen in leontiasis ossea do not form globular tumors, and are only slightly vascular.

Carcinomas occur at a later age, seldom arise

Fig. 30. Cavernoma linguae.

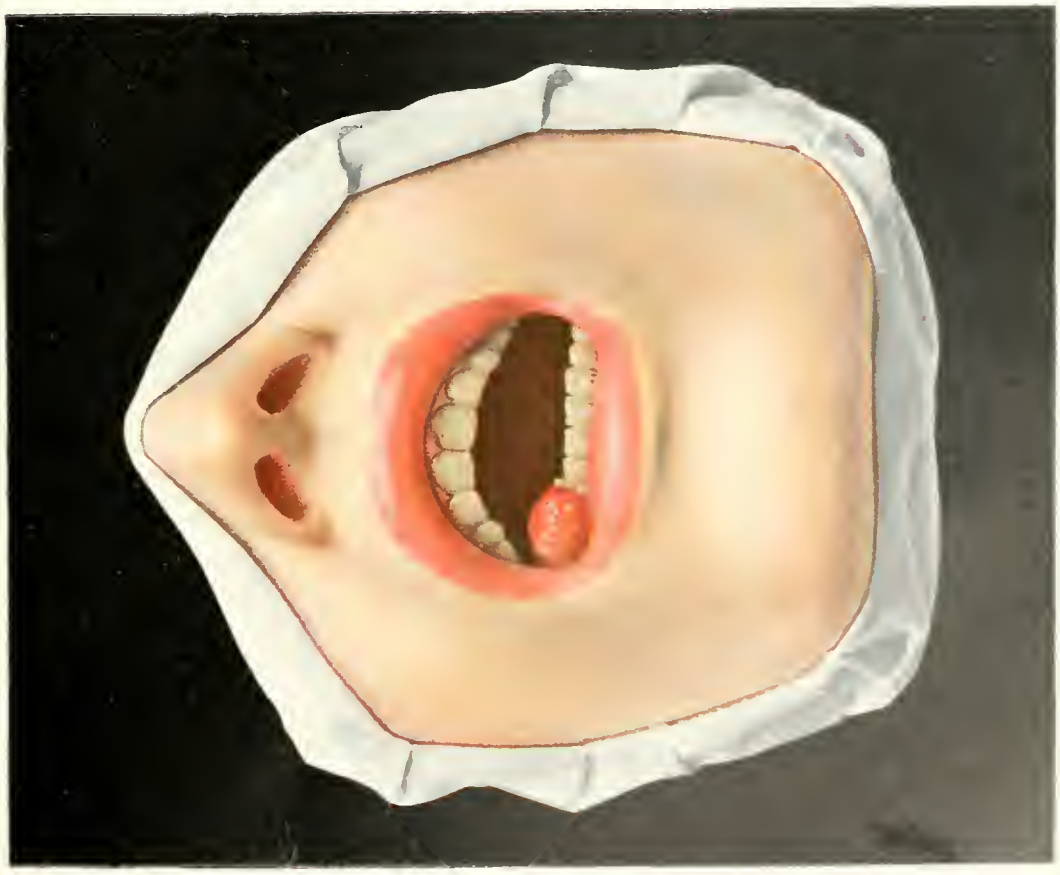

Fig. 35. Sarcoma gigantocellulare — Epulis

from the alveolar border, and can easily be recognized by their hard borders, fissures, and glandular metastases.

Treatment. Epulis should never be removed with scissors. The part of the alveolar border from which it arises should always be removed with the chisel. Hemorrhage can be arrested by plugging with iodoform gauze after previous irrigation with hot saline solution, or by cauterization. Recurrence is rare after thorough removal.

Fig. 35 shows a soft tumor the size of a cherry arising from the alveolar border of the first right bicuspid tooth, in a young woman, which has grown rapidly during pregnancy. On the surface is a pin-point ulceration from which frequent hemorrhage has occurred. It was removed by chiseling the alveolar border.

HEMANGIOMA CAVERNOSUM LINGUAE

(*Cavernous Hemangioma of Tongue*)

Plate XXVII, Fig. 36.

Hemangioma cavernosum (cavernoma linguæ generally develops from a previous congenital hemangioma simplex, a slightly raised red spot which often remains unnoticed. It may also occur as a congenital tumor which becomes fully developed in adolescence or sometimes later, and extends more deeply than simple hemangioma into the mucous membrane and sub-mucous tissue. The tumor consists of new blood-vessels, especially capillaries, and cavities lined by endothelium and filled with blood. The cavernoma presents itself as a tumor with several small nodular projections on its surface, which have a bluish, glistening appearance. The mucous membrane in the region of the tumor is so thin that a dark fluid mass appears to be seen through it. Apart from this characteristic appearance, the softness of the tumor, and the fact that it can be emptied by pressure and made tense by bending the head are worthy of notice. It thus consists of cavernous tissue, such as is found normally in the corpora cavernosa penis, and on this account the name erectile tumor has been applied to it. Besides the superficial growth there is also a deeper growth into the mucous membrane, so that the tumor may involve the whole tongue, the floor of the mouth, the soft palate, the lips and the cheeks. Eventually the tumor may involve the whole side of the face and extend through the orbit to the brain. In other cases the tumors are encapsuled. Sometimes there are multiple encapsuled cavernomas lying

close together, but without any direct connection. Tumors which, arising from the buccal mucous membrane, appear under the skin of the face, give rise to thinning and a bluish glistening coloration of the skin. Apart from the deformity large cavernomas are dangerous, as they may rupture and give rise to profuse and sometimes fatal hemorrhage, as often occurs in cavernomas of internal organs (alimentary canal and liver). Sometimes ulceration occurs at the points of rupture, which may cause general septic infection, and in the tongue acute glossitis and œdema of the glottis.

Differential Diagnosis. Cavernous lymphangiomas are composed of larger protuberances and have a greenish surface. Moreover, lymphangioma, though diminished by pressure, remains independent of the circulation and is not increased by pressure, stooping or coughing. As the result of inflammatory changes, hard nodules form in these tumors, which are disseminated in the soft parts. Sarcomas are rare and can generally be recognized by their smooth surface and rapid growth. Retention cysts of the mucous membrane of the tongue are smaller, circumscribed, and have a uniform surface. On the other hand, they are also covered by thin, bluish, glistening mucous membrane.

Treatment. Simple hemangiomas of the mucous membrane should be removed by caustics or cauterization. Cavernous hemangiomas can be extirpated if they are encapsuled. Injection of perchloride of iron renders the boundaries of the tumor visible and prevents hemorrhage, but is dangerous on account of possible embolism.

Diffuse cavernous angiomas are best incised and scraped with the sharp spoon (*v. Bergmann*). Large vessels can be ligatured and the bleeding surface cauterized, treated with hot saline solution or tamponed

with iodoform gauze or sterile sponges. The operation must be repeated if recurrence takes place.

Inoperable tumors are best treated with injections of alcohol, or with Payr's magnesium. Both methods aim at thrombosis, after which shrinking of the tumor takes place. Injections must be made deeply under the mucous membrane to avoid necrosis.

Fig. 36 shows an encapsuled hemangioma arising from a simple cavernoma after puberty, with the characteristic changes described above. The tumor was treated by incision and scraping.

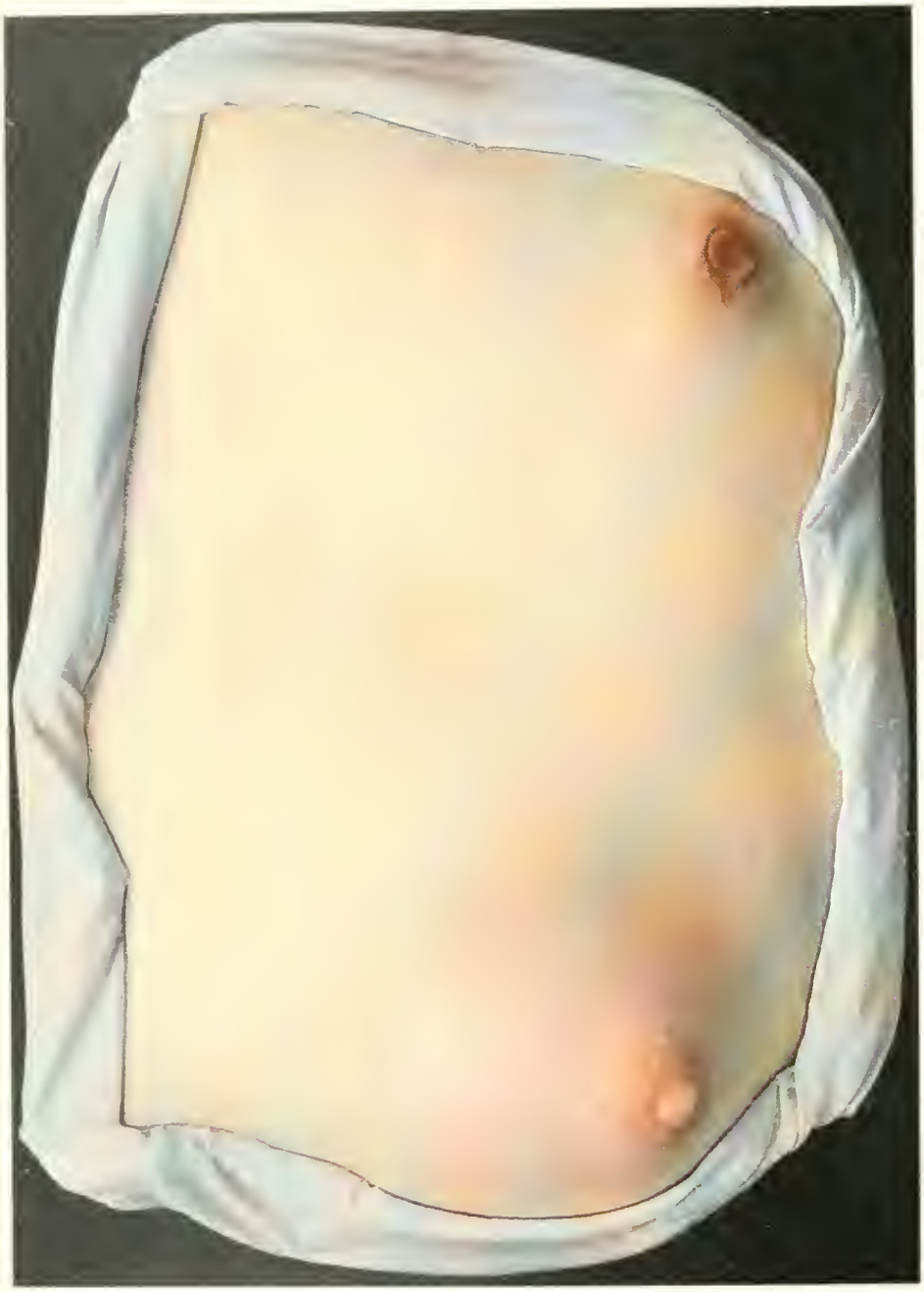

Fig. 37. Fibroadenoma mammae cysticum.

FIBRO-ADENOMA MAMMAE CYSTICUM

(*Cystic Fibro-adenoma of Breast*)

Plate XXVIII, Fig. 37.

Adenomas, distinguished as true tumors (from hyperplasias) by the irregular arrangement of the newly formed glands, are rare in the breast, like pure fibromas. Of the benign tumors of the breast only fibro-adenomas come into consideration, as other tumors are very rare (myxoma, angioma, chondroma, and mixed tumors).

Fibro-adenomas usually develop in the peripheral portions of the mammary gland in young women, in the form of slow-growing, nodular tumors, which are so well encapsuled that they are freely movable within the breast. They are rarely multiple and seldom affect both breasts. When there is an abundant development of connective tissue the tumors are firm; when cystic cavities develop they are soft and fluctuating (fibroadenoma cysticum).

The tumor described as cystadenoma papilliferum, fibroma intracanaliculare, and incorrectly as sarcoma phyllodes, which is formed by connective tissue processes covered by epithelium projecting into the cavity of the cyst, belongs to the group of benign mammary tumors. In older women, especially at the menopause, small multiple cystadenomas occur, chiefly in the region of the nipple, without causing retraction; sometimes in both breasts. These feel like solid tumors owing to their thickened walls. The name of chronic cystic interstitial mastitis has been given to these tumors by *König*.

The benign nature of these tumors is shown by the fact that they cause neither glandular nor organic

metastases. On the other hand, these tumors, especially cystic fibroadenomas, after slow increase in size may become enormous growths, as large as a man's head, and then cause much inconvenience by their weight, and also radiating pains in the arm. Moreover, there is a possibility of a transformation into carcinoma or sarcoma.

Differential Diagnosis. Chronic interstitial mastitis may give rise to a nodular infiltration of the mammary gland, but this disappears under treatment by cleansing the nipple, injection of alcohol into the nodules, and suspension of the breast; in distinction to the steady growth of tumors. Cysts occur chiefly in the neighborhood of the nipple, from which a brownish fluid can be expressed. When they appear under the skin they can be recognized by their bluish, glistening surface. Metastatic tumors which, as in carcinoma, especially occur in the generative organs, are often only to be distinguished by the presence of the primary tumors and cachexia, for they appear in the form of encapsuled movable nodules like benign tumors, and are also of slow growth. Thus, an encapsuled tumor in the breast proved to be a metastasis of a chorionepithelioma of the uterus, in one of the author's cases. Primary carcinomas, especially scirrhus forms in old women, are recognized by their hardness and irregular borders (cf. Plates V–XI).

Treatment. The tumor should be exposed by an incision radiating from the nipple (but avoiding it) and extirpated with the adjacent mammary tissue. Early removal of all chronic nodular formations in the breast is advisable. In doubtful cases an exploratory incision may be made. Large tumors can be removed subcutaneously by raising the breast through a curved incision at its lower border (*Kocher*). In very extensive growths, especially cystic fibroadeno-

mas and multiple cystic formations, the whole breast should be removed.

Fig. 37 shows the right breast of a woman (at the menopause) much more projecting than the left. The upper half of the right breast is involved in a tumor, the irregular surface of which can be recognized by the bulging of the skin. The skin is thin and reddened. The tumor, which was at first remote from the nipple in the inner and upper quadrant of the breast, has grown towards the nipple without causing retraction. The tumor is completely encapsuled, freely movable, and of moderately hard consistence. It was removed through a radial incision, together with the adjacent mammary tissue.

CORNU CUTANEUM (*Cutaneous Horn*)
ADENOMA SEBACEA (*Sebaceous*)
Plate XXIX, Fig. 38.

Cutaneous horns occur more frequently in old people (senile keratoma), and in those subject to exposure (sailors, etc.). They arise on the basis of sebaceous and dermoid cysts and warts, and occur on the eyelids, nose, lips, cheeks and ears, also on the scalp and genital organs. They are seldom multiple. They generally form sessile, freely movable, curved or spiral structures which have an irregular, grooved, yellowish-brown surface and a horny consistence.

These benign formations, which may attain the length of several centimeters, are formed by a proliferation of the horny layer of the epidermis. The papillæ are also lengthened, which accounts for the soft consistence of the interior.

Differential Diagnosis. In young people multiple nævi with cornification occur, but these have a wider base, and a flatter and more prickly surface,

Treatment. As about 10 per cent. of cutaneous horns develop into carcinoma, excision by the knife into the healthy skin is indicated. Recurrence takes place after removal by ligature.

Fig. 38 shows a slightly curved cutaneous horn about one and one-half centimeters long, occurring in an old countrywoman, in the zygomatic region, with all the characteristic features. The skin at the base of the growth is scaly and somewhat reddened.

Adenoma of the skin is another form of growth often occurring in women, both young and old,

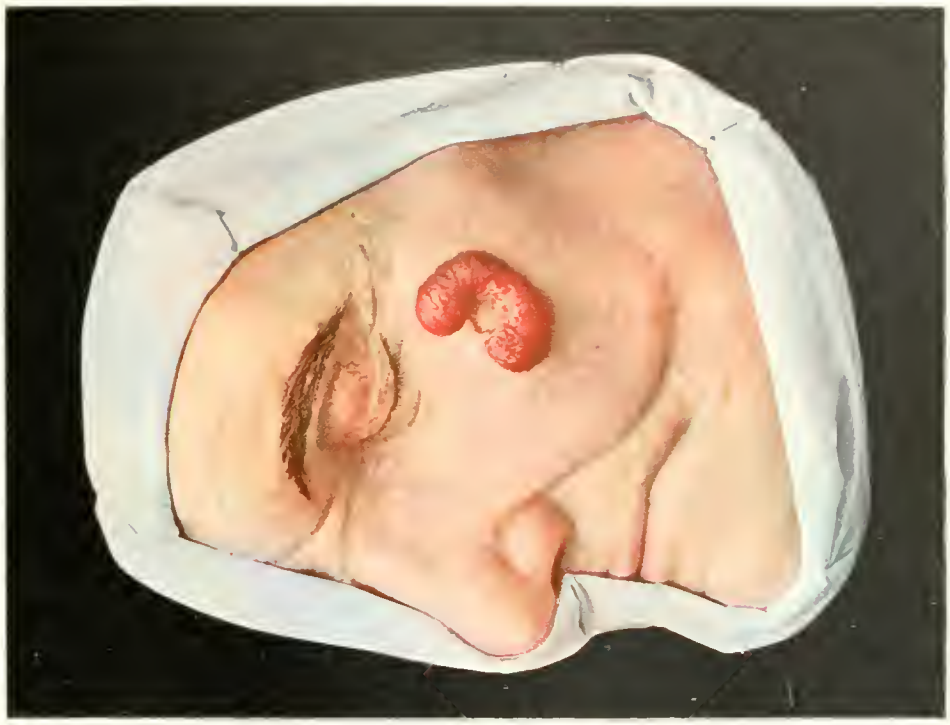

Fig. 39. Endothelioma cutis.

Fig. 38. Cornu cutaneum. Adenomata sebacea.

usually on the face. Adenomas are benign tumors which develop from normal glandular tissue, and may, therefore, occur in all glands. Adenomas which develop in places where glands are normally absent must be assumed to develop from congenital rudiments of supernumerary glands.

In the skin, adenomas often develop from the sebaceous glands (adenoma sebaceum). They often occur in many places as small, round, flat, circumscribed, encapsuled, movable tumors, of firm consistence, and with a dirty gray surface. The lymphatic glands are never affected, and there is no recurrence after extirpation. Adenomas which have become transformed into carcinomas have been incorrectly termed malignant adenomas.

Differential Diagnosis. Intercurrent cystic formation may cause confusion with endothelioma of the skin, and ulceration with carcinoma. The occurrence of calcification in the adenoma may make it as hard as carcinoma. Doubtful cases must be settled by microscopic examination.

Treatment. Small multiple adenomas can be treated by cauterization or X-rays. Larger ones should be extirpated.

Adenomas arising from the sweat glands (adenoma sudiporum) generally form larger, more nodular tumors, which after ulceration simulate carcinomas. The treatment consists in excision.

Fig. 38 shows multiple pin-point adenomas of the sebaceous glands, which disappeared to a great extent under treatment by X-rays. Characteristic smegma-like matter can be expressed from larger adenomas.

ENDOTHELIOMA CUTIS (*of Skin*)

Plate XXIX, Fig. 39.

Endotheliomas (*Golgi*) arise from the endothelium of the blood-vessels and lymphatics, which, according to *Borst* consists of specially modified connective-tissue cells. Owing to the double nature of the endothelium, it is not surprising that those who regard the endothelial cells as epithelial cells give the name of endothelial cancer or connective-tissue cancer to the tumors arising from it, while others, who regard the endothelial cells as connective-tissue cells, call these tumors endothelial sarcomas, plexiform angiosarcomas (*Waldeyer*) and angiosarcoma (*Kollaczek*).

If we hold with *Borst* that the endotheliomas arise from the endothelium, *i.e.* from the connective-tissue cells, which may assume all kinds of modifications, it follows that tumors of varied structure may arise from these different varieties of endothelium, which have the appearance of fibroma, sarcoma or carcinoma, as the latter forms stratified globes, but without cornification. By this means we avoid the endless number of names given to these tumors, and have clinically only the term endothelioma, to be distinguished microscopically as hemangio-endothelioma and lymphangio-endothelioma, which we can designate as alveolar, plexiform or vascular, according to their microscopic structure. *Borst* also includes the basal-cell cancers (regarded as carcinoma by *Krompecher* and *Cönen*) among the endotheliomas as these tumors have no cornification (cf. Plate II, Fig. 4).

It is no wonder that these tumors may appear clinically in the most varied forms and be confounded

with fibromas, adenomas, sarcomas and carcinomas.

The tumors may arise from all kinds of endothelium and are most frequently observed in the skin of the face, the mucous membrane of the mouth and pharynx, the bones of the face and skull, the peritoneum, the pia mater of the brain and spinal cord, and the parotid gland.

Occurring at any age, they form encapsuled, generally slow-growing, comparatively benign tumors which seldom cause glandular or organic metastases, but have a tendency to local recurrence.

As the shape, surface and consistence of the tumors may assume all possible varieties, the clinical signs of endotheliomas are very indefinite. The shape is often irregular, especially in endothelioma of the face (Fig. 39, horseshoe shape). The surface may be smooth, irregular or ulcerated. The consistence may be hard, soft or cystic. Sometimes the tumors are very vascular and the epidermis assumes the reddish-brown coloration which is seen in sarcoma, at other times they are poor in vessels. Although they are at first encapsuled they may later on give rise to a diffuse infiltration of the tissue along the endothelial clefts, and then have irregular boundaries.

Differential Diagnosis. Sarcoma and carcinoma are most often confounded with endothelioma, also fibroma and adenoma, especially when they undergo cystic degeneration or ulceration. The diagnosis can often only be made by microscopic examination.

Treatment. Early excision is indicated, as transformation is possible in rapidly growing tumors. In the diffuse forms, which represent malignant tumors like carcinoma and sarcoma, extensive operations are necessary. When multiple nodules develop in the

extremities amputation is sometimes necessary. Metastases in the lymphatic glands, which appear in the form of soft nodules, should also be removed.

Fig. 39 shows a horseshoe-shaped endothelioma of the zygomatic region, in an old woman. The tumor is situated in the skin and has grown out of it. It is movable over the subjacent tissues. The borders are regular on all sides. The skin over the tumor is reddish brown like sarcoma, very thin, and cannot be raised from the tumor. It shows numerous fine ramifying vessels. In the middle of the horseshoe is an ulcer which resembles a carcinoma planum, but the latter, as previously mentioned, occurs chiefly at the junction of skin and mucous membrane. There are thus resemblances to both carcinoma and sarcoma. The soft borders, the circumscribed form and soft consistence, and the absence of glandular affection, show the benign nature of the tumor. In endothelioma of the face the occurrence of small multiple cysts in the cutaneous covering is more common than ulceration.

Excision of the tumor and repair of defect by a plastic operation. Microscopic examination showed it to be a plexiform hemangio-endothelioma.

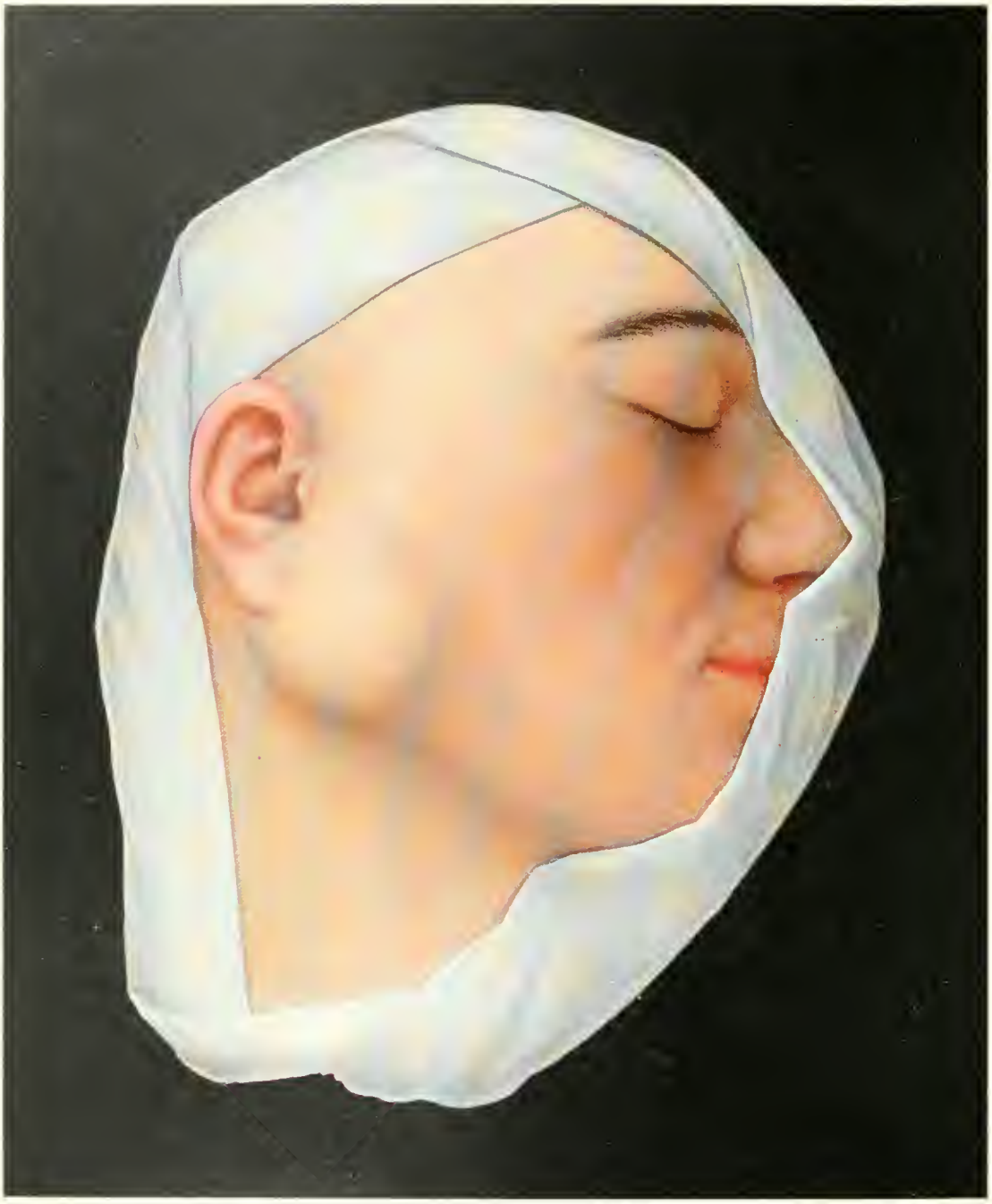

Fig. 40. Endothelioma parotidis — Tumor mixtus.

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ENDOTHELIOMA PAROTIDIS (*of Parotid*)
TUMOR MIXTUS (*Mixed Tumor*)

Plate XXX, Fig. 40.

Mixed tumors occur frequently in the parotid, less often in the other salivary glands. These parotid tumors are regarded as endotheliomas by *Kaufmann*, *Nasse* and *Volkmann*, which is intelligible after the explanation of endothelioma given in Plate XXIX, Fig. 39, if we assume that the epithelioid tracts occurring in the tumors arise from endothelium, the latter, according to *Volkmann*, being also capable of forming cartilaginous, mucoid and connective tissue. Others hold that these mixed tumors, which also occur in the breast, kidneys and testicles, arise from epithelial and connective-tissue cells (*Wilms* and *Hinsberg*).

On section, the tumors show a very variegated structure, in which are found parts resembling carcinoma and sarcoma, mucoid tissue, cartilage, cysts, calcification and ossification.

Parotid tumor occurs more often in young individuals, and appears as an encapsuled, smooth or nodular tumor, movable over subjacent parts, lying under the fascia, and covered by intact non-adherent skin. The rare tumors which lie above the parotid fascia originate in aberrant parotid rudiments, according to *Bergmann*. The consistence of parotid tumors may be hard, soft or cystic, according to their composition, and may differ in different parts of the same tumor. At first they are of slow growth, but may suddenly take on rapid growth, rupture their capsule, infiltrate the surrounding parts like malignant tumors, and finally perforate the skin and

ulcerate. In such cases there are glandular and organic metastases.

Tumors arising from the anterior part of the parotid cause swelling of the cheek; those arising from the posterior part of the gland raise up the external ear. Larger tumors may extend towards the chin, the nape of the neck and the clavicle.

Small tumors cause hardly any pain, but sometimes salivation. Extensive tumors may give rise to pain in the ear, deafness and facial paralysis.

Differential Diagnosis. The more common cartilaginous tumors with uneven surface are easy to distinguish from other growths, but the soft tumors with smooth surface may be confounded with lymphomas, cavernomas, lipomas and cysts. Extensive endotheliomas are often indistinguishable from sarcomas or carcinomas.

Mixed tumors should be extirpated as early as possible, on account of the possibility of their taking on malignant growth. Both benign and malignant recurrence may take place from the remains of the capsule after removal of tumor. The capsule must, therefore, be completely removed during extirpation, taking care to avoid large branches of the facial nerve, while the part of the gland which is unaffected can be left behind. In extensive malignant endotheliomas of the parotid it is hardly possible to save the facial nerve, for in these cases the whole gland must be removed. In tumors of the submaxillary gland the whole gland should always be removed.

Fig. 40 shows a mixed tumor of the parotid which slowly developed during three years in a woman aged thirty. Profuse salivation, and latterly rapid growth of the tumor, led the patient to seek advice. The skin is freely movable over the tumor and shows a fine network of vessels. The tumor lies under the fascia and has spread to the anterior and lower

region of the ear. The surface of the tumor is irregular; the consistence of the posterior portion, where the surface is uneven, is hard; soft and fluctuating in the anterior portion, where the surface is smooth. There is no projection of the tumor into the buccal cavity. The tumor is freely movable over the subjacent parts, and there is no glandular enlargement.

The tumor was extirpated with its capsule, and the facial nerve avoided. Part of the parotid gland was left behind. On section, cartilage, cysts, calcification, and fibrous and sarcomatous tissue were found.

GANGLION CARPALE (*of Wrist*)

Plate XXXI, Fig. 41.

Ganglions occur especially in connection with the joints of the hand, most often on the dorsal surface between the extensor carpi radialis and extensor indicis, less commonly on the palmar side near the flexor carpi radialis (especially in pianists); also on the dorsum of the foot at the joints of the cuboid bone and in the neighborhood of the knee joint.

Colloid degeneration of the joint capsule and the periarticular connective tissue gives rise first to multilocular, then unilocular cystomas, which were formerly regarded as retention cysts. Ganglions of the tendon sheaths arise in a similar manner, but are smaller; they occur chiefly in the sheaths of the flexor tendons over the metacarpo-phalangeal joints, and cause neuralgic pain by pressure on the digital nerves. They often occur after rowing and fencing, *i.e.* from traumatic causes.

Spherical ganglia occur most commonly on the dorsal aspect of the hand in young women, and resemble exostoses on account of their hardness. They often cause neuralgic pains and slight trouble in the movements of the joints.

Ganglions are of slow growth, the skin is unaltered and movable over them; the surface is smooth or slightly wrinkled. The consistence is hard in small ganglions, soft and fluctuating in larger ones. In pedunculated ganglions there is slight mobility over the joint.

Differential Diagnosis. In the knee joint they may be mistaken for affections of bursæ; in the

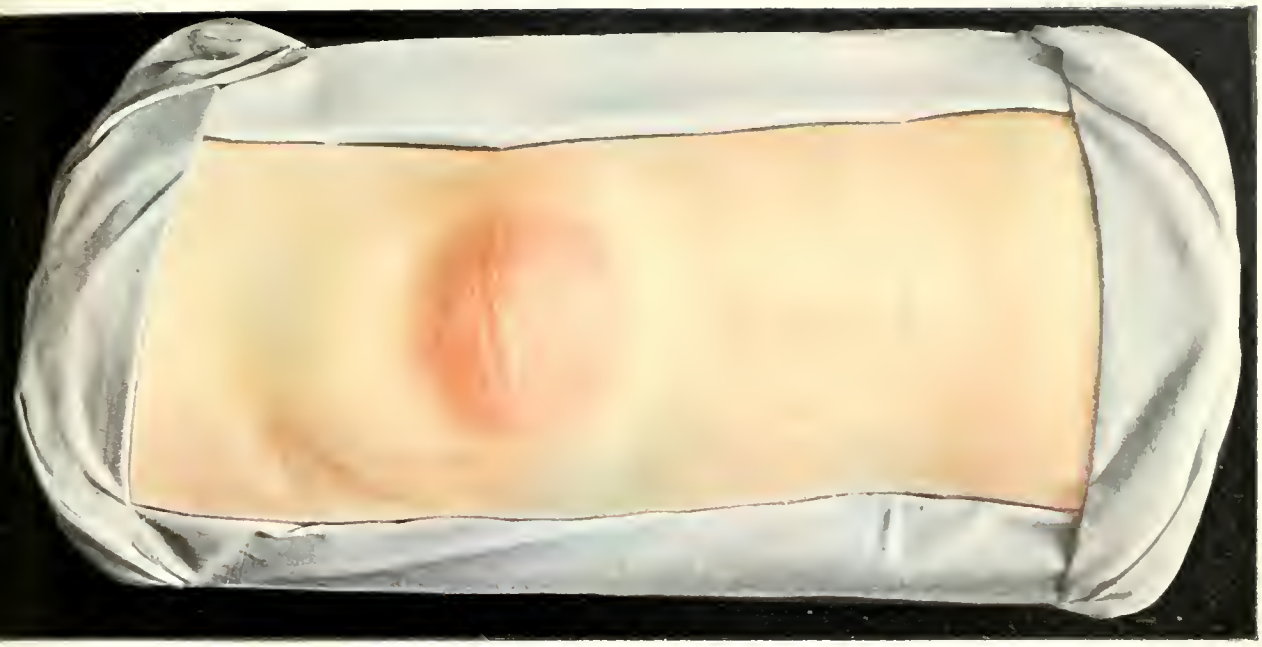

Fig. 42. Bursitis praepatellaris acuta

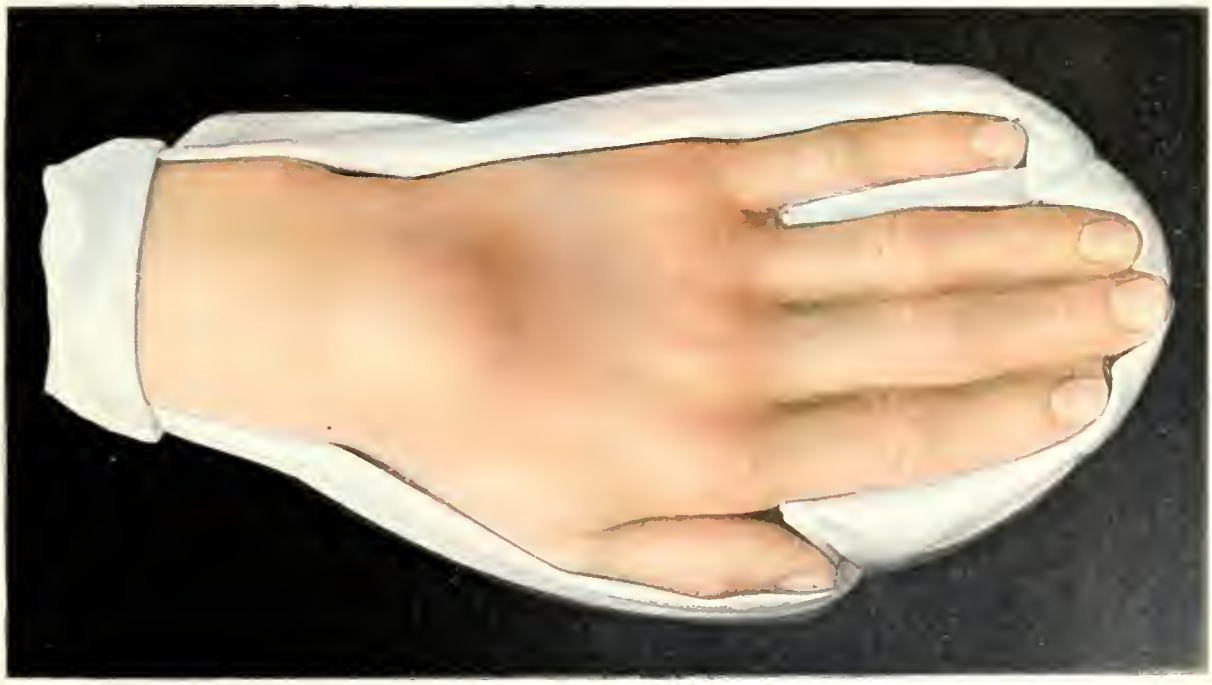

Fig. 41. Ganglion carpale dorsale

foot for ganglions of the tendon sheath. Tuberculous teno-synovitis is distinguished by its nodular surface and by spreading along the tendons.

Treatment. They may be cured by breaking them with a wooden hammer and then compressing with a bandage. Subcutaneous diseission, puncture, injection of alcohol, etc., and even incision do not always prevent recurrence. A permanent cure can be obtained by extirpation of the ganglion with its pedicle. This involves opening the joint, with which they often communicate, or are only separated from it by a thin membrane; hence strict asepsis is necessary.

Fig. 41 shows a ganglion in a typical situation in a young girl, which recurred after being broken. Extirpation of the ganglion resulted in cure. The unilocular cyst contained colloid matter. The presence of septa gave evidence of an earlier multilocular structure.

BURSITIS PRAEPATELLARIS ACUTA

(*Acute prepatellar Bursitis*)

Plate XXXI, Fig. 42.

Affections of the bursæ may be divided into acute and chronic inflammations, and further into purulent and non-purulent (serous, fibrinous, hemorrhagic).

An acute bursitis occurs especially after injuries and inflammation extending from neighboring regions (furunculosis, arthritis). It may also arise from foreign bodies inside the bursa.

In acute serous bursitis the skin is unchanged, while in purulent bursitis it is red and œdematous. In the latter, suppuration often extends beyond the limits of the bursa and is accompanied by fever, pain and difficulty in movement. Under the movable skin, in the case of superficial bursæ (*e.g.* the prepatellar), a hemispherical, tense, sometimes fluctuating, slightly movable swelling with a smooth surface can be felt, limited to the anatomical position of the bursa (Fig. 42).

Chronic bursitis, also called hygroma, occurs more after chronic irritation, in the prepatellar bursa, in housemaids, for instance (housemaid's knee), and in the olecranon bursa in miners (miner's elbow). Villous proliferations in the wall of the bursa lead to thickening, and to the formation of rice bodies. The skin over the bursa is movable and thickened. The hygroma is almost spherical, with a rough, uneven surface.

Hygroma may also develop in adventitious bursæ, especially in places where a bone is subjected to pressure, for instance, on the toe over a clavus. Hygromas give rise to little inconvenience, and only

hinder movement when of large size. In the case of the elbow there is sometimes neuralgic pain from pressure on the ulnar nerve.

Differential Diagnosis. The different forms of bursitis may be mistaken for arthritis of the adjacent joint, owing to limitation of movement, *e.g.* subdeltoid and sub-trochanteric bursitis. The strict localization of the affection to the anatomical position of the bursæ should make the diagnosis easy. Disease of several bursæ is chiefly observed in tuberculosis, syphilis, gonorrhea and gout.

Treatment. Acute purulent bursitis requires early incision and plugging, as infection of the joint may take place. In acute serous or hemorrhagic effusion, puncture and injection of 4 per cent. carbolic lotion, 1 per cent. iodoform-glycerin or absolute alcohol may be tried. In chronic bursitis, painting with iodine is generally useless. It is best to extirpate chronic hygromas, especially when they are large or have thick, hard walls, or when fistulæ develop, taking care to avoid the joints.

Fig. 42 shows an acute purulent prepatellar bursitis. The skin is red and hot and the movements of the knee joint are painful and limited. The tense, fluctuating, spheroidal swelling is clearly situated in front of the patella. The surface is smooth and regular, but the tumor is almost immovable over the subjacent structures. It was shown by incision that all three bursæ—subcutaneous, subfascial and subaponeurotic—were full of pus and in communication with each other.

HYGROMA GENUS MULTILOCULARE

(*Multilocular Hygroma of the Knee*)

BURSITIS PRAEPATELLARIS ET BURSITIS PRAETIBIALIS

(*Prepatellar and Pretibial Bursitis*)

Plate XXXII, Fig. 43.

This figure shows a case of chronic inflammation of the prepatellar bursa and the lower half of the pretibial bursa, occurring in a man who had to do his work in the kneeling position. The skin over the prepatellar bursa is thickened and movable over the cystic swelling. The walls of both hygromas are thickened. They are only slightly movable over the subjacent structures. Pressure on one hygroma causes some of its fluid to pass into the other, so that the two bursæ communicate. Total extirpation was performed owing to the extent of the hygroma and the thickened walls.

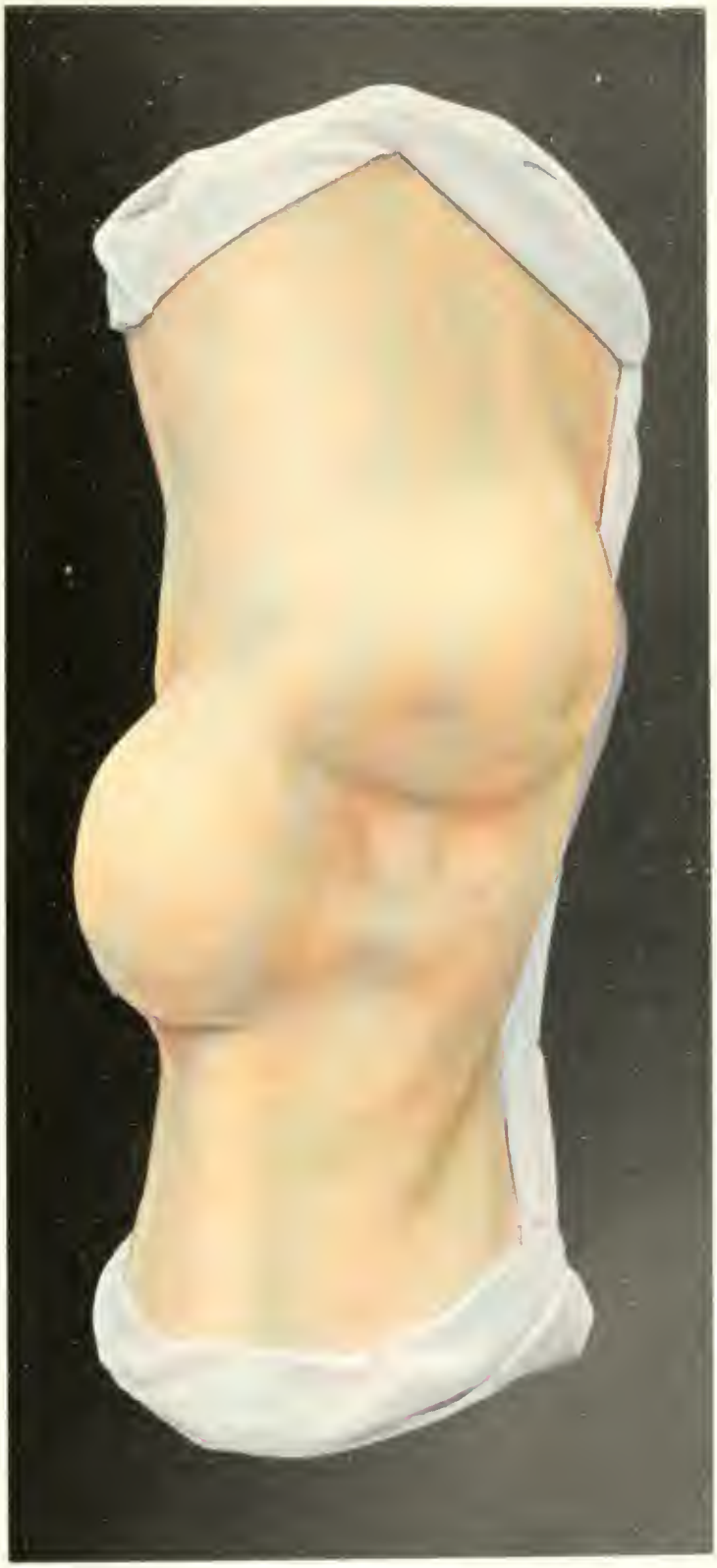

Fig. 43. Hygroma genus malleolare.

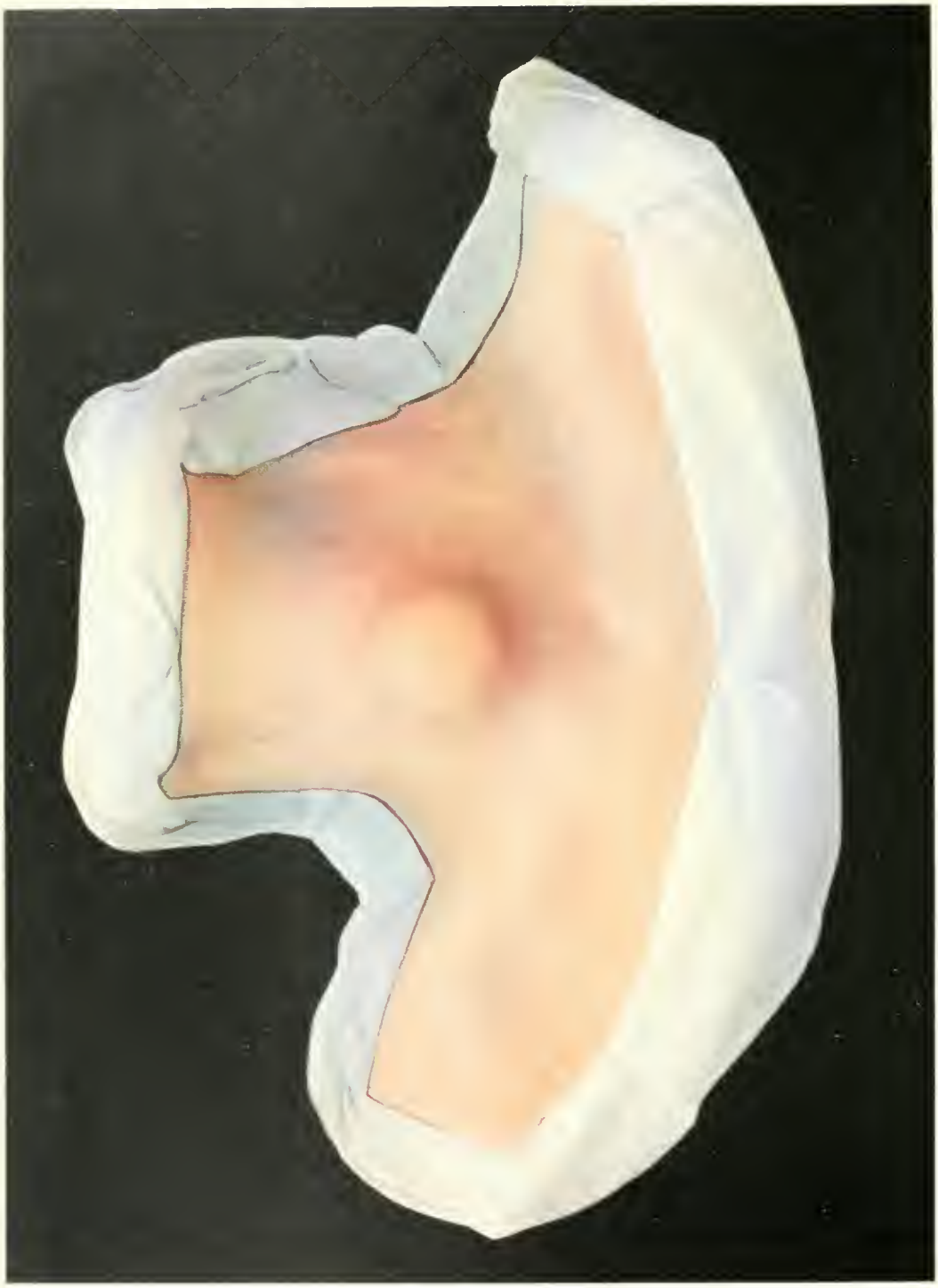

Fig. 44. Struma cystica.

STRUMA CYSTICA (*Bronchocele*)

Plate XXXIII, Fig. 44.

Goitre occurs endemically (Switzerland and other regions) and epidemically in barracks and boarding houses (Strumitis acuta first observed by *Kussmaul*). Heredity, frequent congestion of the blood-vessels of the head, pregnancy, the nature of the soil, water and atmosphere have all been suggested as causes of bronchocele.

Bronchoceles occur twice as often in females as in males (*Schrötter*). Clinically, they are divided into diffuse and circumscribed forms, and pathologically into follicular, colloid, vascular and cystic bronchoceles.

In all cases the typical situation corresponds to the anatomical position of the thyroid gland, and the symptoms are definite. Even small bronchoceles cause marked and early deformity. Further extension results in pressure on the veins, causing prominence of the cutaneous veins and a cyanotic appearance of the face. Pressure on the trachea may give rise to displacement, stricture and changes in its walls, causing it to assume the form of a saber-sheath. This dangerous condition can be seen by the X-rays. Eventually the wall of the trachea may become so much destroyed as to give way after violent movement of the head. Difficulty in breathing during inspiration, causing stridor, is the necessary result, and sudden asthmatic attacks, occurring during violent movements of the patient or during sleep may prove fatal. Pressure on one recurrent nerve is of little consequence and often unnoticed, for unilateral paralysis of the recurrent is compensated,

so that hoarseness is often absent, and the condition is only shown by laryngoscopic examination. Bilateral paralysis of the recurrents is, however, very dangerous, as it may give rise to asphyxia or pneumonia. Small fibrous tumors arising in the middle line from the isthmus of the thyroid, and those lying behind the sternum cause more characteristic symptoms than large, soft tumors, which often cause little trouble.

Every bronchocele moves with the thyroid on swallowing and is thus distinguished from other affections.

The simplest form of bronchocele, which consists in a hyperæmia of the whole organ, is common in young girls at the onset of menstruation, or at the first sexual intercourse, and appears as a soft, uniform swelling of the whole gland, which may disappear spontaneously.

According to *v. Eiselsberg*, this simple form may often give rise to follicular hypertrophy. The latter also occurs in young individuals in the form of hard nodules in the gland, which may also disappear.

More marked enlargement of the thyroid gland, developing gradually in middle age, and leading to the formation of a horseshoe-shaped tumor involving the whole gland and consisting of a number of large nodules, is diagnostic of colloid bronchocele, while the vascular bronchocele is characterized by pulsation and compressibility. The cystic bronchocele (Fig. 43), arising from several colloid nodules owing to hemorrhage and liquefaction, forms small, hemispherical tumors with a smooth surface and distinct fluctuation. When the cyst walls are hardened by calcification the diagnosis is more difficult, but differs from the irregular, nodular formation of fibrous bronchocele. Cystic bronchoceles may attain the size of a man's head.

The different varieties—colloid, cystic, vascular and fibrous—may all occur in the same tumor.

The diagnosis of the different kinds of bronchocele

is important with regard to treatment, which should be begun early, as cardiac symptoms occur in connection with long-standing large bronchoceles.

Differential Diagnosis. An accessory bronchocele is easily diagnosed when it is fixed to the thyroid by a pedicle, as it then gives rise to the same symptoms. Bronchoceles which arise from free accessory glands may be mistaken for other tumors of the neck —lymphoma, sebaceous cyst, dermoid or malignant tumor.

Carcinoma of the thyroid gland occurs in old people and forms a nodular, very hard, rapidly growing tumor, which soon surrounds the whole neck with a hard ring. The diagnosis is settled by the glandular metastases, the early appearance of paralysis of the vocal cords and cachexia. In old people, the sudden occurrence of rapid growth in an old-standing bronchocele always suggests malignant transformation.

Sarcomas, which occur in young people as rapidly growing tumors, are distinguished by their soft consistence and by their diffuse infiltration. They often break through the capsule and give rise to severe hemorrhage.

Basedow's disease (*Grave's* disease, exophthalmic goitre), which, according to *Möbius*, consists in hypersecretion of the thyroid gland resulting in intoxication of the organism, is distinguished from ordinary bronchocele by the presence of tachycardia, tremor, exophthalmus and neuropathic conditions. The swelling in *Basedow's* disease is always very vascular and often pulsates. In long-standing bronchoceles symptoms of *Basedow's* disease may appear, but they are never so marked as in the genuine form; all the other characteristic symptoms of bronchocele are also present.

Mediastinal tumors and aneurisms are occasionally mistaken for retrosternal bronchocele.

Treatment. The treatment varies according to the nature of the bronchocele.

In countries where goitre is epidemic, prophylaxis plays the chief rôle. Water should only be drunk after boiling. Violent exertion should be avoided, on account of causing a determination of blood to the head.

In acute hyperaemia and follicular hypertrophy iodine preparations are most useful — iodide of potassium, or thyroid tabloids containing iodine (to be given carefully on account of tachycardia). Iodine preparations should not be continued too long.

In cystic and colloid bronchoceles iodine treatment gives no results, and operation is indicated—partial extirpation in the case of colloid bronchocele. Sufficient thyroid gland tissue must be left otherwise tetania strumipriva or myxœdema may follow.

Cretinism, which is only observed in countries where goitre is endemic, and causes changes in the skin, disturbance in growth and idiocy, is also due to degeneration of the greater part of the thyroid gland or absence thereof in the cretins themselves or in their parents.

In post-operative tetany, cachexia strumipriva, myxœdema and cretinism, implantation of a piece of human thyroid gland in the diseased subject may be attempted (*Kohn, v. Eiselsberg, et al.*). It is best to transplant a large piece into the spleen (*Payr*).

Isolated cysts and nodules can be enucleated. Recurrence after operation is rare on the whole and then usually causes no trouble.

In *Basedow's* disease ligation of the superior and inferior thyroid arteries has been successfully tried. (*Rehn, v. Bergmann*). The operation is not without danger, so that others have preferred internal treatment with arsenic, or by the galvanic current, etc., often successfully.

Fig. 43 shows a tumor the size of a walnut, in an old woman, which is easily recognized as a cystic bronchocele by its rounded form, regular outline, situation in the isthmus of the thyroid and its movement during swallowing. The tumor was enucleated on account of its causing considerable difficulty in respiration.

PAPILLOMA CUTIS INFLAMMATORIUM

(*Inflammatory Papilloma of Skin*)

Plate XXXIV, Fig. 45.

Papillomas or villous tumors, also occurring on mucous membranes as villous polypi, belong to the group of fibro-epithelial tumors (*Borst*). They consist of vascular connective tissue and epithelial proliferation (squamous more often than cylindrical) and simulate in structure the papillæ of the skin and mucous membrane. These growths represent a special group of tumors, and must not be confounded with papillomatous proliferations found in a similar form in nævi, carcinomas, sarcomas and endotheliomas. Condylomata acuminata are also very similar to papilloma; however, these are not true tumors, but are due to hyperplasia of the papillary body and its epithelial covering. These generally occur as the result of chronic inflammatory irritation from gonorrheal discharge, on the penis, vagina and anus.

True papillomas generally form small superficial tumors of a warty or conical form, single or multiple, occurring at any age, in places exposed to much irritation (skin, genitals, thighs, back, tongue, rectum, bladder and larynx). They are slow-growing, circumscribed, sessile or pedunculated, freely movable, non-infiltrating growths. Papillomas of the skin are yellowish-white dry growths, hard from cornification of the superficial epithelial layers, and form conical or wart-like projections.

Papillomas of the mucous membrane have a reddish fleshy appearance, and on account of their vascularity, bleed easily and are of soft consistence. In the larynx, they occur especially in the region of the

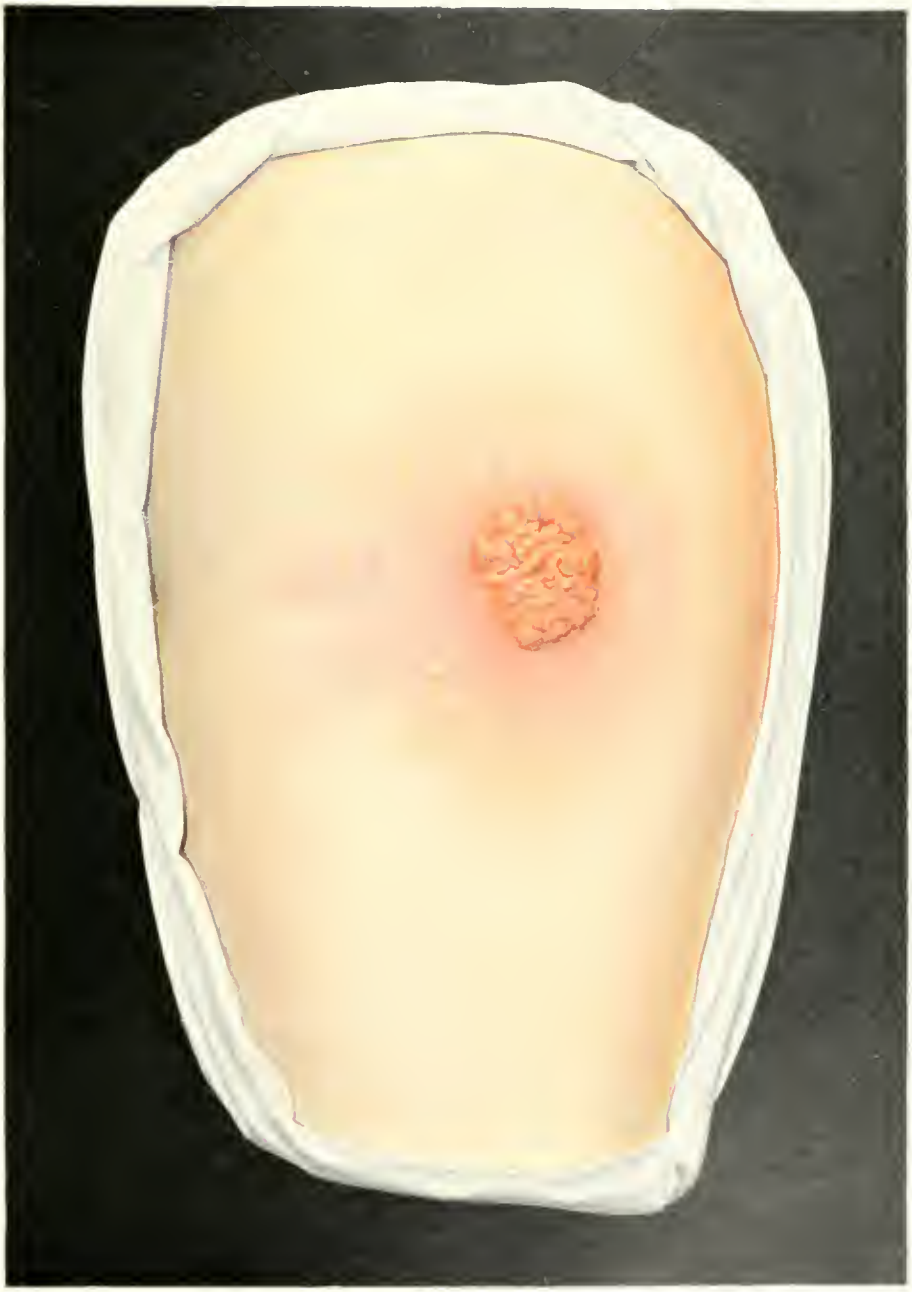

Fig. 45. Papilloma cutis inflammatorium.

vocal cords; they are often multiple in young individuals, prone to recur, and may lead to stenosis. Transition into carcinoma may occur, and is recognized by rapid growth, ulceration, infiltration, and growth into the deeper parts.

Differential Diagnosis. Small papillomas of the skin may be mistaken for common warts. In distinction to carcinoma they present the usual characteristics of benign tumors—soft consistence, free mobility, and no glandular metastases. Papillomas of mucous membranes are usually characteristic formations. It is only in villous polypi of the bladder, which may become transformed into villous cancer, that the diagnosis is difficult.

Treatment. Excision. Extensive operations are often necessary for the removal of papillomas of the mucous membranes (tracheotomy, colostomy, etc.).

Fig. 45 shows a cutaneous papilloma, freely movable over subjacent parts, of moderately soft consistence, and covered with warty projections. The horny layer and the surface of the skin has been destroyed by frequent cauterization. The surface is covered with a yellowish fetid secretion, and between the villous projections are deep depressions caused by ulceration, so that the appearance in some places resembles carcinoma; but the borders are not hard. The skin round the tumor is red and painful from cauterization.

After disinfection of the surface and arrest of the discharge, the tumor was excised in healthy tissue and the wound closed by suture.

Dermoids

RECURRENT DERMOID
Plate XXXV, Fig. 46.
DERMOID—PHIMOSIS—BALANITIS
Fig. 47.
DERMOID CYST
Plate XXXVI, Fig. 48.

True dermoid cysts are formed from the epiblast only, while compound dermoid cysts include all three embryonic layers. (Teratoma, Fig. 146).

As pure dermoid cysts arise through invagination of the epiblast they must be congenital, and can only occur where there were folds, furrows or recesses in embryonic life, or in places where organs are developed by invagination of the epiblast. These tumors are, therefore, of embryonic formation.

Dermoid cysts occur in the cutaneous and subcutaneous tissue in the region of the head (occipital, parietal and temporal bones); in the region of the face (root of the nose and orbit); in the neck (remains of branchial clefts); at the umbilicus; and in the coccygeal region as fissural dermoid cysts. The occurrence of dermoids in the cranial cavity, vertebral canal, thoracic cavity, abdominal cavity, retroperitoneal tissue, kidneys (*Wolffian* duct) is explained by the development of organs by invagination of the epiblast.

Dermoid cysts of the testicles and ovaries, on account of their complicated structure, are not pure dermoids.

Pure dermoids are unilocular or multilocular cysts, the external walls of which consist of connective

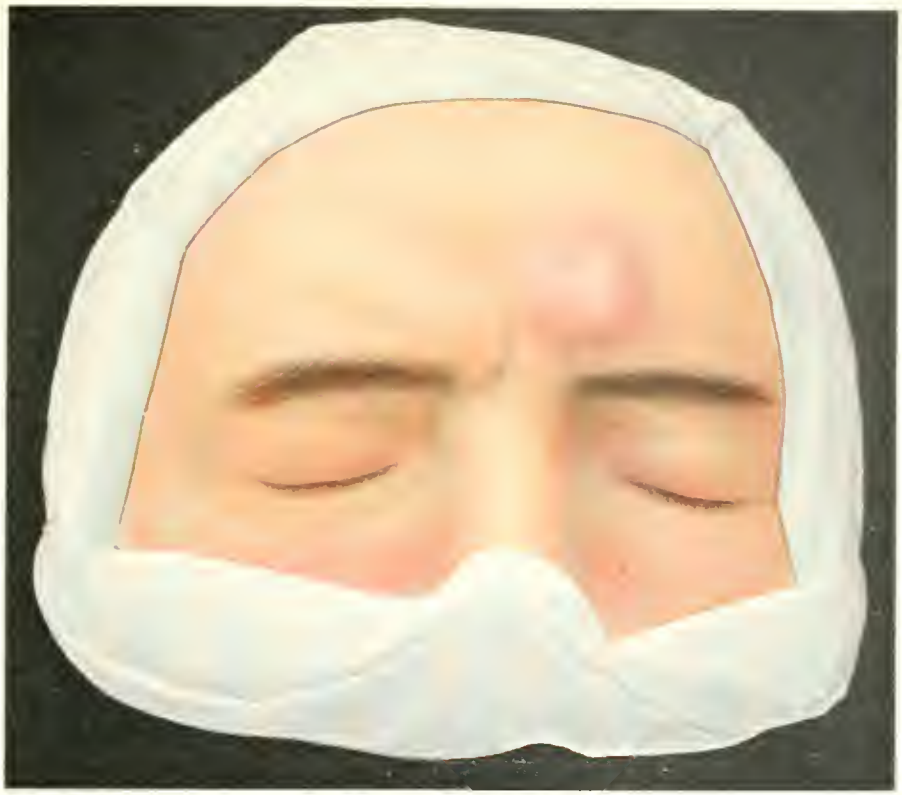

Fig. 46. Dermoid — Recidiv.

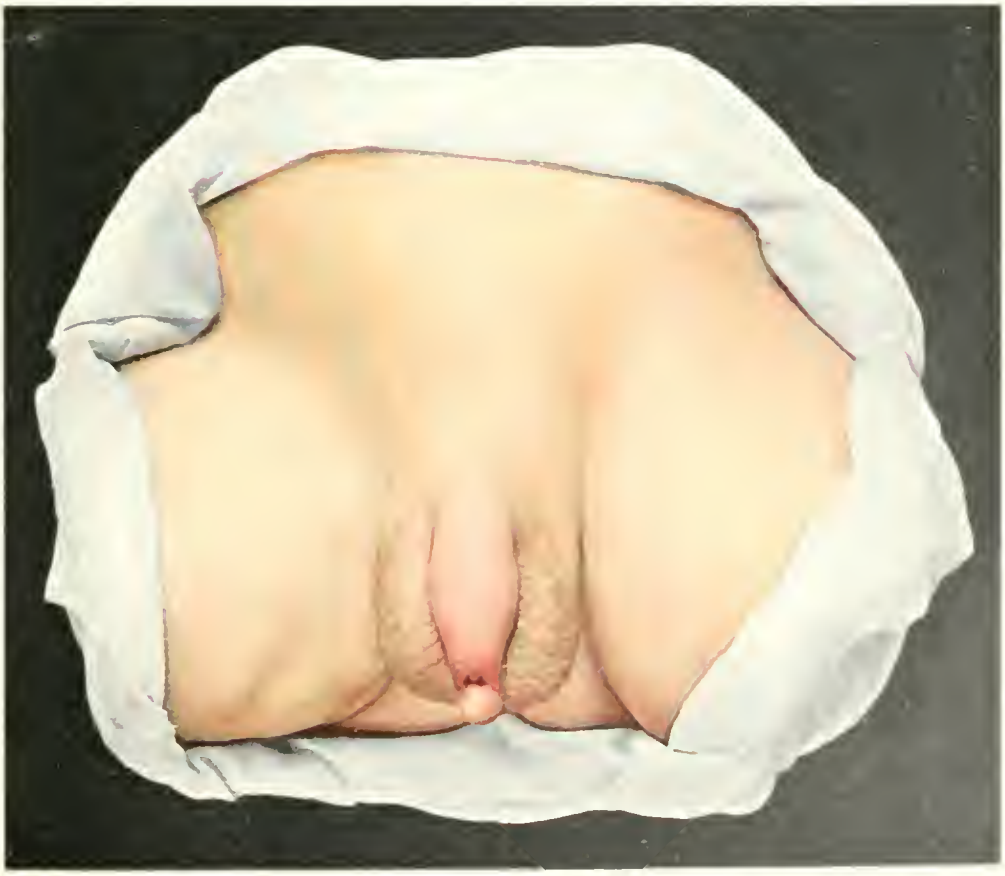

Fig. 47. Dermoid — Phimosis.

tissue, and are connected with the surrounding tissues while the internal surface resembles skin (hence the term dermoid), and presents papillæ, squamous epithelium and hair. Those dermoids which contain bone, cartilage and teeth are formed at a very early embryonic period, before differentiation has taken place.

The contents of the cyst consist of a yellowish-white, caseous, odorless, fatty mass, mixed with numerous hairs, the appearance of which varies according to the situation of the dermoid (in the region of the eye, eyelashes, etc.). The contents are rarely serous or hemorrhagic. In the cutaneous or subcutaneous tissue the cysts form spherical or hemispherical tumors with a smooth surface and tallowy consistence. They are covered by intact skin, and are often attached to the bones. The superficial dermoids usually occur in youth. They are slow-growing and painless, and about the size of a walnut. Sometimes fistulæ form from which hairs protrude. The diagnosis of superficial dermoids is easy to establish by the above signs.

Differential Diagnosis. Superficial dermoids may be mistaken for sebaceous cysts, but the contents of the latter are foul smelling and more dirty yellow. If scars are present (*e.g.* after operations, Fig. 46), the history or microscopic examination only can decide whether it is a traumatic (post embryonic) formation caused by proliferation of an involuted part of the skin—the so-called epithelial cysts. These may also form round a foreign body. Epidermoids can often only be distinguished from dermoids microscopically, the former being lined with squamous epithelium, but containing no sebaceous or sweat glands or hair. At the root of the nose there is a similarity to encephalocele (Fig. 46). In the neck, dermoids may be mistaken for lipomas, lymphomas and branchiogenous cysts.

Dermoids of the umbilicus, on account of their hardness, may be mistaken for malignant tumors, but they are of slow growth and circumscribed. Dermoids of the abdominal walls are often mistaken for sarcomas and fibromas, but the latter are rapidly growing tumors, and often not encapsuled.

Deeply situated dermoids of the various cavities and organs, which are often only noticed accidentally, cannot as a rule be distinguished from other tumors.

Treatment. Extirpation of the whole cyst is necessary, as recurrence takes place if any part is left behind. Commencing carcinoma has been observed in the inner surface of the cyst wall (*Wolff*).

Fig. 46 shows a dermoid of the forehead, where it is often observed, either above the root of the nose, the inner angle of the eye, or laterally near the glabella (fissural dermoid cyst). The skin is movable over the tumor, which was observed in early youth, and shows a small white scar left by a former insufficient operation. The surface of the tumor is smooth and hemispherical. At the periphery there are raised bony walls. The tumor slowly attained its present size after the former operation and then remained stationary. There is no diminution on pressure over the tumor. It is of doughy consistence and only slightly movable over the subjacent bone.

Lipomas occurring on the forehead and having a smooth, not lobulated surface, may resemble dermoids. However, they are not congenital, have no bony ring round them, and are freely movable.

Encephalocele (which may be naso-frontal, naso-ethmoidal, or naso-orbital) is also a congenital tumor, but generally attains a much larger size, diminishes on pressure, and has no bony ring round it.

On account of the scar in the skin an epithelial cyst might be thought of; however, this is not congenital but occurs later as the result of trauma.

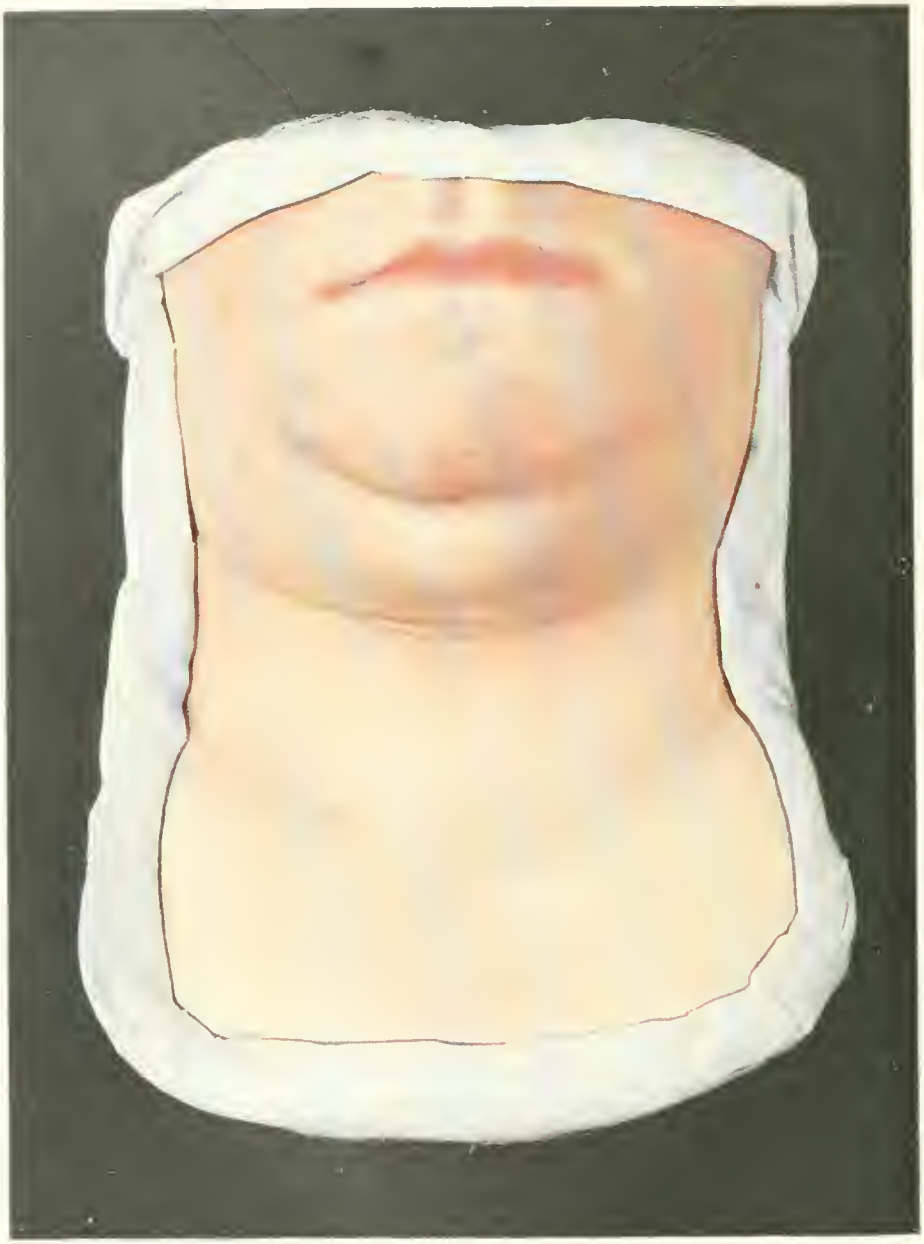

Fig. 48. Dermoid = Cystis.

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Sebaceous cysts are recognized by their superficial position in the skin.

This case was cured by extirpation.

Fig. 47 shows a dermoid of the prepuce, situated symmetrically on both sides of the raphe, and present since birth. The skin is so thin that the contents can be seen through it. The tumor has caused phimosis and balanitis.

Fig. 48 shows a dermoid of the neck in the position of the second branchial arch. Symmetrical dermoids in the middle line may occur above or below the larynx. Dermoids of the floor of the mouth may cause bulging of the sub-mental region. The tumor is the size of a hen's egg, has a smooth surface, is of doughy or semi-fluctuating consistence, movable over subjacent parts and covered by movable, intact skin. It was present since infancy, at first slow-growing, later on stationary, and caused no inconvenience apart from the disfigurement.

It was possible to mistake this tumor for a tuberculous lymphoma, or a thyro-glossal cyst, but the doughy consistence settled the diagnosis. Treated by extirpation.

FIBROMA VAGINAE TENDONIS (*Fibroma of Tendon-Sheath*)

Plate XXXVII, Fig. 49.

Fibroma belongs to the benign connective-tissue tumors, and consists of connective-tissue cells, fibrillar, inter-cellular substance and a variable amount of blood-vessels and lymphatics. When the matrix is hard and abundant, with slight development of spindle-cells, the fibroma is hard, while soft fibroma is formed by spongy tissue with numerous blood-vessels.

Fibromas, which consist of fibrous connective tissue with few nuclei, are also termed desmoids, and occur especially in the fascia of the abdominal walls, while the term fibrosarcoma is applied to tumors which consist of irregularly arranged spindle cells with little intercellular substance, and show degenerative changes and an absence of mature tissue.

Transitional forms from fibroma to fibrosarcoma and sarcoma are especially observed in the tumors occurring in fascia. Mixed forms are often found, such as fibro-lipoma, fibro-myoma, fibro-adenoma and fibro-myxoma. Cystic formation is also seen in fibromas.

Fibromas occur in all situations where fibrillar connective tissue is present—in the cutaneous and subcutaneous tissue (back and thigh), in intermuscular, intertendinous (Fig. 49), submucous and subserous tissue (alimentary canal, uterus, larynx). They may also develop in fasciæ and aponeuroses, nerve sheaths and periosteum (naso-pharyngeal tumors, Fig. 25, and epulis, Fig. 35), and also in the organs.

Fig. 50. Enchondromata manus

Fig. 49. Fibroma vaginae tendinis.

They form circumscribed tumors of firm consistence and smooth surface, often encapsuled, slow-growing, sessile or pedunculated (fibrolipoma pendulum, Fig. 52). Pedunculated submucous fibromas often occur in the larynx in singers. Fibromas form rounded or polypoid growths, which may occur at any age, but are seldom congenital. After metaplastic changes (ossification) they may become hard tumors.

In the skin and subcutaneous tissue they have a yellowish-white surface (Fig. 49). On section they show stratification and a glistening appearance like tendon.

Differential Diagnosis. Superficial hard fibromas of the skin and subcutaneous tissue are easily recognized by their form, consistence, clear demarcation and solitary appearance. It is only transitional forms between fibrosarcoma and sarcoma that present any difficulty. Deep fibromas which often attain a large size (*e.g.* in the abdominal cavity) are recognized by their nodular surface, hardness and encapsulation.

Treatment. Excision of the tumor with its capsule. For the removal of deep fibromas extensive operations are necessary. Sometimes they are so firmly attached to the neighboring tissues or organs that a portion of the latter must be removed with them.

Fig. 49 shows a fibroma of the sheath of the flexor tendon of the finger, the yellowish-white surface of which shows through the skin. The skin is slightly movable over the hard nodular tumor. The tumor itself is movable over the subjacent structures, and remains unaltered in position on moving the finger. Fibromas of tendon sheaths are rare on the whole, and are due to traumatic causes. The tumor was excised.

After injuries and stretching of tendons similar growths occur, sometimes multiple; they are due to proliferation of the cellular tissue. In *Dupuytren's* contraction (Fig. 60) nodules also develop in the palmar aponeurosis, which have a resemblance to fibromas.

Thickenings which occur in tendons and tendon sheaths, and lock the movements of the fingers in certain positions, are not true fibromas.

CHONDROMA

Plate XXXVII, Fig. 50.

Although cartilaginous tumors are pathologically divided into two groups: (1) ecchondromas, or hyperplastic proliferations from pre-existing cartilage, which only occur in places where cartilage is usually present; (2) heteroplastic cartilaginous growths, or enchondromas, which occur in places where cartilage is not normally present; these two forms are often impossible to distinguish clinically.

We, therefore, include both forms under the name of chondroma. The tumors either consist of the different forms of cartilage, or else they form mixed tumors, such as chondro-myxoma, chondro-lipoma, or chondro-sarcoma. Cystic degeneration may also occur in chondromas, and by liquefaction of cartilaginous tumors large cysts may form in the long bones. True chondromas may occur in the soft parts from aberrant pieces of cartilage in the neighborhood. (Salivary glands, neck, ear, lungs, trachea, mammary gland).

The mixed tumors occurring in the testicles and salivary glands, which develop cartilaginous tissue through metaplasia, are not true chondromas.

Congenital chondromas, and those occurring in infancy, according to *Virchow*, are due to disturbances in the development of bone during the period of growth, and arise from islands of cartilage left in the diaphysis. Rickets appear to play a certain rôle in this connection owing to the irregular ossification of the epiphyseal cartilages. In some cases these appear to be a hereditary tendency to the formation of chondromas.

True chondromas, or enchondromas, develop from the periosteum or medulla, most commonly in the phalanges and metacarpal or metatarsal bones; usually multiple. Isolated chondromas also occur in the upper end of the humerus, the lower end of the radius, the head of the tibia, the pelvic bones and the scapula, often combined with cartilaginous exostoses (ossified ecchondromas with a cartilaginous covering).

Chondromas form slow-growing, hard, nodular, circumscribed tumors, which may cause pressure atrophy of neighboring parts (Fig. 50). Multiple tumors, especially in the hands, cause considerable deformity by disturbance of growth (shortening and twisting). Pathological fracture may occur from destruction of the cortex, in tumors growing from the medullary cavity.

The softer forms of chondroma must be regarded as malignant, because they take on an infiltrating growth, extend to the veins and give rise to metastases. (Chondro-sarcoma).

Differential Diagnosis. Central medullary chondromas have to be diagnosed from osteomyelitic abscesses and from central sarcoma. The former, on X-ray examination, show thickening of the periosteum; the latter can often only be distinguished by operation, as the X-ray appearances are very similar in chondroma and sarcoma (when the chondroma is single). Large chondromas of the head of the tibia or upper end of the humerus are easily recognized by their nodular surface and hard consistence.

Treatment. Isolated chondromas should always be extirpated, as they may develop into sarcoma. Multiple chondromas may be incised and scraped. If rapidly growing recurrence takes place, resection or amputation must be performed.

Fig. 50 shows a case of multiple chondromas of the fingers in a young man, which had been present since childhood. The nodular tumors are situated in the phalanges and metacarpal bones, and have caused thinning and reddening of the skin by pressure. The X-rays showed the origin to be in the medullary cavity. The tumors on the first, second and fourth fingers were incised and scraped. The little finger was removed with its metacarpal bone, on account of the multiplicity of the tumors.

HEMORRHOIDES ET FIBROMATA ANI

(*Hemorrhoids and Fibromas of Anus*)

Plate XXXVIII, Fig. 51.

Among the benign growths of the anus, hemorrhoids are the most common. According to the latest researches these must be regarded not only as varicose veins, but as vascular growths or angiomas. Hemorrhoids are called external or internal, according as they are situated in the anus or rectum.

External hemorrhoids are due to the formation of new blood-vessels and dilatation of the veins of the inferior hemorrhoidal plexus. Certain races seem to be predisposed to this affection; constipation and pelvic engorgement may also give rise to it.

These subcutaneous hemorrhoids form bluish, compressible, nodular, sessile growths covered by thin skin, and situated around the anal orifice. There is often moist eczema in the neighborhood (Fig. 51). Through eczema and ulceration the nodules may be transformed into fibrous structures (Fig. 51). In their inflammatory state they cause much itching and pain with tenesmus; while the nodules become hard from thrombophlebitis, and bleed easily. Multiple internal hemorrhoids of the lower part of the rectum bleed easily without becoming inflamed, and have a tendency to prolapse. When they are situated higher up the rectum, diagnosis can be made by digital examination or by the rectoscope.

Differential Diagnosis. External hemorrhoids may be confounded with condylomata acuminata, which are common round the anus in women suffering with gonorrhea. These are often as thick as the

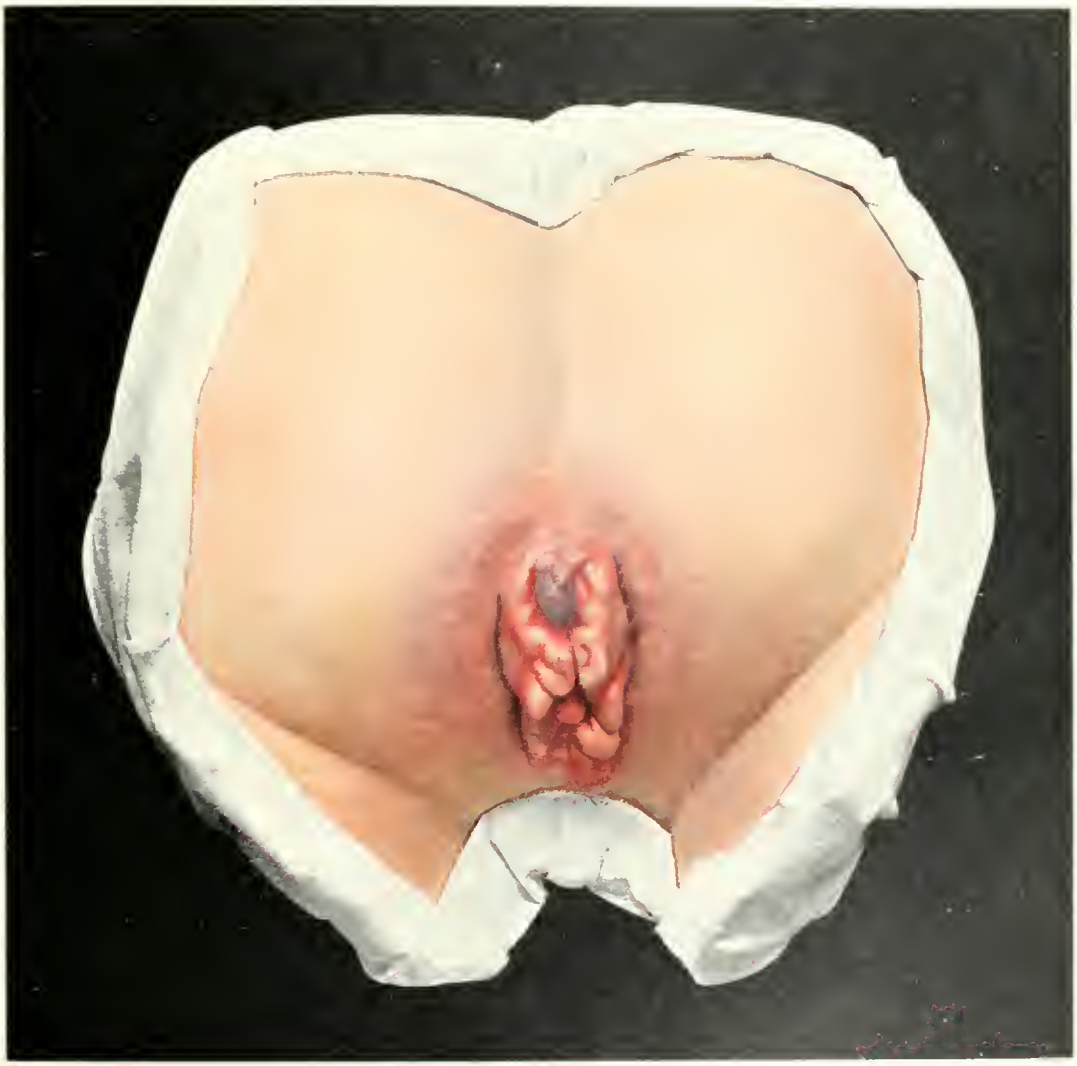

Fig. 51. Hämorrhoides et Fibromata ani.

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finger, and form similar cockscomb growths on account of their papillomatous structure. Fibromas are rare, generally smaller, pedunculated and solitary.

Carcinomas, of the papillomatous type, are recognized by their rapid growth, inguinal glandular metastases, early ulceration with hard borders, and irregular boundaries. In all cases of hemorrhoids the rectum should be digitally explored for carcinoma.

Treatment. Laxatives should be given to create soft stools, and the anus should be washed after defecation. During an attack, rest in bed with the pelvis raised and the introduction of pessaries are useful. Suppurating hemorrhoids must be incised. In cases with frequent hemorrhages and severe pain, a radical operation is indicated, either by cautery or by excision of the nodules with subsequent suture.

Fibromas and condylomas can be removed by scissors, while carcinoma requires more extensive operative interference.

Fig. 51 shows moist eczema in the region of the anus. Round the anus are yellowish, nodular, hemorrhoidal growths, which have a resemblance to fibromas on account of inflammatory changes and ulceration. In one place is a bluish, glistening nodule covered by thin skin. The growths were removed by the thermo-cautery.

Lipoma

FIBROLIPOMA PENDULUM SUBCUTANEUM
(*Pendulous Fibrolipoma*)
Plate XXXIX, Fig. 52.

LIPOMA DIFFUSUM SUBCUTANEUM
(*Diffuse Subcutaneous Lipoma*)
Plate XL, Fig. 53.

LIPOMATA SYMMETRICA SUBCUTANEA
(*Symmetrical Subcutaneous Lipomata*)
Plate XLI, Fig. 54.

Lipomas are tumors formed of fatty tissue, and have, therefore, the yellowish-white color, soft consistence, and lobular structure of fatty tissue. The individual fat lobules are separated by more or less strongly developed connective-tissue septa, and the whole tumor is demarcated from the surrounding tissues by a thin capsule. Lipomas are of soft consistence, often with pseudo-fluctuation; in rare cases harder, from the development of more connective tissue. They are slow-growing globular tumors, which sometimes attain an enormous size, and are usually supplied by a single vessel at the base of the tumor. At the base of the larger tumors the skin is generally drawn out into a pedicle, and is often œdematous. Lipomas are essentially benign tumors; they do not recur or give rise to metastases, nor do they become transformed into malignant tumors. Besides the fatty tissue, other tissues may be developed (fibro-lipoma, myxo-lipoma, angio-lipoma, chondro-lipoma). Cystic degeneration may give rise to so-called oil-cysts in the interior of lipomas.

Multiple, usually symmetrical lipomas, are due to disturbances in development. They may be

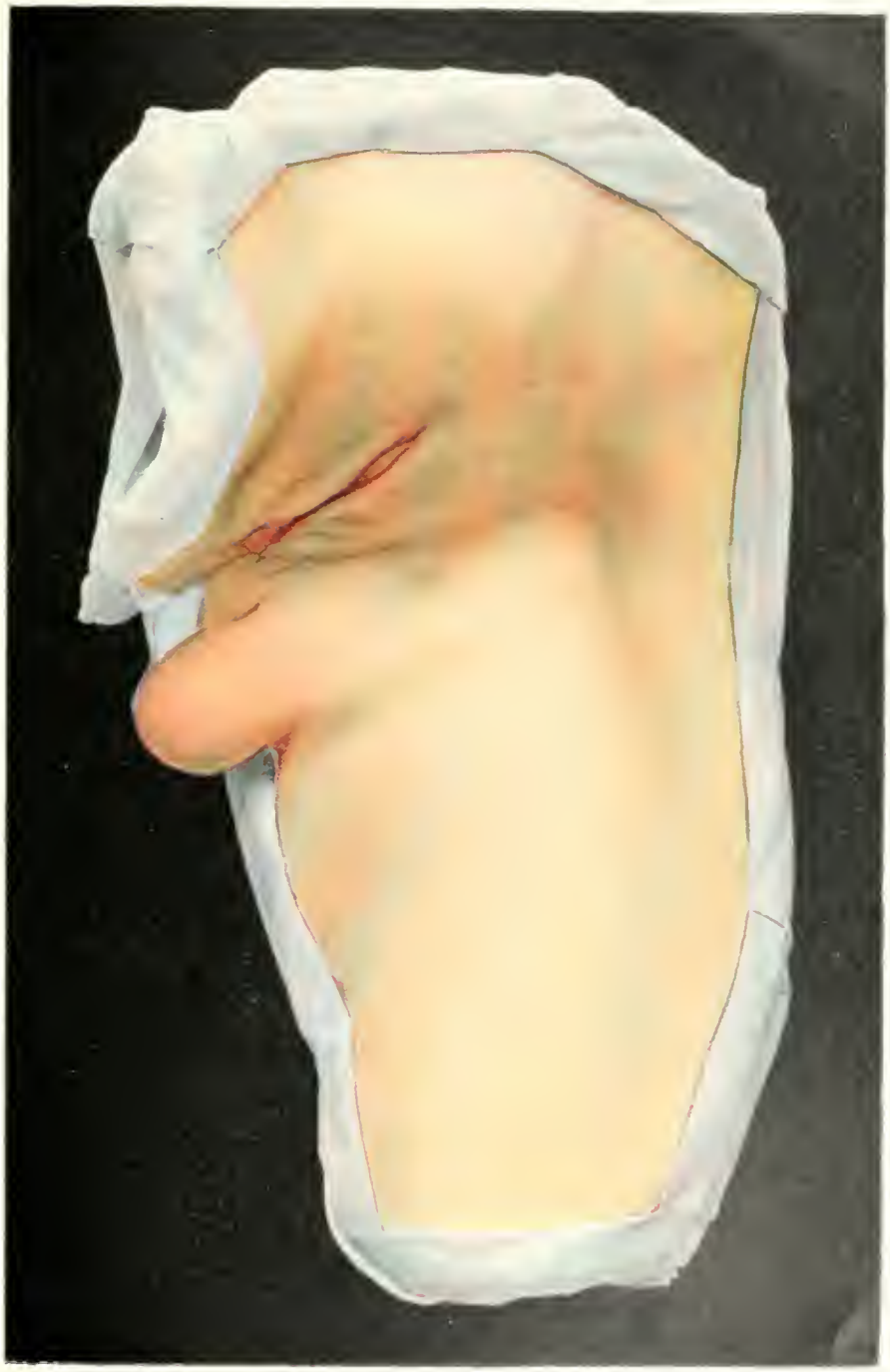

Fig. 52. Fibrolipoma subcutaneum pendulum.

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connected with nerves (multiple lipomas are often painful) or with lymphatic glands, which have been found in multiple lipomas. Congenital lipoma is found especially in spina bifida, which arises as a myelo-cystocele, and usually as a myxolipoma (Fig. 144). That lipomas are true tumors is shown by their persistence in severe emaciation. Long-continued pressure on a lipoma may cause suppuration of the fatty tumor through ulceration of the skin.

That chronic irritation plays a part in the development of lipomas is shown by the occurrence of these tumors on the backs of carriers, and on the foreheads of persons who wear hard hats. Middle-aged women are especially affected by these tumors, which may grow considerably during pregnancy.

Lipomas are most often found in the subcutaneous tissue (Figs. 52, 53 and 54), where they appear as soft, encapsuled tumors with a lobulated surface, covered by non-adherent skin. The skin over the tumor becomes dimpled when pinched up, owing to its connection with the tumor by connective tissue (Fig. 53). The seats of predilection for subcutaneous lipomas are the back, nape of the neck, axilla, shoulder, upper arm, thigh, buttocks and scrotum.

Sub-fascial lipomas are very rare. They may occur under the fascia of the forehead (where they may be mistaken for dermoids) and under the palmar fascia. Intermuscular lipomas occur behind the pectoralis major and in the tongue. In the knee joint arborescent lipoma occurs, which has the typical structure of fatty tissue. Lipomas may also arise from the sub-mucous and sub-serous tissue (gut and larynx); sub-peritoneal lipomas may give rise to hernia through the linea alba. Sub-serous lipomas also sometimes appear in the inguinal and femoral canals; in the omentum and mesentery; in the retroperitoneal tissue, and in the glandular organs (breast and kidney).

All lipomas, especially sub-cutaneous, sub-fascial

and intermuscular, have a tendency to send processes into the surrounding parts.

Differential Diagnosis. Superficial lipomas are distinguished from fibromas, lymphomas, dermoids, sebaceous cysts, hygromas and other tumors by their lobular surface and the puckering of the skin. When they cannot be palpated, lipomas cannot always be distinguished from other tumors.

Treatment. Incision through the skin and removal of the tumor with its processes.

Diffuse lipomas, which consist in an infiltration of the sub-cutaneous tissue with fatty masses without any capsule, are not to be regarded as true tumors (lipomatosis of *Billroth*). In the neck they may be dangerous from pressure on the larynx, so that removal is necessary, although this must generally be incomplete. The fatty masses may also be made to shrink by the injection of alcohol and ether.

Fig. 52 shows a pendulous fibro-lipoma in a middle-aged woman. The skin is somewhat reddened, but non-adherent. The surface of the tumor is smooth, the consistence moderately hard. The tumor is movable over the fascia. The base of the tumor is broad, on account of its small size. The tumor was removed by an oval incision and suture.

Fig. 53 shows a sub-cutaneous lipoma the size of the fist in a common situation in a middle-aged woman. The puckering of the skin is clearly seen. These puckerings (white spots in the figure) are also found in the breast, and are due to processes of the lipoma extending into the breast. The tumor with its processes was extirpated.

Fig. 54 shows symmetrical lipomas in the region of both parotids, in the upper eyelids, and in various parts of the neck (both sides of sub-maxillary region and in sub-lingual region) in an old man. The pain-

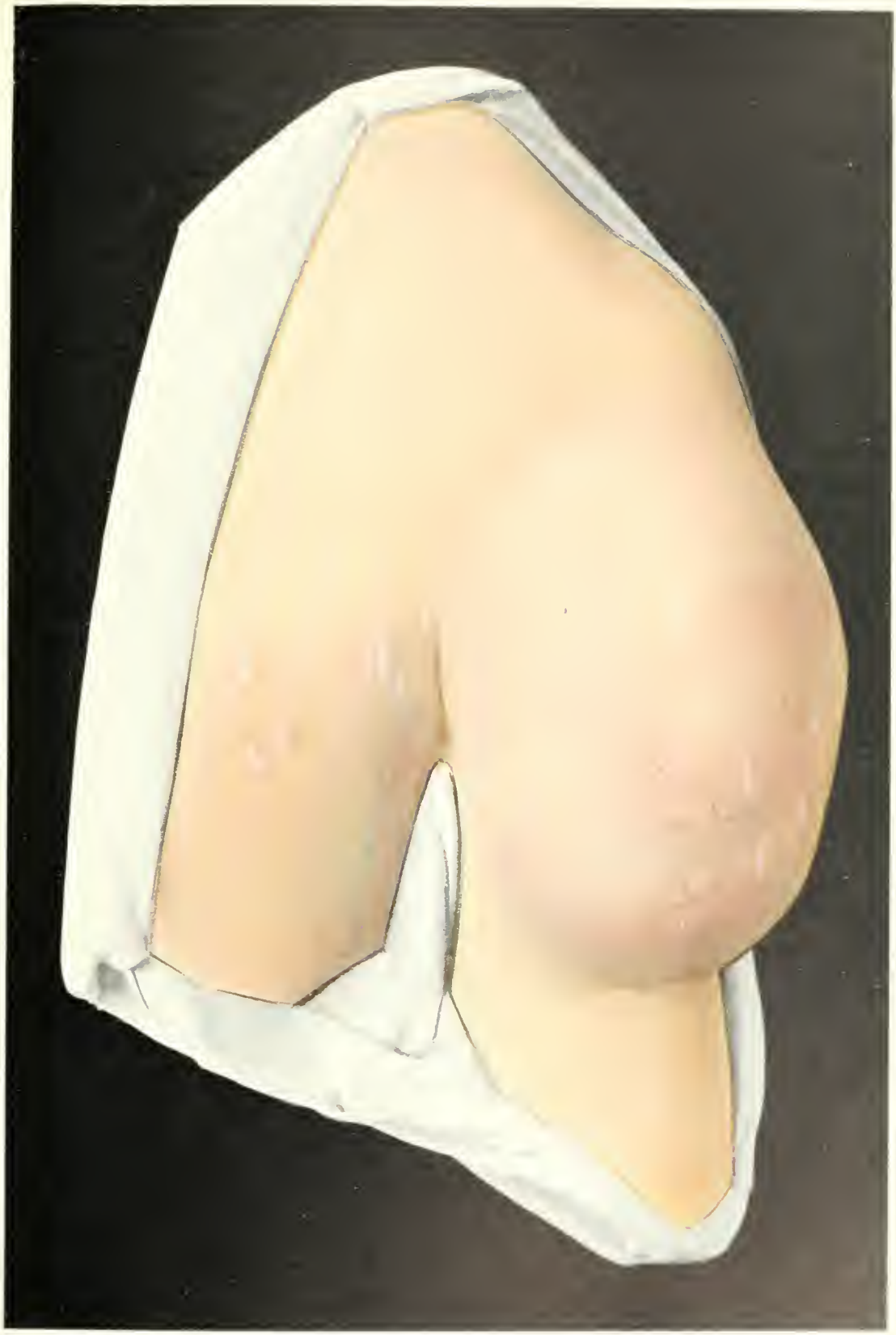

Fig. 53. Lipoma diffusum subcutaneum.

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Fig. 54. Lipomata subcutanea symmetrica.

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less tumors had not increased in size for some years. Their lobular surface and their consistence distinguish these solid tumors from symmetrical cystic formations in the salivary glands, which cause similar swellings in the face and neck. The disease is distinguished from lipomatosis by consisting of multiple, separate, encapsuled tumors. There were no other lipomas in other parts (in distinction to cases in which lipomas occur over the whole body). The tumors were removed at several sittings.

GRANULATIONES ET TRANSPLANTATIONES

(*Granulations and Skin Grafting*)

Plate XLII, Fig. 55.

This plate shows a granulating wound of the right breast, left after extirpation of the mammary gland. After extirpation of the breast, an attempt should be made to close the wound by sutures, but these should not be tied too tightly, especially in the center of the wound, as they are liable to tear through the tissues and cause sloughing. The figure shows the reddish-brown holes of the sutures, which have led to partial closure of the wound in the center. The remainder of the wound can be left to heal by granulation, and *Thiersch's* grafts may be applied. The surface of the wound must first be cleansed, and the granulations must be bright red and exuberant (Fig. 55). Moist dressings of 3 per cent. boric acid lotion and 2 per cent. acetic alum are then applied. The figure shows three epidermic grafts which have become attached to the red granulations. On the axillary side the granulations are still yellowish, and are not yet ready for grafting.

When the whole surface of the wound is covered with red, exuberant granulations, these are removed with a scalpel, and the bleeding surface compressed with hot compresses soaked in saline solution; the largest possible epidermic grafts are then applied and covered with iodoform gauze and plaster. The figure also shows the appearance of such granulations as they occur in the course of the undisturbed wound.

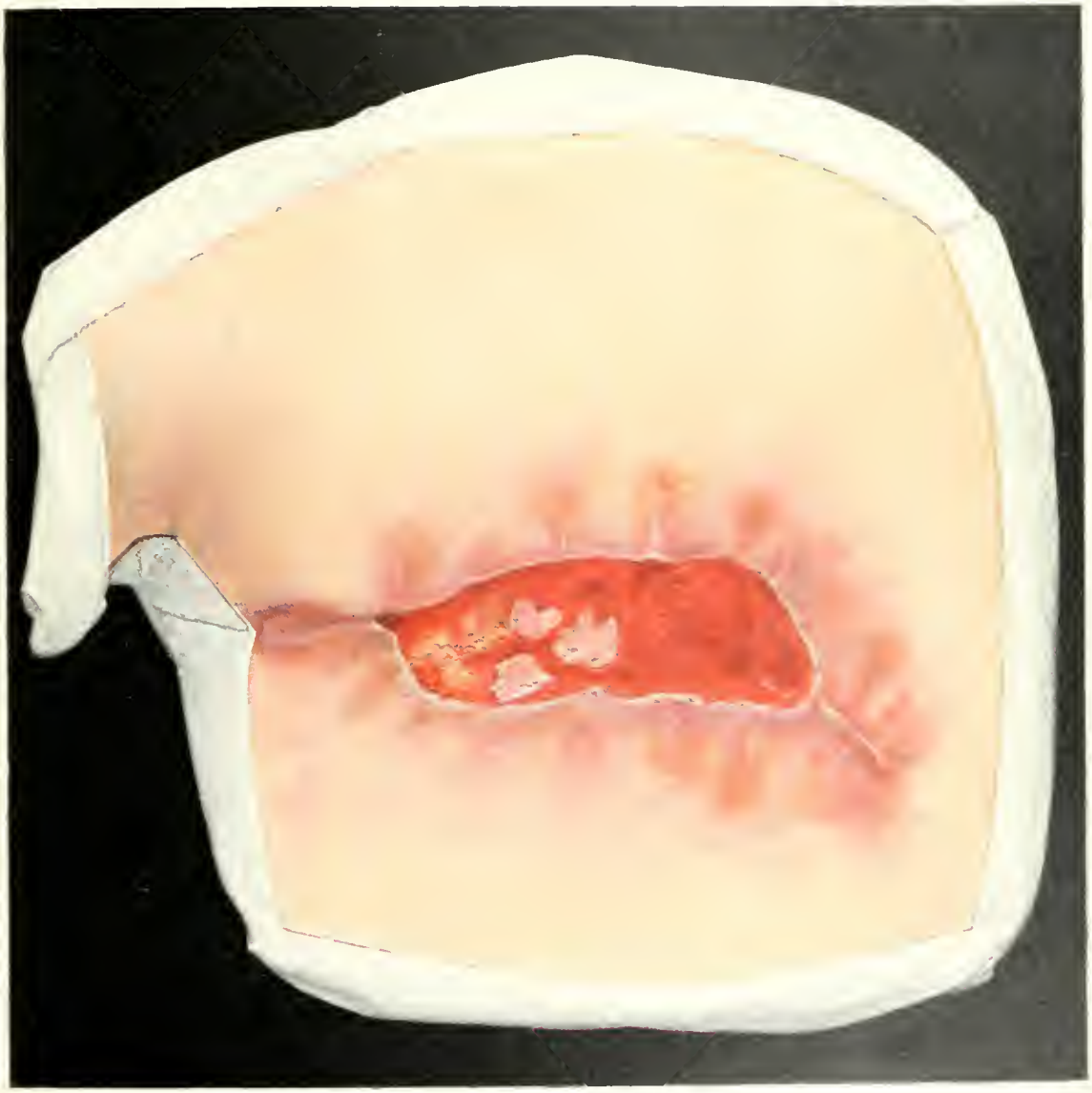

Fig. 55. Granulationes et Transplantationes.

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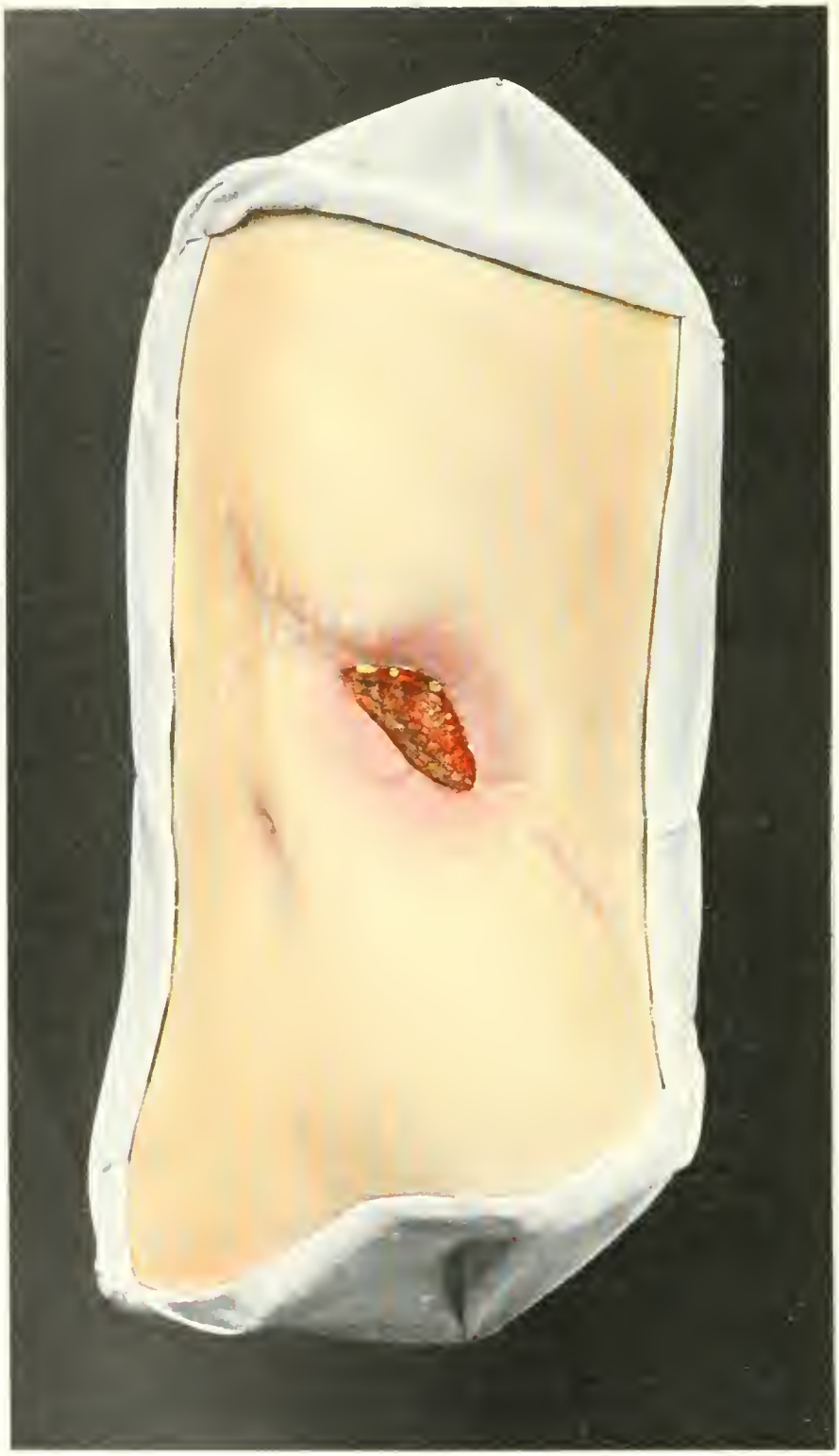

Fig. 56. Fistula ex corpore alieno.

FISTULA EX CORPORE ALIENO (*Fistula from foreign bodies*)

Plate XLIII, Fig. 56.

As the result of incision of a paranephritic abscess, a fistula has remained, which, in spite of drainage, tamponage and repeated scraping, has not healed. The surrounding skin is inflamed and œdematous. The granulations at the opening of the fistula are unhealthy, dirty-brown and purulent. Shreds of tissue with a fetid odor are discharged from the fistula.

Such an appearance of the fistula and its surroundings is typical of all cases where, either the external opening is too small, so that an abscess in connection with it is not sufficiently drained, or where necrosed pieces of tissue in the deeper parts are cast off and act as foreign bodies (*e.g.* bony sequestra in coxitis, etc. (Figs. 95 and 96). Similar fistulas, with an offensive sanious discharge, sometimes result from tampons, drains, or instruments being left behind after operations.

In pyogenic lesions which have been insufficiently incised, the presence of unhealthy, purulent granulations shows that the pus has not a free outlet, or that the lesion is extending. When a local pyogenic lesion gives rise to general pyæmia the wound shows similar changes, but the granulations besides having a dirty-yellow appearance are quite dry.

Treatment must be directed to the cause of the fistula. The latter should be laid open freely, and foreign bodies or pieces of necrosed bone removed, after which healing will take place.

In the case represented in Fig. 56, the kidney was found to be almost completely destroyed by suppuration. Healing quickly took place after removal of the kidney.

FISTULA COLLI MEDIANA (*Median Fistula of the Neck*)

Plate XLIV, Fig. 57.

Median fistula of the neck is due to the persistence of the thyro-glossal duct, which in embryonic life leads from the foramen cæcum at the back of the tongue to the middle lobe of the thyroid gland. Lateral fistulæ of the neck are due to imperfect closure of the second branchial cleft.

The lateral fistulæ may also open in the middle line, so that their true nature can only be made out by tracing their course. This can be done by palpation, by the passage of a probe, or by injection of milk. The lateral fistulæ of the neck deviate from the middle line, perforate the superficial fascia of the neck parallel to the sterno-mastoid muscle behind the greater cornu of the hyoid bone, and open into the side of the pharynx near the tonsil, while the course of median fistulæ remains in the middle line, passing behind or through the hyoid bone to the base of the tongue, and opening at the foramen cæcum. If the internal opening of a fistula is open and the outer opening closed, it is an internal incomplete fistula; if the outer opening is open but the inner one closed, it is an external incomplete fistula. If both openings are closed, branchial cysts are formed in the case of lateral fistulæ, and median cysts (from the thyro-glossal duct) in the case of median fistula.

Median fistula of the neck (Fig. 57), although of congenital origin, is not usually noticed for several years, for it is formed by an internal incomplete fistula which gradually perforates the skin of the neck. The fistula generally opens in the middle line

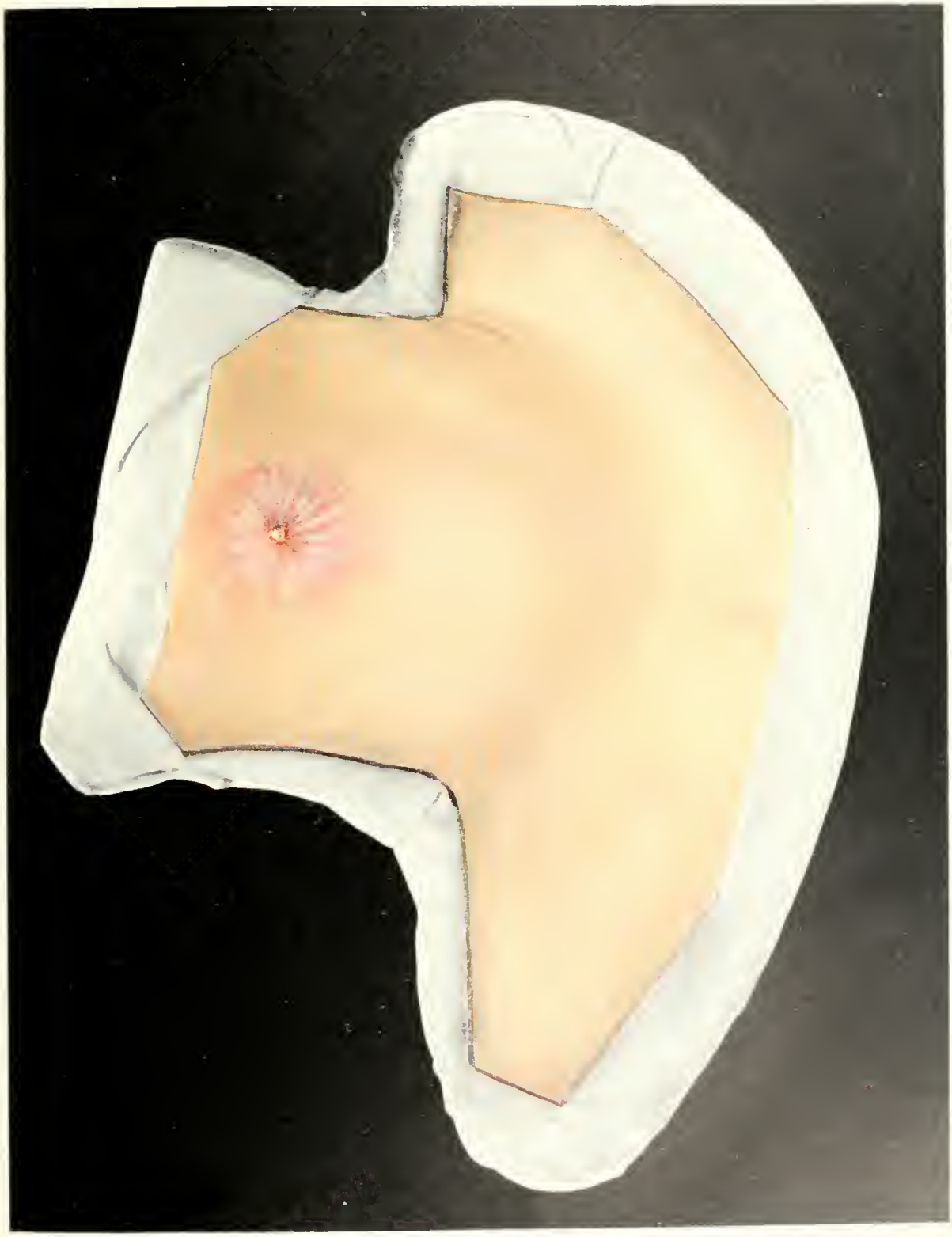

Fig. 57. Fistula colli mediana.

between the hyoid bone and the sternum, and is characterized by certain signs which are also found in lateral fistula which opens on the inner border of the sterno-mastoid muscle. The latter are more often congenital. In both cases there is a small button-shaped opening, which is sometimes glued together, sometimes discharges a drop of clear whitish fluid. There are regularly arranged radiating cicatrices round the fistula. If there is much secretion the skin may be eczematous. On palpation, a hard cord, as thick as a quill pen, can be felt passing towards the middle line or laterally, according to the nature of the fistula. Above the hyoid bone the cord cannot be felt. The direction of the fistula is shown better by probing; the probe can hardly ever be passed beyond the hyoid bone. However, if milk is injected it can be seen to flow out near the tonsil in the case of lateral fistula, and at the foramen cæcum at the base of the tongue in the case of median fistula.

Narrow fistulas cause little trouble to the patient, but in wide, lateral fistulas accumulation of food may cause inflammation and abscess. Carcinoma may arise from fistulas and cysts of the neck; it is called branchiogenous, as it is derived from the epithelium of the branchial clefts.

Differential Diagnosis. Fistulas arising from tuberculous or inflammatory processes differ both in their external appearance and in the course of the fistulous track. In doubtful cases microscopic examination may be made.

Treatment. Injections with the object of causing obliteration of the fistula are useless. The only rational treatment is total extirpation of the fistula through a long incision, bearing in mind the anatomy of the parts. In lateral fistula it is best to remove the internal orifice together with the tonsil. In median fistula, it is sometimes necessary to remove

the middle part of the hyoid bone, in order to follow the track to the foramen cæcum. Recurrence is frequent if the smallest part of the fistulous track is left behind. Microscopic examination of both median and lateral fistulas shows squamous epithelium in distal sections, cylindrical epithelium in proximal sections. The presence of lymphoid tissue in the wall of the fistula is characteristic.

Fig. 57 shows a median fistula of the neck in a girl aged nineteen. The fistula first appeared at the age of fifteen, and was treated by injection and incision, without any result. A drop of secretion is seen at the orifice of the fistula. Radiating cicatrices are also visible. The fistulous track could be felt as a cord as far as the hyoid bone, but its further course could not be made out by injection of fluid. The foramen cæcum was deep. After an incision round the opening of the fistula together with the scar tissue, the track was dissected out. The center of the hyoid bone, through which the track penetrated, was removed, so as to continue the extirpation to the base of the tongue. Microscopic examination showed squamous epithelium in the lower part of the fistula and ciliated, cylindrical epithelium in the upper part.

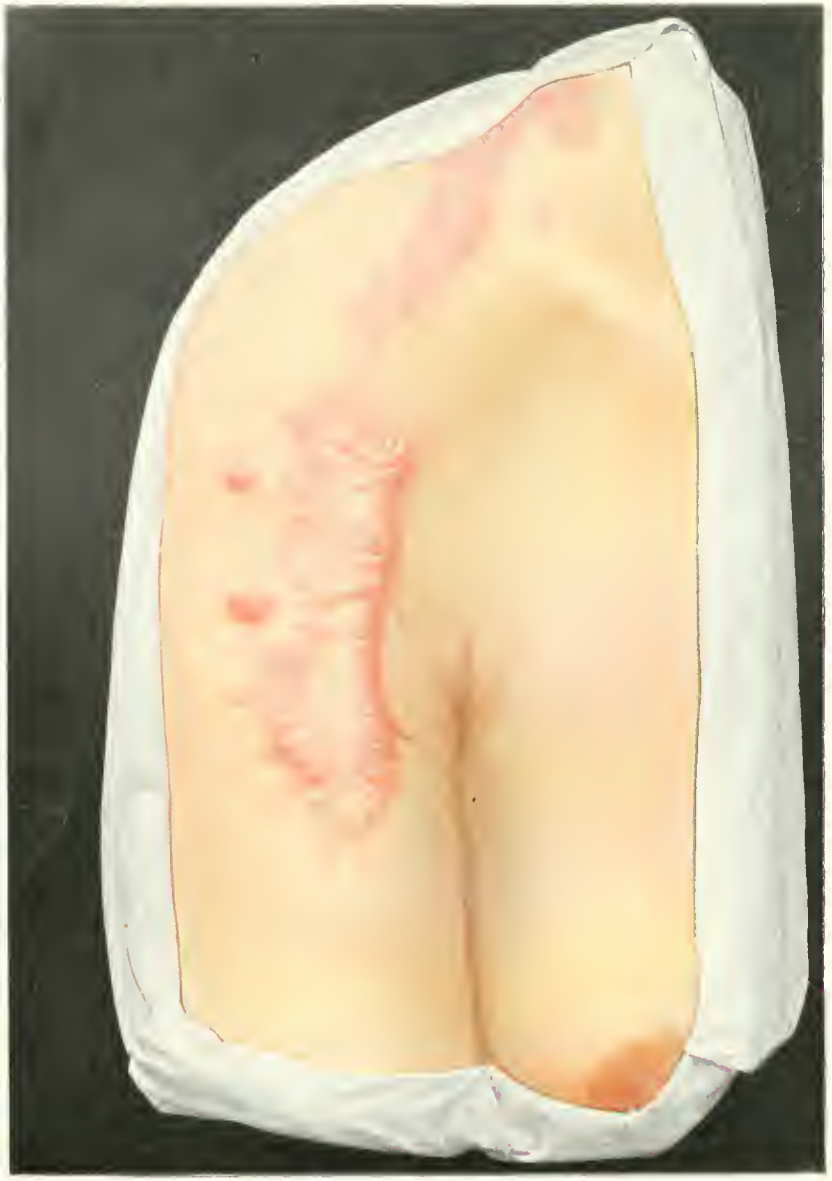

Fig. 58. Keloide post vaccinationem.

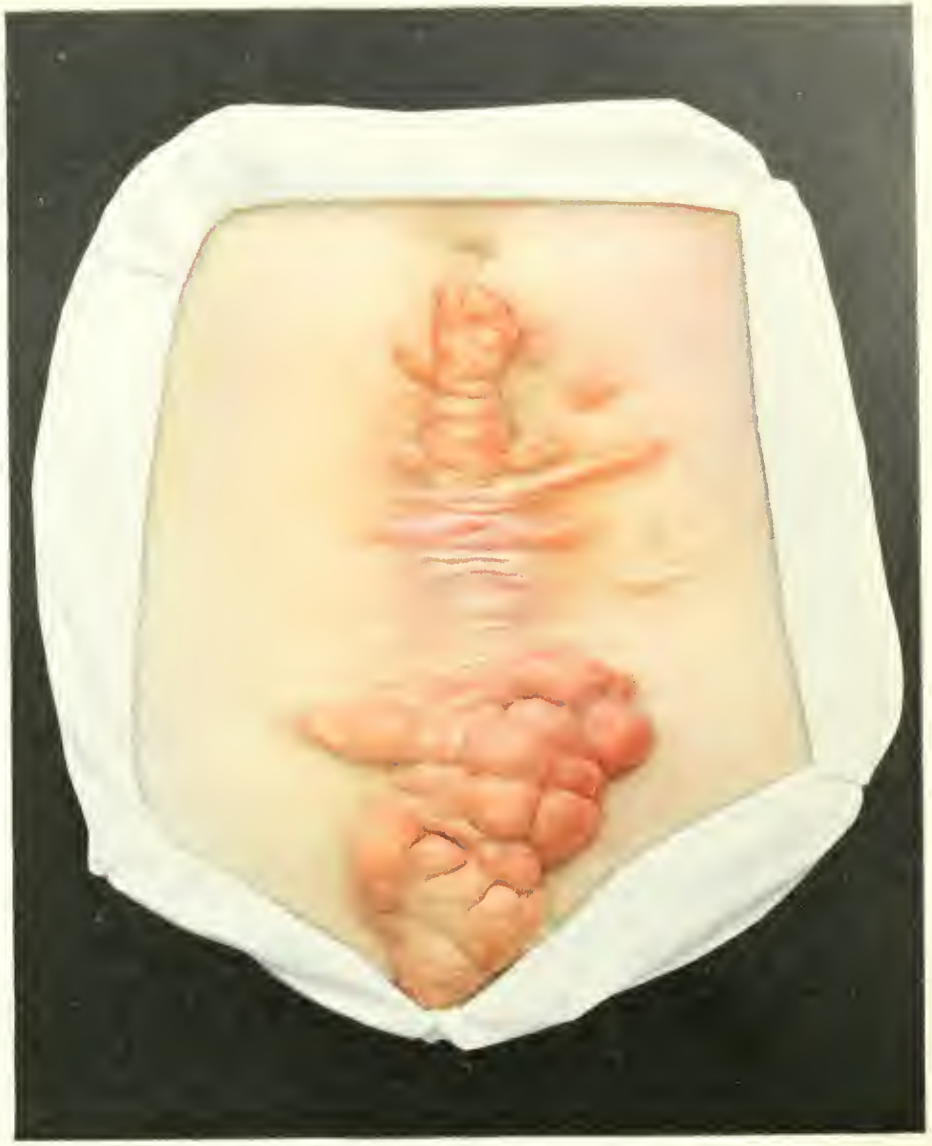

Fig. 59. Keloide post laparotomiam.

Keloid

Plate XLV.

KELOID POST VACCINATIONEM (*Keloid after Vaccination*)
Fig. 58.

KELOID POST LAPAROTOMIAM (*Keloid after Laparotomy*)
Fig. 59.

This disease, the etiology of which is still obscure, consists in the formation of homogenous, fibrous tumors in the skin which are formed of hypertrophic scar tissue with thickened blood-vessels. The chief part of the growth consists of dense, hyaline, often interlacing bundles of connective tissue, while cells and elastic fibers are few in number. Only a few cases can be spoken of as true tumors.

The papillary bodies are unchanged, but lying under them are nodules or lamellæ, more or less rich in cells (keloid-nodular cancer). In the lamellar form (Fig. 58) there are radial processes at the periphery which are often prolonged as fine processes into the skin. The keloid presents itself as a tumor of hard consistence, with a smooth, glistening surface, of reddish (Fig. 58) or yellowish-white color (Fig. 59), situated in the skin and movable over subjacent structures. Keloids are painless, of slow growth, and then remain the same size for some time. They are common in young women. Pain and irritation may be caused by pressure on the tumors, especially when they are of large size, or situated in places exposed to frequent pressure or contact.

It is now believed that keloids occur exclusively after injuries (operations, vaccination, scars caused by flagellation, burns, chronic ulcers, etc.), and that

there is a local or general disposition to keloid formation in the individual affected. It has not been proved that infected wounds are more liable to form keloids. Certain parts of the body are more affected than others—the shoulders, face, abdomen and external ears—while the extremities are seldom affected. Dark races have a special tendency to keloid formation.

Glandular enlargement and metastases are not observed, but large keloids may ulcerate, and cancer may develop from the ulcers.

Differential Diagnosis. Hypertrophic scars may be mistaken for incompletely developed keloids, but the former are usually very sensitive, are not so extensive as keloid, occur especially after infected wounds, and nearly always undergo partial resolution after some years.

Treatment. Operation is to be avoided, as recurrence nearly always takes place after extirpation, with or without a plastic operation, after cauterization and scraping, and the recurrent growth is often more extensive than the original. Electrolysis, or injection of a 10 per cent. solution of thiosinamin sometimes cause improvement.

Fig. 58 shows a keloid in a young girl, which arose from a vaccination scar and recurred extensively after extirpation. An extensive flat growth is seen with radiating processes; also smaller nodular growths in the neighborhood.

Fig. 59 shows an extensive nodular keloid in a woman of twenty, which developed in the scar of a laparotomy. At each suture hole a nodule has developed. At the lower part are hard, cauliflower nodules, freely movable and covered by epidermis. Injection of thiosinamin solution into the nodules caused partial disintegration, but later on further recurrence took place in the parts treated.

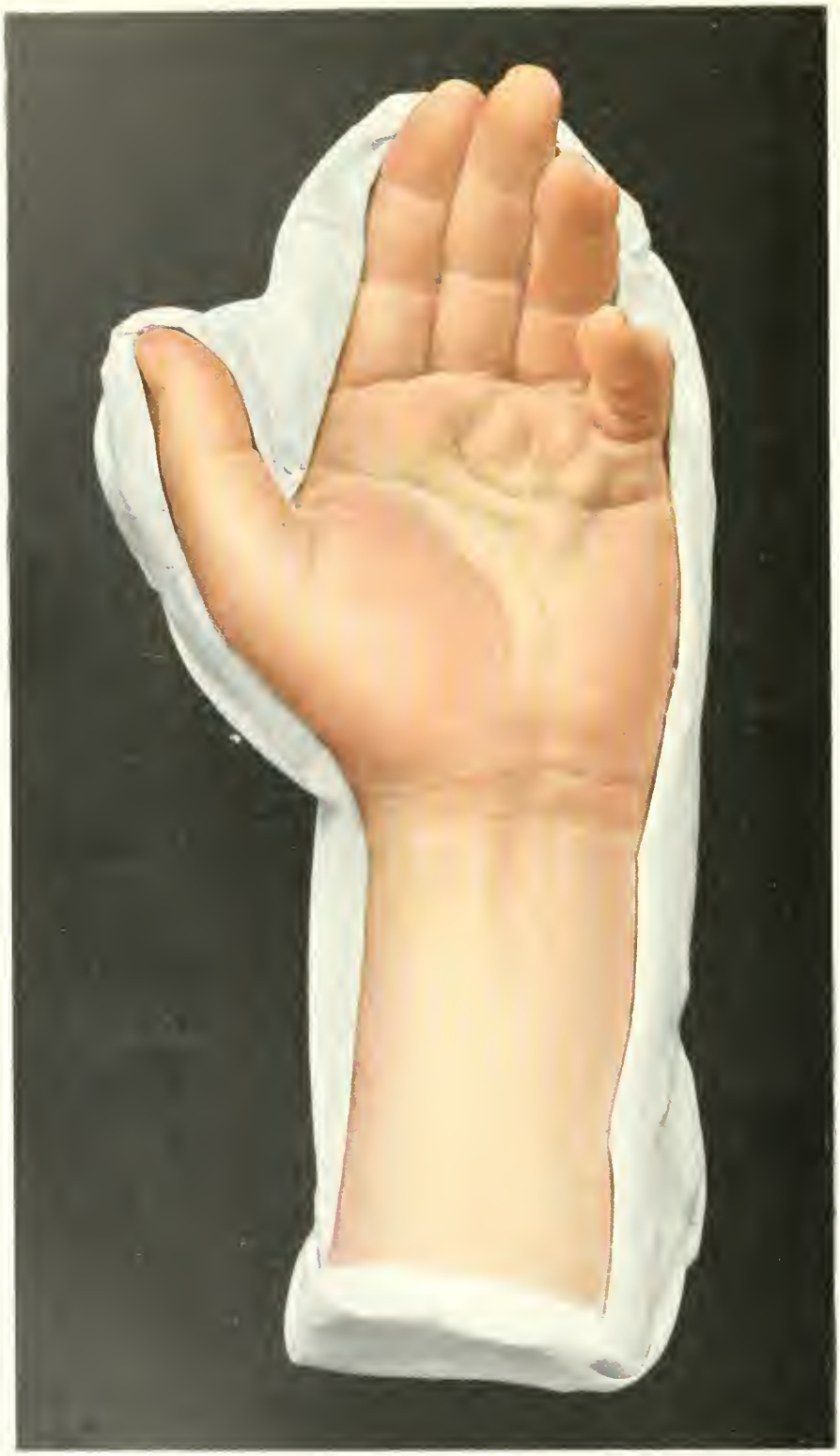

Fig. 60. Contractura aponeurosis palmaris (Dupuytren).

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CONTRACTURA APONEUROSIS PALMARIS (*Dupuytren*)

(*Dupuytren's Contracture of Palmar aponeurosis*)

Plate XLVI, Fig. 60.

The palmar aponeurosis, the continuation of the palmaris longus muscle, which spreads over the palm and sends processes to the proximal phalanges of all the fingers, and is also connected with the skin, may be affected by chronic inflammation leading to connective-tissue formation and subsequent contracture. Hard nodules develop in the aponeurosis and skin, which finally become hard cords. These cord-like thickenings occur not only in the palm, but even more commonly in the processes of the aponeurosis connected with the second, third, fourth and fifth fingers. Contraction of these cords, which at the base of the phalanges are connected with the tendon sheaths, gives rise to an abnormal position of the fingers, called *Dupuytren's* contracture. This term signifies limitation of movement in the joints which may be of arthrogenous, neurogenous, myogenous, tendogenous, or dermatogenous origin.

The fourth and fifth fingers are those most often affected by *Dupuytren's* contracture, the second and third less often, and the thumb least often. The disease usually begins in the fourth or fifth finger and may spread to all the others. It is often symmetrical, affecting both hands at the same time and to the same extent. Before the commencement of contraction, nodular, fibrous thickenings can be felt in the skin, later on fibrous cords are formed, by which first the proximal phalanges, later on the middle phalanges become fixed in a position of flexion, while the terminal phalanges maintain their power

of extension. After some years the contraction becomes so severe that the finger is completely doubled on itself into the palm, and cannot be extended. There is generally some power of extension of the middle and terminal phalanges, but as this is painful it is avoided by the patient.

The affection occurs exclusively in men and was hence attributed to traumatic influence by *Dupuytren*. At any rate the affection is often found in people in whom the palm of the hand is exposed to continued pressure (in post-office clerks, as the result of stamping, persons who carry guns, carpenters, etc.). Some authorities attach little importance to the action of trauma, and the disease often occurs in gouty people. As the contraction is often symmetrical and equally developed on both sides, a central nervous origin is possible.

Differential Diagnosis. *Dupuytren's* contracture differs from contracture due to cutaneous scars, by the skin over it being intact. Fibromas of tendons or tendon sheaths (Fig. 49) form rounded swellings. In occupational contracture of the fingers, there are no hard cords in the palm, and the phalanges of all the fingers are usually equally flexed. In arthrogenous contracture the joints are obviously affected.

Treatment. Mechanical treatment and massage are incapable of arresting the progress of the disease. In severe cases operation is indicated, according to *Kocher* excision of the affected parts of the palmar aponeurosis. Those parts of the skin which show fibrous changes should also be removed, and the wound repaired by skin flaps. Massage, commenced soon after the operation, may give good functional results. Treatment by injection of thiosinamin is at present inconclusive.

Fig. 60 shows a case of *Dupuytren's* contracture of the fourth and fifth fingers in a man of fifty. The little finger is considerably contracted, and only the last phalanx can be freely extended. The fourth finger shows contracture of the first phalanx and commencing contracture of the second. Contracture is also beginning in the third finger. The affection was of several years duration, and caused so little trouble that operation was refused.

CONTRACTURA POST PANARITIUM TENDINOSUM

(*Contracture after Tendon Sheath Suppuration*)

Plate XLVII, Fig. 61.

Cutaneous contractures affect chiefly the flexor surface of the fingers and palm, and originate in the scars of operations, wounds, burns and inflammations. Tendon contracture is often associated with cutaneous contracture, especially when there is suppuration within the tendon-sheaths, so that the finger becomes stiff and fixed firmly in a contracted position. Fig. 61 shows a hard, slightly movable scar, extending from the flexor surface of the last joint of the middle finger to the center of the palm, arising from an incision for suppuration of the tendon sheath (cf. Fig. 93). The nature of the lesion, and the fact that there is no power of motion in the finger, shows that the flexor tendon is destroyed. Hence, the contracture is both dermatogenous and tendogenous, *i.e.* caused by contraction of both skin and tendon.

In cases where the tendon is partly destroyed, or very firmly connected with the hypertrophic cutaneous scar, operative treatment is not successful. After excision of the scar, contracture occurs in the new scar, in spite of extension of the finger, lengthening of the tendon, transplantation of tendon or catgut, or plastic operations. If the patient is incapacitated from work by the contracture, exarticulation of the fingers gives the most useful result, the use of the thumb being cultivated to take their place.

In cases of tendon-sheath suppuration, contracture may be prevented by making small lateral incisions in the finger. If the tendon is not destroyed by sup-

Fig. 61. Contractura post panaritium tendinosum.

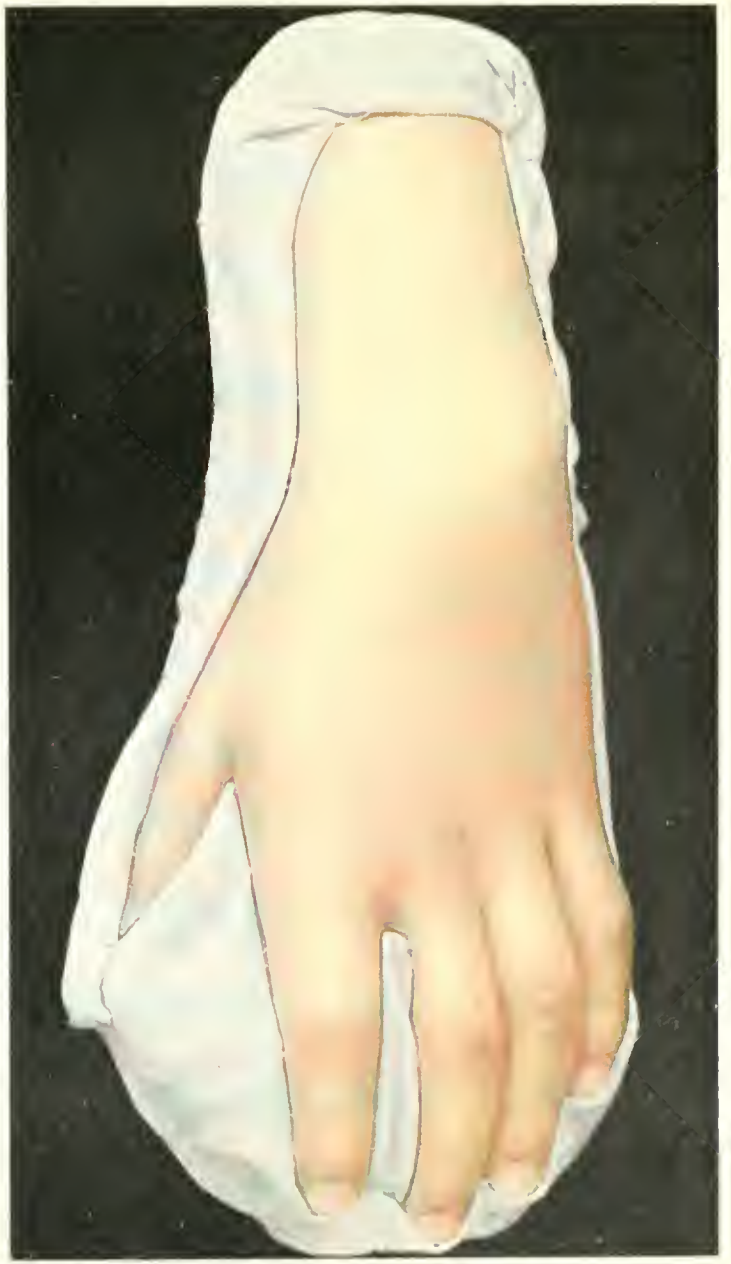

Fig. 62. Haemarthros — Compressio N. ulnaris

puration, the skin contracture can then be prevented by early, active and passive movements, massage, baths, etc.

In cases of contracture limited to the skin, such as those after cuts and burns, keloid scars, superficial suppuration, etc., the prognosis is much better. The mobility of the scar over the deeper structures and the power of moving the individual phalanges, show that the tendon is not implicated. Excision of the scar, extension of the finger, in some cases lengthening of the tendon, and repair of the wound by skin flaps, in these cases restores the function of the finger. In young persons good results can be obtained by orthopedic treatment, when the scar is not very extensive, nor hypertrophic, nor of too long standing.

HAEMARTHROS COMPRESSIO N. ULNARIS

(*Hemarthrosis Compression of Ulnar Nerve, Neurogenous Contracture*)

Plate XLVII, Fig. 62.

Neurogenous contractures affect the hand and fingers, and result from injuries to the radial, ulnar and median nerves. They may be of peripheral or central nervous origin, In contractures of central origin, especially in the paralytic contractures due to anterior poliomyelitis, nerve transplantation, and shortening or transplantation of tendons may be performed. Treatment by massage, electricity and orthopedic apparatus is also useful. In contractures due to lesions of the peripheral nerves (division of nerve; pressure from badly united fracture, effusion of blood, or tumors on the nerve), exposure of the nerve, with excision of the injured part and subsequent suture is sometimes successful.

Fig. 62 shows a reflex contracture resulting from a blow on the ulnar side of the wrist joint, causing effusion of blood into the joint (hemarthrosis) which pressed on the ulnar nerve. Compression of the ulnar nerve by the joint effusion gave rise to "claw hand"—by hyperextension of the proximal phalanges and flexion of the second and third phalanges. There was slight swelling on the back of the wrist joint, chiefly on the ulnar side. Fluctuation was present. The sign of "snowball crunching" indicated the presence of blood clots, and therefore of hemarthrosis. The movements of the joints were limited and very painful. The joint was in a position of slight flexion, but could be easily extended.

The hand was fixed on a splint and recovery took place after absorption of the blood.

The diagnosis between the different kinds of neurogenous contractures, and between these and other contractures often requires an examination of the whole nervous system. Hysterical contracture of the knee and hip joints, which is common in children, disappears under an anæsthetic.

CONTRACTURA ISCHAEMICA BRACHII

(*Ischaemic contracture of the arm*)

Plate XLVIII, Fig. 63.

Myogenous contractures occur most commonly in the upper extremity, as a result of injuries and suppuration in the muscles, which cause shortening of the muscles and their tendons. They also occur in diseases of the nervous system, both peripheral and central. Contracture also results from too long immobilization of a limb, the over-action of the flexor muscles causing flexion contracture of the arm, wrist and fingers.

These contractures are most marked in ischaemic muscular contracture (*Volkmann*), which is generally observed in the upper extremity of young persons. The causes of this condition include fractures (*e.g.* supra-condyloid fracture of the humerus), rupture of the intima of blood-vessels, obstruction of large vessels, exposure to cold, prolonged action of *Esmarch's* elastic bandage, and constriction by plaster of Paris bandages. A constricting bandage is sufficient to cause ischaemia in the arm.

The greater frequency of contracture in the upper extremity is explained by the fact that, owing to there being less muscle in the arm than in the thigh, the vessels are more easily compressed. Out of thirty-five cases collected by *Bardenheuer*, there was only one affecting the leg. The greater frequency of ischaemic contracture in young individuals is due to the greater compressibility of their muscles and vessels. In older persons great pressure on the vessels is liable to cause gangrene owing to arteriosclerosis; even slighter pressure may give rise to obliterative thrombosis and consequent gangrene.

Fig. 63. Contractura ischaemica.

It must be borne in mind that muscular tissue is more affected than skin and bone even by short interruption of the blood supply, because the compressed vessels are terminal branches.

The affection begins in the peripheral parts of the extremities. The fingers become blue, swollen, cold and moist, painful on movement, which can only be done passively, and flexed. In cases where the affection is due to tight bandaging, after early removal of the bandage the skin appears white, while the muscles feel as hard as a board and immobile, but recover after proper treatment. If the constricting bandage is allowed to remain, in a few hours the muscles become bloodless and undergo degeneration, having a waxy-yellow appearance as in typhus. As the result of extensive muscular atrophy, shrinking of the muscles takes place and causes contracture. The patients suffer severe pain for a long time after removal of the bandage. The skin of the fingers gradually becomes yellowish-white like parchment. The swelling of the fingers is followed by shrinking. First of all the fingers, then the metacarpal bones, and finally the wrist become fixed in a position of flexion. The fingers are eventually so strongly flexed that the hand becomes useless. The movements of the wrist are also very limited, and the muscles of the forearm become atrophied and are covered by pale skin. Sensory disorders may occur from pressure of the shrunken muscles on the nerves, and in some cases ischaemic muscular contracture is followed by ischaemic paralysis.

The clinical appearance of myogenous contracture, especially ischaemic muscular contracture, is so characteristic that it can hardly be mistaken for other forms of contracture.

Treatment. Myogenous contracture, when not of too long standing, may be improved by massage, electricity, baths and hot-air treatment. Prophy-

lactic treatment consists in avoiding the use of too tight bandages, and too long fixation of the limb.

In the application of plaster bandages to fractures of the upper extremity certain definite rules must be observed. The limb must be well wrapped in cotton wool, which must be loose at the extremity, and the limb should be suspended to assist the venous circulation. The bandage must be removed if the fingers become blue, swollen or painful. Patients with plaster of Paris bandaging must be kept under continuous observation. The bandage should always be changed on the eighth day, when light massage of the muscles and movement of the joints can be carried out. After this movable plaster casing is used (*i.e.* plaster casing cut through on both sides after fixation, then removed and reapplied with bandages). In every fracture careful examination should be made to see if there is any injury to the nerves, so that paralysis appearing later on may not be unjustly attributed to the bandages.

In severe cases of ischaemic muscular contracture, resection of several centimeters of the radius and ulna may be performed, whereby the flexed position of the fingers and hand is corrected and a certain amount of function is restored.

In cases where the nerves are implicated, transposition of the large nerve trunks from the shrunken muscles above the fascia has been successfully performed.

Fig. 63 represents a case of ischaemic muscular contracture without implication of the nerves, resulting from the application of plaster of Paris bandages to a supracondyloid fracture of the humerus. The bandages were left on for four weeks, in spite of pain, swelling and blueness of the fingers occurring soon after their application. After removal of the bandages, the muscles of the forearm were found to be much atrophied. The hand and fingers gradually

assumed the form of claw-hand, so that the patient could not use his arm. Extensive resection of the radius and ulna with subsequent suture corrected the flexed position of the hand and restored the function of the limb to a certain extent.

HALLUX VALGUS (*Hammer-toe—Arthrogenous Contracture*)
Plate XLIX, Fig. 64.

In the foot contractures occur which are generally limited to the first and second toes. Pointed shoes cause external deviation of the great toe, known as hallux valgus. The deviation may be as much as fifty degrees, so that the great toe lies over or under the second toe. As the result of changes in the joint (atrophy, inflammation, arthritis deformans), arthrogenous contracture takes place in the metatarso-phalangeal joint, so that in advanced cases the deformity cannot be corrected. Over the projecting metatarso-phalangeal joint exostoses, clavus and bunions may develop, while an ingrowing toe-nail usually forms on the outer side of the great toe (Fig. 99). Clavus most commonly forms a circumscribed thickening of the horny layer of the epidermis, causing pain by pressure on the papillary nerve endings. Underneath the clavus a bursa generally forms which may suppurate (bunion) and perforate externally or into the joint. Clavus most often occurs on the first and fifth toes. In hallux valgus and in hammer-toe clavi are always found, often between two toes or under the toe-nails. Subungual exostoses also occur in these cases (Fig. 140).

Hammer-toe is an arthrogenous flexion contracture usually affecting the second toe, as the result of wearing too short boots, or secondary to hallux valgus. The first phalanx is extended, the second and third flexed. The third toe is rarely affected.

Hallux valgus and hammer-toe are often combined with flat foot, and then render walking still more awkward and painful.

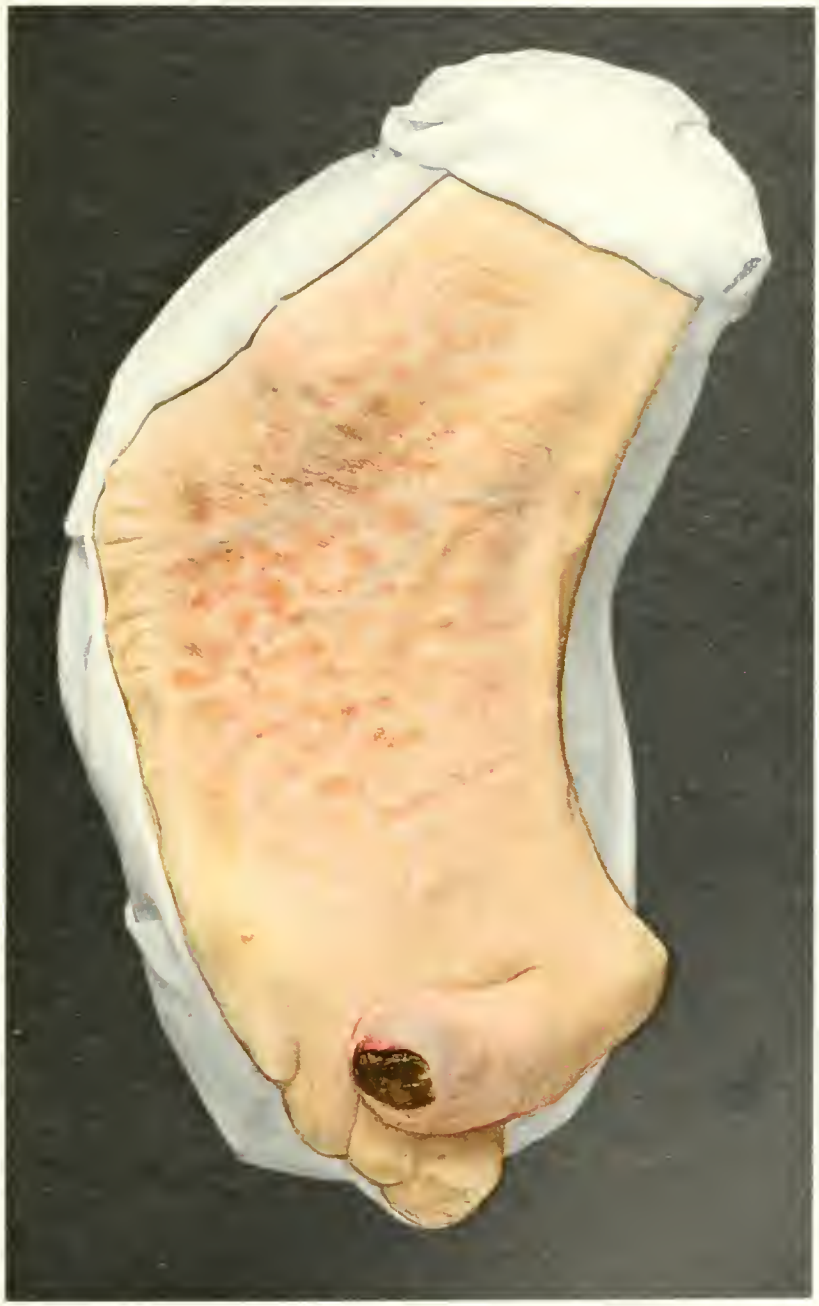

Fig. 64. Hallux valgus – Hammerzehe – Arthrogene Kontraktur.

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Treatment. Prophylactic treatment consists in attention to the feet, baths, cutting the toe-nails straight instead of curved, properly made boots, etc.

Hallux valgus, if it gives much trouble, is best treated by cuneiform osteotomy of the metatarsus and subsequent correction in plaster of Paris.

Hammer-toe is often treated by fixation to a splint, after correction of the deformity, but this is unsatisfactory. It is better to cut through the soft parts at the seat of flexion, and resect the joint from the extensor surface; or in bad cases to disarticulate the toe.

Exostoses can be chiseled; subungual exostoses after removal of the nail.

Clavi are best removed by the knife. In subungual clavus the nail must be removed first. Fistula from a bunion should be freely incised and cauterized; or the whole bursa may be extirpated. (For the treatment of ingrowing toe-nail and flat foot see Figs. 99 and 83).

Fig. 64 shows the result of neglect and badly fitting boots. The great toe shows typical hallux valgus. On the inner side of the metatarso-phalangeal joint is a clavus, on which opens a fistula from a bunion lying under it. On the outer side of the great toe the nail is ingrowing. The second toe is affected with hammer-toe and also clavus. The back of the foot is covered with dry eczema, due to uncleanliness. Owing to these disorders and a considerable degree of flat foot the patient could hardly walk. The hallux valgus was corrected by cuneiform osteotomy of the metatarsus. The clavus and bunion were excised, and the second toe disarticulated. The eczema healed quickly with *Hebra's* ointment. After this the patient could walk normally, with a well-made boot.

RHACHITIS—INFRACTIONES CRURIS UTRIUSQUE

(*Rickets, Greenstick, Fractures of Both Legs*)

Plate L, Fig. 65.

Rickets, which is also known as the English disease, is a disturbance of growth affecting the whole skeleton. It consists in softening of the bones in the course of their growth, from defective ossification due to deficiency in calcium and magnesium phosphates. In the epiphyses there is abnormal proliferation of cartilage, and at the same time imperfect calcification of the cartilage. This causes thickening of the epiphyses and interference with the growth of the long bones in rickety children. Irregularity in the formation of the medullary spaces also plays a certain part. In the flat bones growth in thickness is hindered.

In the skull the disease affects chiefly the frontal and parietal bones. The bony substance may be so poorly developed that the bones are soft and flattened, yielding to pressure (cranio-tabes). In other places, especially the frontal and parietal eminences, the bones are thickened and prominent from the overformation of bony tissue. The cranial sutures and fontanelles remain open for a long time, and hydrocephalus is often present. The upper and lower maxillæ are flattened and irregularly developed, and the implantation of the teeth is irregular and abnormal.

The weight of the body causes bending of the softened bones; the spine becomes kyphotic or scoliotic; the thorax is constricted laterally, and the junctions of the cartilage and bone of the ribs become thickened (beaded ribs or rickety rosary). The pel-

Fig. 65. Rhachitis. Infractiones cruris utriusque

vic bones remain small, so that the rickety pelvis is a cause of obstructed labor. Lastly, in severe cases, the lower extremities become extremely bent and the bones are liable to greenstick fracture.

In the second year there is usually thickening of the epiphyses of the bones of the limbs, especially the lower ends of the ulna, radius and tibia; while the diaphyses, especially of the femur, tibia and fibula are curved. The femurs are bent outwards, the bones of the leg outwards and forwards (Fig. 65). Genu valgum occurs in the knees. The arch of the foot sinks in, causing flat foot. In severe cases of rickets the children remain so backward in growth that they become dwarfs. The so-called fetal rickets, according to recent investigations, has nothing to do with rickets. True rickets occurs exclusively in children between the first and sixth years, especially in the second year, and at puberty as late rickets, especially when heavy weights act on the limbs (genu valgum, coxa vara, scoliosis, pes valgus).

The origin of rickets and its absence in certain countries (China, Japan, Australia) is not yet quite clear, but bad hygienic conditions and especially improper feeding play an important part. Hereditary syphilis is a predisposing cause.

The disease often begins with anæmia, digestive troubles and diarrhea, while spasm of the larynx (laryngismus stridulus) or lung affections often occur and may be fatal.

Differential Diagnosis. Osteomalacia, which consists in softening of normally developed bones, occurs at a later age, more often in women. Hereditary syphilis affects fewer bones, especially the tibia, and is almost always associated with other signs of congenital syphilis—interstitial keratitis, notched teeth, etc.).

Rickety scoliosis and kyphosis are distinguished

from tuberculous spinal disease by the presence of rickety changes in other parts of the body.

The prognosis is favorable on the whole. Calcification may take place in the osseous tissue and the bones may assume a sclerotic condition, without a trace of shortening or bending being left. According to the researches of *von Schlauge* and *Veit* this occurs in the course of four years in all children who do not remain markedly backward in growth. The disease generally comes to an end about the sixth year, but it may recur afterwards, especially in the winter.

Treatment. In the first place hygienic conditions must be improved. Infants should be suckled by the mother. Later on meat, eggs and vegetables should be prescribed. Fresh air, high altitudes and sea bathing are all beneficial. Internally cod-liver oil and phosphates. The children should be kept off their feet, and sleep on hard beds. Surgical treatment consists in the treatment of green-stick fractures and in correcting the curvature of the bones of the limbs. Complicated apparatus only leads to atrophy of the limbs. Ricketty spine should be treated by a strong corset.

Curvatures of the bones should only be operated on when they are severe, and then only when the disease has come to a standstill. An X-ray examination is useful; in active rickets the epiphyseal lines appear wide and irregular, sometimes with incomplete fractures and irregular arrangement of cartilage, and the cortex appears much thinned; while, in quiescent rickets, the epiphyseal lines have become regular, and the cortex appears the same thickness as the deeper parts.

As a rule, operation should not be performed before the sixth year. The curvature can be corrected manually or by the osteoclast; better still by linear or cuneiform osteotomy, followed by plaster of Paris.

Operation is also indicated in cases where there is early sclerosis of the bone, which is shown by the X-rays. In this case the curvature must be corrected by osteotomy, otherwise the bones will be arrested in growth.

Fig. 65 shows rickets affecting the whole skeleton in a girl aged four years. The left femur was so much curved and sclerosed that osteotomy was performed, while the curvature of the right femur underwent spontaneous cure. The epiphyses of the knee and ankle joints are much thickened, the upper and lower ends of the tibias are much bent. At the lower ends the X-rays showed green-stick fractures. Operation here was contra-indicated, as the X-rays showed the disease to be still in an active state. In the hip joints the X-rays showed coxa vara of the neck of the femur. The child was very feeble and backward in growth.

LUXATIO CUM FRACTURA CRURIS

(*Fracture-dislocation of the leg*)

PSEUDARTHROSIS

Plate LI, Fig. 66.

False joints (pseudarthrosis) occur in the leg, chiefly after oblique fractures with dislocation, or comminuted fractures; in the thigh and upper arm after transverse fractures also, as the result of interposition of the soft parts, chiefly the muscles.

Advanced age, pregnancy, rickets, syphilis, tuberculosis, may delay union of the fragments in a fracture.

Extension treatment is the best to obtain rapid and sure union. Delayed union may be accelerated by percussion of the fragments, injection of iodine and other preparations, or of blood, into the callus; by passive hyperæmia, or by the administration of phosphate of lime.

Badly united fractures can be brought into better position by the osteoclast or by osteotomy.

In the treatment of pseudarthrosis situated close to a joint resection comes into question. Pseudarthrosis in the shaft can be repaired by bone suture. When the ends of the fragments are much atrophied (X-ray examination) they must be resected before suturing. The fragments may be resected so as to overlap each other (dovetailed). The periosteum must always be spared as much as possible.

Transplantation of bone has sometimes proved successful. If no union occurs after these methods, apparatus must be worn, or amputation must be performed.

Fig. 66. Luxatio cum fractura cruris — Pseudarthrosis.

In the treatment of fractures and dislocations, especially in fracture-dislocations, the X-rays are especially useful in making an early diagnosis.

Fig. 66 shows marked deformity of the lower part of the right leg as far as the ankle joint. On the outer side there is slight outward curvature of the fibula above the external malleolus. The peripheral end of the fibula is dislocated, so that the external malleolus projects and the skin bulges on the outer side of the ankle joint. There is an outward curvature of the right tibia above the inner malleolus. The foot is in the position of advanced flat-foot.

The nature of the injury is an ununited supra-malleolar oblique fracture of the tibia. The distal part of the tibia is freely movable, although the fracture is of two years standing. X-ray examination shows that the fragments have overlapped, and that there is a united fracture of the distal end of the fibula a few centimeters above the external malleolus, in the position of the above-mentioned projection.

The patient (aged sixty), owing to effusion into the left knee and left flat foot, depended entirely on the right leg; the injury being due to the giving way of the right foot in a position of supination. The fracture dislocation had not been diagnosed, and the patient had been treated with poultices, etc. The foot was brought into proper position by resection of the lower ends of the tibia and fibula and freshening the head of the astragalus.

Nævi

NÆVUS PIGMENTOSUS PILOSUS (*Hairy Pigmentary Nævus*)
Plate LII, Fig. 67.

Nævi (or birthmarks) are congenital, fibrous new formations of the skin. Lentigines and ephelides (freckles) resemble nævi in their histological structure.

Only the larger nævi are present at birth; the rest develop during childhood and cease growing at puberty.

Nævi formed of blood-vessels are called vascular naevi (Figs. 75 and 76), while those formed of lymphatics are known as lymphangiectasis.

A special form of nævus is the pigmentary nævus. Owing to the presence of lymphatics this is called by *von Recklinghausen* lymphangio-fibroma, by *Borst* fibroma melanodes. These are often covered with hairs and are also known as pigmented hairy nævi (Fig. 67). In pigmentary nævi there is proliferation of fibrous cells in the dermis, dilatation of lymphatic vessels, and pigment within the cells of the dermis and epidermis.

These nævi are round, oval, or irregular in shape, with a sharply defined margin, and brown, yellowish-brown, blackish-brown or black color. Clinically they are divided into two forms, flat nævi, on a level with the skin, and projecting nævi.

Flat nævi occur on one side or over the whole body. Their distribution sometimes corresponds to that of the cutaneous nerves, and on this account their origin has been attributed to trophic changes

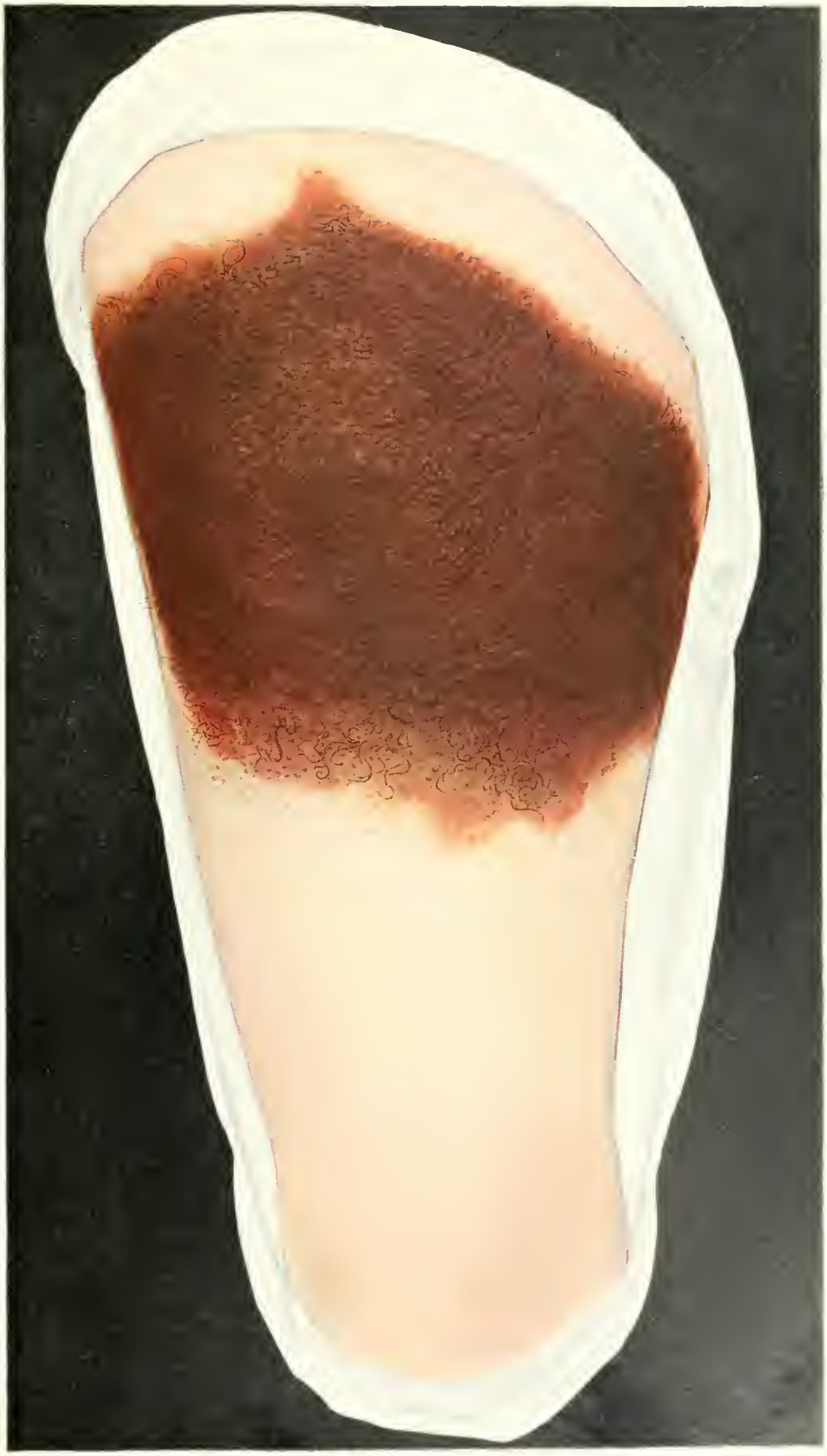

Fig. 67. Naevus pigmentosus pilosus.

in the spinal ganglia, also to fibromas of the smallest cutaneous nerves. In elephantiasis of nerves flat nævi are generally found on the body. Projecting nævi, especially pigmentary, often have a surface resembling that of a wart, and may assume a villous appearance. Lastly, papillomas, carcinomas and sarcomas may arise from nævi.

As a rule, nævi cause no trouble, but occasionally they may become ulcerated.

Differential Diagnosis. Nævi may have some resemblance to warts, fibromas and pityriasis versicolor, but the diagnosis is usually easy.

Treatment. On exposed parts of the body nævi should be excised, for cosmetic reasons. Removal is also indicated in rapidly growing nævi, and when inflammation occurs.

Ephelides may be removed by the application of strong resorcin paste.

Fig. 67 shows a very extensive pigmentary hairy nævus which was present at birth, and increased in size till the age of puberty. The borders are smooth, but the central parts of the surface are warty (nævus verrucosus). The color is blackish brown in the center and brown at the periphery.

NÆVUS NEUROMATOSUS—FIBROMA CUTIS

(*Cutaneous Fibroma*)

Plate LIII, Fig. 68.

The distribution of certain nævi in the course of nerves has been already mentioned. *Von Recklinghausen* was the first to show the connection between disseminated pigment spots and nervous diseases. The researches of *Soldan* have shown that in pigmentary nævi the presence of nerves can be demonstrated, in the sheaths of which fibromas develop which can only be seen with the microscope, but arise like the larger fibromas of nerve sheaths; also that they appear in the form of multiple soft tumors (fibroma molluscum), or as congenital elephantiasis of nerves.

Fig. 68 shows a slightly pigmented nævus extending over most of the forearm, with a bluish-red, irregular elevation in the center. The presence of numerous small, soft nodules in the skin (fibromata mollusca); also the presence of a small projecting growth, painful on pressure, which is formed by a fibroma of the nerve sheath of a large subcutaneous nerve, shows it to be a case of nævus neuromatosus. Multiple cord-like formations could be felt under the nævus, which were probably plexiform neuromas. Pigmentary spots were present over the whole body, and fibromata the size of a nut on the upper arm and axilla.

Fibromas of nerve-sheaths have been incorrectly called neuro-fibromas; but they consist of fibrous tissue only, without any proliferation of nerve fibres. They are generally multiple and disseminated over the whole body, forming small, soft fibromas when

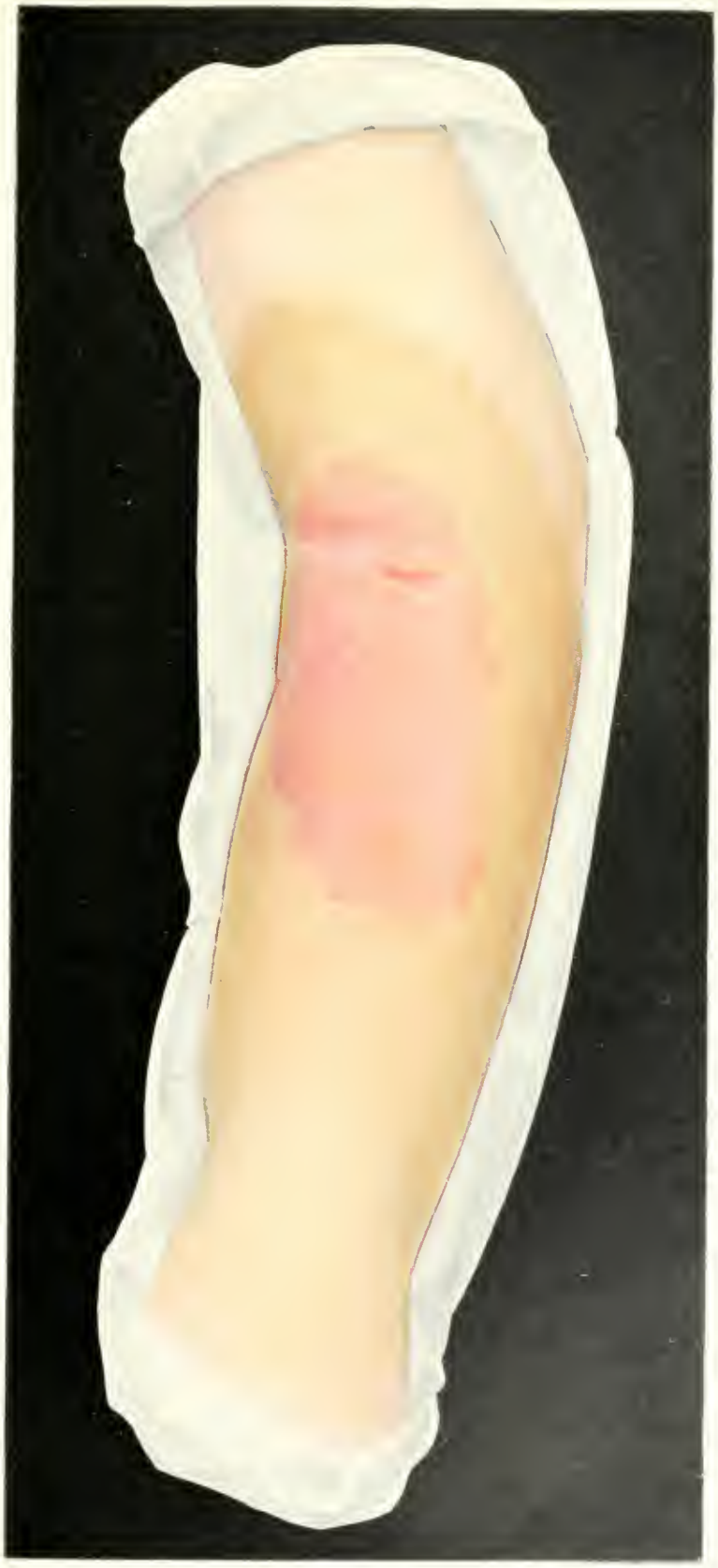

Fig. 68. Naevus neuromatosus — Neurofibroma cutis.

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they affect the fine cutaneous nerves, and are combined with numerous pigment spots (neuro-fibromatosis of *von Recklinghausen*). The small tumors may lie so closely together that the skin assumes a finely lobulated appearance (temples, neck and back). This condition has been termed elephantiasis nervorum, and consists in fibrous tissue formation with lymphatic vessels (Fig. 69). The disease is either congenital or appears at an early age, and is due to developmental disturbances. There is sometimes also a hereditary predisposition.

In distinction to these small, soft, multiple fibromas, fibromas of the larger nerve trunks appear as hard fusiform tumors of the sheaths of the cutaneous (Fig. 68) or subcutaneous nerves. They are very painful on pressure. Functional disorders occur in the form of paræsthesia.

In addition to these two forms of fibroma, there are true neuromas which resemble cirsoid aneurism, and are, therefore, called cirsoid neuroma or plexiform neuromas. These are formed of twisted cords which may form an inextricable network of nerve cords.

In distinction to the fibromas of nerve-sheaths, in which there is no new formation of nerve fibers, there is in true neuromas a new formation both of fibrous tissue and nerve fibers, which is due to developmental disturbance, which generally appears at birth, and chiefly affects the scalp, temples, nape of the neck and the back. In this case also there occur combinations with pigment spots, fibromatosis, fibromas of nerve-sheaths and elephantiasis of nerves.

Differential Diagnosis. Isolated fibromas of nerve-sheaths may be mistaken for other tumors, but there are generally other anomalies present, such as pigment spots, etc.

Treatment. Nævus neuromatosus should only be excised when it shows papillomatous proliferation,

or when fibromas or plexiform neuromas are situated beneath it.

Isolated fibromas of the nerve sheaths can generally be excised without injuring the nerve; but in large fibromas the nerve may have to be removed, with subsequent nerve suture. Recurrence is rare.

Multiple fibromas are apt to recur after operative interference, which seems to show that irritation and trauma favor their development. Rapidly growing tumors should be removed as they may undergo transformation into sarcoma and myxosarcoma.

Plexiform neuromas must be completely extirpated, as recurrence takes place if any part is left behind. At the same time the thickened skin should be removed, if it shows elephantiasic changes (Figs. 68 and 69). In extensive cases the operation may be done at several sittings.

Fig. 68 shows the various affections mentioned above in the left arm of a young man. The extensive nævus pigmentosus was present at birth. The smaller nævus neuromatosus, and the multiple, small, soft fibromas lying in it; the hard fibroma, arising from the sheath of a large nerve, seen at the upper end of the nævus neuromatosus near the bend of the elbow; also the plexiform neuroma appearing in the subcutaneous tissue in the form of twisted cords, all developed later, but had been present many years. Small pigment spots were present all over the body. There were also fibromas of different sizes in the course of the different nerves of the same arm. A fibroma situated in the axilla caused much pain, and was removed. Excision of the nævus neuromatosus and the underlying plexiform neuroma was performed later.

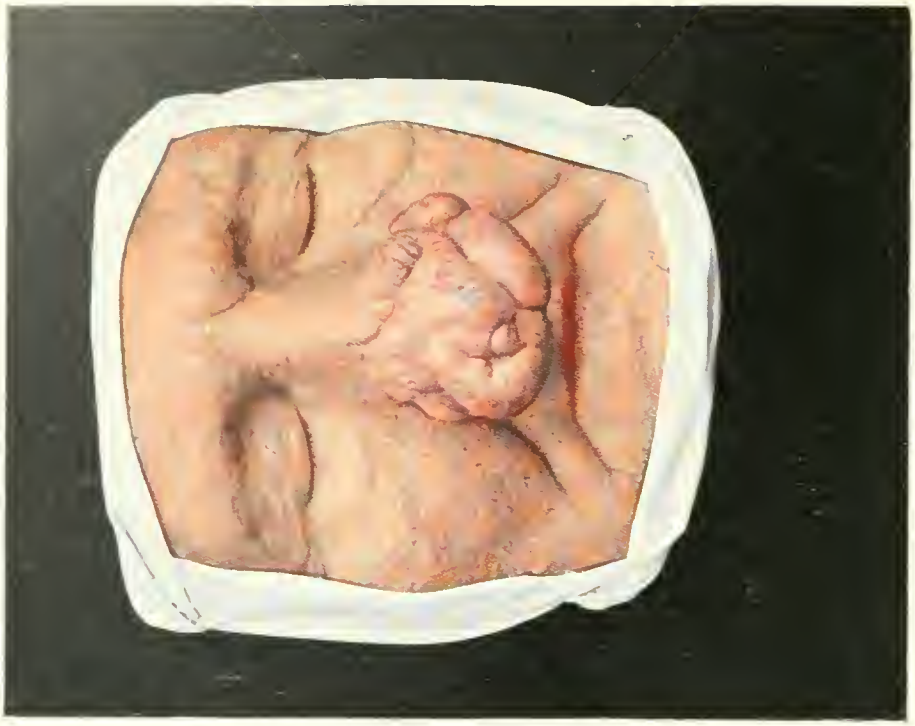

Fig. 70. Rhinophyma — Akne rosacea.

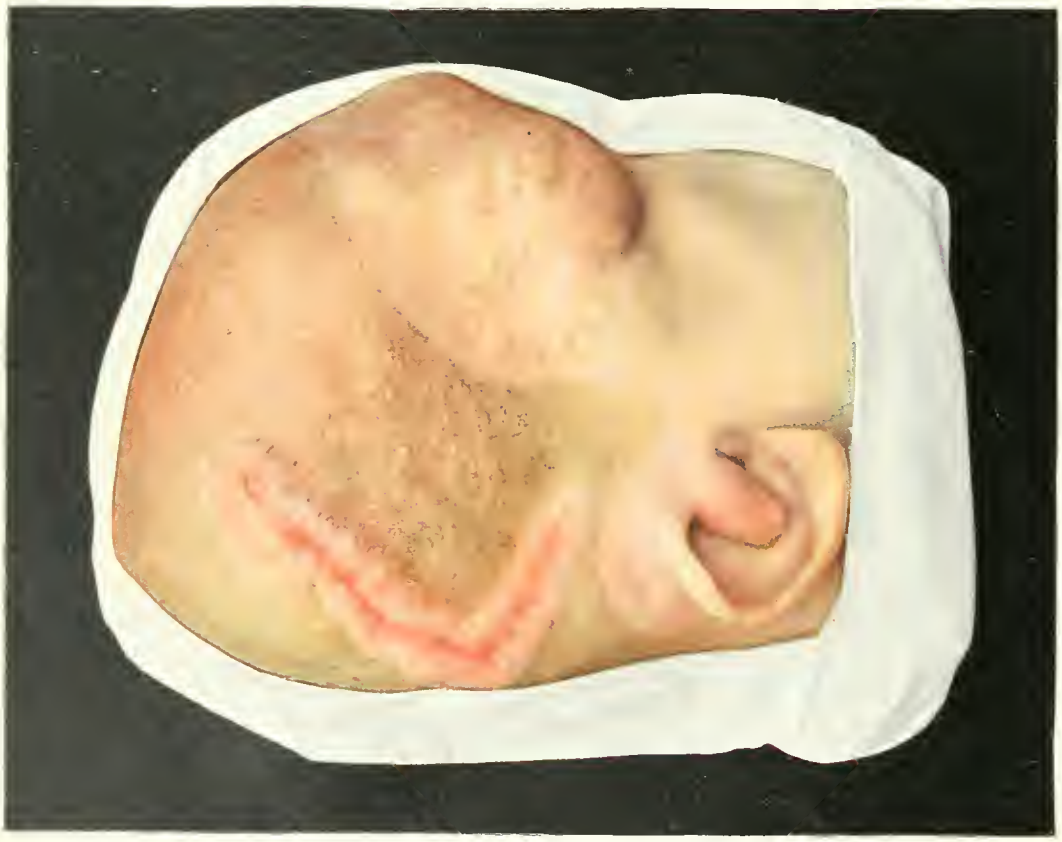

Fig. 69. Elephantiasis nervorum — Fibromata molluscа.

ELEPHANTIASIS NERVORUM (*of the Nerves*) **—FIBROMATA MOLLUSCA**

Plate LIV, Fig. 69.

Fig. 69 shows a similar case in a girl, aged twenty. The whole of the right half of the scalp, the right side of the forehead and the ear are the seat of a lobulated growth (elephantiasis nervorum) fixed on the head like a cap. The growth was congenital, and on its surface are numerous pigment spots and soft, small, painless tumors (fibromata mollusca). Numerous cord-like formations were found in it by palpation (plexiform neuroma). The tumor was partially removed by a curved incision, the scar of which is shown in the figure. Total extirpation was performed subsequently at several sittings. Microscopic examination confirmed the above-mentioned explanation of the affection, the lymphatic vessels being increased and dilated in the region of the tumor.

ACNE ROSACEA—RHINOPHYMA

Plate LIV, Fig. 70.

Fig. 70 shows an irregular, lobular thickening of the nose, along with changes in the skin of the face, in an old man. Commencing as acne rosacea, the affection consists in a dilatation of the blood-vessels and the formation of new blood-vessels, giving the face a dark-red coloration, which, beginning in the nose, may spread over the whole face. Later on there occurs hyperplasia of the connective tissue and sebaceous glands, giving rise to brownish-red or bluish-red nodules in the nose (rhinophyma). The whole skin of the face takes part in the thickening in a lesser degree, becomes reddish-brown, and shows numerous pits representing the dilated orifices of the sebaceous glands. From these pits yellowish-white secretion can be expressed. There are often numerous acne pustules on the face.

The origin of the disease has been attributed to congenital anomaly, alcoholism, indigestion, diseases of the digestive organs, affections of the genital organs, and influences which cause congestion of the blood-vessels of the head (*e.g.* cooks who are exposed to heat). The disease usually occurs in old men.

Differential Diagnosis. A pachydermatous condition of the skin may result from repeated attacks of erysipelas, but differs from rhinophyma in not affecting the nose any more than the rest of the face. Lupus is distinguished by its apple-jelly nodules and ulceration.

Rhinoscleroma causes softer tumors which soon ulcerate, and may destroy the whole face.

Treatment. In the early stages massage of the face and inunction of ichthyol-resorcin ointment (one to ten per cent.) are useful. Attention should be paid to the diet and all exciting causes avoided. In rhinophyma the tumors may be excised or treated with *Pacquelin's* thermo-cautery. Good results have been obtained by peeling off the nodules with a sharp knife (decortication). The wound is soon covered by new epidermis, and the cosmetic results are very satisfactory.

ELEPHANTIASIS PENIS LYMPHANGIECTATICA

(*Lymphangiectatic elephantiasis of the penis*)
Plate LV, Fig. 71.

In distinction to congenital elephantiasis of nerves there is a second form of elephantiasis arabum, which for various reasons chiefly affects the lower extremities, and is known as acquired elephantiasis or pachydermia. It consists in a chronic, inflammatory hyperplasia, and there is no formation of true tumors. There is diffuse thickening of the connective tissue (fibromatosis), both in the cutis and in the subcutaneous tissue. Finally the muscles are attacked and replaced by hyperplastic connective tissue. The periosteum of the bones may present osteophytic deposits. Lastly, the epidermis takes part in the proliferative process, so that the skin becomes thickened and horny, or eczematous.

The affected parts thus become greatly thickened. The thickening may be uniformly distributed, or may assume a lobulated formation as in elephantiasis nervorum. In addition to the proliferation of connective tissue there is always dilatation of the blood-vessels and lymphatics. The disease thus appears to originate in lymphatic engorgement, and the proliferation of connective tissue results from lymphatic infiltration of the tissues.

All processes which give rise to lymphatic engorgement may, in certain cases, lead to elephantiasis. For this reason, in the endemic form of this elephantiasis which occurs especially in Arabia, Egypt, Australia, and generally in tropical countries, it has been assumed that the parasites (filaria sanguinis) block up the lymphatic vessels, causing lymphatic varices which rupture and deluge the tissues with lymph,

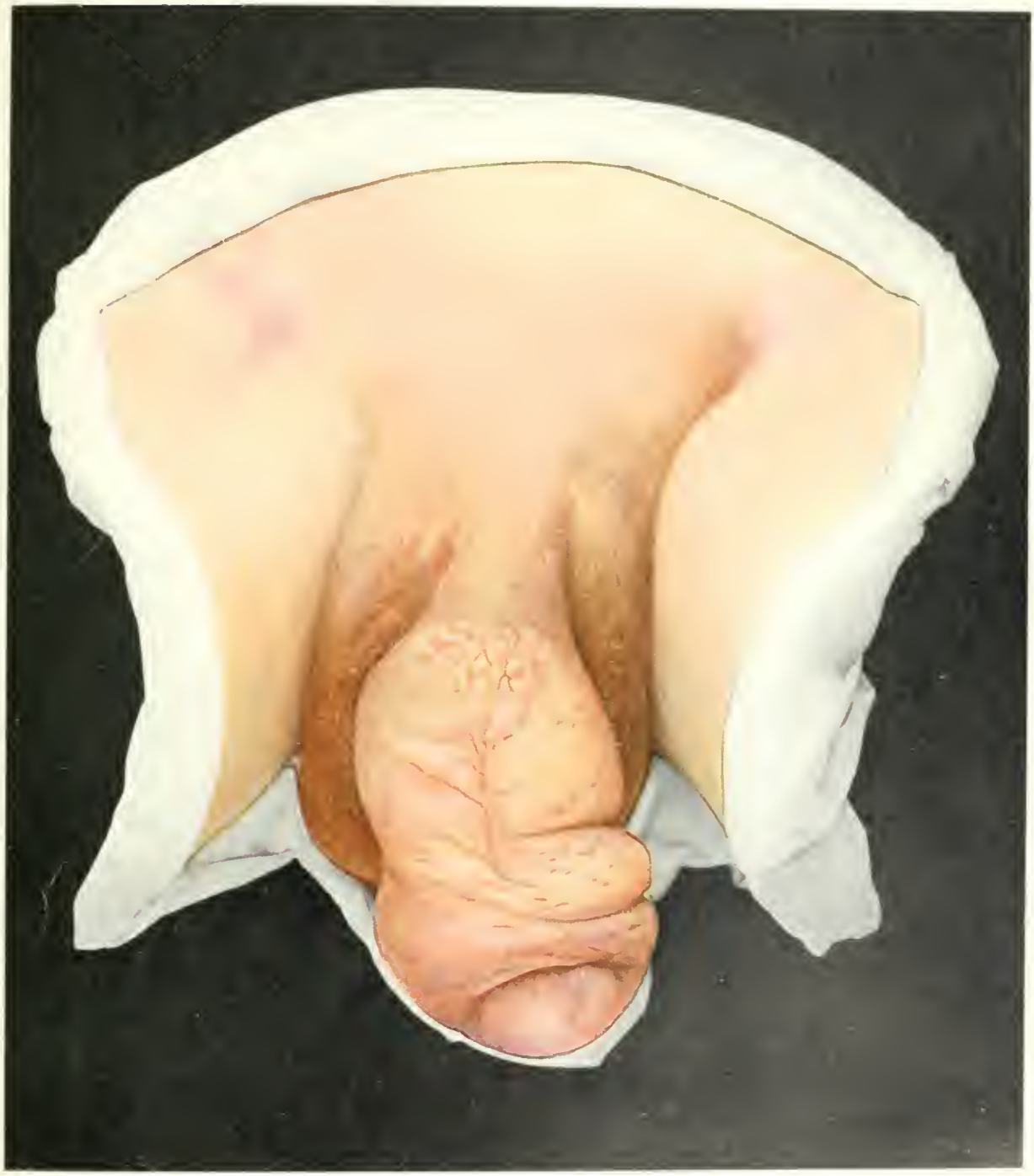

Fig. 71. Elephantiasis penis lymphangiectatica.

and give rise to hyperplasia of the connective tissue. The lymph vessels may be so dilated that small bladders filled with lymph may be visible on the surface of the skin.

The endemic form generally has an acute onset with fever and lymphangitis. After the acute symptoms have subsided, swelling of the lower extremities remains behind. Further attacks follow which cause increased thickening. Endemic elephantiasis principally affects the scrotum, penis, and female genitals. As in the sporadic form, the thickening is soft at first, but becomes hard later on from diffuse fibromatosis.

Sporadic elephantiasis is caused by affections which give rise to lymphatic engorgement—chronic œdema, recurrent erysipelas, chronic inflammations such as tuberculous and syphilitic, varicose ulcer, phlebitis and thrombosis of veins, and purulent inflammations (especially streptococcus infection). The lower extremities are generally affected, often in women with chronic eczema and varicose ulcer (Fig. 72). In prostitutes, the labia, clitoris and perineum sometimes become affected with elephantiasis, from gonorrheal discharges and syphilis. In men, the penis may be affected, especially after removal of the inguinal glands on both sides (Fig. 71).

In elephantiasis the tissues at first feel soft, afterwards firm and elastic. Eczema, bullae, pigmentations, scabs and crusts, condylomatous or papillomatous proliferation, or finally ulceration may occur on the surface. The leg or scrotum may be so much thickened that the patient can hardly move. Ulceration causes intolerable suffering.

Differential Diagnosis. Acquired elephantiasis differs from elephantiasis nervorum in the nature of its origin, and in the absence of true fibromas and plexiform neuromas. In partial giantism there is an overgrowth from early infancy of all the tissues, including the bones.

Treatment. As endemic elephantiasis is conveyed by means of drinking water and parasitic insects, precautionary measures must be taken for its prevention.

In sporadic elephantiasis all chronic inflammatory processes, etc., which excite the disease, must be avoided. Bubos should be incised early to avoid lymphatic obstruction, and ulcers of the foot must be treated (Fig. 72).

In slight cases of elephantiasis moderate results have been obtained by elevation of the limb, massage and injections of alcohol. More extensive cases may be treated by cuneiform excision. Ligation of the arteries of the skin is useless and dangerous. In extensive ulceration of the leg, amputation may be necessary.

Fig. 71 shows a case of acquired elephantiasis of the penis and scrotum in a man, aged forty, after extirpation of the inguinal glands on both sides. According to the patient the thickening of the penis and scrotum developed gradually during some years, and caused no inconvenience. Still greater acute swelling of the penis often developed suddenly, showing that it was a form of acquired elephantiasis which has been called lymphangiectatic. According to the patient this acute swelling subsided after a few days in bed. The thickened tissue felt soft and spongy, and appeared to consist of several lobulated growths rather than uniform thickening. The skin was pigmented and the scrotum covered with crusts, and there were numerous depressions as in rhinophyma. The patient was treated by suspension, elastic pressure, and later on cuneiform excision.

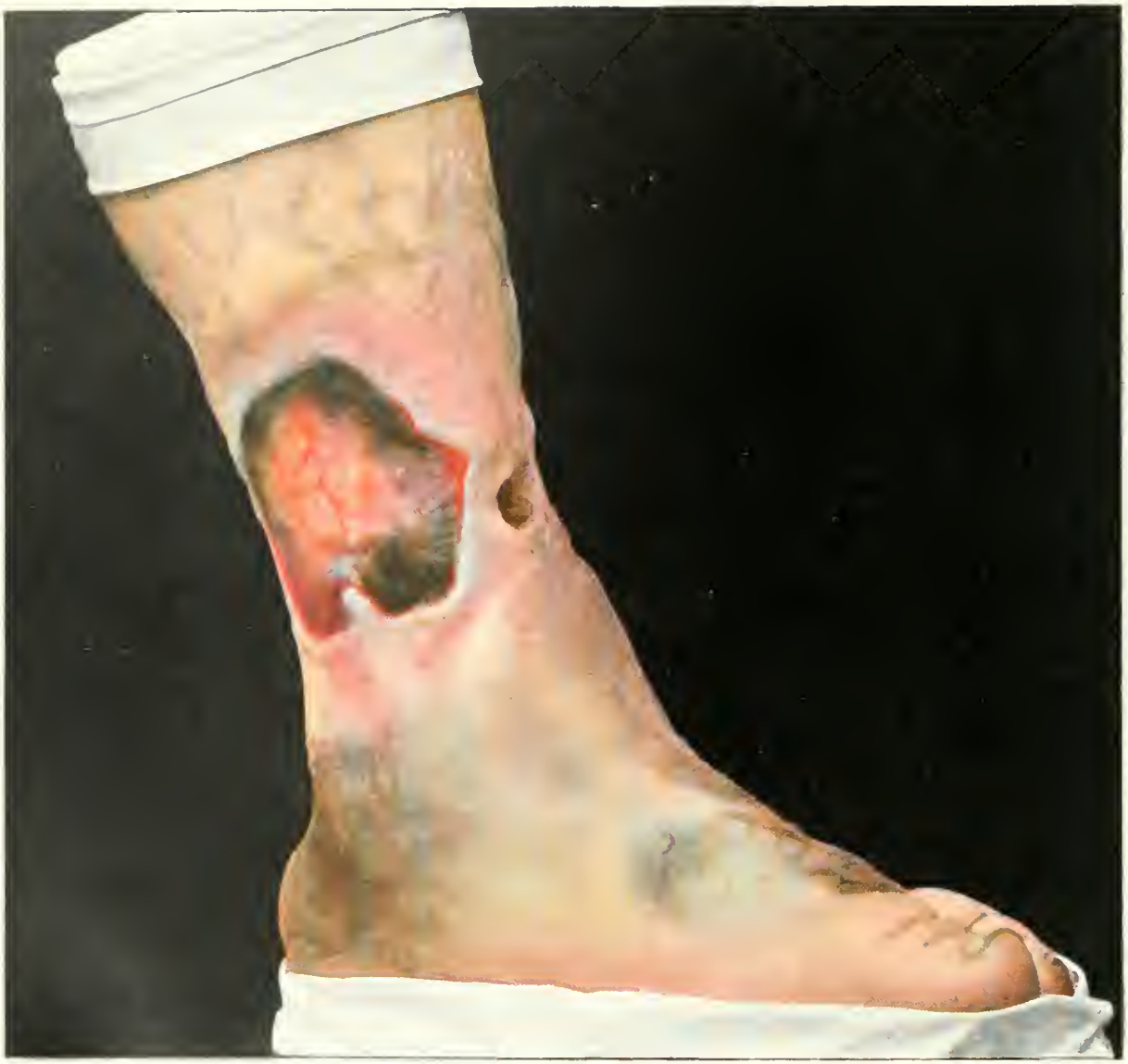

Fig. 72. Ulcus cruris varicosum – Elephantiasis, Pachydermia acquisita.

ULCUS CRURIS VARICOSUM (*Varicose ulcer of the leg*)
ELEPHANTIASIS S. PACHYDERMIA ACQUISITA
(*Acquired elephantiasis or pachydermia*)
Plate LVI. Fig. 72.

In this case an elephantiasic thickening of the toes has developed in connection with a varicose ulcer of the leg; which, as already explained (Plate LV), is due to connective-tissue hyperplasia of the skin resulting from lymphatic engorgement (acquired lymphangiectatic pachydermia). The toes are enormously thickened, and constricted in places; the whole foot is also enlarged, and the arch of the foot is obliterated. The thickening of the foot continually increased, and extended to the ankle. Frequent attacks of erysipelas aggravated the affection.

At the lower third of the leg, on the inner side, is an ulcer extending over nearly the whole circumference of the leg. Ulcers develop in this situation from various causes—blows on the leg, chronic eczema, abscess, erysipelas, thrombo-phlebitis, varicose veins, burns and frost-bite.

These ulcers are most commonly connected with disturbance in the blood and lymphatic circulation both as regards their origin and chronic progress. They generally occur in old people of the poorer classes who have to do much standing, and are especially aggravated by uncleanliness. They often occur on both legs. Arteriosclerosis, diabetes, and diseases of the central nervous system give rise to especially obstinate and extensive ulcers (trophic ulcer).

Varicose ulcer of the leg is characterized by its irregular slightly raised edges, while the parts round

the ulcer may be covered with scattered flabby granulations, crusts and blood-scabs (Fig. 72). There is frequent bleeding from the dilated veins at the base of the ulcer. The ulcer is often connected with a ruptured varicose vein. In small ulcers temporary healing may take place, but the scar is very thin, generally pigmented, and gives way again on the slightest cause; after which no further healing usually takes place, but the ulcer continues to extend. The whole neighborhood of the ankle joint, and even the whole leg, may be involved in ulceration, which often has a sanious discharge. In extensive ulcers there is generally severe pain and the leg becomes more or less useless owing to the extent of the ulcer and the elephantiasis.

Differential Diagnosis. Large ulcers with sanious discharge may suggest carcinoma, owing to their hard borders, but in carcinoma there are always irregular, hard-tumor masses in the whole extent of the ulcer. The possibility of transition of an ulcer of the leg to carcinoma must be borne in mind.

Gummatous ulcer is more regular, often circular, and has a punched-out appearance. The base of the ulcer is smooth and covered with a tenacious yellowish fatty core. The ulcer is generally less extensive and there is no bleeding. It heals quickly under iodide of potassium. (Fig. 123).

Treatment. To improve the circulation, rest in bed and support with elastic bandages (flannel or Japanese mull) are absolutely necessary. In cases with extensive varicose veins (Fig. 83) ligation of the saphenous vein is beneficial. The ulcer itself requires antiseptic dressings (iodoform, *Hebra's* ointment, *Lassar's* zinc paste, balsam of Peru, acetate of aluminium). The application of fenestrated compressing-bandages with *Unnas'* zinc gelatin or pep-

tonated paste is also recommended. In out-patient practice compressing bandages of mastich or starch may be used. Compressing bandages should be left on for several weeks, and the ulcer can be treated daily through the hole in the bandage.

In very obstinate ulcers incisions above the ulcer have been recommended to improve the circulation. Other measures are scraping, cauterization, or excision of the whole ulcer followed by skin grafting. Very severe cases, and those suspected of carcinoma, may require amputation.

DECOLLEMENT DE LA PEAU (*Detachment of the Skin*)

Plate LVII, Fig. 73.

Detachment of the skin is a term applied by *Morel-Lavallée* and *Köhler* to a lesion which consists in subcutaneous separation of the skin from the subjacent tissues and fascia. The skin itself is uninjured, as the lesion is produced by a force acting at a tangent which separates the skin from its foundations. The lesion is more liable to occur in the neighborhood of the elbow joint, and over the tibia (*e.g.* after being run over). Besides the detachment of skin the deeper structures may be severely injured and the bones fractured. The blood-vessels and lymphatics are injured, giving rise to effusion into the newly formed subcutaneous space and bulging of the skin. If the larger blood-vessels are torn there is subcutaneous effusion of blood and dark-red discoloration of the skin, forming an extensive tense swelling which generally disappears quickly. If the larger lymphatic vessels are torn, as usually happens, the lymphatic effusion often appears several hours after the injury. The skin is hardly altered, perhaps somewhat livid and excoriated, while the subcutaneous swelling subsides slowly, owing to the long, continual effusion of lymph.

The lymphatic effusion, which is generally more or less mixed with blood, accumulates in the dependent parts of the injured region. Fluctuation of the fluid in the subcutaneous cavity can be felt.

Treatment. Subcutaneous effusion of blood soon undergoes spontaneous absorption. The lymphatic effusion gradually disappears after repeated punc-

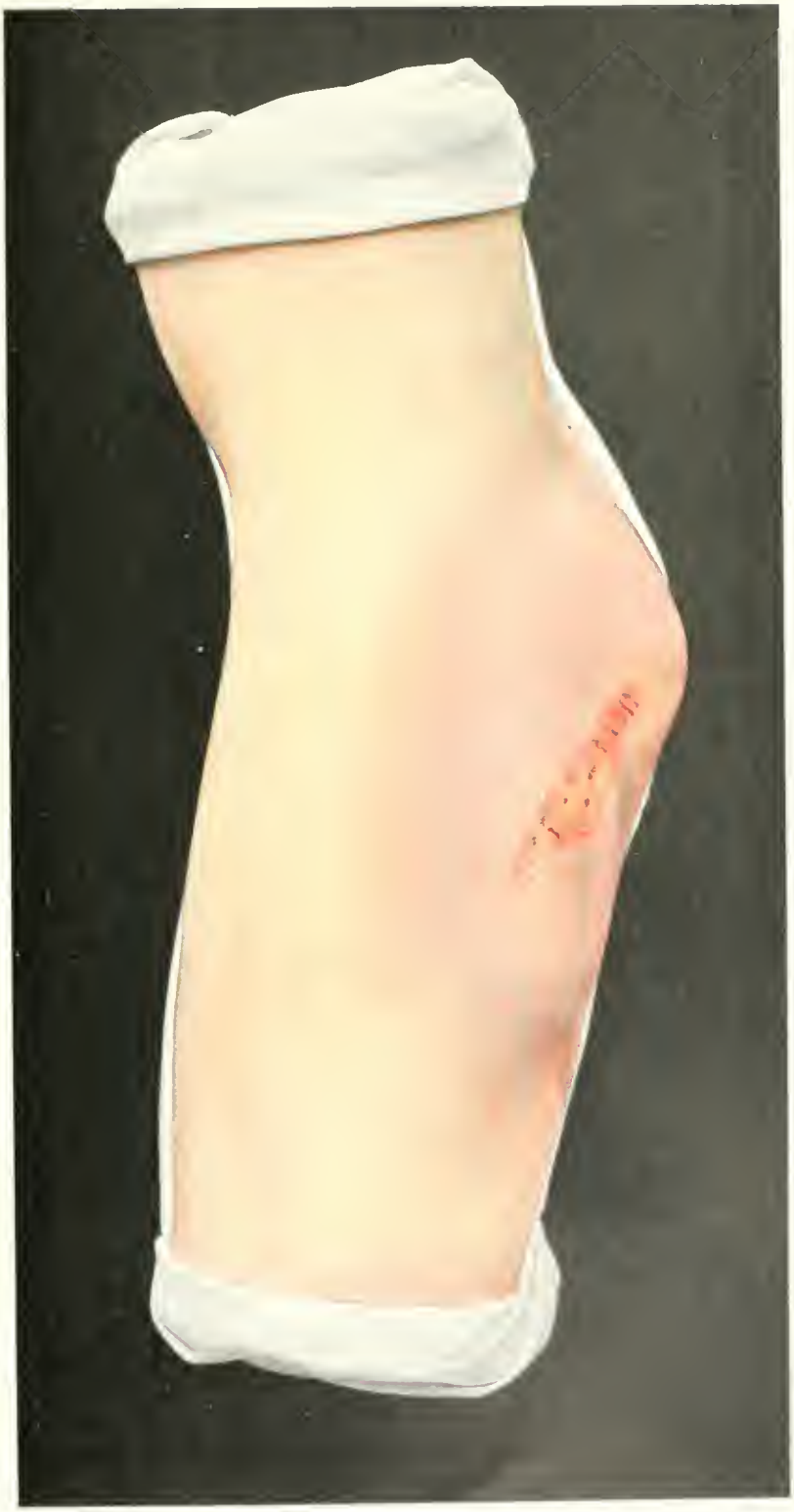

Fig. 73. Detachment of the Skin

ture, injection of tincture of iodine and compression by bandages. Incision should only be performed if there is suppuration.

Fig. 73 shows a detachment of the skin resulting from a blow on the left elbow. A few days after the injury effusion took place in the subcutaneous cavity, chiefly in the forearm. The cavity was not completely filled so that several swellings are shown. There is a slight abrasion of the skin over the olecranon, the appearance and direction of which show that the blow was a tangential one. The skin is livid over the whole swelling. Yellowish fluid was evacuated by puncture, showing very slight mixture with blood.

Submucous effusion in the nasal septum and in the larynx may also be caused by the action of tangential force (generally foreign bodies). Here also the effusion only occurs where the submucous tissue is situated over a hard substratum of cartilage.

OTHAEMATOMA (*Hematoma of the Ear*)

Plate LVIII, Fig. 74.

The majority of cases of hematoma of the external ear are caused by a tangential force which tears the perichondrium from the cartilage and is followed by effusion of blood or lymph into the subcutaneous cavity. The lesion occurs especially in the upper half of the auricle, and is found in the mentally affected as the result of ill-treatment by blows on the ear, etc.; in workmen who carry loads on the shoulder which graze the ear; in carpenters through carrying planks; in butchers through carrying troughs, etc. It is also a common injury in boxers and acrobats. It generally causes little trouble.

Blood effusion is indicated by the rapid development of a tense, dark-blue swelling which, after a time, subsides. Lymph effusion is indicated by a swelling which does not develop till some time after the injury and has less tendency to subside; the skin is not discolored. Lymph effusion is nearly always slightly mixed with blood, and always forms a tense swelling, in distinction to lymph effusions in other parts. (Fig. 73).

Blood and lymph effusions in the auricle may undergo chronic inflammation, which first causes thickening, later on atrophy and necrosis of the auricle, with considerable mutilation. If the skin is much abraded, the effusion may become septic, with consequent destruction of the cartilage.

Differential Diagnosis. Cavernous hemangioma, which often occurs in the upper part of the auricle, has some resemblance to hematoma. Hem-

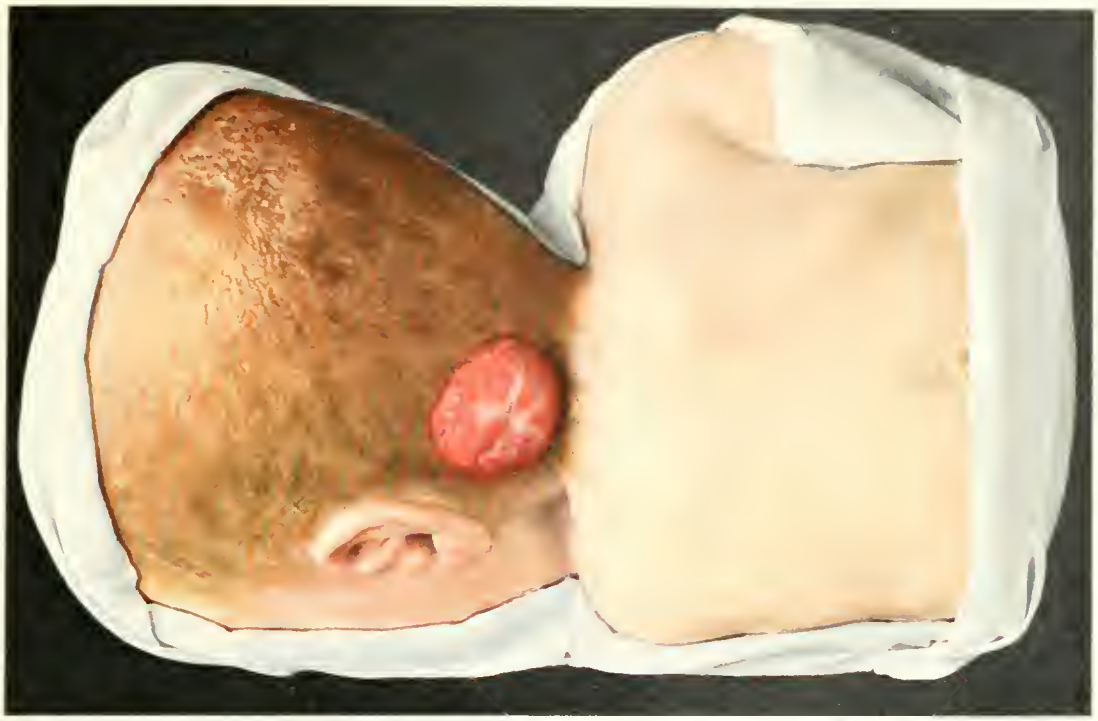

Fig. 75. Haemangioma simplex.

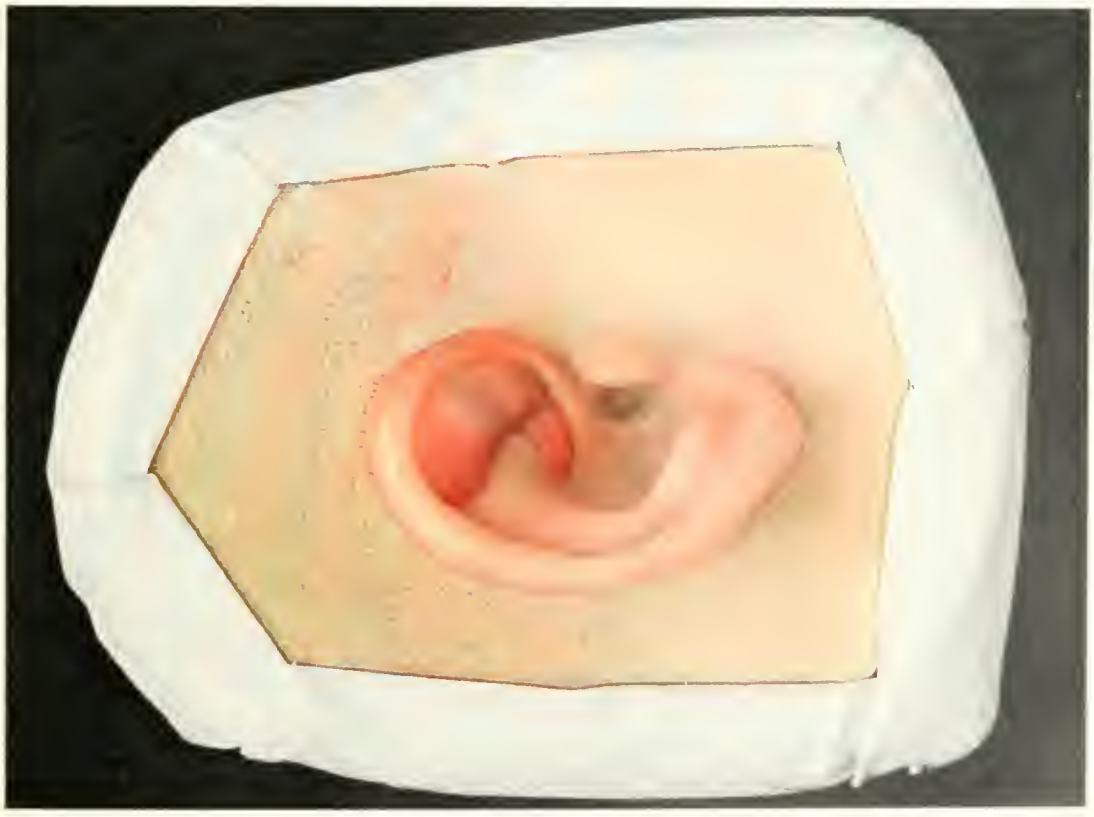

Fig. 74. Othaematoma.

angioma, however, is often congenital; it forms a tumor which can be diminished by pressure, and has a bluish coloration and an uneven surface. Other vascular anomalies are also usually present in the neighborhood of the tumor.

Treatment. Prophylactic treatment consists in the wearing of ear caps. The hematoma must be protected from injuries which may cause septic infection of the effusion. It undergoes spontaneous resolution, but more slowly than in other places. Lymph effusions recur after repeated puncture; injection of tincture of iodine and compression by strips of plaster are not of much value; massage is useful in most cases. If suppuration occurs, they must be incised.

Fig. 74 shows an effusion in the upper third of the auricle. The patient first noticed a small pimple, and as the result of scratching this the swelling gradually developed; at first soft, afterwards tense. The skin is red, not bluish red as in blood effusion. A small, blue spot in the figure represents the original pimple. The condition is one of lymph effusion. Lymph mixed with blood was evacuated by puncture, but the swelling recurred. The effusion gradually subsided after massage.

HEMANGIOMA SIMPLEX (*Simple Hemangioma*)

Plate LVIII, Fig. 75 (cf. also Figs. 76 and 81).

The term Angioma includes new growths arising from blood-vessels and lymphatics; the former are called hemangiomas, the latter lymphangiomas. Hemangiomas may be simple or cavernous (cavernoma, Figs. 36 and 80).

The red spots formed by tortuous and dilated blood-vessels (telangiectasis, nævus vasculosus) are by some classed as tumors and included among the simple hemangiomas; by others they are considered as hypertrophic formations, and not as true tumors, as they consist in dilatation, lengthening and tortuosity of the vessels, rather than new formation of vessels. The form known as racemose or plexiform angioma also almost always consists in a dilatation of a vascular region, not a true, new formation of vessels. It is, therefore, better to give the name cirsoid aneurism to these formations, which are usually congenital and due to fetal remains, but sometimes traumatic. Lastly, neither aneurisms nor varices belong to true vascular tumors. The red spots with more or less regular outlines, often only punctiform, which occur in the skin of old persons, are also not true tumors but only dilated and tortuous blood-vessels (telangiectases). A form described by *Ziegler* as hypertrophic angioma is best named hemangio-endothelioma, as, in addition to new formation of vessels, there is extensive proliferation of the endothelium.

Clinically, we distinguish telangiectases, which are situated superficially in the skin, from simple hem-

angiomas which appear in the skin and subcutaneous tissue. The latter tumors, also called angiomas (Fig. 75), appear as raised growths with well-defined borders. The overlying skin is thin and adherent, and of a reddish-blue color. In places there are islands of normal skin. The edges of cutaneous angiomas are dark-red, slightly raised, and often bordered by an areola of fine ramifying blood-vessels. The tumors are soft, spongy, somewhat compressible, and easily movable over subjacent parts. They are sometimes present at birth and are often situated on the face, lips, cheeks and neck, in the regions of the fetal clefts. In other cases they appear soon after birth, usually in the form of slow-growing red spots. Angiomas distributed in the region of the trigeminal nerve have been called neuropathic angiomas. Angiomas may also develop in scars.

More extensive growth may form large, nodular lobulated tumors, which when situated in the orbit may be dangerous from extension to the brain; but they cannot be regarded as malignant tumors, because they give rise to no metastases.

Involution of angioma has been observed as the result of inflammation. Angiomas are usually multiple, cutaneous or subcutaneous. They may also occur in the muscles, bones, brain, breast and liver, generally in the form of cavernous hemangioma. They cause no trouble apart from that due to their disfigurement.

Differential Diagnosis. The tumors are so typical that they cannot easily be mistaken. Subcutaneous hemangioma generally appears later under the skin, which gradually assumes a bluish coloration.

Cavernous hemangioma (cf. Figs. 36 and 80) appears as a multilobular swelling, which diminishes on pressure. When it forms in the skin, the latter is colored bluish green (Fig. 81).

Treatment. Large hemangiomas of the skin and subcutaneous tissue are best excised, especially when situated on the face. Small angiomas can be treated by multiple puncture with the thermocautery into the subcutaneous fatty tissue, at several sittings (especially in subcutaneous angiomas), but the scars are often unsightly. After electrolysis the scars are smoother and less visible. Angiomas sometimes recur in the scars.

Angiomas of the eyelids, which may extend through the orbit to the brain, or those situated over a fontanelle which may implicate a sinus, also very extensive angiomas of the face are not suitable for operation. In these cases the introduction of magnesium, which causes coagulation and shrinking of the tumor, may be tried.

Fig. 75 shows a typical simple cutaneous hemangioma of the nape of the neck, which appeared as a red spot soon after birth and ceased growing after the second year. The borders of the growth are red and show small, ramifying blood-vessels. The center is bluish red and partly covered by normal skin. The tumor was soft, freely movable over subjacent parts and sharply defined. It was excised with subsequent suture.

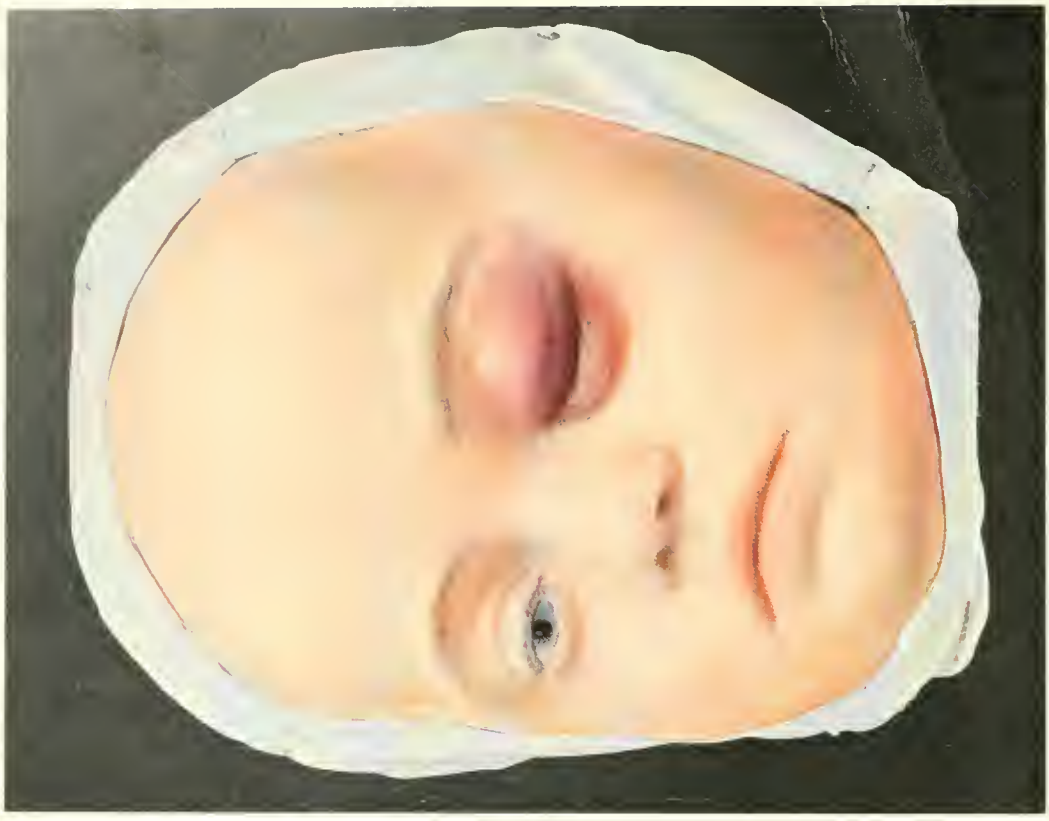

Fig. 77. Haematoma diffusum — Haemophilia.

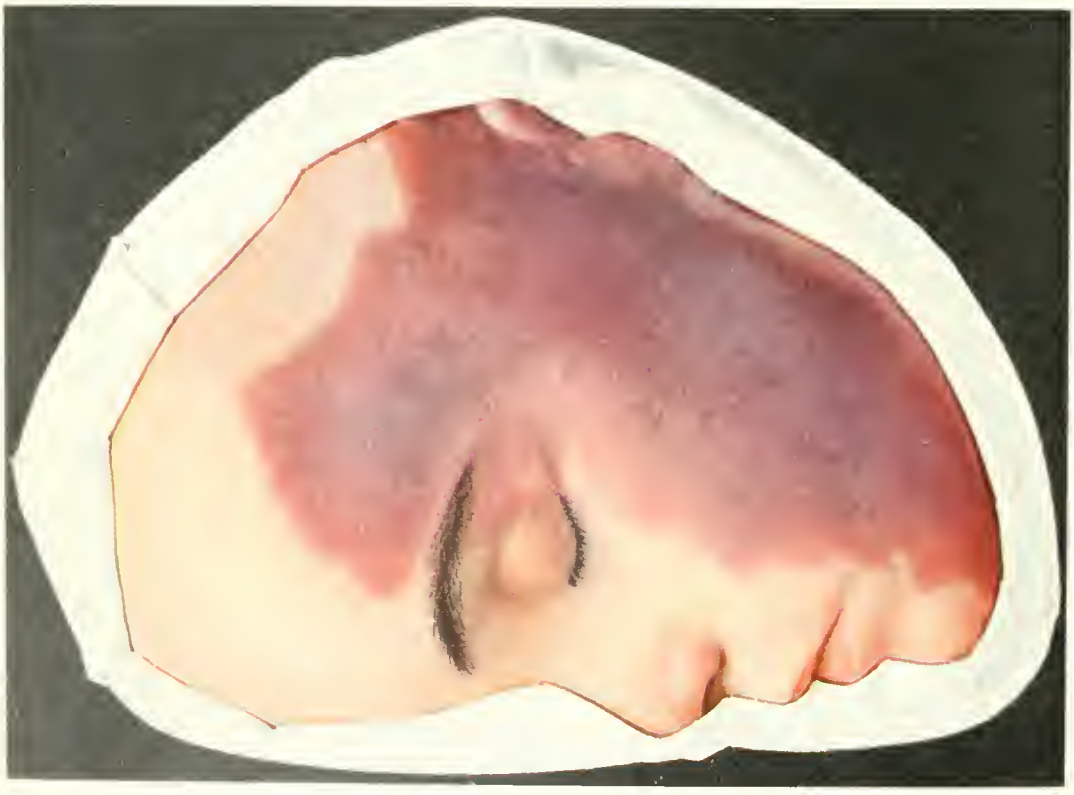

Fig. 76. Naevus vasculosus.

NÆVUS VASCULOSUS (*Vascular Nævus*)

Plate LIX, Fig. 76.

In distinction to the projecting hemangioma we find in telangiectasis a flat reddening in the skin which may be punctiform, annular, or of various shapes.

The greatest degree of telangiectasis is attained in the so-called vascular nævus which most often occurs on the face, and is either congenital or appears soon after birth as a red spot. This rapidly extends and often spreads irregularly over half the face. The edges are jagged and show fine ramifying vessels. The coloration of the skin varies, and there are usually different tints in the same nævus. It is often dark purple in the center and bright red at the periphery. It is often broken up by normal skin, giving a variegated appearance. Spontaneous involution has been observed in small nævi. Apart from the disfigurement they cause no trouble.

Treatment. Good results have been obtained by X-ray treatment. Cauterization with fuming nitric acid causes the nævi to disappear and leaves smooth cicatrization. (This must be used cautiously on the eyelids).

HEMATOMA DIFFUSUM (*Diffuse Hematoma*) —HEMOPHILIA

Plate LIX, Fig. 77.

Hemophilia is a congenital hemorrhagic diathesis, which presents a good example of hereditary transmission, as it is well established that there are definite families of bleeders. As a rule only the male descendants are bleeders, but the hereditary tendency is transmitted solely through the female line. Imperfect coagulability of the blood, abnormal elements in the blood, weakness of the vessels, or vasomotor dilatation of the vascular system give rise to uncontrollable and exhausting hemorrhage, which may occur in the skin, mucous membranes, joints or internal organs, either spontaneously or after slight injuries. The effusion in the skin causes purple coloration, and is most extensive in parts where the skin is more loosely attached to the subcutaneous tissue (eyelids, Fig. 77). A subcutaneous hematoma usually forms, which may be very extensive, especially on the scalp, where it generally infiltrates the periosteum. Blood effusions into the skin, subcutaneous tissue and periosteum have a tendency to continual increase.

In addition to these spontaneous hemorrhages, bleeding occurs after the slightest injuries, such as needle pricks, abrasions of the skin, tooth extraction, and even after cleaning the teeth. The blood flows at first continually, afterwards intermittently, and is pale and watery. In larger wounds the surface is covered with blood-points, and oozes like a sponge. The most dangerous conditions are those in which an injury to the soft parts is associated with abscess formation.

Bleeding into the joints causes typical hemarthrosis, which is recognized by the "snowball crunching" of the blood clots and hemorrhagic infiltration of the skin. The effusions at first increase intermittently and later on become stationary. From the deposit of fibrin on the articular ends of the bones, the cartilages may be extensively destroyed, with resulting anchylosis in a flexed position, or subluxation. However, in spite of numerous bleedings into a joint complete recovery of the joint has been observed.

Spontaneous hemorrhage in the kidneys may give rise to great exhaustion. The diagnosis is established by the mode of origin of the hemorrhage, its frequent occurrence and progressive character. Patients generally know that they belong to a family of bleeders, and they have an anæmic appearance. Many cases are fatal from repeated bleeding.

Differential Diagnosis. Scurvy, which causes bleeding of the mucous membrane of the mouth from ulceration, only causes bleeding in the skin, joints and other organs in very severe cases.

Purpura hemorrhagica, which also gives rise to hemorrhages in the skin, mucous membranes and organs, may be difficult to diagnose from hemophilia unless there is a history of hereditary tendency to bleeding, or of the former occurrence of bleedings pointing to hemophilia.

Barlow's disease is a hemorrhagic diathesis occurring in badly nourished infants, which give rise to subperiosteal hemorrhages. This disease, which may also cause hemorrhage into the skin and mucous membranes, only occurs in children and is generally associated with rickets (scurvy-rickets).

Other hemorrhages, such as those which occur in some cases of hysteria, in vicarious menstruation, in certain nervous affections, or in general pyogenic infection, are not so extensive as those of hemophilia and are easily distinguished by their history.

Renal hemorrhage in hemophilia may be mistaken for renal hemorrhage due to other causes (stone, tumor, tuberculosis), but the bleeding in hemophilia quickly leads to exhaustion, and gives no evidence of other changes in the kidneys.

The hemarthrosis of bleeders is so characteristic that it can hardly be mistaken. It differs from traumatic hemarthrosis in its progressive increase and slow absorption. Myeloid sarcoma extending to the joint is characterized by rapid growth and the presence of a malignant tumor (X-ray examination), and has only a similarity to hemophilia in its early stages.

In the diffuse bleeding which sometimes occurs after operations, a diagnosis of hemophilia must not be too hastily made, as this disease is quite uncommon.

Treatment. Cutaneous and subcutaneous blood effusions should be left alone; puncture is useless, and profuse bleeding often takes place from the puncture. For the same reason puncture of a joint effusion with injection of three per cent. carbolic lotion is a doubtful procedure. Compression and extension of the joint is the best treatment.

Wounds should be plugged with iodoform gauze and tightly compressed. Bleeding from the gums and nose may be treated with the thermocautery. Bleeding after tooth extraction may be averted by plugging the socket with a wedge of cork.

The most difficult cases are those in which bleeding occurs in extensive injuries, especially when there is suppuration. The application of perchloride of iron stops the bleeding for a time, but forms a scab, and after this becomes loose bleeding recurs. There is also the danger of embolism and septic infection.

It is better to use hot gelatin solution. This must be carefully sterilized before use to free it from tetanus spores, and should always be used freshly prepared, in a ten per cent. solution. Gelatin is

also useful administered internally or by subcutaneous injection. In extensive, uncontrollable bleeding affecting the extremities amputation may have to be considered; in this, all the vessels must be carefully ligatured.

In renal hemophilia nephrotomy and nephrectomy has proved successful.

During the bleeding, which often ceases spontaneously after a time, the patient's general condition must be kept up by forced nourishment. Bleeders must naturally avoid everything which may cause bleeding.

Fig. 77 shows blood effusion into the subcutaneous and subconjunctival tissue of both eyelids, and an extensive hematoma on the left side of the forehead in a child aged six years, who belonged to a family of bleeders. The effusions occurred spontaneously; the one on the forehead occurred intermittently for a time and then gradually subsided. There was no bleeding in any other part of the body.

SUGGILLATIONES ET SUFFUSIONES

(*Suggillations and Suffusions*)

HÆMATOMA SUBCUTANEUM (*Subcutaneous Hematoma*)

Plate LX, Fig. 78.

Hemorrhages into the skin when of small extent are called petechiæ or ecchymoses (Fig. 79); when of larger extent suggillations or suffusions (Fig. 79). Hemorrhages into cavities are called hematomas. The latter often occur in the subcutaneous tissue, giving rise to convex swellings of the skin (Fig. 77). Subcutaneous hematomas are common after all kinds of injury—gunshot wounds, fractures, contusions, punctured wounds, etc.; also as the result of secondary hemorrhage after operations. In these cases the skin assumes first a purple, afterwards a greenish-yellow coloration, which extends beyond the area of the hematoma and persists for several weeks. There is often a visible swelling with fluctuation. Patients complain of slight pain and a feeling of tension. If the swelling persists, the sensation of "snowball crunching," which is characteristic of all blood effusions, is felt by palpation.

In parts where the skin is loosely attached, as in the eyelids (Fig. 77) or scrotum, there is much swelling and discoloration of the skin. After injury to a large blood-vessel, enormous, often pulsating, swellings may occur (pulsating hematoma or false aneurism).

Subcutaneous hematomas usually have ill-defined margins, owing to their gradual extent into the soft parts. Sometimes, however, they become encapsuled, and periosteal hematomas of the scalp are

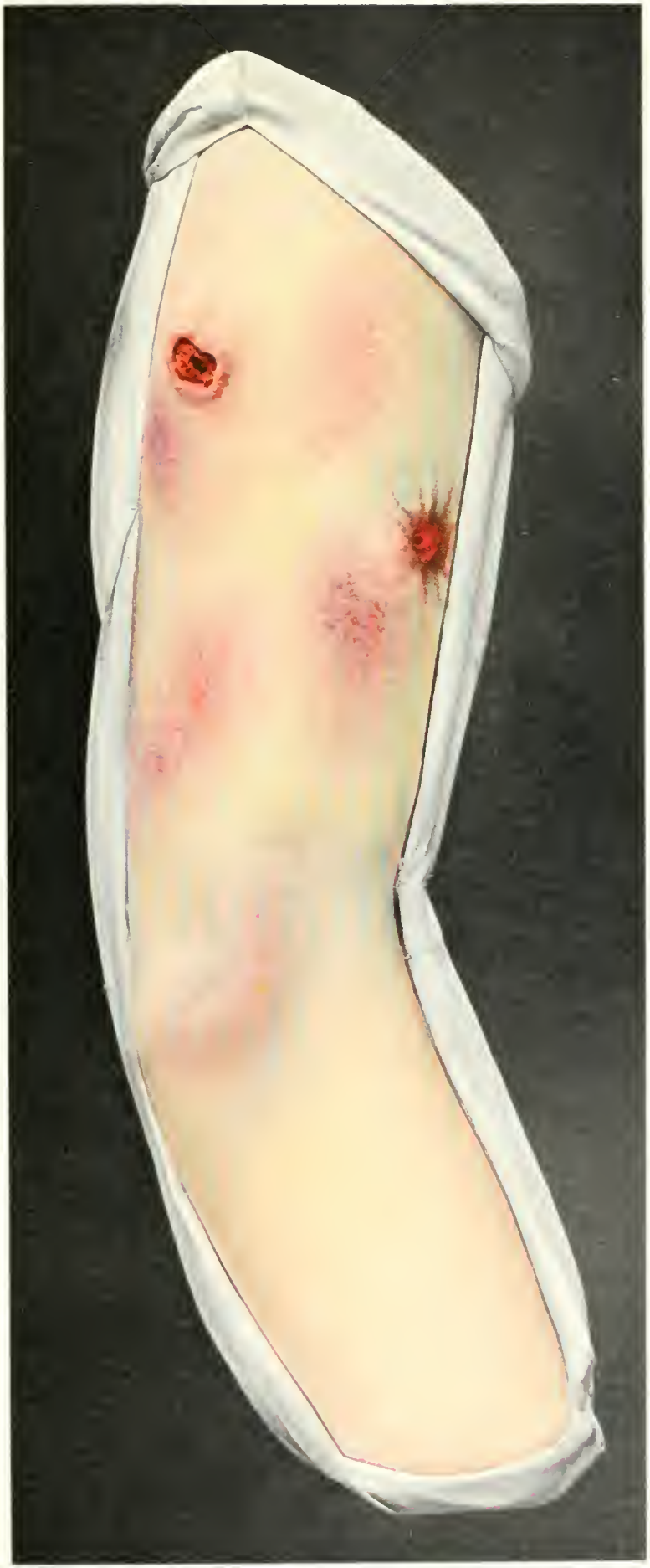

Fig. 78. Sugillationes et Suffusiones — Haematoma subcutaneum.

surrounded by a wall of bony hardness (also in cephalhematoma).

Treatment. Light compression by bandages soon causes resorption of the effusion. In delayed resorption the fluid may he evacuated by puncture. If suppuration occurs an incision must be made.

Fig. 78 shows extensive suggillations and suffusions of the skin of the whole arm, which is colored purple, brownish-red, green and yellow. The presence of a subcutaneous hematoma is shown by swelling and fluctuation.

It is a typical case of gunshot injury to the soft parts, in which the apertures of entry and exit are characteristic. The aperture of entry is smaller than that of exit and shows radiating processes in the skin. The skin is colored black and contains granules of powder, owing to the shot being fired at close quarters. In shot wounds of the face these powder granules remain for a long time after the wound has healed, and cause an unsightly appearance. The aperture of exit is larger with irregular everted borders. These wounds are typical of modern projectiles with great penetrating power.

Septic infection does not usually occur in gunshot wounds, as the bactericidal power of the organism is sufficient to counteract the slight infection caused by projectiles. Even infected foreign bodies, such as shreds of cloth, may heal up in the body.

The prognosis of gunshot wounds of the soft parts is good if undue interference is avoided. All probing of the wound and search for the bullet is to be condemned, as it generally sets up virulent infection of the wound. Disinfection of the wound is also unnecessary. The best treatment is to apply an antiseptic sterilized gauze dressing (iodoform gauze if there is much bleeding) and keep the part at rest; in the extremities by the aid of plaster of Paris. By

this simple treatment, first introduced by *von Bergmann*, the best results are obtained, not only in gunshot wounds of the soft parts, but also in wounds of the joints and bones, even comminuted fractures.

In gunshot injuries of large blood-vessels operative interference is necessary; *e.g.* ligation of the middle meningeal artery.

If the wound becomes infected, as often happens after injuries with explosive bullets (dum-dum bullets, etc.), a free incision must be made to give outlet to the pus. Bullets and pieces of clothing which have become healed over may give rise to abcess after some years.

As a rule bullets should be left alone; a bullet has even remained in the apex of the heart without causing trouble (*Trendelenburg*). Only superficially situated bullets should be removed, after locating them by means of the X-rays. Bullets in the frontal or maxillary sinuses, or in the mastoid process should be removed, as they give rise to pain and chronic catarrh. Bullets should also be removed which cause pressure on tendons and nerves, or are situated in the phalanges, or prevent union of fractures.

Blank cartridges, in which tetanus spores are often present, should be removed on account of the danger of tetanus. In war, there is always a danger of tetanus infection of every large bullet wound, from the presence of tetanus bacilli in the ground on which the wounded lie. As the treatment of antitoxin is only efficacious before the tetanus appears and is too complicated to be used in warfare, the author recommends, on the strength of experimental research, the application of fat to wounds suspected of tetanus infection, as fatty substances attenuate the tetanus toxin (Surgical Congress, 1907 *Bockenheimer's* antitetanus ointment).

The search for deep-seated bullets in the brain causes much injury. Accumulation of blood or cerebrospinal fluid, may abolish the reflexes for a time,

and paralysis may appear, but in spite of this recovery may take place after a time.

Bullets situated outside the cortex of the brain must be removed when convulsions occur from pressure of the bullet, or a splinter of bone, or an accumulation of blood or pus.

Effusion of blood in the thorax through wound of the lung should be left to be resorbed. If it becomes so extensive as to displace the heart puncture must be performed, and if suppuration occurs resection of the ribs.

In gunshot wounds of the heart, free exposure of the organ may be performed in some cases.

Gunshot wounds of the abdomen require laparotomy at the earliest possible opportunity.

In wounds of the larynx immediate tracheotomy is necessary to avoid death from asphyxia.

In the above-mentioned cases resorption of the blood effusion and healing of the wounds takes place in a few weeks under the application of fixed aseptic dressings.

PETECHIÆ ET HÆMORRHAGIÆ PER COMPRESSIONEM

(*Petechiæ and Hemorrhage from Compression*)

Plate LXI, Fig. 79.

Punctiform and striate hemorrhages in the skin in the form of petechiæ and ecchymoses, and diffuse cutaneous extravasations of blood are included in the term congestive hemorrhages. These appear in the head and neck; hemorrhage from compression of the lower parts of the body generally occurs in the thorax. Sometimes subconjunctival effusion of blood occurs after abdominal compression—an important point in criminal and accident cases in which there is no visible lesion of the abdomen. The sudden appearance of this extensive hemorrhage in the head and neck causes a dark-blue coloration of the skin, protrusion of the eyes, and a swollen and bloated appearance of the skin and mucous membranes. It occurs in cases of crush, run-over cases, and compression by machinery, and is due to back pressure on the valveless veins of the neck from compression of the thorax and abdomen, with rupture of the veins and infiltration of blood into the tissues. There is no hemorrhage into the brain or its membranes. The fundus oculi is normal, as the intraocular pressure prevents extravasation of blood from the retinal vessels.

The diagnosis is easy, and treatment consists only in rest in bed.

Fig. 79 shows a case of congestive hemorrhage due to compression of the thorax in a rolling mill. The whole face was colored dark purple and the mucous membranes of the lips and nostrils were swollen.

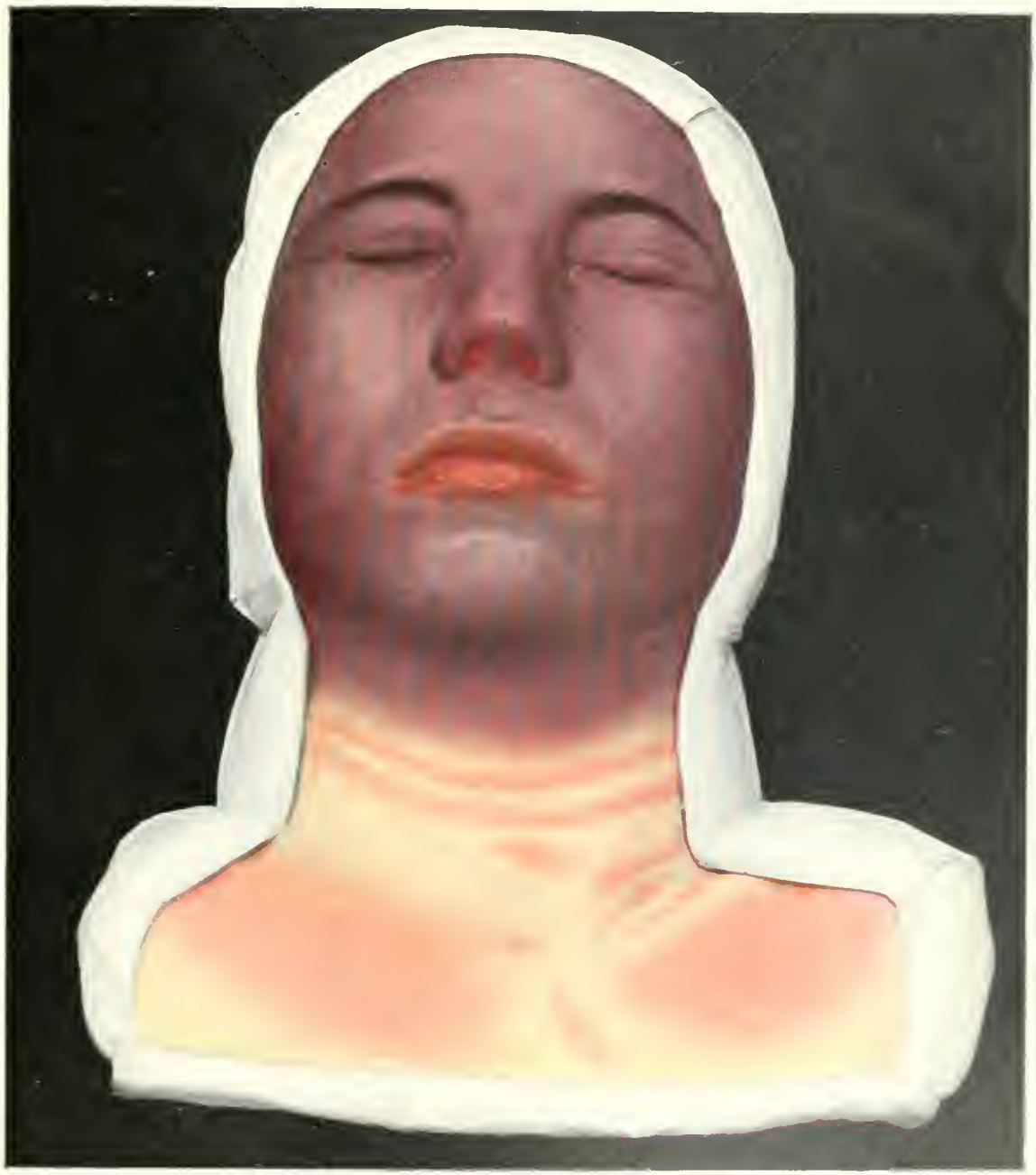

Fig. 79. Petechiae et Haemorrhagiae per compressionem.

Rebman Company, New-York

There was also subconjunctival effusion of blood. In the neck, the continuous purple coloration of the face was replaced by a brighter red coloration in the form of stripes (petechiæ and ecchymoses). The petechiæ were situated over the shoulder and the upper part of the back; also in the auditory canal and the tympanic membrane. No visible lesion was present. The swelling of the face disappeared in a few days, and the purple coloration subsided in the course of time without any treatment. The discoloration remained longest in the eyelids and conjunctiva.

HÆMANGIOMA CAVERNOSUM SUBCUTANEUM

(*Subcutaneous Cavernous Hemangioma*)

Plate LXII, Fig. 80.

Fig. 80 shows a subcutaneous cavernous hemangioma, which often occurs in the region of the rectus abdominis muscle, sometimes in the muscle itself. Mention has already been made of cavernoma in Plate XXVII. They occur most frequently in the skin and subcutaneous tissue, where their purple color and lobulated surface has somewhat the appearance of a mulberry. They are often combined with simple hemangioma or with telangiectases, and often appear soon after birth. In cutaneous hemangioma the skin is much thinned and appears lobulated and of a bluish-black color. In subcutaneous hemangioma the skin may be unaltered at first, or slightly irregular and marked by telangiectases. Afterwards the skin becomes thinned or destroyed by pressure of the subcutaneous growth, and assumes various colors (Fig. 80). In the case represented in the figure the skin is already destroyed over the blue parts of the growth, and is of a livid color at the periphery. The growth is encapsuled and freely movable over the abdominal fascia (in distinction to infiltrating cavernoma). In some parts the cavernous spaces can be seen through the surface. In the center of the growth the skin is yellow in some parts and brown in others. The growth was soft, elastic and compressible; in some places there was thrombosis with consequent shrinking. The growth had remained stationary for a year.

Subcutaneous cavernomas of the scalp require special mention, as they may communicate with a

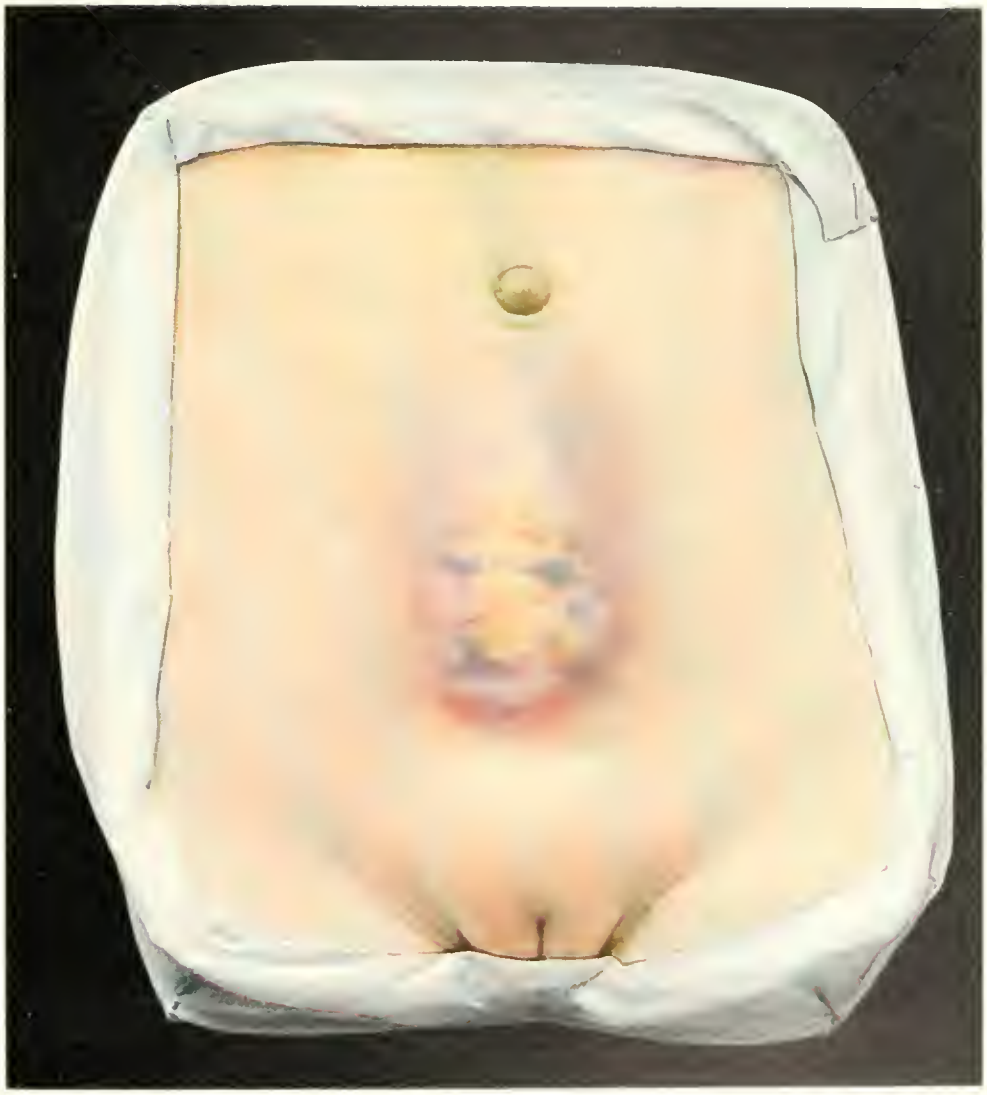

Fig. 80. Haemangioma cavernosum subcutaneum.

sinus through the emissary vessels, without the scalp showing much change.

For **Differential Diagnosis** and **Treatment** see Plate XXVII, Fig. 36.

On account of the danger of rupture and hemorrhage, the case in Fig. 80 was extirpated and the wound closed by suture. Recurrence sometimes occurs after total extirpation.

HÆMANGIOMA CUTANEUM ET SUBCUTANEUM
(*Subcutaneous and Cutaneous Hemangioma*)
TELEANGIEKTASIAE (*Teleangiectases*)

Plate LXIII, Fig. 81.

Fig. 81 shows a combination of cutaneous and subcutaneous hemangiomas with telangiectases, affecting the leg. The telangiectases are seen as red spots, in some places arranged in the form of a wreath. There is also an extensive subcutaneous hemangioma, of a bluish-red color, with more or less normally colored skin in the central parts. These growths may remain covered by intact skin for a long time, while the growth seen through it gives it a bluish coloration. In this case, at the lower part of the subcutaneous hemangioma, there were cutaneous hemangiomas in the form of more elevated, round formations in the skin, resembling the simple cutaneous hemangioma represented in Fig. 75. In the whole region of the subcutaneous hemangioma fine ramifying blood-vessels can be seen. In the face, combinations of cutaneous and subcutaneous hemangiomas sometimes form a characteristic appearance, the subcutaneous growth giving a blue color to the skin, while the cutaneous angioma appears in the form of lobulated growths or of bluish-red nodules projecting from the surface. In Fig. 81 the difference in color between the cutaneous and the subcutaneous hemangiomas is very marked, the former being red, the latter bluish in color. A combination of subcutaneous with cutaneous hemangioma and telangiectases is not very rare. The cutaneous hemangioma sometimes develops when the subcutaneous growth appears under the skin.

For **Differential Diagnosis** and **Treatment** see Fig. 75.

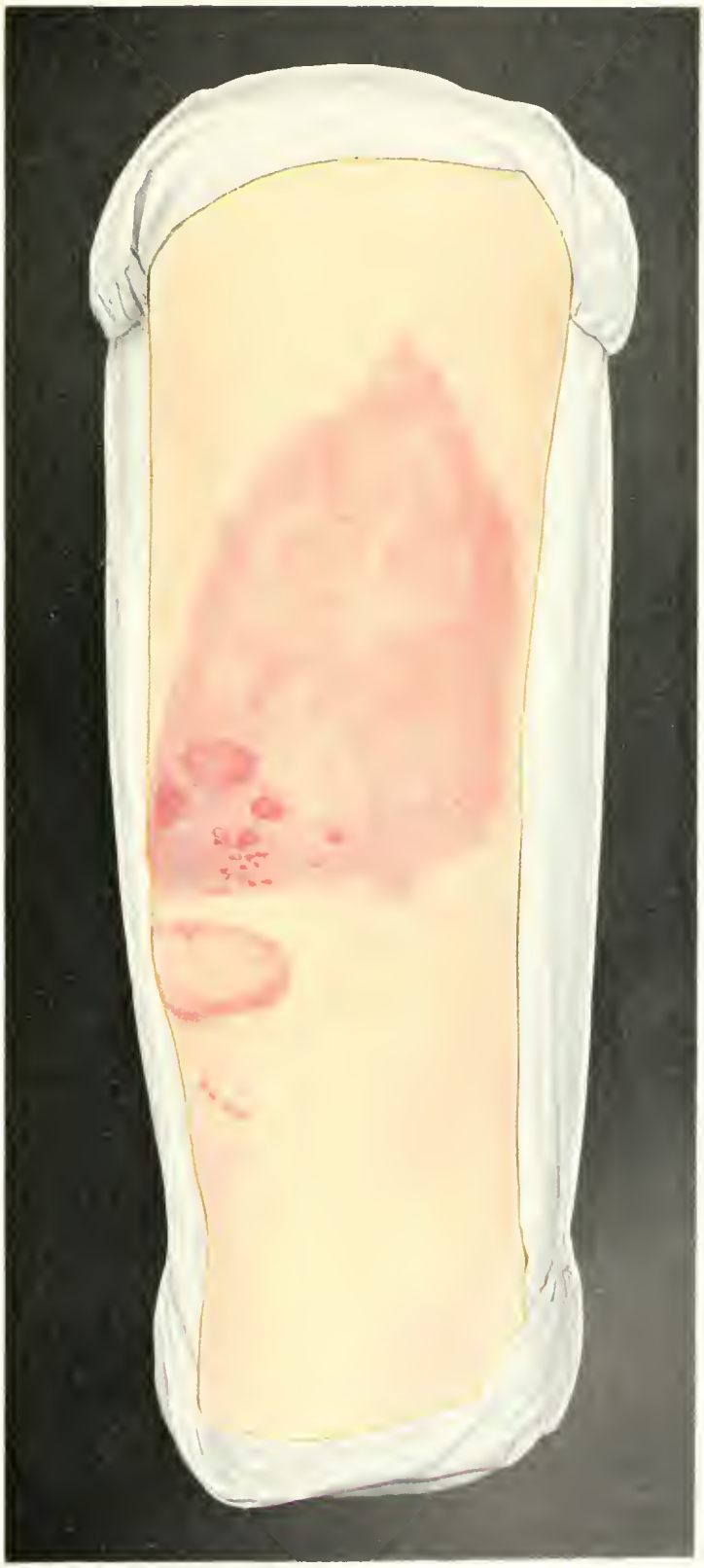

Fig. 81. Hämangioma cutaneum et subcutaneum — Teleangiektasiae

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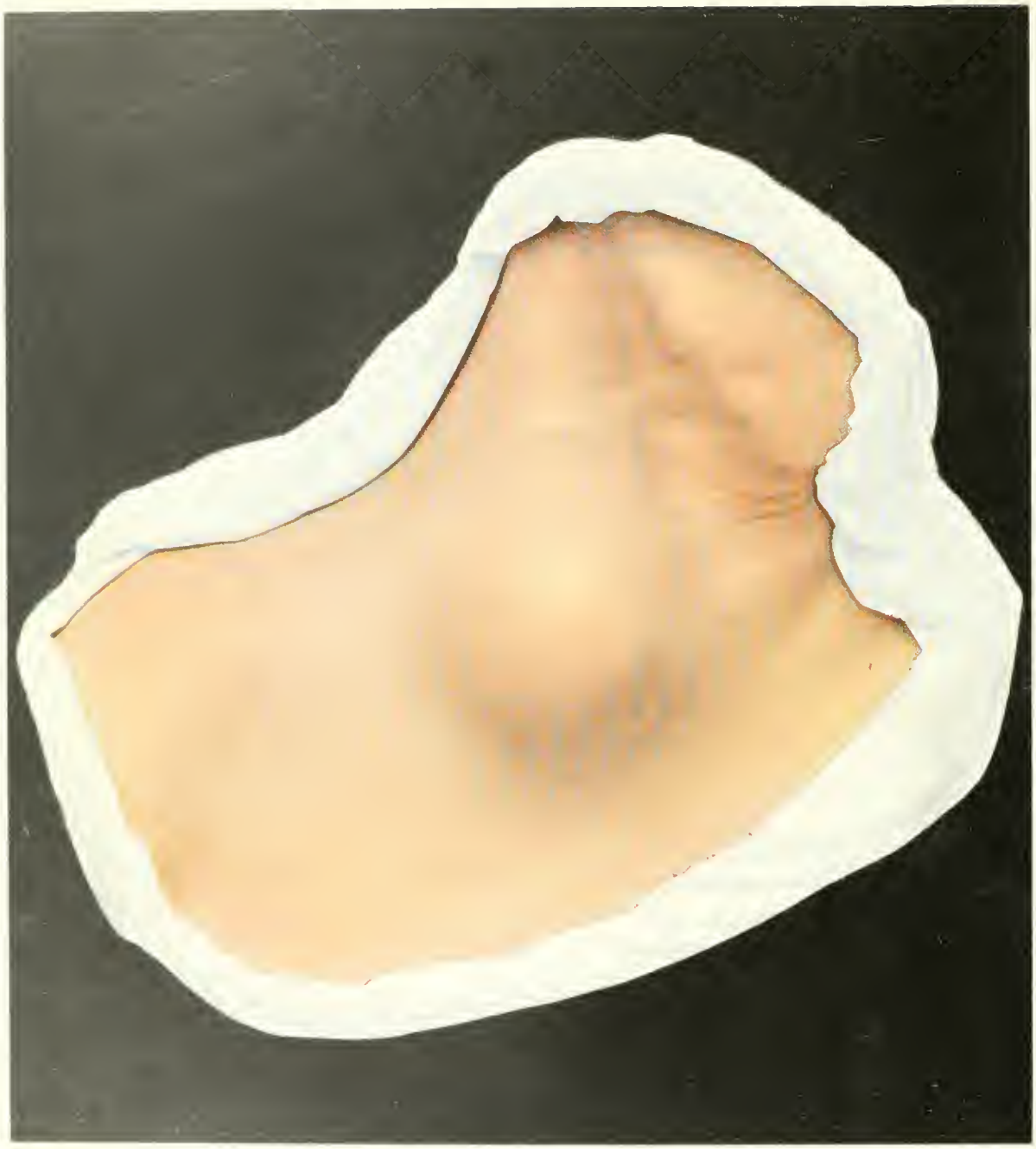

Fig. 82. Aneurysma arteriale.

ANEURISMA ARTERIALE (*Arterial Aneurism*)

Plate LXIV, Fig. 82.

An aneurism is a partial dilatation of an artery. The term *true aneurism* is applied to those dilatations which are formed by all the three coats of the artery. Through wearing away of the arterial wall, the blood escapes from the vessel and is enclosed by the neighboring soft parts, forming a *false aneurism*. A form of false aneurism has already been mentioned as pulsating hematoma (Fig. 78); in this case there is a subcutaneous injury to large blood-vessels.

In both true and false aneurism we distinguish a circumscribed and a diffuse form, but the classification of aneurisms into cylindrical, saccular and fusiform is of no importance, and only has a clinical interest in cirsoid aneurisms (Fig. 75).

True aneurisms are caused by disease of the arterial walls from infective diseases, chiefly syphilis. When the morbid processes extend over large areas of the arterial system the aneurisms may be multiple. These occur especially in the small arteries of the brain, sometimes also in the lungs, and by their rupture give rise to multiple apoplexy. This occurs chiefly in syphilitic disease of the arteries, and in the arteriosclerosis of young people.

True aneurisms are often situated in the ascending aorta (syphilis), also in places where the arteries are liable to traction or pressure from flexion of the extremities: *e.g.* aneurism of the femoral artery from pressure of an osseous growth ("rider's bone") in the adductor muscle; aneurism at the entrance of the femoral artery in *Hunter's* canal; popliteal aneurism, etc.

False aneurisms may arise from true aneurisms (consecutive false aneurism), or from injury to an artery, causing pulsating hematoma (traumatic false aneurism). Aneurisms only attain large dimensions when they are surrounded by soft tissues (skin, muscle, and fat). They are at first diffuse and ill-defined, but eventually become circumscribed swellings, owing to the formation of a connective-tissue capsule from the surrounding tissues.

If both artery and vein are injured, which happens in the majority of cases, an *arterio-venous aneurism* is produced. This is called *aneurismal varix* when there is direct communication between the artery and vein, and a varicose swelling of the latter; *varicose aneurism* when the two vessels communicate through a sac which is formed between them. However, this distinction is not always evident clinically, especially when a series of inextricable sacs and communications is formed through multiple perforations of the artery and vein. Traumatic aneurisms, both arterial and arterio-venous, were formerly common in the bend of the elbow as the result of phlebotomy. They generally arise from punctured wounds, or gunshot wounds with modern bullets.

Clinically, both true and false aneurisms are of gradual development, as in traumatic aneurism there is also a long interval before the sac is formed. The sac may attain the size of a man's head, forming a visibly pulsating swelling, the pulsation ceasing after compression of the artery on the side next the heart. The pulsation may be absent when the sac wall has become thickened by thrombosis. The swelling can be diminished by pressure. On auscultation of the sac a bruit is heard, which is synchronous with systole of the heart in arterial aneurism; irregular during both systole and diastole, in arterio-venous aneurism. In the latter condition there is congestion in the region of the vein, with consecutive disturbance of nutrition, eczema, ulcers, and abscess formation.

Aneurisms as a rule have a slow but persistent growth, and tend to eventual rupture. In arterial aneurism a cure sometimes occurs from thrombosis.

Aneurisms often cause severe symptoms from pressure on the neighboring organs; *e.g.* paræsthesias, neuralgia and paralysis from pressure on the nerves; congestion and elephantiasis from pressure on the veins. A large aneurism may cause atrophy of the bones from pressure (sternum and vertebræ).

Differential Diagnosis. True aneurisms can be distinguished from false traumatic aneurisms by careful examination. Abscesses, or benign and malignant tumors, especially sarcoma, when they receive pulsation from an underlying vessel, may be mistaken for aneurism. Aneurisms in which there is no pulsation or bruit, owing to thickening of their walls from thrombosis, and which have caused inflammatory changes in the skin by pressure, may be mistaken for abscesses and be incised.

In cavernoma there is dilatation of the vessels but no pulsation. Racemose aneurism presents itself as an irregular serpentine arterial swelling caused by the tortuous dilatation of a vascular area.

In many cases the X-rays are useful in the diagnosis of aneurism, which gives a dark shadow in the X-ray picture.

The prognosis of aneurism is always unfavorable.

Treatment. For large spontaneous subcutaneous aneurisms, the injection of coagulating fluids has been recommended, but these are not free from danger. The best is injection of solution of gelatin into the sac. Other methods, which also aim at coagulation, are the introduction of needles or magnesium into the sac, and electropuncture. In the extremities, digital compression or compression by instruments generally causes only temporary improvement. Compression of the common carotid artery and the internal carotid

are not without danger, as they may cause convulsions and unconsciousness.

The most certain method is ligation of the vessel above and below the sac and removal of the sac.

In arterio-venous aneurism all the sacs must be removed after ligation of all the vessels connected with them. Ligation of the common carotid, which may lead to softening of the brain, may be performed if a temporary ligature of the carotid is well borne.

The ideal method is extirpation of the aneurism with restoration of the blood-stream by suture of the vessel (*Payr*) with the aid of prothesis, which avoids such complications as softening of the brain and gangrene of the extremities after ligation of the main vessel. *Lexer* recommends lateral suture of the vessels, circular suture, or transplantation of vessels.

In some cases peripheral ligation only is possible; *e.g.* in aneurism of the subclavian artery. In the extremities, when there is much disturbance of nutrition, the question of amputation arises.

Internal medication consists in the administration of iodide of potassium, with a view to the syphilitic origin of aneurism.

Fig. 82 shows a visibly pulsating swelling in the region of the sterno-clavicular joint in a middle-aged man with a probable history of syphilis. It consists in a circumscribed arterial aneurism, and presented all the clinical symptoms of arterial aneurism—pulsation, diminution on pressure, systolic bruit and buzzing over the swelling. The swelling increased in size slowly but continually, and was shown by the X-rays to be an aneurism of the aorta. There was paralysis of the left recurrent laryngeal nerve from pressure of the dilated aortic arch, a characteristic symptom of aortic aneurism, which sometimes manifests itself by hoarseness; but, when there is compensation of the paralysis, it can only be recognized by laryngoscopic examination. An early symptom of

aortic aneurism is also the phenomenon first described by *Ollier*—pulsation of the larynx. When the larynx is pulled upwards there is a sensation of traction from below ("tracheal tugging").

In this case, pressure on the brachial plexus caused paræsthesias in the right arm; pressure on the veins caused cyanosis of the face and neck; while the dysphagia from pressure on the esophagus, and dyspnœa, which frequently occur in such aneurisms, were absent.

Non-pulsating aneurisms may be mistaken for gumma, which is common in this situation. Aneurisms of the aorta are often unrecognized till they rupture, an event which may occur after sounding a stricture of the esophagus caused by the aneurism itself.

VARIX CIRSOIDES—PES VALGUS (*Cirsoid Varix—Flat Foot*)
Plate LXV, Fig. 83.

The term *phlebectasis* is applied to dilatations and tortuosities of veins. They may occur in various parts of the body; *e.g.* in the inferior hemorrhoidal plexus of veins, as hemorrhoids; in the pampiniform plexus, as varicocele (this is more common on the left side owing to the fact that the left spermatic vein opens at right angles into the renal vein and is thereby more liable to backward pressure and congestion); more commonly in the veins of the leg (large and small saphenous veins), where they are known as varicose veins or varix.

Phlebectases appear as multiform tortuous blue cords (cirsoid varix) clearly visible under the thinned skin, on the inner side of the leg in the region of the large saphenous vein. Varices of the small saphenous vein on the outer side of the leg and calf are less common.

Nodular swellings occur in places where the veins have valves.

In the upper extremity phlebectasis is less often observed, but may occur in connection with tumors of the neck and shoulder. Phlebectases on the abdomen (called caput medusæ) are due to obstruction of the portal circulation. Submucous varices occur in the esophagus and alimentary canal. Varicose veins also occur in the brain, especially in the Sylvian fissure.

Phlebectases in the legs are usually due to disturbance in the circulation; *e.g.* from the pressure of pelvic tumors. Phlebectases may occur on both sides

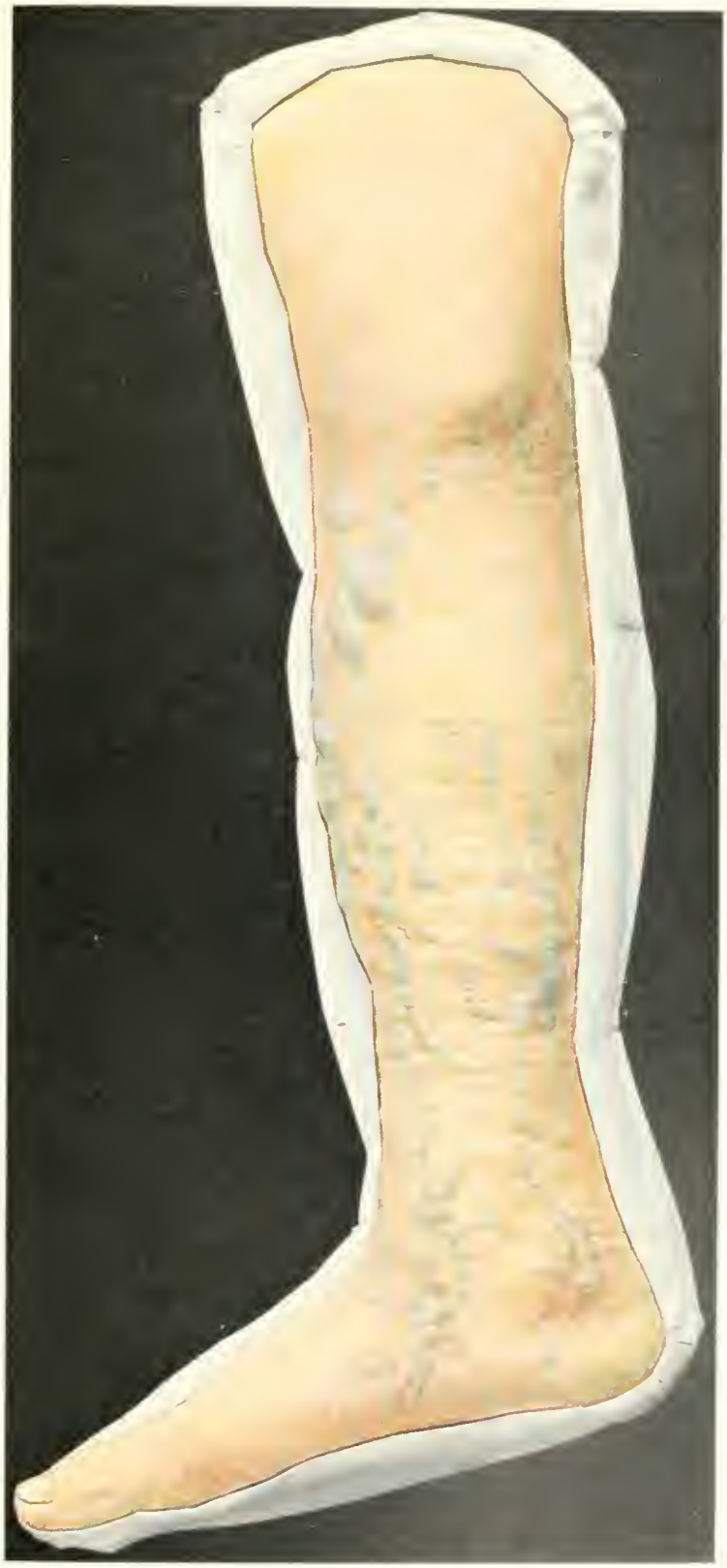

Fig. 83. Varix cirsoides — Pes valgus.

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and be combined with hemorrhoids, especially in women who have had many pregnancies.

Under the thinned skin hard lumps can be felt where thrombosis has occurred. Sometimes the thrombi are calcified, and are then known as phleboliths. At the commencement of the affection, before the varices become prominent, fine ramifying vessels are found under the skin, which later on appear between the veins. These ramifying vessels give the skin a brownish appearance.

Varices which extend in the form of ramifying anastomoses and networks over the whole leg are connected both with the skin and subcutaneous tissue, and become very extensive when the valves of the large saphenous vein are destroyed, thus impeding the circulation. The insufficiency of the valves can be shown by raising the limb till the varices have emptied themselves of blood; then compress the saphenous vein at its opening into the femoral vein in the thigh, lower the limb and suddenly remove pressure on the saphenous vein; the varices then become again filled with blood from the femoral vein.

The patients suffer more when standing than when walking. The chief symptoms are tingling and numbness in the limb, cramps in the calves, especially when the deeper veins are affected, swelling of the feet, eczema, ulceration and even elephantiasis. These troubles often cause much suffering.

Varices may be dangerous from rupture and hemorrhage. As a rule the small, thin, ramifying peripheral vessels rupture, sometimes the larger trunks. The blood being under considerable pressure spurts out in a jet. Fatal hemorrhage may take place unless the limb is elevated and the bleeding stopped by pressure. Death may occur in rupture of subcutaneous varices in the leg and in the internal organs (*e.g.* brain and liver). The second danger is thrombo-phlebitis which may lead to embolism, especially when it becomes purulent (Fig. 84).

Differential Diagnosis. Varicose veins are so typical in appearance that they cannot be mistaken for the vascular formations, such as aneurism, cirsoid aneurism or cavernoma. Primary phlebectasis must not be confounded with the dilatation of superficial veins caused by thrombosis of the deeper veins; *e.g.* after infective diseases.

Treatment. Prophylactic treatment consists in avoiding long standing, in cleanliness and massage. In slight cases the circulation of the limb can be improved by the application of flannel bandages from the toes upwards (*Martin's* rubber bandage is liable to cause eczema). If the varix is caused by pressure of a tumor, this must be removed when possible.

The most radical treatment consists in extirpation of the varices, especially when very tortuous. If the valves of the vein are destroyed (shown by the method mentioned above), it is best to ligature the saphenous vein near its opening into the femoral vein, and to resect a part of it as well. After the operation small varices and eczema quickly disappear, but elastic bandages should be worn for some time. The extirpation of secondary varices due to thrombosis of the deeper veins is useless.

Varicocele should be excised in its whole extent; the testicle can be drawn up by suture.

Submucous varices of the esophagus and varices in the brain and liver are inaccessible to treatment.

Fig. 83 shows somewhat extensive varices in the region of the large saphenous vein in the leg, in a woman of forty, after many pregnancies. The above-mentioned ramifying vessels are seen between the varices, giving the skin a reddish-brown appearance.

In this case the foot was in a position of pronation and abduction (pes valgus or flat-foot)

The treatment of pes valgus depends on its cause. The deformity may be congenital or acquired (traumatic, paralytic, rickety (Fig. 65), or due to long standing).

In all these forms the foot is more or less in a position of pronation and abduction, and eventually there is displacement at the astragalo-scaphoid articulation. Along with changes in the bones and destruction of cartilage in the joints, the ligaments, tendons and muscles are also affected.

Traumatic flat-foot occurs not only after fractures of the leg and ankle, but also as the result of rupture of the ligaments from twisting of the foot, especially when the injury is not treated by fixation. Paralytic flat-foot occurs after acute anterior poliomyelitis, in which the plantar flexors are paralyzed and there is over-action of the extensors.

Rickety flat-foot is due to sinking of the arch of the foot owing to softness of the bones.

The commonest form is static flat-foot, which occurs in persons of weak muscular power, as the result of prolonged standing (waiters, etc.). It generally develops at the age of puberty. The symptoms are fatigue, pains in the ankle and tarsal joints, and on the outer side of the leg. The pains are often cramp-like (tarsalgia).

Differential Diagnosis. Pes valgus must not be confounded with the flat-foot which occurs in certain races (Jews, negroes). The latter is due to imperfect development of the arch of the foot, but there are no

changes in the mid-tarsal joint, and the condition causes little trouble.

Treatment. In congenital flat-foot the position can be corrected by manipulation and massage. In traumatic flat-foot caused by fractures and sprains, the patients should not walk too soon, and then only with a well-made boot provided with a flat-foot sole. In more severe degrees of traumatic flat-foot, the question of cuneiform osteotomy of the scaphoid bone or head of the astragalus, or linear osteotomy of the tibia and fibula may arise. These operations may be considered in cases where manipulation has failed to correct the position. If the tendon Achilles is much shortened it should be tenotomized before manipulation. After manipulation the foot should be put up in plaster of Paris in an over-corrected position.

In paralytic flat-foot tendon-transplantation is useful. The peripheral end of the divided tendon of the paralyzed tibialis anticus muscle can be connected with the tendon of the healthy extensor longus hallucis muscle.

Inflammatory flat-foot, which causes painful contracture, should be treated by rest in bed and hot fomentations. If the pain is very severe cocaine may be injected.

General treatment consists in strengthening the muscles (tibialis anticus and posticus, and calf muscles); active movements and massage. When standing the toes should be turned inwards, and when walking the foot should not be turned outwards. The boots should be well-made with flat-foot pads; the latter are made after an impression of the foot taken on smoked paper, and should extend from heel to toes over the whole sole.

PYOGENIC INFECTIONS

Plate LXVI et seq.

The bacterial invasion of injured or uninjured parts of the body plays a great part in surgery, as there is always the possibility of bacterial infection in every injury and operation.

According to the nature of the infection, definite clinical pictures are produced which are generally represented by various degrees of inflammation and reaction of the body. These processes may be incited not only by bacterial irritation but by mechanical irritation, such as trauma without infection, also by chemical irritation (*e.g.* poisons of all kinds, animal poisons such as snake poison), and by the action of heat and cold (burns and freezing).

In bacterial infection the inflammation is most marked, as it does not remain limited to the place of origin, but extends more or less rapidly in the surrounding parts, and may eventually reach remote parts of the body by way of the blood and lymphatic vessels (general infection). According to the rate of its extension, the inflammation may be acute, chronic or subacute. All three forms may pass into each other.

Bacterial infection causes various clinical phenomena according to the nature, number and virulence of the bacteria, and according to the parts of the organism which are invaded, and the power of resistance of the individual. Old, feeble and diseased bodies (*e.g.* diabetes) are less capable of combating bacterial invasion, while a healthy body shows a strong reaction against it. This reaction

manifests itself by inflammation at the point of infection.

This inflammatory reaction is manifested by the cardinal symptoms—redness, heat, swelling and pain. The redness and heat are due to dilatation of the blood-vessels from irritation of the tissues (active or arterial hyperæmia); the swelling and pain are due to the transmigration of blood elements, especially leucocytes, owing to the slowing of the blood stream. In every severe infection the function of the part concerned is also interfered with.

The exudation varies in degree according to the nature of the infection. It may be serous, fibrinous, sero-fibrinous, or purulent; and when mixed with red blood corpuscles becomes hemorrhagic. Purulent exudation is the most common, and recurs in its simplest form in wounds which do not heal by primary union.

Pyogenic infections are also distinguished according to their situation and extent. They may thus be superficial or deep; circumscribed or diffuse; cutaneous, subcutaneous, muscular, glandular, or osseous, etc.

Besides the local inflammatory reaction of the part of the body attacked, there is a general reaction shown by considerable and prolonged rise of temperature. This must be distinguished from the slighter degree of so-called aseptic fever which occurs during resorption of blood effusions. The temperature chart in pyogenic infections, together with the local reaction and the general symptoms (rigors, pains in the joints, dry tongue, sweating, diarrhea and vomiting) are of the greatest importance in estimating the degree of wound infection.

After the first stage of inflammation, which causes more or less destruction of tissue, comes the stage of regeneration.

Owing to the formation of granulation tissue from the fixed connective tissue cells the inflammatory

area becomes isolated and demarcated, the necrosed tissue becomes separated and is discharged with the pus, and the wound eventually heals by scar tissue which is developed from the vascular granulations. As the stage of reparation proceeds, the clinical symptoms of inflammation subside.

If the infection is very virulent, the body cannot overcome the bacteria and their products of metabolism. From the local infection arises a general infection which the defensive power of the body is generally unable to combat.

The researches of *Ehrlich* and *Morgenroth* have thrown much light on this complicated process. This is not sufficiently explained by the presence of a substance (called alexin) present in the blood-serum, nor by *Metchnikoff's* theory of phagocytosis (destruction of bacteria by the white blood corpuscles), but depends on the combined action of several factors. Also, the still more complicated processes of the formation of antitoxins, and the immunization of the organism, have been made comprehensible by *Ehrlich's* "side-chain" theory.

Again, the knowledge of surgical infections due to bacteria has been extended by numerous observers (*Koch*, *Fehleisen*, *Rosenbach* and others). The harmful action of bacteria is due to their multiplication in the organism, and to the formation of products of metabolism, the most dangerous of which are the toxalbumins (or toxins) excreted by living bacteria; while the poisons found within the bacteria, which lead to their destruction, are known as endotoxins and are of less importance.

While the normal skin and mucous membranes only rarely harbor bacteria, every wound forms a favorable soil for their development, and from this they spread by the blood and lymphatic vessels. The organism may be infected by one or several kinds of bacteria (mixed infection).

The most important bacteria from the surgeon's

point of view are those which cause pyogenic infections—the *staphylococcus aureus* and *albus* and the *streptococcus pyogenes*. Most acute inflammatory processes, whether a wound is present or not, are due to these forms of bacteria.

Staphylococcal infections are very common (furuncle, carbuncle, osteomyelitis, etc.), and generally lead to circumscribed purulent inflammations. Streptococcal infections are more diffuse and often cause general infection.

Both these forms of bacteria are especially virulent when they give rise to pyogenic infection of the human body. Other bacteria only cause a slighter degree of inflammation; generally serous or serofibrinous, only occasionally purulent (pneumococcus, typhoid bacillus, bacterium coli commune, gonococcus, bacillus pyocyaneus, tubercle bacillus, diphtheria bacillus).

Differential Diagnosis. Pyogenic infections present such characteristic clinical symptoms that a general diagnosis is not difficult. A stricter diagnosis depends on the history of the case, the local and general condition and bacteriological examination.

Prognosis. With early diagnosis and appropriate treatment the prognosis is favorable as regards life, but doubtful as regards function in certain regions. There is always danger to life in every pyogenic infection, as a circumscribed inflammatory focus may become diffuse and set up general infection. In consideration of this fact, every apparently insignificant pyogenic affection must be treated with the greatest care.

Treatment. In the first place all sources of irritation must be removed (foreign bodies, stone, etc.). Whenever signs of suppuration appear, the affected part must be kept at rest; in the extremities by sus-

pension. When there is inflammatory infiltration of the skin without any formation of pus, it may be smeared with ointment; but the application of an ice-bag is injurious, as it delays the localization of the process in the form of a circumscribed collection of pus, which is the object desired. Hot, moist fomentations are best avoided, as they favor the growth of bacteria. When a circumscribed collection of pus has formed, it must be evacuated by a free incision (pyogenic conditions which require earlier incision will be mentioned later). Small abscesses can be opened under local anæsthesia, but more extensive ones require a general anæsthetic. Local anæsthetics should never be injected into inflammatory tissue, as they are very painful and may also give rise to general infection.

Large incisions, made so as to give the best outlet for the pus, lead to more rapid healing than small incisions. The after-treatment is rendered much simpler by large incisions, while small incisions often require further incision. For the same reason, evacuation of pus by an aspirator is more uncertain and uncleanly.

After-treatment consists in loosely plugging the wound with dry iodoform gauze, and later with sterile gauze, applied daily. Immobilization should be continued till all signs of inflammation have subsided.

In cases where dry tampons cause pain they may be replaced by moist tampons with two per cent. boric acid lotion, one per cent. aluminium acetate, or three per cent. oxygenated water, renewed two or three times a day. Tampons should not be left in too long, as they cause irritation of the tissues. They must, therefore, be managed as carefully as possible, if necessary, under an anæsthetic. The application of alcohol, iodine, carbolic acid, balsam of Peru to infected wounds (cf. treatment of tetanus, Fig. 78), is not to be recommended, as they cause much irrita-

tion in the wound. *Von Bergmann's* method of dry antiseptic dressings is the simplest and most practical method of dealing with pyogenic infections.

Granulation tissue should be treated by ointments of zinc oxide or nitrate of silver, and by baths. Later on, massage, active and passive movements and electricity are indicated, according to the situation and nature of the affection. The general condition also requires treatment in every pyogenic infection, by tonics and nourishing diet. When necessary subcutaneous injections of normal saline solution and nucleinic acid should be given (20 cc. of nucleinic acid in 200 cc. of normal saline solution). Antitoxic or bactericidal serums have so far given no result in pyogenic infections.

The method of passive hyperæmia advocated by *Bier* for the treatment of acute pyogenic infections has, after the experimental and clinical research of *Lexer*, *Wrede*, *Wollf-Eisner* and others, proved itself to be "a double-edged sword." (Discussion at the Surgical Congress, 1906). It cannot be recommended as a practical method, as it necessitates prolonged internment of the patient in hospital. It is true that an increase in the power of defense takes place at the seat of infection after passive venous hyperæmia, as it does after active hyperæmia induced by painting with iodine or hot-air treatment. On the other hand, nutrition is impaired, and the resorption of the bacteria and their poisons delayed by the venous hyperæmia, which may result in further destruction of tissue at the seat of infection. Again, if the infection is a virulent one, especially streptococcal, there may be rapid resorption of bacterial poisons in the organisms after removal of the elastic compression, which may be fatal. In infection by gas-forming bacteria, which may cause gangrene of the tissues by pressure of gases, passive hyperæmia only aggravates this action.

We, therefore, consider treatment by passive hyper-

æmia (which cannot be endured by many patients) as unnecessary in the milder forms of pyogenic infection. The above-mentioned treatment is sufficient in these cases, especially when combined with immobilization. Again, treatment by passive hyperæmia often obscures the indications for incision. Small incisions are often insufficient even in mild cases, and require to be enlarged or repeated, thus complicating and lengthening the treatment. (For the treatment of suppuration in tendon-sheaths, see Fig. 96).

In the more acute pyogenic infections, which present severe clinical symptoms and have a tendency to progress, treatment by passive hyperæmia is unsafe, and has often aggravated the condition; *e.g.*, by thrombo-phlebitis of the small veins, multiple abscesses, and even general infection.

Finally, the treatment of acute pyogenic infections by passive hyperæmia has not a scientific foundation on bacteriological research, nor is it supported by the results of clinical experience.

THROMBOPHLEBITIS ACUTA PURULENTA

(*Acute purulent Thrombo-phlebitis*)

Plate LXVI, Fig. 84.

Acute purulent thrombo-phlebitis may arise from infection of the neighboring parts. In every pyogenic infection purulent thrombi are found in the smaller veins. In the larger veins it arises from periphlebitis, in which there is infection of the wall of the vein. Infection of the walls of veins may also result from internal infection by the blood. Purulent phlebitis always results in the formation of a thrombus which may cause complete occlusion of the vessel. The thrombus generally contains pus (thrombo-phlebitic abscess); it may extend and infect larger areas, or may disintegrate and give rise to general infection by embolism (cf. Fig. 108).

Various pyogenic affections may give rise to thrombo-phlebitis (lymphangitis, furuncle, carbuncle, erysipelas, varicose ulcer of the leg). Otitis media may cause thrombo-phlebitis of the lateral sinus. In the portal vein, infection by the blood may cause pylephlebitis and subsequent multiple abscesses in the liver. Carbuncle of the lips may cause meningitis through thrombo-phlebitis of the facial and ophthalmic veins. When the lesion is superficial, it gives rise to all the symptoms of purulent inflammation—redness, swelling and œdema of the skin and subcutaneous tissue, pain, fever and rigors. The skin is often tense and hard. The infiltration extends along the course of the veins, in the form of hard cords. The presence of pus and the formation of abscess is indicated by yellowish coloring of the skin (Fig. 84), and later by fluctuation.

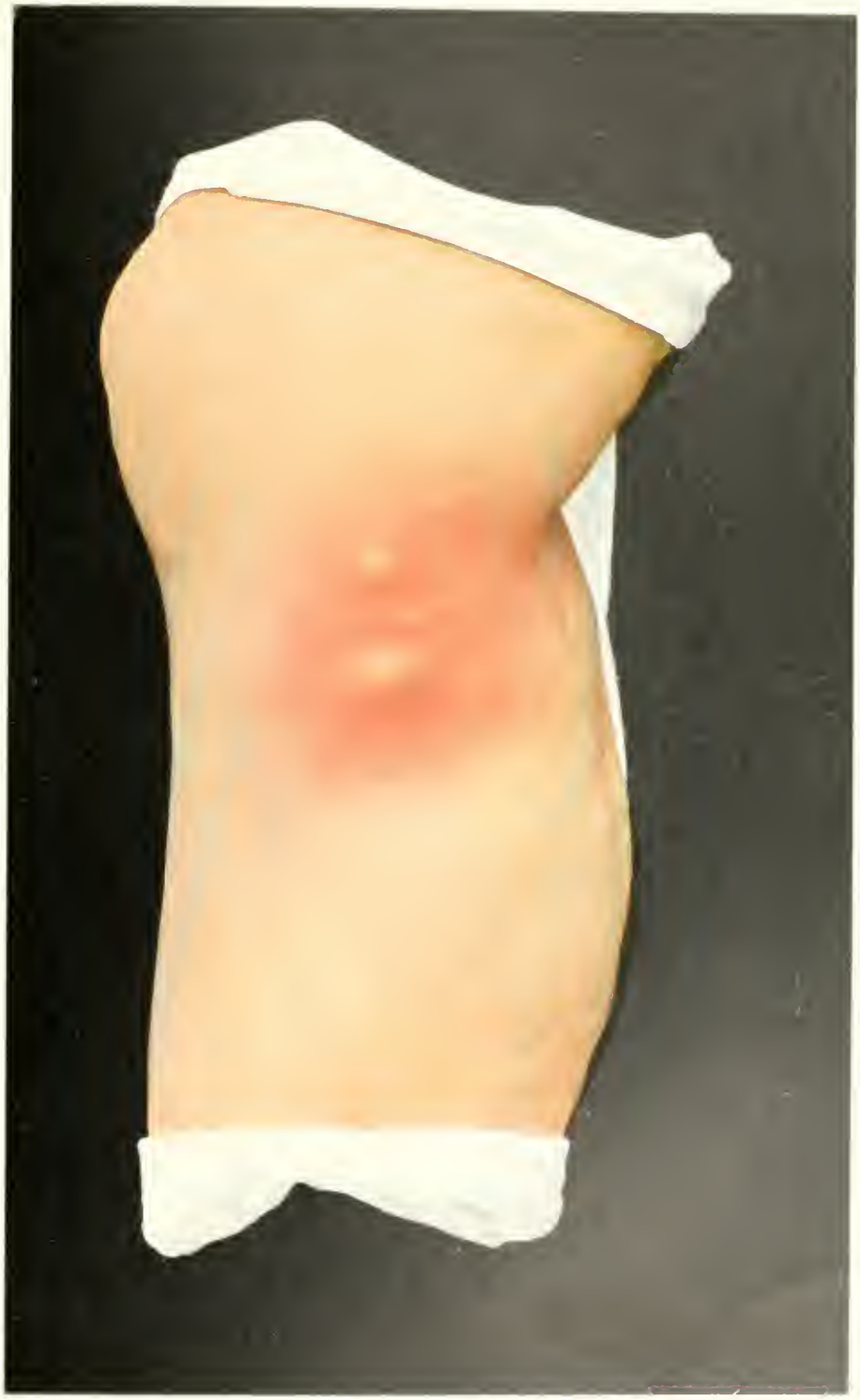

Fig. 84. Thrombophlebitis purulenta acuta.

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Thrombo-phlebitis of the deeper veins gives rise to severe symptoms—pain, high fever, rigors and change in the general condition.

Thrombo-phlebitis of the femoral vein, occurring in women as the result of puerpural parametritis, is known as *phlegmasia alba dolens* (white leg). In this affection the whole leg is affected by painful, hard œdema, preventing any movement. The thrombosis may be so extensive as to cause gangrene of the extremity.

In every case of thrombo-phlebitis the walls of the veins remain thickened causing congestion which, in the lower extremities, leads to deficient nutrition (ulcer, eczema, elephantiasis). Thrombi may become transformed into hard, painful phleboliths, by deposit of calcareous salts.

Differential Diagnosis. Superficial thrombo-phlebitis differs from lymphangitis in the veins being thicker and harder. Deep thrombo-phlebitis is often impossible to distinguish from other pyogenic affections.

The prognosis is always doubtful, owing to the possibility of general pyogenic infection.

Treatment. In the early stages suppuration of the thrombi may be avoided by rest. In the extremities, these should be suspended. The treatment must be conducted according to the general rules for pyogenic affections. Abscesses must be incised; there is no fear of hemorrhage owing to thrombosis of the vessels for some distance from the seat of inflammation. If general infection appears to be imminent the vein should be resected after double ligation of the diseased section. For example, ligation of the internal jugular vein is indicated in otitis media, and in furuncle of the lips (in the latter, also, ligation of the anterior facial vein).

Phlegmasia alba dolens does not suppurate as a

rule and can be treated by rest in bed and the application of mercurial or silver ointments (unguentum cinereum and unguentum Crédé).

Fig. 84 shows acute purulent thrombo-phlebitis in a woman, affecting a varicosity of the saphenous vein, which developed after pregnancy. There is diffuse redness, with yellowish nodules indicating the commencement of abscesses in connection with the infiltrated and thrombosed vein.

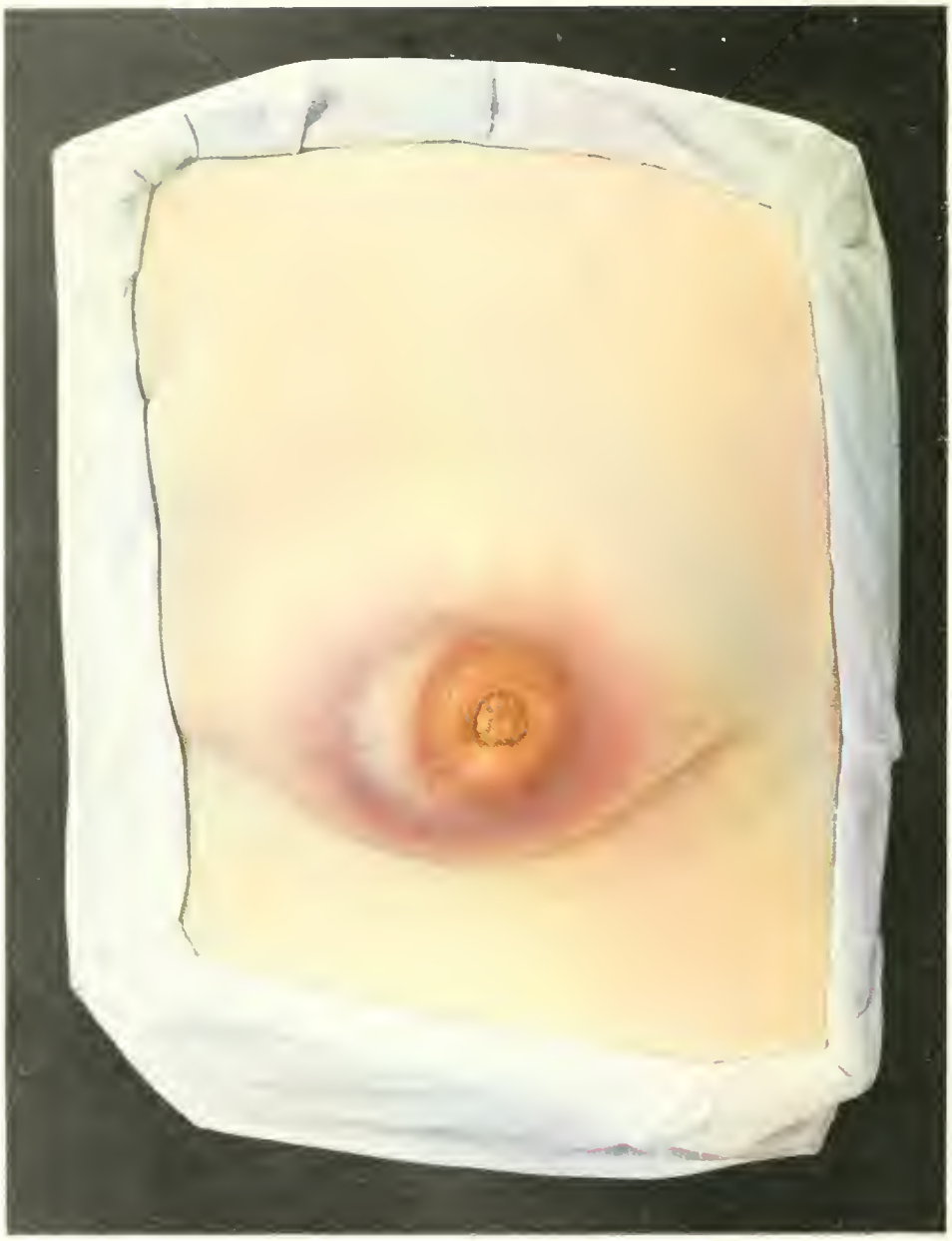

Fig. 85. Abscessus subcutaneus.

ABSCESSUS SUBCUTANEUS PARAMAMMILLARIUS

(*Subcutaneous paramammillary abscess*)

Plate LXVII, Fig. 85.

The term abscess is applied to a circumscribed collection of pus which arises from loss of tissue. The terms purulent exudation or empyema are applied to collections of pus which form in pre-existing cavities (maxillary antrum, pleura, abdomen). Abscesses may occur in the skin, subcutaneous tissue, muscles, bones, and also in the internal organs (liver, lungs, brain).

Cold abscesses, which are due to chronic infections, such as tuberculosis (Fig. 125), must be distinguished from acute abscesses, which, in most cases, occur in the subcutaneous tissue as the result of acute pyogenic inflammation, due to staphylococci and streptococci. The formation of an abscess may usually be considered a favorable sign, as it arrests the progress of infection in the organism by damming up the inflammation. After the diffuse inflammation has become circumscribed in the form of abscess, the severe inflammatory symptoms subside. Granulation tissue formed by the fixed connective-tissue cells forms a continuous boundary known as the abscess membrane.

The majority of abscesses arise from diffuse, infiltrating, purulent inflammation of the subcutaneous tissue. Abscesses also occur in the various organs of the body in all other pyogenic affections (erysipelas, lymphangitis, osteomyelitis, lymphadenitis, myositis). The abscesses may spread from the deeper parts to the surface, or inversely.

Blood effusions may suppurate and form abscesses if another part of the body is invaded by bacteria (*e.g.* furuncle). The so-called embolic or metastatic abscesses are formed by way of the blood stream in general infection, and may occur in any part of the body.

The clinical symptoms are those already mentioned. In subcutaneous abscess the skin is at first red, and shows diffuse inflammatory infiltration. There is pain, tension and fever. The red color of the skin becomes gradually darker and more circumscribed. The skin becomes thinner and yellowish and bulging at one spot, through which the abscess bursts. The deeper the abscess, the more diffuse and extensive are the infiltration and inflammatory œdema (*e.g.* in osteomyelitis, Fig. 82).

Erysipelas, lymphangitis, and other pyogenic affections may be present along with abscess formation. The part of the body affected is stiff and painful on movement, and as every abscess may lead to general infection all movements should be avoided.

Differential Diagnosis. Acute abscess is recognized by the presence of all the symptoms of acute inflammation. The cause of the abscess must be found, and the occurrence of metastatic abscesses must be borne in mind.

Treatment. As soon as an acute abscess is diagnosed by the presence of fluctuation, or by an exploring syringe in the case of deep abscess, it must be freely opened. When the suppuration is once circumscribed, early incision prevents further destruction of tissue, leads to quicker healing and leaves less scar. Treatment by hot fomentations or poultices, to cause spontaneous bursting of the abscess, causes more destruction of tissue and delays healing.

After incision the abscess should be plugged with sterile gauze, after which granulation tissue is quickly

formed. Treatment by aspiration is not so good as it does not remove the abscess membrane.

Deep abscesses must be freely opened, plugged and drained. In large abscesses a counter incision should be made at the deepest part of the abscess cavity, and all recesses should be opened up. The affected part should be then immobilized.

Fig. 85 shows a subcutaneous abscess surrounding the nipple in a lying-in woman, arising from a cracked nipple, which gave entrance to bacteria. The skin round the nipple is bluish red and swollen. The presence of fluctuation indicates a collection of fluid in the subcutaneous tissue. The inflammation has already become circumscribed. In spite of the apparently slight extent of the abscess, the patient suffered from severe pain, fever and general *malaise*. The abscess healed quickly, after incision and plugging and suspension of both breasts.

MASTITIS PUERPERALIS PURULENTA

(*Purulent puerperal mastitis*)

Plate LXVIII, Fig. 86.

Bacterial inflammation of the breast (phlegmonous mastitis) ending in suppuration (purulent mastitis), occurs almost exclusively in women during the puerperium, as the result of direct infection of the lactiferous ducts with bacteria (mostly staphylococci), through cracks and fissures of the nipple. The clinical symptoms are those of pyogenic infection, with the formation of a hard, painful infiltration, usually in the lower and outer quadrant of the breast. The skin is tense, œdematous, reddened and often glistening. The redness quickly extends over the whole mamma and beyond it. The patients suffer from a feeling of tension in the breast, and radiating pain in the arm of the affected side. There is also general *malaise*. The affection is often ushered in by rigors and high temperature.

The axillary glands may be enlarged and painful. In severe cases there is diffuse infiltration of the whole mammary gland, which may extend into the lymphatic vessels round the breast. Abscesses form in one or more places; the superficial ones being recognized by fluctuation, the deeper ones by the extensive nature of the lesion. Purulent inflammation of the mamma may occur in general infection; on the other hand, it may also give rise to general infection by thrombo-phlebitis.

Differential Diagnosis. A non-bacterial inflammation of the breast occurs in sucklings soon after birth (mastitis neonatorum). This is a physio-

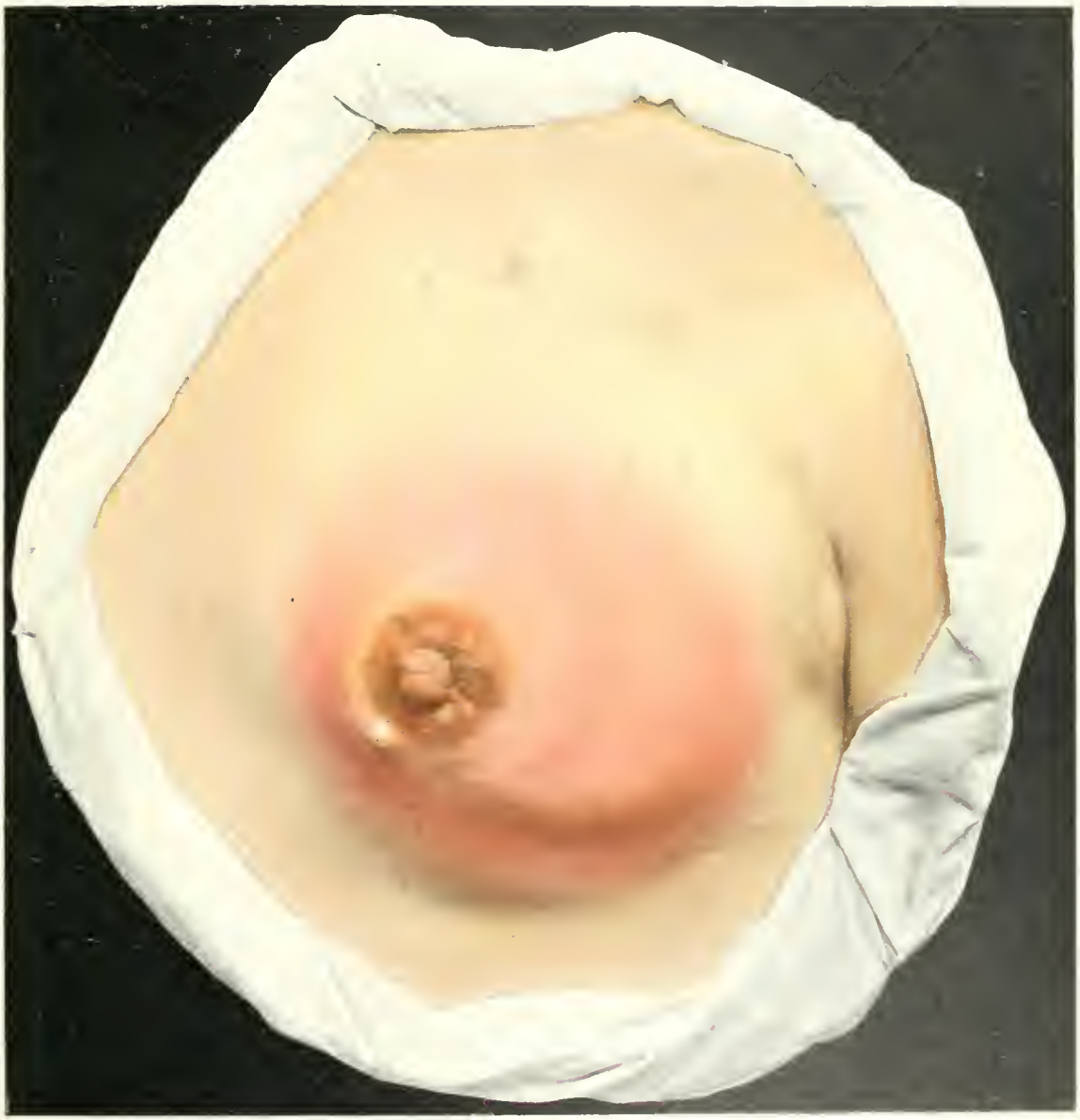

Fig. 86. Mastitis puerperalis purulenta.

Pebbl. Company, New York.

logical swelling of the gland with excretion of a secretion resembling milk. In some cases there is circumscribed abscess formation, which soon heals after incision. The inflammation, however, usually subsides under ointments and moist fomentations. Similar mastitis may occur at the age of puberty, both in boys and girls, which yields to the same treatment and seldom leads to abscess. Pigmentation of the areola remains after these cases of mastitis.

During the period of lactation, accumulation of milk due to stopping its outflow may cause hard inflammatory infiltration of the breast (milk abscess) which disappears after removal of the milk by a breast pump, etc. In these cases both breasts should be supported by a suspensory bandage.

Mastitis may be caused by trauma, by suppuration in a blood effusion caused by injury. In cases of furunculosis and diabetes mastitis may occur, with the formation of hard, deeply situated abscesses resembling malignant tumors.

Tuberculous mastitis is generally due to extension from tuberculous axillary glands and is characterized by its chronic course. Actinomycosis gives rise to hard swellings (cf. Fig. 115). Syphilis may also cause interstitial mastitis, but there is no suppuration. Gonorrheal infection of the lactiferous ducts has also been described, as the result of uncleanliness of the mother, or gonorrheal stomatitis in the infant.

Interstitial mastitis and chronic cystic mastitis which form tumor-like nodules in the mamma, cannot be mistaken for phlegmonous mastitis as they cause no acute inflammatory symptoms.

Superficial abscesses in the region of the nipple (Fig. 85) are easily distinguished from purulent mastitis, and are only of limited extent. Retro-mammary abscesses may cause difficulty in the diagnosis when there are also signs of inflammation in the mamma. In these cases the skin is usually intact,

the whole breast is raised from the thorax, and palpation of the breast causes no pain; but there is pain on pressing the breast against the thorax. There is generally acute adenitis of the axillary glands and pain on moving the arm in retro-mammary abscess.

Treatment. As soon as suppuration in the breast is diagnosed it must be incised. The earlier incision is made the more rapidly do the symptoms subside. The case should not be left till the abscess points under the skin, but a radial incision should be made, under an anæsthetic, through the breast tissue, if necessary as far as the pectoral fascia. All recesses and pockets must be opened up, and counter-openings made if necessary. Glandular tissue destroyed by suppuration can be removed with the sharp spoon.

The after-treatment consists in plugging and drainage, and must be carefully carried out, otherwise there may be purulent infiltration of the neighboring gland lobules and further extension in the form of diffuse inflammation. Large incisions are indicated, as they lead to more rapid healing, and enable the mammary gland to retain its function of lactation. Both breasts should be suspended, and the child removed from the breast. Purgatives and iodide of potassium may be given to diminish the formation of milk. Treatment by moist fomentations is not to be recommended, as it may lead to destruction of the whole glandular tissue.

Treatment of the abscess by aspiration, which aims at the least possible destruction of the mammary tissue, is only indicated in the rare cases where the inflammation and abscess formation is circumscribed. In the more common phlegmonous form this method is dangerous, and has in more than one instance necessitated amputation of the breast. Aspiration has also the disadvantage of being uncleanly.

Fig. 86 shows a case of acute purulent mastitis in a lying-in woman, situated in the lower and outer

quadrants of the breast. It may be mentioned, by the way, that congestive mastitis of the lower quadrants of the breast may predispose to infective mastitis. In Fig. 86 the inflammatory signs are very marked. The skin is reddened, tense and infiltrated; the whole of the outer and lower part of the mamma is hard and painful. Fluctuation was nowhere present. The case healed rapidly after incision, plugging and suspension.

Persistent fistulas of the breast with unhealthy granulations (cf. Fig. 56) may be due to deep collections of pus which have not been opened up, or to tampons or drainage tubes which have been left behind. They often require multiple incisions.

FURUNCULUS—LYMPHANGITIS (*Furuncle—Lymphangitis*)
Plate LXIX, Fig. 87.

FURUNCULOSIS (*Furunculosis*)
Plate LXIX, Fig. 88.

Bacterial invasion of the skin occurs through the ducts of the sebaceous glands. Even slight friction is sufficient to cause staphylococci, which are always present on the skin, to enter the sebaceous glands, where they find more favorable conditions for their growth than on the surface of the skin. In uncleanly persons pustules often occur on the skin, each one pierced by a hair. This purulent inflammation of the sebaceous glands is called *folliculitis*. In the eyelids folliculitis of the eyelashes forms *hordeolum*, or stye. Folliculitis is cured by epilation of the hairs, and may be avoided by cleanliness.

The inflammation may extend beyond the sebaceous gland and cause inflammatory infiltration of the skin. Furuncle (boil) is a circumscribed pyogenic affection of the skin caused generally by staphylococci, sometimes by streptococci and other bacteria. The pathological process consists in hyperæmia and exudation, with redness and hard swelling of the skin, followed by necrosis of the tissue in the center of the infiltration; afterwards regeneration by the formation of granulation tissue. Furuncles occur especially in parts which are exposed to irritation—the nape of the neck, the wrist joint, the buttocks, the thigh and the face. Furuncles often occur secondary to cracked conditions of the skin caused by eczema, excoriations, etc. In diabetics, furuncles are very common owing to the dry condition of the skin and the scratching produced by pruritus, also to the

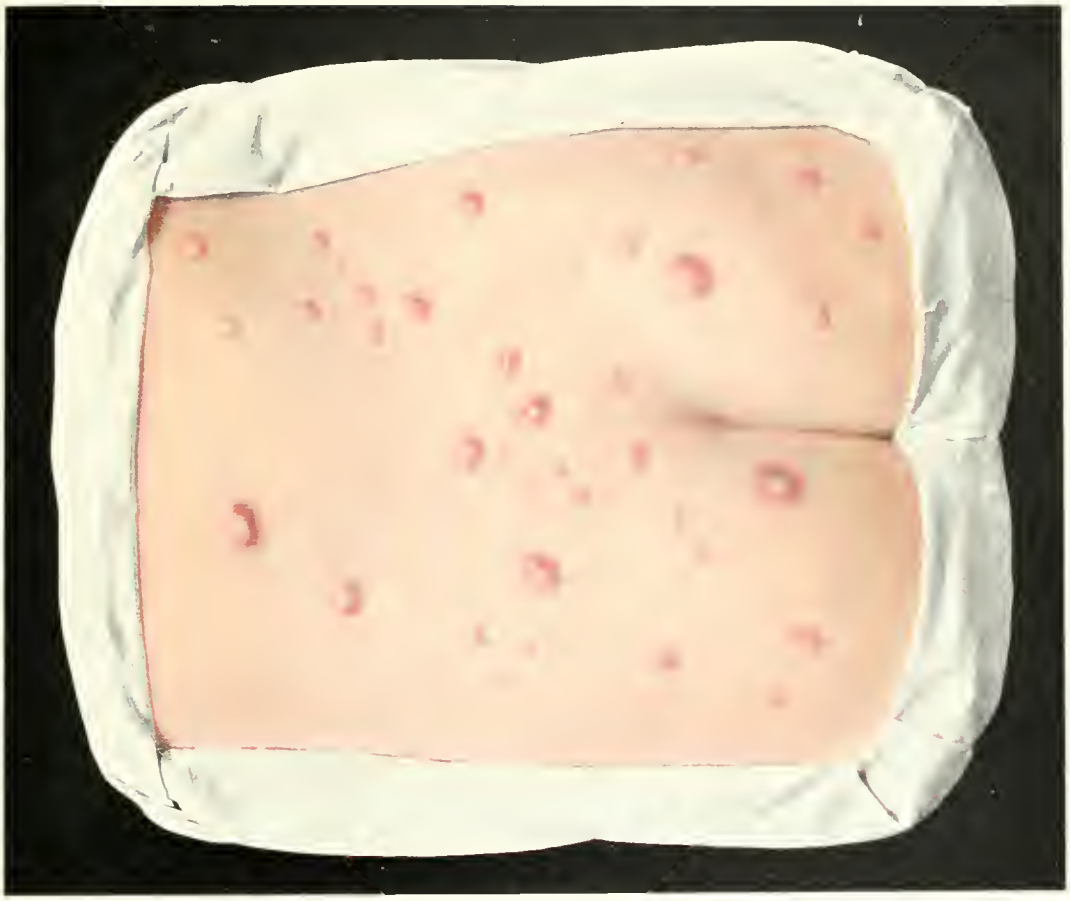

Fig. 88. Furunculosis.

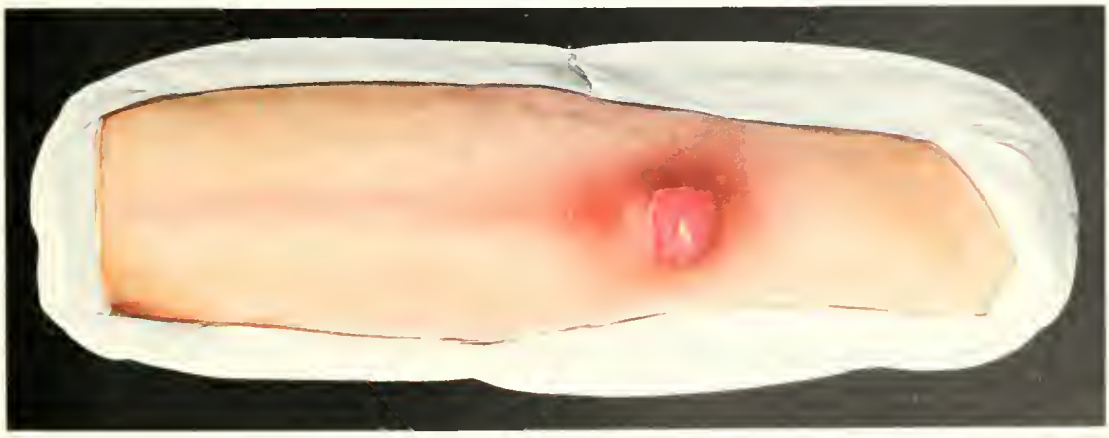

Fig. 87. Furunculus Lymphangitis.

body being especially vulnerable to bacterial invasion (Fig. 140). Furuncles may also appear in all cases where the bodily resistance is impaired—in children, old people, and the tuberculous.

The clinical appearance of furuncle is typical. From a small punctiform redness develops a hard, redder, painful nodule in the skin, which extends at its periphery and also deeply towards the fascia. The epidermis is at first intact, but afterwards ruptures at the apex of the projecting furuncle, exposing a yellowish center which becomes more and more demarcated from the hard, red infiltration. In this way a round, crateriform ulcer is produced with a central yellowish core (Fig. 87). Sometimes a hair is situated in the center of the furuncle. Large furuncles are extremely painful, especially on movement, and are often accompanied by fever and general debility. The symptoms subside when the central core becomes loosened by suppuration. The cavity is then quickly filled by granulation tissue, which may form a cicatrix in a few days. The hard infiltration remains for a long time and generally causes unpleasant itching of the skin. The scar, which is always hypertrophic in all inflammatory processes, may also cause trouble.

Complications may increase the severity of furuncle. There is always lymphangitis, especially in the extremities, and often lymphadenitis. Early implication of the lymphatics signifies extensive inflammation and virulent bacteria.

Several furuncles are sometimes found close together, either from simultaneous infection of several sebaceous glands or from secondary infection from the primary furuncle. This often occurs after the application of plaster or other measures with the object of "drawing out" the furuncle.

In individuals with a feeble power of resistance (diabetics, infants and old people), there may be an outbreak of furuncles over the whole body, a condi-

tion known as *furunculosis* (Fig. 88). In children this process often consists in the formation of multiple, small nodular infiltrations in the skin, in which there is no central core but a small abscess. Extensive furunculosis may be fatal from exhaustion. As in every pyogenic infection, furunculosis may lead to purulent thrombo-phlebitis and general pyogenic infection. Furuncle of the lip may cause meningitis by thrombo-phlebitis of the facial vein, and general infection may be caused by thrombo-phlebitis of the veins of the neck (Fig. 108). Furuncles may lead to renal abscess and osteomyelitis (Fig. 104), especially when not properly treated.

Differential Diagnosis. Furuncles arising from sebaceous glands are so characteristic that they cannot be mistaken. Metastatic furuncles in general infection are multiple, and are associated with other pyogenic affections.

Furuncles arising from the sweat glands develop under the skin and form subcutaneous abscesses. These occur in hairy regions where there is much excretion of sweat, such as the axilla. They must not be confounded with the more deeply situated glandular abscesses. They generally affect several sweat glands and form multiple superficial abscesses, in distinction to lymphadenitis, which either assumes a diffuse phlegmonous form, or is converted into a large abscess.

Treatment. Individuals who have a tendency to furunculosis should take precautions against infection, by careful attention to hygiene; frequent baths, rubbing ointment into dry, cracked skin, etc.

Small furuncles can sometimes be aborted by frequent friction with sulphuric ether, or spraying with ethyl chloride. When painful infiltration of the skin has developed, the best method is an incision extending through the whole depth and breadth of the infil-

tration, after careful disinfection of the skin, under local anæsthesia. There is no need to wait for complete separation of the core, but the incision may be made as soon as necrosis is commencing, which is shown by rupture of the skin in the center. Early incision diminishes pain and lymphangitis and has a favorable influence on the whole process. Larger furuncles require a crucial incision. After incision the wound should be loosely plugged with iodoform gauze. The core generally separates within twenty-four hours. The core must never be forcibly expressed, as this causes irritation of the inflamed tissues, suppuration in the lymphatics, and delay in healing. Friction of the skin with ether is useful at each change of the dressings. As soon as granulations appear the plugging should be left off, and the formation of granulations promoted by ointments and the nitrate of silver crayon. In the extremities absolute immobilization with suspension is necessary till complete healing has taken place, otherwise healing is delayed or fresh infection follows. The cicatrices may be treated with iodide of potassium ointment.

Incision by the thermo cautery is not to be recommended, as the formation of eschars hinders the exit of infectious secretion. Moist fomentations are also to be avoided, as they cause greater destruction of tissue and often lead to extensive furunculosis. Dry cupping has been recommended both as an abortive method, and also for removal of the core.

Furunculosis of young children should be treated by incision of the multiple abscesses, followed by antiseptic baths. The skin must be kept clean to avoid recurrence. In adults the general health requires treatment, by purgatives, etc. Yeast preparations have also been recommended. Diabetic furuncle requires special treatment.

LYMPHANGITIS

In pyogenic affections the lymphatic vessels and glands exercise a beneficial function by harboring and destroying bacteria and their products. If the bacterial invasion is very severe, or the bacteria very virulent, the lymph is coagulated and inflammation takes place in the walls of the lymphatics, first as hyperæmia, later as small-celled infiltration of the walls of the vessels. Virulent bacteria may give rise to lymphangitis and lymphadenitis (Fig. 110) through slight abrasions of the skin, or in connection with pyogenic affections, such as whitlow, furunculosis, etc.

Lymphangitis is most clearly observed in the superficial lymphatics of the extremities, in the form of red, diffuse patches, which soon develop into irregular red cords extending from the periphery to the root of the limb. The number of cords diminishes in the upper part of the limb, and eventually only one large cord remains in the region of the lymphatic glands (inguinal or axillary). These signs are most marked in infection by virulent bacteria.

The lymphatic cords are somewhat raised above the level of the skin and feel hard. They are painful to touch and on movement. There is also itching and a feeling of tension in the whole limb. The regional lymphatic glands are at the same time swollen and painful. In some places abscesses form in the hard cords. There is generally fever and rigors.

Lymphangitis of the deep lymphatics of the extremities can be recognized by the feeling of tension and the general symptoms. Peritonitis may give rise to

pleuritis through the lymphatic vessels of the diaphragm.

The prognosis of lymphangitis is generally favorable, as it disappears after removal of the cause.

Chronic lymphangitis, caused by long-continued irritation of the skin, eczema, ulcers, etc., gives rise to hard, cord-like formations, which persist for a long time. Obliteration of the lymphatics may cause elephantiasis.

Differential Diagnosis. Similar symptoms are caused by acute purulent thrombo-phlebitis (Fig. 84), but the cords are thicker and not so numerous.

Treatment. This consists in treatment of the primary affection which causes the lymphangitis (furuncle, etc.) and in absolute immobilization of the limb, with suspension. The thickened lymphatic cords may be painted with mercury or silver ointments (unguentum cinereum, unguentum Crédé), but these should not be forcibly rubbed in. In chronic lymphangitis, baths and massage are indicated. Abscesses must be incised.

Fig. 87 shows a furuncle with lymphangitis. It was cured in eight days by incision, iodoform gauze, plugging and suspension of the arm.

Fig. 88 shows a case of furunculosis in a young child. Abscess formation is seen in the center of the furuncles. The case was cured by incisions and almond bran baths.

CARBUNCULUS (*Carbuncle*)

Plate LXX, Fig. 89.

Carbuncle, which generally occurs in middle life, differs from furunele only its greater extent, both superficially and deeply. It eonsists of an infection of several sebaccous glands, thus forming an agglomeration of furuncles. The skin gives way in several places and there are several yellow cores. Commencing as a small, red nodule, it quiekly develops into a hard infiltration, extending to the fascia, and may eventually attain the size of a hand, and cause more or less diffuse inflammatory infiltration of the neighboring parts. Lymphangitis and lymphadenitis are generally present. The affection is accompanied by severe pain, high fever and rigors.

Carbunele is gencrally caused by streptococcal infection. Eczema and other affections of the skin which cause furuncle, may also give rise to carbuncle. Moreover, furuncle may develop into carbuncle, especially when the core has been forcibly expressed, or when hot fomentations have been applied. In diabetics carbuncle is still more common than furunele, and leads to extensive necrosis of the fascia; it often eauses death from exhaustion. Carbuncle of the face is dangerous owing to its liability to cause general infection, or meningitis by infection of the facial vein. Carbuncle of the nape of the neck may attain enormous size, and extend from one ear to the other.

Differential Diagnosis. Anthrax (malignant pustule) differs from carbuncle in the presence of small vesicles filled with turbid fluid and early cen-

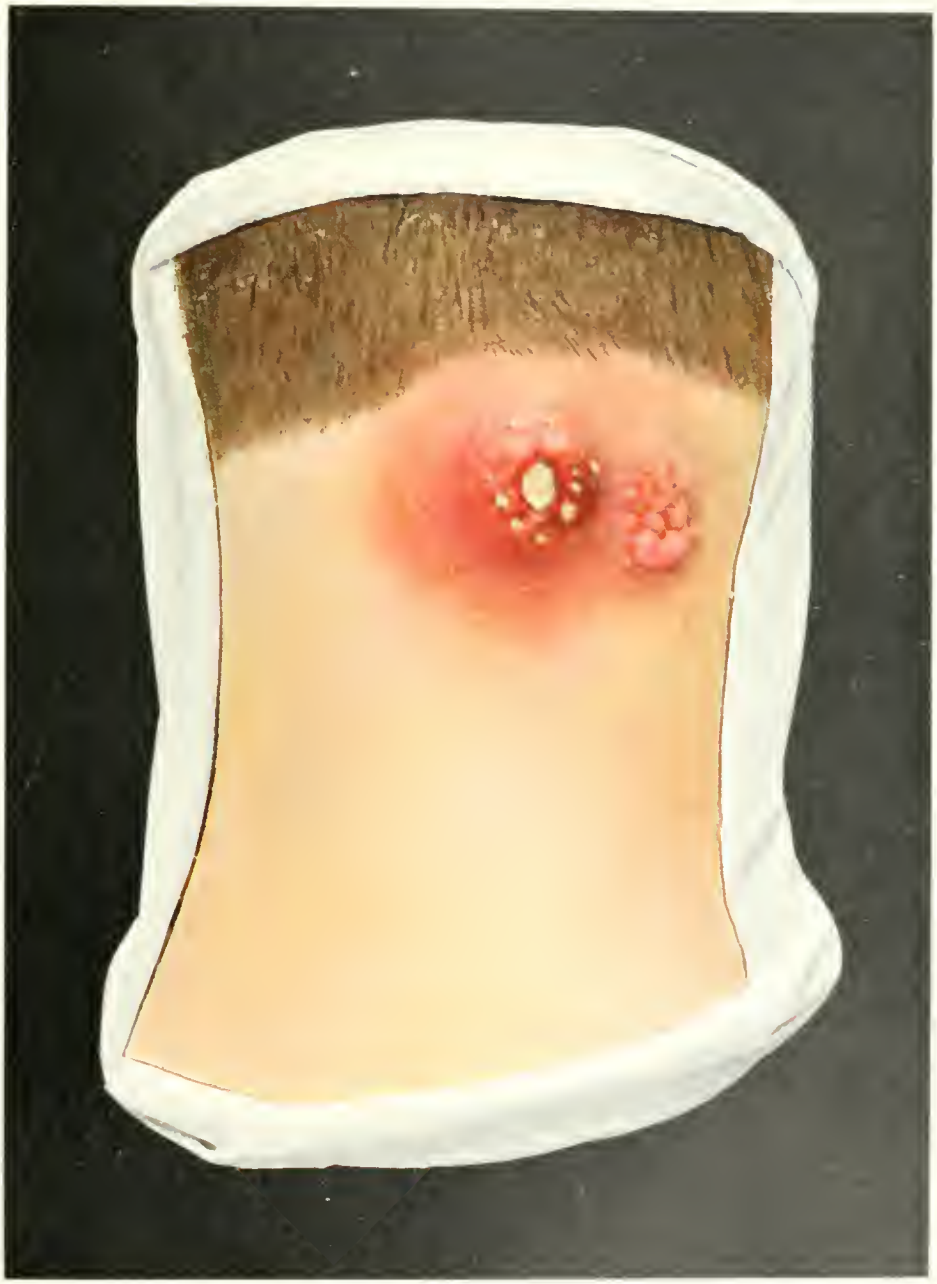

Fig. 89. Carbunculus.

Rebman Company, New-York.

tral necrosis of the skin, and in the absence of cores. In doubtful cases a bacteriological examination must be made.

Treatment. Under an anæsthetic, a crucial incision is made through the whole extent and depth of the carbuncle, and the central necrosed parts excised. The wound is plugged with iodoform gauze.

In diabetic carbuncle, progressive necrosis of the fascia often necessitates counter-incisions. Iodoform gauze should not be used in these cases, but sterile gauze. Special treatment is required for the diabetes.

In every carbuncle there is severe constitutional disturbance which requires general treatment by nourishing diet, etc.

Fig. 90 shows a carbuncle of the nape of the neck in a patient of forty. The infiltration is very extensive. In the central parts the skin is ruptured in several places, and shows the deeply situated, necrotic cores. Round this is a zone of reddish-blue skin, and beyond this zone an area of hard, red infiltration. There was high fever. The case healed under the above-mentioned treatment.

ERYSIPELAS ERYTHEMATOSUM (*Erysipelas*)

Plate LXXI, Fig. 90.

While in lymphangitis the deeper and larger lymphatics are infected, in erysipelas the smaller lymphatic spaces of the skin and subcutaneous tissue are plugged with streptococci. A similar condition may occur in the superficial layers of the mucous membranes. The causes of this bacterial infection are streptococci (*Fehleisen*), but their identity with the *streptococcus pyogenes* is not yet agreed upon.

The affected skin is red, tense, somewhat glistening and slightly raised above the level of the rest of the skin. The borders are well-defined, distinctly raised and zigzag, so that the extension of erysipelas, especially on the face, has been compared to lambent flames. When the disease spreads over the whole body, it is spoken of as migratory erysipelas.

Erysipelas may occur wherever there is a solution of continuity in the skin—after scratches and excoriations, after all injuries and operation wounds. It may also be combined with various pyogenic affections—whitlow and phlegmon (especially staphylococcal phlegmon). Conditions which give rise to constant irritation of the skin, such as lupus, tuberculous fistula, ulcer of the leg, foreign bodies, etc., may also give rise to erysipelas, which is then often relapsing. Relapsing erysipelas of the face and leg may cause elephantiasis. Lastly, erysipelas may arise in general streptococcal infection, and is then always combined with other pyogenic conditions—abscess, phlegmon, etc.

The common form of erysipelas, which consists in a red elevation of the skin, is called erythematous

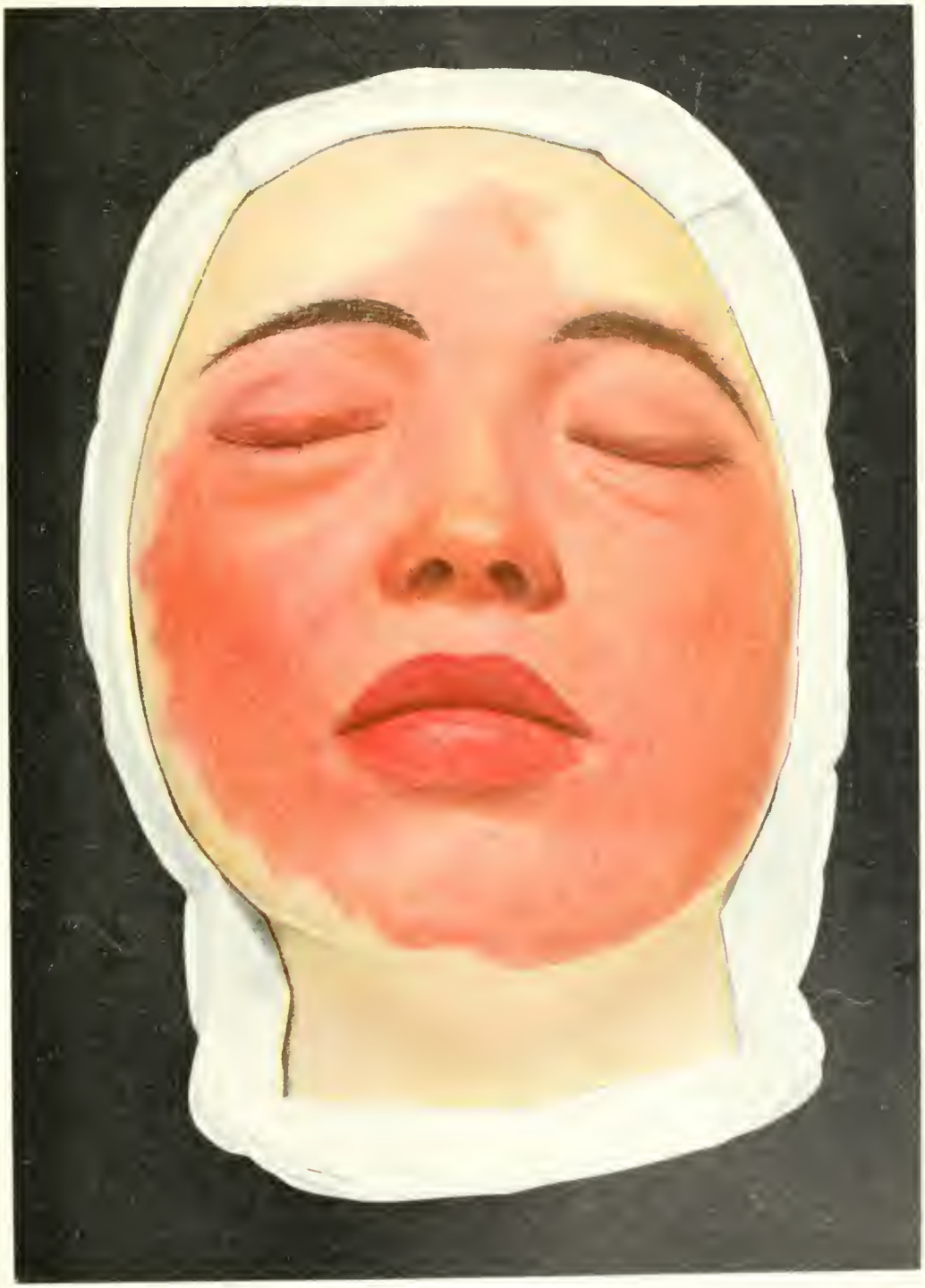

Fig. 90. Erysipelas erythematosum.

erysipelas (Fig. 90). In bulbous erysipelas the skin is covered with vesicles (Fig. 91). In hemorrhagic erysipelas there is hemorrhage in the skin (Fig. 91). In the great majority of cases there is resolution, but sometimes erysipelas may cause cutaneous abscesses, and in the form of gangrenous, phlegmonous erysipelas may give rise to ulceration and extensive destruction of the skin.

The clinical symptoms of erysipelas are characteristic. The disease usually commences by a rigor, high temperature (40°–42° C.) and redness of the skin. There is itching and tension in the skin, and tenderness on pressure. There is considerable constitutional disturbance owing to high fever, headache and vomiting which continue while the disease progresses. The temperature falls suddenly, the redness ceases to extend, and the skin, after slight desquamation resumes its normal condition in about a week from the onset of the disease. In relapsing erysipelas the whole process may take place within one or two days. Erysipelas occurs most frequently on the face, after this on the extremities and genital organs. In places where the skin is loosely attached (eyelids, scrotum), there may be considerable swelling and œdema.

Erysipelas of the mucous membranes is generally difficult to recognize, except when it is an extension from erysipelas of the skin. The mucous membrane is swollen, œdematous, sodden and of a deep-red color. Constitutional disturbance is generally severe. Erysipelas of the buccal mucous membrane may occur after tooth extraction with dirty instruments. It may cause death by meningitis or œdema of the glottis. The average mortality of erysipelas is ten per cent.

Differential Diagnosis. Erythematous erysipelas is so characteristic that it can hardly be mistaken for other affections. The advancing, irregular, raised

edge distinguishes it from other inflammatory conditions.

Treatment. The affected parts must be covered with antiseptic ointments to prevent infection and auto-infection. If pain is very severe scarifications are useful. In erysipelas of the extremities the healthy skin, at the upper limit of the lesion, may be painted with a single application of pure carbolic acid, which destroys the superficial layers of the skin. However, in spite of this procedure, the erysipelas often extends further up the limb. The induction of passive hyperæmia, by surrounding the limb with adhesive plaster, has also been recommended. Among other methods, painting with iodine may be mentioned. The patient should always be kept in bed.

Serum therapy has so far proved useless, and is likely to remain so, since repeated attacks of the disease do not confer immunity.

The formerly extolled curative action of erysipelas on tumors has proved illusory. If erysipelas extends over a malignant tumor (carcinoma or sarcoma), the tumor may diminish in size owing to destruction of its cells, but it soon begins to grow again. The same thing occurs after injection of the fluid, and this explains the temporary action of the so-called cancer serum.

On account of the infectious nature of the disease, the patient should be isolated, and the room disinfected with formalin vapor. The same disinfection must be carried out in operation theaters when an epidemic of erysipelas occurs. However, it is more often the hands of the surgeon which convey infection; hence great care must be taken in avoiding contact with the patient as much as possible, and in disinfecting the hands.

Fig. 90 shows a typical case of erythematous erysipelas of the face, which originated from a fissure on

the nose. In a few days there occurred high fever and rigors, followed by erysipelas, first on one side of the face, then on the other. The skin was tense, purple and somewhat raised. There was considerable pain and itching. The eyelids were so œdematous that the patient could hardly open them. The lips were also much swollen, and there was commencing erysipelas of the buccal cavity. The sharp zigzag borders are seen towards the scalp and the neck.

ERYSIPELAS BULLOSUM HÆMORRHAGICUM

(Hemorrhagic Bullous Erysipelas)

Plate LXXII, Fig. 91.

This case is interesting on account of the origin of the infection from a horse bite in the arm. Round the three wounds (which were only superficial abrasions) the skin is dark red and there are annular extravasations of blood. There are also several vesicles filled with turbid fluid. There is extensive diffuse reddening, especially on the forearm, and a brownish coloration due to numerous extravasations of blood from the smaller blood-vessels situated round the lymphatic vessels. In the upper arm there is macular and cord-like reddening due to lymphangitis. The axillary glands are much swollen and painful.

Wounds caused by bites from animals or men tend to become severely infected. In this case, the swelling of the forearm was so extensive that a deep phlegmon was suspected. The symptoms quickly subsided after suspension of the arm. In the place where the erysipelas was hemorrhagic and bullous, there occurred a superficial phlegmonous inflammation, which led to gangrene of the skin.

Differential Diagnosis. This has to be made from several other affections. Anthrax also commences with redness of the skin and the formation of vesicles (Fig. 112), fever and rigors, and may, in its early stage, be confounded with this form of erysipelas. But the redness is not so extensive in anthrax, nor so rapidly developed. Anthrax always causes early gangrene of the skin. In doubtful cases

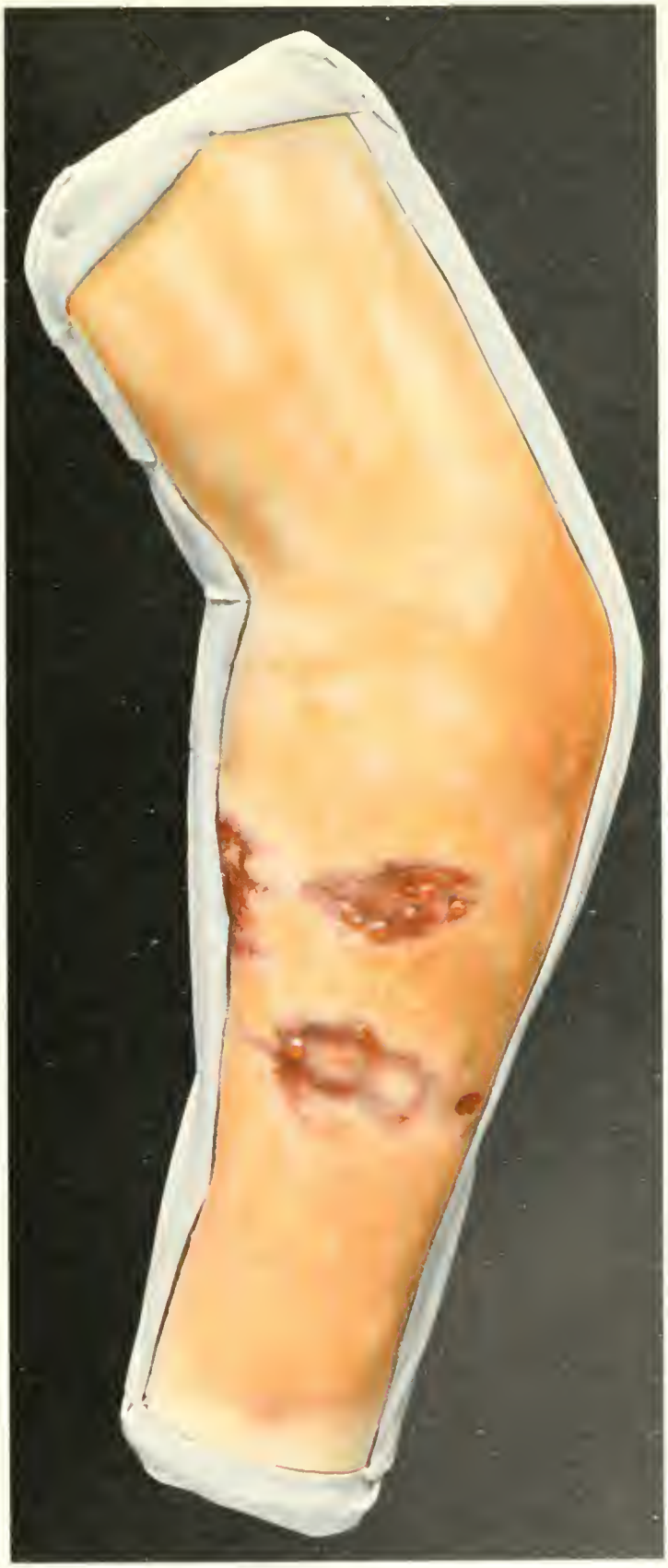

Fig. 91. Erysipelas bullosum hämorrhagicum.

anthrax bacilli must be looked for in the contents of the vesicles.

In this case, which arose from a horse bite, there was a suspicion of glanders. But, in the latter the redness is punctiform or macular; the vesicles are larger and purulent, and soon rupture, giving rise to gangrenous ulcers.

Subcutaneous phlegmons, which arise from very virulent streptococci, may cause an erysipelatous redness of the skin, but this only occurs in the region of the phlegmon, and does not extend so rapidly as erysipelas. Vesicles may also form on the skin in virulent streptococcal infection.

Phlegmons due to gas-forming bacteria (*e.g.* malignant œdema, Fig. 109) cause rapid redness and swelling of a whole limb. Increase of pressure in the tissues from the formation of gas also gives rise to the formation of vesicles, but these are very large and often raise the epidermis over the whole part affected (Fig. 109). In these severe forms of phlegmon there are signs of general infection from the beginning—rigors, delirium, diarrhea, dry tongue, and bacteria in the blood.

In all the above-mentioned cases the clinical pictures may be very similar, and the diagnosis should always be established by bacteriological examination. Correct diagnosis is all the more important to establish, as the treatment differs in the different affections. In erysipelas, anthrax and glanders conservative treatment is indicated, while streptococcal phlegmon requires early incision to prevent general infection and in gas-phlegmon very extensive incisions, or even early amputation of the limb, may be necessary to save the patient's life.

In Fig. 91 streptococci were found in the vesicles, and from this, together with the clinical symptoms the diagnosis was made of hemorrhagic bullous erysipelas; but the possibility of a deep phlegmon

due to the bite still remained. However, the mildness of the constitutional disturbance, and the rapid disappearance of the swelling showed it to be a case of erysipelas only. Recovery took place in the course of three weeks, with cicatrization of the gangrenous part.

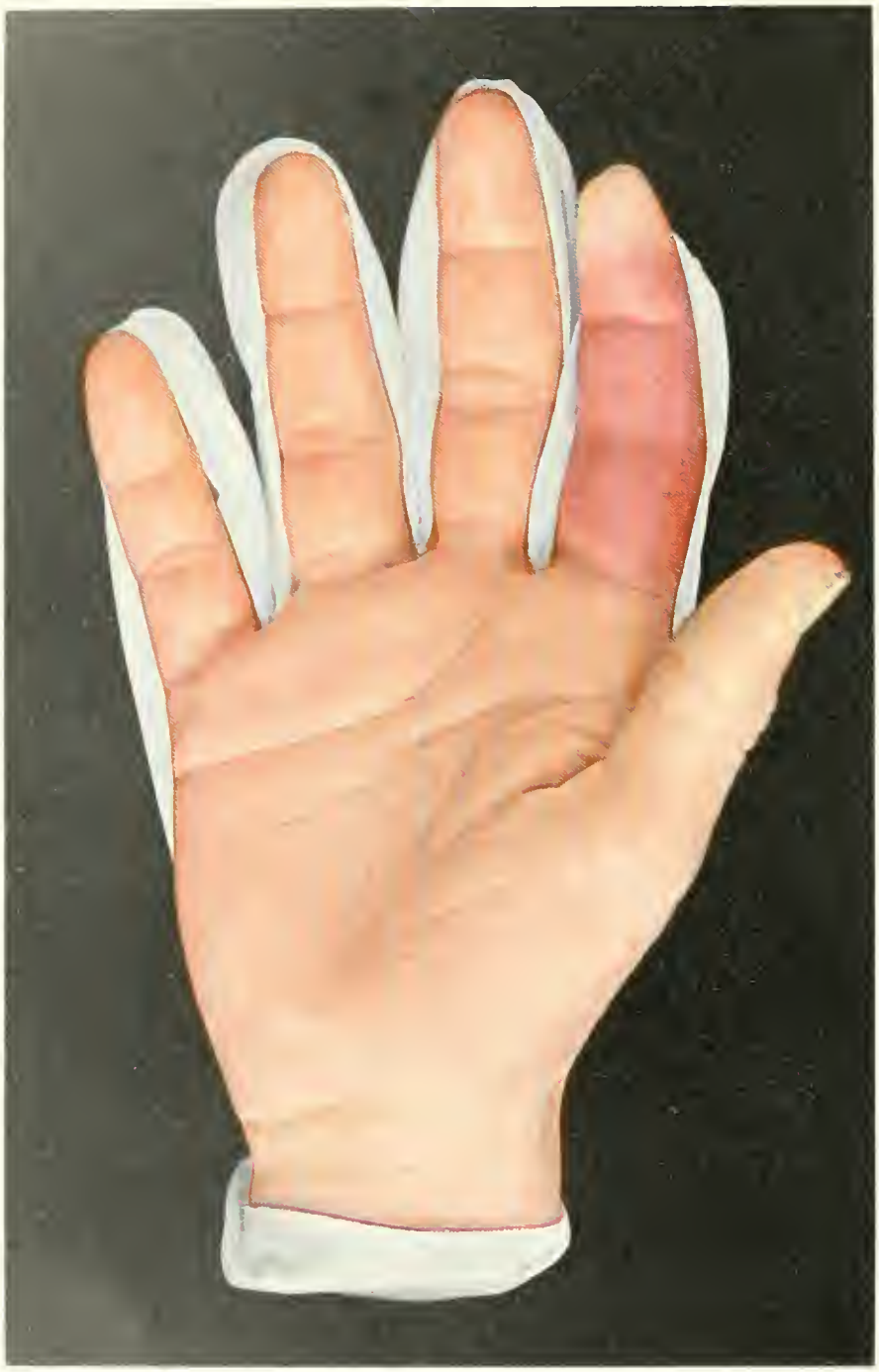

Fig. 92. Erysipeloid.

ERYSIPELOID

Plate LXXIII, Fig. 92.

An affection very similar to erysipelas, called chronic erysipelas by *Rosenbach*, is now known by the term erysipeloid. This is also a bacterial infection of the skin (according to *Tavel*, also of tendon-sheaths and joint capsules) but of a very harmless nature. The specific cause of erysipeloid is unknown; in some cases the staphylococcus albus has been found.

The affection begins with redness and swelling of the fingers. Like erysipelas, the redness has sharp, irregular borders. The redness spreads slowly but continuously over the whole finger, and may extend to the next finger and as far as the wrist. At this point the inflammation stops. There are no constitutional symptoms; no fever nor rigors. The patients only complain of itching and a feeling of tension in the skin. In some cases there is lymphangitis, generally on the extensor surface, as far as the axilla. In rare cases lymphadenitis with high temperature has been observed.

Erysipeloid generally occurs after injuries to the fingers, especially by fish and game. It is, therefore, more common in venders of fish and game, cooks, butchers, curriers, etc. Sometimes the injured spot is invisible, as the redness and swelling generally appear a few days after the injury. In other cases foreign bodies are found in the skin. The affection has been observed in doctors after operating upon infected persons. The symptoms generally subside in a week, but relapses are common. The disease is more common in the autumn.

Differential Diagnosis. Erysipeloid differs from erysipelas in its chronic course, absence of fever, paler color, and demarcation at the wrist.

Treatment. Ointments, rest and support on splints. Movements must be restricted after removal of splints, to avoid relapses. Foreign bodies must be removed. Suppuration has never been observed. Baths and iodide ointment may be used if swelling persists.

Fig. 92 shows erysipeloid in a cook, which appeared soon after handling game. A few days after a slight wound, redness and swelling developed at the tip of the right forefinger, and gradually extended over the whole finger. At the base of the finger the edge of the redness is irregular and zigzag.

Panaritium or Panaris

(*Whitlow*)

PANARITIUM SUBEPIDERMOIDALE (*Sub-epidermic whitlow*)
Plate LXXIV, Fig. 93.

PANARITIUM SUBCUTANEUM (*Subcutaneous whitlow*)
Plate LXXV, Fig. 94.

PANARITIUM OSSALE ET ARTICULARE
(*Osseous and articular whitlow*)
Plate LXXVI, Fig. 95.

PANARITIUM TENDINOSUM (*Tendon-sheath whitlow*)
Plate LXXVII, Fig. 96.

PANARITIUM INTERDIGITALIS (*Interdigital whitlow*)
Plate LXXVII, Fig. 97.

Subcutaneous suppuration in the fingers and toes is called *whitlow*. Although various forms of whitlow are distinguished, this usually begins as an infection of the subcutaneous tissue (primary subcutaneous whitlow), from which may arise tendinous, periosteal, osteal or articular whitlow, according to the extent of the inflammatory process.

Subcutaneous whitlows occur most often in the fingers, especially among the working classes who are subject to cracks and fissures of the skin. They often occur after punctured wounds, through which staphylococci, or more rarely streptococci, gain entrance to the subcutaneous tissue.

The anatomical formation of the subcutaneous tissue is peculiar, vertical connective-tissue septa separating the fatty connective tissue into a number of distinct compartments. If bacteria gain an entry into such enclosed chambers the inflammation they cause is at first circumscribed.

As in all infections, there is hyperæmia, exudation and necrosis of tissue; the latter occurs rapidly, owing

to the impairment of nutrition from pressure in the inflamed area. In this way a necrotic core is formed, as in furuncle. The increase of tension in the tissues causes severe pain, and the finger becomes red and swollen. In horny-handed workmen the seat of infection is at first difficult to see, and is only made evident by the great pain on pressure. Later on, when the suppuration has extended further, the pain is not so circumscribed. In a few cases only, the skin gives way and a yellow core becomes loosened and cast off, after which healing takes place by granulation tissue. The hard skin on the palmar surface of the fingers prevents escape of pus, so that the latter takes paths of less resistance. The vertical connective tissue septa, mentioned above, direct the pus towards the peritendinous tissue, where it may spread along the whole length of the tendon. The pus may also reach the loose connective tissue on the dorsal surface, and give rise to redness, swelling and œdema, while inflammatory signs may be absent at the seat of infection on the flexor surface. If the tendon sheath is bathed in pus for some time it becomes perforated, and the pus extends within the tendon sheath (tendinous whitlow, Fig. 96). In the same way the periosteum, bony cortex, medullary cavity and joint may become infected from a subcutaneous whitlow (Fig. 95).

A further danger of whitlow is spreading of pus to the hand and forearm along the tendon sheaths. General infection may also occur.

The clinical symptoms vary according to the duration and extent of infection, and the virulence of the bacteria. In sub-epidermic whitlow (Fig. 93), a purulent vesicle develops, generally on the dorsal surface, with slight redness of the surrounding skin. The raised epidermis sometimes shows several yellow spots, where the pus breaks through. Pain and functional disturbance are slight, the inflammation remaining local. There is seldom lymphangitis, no

tendeney to spread, and little or no constitutional disturbance.

In subcutaneous whitlow it is quite otherwise (Fig. 94). The whole finger is red, swollen, flexed and extremely painful, especially at one spot. Redness, swelling and œdema are often more marked on the dorsal surface, together with lymphangitis of the hand and forearm. There is moderate fever (39° C.) and some constitutional disturbance.

The symptoms are most severe in tendinous whitlow (Fig. 96). There is more swelling of the finger, and the latter is more flexed. There is pain on pressure along the whole tendon sheath, and usually over the whole palm. Movement of the tendon causes great pain, and extension is almost impossible. Lymphangitis and erysipelatous reddening often extend far beyond the seat of infection. There are rigors and rise of temperature (40° C.), sleeplessness, and considerable *malaise.*

If the tendon sheath of the thumb or little finger is infected, the pus may extend along the course of these sheaths as far as the wrist; whereas, suppuration in the tendon sheaths of the second, third and fourth fingers does not extend beyond the metacarpophalangeal joints, where these tendon-sheaths end.

In the wrist the tendon-sheaths become widened and lie so close together that suppuration may extend from one to the other. In this way, infection of the tendon-sheaths of the thumb may result from a lesion of the tendon of the little finger; and inversely, infection of the little finger from the thumb. This has been called V-shaped whitlow. It is obvious that infection of both tendon-sheaths causes severe symptoms—high fever and much constitutional disturbance. The thumb and little finger are flexed, swollen and very painful on pressure. The pus often breaks through the tendon-sheaths and extends between the muscles of the forearm up to the elbow joint, in the form of deep, progressive suppuration.

In other cases the wrist-joint is infected. Such cases may give rise to general infection.

The V-shaped whitlow is recognized by its severe clinical symptoms and typical appearance. In the early stages there is often pain, redness and swelling in the palm, or on the flexor surface of the wrist. When suppuration has existed some time and become extensive it seeks a way to the surface. In this way fistulas are formed in the course of the tendon-sheaths, discharging much pus, and often exposing the greenish-yellow remains of the necrosed tendon (Fig. 96). The orifices of these fistulas are surrounded by flabby, unhealthy granulations which, as mentioned before (Fig. 56), indicate necrosis in the deeper parts.

In periosteal and osteal whitlows, which generally occur at the ends of the fingers, the periosteum and bone are surrounded by pus and destroyed. In the terminal phalanx total necrosis may occur. A fistula forms and discharges the fetid, slimy pus, which is characteristic of necrosed bone. Eventually dead bone is discharged. (Fig. 95). Parts of the skin may become necrosed, so that, eventually, the whole finger-joint may be lost. Commencing with sharp pain, the acute stage gradually becomes more chronic, and in this stage infection of the bones may be overlooked.

In the first and second phalanges there is often infection of the joints, either secondary to infection of the periosteum, or directly from the surface. Articular whitlow generally manifests itself by rigors. The joint is fixed in a position of flexion and is very painful on movement. The capsule and ligaments are soon destroyed, and destruction of the cartilage causes grating on movement. Articular whitlow may give rise to general infection.

It is not always easy to diagnose the stage of the whitlow. Patients of the working class generally come so late for treatment that there is often infection

of the tendon-sheath, periosteum and joint. In other cases the pain is so severe as to suggest tendinous whitlow, while it is only subcutaneous. A correct diagnosis can often only be made after incision.

Differential Diagnosis. Tuberculous and syphilitic inflammations are more chronic and cause less pain and fever. They do not heal after incision, but require specific treatment.

Treatment. All whitlows require early incision. In sub-epidermic whitlow the purulent bulla must be opened and dressed with antiseptic dressings, and the arm suspended in a sling. Sub-epidermic whitlow may cause infection of the deeper tissues, and there is also the danger of erysipelas. Hence, plenty of dressing should be used.

Subcutaneous whitlows should be incised as soon as possible, under an anæsthetic. *Schleich's* infiltration anæsthesia is dangerous and painful in infected areas. However, endoneural injection of one per cent. cocaine may be made in the first phalanx, according to the method of *Oberst-Corning*, if there is no sign of inflammation at this place. But general anæsthesia should be employed in all cases where the extent of the suppuration is not clear. Incision should be made into the subcutaneous tissue on the palmar surface away from the middle line, and between the joints. The wound is then held open by retractors and examination made for pus in the tendon-sheath or under the periosteum. This examination can only be made by a free incision, after the hand is made bloodless by the elastic tourniquet.

This is the safest method of dealing with whitlows; for although some cases may be cured by evacuation of the pus through a small incision, suppuration in the tendon-sheath may be overlooked, and this may lead to spread of suppuration, destruction of tendon, etc., and even death from general infection.

No doubt, infected wounds of the finger often subside with rest in a sling; but sometimes the periosteum is infected, and this conservative treatment then results in necrosis of the phalanx. Therefore, we must urge the treatment of all such infected wounds by early incision, especially in doctors who are liable to virulent infections.

Tendon-sheath whitlows require very careful treatment, in order to preserve the tendon and the function of the finger. Some cases come too late for treatment for the tendon to be preserved. Many cases of tendon-sheath whitlow extend so rapidly, and so often lead to general infection, that they require free incision of the whole area of suppuration. In some cases, no doubt, this may cause injury to or loss of the tendon; but it is far worse to be responsible for a general infection which might have been avoided by more extensive incision. Therefore, in extensive tendon-sheath whitlows, especially in V-shaped whitlows, free incisions are necessary, but these should always be made laterally. In V-shaped whitlows care must be taken to preserve the palmar carpal ligament; this must only be divided when there is threatening infection of the wrist joint, or extension of suppuration up the forearm.

Better functional results are obtained by several smaller incisions instead of one continuous incision. Too much plugging of the wound is to be avoided, as it interferes with the nutrition of the tendon. After-treatment consists in early passive movements.

In osteal whitlow necrosed bone must be removed if present. In the terminal phalanx it is often sufficient to remove the peripheral end. If the joint is much destroyed resection of the bone, or even amputation may be required.

Progressive suppurations, due to infection by virulent bacteria or to extensive injuries, must be freely laid open, sometimes as far as the bone. If general infection supervenes the question of amputation arises.

Although early incision removes the danger of the pyogenic condition spreading by subcutaneous suppuration, this danger may recur if the after-treatment is neglected.

The incisions should be lightly plugged with iodoform gauze, which best absorbs the discharge. After the first dressing this should be replaced by small pieces of sterilized gauze, sufficient to keep the edges of the wound open and allow the pus to escape. The hand and forearm should be immobilized on a splint. Under this treatment even deep cavities begin to granulate in a few days, when the plugging should be left off and replaced by baths and ointment.

To decide the time when plugging may be left off is a matter of experience. If it is kept on too long the nutrition of the tendon (in the case of tendinous whitlow) is impaired. If it is left off too soon, suppuration may extend into the deeper parts; this is manifested by further redness, swelling and pain, and by a fetid, slimy discharge from the wound and the formation of flabby, unhealthy granulations. Increase of pain is often a sufficient sign of fresh infection. If the extension of infection is not immediately noticed it may cause severe complications and general infection, even during the period of after-treatment. This reinfection may be avoided by several measures. First of all, patients with severe forms of whitlow should be treated in hospital, where they can be kept under observation and treated under more favorable conditions.

The temperature, in severe cases of whitlow, should be taken every four hours. The dressings should be changed every day, if necessary under an anæsthetic, so that the local condition can be examined. The gauze tampons should be carefully removed during irrigation with peroxide lotion. The wound should then be irrigated with normal saline solution under very slight pressure, and the dressing renewed. It is often necessary to hold the edges of the wound apart

by retractors, so as to obtain a better view of the condition of the wound, and drain all suspicious pockets. Drains should be only retained after the first change of dressing in extensive whitlows. When the dressings are changed examination must be made for inflammation and suppuration in parts remote from the wound—in the palm in tendinous whitlow, and in the wrist and elbow joints in V-shaped whitlow. Even in the slighter forms of whitlow the dressings should be changed every day, especially in out-patients (polyclinic). This avoids stiffening of the fingers by prolonged immobilization, also the troublesome condition called "glossy skin."

After-treatment is begun when the suppuration has ceased and the temperature has become normal. This consists in performing passive movements of the fingers each time the dressings are changed. In out-patient practice (polyclinic), large immobilizing dressings should be applied after these passive movements have been performed. This is especially necessary in alcoholic patients, in whom the inflammation is much aggravated. Moreover, small dressings may be removed by the patient himself. The application of large immobilizing dressings has a favorable influence on the inflammation, and renders the after-treatment easier and shorter, while the disadvantage of immobilization is removed by daily passive movements when the dressings are changed.

In the treatment of whitlows it is best to pursue a middle course. On the one hand, too large incisions, too much plugging and too long immobilization cause impairment of function; on the other hand, small incisions, too little plugging and too free movement may lead to general infection. Radical treatment is best for the beginner, although more conservative methods may be adopted with further experience.

After-treatment must be commenced directly suppuration has ceased (massage, baths and passive movement).

Cicatricial contractions sometimes yield to gradual extension; but some cases may require excision of the scar, followed by a plastic operation.

As already mentioned *Bier's* passive hyperæmia treatment is contra-indicated in acute pyogenic affections; in mild cases it is unnecessary, and in severe cases it is dangerous.

Other methods, such as injection of carbolic acid lotion, staphylococcal serum, carbolic and alcoholic fomentations generally do harm.

PANARITIUM SUBEPIDERMOIDALE (*Subepidermis Whitlow*)
Plate LXXIV, Fig. 93.

In this case a circumscribed redness developed on the dorsal surface of the left forefinger, without any obvious injury. This was followed by the formation of a purulent blister. The epidermis is raised and shows several yellow points due to the presence of pus. The movement of the finger was not impaired. The blister was opened, the pus evacuated and the thin epidermis removed. The wound was dressed with sterilized gauze, and the finger put up on a splint extending above the wrist.

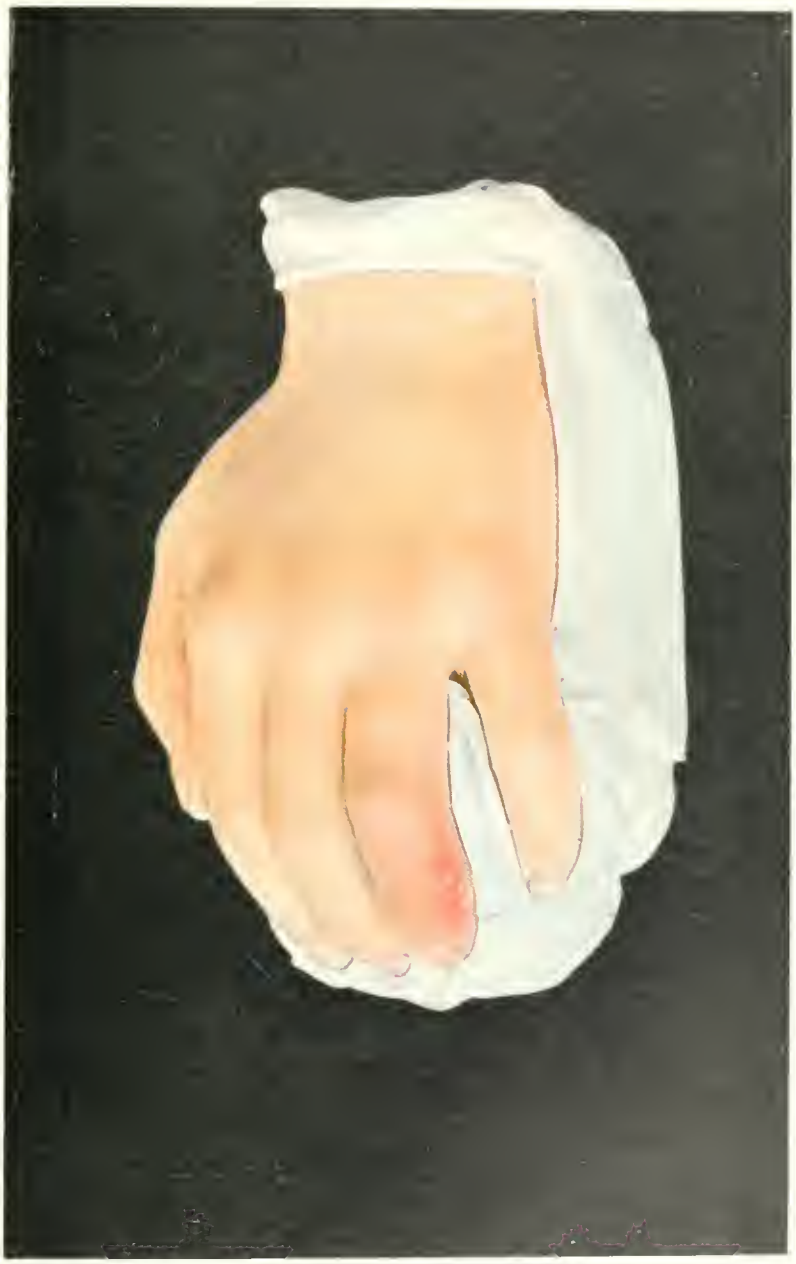

Fig. 93. Panaritium subepidermoidale.

Fig. 94. Panaritium subcutaneum Lymphangitis acuta.

PANARITIUM SUBCUTANEUM (*Subcutaneous Whitlow*)
Plate LXXV, Fig. 94.

This figure shows a subcutaneous whitlow, which is the most common form of pyogenic infection of the fingers; according to *von Bergmann*, it is the first stage in all the other forms of whitlow.

A few days after a slight abrasion of the skin, redness and swelling developed on the dorsal surface of the thumb (the volar surface is most commonly affected). This extended to the volar side, where the color was paler and more bluish. There was also inflammatory reddening on the back of the hand. As there was only slight pain the patient continued to use the arm. After this fever and rigors occurred, with acute lymphangitis extending over the back of the hand and forearm, and lymphadenitis of the axillary glands, so that the patient could no longer use the finger. At the seat of infection the skin gradually became thin and yellow, showing that the pus was about to discharge through the skin. (In subcutaneous whitlow of the volar side this is prevented by the thickness of the skin). The appearance of the lesion at this time resembled a furuncle. Above this there were several purulent vesicles surrounding a circumscribed gangrene of the epidermis caused by œdema. Fluctuation is seldom present in whitlow.

An incision about half an inch long was made on the volar side away from the tendon. The wound was plugged with iodoform gauze. The lymphangitis was treated with ointment, and the whole arm put on a splint. Function of the finger was restored in ten days.

PANARITIUM OSSALE ET ARTICULARE

(*Osteal and Articular Whitlow*)

Plate LXXVI, Fig. 95.

In this case a punctured wound of the tip of the finger was followed by pain, redness, swelling and some fever. It was treated with poultices. The skin gave way at one place, forming a fistula which discharged fetid pus. Part of the necrosed phalanx protruded. The skin above the fistula became gangrenous, and unhealthy granulations formed round the fistula. Owing to absence of operative treatment, the suppuration extended to the joint and destroyed ligaments, capsule and cartilage, so that the function of the joint was destroyed. After further treatment with fomentations, the whole finger became swollen and the skin assumed a pale, glistening appearance (glossy skin), indicating necrosis of the whole basal phalanx.

Under an anæsthetic an incision was made, and the first and second phalanges were found to be so much destroyed that they were removed.

As already mentioned, punctured wounds of the terminal phalanx, beyond the insertion of the tendon, often lead to infection of the periosteum. Commencing in acute inflammation with pain and swelling, they often assume a more chronic condition. If an incision is not made in the acute stage there may be extensive destruction, even of the whole finger; especially after treatment with poultices. In the above case an early incision would have saved the finger and restored normal function.

"Glossy skin" (*Paget*) is a condition which affects chiefly the phalanges of the fingers, after badly cov-

Fig. 95. Panaritium ossale et articulare.

ered amputation stumps, or after too-long immobilization. This condition may extend over the whole finger. The skin is at first thickened, bluish red, and cold to the touch; later on it becomes pale yellow and has an appearance like parchment. The circulation is bad and there are often neuralgic pains and a feeling of coldness. It may finally lead to traumatic neurasthenia. This condition can be prevented by avoiding too long immobilization and by providing the amputation stumps with sufficient well-nourished flaps.

PANARITIUM TENDINOSUM (*Tendinous Whitlow*)
Plate LXXVII, Fig. 96.

This is a case of subcutaneous whitlow, following a punctured wound, which rapidly spread to the tendon-sheath of the thumb. A severe form of infection was indicated by the acute redness and swelling, severe pain, high temperature and constitutional disturbance. As no incision was made, the terminal phalanx continued to swell and finally gave way, forming a fistula discharging pus and parts of necrosed tendon. Apart from this, the diagnosis of tendinous whitlow could be made from the severity of the symptoms; from the complete loss of movement in the thumb, the great pain on pressure over the course of the tendon, the swelling and redness of the ball of the thumb, and the discharge of pus from the fistula on pressure over this part. The tendon sheath of the little finger was unaffected, and there was no sign of abscess above the wrist.

Under an anæsthetic an incision was made along the whole of the terminal phalanx and pus evacuated from the tendon-sheath. A second incision was made in the palm, a little below the wrist, and the tendon-sheath opened again at this point. By this means the suppuration ceased and infection of the tendon-sheath of the little finger was avoided. As the tendon of the thumb was already partly destroyed, the end joint remained functionless. In spite of a certain degree of contracture, the patient could use the thumb, by movement at the metacarpo-phalangeal joint.

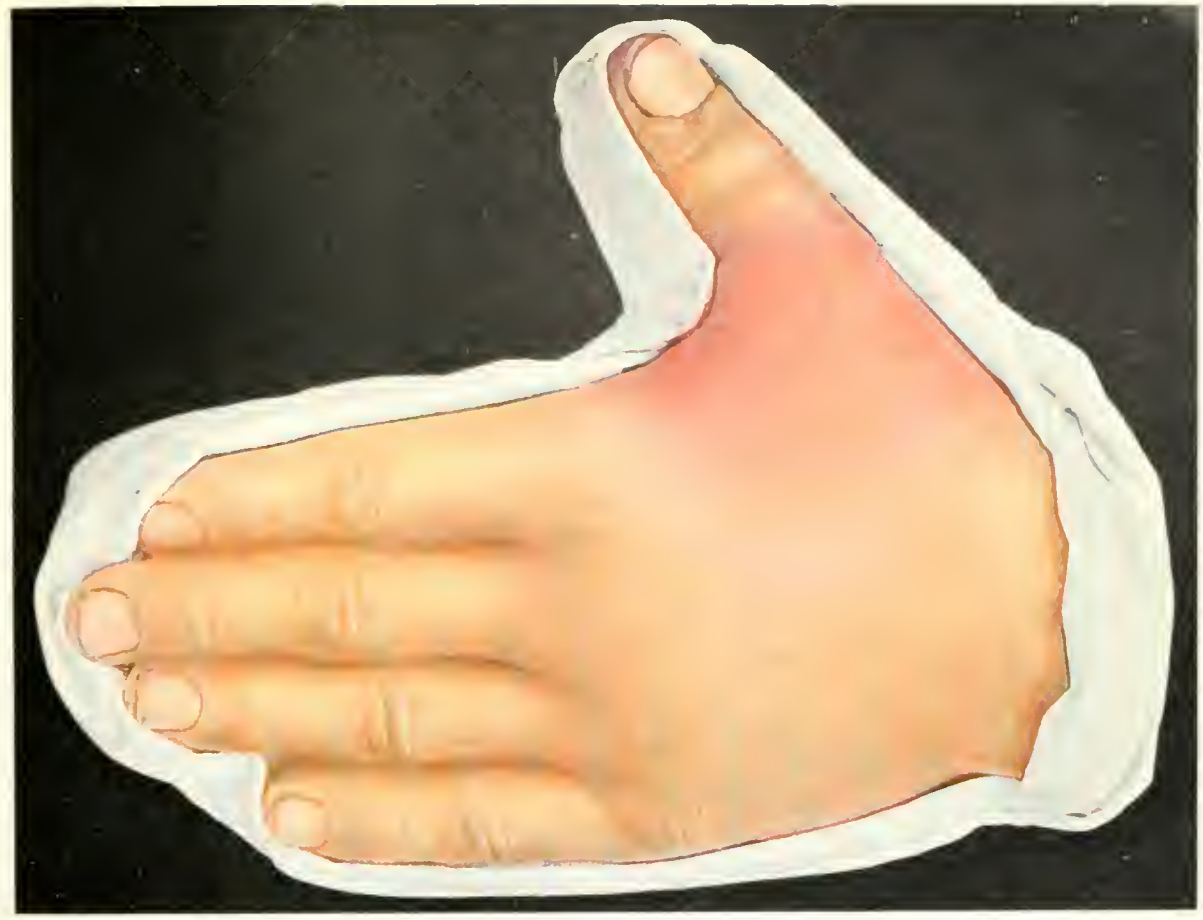

Fig. 97. Phlegmone interdigitalis.

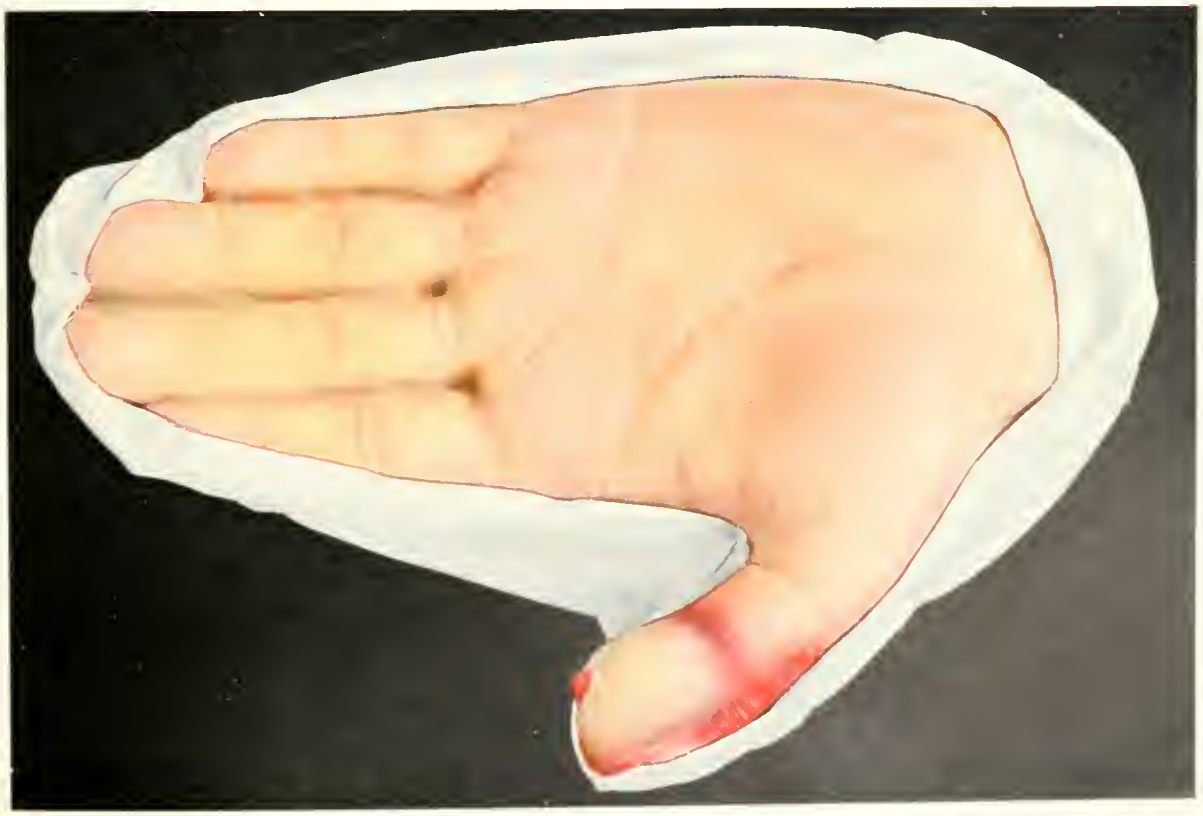

Fig. 96. Panaritium tendinosum – Phlegmone subcutanea.

PHLEGMONE INTERDIGITALIS (*Interdigital Whitlow*)
Plate LXXVII, Fig. 97.

This term is applied to subcutaneous suppuration between the metacarpal bones. In Fig. 97 this occurred between the metacarpal bones of the thumb and index finger. Redness and œdema appeared on the dorsal surface and movement of the fingers was painful. In these cases there is usually some fever, but no lymphangitis or constitutional disturbance. As the amount of pus is usually considerable, there is fluctuation. The pus was evacuated by a dorsal incision (incision on the palmar side is to be avoided); the wound was plugged for a short time and the arm suspended in a sling. Complete function was restored.

Early incision prevents spreading of suppuration to the palm. Interdigital whitlow in the palm is distinguished from tendon-sheath whitlow by there being less pain on movement of the fingers, and less tenderness on pressure over the tendons.

PARONYCHIA (*Peri-ungual Whitlow*)

Plate LXXVIII, Fig. 98.

Inflammation of the tissues under the nail is called *sub-ungual whitlow*. Owing to pressure of the nail, the virulence of the infecting bacteria is increased, so that the inflammation extends rapidly and soon leads to necrosis of the tissues. Sub-ungual whitlow causes severe pain and lymphangitis. It is often overlooked, as the changes under the nail are not at first visible, and the first sign is usually a yellow coloring seen under the nail. The diagnosis is suggested by the severe pain on pressure on the nail. As the pus cannot break through the nail, it extends deeply and may cause necrosis of the terminal phalanx by infection of the periosteum. Clavi and exostoses may also develop under the nail and cause inflammation with severe pain. Under local anæsthesia the nail may be pared down with a knife, so that the inflammatory area can be incised. If suppuration is extensive the nail must be removed.

When the inflammation is not under the nail but around the nail bed, the condition is called *peri-ungual whitlow* or *paronychia*. This may be caused by punctured wounds, tearing of the nail, foreign bodies, or by manicure with dirty instruments. The bed of the nail is red, infiltrated and painful on pressure. There is often suppuration round the nail, which is raised from its bed and may become quite loose. In severe cases there is much pain, fever and lymphangitis.

Differential Diagnosis. Syphilitic chancre of the finger often resembles paronychia. It begins with

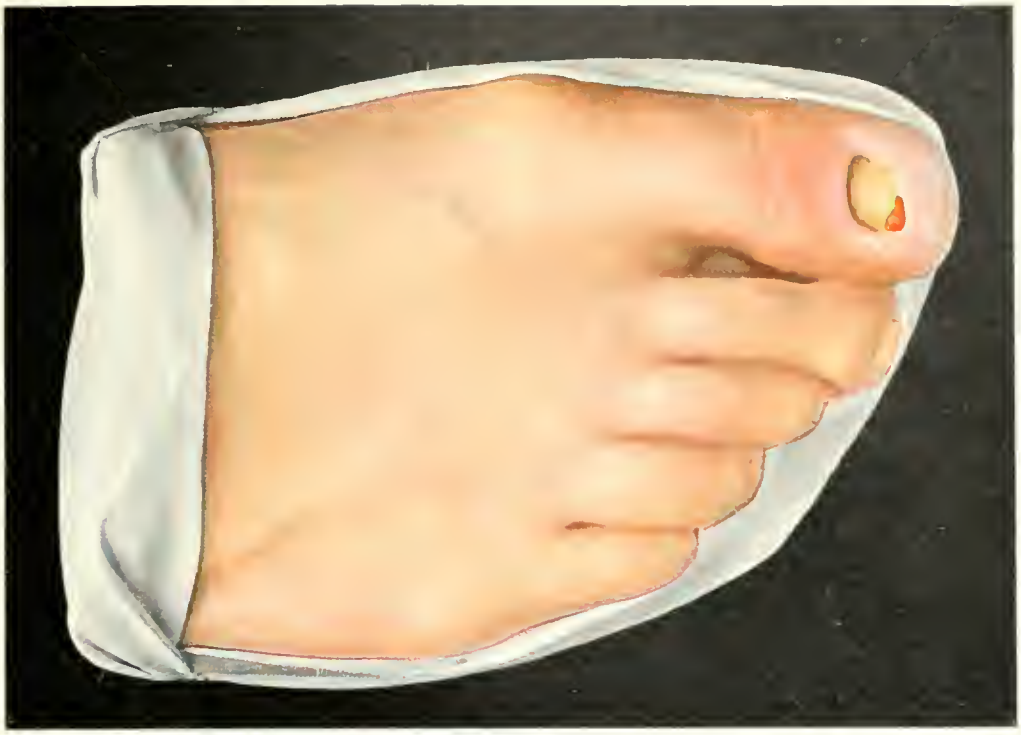

Fig. 09. Unguis incarnatus.

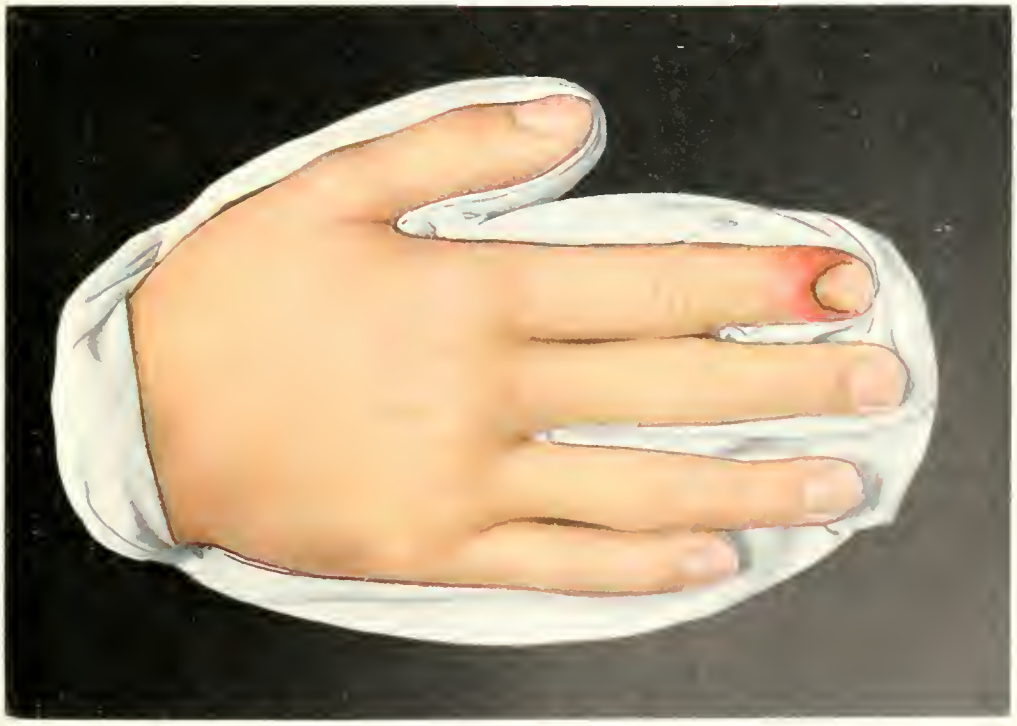

Fig. 08. Paronychia.

redness and hard infiltration which develops into an unhealthy ulcer with flabby granulations. This is followed by painful infiltration of the lymphatic vessels and glands. This form of chancre is very chronic and painful (thus differing from most other chancres). Syphilitic chancre should be borne in mind in every case of chronic paronychia which is refractory to treatment. It is especially common in medical men and midwives.

Tuberculous infection of the nail bed may also occur among doctors and nurses. This begins in a dark-red infiltration of the skin. Nodules then develop and break down into an ulcer with flat, irregular borders. The tuberculous granulations are grayish red and bleed easily. This affection is very chronic. The nail may be lost and replaced by thickened tissue in both tuberculous and syphilitic paronychia. In some cases the whole finger may be destroyed. The diagnosis of tuberculous paronychia can sometimes only be settled by microscopic examination, or by inoculation of the guinea pig. The diagnosis of syphilitic chancre is confirmed by finding the *spirochaeta pallida* in scrapings.

Treatment. In peri-ungual whitlow or paronychia an early incision should be made, before the pus has loosened the nail. It is best to make a horseshoe incision through the soft parts some distance from the nail, to avoid interfering with its nutrition. The hand should be immobilized for a few days. If the nail is extensively separated it must be removed.

Tuberculous paronychia requires treatment by the sharp spoon or *Paquelin's* cautery. Syphilitic chancre must be treated by mercury.

Fig. 98 shows acute inflammatory infiltration round the nail. The skin is bluish red and tender to the touch. Under local anæsthesia a horseshoe incision was made through the infiltrated tissue. Healing took place with preservation of the nail.

UNGUIS INCARNATUS (*Ingrowing toenail*)

Plate LXXVIII, Fig. 99.

Ingrowing toenail affects almost exclusively the nail of the great toe; generally the outer side, less often the inner side, occasionally both sides. It gives rise to severe inflammation of the soft parts next the border of the nail; first redness and swelling, afterwards ulceration and granulation tissue. The inflammation is usually limited to a small area, but may sometimes spread over the whole nail-bed. The affection causes considerable pain and often prevents the patient from walking. There may be lymphangitis. If both sides of the nail are affected the symptoms are naturally more severe. Ingrowing toenail often occurs in connection with hallux valgus (Fig. 64); it may also be caused by anomalies of the nails or toes, by wearing too short boots, or by cutting the nails too much at the sides.

Differential Diagnosis. Subungual clavus or exostosis may cause inflammation round the nail, but in these cases the nail is always raised in front and is very tender to pressure. Syphilitic chancre has also been known to occur on the great toe, after sucking the toe (*Bockenheimer*).

Treatment. Ingrowing toenail may be avoided by prophylactic treatment. The toenails should be cut straight and not too short, so that the free border extends beyond the soft parts, especially at the sides. Attention should be paid to cleanliness and to the wearing of properly made boots. In slight cases the edge of the nail may be raised from the inflamed soft

parts by an iodoform tampon, or partial excision of the nail may be performed. In severe cases these methods are useless. Excision of the nail, which was formerly practiced, is useless, as the condition recurs after. The most rational method consists in excision of the whole lateral border of the nail together with the inflamed soft parts, down to the bone; taking care to include the posterior part of the matrix, so that recurrence cannot take place. The wound is dressed with iodoform powder and sterilized gauze and immobilized for a week, after which the wound is usually healed. In ingrowing toenail affecting both sides the same operation is performed on each side, leaving the center part of the nail in place.

Fig. 99 shows an ingrowing toenail on the outer side of the right great toe. The thickened soft parts have grown over the border of the nail. There is a purulent discharge from unhealthy granulations. The nail is so imbedded in the swollen soft parts that it is only partly visible. The above operation was performed with good result.

CLAVUS INFLAMMATORIUS (*Inflammatory Clavus*) (*Corn*)
Plate LXXIX, Fig. 100.

The figure shows an inflammatory condition affecting the whole of the second toe and extending to the dorsum of the foot. The skin on the dorsal surface of the toe was at first raised by purulent vesicles. After these had broken, the necrosed epidermis came away, exposing a considerable extent of the corium. The redness and swelling are most marked over the first interphalangeal joint, which was very painful on movement. On the dorsal side of the joint fluctuation was present. The remains of a clavus (corn) are seen on the great toe, in the form of a yellowish-white projection, together with a fistula leading to the deeper parts. The clavus on the second toe was due to its being exposed to pressure from its crooked position.

Clavi, or corns, are circumscribed growths which arise from the horny layer of the epidermis. They generally occur on the great and little toes; sometimes between the toes, especially when these are crooked owing to bad boots. They also occur in connection with hallux valgus, hammer-toe, club-foot, etc. The more they project above the level of the skin the more painful they are to pressure. They differ from the diffuse, horny thickenings which occur on the hands, and consist in a circumscribed horny formation which develops from a soft conical core situated in the depth of the cutis. When the horny layer is removed the soft yellowish-white core is seen in the center. Lacerations caused by unskillful cutting of corns may easily give rise to subcutaneous abscess. Underneath large clavi there is usually

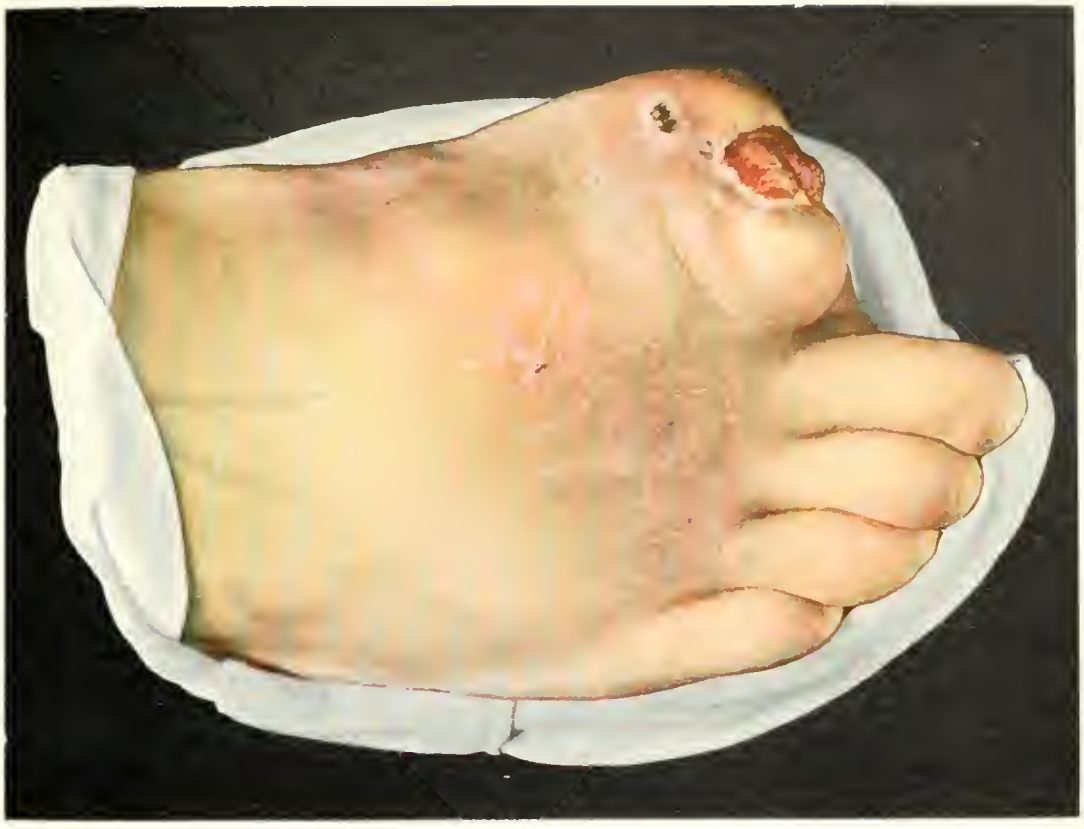

Fig. 101. Phlegmone progrediens putrida.

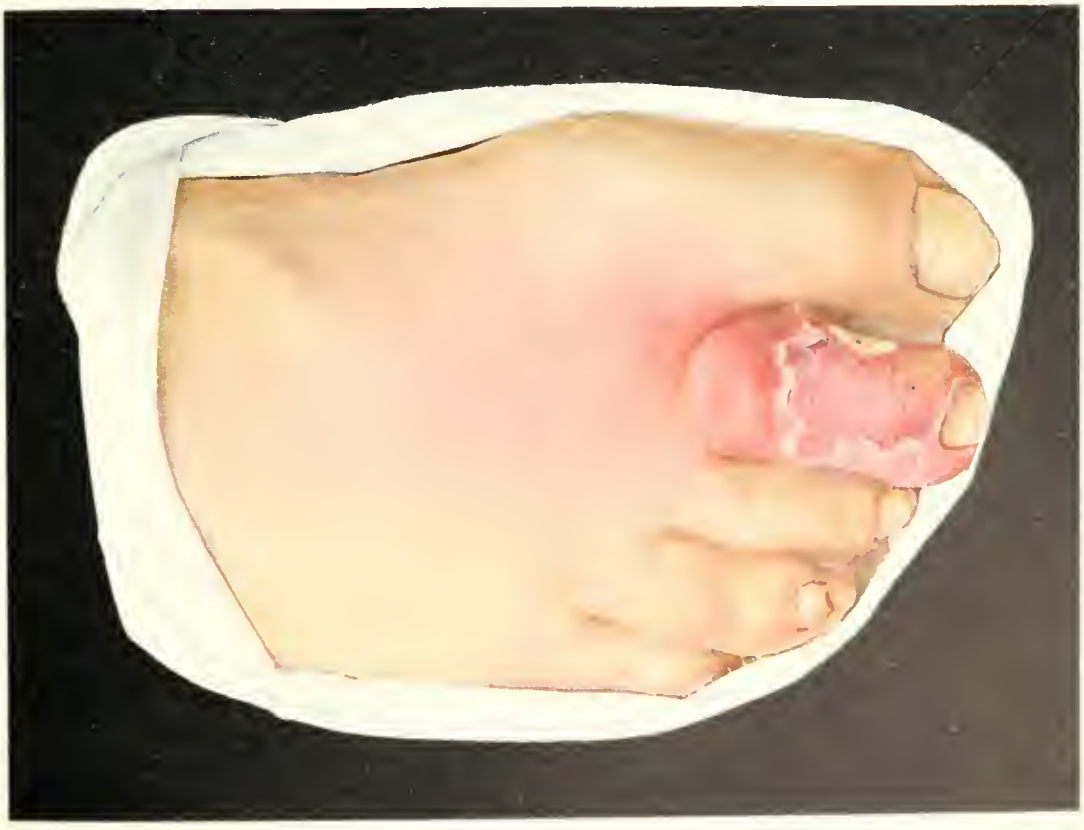

Fig. 100. Clavus inflammatorius — Arthritis purulenta.

developed a bursa, which is liable to become inflamed from external pressure. The inflammatory exudation from the bursa generally discharges by a fistula near the clavus (Fig. 100). Septic infection of the bursa may be caused through the fistula, and this may extend to the neighboring tendon-sheath or joint. Joint infection is especially frequent when the bursa communicates with the joint; and is manifested by severe local inflammation, fever, rigors and constitutional disturbance. The purulent arthritis may even give rise to general infection.

Treatment. Prophylactic treatment of clavus consists in cleanliness and the wearing of proper boots. If a clavus forms it should be removed with a sterilized knife. It is not sufficient to remove the horny layer; the deeply situated core must also be removed, otherwise recurrence takes place. Other methods, such as the application of salicylic collodion, only loosen the horny layer and do not prevent recurrence.

If a bursa forms under the clavus it must either be incised and plugged, or excised. If suppuration extends to the joint this must be opened; in some cases resection or disarticulation may be necessary.

In Fig. 100 there was inflammation of a bursa which communicated with the joint. The bursa discharged through a fistula, and infection through the fistula gave rise to suppuration and to inflammation of the joint. Severe symptoms developed, with rigors and fever, and lymphangitis of the foot and leg. The joint was opened on the dorsal surface by a transverse incision, and the superficial suppuration by another incision on the dorsum of the foot. The clavus and the bursa were excised subsequently.

PHLEGMONE PROGREDIENS PUTRIDA

(*Putrefactive Phlegmon*)

Plate LXXIX, Fig. 101.

Pyogenic affections are especially dangerous when the infection is caused by very virulent bacteria, and also when bacteria invade a debilitated body (*e.g.* diabetes). In this case (Fig. 101), subcutaneous suppuration, following a slight wound of the great toe, rapidly spread to the tendon-sheath and the joint, necessitating amputation of the toe on account of the extensive infection and severe constitutional symptoms. Although the operation was made through tissues not yet inflamed, further suppuration occurred on the sole of the foot, which spread rapidly and destroyed the soft parts, tendons, muscles and fascia, and infected the metacarpal bones. The severity of the inflammation is shown by the great swelling around the metacarpus. This is not a case of the progressive suppuration which is common in diabetes, but one of secondary infection by bacteria of putrefaction, giving rise to a putrid, sanious inflammation. If pyogenic and putrefactive phlegmons are combined, there is not only rapid necrosis of all the tissues with extension of the process to the neighboring parts, but also general infection (cf. Fig. 108).

The appearance of the wound in this form of inflammation, which is also called gangrenous, is characteristic. Owing to the fibrinous exudation, the wound is coated with a diphtheroid membrane. This condition has been called "wound diphtheria"; but it is better to use the term diphtheroid, as cases of true infection of wounds with diphtheria bacilli are rare. In putrefactive phlegmon dry, unhealthy granu-

lations are present along with the diphtheroid membrane. There is also a sanious, fetid, dirty discharge from the wound, containing numerous pieces of necrosed tissue. Similar conditions are found in wounds in general infection.

In diabetics, these putrefactive phlegmons assume a very extensive and dangerous character, as the diabetic tissues constitute a favorable nutritive medium for bacteria, especially those of putrefaction, while the debilitated body offers little resistance to them. If an incision is made in these cases all the tissues are seen to be bathed in a dirty green fluid and in a state of necrosis, often consisting only of yellowish-green necrotic shreds. The skin, fascia, muscles and tendons are the first to be destroyed, while the bones resist longer. In our case, the pyogenic and putrefactive phlegmon had already loosened the periosteum from the bones and caused infection of the cortex and medullary cavity (osteomyelitis, cf. Fig. 104). The infection of the bones at first gave rise to severe rigors, but afterwards assumed a more chronic form of inflammation. There was also extensive lymphangitis and thrombo-phlebitis of the leg.

Treatment. In cases of putrefactive phlegmon, free incisions must be made in the diseased tissues as early as possible, as general infection often occurs rapidly from the action of toxins. If the process continues to extend in spite of the incisions, amputation through healthy tissues must not be delayed too long; otherwise the patient will succumb in spite of amputation.

In the phlegmonous inflammations occurring in diabetes, which often begin in the toes and spread destruction over the whole foot in a few hours, the conditions are especially complicated. If, after extensive incisions, the temperature does not immediately fall, amputation must be performed; otherwise general infection will occur rapidly. In any case of

phlegmonous inflammation in a diabetic patient death may occur from coma or heart failure.

In Fig. 101 there was a combination of pyogenic and putrefactive phlegmon of a progressive character in a diabetic patient. High temperature, rigors, dry tongue and somnolence suggested the commencement of general infection. Amputation was performed above the knee, owing to the presence of lymphangitis, thrombo-phlebitis in the leg, and also advanced arterio-sclerosis. The operation was performed under lumbar anæsthesia and led to healing.

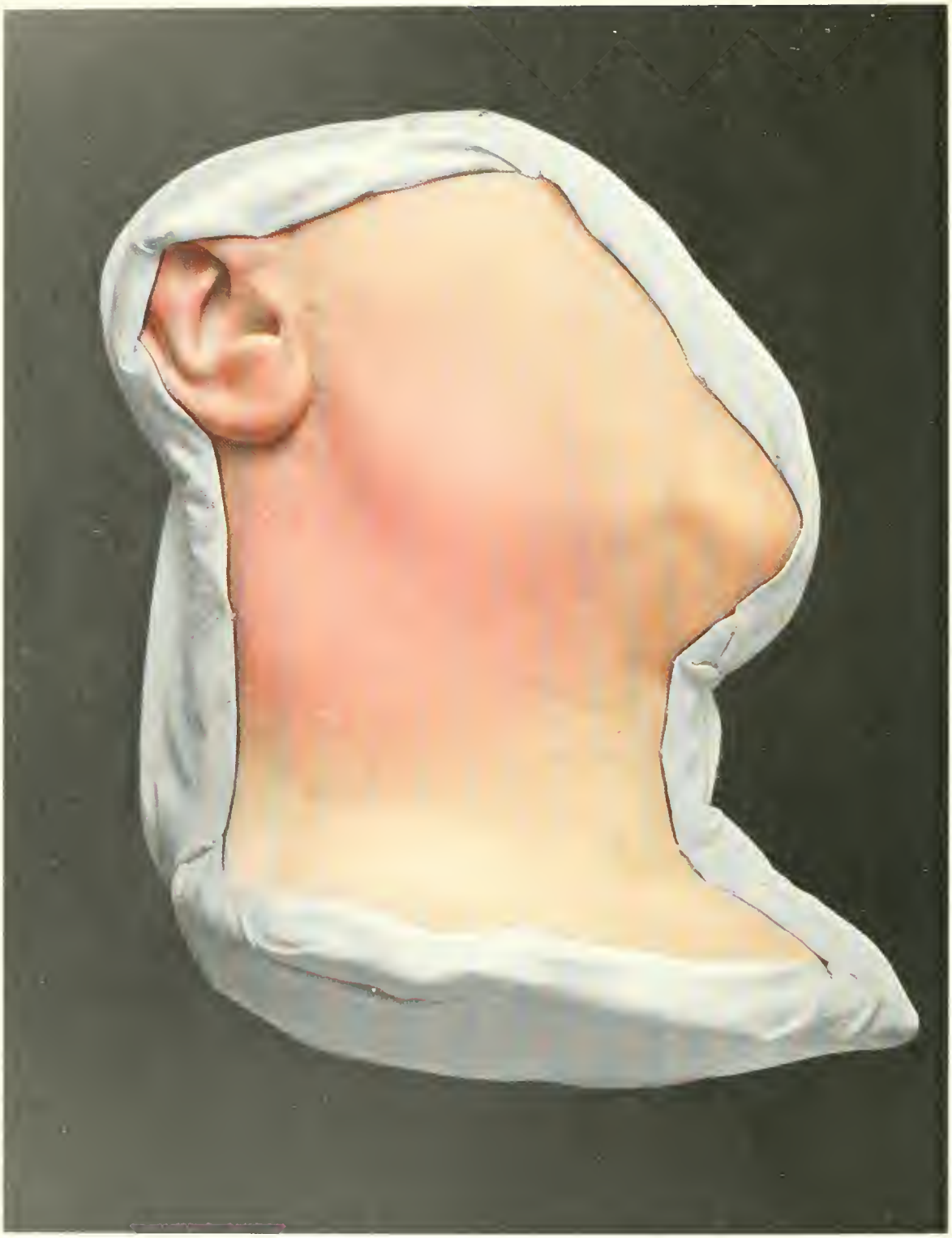

Fig. 102. Phlegmone colli – Phlegmon ligneux.

PHLEGMONE COLLI (*Phlegmon of the neck*)

Plate LXXX, Fig. 102.

In the region of the neck, subcutaneous and subfascial phlegmons are common, owing to the numerous groups of lymphatic glands in this situation. Suppurative inflammation of these glands may be caused by affections of the mouth and pharynx, carious teeth, angina, otitis media, alveolar periostitis, foreign bodies, etc. Eczema and other affections of the head and face may also cause suppuration in the glands of the neck, especially in young individuals. The infection is generally due to staphylococci, sometimes streptococci and other bacteria. In lesions of the mouth and pharynx putrefactive bacteria are sometimes found in the buccal cavity.

Subcutaneous phlegmon in the neck manifests itself by redness of the skin, inflammatory infiltration and fever; later on fluctuation can be made out. In nearly all cases a circumscribed abscess forms on one side of the neck. Large abscesses may cause dyspnœa by pressure on the larynx, and dysphagia by pressure on the esophagus.

In the submaxillary region the inflammation occurs most commonly in the subcutaneous lymphatic glands, and the abscess is situated outside the capsule of the submaxillary gland. This must be distinguished from intracapsular suppuration of the submaxillary gland itself, which is called *Ludwig's* angina (*angina Ludovici*). In this case the symptoms are much more severe—fever, rigors, swelling in the buccal cavity and pharynx, causing difficulty in respiration and swallowing.

Infection of the sub-mental lymphatic glands gives

rise to an abscess in the middle line. These cases are rare, and generally due to lesions of the lower lip.

Deep suppurations in the neck, under the fascia, arise from the deep lymphatic glands. They occur after lesions in the pharynx, esophagus and larynx, also after tonsilitis and scarlet fever, and are more dangerous on account of their deep situation. They develop with fever and rigors, and diffuse inflammatory infiltration in the neck, while the deep suppuration can seldom be detected by fluctuation. This deep suppuration manifests itself by cyanosis of the face, oblique position of the head, trismus of the jaw, attacks of asphyxia and difficulty in swallowing. The pus may make its appearance in the supraclavicular fossa or in the axilla.

In some cases (especially in streptococcal infection) there is no formation of pus, but a dirty, fetid, greenish fluid which infiltrates all the tissues. Such cases often lead to general infection. Diffuse inflammation may also occur after operations on the neck, larynx and esophagus, and cause death by extension to the mediastinum.

The term "wooden phlegmon" (*phlegmon ligneux*) is given to a chronic inflammation of the neck, which gives rise to an infiltration of wooden hardness, often extending over the whole neck, with slight inflammatory symptoms. The skin is slightly blue, œdematous, and pits on pressure. There is no fever nor pus formation. The infiltration may cause dyspnœa by pressure on the larynx. When incised, a dirty, greenish-yellow fluid is seen in the subcutaneous, subfascial and inter-muscular tissues, extending through the whole region of the neck. This affection often occurs in old and cachectic people after lesions of the mouth and pharynx, probably from infection by bacteria of slight virulence.

Differential Diagnosis. This has to be made from alveolar periostitis (Fig. 104), osteomyelitis of

the lower jaw (Fig. 105), tuberculous adenitis, and cystic tumors in the neck (blood cysts, dermoids sebaceous cysts, branchial cysts). Changes in the bone are revealed by an incision in the case of periostitis and osteomyelitis. Acute symptoms and fever are absent in the other formations, but suppuration of a cystic tumor may resemble glandular suppuration. In cases of deep suppuration in the neck, retro-pharyngeal abscess must be borne in mind.

Wooden phlegmon of the neck may be mistaken for commencing actinomycosis, but the latter soon gives rise to a fistula which discharges pus mixed with the characteristic yellow bodies (Fig. 115).

Treatment. Poultices are contra-indicated, as they cause considerable destruction of tissue, and allow the right time for incision to be passed by. Early incision is indicated in most cases. In subcutaneous phlegmons with a tendency to become circumscribed, incision should not be made until an abscess forms. Under local anæsthesia an incision is made through the skin at the lowest part of the abscess, and the pus evacuated by means of blunt dressing forceps. In the submaxillary region the facial nerve and vessels must be avoided.

In intracapsular inflammation of the submaxillary gland, the gland must be freely incised before suppuration occurs, otherwise general infection may occur from increased virulence of the bacteria due to pressure of the capsule.

In all cases of phlegmons in the neck in which there is much infiltration of the floor of the mouth with difficulty in breathing and swallowing, it is advisable to perform a preliminary tracheotomy, as death may occur from sudden œdema of the glottis during anæsthesia.

In deep suppurations of the neck we must not wait for the appearance of a superficial abscess. A free incision must be made along the median border of

the sternomastoid muscle. Extensive cases require counter-incisions. The wounds should be drained by gauze tampons, as drainage tubes may injure the large vessels.

Wooden phlegmon of the neck sometimes requires multiple deep incisions, laterally and in the middle line.

Fig. 102 shows acute inflammation of the submaxillary lymphatic glands, with the formation of an abscess under the skin. It was treated under local anæsthesia by incision and drainage.

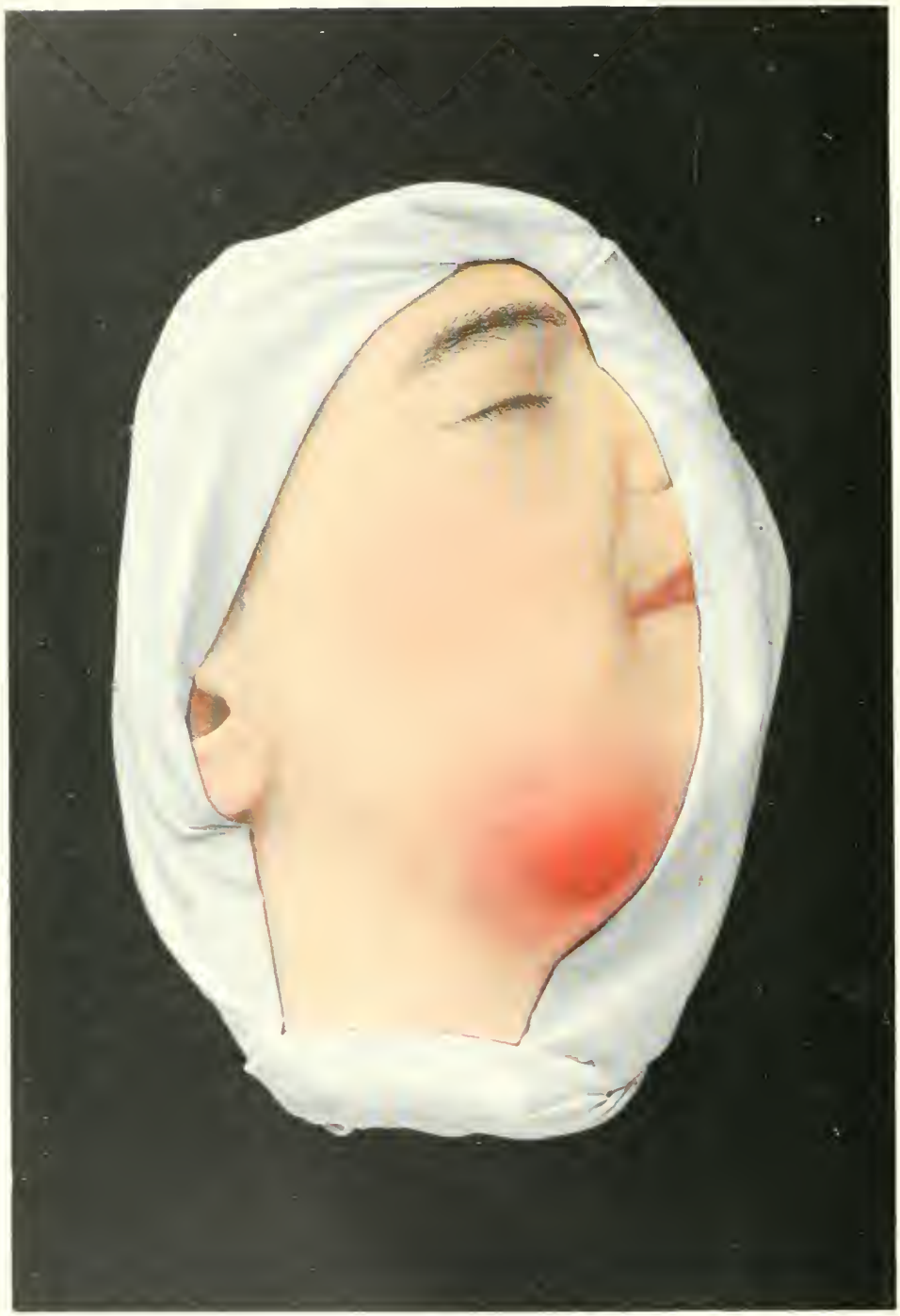

Fig. 103. Periostitis alveolaris purulenta — Parulis.

PERIOSTITIS ALVEOLARIS PURULENTA—PARULIS

(*Purulent alveolar Periostitis*)

Plate LXXXI, Fig. 103.

Parulis is a name given to purulent alveolar periostitis of the lower jaw, which usually gives rise to a subcutaneous abscess. It may be caused by lesions of the gums (*e.g.* after tooth-extraction with dirty instruments), fractures of the jaw, operations on the jaw, caries of the teeth, fistulas from the stumps of teeth. Infection of the periosteum of the alveolar portion of the lower jaw gives rise to a circumscribed subperiosteal accumulation of pus which descends to the submaxillary region and lies over the fascia covering the submaxillary gland. The signs of purulent inflammation are most apparent in this region, while symptoms at the seat of infection are often slight.

The symptoms commence with fetor of the breath, fever and rigors, and inflammatory infiltration in the submaxillary region. Soon afterwards the presence of fluctuation indicates abscess formation, after which the symptoms diminish. In most cases the suppuration is circumscribed, but sometimes there is diffuse inflammation, causing considerable infiltration of the soft parts and swelling and redness of the side of the face. There is then often trismus and œdema of the mucous membrane of the mouth, with difficulty in mastication and often difficulty in breathing. In these diffuse forms there are severe constitutional symptoms—rigors, fever, headache, etc.

Although the circumscribed form is harmless, the diffuse form may be dangerous to life, especially when improperly treated. Treatment of the circumscribed form by poultices may give rise to the diffuse form. If the pus is allowed to remain for long under

the periosteum, it may cause osteomyelitis of the jaw and all its consequences (Fig. 104). Meningitis and general infection may also occur from thrombophlebitis.

In the upper jaw, infection of the periosteum may also cause subperiosteal suppuration, which has not such favorable conditions for extension to the subcutaneous tissue as in the case of the lower jaw. Small abscess caused by morbid conditions of the teeth may burst into the mouth and cause no trouble, but more virulent infection may cause osteomyelitis of the upper maxilla, which rapidly extends over the whole of the bones of the face, and often causes death by general infection. In these cases there is infiltration of the upper part of the face, œdema of the eyelids, high temperature, rigors, headache, etc.

In these morbid conditions pyogenic inflammation generally staphylococcal, is often combined with putrefactive inflammation from bacteria in the mouth. We, therefore, find the fetid, dirty, reddish-brown pus, mixed with broken-down tissue, which is characteristic of putrefactive inflammation.

Differential Diagnosis. Although parulis of the lower jaw may cause swelling of the neck resembling glandular abscess, it can usually be distinguished by the history, and by inspection of the mouth. If the parulis has been present some time the bone becomes to a considerable extent denuded of its periosteum which distinguishes it from glandular abscess. In the upper jaw empyema of the antrum of *Highmore* may be mistaken for parulis, especially when the empyema has broken through the bony wall of the antrum and appears as an abscess under the gum. If the antrum of *Highmore* is translucent to light there is no pus in it; on the other hand, absence of translucency does not necessarily indicate the presence of pus, as this sometimes occurs in the normal condition.

Primary acute osteomyelitis commences with more severe symptoms—high fever, frequent rigors, etc.

Treatment. Circumscribed abscesses should be incised under local anæsthesia. Poultices are to be avoided. Diffuse inflammations should be incised under general anæsthesia before the formation of abscess. By this means the above-mentioned complications may be prevented. In parulis of the lower jaw an incision should be made through the skin and the pus evacuated by dressing forceps; in this way pus can be found which was not apparent from the external appearance. If the rough bone is found a large drainage tube should be inserted. The incision should be made about three-fourths inch below the border of the jaw to avoid the branches of the facial nerve which supply the muscles at the angle of the mouth.

In the upper jaw operation should be performed from the mouth; with the head hanging low, in cases of large accumulations of pus.

In all cases of parulis the teeth must be attended to; carious teeth and stumps, which have given rise to the condition, should be removed. Drains and tampons can be left out in a few days, when suppuration has ceased. If the movements of the jaw are limited, fluid diet may be necessary at first.

Fig. 103 shows a case of parulis arising from a carious premolar of the lower jaw. It began with pain and fever, and the formation of an abscess under the gum. Eventually, an abscess formed in the neck, after which the symptoms subsided. Under general anæsthesia an incision an inch long was made at the lower border of the abscess and fetid pus evacuated. Staphylococci and putrefactive bacteria were found in the pus. Owing to the previous treatment of the patient with poultices, the bone was considerably denuded of periosteum. Healing took place in fourteen days.

Osteomyelitis

OSTEOMYELITIS MAXILLÆ INFERIORIS
(*Osteomyelitis of the lower jaw*)
Plate LXXXII, Fig. 104.

OSTEOMYELITIS SCAPULÆ ACUTA
(*Acute osteomyelitis of the scapula*)
Plate LXXXIII, Fig. 105.

OSTEOMYELITIS HUMERI CHRONICA
(*Chronic osteomyelitis of the humerus*)
Plate LXXXIV, Fig. 106.

OSTEOMYELITIS TIBIÆ—NECROSIS TOTALIS
(*Osteomyelitis and necrosis of the tibia*)
Plate LXXXV, Fig. 107.

The term osteomyelitis is applied to pyogenic affections of bone in general, while in the stricter sense these are divided into purulent periostitis, osteitis and osteomyelitis. Since all three parts of the bone are generally the seat of suppuration and the process can only be localized clinically to the bones as a whole, and as the majority of cases begin with infection of the bone-marrow, the name osteomyelitis is rational.

Infection of the bones may result from lesions of the soft parts, compound fractures, operations (this was common after amputations in the pre-antiseptic days); after pyogenic affections of the neighboring parts (subcutaneous abscess, whitlow, otitis media). In the latter cases the periosteum is first infected, the cocci then invade the Haversian canals in the cortex and infect the medullary cavity. As in all pyogenic infections, the great majority of cases are caused by the *staphylococcus pyogenes aureus;* while the staphylococcus albus, pneumococcus and streptococci only in rare cases cause infection of bone.

Apart from the above-mentioned modes of infection this may take place through the blood; the medulla is then first infected, and the suppuration spreads to the cortex and periosteum, finally appearing as a subcutaneous abscess.

In all pyogenic affections (furunculosis, whitlow, quinsy, otitis media) the bone marrow is infected by staphylococci, but the power of resistance of the body is generally sufficient to withstand their action. The cocci remains harmless till the power of resistance of the body is weakened by some exciting cause, such as fracture, overexertion, exposure to cold, etc. Osteomyelitis may thus occur after injury to a bone, even after a slight contusion. In this case the resulting effusion of blood favors further growth of the cocci and leads to infection. It follows from this that, according to the circumstances, purulent infection of the bones may develop sometimes directly after and sometimes a long time after purulent inflammation in other organs of the body; also that, according to the number and virulence of the bacteria, it may assume an acute or chronic form, with corresponding violent or mild symptoms. Like all purulent inflammations, the process begins at the seat of infection with hyperæmia, exudation, suppuration, degeneration and regeneration; these processes assuming a special form corresponding to the structure of the bone. Thrombo-phlebitis may occur and give rise to metastatic infection by embolism in other parts of the body (bones, endocardium, meninges, etc.)

As the great majority of cases arise from blood infection, it is clear that the bones most liable to infection are those which are most richly supplied with blood-vessels, especially during their period of growth when they are most vascular. The diaphyses of the long bones are thus most often affected at their junction with the epiphyses. The lower ends of the femur and radius and tibia, and the upper ends of

the humerus and tibia are the places of predilection. Osteomyelitis is rare in the short bones and in the flat bones. It is also rare after the thirtieth year. According to the statistics of *Garrés*, in one-fifth of the cases several bones are affected simultaneously.

The symptoms of acute purulent osteomyelitis are more severe than in any other pyogenic affection. The deeper the infection, the greater is the virulence of the bacteria. Bacteria in the bone-marrow are under greater pressure than in any other tissue, and this increases their virulence. In young individuals osteomyelitis often occurs suddenly after an injury, with high fever, rigors, pains in the joints and severe constitutional disturbance. Pain on pressure and movement, and loss of function point to an affection of the bones. Serous effusion soon takes place in the nearest joint. Changes first appear under the skin when pus forms under the periosteum. The subperiosteal abscess appears as a sharply defined fluctuating swelling with hard borders, and the skin over it is tense and reddish blue. If the subperiosteal abscess bursts, it gives rise to intermuscular and subcutaneous infiltration, with redness and swelling of the skin, and œdema of the soft parts; the regional lymphatic glands are swollen and painful.

Although operation often only reveals a subperiosteal abscess, especially in children, in cases of hematogenous origin (blood infection) the cortex and medulla of the bone are also affected. Infection of the cortex is shown by the presence of yellow spots on the surface, which correspond to small holes discharging pus. After removal of the cortex, the infected medulla shows reddish-brown or yellowish spots, which may lead to the formation of a circumscribed abscess, or to diffuse suppuration in the medullary cavity. If the condition is not recognized early and the spread of infection arrested by operation, separation of the epiphyses or infection of the joint may occur, or general infection with death in

a few days. In extensive disease the whole bone is whitish-yellow; white from bloodlessness due to thrombo-phlebitis, and yellow from pus formation. Numerous pits are seen from which pus has been discharged under the periosteum.

The amount of necrosis corresponds to the degree and extent of infection. In subperiosteal necrosis the infected cortex and medulla may regenerate without loss of substance, especially when the pus has obtained an early exit. If the cortex has been for some time the seat of extensive purulent inflammation necrosis must result with the formation of a *sequestrum*. According to the extent of the inflammation this necrosis will be limited to one part of the bone or extend through the thickness and length of the bone partially or completely. In disease of the cortex the sequestrum is generally lamelliform, slightly corroded and pitted; in disease of the medullary cavity the sequestrum is, to a certain extent, a cast of the cavity, and in the form of a trough.

The sequestrum in osteomyelitis is large and continuous and may include the whole length and thickness of the diaphysis (Fig. 107), thus differing from the sequestra in tuberculous bone disease, which are generally multiple, small and much corroded. Such complete necrosis occurs in acute cases which have been operated upon too late and in chronic cases. The dead bone (sequestrum) becomes separated from the healthy bone by a zone of inflammatory demarcation, more or less rapidly according to its size.

In extensive necrosis the demarcation process may continue for months, so that patients who escape death from general infection may succumb from exhaustion, albuminuria or amyloid degeneration of the kidneys. Spontaneous expulsion of the dead bone should be assisted by operation (sequestrotomy).

The regenerative or osteoplastic process goes hand in hand with the degenerative. The purulent inflammation not only causes necrosis, but causes irritation which stimulates the periosteum to form new bone (osteoplastic periostitis). This results in thickening of the cortex at the seat of necrosis; and in cases of total necrosis, complete repair of the destroyed bone. This irregular formation of new bone is sometimes called the "sequestral capsule." There are numerous holes (cloacas) in this capsule where the periosteum has been destroyed. From these holes pus is discharged from the zone of inflammatory demarcation, and eventually the sequestrum, through a fistula in the skin (Fig. 107). The X-rays are useful in showing the extent of necrosis, and also separation of the epiphyses.

The whole process of degeneration and regeneration take much longer than in purulent inflammation of the soft parts, and the acute stage is followed by a chronic stage after the pus has been evacuated spontaneously or by operation. However, an acute relapse may occur at any time during the chronic stage, especially after improper treatment, or after an injury.

In distinction to this form of acute osteomyelitis there is a subacute form which is chronic from the beginning. In these cases there is often a history of previous acute inflammation of the bone, and the condition is really one of recurrence in a milder form, often at the age of puberty. Recurrence may also occur later in life, hence bones which have been previously affected with osteomyelitis must be regarded as places of less resistance and must be protected from the action of trauma and over-exertion.

The clinical symptoms in these cases often resemble rheumatic pains, but the pain is localized to one bone, or sometimes a definite part of a bone. There is often a history of pyogenic disease in youth, and scars and fistulas may be found in the bone con-

cerned or in other bones. The affected bone is often very tender to pressure at certain points. In the course of time the bone becomes thickened, and the diaphysis lengthened. The growth in thickness may be enormous at the seat of disease, the thickening being both periosteal and cortical.

The changes in the bone in chronic osteomyelitis are as follows: Sometimes there is a small sequestrum in the interior of the bone, shown as a clear spot surrounded by bony proliferation in an X-ray picture; sometimes a circumscribed abscess in the medullary cavity, shown by the X-rays as a round space surrounded by bone. If bony proliferation is absent the X-ray pictures resemble tumors or cysts in the bone. The diagnosis of chronic osteomyelitis is, therefore, sometimes difficult when there is no history or evidence of former osteomyelitis. Pain on pressure suggests the infective nature of the disease. In doubtful cases search may be made for staphylolysin, according to the method of *Bruck*, *Michaelis* and *Schultze*.

If large portions of the cortex and medulla are affected by chronic osteomyelitis large sequestra are formed, which seek a way to the surface in spite of the considerable formation of new bone. In these cases we find numerous cloacas in the bony capsule, subcutaneous abscess and fistulas (Fig. 106); while the whole bone is thickened, and the X-rays show changes in the periosteum, cortex and medulla.

A third form of chronic osteomyelitis is limited to the periosteum, under which a hyaline sero-mucoid fluid develops, forming a sharply defined, fluctuating swelling with hard borders. This has been called albuminous periostitis but is a form of osteomyelitis. Staphylococci are present in the fluid.

All these chronic forms are due to infection by less virulent staphylococci. However, every chronic osteomyelitis may become acute, especially when the bones are exposed to the effects of overexertion,

injury, or massage (performed on account of wrong diagnosis). Chronic fistulas in osteomyelitis may give rise to carcinoma (cf. Plate XIV). In the long bones both acute and chronic osteomyelitis may cause disturbance in growth, pseudarthrosis and contractures. Although the great majority of cases of acute and chronic osteomyelitis affect the long bones, both forms may occur in the short and flat bones; in the skull, after compound fractures, incised and punctured wounds; in the scapula, pelvic bones and vertebræ; in the bones of the face (after tooth extraction). In *Fröhner's* statistics, four hundred and seventy cases of osteomyelitis affected the long bones and thirty-four the short and flat bones. As the cortex is thin in these bones, there is greater destruction. Osteomyelitis of the cranial bones may spread through the diploë to half the skull, form large sequestra of the inner table, and epidural abscess. In the scapula the whole bone may be destroyed by multiple abscesses and sequestra, necessitating complete removal of the bone. In osteomyelitis of a facial bone, infection may spread to all the bones of the face, causing extensive destruction and consequent deformity. Osteomyelitis of the cranial and facial bones may give rise to meningitis.

In streptococcal osteomyelitis the pus is thinner and very abundant, and the disease is more severe like all streptococcal infections. In these cases the skin usually shows erysipelatous reddening.

Osteomyelitis after infection by typhoid bacilli or pneumococci can only be distinguished from the other forms by the history and by bacteriological examination.

Differential Diagnosis. Acute osteomyelitis may be mistaken for deep abscess, but this is made clear by incision. The redness of the skin in osteomyelitis resembling erysipelas is limited to the affected part and gradually diminishes. Acute osteo-

myelitis of the diaphyses is characterized by the severity of the symptoms, the marked swelling and the loss of power in the limb.

Chronic forms are most often mistaken for tuberculous bone disease, but the latter generally affects the epiphyses, while osteomyelitis attacks the diaphyses. Osteomyelitic fistula has hard borders and bright red granulations, and passes directly to the bone, while tuberculous fistula has yellow, slimy granulations, irregular borders and an irregular course through the deep parts (Figs. 125 and 130). In osteomyelitis the pus is reddish brown, in tuberculosis it is thin and greenish yellow. In doubtful cases an incision will decide the diagnosis; in osteomyelitis the periosteum and cortex will be found thickened and the sequestrum large and continuous; in tubercular bone disease there are multiple, small corroded sequestra.

Chronic osteomyelitis causing much swelling of the bone may be mistaken for syphilitic bone disease, especially in the tibia. In syphilitic bone disease the X-rays show a diffuse thickening of all layers of the bone, and a uniform dark shadow with irregular borders, corresponding to the periosteum; while, in osteomyelitis, dark shadows together with clear spaces are shown, corresponding to sequestra and abscesses respectively. If fistulas form in syphilitic bone disease they present the characteristic sharp borders and prolific granulation tissue round them (Fig. 122).

Osteitis deformans (*Paget's* disease) is characterized by affecting the whole extent of both tibias, and by the early appearance of marked curvature.

Osteomyelitic abscesses in the diaphysis, when they extend to the epiphyses may be mistaken for tuberculosis, but the pronounced new bone-formation is absent in the latter. Sarcoma and bone-cysts may also in some cases be difficult to distinguish from chronic osteomyelitic abscess, even by the X-rays.

In doubtful cases an exploratory incision may be made, or staphylolysin looked for.

In the majority of cases, however, the diagnosis of osteomyelitis is established by the history and the typical appearance, situation and course of the disease.

The earlier diagnosis is made and treatment commenced, the better the prognosis.

Treatment. In the most acute cases with purulent joint-effusion and signs of general infection (dry tongue, delirium, presence of bacteria in the blood) amputation is sometimes the only means of saving life.

In acute osteomyelitis incision must be made as soon as possible, before the abscess has broken into the subcutaneous tissue. After opening the abscess the bone must be examined; if it is unaltered it can be left alone. If the temperature does not fall after opening the abscess and the condition becomes worse, with rigors, etc., the bone must be laid open as far as the medullary cavity. This should be performed freely with a gouge; it is useless simply to bore holes as they do not give sufficient outlet for pus, nor for subsequent necrosed pieces of bone. On the other hand, in cases with severe constitutional symptoms, especially in children, the whole extent of bone should not be gouged at one sitting, owing to the severe shock, and the possibility of general infection; the gouging should be performed at several sittings. After gouging, the infiltrated bone-marrow must be scraped with the sharp spoon and the cavity drained with iodoform gauze. The wound must be kept open by a drainage tube to allow pus and sequestra to escape.

The after-treatment is sometimes hindered by narrowing of the opening in the bone from the formation of callus; if there is no suspicion of necrosis, this callus must be removed with the knife, to establish

sufficient communication with the medullary cavity. Complete immobilization is necessary in the extremities, to avoid spread of inflammation and the possibility of fracture.

Serous effusion into a joint must be punctured when extensive. Purulent effusion requires incision, and sometimes resection of the joint. If there is purulent arthritis with high fever and rigors, resection must not be delayed, or general infection may follow.

In chronic osteomyelitis it is best to wait till the sequestrum is complete and new bone has begun to form round it (X-ray examination) before performing sequestrotomy. If there are subcutaneous abscesses these must be opened. As small sequestra and abscesses often cause considerable pain, in some cases the bone must be gouged when the X-ray examination shows no changes. The operation is troublesome, as the small sequestrum or abscess is often situated in the middle of hardened sclerotic bone. The fistulas in chronic osteomyelitis must be freely opened up and the callus removed. The cavity in the bone left after gouging must be left open and drained till healing takes place from the bottom. Immediate plugging of the bone cavity with iodoform is only of use in a few cases of circumscribed chronic osteomyelitis, as in extensive cases the plugs are often expelled through a fistula; but when the cavity is filled with fresh granulations, all cases of osteomyelitis can quickly be made to heal with plugging. The cavity is then scraped, disinfected with peroxide lotion, dried with *Hollander's* hot air apparatus, and filled with a mixture of iodoform, glycerin and spermaceti. Whenever possible, the periosteum should be united over the plug and a covering of skin made over the cavity. Strict asepsis is necessary.

Frequent recurrences in chronic osteomyelitis, with emaciation, albuminuria, etc., necessitate amputation. Contractures must be treated by extension on a splint, or when they cannot be extended, by resection.

Large defects in the skin can be covered by pedunculated flaps.

In the flat bones subperiosteal removal of the whole bone is often necessary (*e.g.* scapula). This may be followed by complete regeneration and restoration of function. In osteomyelitis of the cranium sequestra and epidural abscesses must be evacuated through a large trephine hole, which can afterwards be repaired by bone grafting.

Treatment of acute osteomyelitis by passive hyperæmia is to be condemned, as it obscures the signs and symptoms. It may also lead to diffuse suppuration by thrombo-phlebitis, rendering amputation necessary; but its chief danger is general infection.

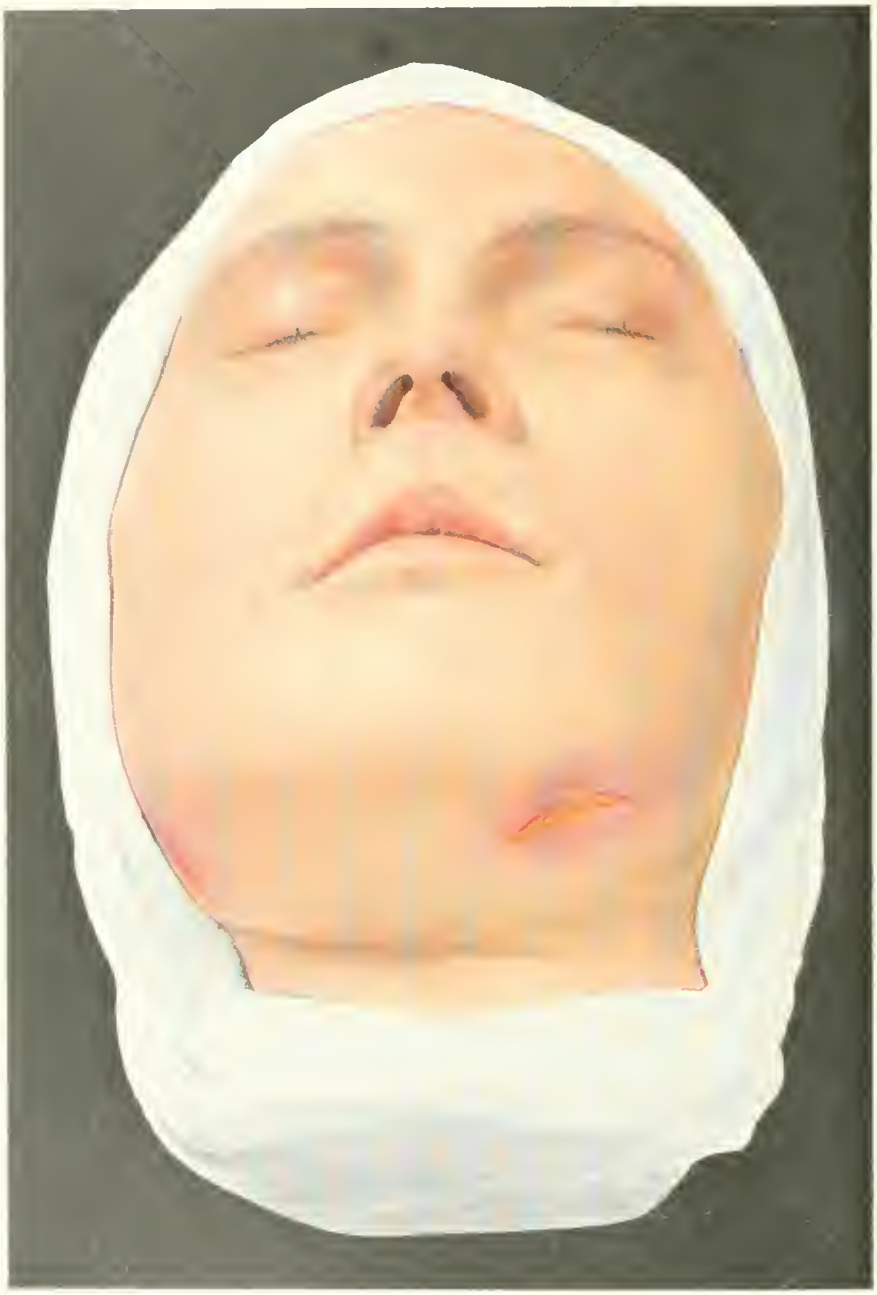

Fig. 104. Osteomyelitis maxillae inferioris.

OSTEOMYELITIS MAXILLÆ INFERIORIS

(*Osteomyelitis of the Lower Jaw*)

Plate LXXXII, Fig. 104.

This figure shows chronic osteomyelitis in a girl of nineteen, which occurred in connection with tooth extraction. Osteomyelitis of the lower jaw often occurs after tooth extraction, when there is much inflammation of the gum and periosteum, or when the alveolus is extensively injured. It may also follow injuries to the jaw. Osteomyelitis of the lower jaw, due to blood infection, is generally combined with disease of other bones, and occurs especially in children. Acute osteomyelitis of the lower jaw commences with high fever, rigors, œdema of the face and mucous membrane of the mouth, difficulty in breathing and swallowing, headache and delirium. It is often fatal from meningitis or general infection. In some cases the whole of the lower jaw may become necrosed.

In the chronic form (Fig. 104) a painless circumscribed or diffuse painless swelling slowly develops in the lower jaw. The skin gradually becomes tense, red and œdematous; one or more fistulas develop, and later on necrosis takes place. In extensive cases the teeth become loosened and trismus may occur. In the stage of painless swelling the case may resemble cystic adenoma. In actinomycosis the swelling is situated in the floor of the mouth and in the muscles, and only extends to the bones later on.

Osteomyelitis of the lower jaw should be treated by early incision down to the bone, at the lower border of the jaw. Healing without necrosis occurs more often than in the long bones. If necrosis occurs it is best to wait, in chronic cases, till sufficient

new bone is formed, so as to avoid fracture of the jaw during removal of the sequestrum.

Sequestra are best removed by external incisions. The cavity should be plugged with iodoform gauze for a long time. In extensive necrosis, bone grafting may be tried, or the patient may wear a prothesis.

In Fig. 104 the fistula was opened up; after which the discharge diminished, but the swelling of the bone remained and the fistula did not heal, indicating necrosis. The X-rays showed diffuse swelling of the jaw.

A condition affecting the bones, observed by *Billroth* in workers in mother-of-pearl, which resembles osteomyelitis, and chiefly affects the lower jaw, undergoes spontaneous resolution; so long as the patients are not exposed to fresh injury through their work.

Phosphorous necrosis of the lower jaw, which occurs in workers in yellow phosphorus, is probably due to infection of the bone. The phosphorous vapor causes ulceration of the gums, through which the periosteum and bone are infected. This condition gives rise to great swelling of the whole of the lower jaw. The teeth become loose and fall out. The gums become ulcerated and fetid, so that many patients succumb to septic pneumonia or to general septic infection. The bone becomes both sclerosed and brittle. After some years total necrosis occurs with a row of fistulas along the lower border of the jaw.

As there is generally total necrosis in these cases, partial resection is useless, and subperiosteal resection of one or both sides of the jaw should be performed. After this regeneration of the jaw takes place if the periosteum has been preserved, and relapses are avoided.

Phosphorous necrosis (which is fatal in fifty per cent. of the cases) has been prevented by the prohibition of the use of the dangerous yellow phosphorus in the manufacture of matches.

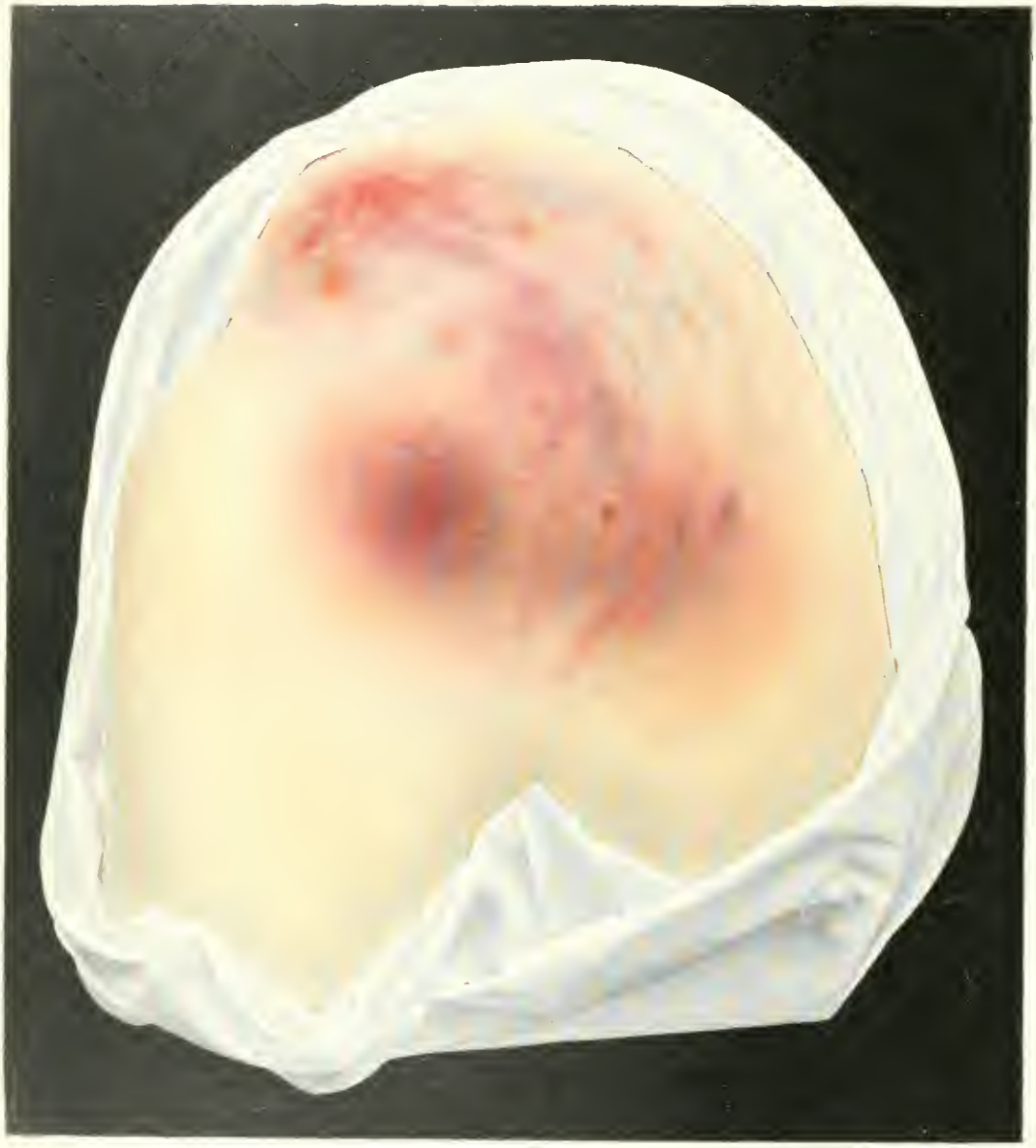

Fig. 105. Osteomyelitis scapulae acuta.

Rebman Company, New-York

OSTEOMYELITIS SCAPULÆ ACUTA

(*Acute Osteomyelitis of the Scapula*)

Plate LXXXIII, Fig. 105.

This is a case of acute osteomyelitis of the scapula following an injury. A few days after the injury a swelling appeared over the whole scapular region as far as the supra-clavicular fossa, accompanied by fever and rigors. The skin became red and mottled, and a large fluctuating subcutaneous abscess developed. The function of the shoulder-joint was abolished. An incision was made and pus evacuated; the bone at the seat of injury was infiltrated with pus. Healing took place without any necrosis.

In osteomyelitis of the scapula, especially when due to blood infection, an abscess usually forms at the anterior border of the scapula, as the osteomyelitic focus in this mode of infection is situated in the body of the bone. The pus is at first limited by the subscapularis muscle; on the other hand, the pressure of the muscle causes rapid extension of suppuration in the medulla of the bone. The abscess may thus not be recognized till it breaks through into the axilla. An early symptom of osteomyelitis of the scapula is painful effusion into the shoulder joint; on this account it may be mistaken for an affection of that joint, the true seat of disease only being revealed after incision. In doubtful cases the anterior surface of the scapula should be exposed by an incision in the axilla. In most cases of osteomyelitis of the scapula, the wound does not heal after incision of the abscess; the occurrence of multiple abscesses and necrosis is unavoidable, owing to the extension of suppuration through the medulla of the bone. For

this reason the disease may last for years. In these cases, and also in acute cases where incision shows extensive destruction of the bone, subperiosteal total extirpation of the scapula is indicated, taking care to preserve the muscular attachments and the important nerves. This is especially indicated in acute osteomyelitis of the flat bones, which often gives rise to early general infection. After total extirpation of the scapula relapses are avoided, and complete regeneration of bone with normal function is possible (*Bockenheimer*).

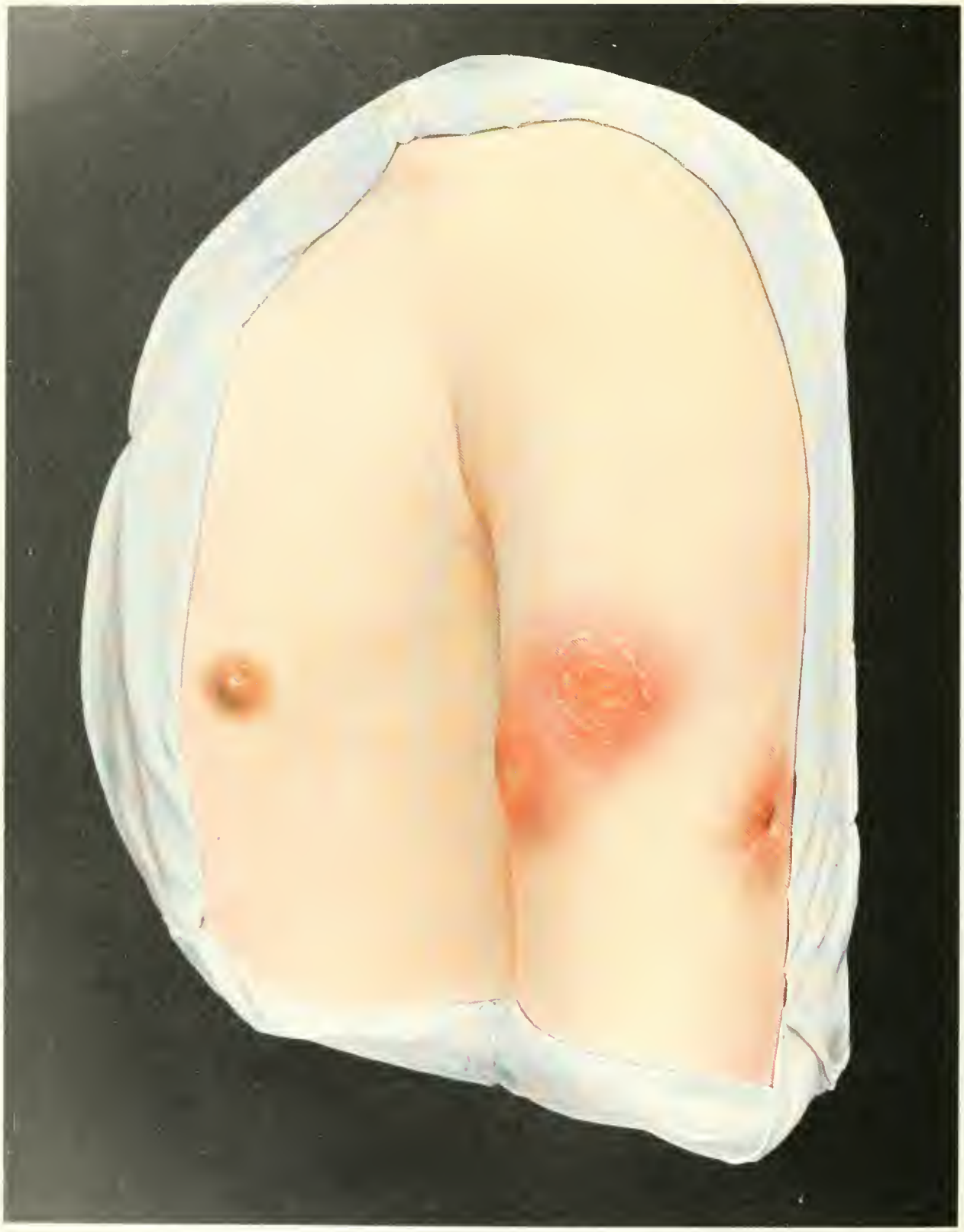

Fig. 106. Osteomyelitis humeri chronica.

OSTEOMYELITIS HUMERI CHRONICA

(*Chronic osteomyelitis of the Humerus*)

Plate LXXXIV, Fig. 106.

Fig. 106 shows a painful club-shaped swelling of the left humerus, which gradually developed at the age of puberty, in a patient who had frequently suffered from tonsilitis in childhood. The patient attributed it to over-exertion at his work as a blacksmith. A year after the onset, a fistula formed at the posterior and external side of the arm, with hard borders and red granulations at its orifice. A probe passed down the fistula discovered rough bone, denuded of periosteum. Subcutaneous abscesses formed at the front of the arm, where the skin was thin and reddened. Examination by the X-rays showed a sequestrum, along with new bone formation. Chronic osteomyelitis of the diaphysis of the humerus was diagnosed. An incision was made down to the bone in the lower third of the outer side of the arm, avoiding the radial nerve. The periosteum was destroyed at one place and a cloaca was found leading to a sequestrum. The sequestrum was removed by carefully gouging the bone; the cavity was scraped and plugged, and the fistulous track with its hardened walls excised. The subcutaneous abscesses were opened and scraped. The arm was immobilized for a long time. Healing took place after some months, and the patient was told to choose a lighter occupation in order to avoid recurrence of the disease.

OSTEOMYELITIS TIBIÆ—NECROSIS TOTALIS

(*Acute Osteomyelitis and Necrosis of the Tibia*)
Plate LXXXV, Fig. 107.

In this case acute osteomyelitis of the tibia in a child, aged nine years, commenced with severe pain in the leg and knee joint, accompanied by high fever and rigors. There was no history of a previous attack. A few days before the onset the child received a blow on the tibia. In spite of the severe clinical symptoms and the marked swelling of the knee joint, operative treatment had been neglected, and, only when a subcutaneous abscess developed, was an incision made. Although the acute symptoms gradually subsided after this, the swelling of the leg remained, and the wound discharged fetid pus. In a few months almost the whole shaft of the tibia became necrosed. Fig. 107 shows the yellow necrosed bone, with the open medullary cavity containing slimy granulations. Between the necrosed bone and the healthy bone are granulation tissue and pus. As the leg had not been properly fixed, a fracture occurred at the lower part of the tibia. The condition of the child on admission to hospital was very bad, owing to the prolonged suppuration. Examination by the X-rays showed that the sequestrum extended further down, and that a thick, bony capsule had already formed behind and at the sides.

Under an anæsthetic, the wound was extended downwards, the necrosed bone removed, the cavity scraped and plugged, and the leg put up on a splint with extension, to correct the position of flexion. The equinus position of the foot, due to insufficient fixation, was gradually corrected.

Such extensive necrosis could have been avoided by early gouging of the bone and proper after-treatment.

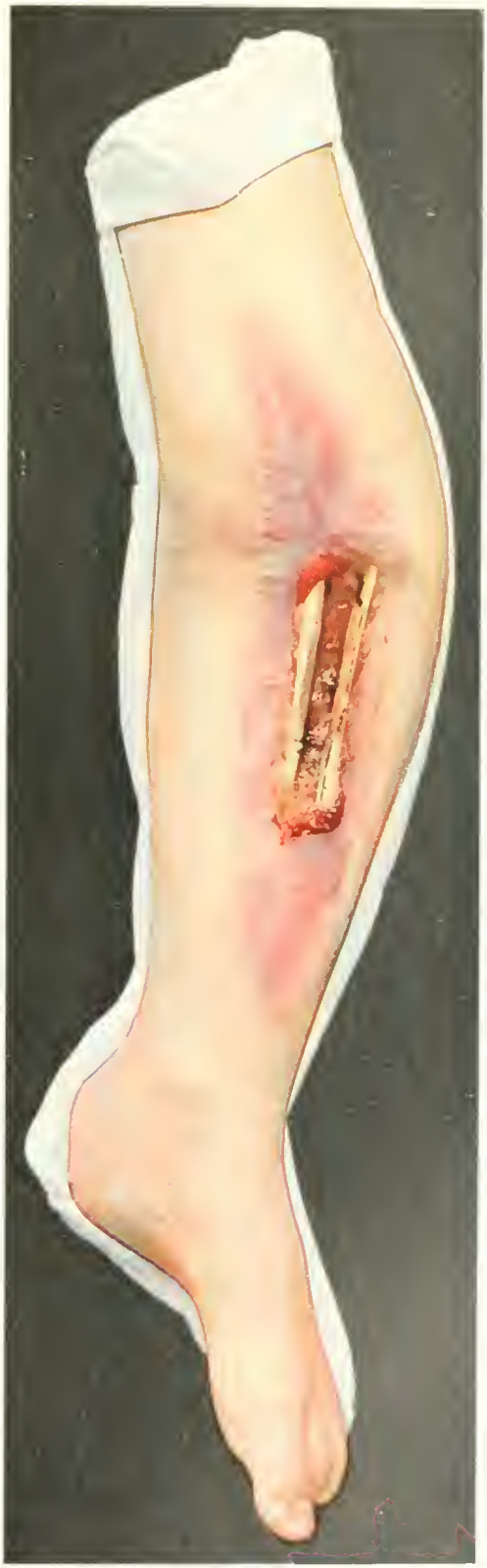

Fig. 107. Osteomyelitis tibiae Necrosis totalis.

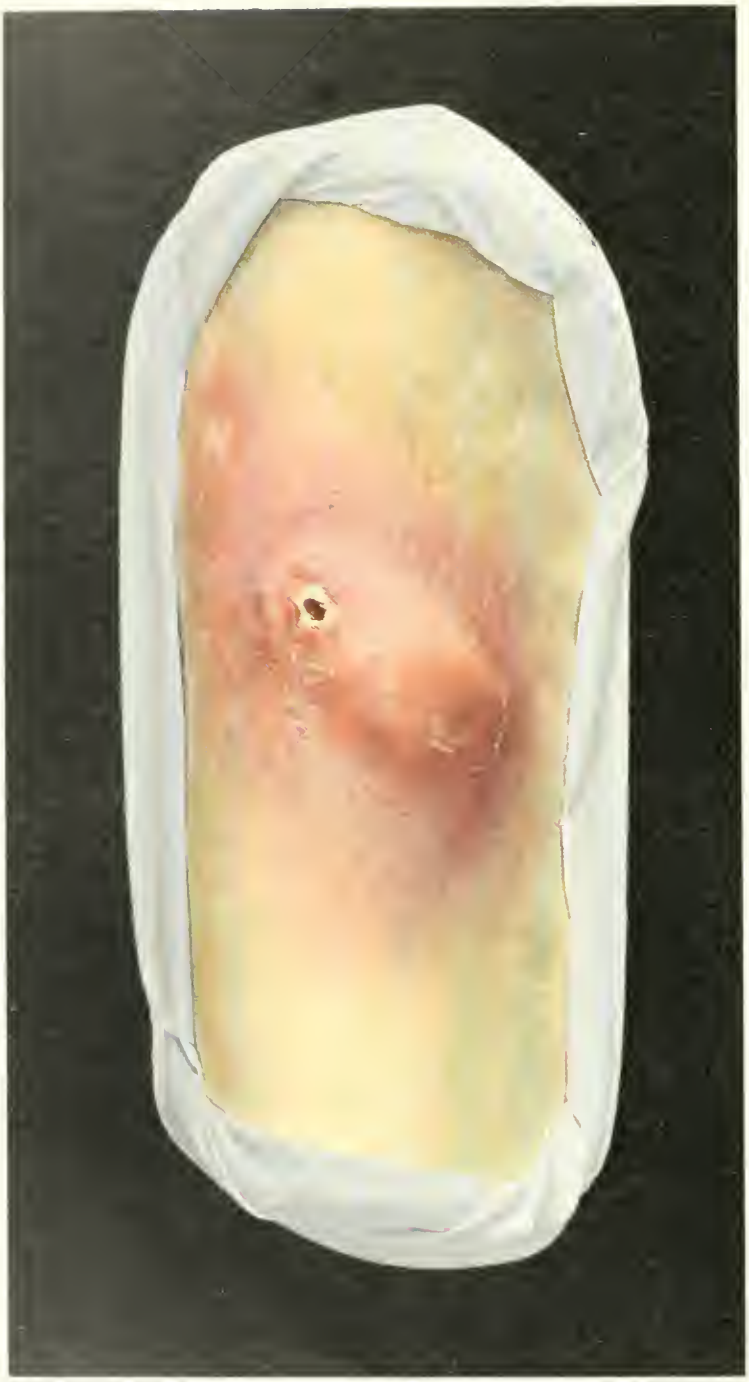

Fig. 108. Infectio generalisata.

INFECTIO GENERALISATA (*General Infection*)

Plate LXXXVI, Fig. 108.

In the description of the various local pyogenic infections, mention has already been made of general infection. In every pyogenic and putrefactive infection there is a certain degree of general infection, but this is not generally sufficient to be recognized clinically or bacteriologically. In apparently benign pyogenic affections, such as furuncle, bacteria may be found in the blood. This explains the occasional occurrence of metastatic osteomyelitis in connection with such affections; and also the fact that the impairment in general health is often out of proportion to the local inflammation.

General infection assumes different clinical forms, but it is impossible to make a classification of these which is free from objection. Moreover, such a division is of little practical value, as the same measures must be employed against different forms of general infection. From the clinical point of view, it is, therefore, best to speak only of general infection, and abandon the old, and often inappropriate, terms sepsis, septicæmia and pyæmia. In any case the term sepsis should be confined only to that form of general infection which is caused by the putrefactive bacteria; but this form is rare, and it is generally a question of mixed infection with putrefactive bacteria and streptococci.

Again, the distinction into metastatic and non-metastatic general infection, proposed by *Lexer*, is practically without value and does not hold good for all cases. In many cases non-metastatic cannot be distinguished from metastatic general infection,

especially as both often co-exist, or one may merge into the other. Lastly, when only small metastases are present in the internal organs, and they remain unrecognized, such a metastatic form may be wrongly regarded as non-metastatic.

Bacteriological research has shown that general infection is not due to one specific cause; staphylococci, streptococci, pneumococci, typhoid bacilli, bacterium coli commune give rise to *pyogenic general infection*, while putrefactive bacteria (proteus vulgaris, etc.) cause *putrefactive general infection*. These two forms are often combined, and clinically indistinguishable, so that the designation general infection is sufficient for practical purposes. On the other hand, the nature of individual cases should be made clear by bacteriological investigation.

It has been shown that in general infection caused by staphylococci there are usually metastasic formations (ninety-five per cent. according to *Lehnartz*). Local infection with staphylococci is generally circumscribed, while streptococcal infection is more diffuse. This may depend on the fact that the staphylococci are accumulated in large masses, but it has not been proved.

In streptococcal general infection, on the other hand, there are hardly ever any metastatic formations. As cases without metastases are clinically the most severe, and almost always fatal, a division into metastatic and non-metastatic general infection is identical with less-severe and more-severe infection. However, just as infection with very virulent staphylococci may be fatal without metastatic formation, so may infection with less virulent streptococci cause metastatic formation and end in recovery. In practice, we know that streptococcal local infection is more severe than staphylococcal, and this usually holds with general infection.

It is impossible to introduce the ideas of bacteriæmia and toxinæmia into clinical nomenclature, for

the characterization of general infection. Although general infection may exist without the presence of bacteria in the blood being capable of demonstration by the present methods of bacteriological research, bacteria are no doubt present in the blood in every case of general infection, but are quickly destroyed by the bactericidal substances. On the other hand, bacteria may be found in the blood in cases of general infection in which toxinæmia is not recognizable. If toxins are always present in the blood, they are not easy to find, especially as they have a tendency to form combinations with the organs. In general infection there is always bacteriæmia and toxinæmia, but in practice we only speak of general infection which is most often acute, rarely chronic.

Acute general infection may be primary or secondary; mild or severe. The severity of general infection depends on the number and virulence of the bacteria, and on the power of resistance of the body. The severest forms of general infection appear so rapidly after the local infection that the latter remains in the background; these forms are often fatal before the typical inflammatory processes have developed at the seat of infection. Such cases include those which often occur in doctors from infection during operations or post-mortem examinations (streptococcal infection); also from infection by putrefactive bacteria; or by mixed infection by a symbiosis of streptococci and putrefactive bacteria. To this class belong cases formerly called cryptogenetic pyæmia, which are better considered as latent general infection arising from unrecognizable foci of infection. Virulent bacteria must often invade the intact mucous membrane and give rise to general infection.

In the great majority of cases, however, general infection is of gradual onset, arising from a local infection; but it is often in an advanced condition before it is recognized. It may occur by direct

extension of suppuration, or may arise without further extension of the local disease.

The more rapidly virulent bacteria enter the blood from the local seat of infection, the more severely is the organism affected. This is shown in the temperature chart.

In the most severe forms the temperature rises rapidly and remains at 40° or 42° C. (104°–107° F.); such cases generally cause death in a few days without metastatic formations. In less severe forms the temperature does not remain high, but is intermittent. This may be due to the intermittent entry of the bacteria and their toxins into the blood from the seat of infection, or to smaller quantities of them. When the organism conquers the bacteria and their toxins by the formation of antitoxin, the temperature falls; when the bacteria gain the upper hand the temperature rises.

The longer the process continues, the more frequent are the rigors, with intermissions of temperature. When these variations in temperature follow each other rapidly (as occurs in the severest cases) the temperature becomes continuous, the rigors cease and there are no metastases. If the organism gains the upper hand, the infection expends its energy in the formation of local metastatic formations in various places. This, in a way, may be regarded as a victory of the organism over the bacteria.

In the milder forms of general infection we therefore find metastatic formations in those parts of the body which are specially constituted to absorb bacteria and render them harmless (peritoneum, pleura, endocardium joint cavities). Metastatic formation is to be regarded as a curative process, as the bacteria are to a great extent destroyed. These metastases caused by bacteria in the blood must be distinguished from metastases propagated from purulent thrombophlebitis, or emboli containing bacteria. In all these cases the blood-stream plays the principal part in

general infection, the rôle of the lymphatics being subordinate.

As in local infection, general infection is predisposed to by debilitation of the organism by exhaustion, hunger, and exposure to cold, and by diseases such as diabetes and tuberculosis, etc. Along with general predisposition, there is a local predisposition depending on the nature and seat of the lesion. Foreign bodies often lead to general infection, also machine-injuries, compound fractures, bites, and wounds of the mouth and rectum.

The deeper the infection and the greater the pressure on the bacteria, the greater is their virulence, and therefore the more frequent is general infection. This accounts for the frequency of general infection in deep suppurations, such as those under the cervical fascia, and in the bones and joints. It is well known that the internal surface of the uterus during the puerperium is especially liable to infection, which may become general, and that the retention of pus and blood effusions are dangerous. Lastly, the treatment of infected wounds with strong caustics, such as carbolic acid, may give rise to general infection.

As regards the clinical symptoms of general infection, various clinical pictures may be produced according to the kind of infection, but the morbid condition is uniform as regards its most essential points. Bacteriological examination must decide which bacteria have caused the infection, whether one or more different kinds are present, and whether they are present in the blood (bacteriæmia). As regards metastases, we can only speak of metastatic general infections when metastases are found during life; while cases in which no metastases are found cannot be called non-metastatic till the absence of metastases has been established by post-mortem examination. Small metastatic foci are often found post-mortem (especially in the kidneys), which were not recognizable during life.

The symptoms of general infection differ according as the onset is sudden and acute, or gradual and chronic. In the most acute forms the symptoms appear suddenly, while in the other forms there is a latent stage with disturbances in the general condition (insomnia, loss of appetite, headache, pain at the seat of infection) which are premonitory of general infection. A frequent small pulse points to the onset of general infection, before the rise of temperature. The temperature then rises suddenly to 39° or 41° C. (102°–106° F.), with rigors. We have already pointed out that in the most severe cases, in which numerous virulent bacteria remain in the blood, the body is only able to offer a slight degree of resistance. In these cases there is no fall in temperature and no formation of abscesses, and the infection is often fatal in twenty-four hours or a few days, with high, continued fever.

On the other hand, if the bacteria only enter the blood intermittently, there may be periods during which fever is absent (*e.g.* after evacuation of retained virulent secretion by incision). With fresh infection of the blood there is at the same time a rise of temperature. Hence the variations in the temperature chart. Although remissions in temperature are characteristic of mild, general infection, this remittent fever after some days may become continuous and fatal. For example, when an extremity has been amputated for progressive suppuration, the temperature falls; but it may rise again after a time, showing that the organism was already saturated with bacteria and their toxins, and that the operation was performed too late to save life. It is noteworthy that the pulse in remittent fever remains small and rapid during the fall of temperature, even after complete cessation of the fever, showing how much the heart is affected by the process.

If, after extensive operative interference, the temperature approaches normal, this may be regarded

as a good sign for the further progress of the case. A subnormal temperature is sometimes observed in the most severe cases of general infection, and signifies complete collapse of the organism.

The respiration is rapid, as in all feverish conditions, and may become stertorous in severe cases with loss of consciousness.

Besides sudden rise of temperature and rapidity of the pulse, the tongue shows conditions which are characteristic of general infection. Changes in the tongue are observed even in slight disturbance in the wound. The tongue is at first smooth, dry and salmon colored; later on it becomes rough, fissured and brownish black. In severe cases of general infection the teeth are also dry and coated with sordes. The conjunctivæ are yellow, and in severe cases there may be jaundice of the whole body (hematogenous icterus). The patients are continually tormented by sweating and thirst.

These characteristic symptoms are diagnostic of a general infection whose point of origin is concealed. On the other hand, in general infection arising from infected wounds, the earliest signs pointing to general infection are often observed in the wound itself. As every pyogenic condition may lead to general infection, the wound must be continually watched by frequent changing of the dressings. The experienced can often foresee the onset of general infection, from the appearance of the wound. Apart from cases of general infection following a slight abrasion of the skin or mucous membrane, the wound generally becomes painful and œdematous; the granulations become unhealthy and flabby; the discharge of pus subsides and gives place to a scanty, dirty, often fetid secretion; the surface of the wound becomes dry and often covered by diphtheroid membrane (Fig. 101). Retention of pus, necrosis, extension of suppuration, lymphangitis and lymphadenitis are often concomitant signs. In infection by putrefactive

bacteria (Fig. 109) there are bullæ in the infiltrated skin and crepitation due to the formation of gas, and bubbles of gas in the secretion. Unfortunately, these characteristic signs are often overlooked; operative interference which could prevent extension of the already commencing general infection is neglected, and the condition passes into a stage which is almost always incurable.

In no other condition is the organism so much altered as in advanced general infection, so that the clinical symptoms become indelibly imprinted on the memory of the observer. All the already-mentioned symptoms of commencing general infection become intensified in advanced cases. The patients at first become light-headed, then delirious, and finally unconscious. The indifference of patients in the advanced stage is in marked contrast to their feeling of fear in the early stage of infection, and is an unfavorable sign. In the final stage, shortly before death, if the patient has not permanently lost consciousness, he often has attacks of fear, or even maniacal attacks, followed by collapse. In this stage the patient can hardly be kept in bed, as he makes repeated attempts to go home, etc.

The gastro-intestinal canal is severely affected; vomiting of blood from submucous hemorrhage, vomiting of bile and uncontrollable diarrhea result from the action of toxins. The skin is pale and cold, and may present morbilliform eruptions, erythema, erysipelatous reddening, vesicular eruptions, punctiform hemorrhages or more extensive blood-effusions. Bedsores are also common.

Almost all the internal organs are saturated with bacteria and their toxins, and react in their special manner. Nephritis is manifested by albuminuria; meningitis gives rise to stiffness of the neck; pleuritis causes blood-spitting; pericarditis is manifested by pericardial friction, and endocarditis (which is very common and often ulcerative) by cardiac murmurs.

As in every severe infection, the spleen is enlarged, and sometimes there is acute bronchocele.

In streptococcal general infection there is nearly always suppuration in the joints; in staphylococcal infection, suppuration in the bones. Lastly, infective emboli or propagated thrombo-phlebitic abscesses (metastatic) may occur in all the organs, especially in staphylococcal infection. In this way multiple abscesses may appear in the skin. Metastatic abscesses may be cold and painless, and often contain few bacteria. Deeply situated subfascial and intermuscular abscesses often escape observation. Lastly, small multiple or large abscesses may occur in the lungs, heart, liver, kidneys, etc. According to *Waldeyer*, these abscesses are due to plugging of the smallest vessels. For example, plugging of the central artery of the optic nerve causes panophthalmitis, while plugging of a terminal artery in the lung causes an infarct. In this advanced stage of general infection, there is often frequent bleeding from the wound at the seat of the local infection, due to affection of the arteries. In the pre-antiseptic period many cases of amputation were fatal owing to this so-called septic secondary hemorrhage. In this stage bacteria are nearly always found in the blood. While an increase of bacteria in the blood is a bad sign, their disappearance is not always a good sign for the further progress of the case; for after the disappearance of bacteria from the blood in many diseases, the action of their toxins (toxinæmia) becomes manifest. Streptococci are more easily demonstrated in the blood than staphylococci.

According as the onset is gradual or sudden, and according to the degree and the course of the general infection, a many-sided but unmistakable clinical picture is produced.

The chronic forms of general infection, which occur after long-standing fistulas, suppuration and necrosis, are characterized by their gradual development and by

the slight severity of the symptoms. Many cases, however, are fatal from heart failure or albuminuria; or the chronic form may become acute. In chronic general infection there are often long periods free from fever, followed by rigors and rise of temperature. In the chronic forms metastatic abscesses are more common. In such cases recovery may take place after removal of the primary cause, but it requires several months to restore the weakened body. Again, acute general infection may become chronic, and occasionally end in recovery.

It is only young and robust bodies that can offer an effective resistance against such a destructive morbid condition, and then only in the early stages of infection. The organism cannot withstand the destructive action of a fully developed general infection. These cases are all fatal. Even in the early stages of general infection the heart may become so weak by the action of toxins, that death occurs from collapse before the full development of the clinical picture. Staphylococcal infection, with its tendency to metastatic formation and its remittent type of fever, is more likely to recover than streptococcal infection; this is generally fatal in a few days, with continued fever and increase of all symptoms, but without metastatic formation.

Differential Diagnosis. Although the clinical symptoms of a typical case of general infection are unmistakable, cases in which the origin of infection remains unrecognized, or cases of chronic general infection may be mistaken for typhoid, miliary tuberculosis or acute rheumatism. Severe inflammations, erysipelas (especially hemorrhagic bullous erysipelas) may be associated with such high temperature and rigors, etc., that it is difficult at first to distinguish whether the symptoms are due to the local condition, or to the commencement of general infection. The progress of the disease will decide. It must, how-

ever, be borne in mind that in these cases there is generally already commencing general infection, especially in cases of progressive inflammation.

Treatment. Apart from cases in which the most acute form of general infection arises from comparatively slight lesions, some cases may be cured by proper treatment of infected wounds (Fig. 93), and by early diagnosis of commencing general infection. Special attention must be devoted to the place of entry of the infection. Free incisions are here required. Infected joints must be resected. In some cases of severe general infection and progressive suppuration in the extremities, amputation should not be too long delayed.

In threatening general infection from purulent thrombo-phlebitis of the large veins, ligation should be performed; for instance, of the jugular vein and anterior facial vein in carbuncle of the face; of the internal jugular vein in otitis media. Metastatic abscesses must be opened early. Metastatic joint effusions should be incised. Pleural effusions require aspiration or resection of the ribs. Suppuration in the internal organs (liver, brain, kidneys) require operative interference.

Antipyretics are best avoided on the whole, as they obscure the symptoms and weaken the heart. In severe cases high temperature may be reduced by tepid sponging. The heart must be supported by stimulants. Nourishing diet is required (if necessary by esophageal tube). Subcutaneous or intravenous injections of saline solution are often useful. Subcutaneous injections of nucleinic acid with salt solution have been recommended. Not more than two hundred to three hundred cubic centimeters of solution should be injected at one time into the veins. Injections of colloidal silver, anti-streptococcal serum and polyvalent serum (*Aronsohn*) have generally no influence on the disease.

On account of the danger of infection to others, the patients should be isolated and treated by special attendants. The body must be frequently bathed with alcohol or spirit of camphor to prevent the formation of bedsores, especially on the back and buttocks. The wound at the seat of infection must be dressed at least once or twice a day to prevent accumulation of pus. Frequently changed moist dressings are the best. Iodoform gauze should be avoided, as it is rapidly decomposed by the secretion and gives rise to toxic symptoms. Disinfection of the wound with strong antiseptics is to be avoided on account of its injurious effect on the tissues. The affected parts of the body should be completely immobilized. Rubber gloves should be worn when dressing the wounds, and no aseptic operation should be performed on the same day by the surgeon who dresses them.

After recovery from general infection great care must be taken of the body, in order to give encapsuled traces of the disease an opportunity to heal. These encapsuled metastatic foci may at any time (even after some years) become virulent from some exciting cause, and give rise to fresh infection. Patients often succumb, after some years, to nephritis, endocarditis, pleurisy or pneumonia. In these cases strychnine is useful.

Fig. 108 shows a case of acute general infection arising from a subcutaneous whitlow, which was insufficiently incised and extended to the tendon-sheath and the joint. The temperature rose to 41° C. (106° F.), with rigors; remained high for a few days and then became remittent, during the formation of several subcutaneous metastatic abscesses. An abscess developed gradually in the thigh; this was incised, and thin pus containing a few staphylococci evacuated. Staphylococci were also present in the blood for some time. Other symptoms were—dry tongue, jaundice, slight delirium, and diarrhea.

The wound in the finger was dry and unhealthy. After disarticulation of the finger there was no extension of infection to the hand, and the whole condition improved. Under the above-mentioned treatment, with injection of saline solution, etc., recovery took place in a few months. Several metastatic abscesses required incision during the course of the disease. After removal of the finger, bacteria were no longer found in the blood—a proof that the virulent bacteria in the blood were derived from the seat of infection. The pulse remained rapid for a long time after recovery.

GASPHLEGMONE (*Gaseous phlegmon*)
ŒDEMA MALIGNUM (*Malignant Œdema*)
PHLEGMONE EMPHYSEMATOSA—GANGRAENOSA
(*Gangrenous, emphysematous phlegmon*)
Plate LXXXVII, Fig. 109.

We have already mentioned (Fig. 101) the progressive putrefactive inflammation which often occurs in necrosed tissues, and in the wounds of diabetics. Similar conditions of progressive inflammation, under various names, accompanied by rapid necrosis and the formation of gases in the tissues, give rise to general infection, and run an unfavorable course.

Pirogoff described these cases as acute purulent œdema, *Maisonneuve* as fulminating gangrene, others as gasphlegmon, gangrenous phlegmon, etc. The putrid necrosis of wounds known as "hospital gangrene," which was so common in the pre-antiseptic days, appears to be nothing more than putrefactive inflammation due to gas-forming bacteria. All these conditions are best included under the name *progressive gaseous phlegmon*. The causes of these phlegmons are not well known, as they are anærobic bacteria which have not yet been well differentiated from each other by bacteriological methods. They are found most often in dust, manure and putrid flesh.

The bacillus of malignant œdema, the *bacillus emphysematosus* and the *proteus vulgaris* are the bacteria at present found, generally in symbiosis with the ordinary pus-forming bacteria, especially streptococci. By this symbiosis the growth of the anærobic bacteria is at first made possible in open wounds, and through the combined action of both

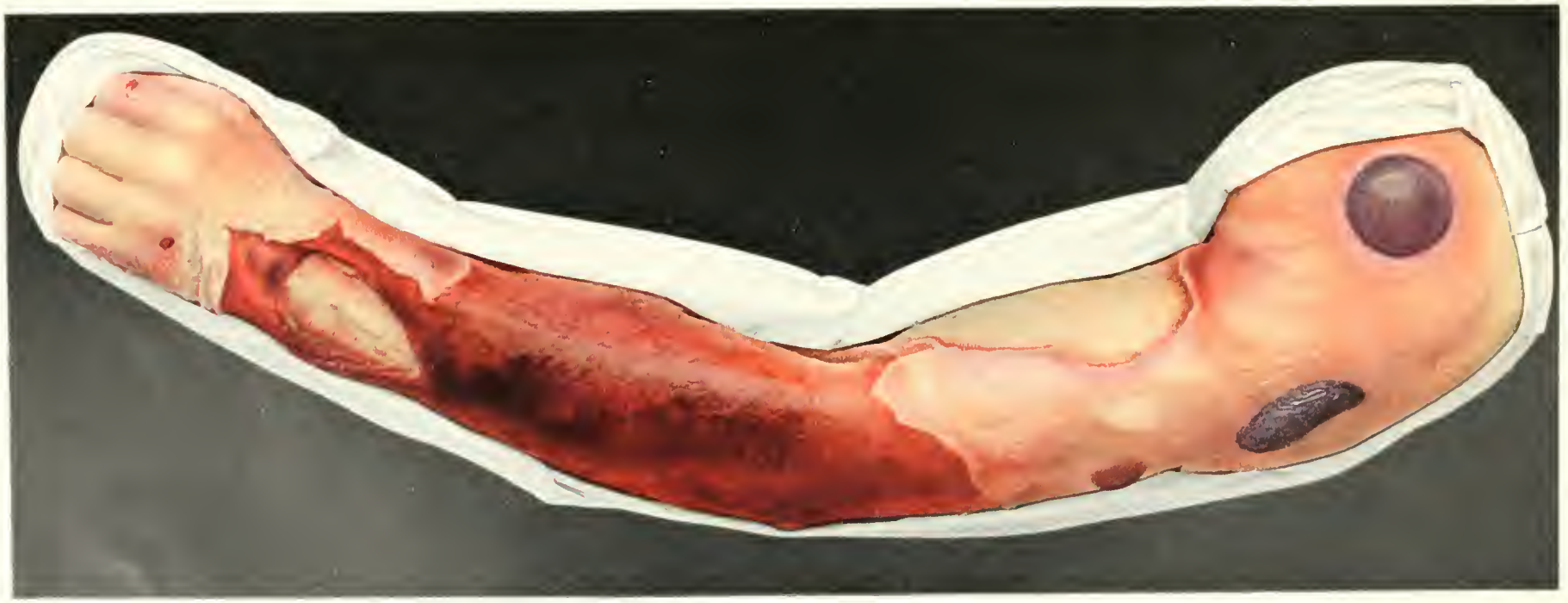

Fig. 109. Oedema malignum. Phlegmone emphysematosa-gangraenosa.

forms of bacteria rapid and extensive destruction of tissue may be caused. Sometimes gaseous phlegmon is found after quite harmless lesions of the skin (Fig. 109), also after compound complicated fractures with small wounds.

Gaseous phlegmons occur in the extremities; on the back, in connection with bedsores; in operative wounds on the rectum, through infection by fæces; in the penis, scrotum and perineum, from lesions of the urethra with extravasation of urine; in the neck, after lesions of the esophagus and pharynx. The progress of gaseous phlegmon is extremely rapid; in a few hours large portions of the body are affected by the rapid formation of gas. As gaseous phlegmon may occur after apparently slight injuries, it is necessary to emphasize the necessity of frequent dressings in order to control the progress of infection.

The wound becomes dry, coated and fetid, and extensive swelling rapidly extends from it on all sides. The discharge from the wound is brownish or greenish, fetid, and mixed with necrotic shreds of tissue. High temperature, rigors, severe pain, anxiety and later on delirium and frequent pulse indicate the onset of general infection.

The circulation is obstructed by the great pressure of gas in the tissues. The skin of the extremities becomes pale and cold, and presents brown and green spots, and punctiform hemorrhages. Small vesicles filled with dark fluid then appear, which later on become larger; finally the whole epidermis of the affected parts is raised, and underneath it is offensive, dirty fluid. In other places the skin is reddish brown, hard, and infiltrated. There is no formation of a circumscribed fluctuating collection of fluid, but the tissues are saturated with fetid, sanious fluid containing bubbles of gas. On pressure the characteristic crepitation of cutaneous emphysema is heard. The infiltration is seen best after incision. The tissues cannot be distinguished from each other—muscles,

fascia and periosteum are transformed into sodden, homogenous, greenish shreds. If the medullary cavity of a bone is opened, it is filled with sanious fluid. Sometimes circumscribed cavities containing fluid and gas are found under the skin. Pressure of gas may cause gangrene of the peripheral parts of the extremities, resembling the putrefaction of a corpse (Fig. 109). At the same time there is rapidly extending lymphangitis, in the form of reddish-blue or reddish-brown cords; the color being due to congestion in the tissues. The lymphatic glands are infiltrated and painful. The veins are affected with thrombo-phlebitis. Finally, the arteries are destroyed, and severe hemorrhage ensues. The neighboring joints are filled with sanious fluid (*e.g.* the hip joint after extravasation of urine.

The formation of gases in the subcutaneous tissue may extend to large portions of the body; for instance, from the neck to the thorax and abdomen, and from the coccyx over the whole of the back. Death generally occurs from general infection, when the formation of gases is found in the internal organs at the autopsy. Gaseous phlegmon in the neck may cause death from œdema of the glottis or from mediastinitis. In spite of the general infection bacteria are not usually found in the blood.

Differential Diagnosis. Gaseous phlegmon in the early stages may be mistaken for progressive streptococcal inflammation. Hemorrhagic bullous erysipelas (Fig. 91) and anthrax (Figs. 112 and 113) may also cause great swelling of the skin with formation of bullæ. However, gaseous phlegmon is distinguished from the above by its rapid course, by the necrosis of the tissues, by the fetid secretion containing gases, and by the crepitation in the œdematous parts. In doubtful cases bacteriological examination must be made.

Treatment. Early and free incisions are indicated to open up the tissues and deprive the anærobic bacteria of their conditions for existence. In compound fractures with infection of the bones and joints, amputation is necessary to save life. If the gaseous infiltration has already extended above the seat of fracture, amputation may be performed a short distance above this point, and the infiltrated tissues of the stump freely incised. The wound should be dressed with dry aseptic tampons (*not* iodoform), or moist dressings with mild antiseptic lotions. Disinfection with strong lotions is injurious.

In extravasation of urine external urethrotomy is required, besides free incisions. In gaseous phlegmon of the neck a preliminary tracheotomy is necessary before making incisions, on account of the danger of œdema of the glottis.

Fig. 109 shows a characteristic case of gaseous phlegmon. In a young man two small abrasions were caused by a meat-knife, one on the index finger and one over the fifth metacarpo-phalangeal joint. In a few hours the forearm became enormously swollen, and in a few days the swelling extended over the whole arm. The patient became delirious and finally completely comatose. After incision, the tissues were found infiltrated with fetid sanious fluid containing numerous necrotic shreds. The elbow and shoulder joints were full of sanious fluid. The fingers were cold. Bacteriological examination showed the presence of putrefactive bacteria and streptococci. There were no bacteria in the blood. There were the usual signs of severe general infection (dry tongue, jaundice, etc.). In spite of free incisions, and disarticulation at the shoulder joint on the third day, the patient died.

LYMPHADENITIS (BUBO) INGUINALIS DIFFUSA

(*Diffuse Inguinal Adenitis* (*Bubo*)

Plate LXXXVIII, Fig. 110.

Pyogenic affection of the lymphatic glands has already been mentioned in the case of glandular inflammation in the neck (Fig. 102). The lymphatic glands act as barriers which stop the bacteria brought to them by the lymphatic vessels and destroy them, unless they are too numerous and virulent, when they become themselves affected. Besides the common pyogenic affections of the glands of the neck, the axillary and inguinal glands are often affected. The inflammation may be acute or chronic. Injuries, eczema, and pyogenic affections such as whitlow, abscess, lymphangitis or erysipelas may give rise to an acute purulent lymphadenitis or to chronic lymphadenitis, usually staphylococcal. The point of origin is often invisible, for a small excoriation of the skin may heal before the lymphangitis to which it gives rise becomes apparent.

Abscesses of unknown origin (*e.g.*, in the abdominal wall) generally arise from suppurating aberrant lymphatic glands. The inguinal glands (inguinal bubo) may be affected after ingrowing toenails, excoriations (Fig. 110), soft chancre or gonorrhea. In the last case gonococci are found in the pus.

The acute forms are very painful and prevent movement of the limb. The skin becomes red, and is at first movable over the inflamed glands; but it gradually becomes infiltrated and bluish red in color. Pyogenic infection of the lymphatic glands may give rise to diffuse suppuration of the surrounding tissue (periadenitis) which may extend rapidly in the sub-

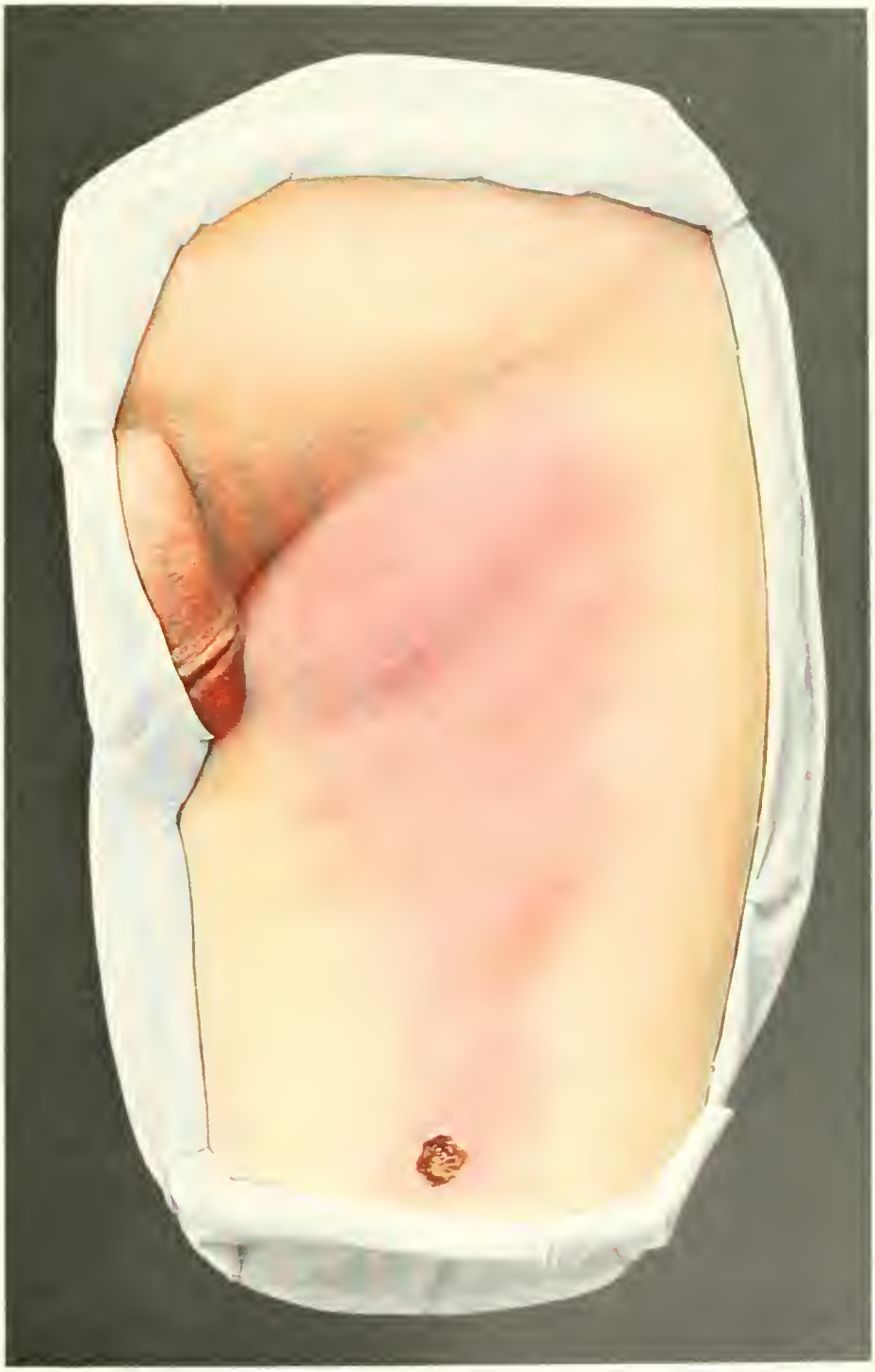

Fig. 110. Lymphadenitis inguinalis diffusa (Bubo).

cutaneous tissue, both superficially and deeply (Fig. 110). In this form there are rigors, fever and constitutional disturbance. More often the inflammation is localized and gives rise to a circumscribed abscess (Fig. 114). The skin becomes thin and the pus is discharged through a fistula. After this the pain subsides; but the fistula does not heal, because the whole gland is generally necrotic and is gradually cast off, giving rise to infection of the neighboring lymphatic glands and the formation of multiple fistulas.

Diffuse suppurative lymphadenitis causes still greater destruction for there is not only necrosis of the glands themselves but also of the periglandular tissue, and even of the subcutaneous tissue in extensive cases. Moreover, burrowing abscesses may develop in remote places; for instance, in the pelvis after inguinal adenitis, and in the retro-pharyngeal tissue after cervical abscesses. Again, general infection may occur from thrombo-phlebitis (*e.g.*, from thrombo-phlebitis of the pelvic veins after inguinal bubo. All these complications can be avoided by early incision.

In the chronic forms inflammatory symptoms are absent. A slightly painful thickening develops in one or more glands, after long-continued irritations, inflammation in the neighboring parts, eczema, pediculosis, ulcers, etc. Finally, a small, irregular, movable swelling is formed in the subcutaneous tissue, covered by normal skin. Recovery takes place after removal of the cause; but in long-standing cases a permanent swelling may remain (fibrous hyperplasia).

Differential Diagnosis. Acute lymphadenitis is characteristic and easy to diagnose by occurring in the situation of the various groups of lymphatic glands. The diagnosis of submaxillary and cervical lymphangitis from alveolar periostitis, dermoids, sebaceous cysts and tuberculous abscesses has al-

ready been given (Fig. 102). Acute lymphangitis may be mistaken for sweat-gland abscesses, especially in the axilla, but these are usually small, multiple and circumscribed. In the inguinal region a hernia may be mistaken for a bubo, especially when the sac of the hernia is inflamed and is situated over the glands. This error is more likely to occur in incomplete hernias in women. In these cases diagnosis is often only made after incision. Suppuration arising from neighboring bones or joints may also simulate lymphadenitis. Tuberculous lymphangitis may cause inflammatory infiltration, and painful enlargement of the glands accompanied by fever; but the glands are softer and of less uniform consistence. If a fistula is present the diagnosis is more easy (Fig. 125). Tuberculous abscess is of slower development, and is generally associated with various degrees of infiltration of neighboring glands. Lastly, the thin greenish pus is characteristic.

Chronic lymphadenitis may be mistaken for metastatic carcinomatous disease of the glands; *e.g.*, of the inguinal glands after cancer of the anus. These glands, however, are hard and more or less fixed. Syphilis gives rise to multiple hard infiltrations of the lymphatic glands in various parts of the body.

Treatment. Pyogenic infection of the lymphatic glands can often be avoided by removal of the primary cause. In acute lymphadenitis early incision will prevent the complications mentioned above. If this is neglected, not only the whole of the lymphatic glands of the affected region, but also the subcutaneous tissue may undergo necrosis; also œdema or elephantiasis of the extremity may develop, owing to the obstruction of the lymphatic circulation. Elephantiasis may also occur after total extirpation of the lymphatic glands (Fig. 71). This may be avoided by taking care not to remove too much of the fatty connective tissue along with the glands; this tissue

carries on the lymphatic circulation after removal of the glands, and new glands are also formed from it. In the groin and axilla a careful dissection of the glands must be made, avoiding the great vessels.

Circumscribed abscesses are best opened by a free incision. Treatment by poultices or icebags, aspiration, puncture and injection of various fluids, massage and inunction of mercurial ointment are best avoided. The affected parts should be immobilized to prevent extension of the infective process. Patients should, therefore, stay in bed. Commencing infection of the lymphatic glands often undergoes spontaneous resolution. Acute lymphadenitis of the neck caused by infections such as diphtheria, may subside spontaneously; so may chronic lymphangitis when it is not of too long standing, and when the cause is removed. Inunction with iodide of potassium or iodine-vasogen ointments is useful in chronic lymphangitis. In cases of large glands causing pain, or of multiple fistulas connected with chronic lymphadenitis, the glands should be extirpated, and the wounds plugged for a long time with iodoform gauze to prevent relapse.

Fig. 110 shows a case of acute lymphadenitis of the inguinal region, occurring after an excoriation of the skin of the thigh, which has already scabbed over. Infiltration of the skin and subcutaneous tissue extends from the genito-crural fold down the thigh. The symptoms were pain and difficulty in walking, followed by fever and rigors. Under an anæsthetic an incision was made below and parallel to *Poupart's* ligament. The inguinal glands were swollen, and contained numerous foci of suppuration; but there was no extensive necrosis, nor any large collection of pus. The wound was plugged with iodoform gauze and the leg immobilized on a splint. The wound healed after a part of the gland which had necrosed came away.

ARTHRITIS GONORRHOICA PHLEGMONOSA

(*Phlegmonous Gonorrheal Arthritis*)

Plate LXXXIX, Fig. 111.

In the course of both acute and chronic gonorrhea the joints may be affected by general gonococcal infection of the blood. In the acute stage of gonorrhea, arthritis may be caused by the passage of bougies or by overexertion, etc. In women it may occur during pregnancy. In chronic gonorrhea it may be caused by sexual excess. Gonococci may remain for a long time in a latent state encapsuled in the mucous membrane, and when set free by mechanical irritation may again become virulent. Recurrence of gonorrheal arthritis may take place in cases of neglected gonorrhea, also after a fresh attack of gonorrhea.

Through invasion of the joints by the gonococci and their toxins inflammation is set up which may be serous, fibrinous or purulent. Most commonly the arthritis is fibrinous, suppurative arthritis being rare and generally caused by mixed infection. One or several joints may be affected at the same time, or successively. Acute gonorrheal arthritis is very sudden in its onset, and characterized by severe pain, preventing any movement of the affected joint. In a few hours the soft parts become infiltrated and œdematous, the infiltration remaining more or less limited to the region of the joint, or spreading to the neighboring muscles and tendons. The skin is red and tense (Fig. 111). In severe cases there is high fever and complete loss of function. In chronic gonorrheal arthritis there are usually aching pains in the joint before the arthritis becomes evident.

Fig. 111. Arthritis gonorrhoica phlegmonosa

The knee joint is most often affected in men; the elbow and wrist in women. The hip, ankle and temporo-maxillary joints are also often affected.

In cases of serous or sero-fibrinous effusion, limited to the joint, the swelling generally subsides in one or two weeks, and recovery takes place without loss of function. In the more common form of *fibrinous arthritis*, however, the process is more severe, especially when the infiltration extends to the periarticular tissue and the soft parts. In these cases the arthritis is accompanied by fever and rigors, and there is sero-fibrinous effusion into the neighboring parts, but no formation of pus. The inflammation affects not only the synovial membrane, but may cause destruction of the cartilage and extend to the bone. This may result in fibrous, cartilaginous or bony anchylosis (X-ray examination). Destruction of the capsule of the joint may cause subluxations or dislocations, and the prolonged immobility may lead to muscular atrophy.

In the rarer forms of suppurative arthritis there is continued high fever with rigors, and severe constitutional disturbance. The skin is red and there is great swelling of the affected parts.

If several joints are affected different forms of gonorrheal arthritis may occur in the various joints. Multiple relapsing arthritis may reduce the patients to a deplorable condition, as they often cannot walk or use their arms. Such cases may be fatal from gradual exhaustion.

Differential Diagnosis. Gonorrheal arthritis may be mistaken for acute rheumatism; but the latter usually affects a greater number of joints, and the acute stage of inflammation is not so prolonged as in gonorrheal arthritis. Purulent gonorrheal arthritis must be diagnosed from other suppurations in joints by the history, by the presence or history of acute or chronic gonorrhea, or by bacteriological examination after puncture of the joint.

Chronic gonorrheal arthritis is often difficult to distinguish from certain forms of syphilitic arthritis, especially when both diseases have been contracted together.

Tuberculous arthritis is usually easy to distinguish by its characteristic signs (Fig. 125).

Treatment. On account of the severity of the disease and the possibility of a fatal ending, especially from endocarditis, the prophylactic treatment of gonorrhea is important. Washing immediately after coitus, vaginal injections in women, the instillation of a few drops of weak silver nitrate solution into the urethra after coitus, and the avoidance of any kind of irritation (alcohol, etc.), will often prevent gonorrheal infection. Gonorrhea should be regarded as a serious disease and treated accordingly. In gonorrheal arthritis the urethra should always be examined, and treated if gonorrheal urethritis is present.

The subacute or serous forms of gonorrheal arthritis subside in one or two weeks after rest in bed; but too early movement may cause relapse. In fibrinous arthritis, on the other hand, too long immobilization may lead to anchylosis. Immobilization (by plaster of Paris bandages, or better by extension splints) should, therefore, not be continued longer than one or two weeks; after which gentle massage, active and passive movements or hot air treatment should be tried. *Langenbeck* has recommended "animal baths" for cases of stiffness; *i.e.*, placing the affected part in the viscera of a freshly killed animal, to obtain the effect of animal heat. Sandbaths are also worth a trial. If an acute relapse occurs in the course of the disease the joint must be again immobilized. In any case, movements of the joint must be carried out after two or three weeks; otherwise bony anchylosis may occur. Injections of morphine may be given before the performance of massage or passive movements, or cocaine may be injected into the joint (0.05 cubic

centimeters of a five per cent. solution). Injections of carbolic acid and protargol solution into the joint have also been recommended. The best method of treatment would be injection of antitoxin, as the inflammation is primarily caused by the gonotoxin.

[In one case a good result was obtained by injection of meningococcus-serum *Boekenheimer.*]

By careful after-treatment complete function can generally be restored even in severe forms of gonorrheal arthritis.

Bier's treatment by passive hyperæmia has a good effect in these cases, and may be tried in all cases of gonorrheal arthritis where there is no suppuration. After application of the elastic bandages, the joints become painless (in about fifty per cent. of cases), so that the patients do not hold them so stiffly, and early movements can be performed, thus giving a better functional result. In severe cases the joints should be bandaged to protect them against injury, the bandages being frequently removed and movements performed. The elastic compression bandages should be applied at first for two or three hours, later on for twenty hours. This treatment may be carried out without danger in out-patient practice (polyclinic).

If there is much destruction of the joint, with subluxation or anchylosis in a faulty position, resection may be required. Fibrous contractures are common after gonorrheal arthritis; these can be corrected under an anæsthetic, and that function restored by appropriate after-treatment. In suppurative arthritis, which is often complicated by lymphangitis, lymphadenitis and other pyogenic conditions, arthrotomy or resection of the joint must be performed to avoid general infection. These cases require longer immobilization of the joint.

Fig. 111 shows a case of acute and painful swelling in the region of the wrist joint in a woman. The skin was red and tense. The swelling rapidly extended

to the forearm and to the fingers, so that the patient could not use the arm. The wrist joint and the metacarpo-phalangeal joints could not be moved. Examination of the genitals showed gonorrhea. On the following day the joint effusion increased and was partly evacuated by puncture. Gonococci were found in the fluid. Under treatment by passive hyperæmia the pain subsided in a few days and the acute inflammation became chronic. Massage, active and passive movements, combined with passive hyperæmia, restored the function in four weeks.

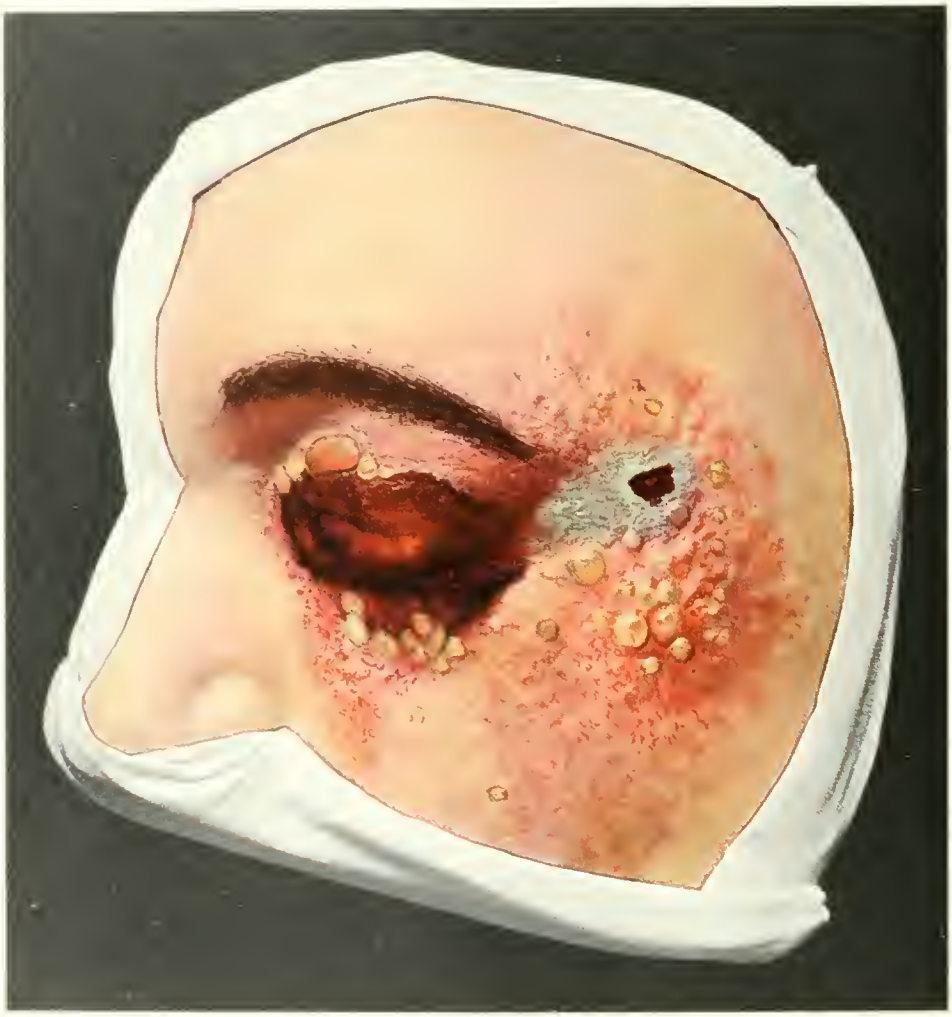

Fig. 112. Anthrax Pustula maligna.

ANTHRAX — PUSTULA MALIGNA

(*Anthrax—Malignant Pustule*)

Plate XC, Fig. 112.

ANTHRAX — NECROSIS (*Anthrax necrosis*)

Plate XCI, Fig. 113.

Anthrax (splenic fever) is a bacterial disease which occurs externally on the skin, and internally in the lungs and alimentary canal. The bacteria have a characteristic appearance. They consist of immobile rods (bacilli) with sharp, angular corners, and are often arranged in a row in long chains. In the center of the rods are clear spaces corresponding to spores, which are very resistant to dryness and heat. The anthrax bacillus was carefully studied by *Koch*, while *Pasteur* originated the protective inoculation of animals with attenuated cultures. The bacilli and spores are found in the alimentary canal of animals (horses and cattle); also in damp soil on which these animals graze, and in the skin, fur and excrements of animals infected with splenic fever (Rinderpest or cattle fever). Epidemics of anthrax are common in Egypt, as the excrements of animals are used as fuel for cooking purposes. The disease is common in Siberia in the skin trade and is known as Siberian plague. Butchers, skinners, ragsorters, tanners, paper makers and workers in horsehair are liable to anthrax infection. The disease has been observed in farmers, owing to the custom of treating horses and cows affected with colic by passing the hand into the rectum. The disease may also be transmitted by earthworms and flies. The bacilli may remain localized at the seat of infection, or may enter the bloodstream and give rise to metastatic foci in other places; while their toxins play a subordinate part.

The external form of anthrax occurs on the skin of the neck or face after small abrasions of the skin, through which the bacilli enter. The infection may be conveyed to the mouth by the finger, and the spores may thus be inhaled or swallowed, and give rise to anthrax of the lung or intestines respectively.

Anthrax of the skin has a very characteristic appearance. A small, red spot first appears, with fever and often rigors; this develops into a small vesicle with yellowish or turbid fluid containing anthrax bacilli (malignant pustule). The pustule ruptures and is replaced by a scab. At the same time the surrounding skin becomes green—a sign of commencing necrosis. The early appearance of necrosis of the skin is characteristic of anthrax (Fig. 112). The tissues become infiltrated in the same way as in carbuncle (cf. Fig. 89), and œdema occurs where the skin is loosely attached to the subcutaneous tissue (*e.g.* eyelids). The redness of the skin extends rapidly and irregularly, resembling erysipelas. Other vesicles appear and rupture, after which there is extensive necrosis of the skin (Fig. 113).

In the extremities, along with the above symptoms, there is always lymphangitis and lymphadenitis, which may form abscesses by mixed infection. There is always considerable constitutional disturbance, with fever, rigors, headache and rapid pulse. Multiplication of the bacilli in the blood gives rise to symptoms of general infection—dry tongue, jaundice, diarrhea and swelling of the spleen. Death may result from collapse in a few days.

External anthrax has a more favorable prognosis than internal (mortality twenty-five per cent.), but anthrax of the face is very dangerous. The more marked are the local symptoms the more likely is general infection. Moreover, anthrax of the face may easily infect the mouth, and thereby cause infection of the lungs or alimentary canal. In the milder forms of general infection metastatic inflammations

are caused by emboli in the skin, lungs, alimentary canal and brain; giving rise to pleurisy and pneumonia, ulcers of the gut, peritonitis and meningitis, which are generally fatal. Primary internal anthrax may also cause secondary infection of the skin by metastatic deposits.

The usual form of internal anthrax is that affecting the intestine, caused by infection from the mouth; by bacilli conveyed by the finger, or by eating the flesh of infected animals. This gives rise to hemorrhagic ulceration of the small intestine, with a tendency to gangrene. About eighty per cent. of cases are fatal from peritonitis or general infection. Bacilli are found in the stools.

In the lungs anthrax is more rare and is caused primarily by inhalation of the spores. It occurs among manufacturers of paper and horsehair and among ragsorters, sometimes in an epidemic form. The patients are suddenly attacked with symptoms of pneumonia and high fever. The sputum is blood-stained and contains anthrax bacilli. About eighty-nine per cent. of these cases are fatal from pulmonary œdema and pleurisy.

Both external and internal anthrax may occur simultaneously, and the disease is then almost always fatal from general infection.

Differential Diagnosis. Pyogenic infections, such as virulent streptococcal or putrefactive inflammations (cf. Fig. 109), and hemorrhagic bullous erysipelas may cause the formation of bullæ on the skin, and may, therefore, be mistaken for anthrax; but these affections run a different course and do not lead so quickly to necrosis of the skin. Glanders also gives rise to the formation of bullæ and gangrenous ulceration, but the characteristic carbuncular infiltration of anthrax is absent. In doubtful cases anthrax bacilli must be looked for in the fluid of the bullæ. This is especially important, as the

treatment of anthrax differs from that of the above-mentioned affections.

Treatment. Prophylactic treatment consists in strict supervision of trades in which there is a danger of anthrax infection. Skins of animals should be disinfected, and workmen should be warned of the danger of infecting the mouth from handling skins, rags, horsehair, etc., especially during meals.

The less the local infection is irritated, the less is the danger of the bacilli entering the blood. For this reason both incisions and the thermo-cautery are contra-indicated, as they often cause extension of the infiltration or even general infection (*von Bergmann*). Scabs and necrosed tissue must, therefore, be left to separate spontaneously. The infected area should be dressed with ointment to prevent auto-infection of the patient. If the disease occurs in the extremities they must be fixed on splints. Abscesses in the lymphatic vessels and glands caused by mixed infection must be opened. Extensive necrosis of the skin sometimes necessitates a plastic operation (Fig. 113). As in other infective diseases, nourishing diet, stimulants, absolute rest and isolation are required. In severe cases the injection of *Sclavo's* serum in the region of the infected area is recommended.

Fig. 112 shows a case of external anthrax in a tanner, which developed after a slight abrasion of the skin. It began as a red papule, followed by several vesicles full of yellow fluid containing anthrax bacilli. At the same time there was erysipelatous reddening of the skin, carbuncular infiltration of the tissues, and œdema of the eyelids. The vesicle at the point of infection ruptured and was replaced by a scab, round which the skin gradually became gray and necrotic. Fever and rigors set in, and the disease spread to the eyelids. Fresh vesicles appeared, with further gangrene of the skin after their rupture. The

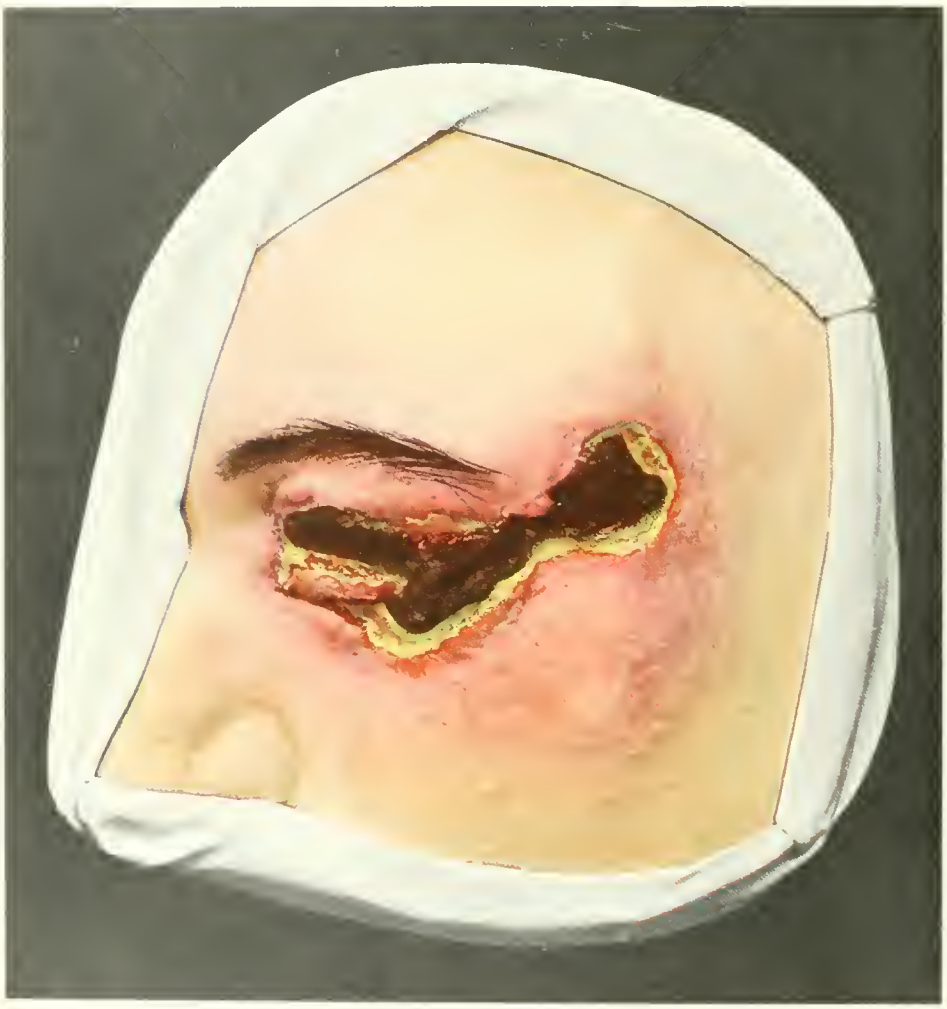

Fig. 113. Anthrax Necrosis.

affected area was covered with ointment and the symptoms gradually subsided, without internal anthrax or general infection supervening.

Fig. 113 shows the same case a few weeks after infection. The leathery, blackened, necrosed skin is separated by a zone of pus and slimy granulation tissue from the surrounding skin, which is still red and infiltrated. The necrosed skin is firmly adherent to the subjacent tissues. Removal of this by the knife or sharp spoon would only cause a further outbreak of infection. It was, therefore, allowed to separate gradually under treatment by moist dressings of peroxide and boric acid and ointments. In this case, after separation of the necrosed skin, the defect was repaired by a plastic operation, and the upper eyelid restored by a pedunculated flap. The patient recovered, in spite of the unfavorable prognosis in anthrax of the face and the severity of the local infection.

LYMPHADENITIS CIRCUMSCRIPTA ABSCEDENS

(Circumscribed suppurative lymphadenitis)

Plate XCII, Fig. 114.

In this case a circumscribed abscess formed in the lymphatic glands behind the ear, as the result of pediculosis of the scalp. The skin was red and thin at apex of the swelling. Fluctuation was present. There was no fever nor constitutional disturbance. The submaxillary lymphatic glands were enlarged and slightly painful on pressure. The abscess was incised, and the submaxillary glands inuncted with iodide of potassium ointment. Healing took place in a short time.

The figure shows the gluing together of the hairs and the punctiform deposits on them (nits) due to pediculosis. The frequent irritation has caused eczema of the scalp. Infection of the lymphatic glands is caused by infection through scratches. The treatment consists in removing the cause (*i.e.* the pediculosis) by rubbing in ten per cent. naphthol ointment. The nits can be removed by washing with soft, green soap, weak liquor potassæ or weak acetic acid and subsequent combing. The eczema generally disappears when the pediculosis is cured. The prophylactic treatment of pediculosis consists in cleanliness.

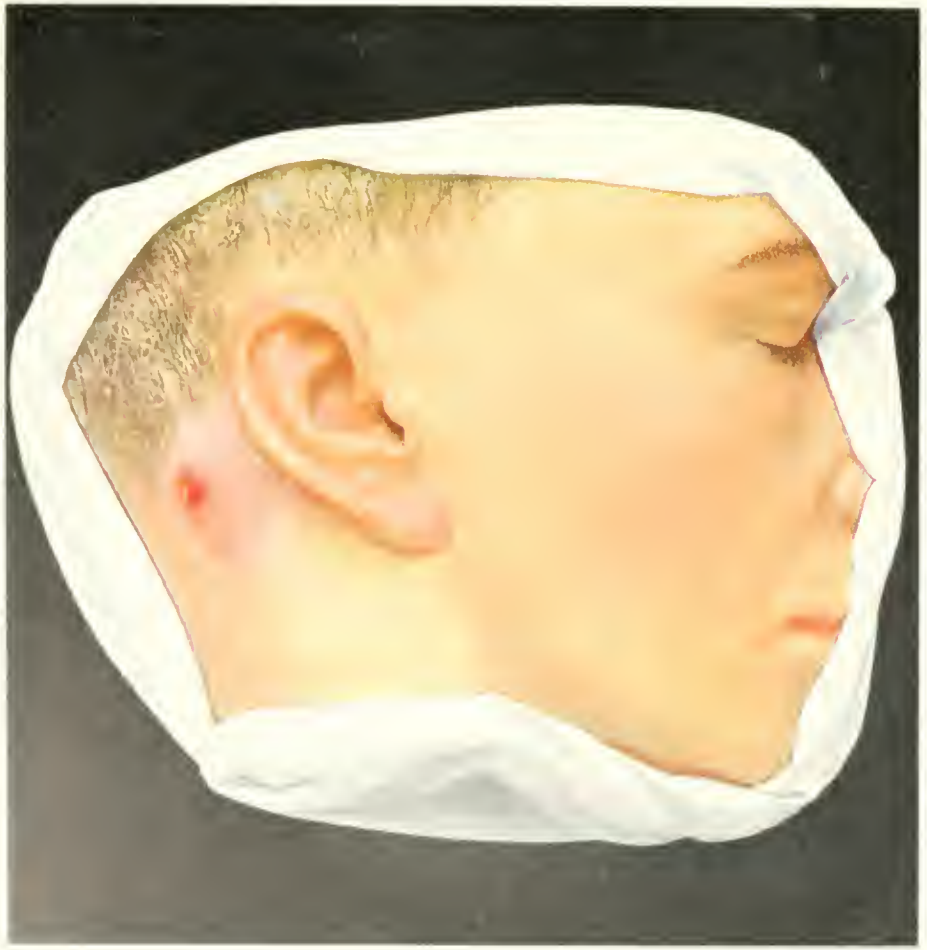

Fig. 111. Lymphadenitis circumscripta abscedens.

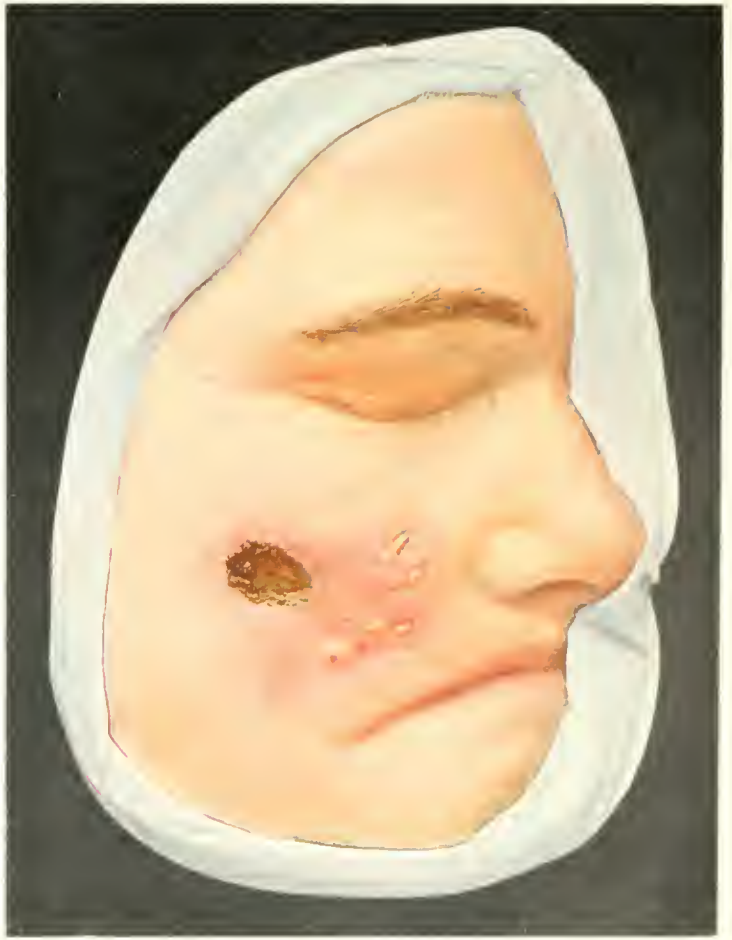

Fig. 115. Aktinomykosis incipiens.

Actinomycosis

ACTINOMYCOSIS INCIPIENS (*Incipient Actinomycosis*)
Plate XCII, Fig. 115.
ACTINOMYCOSIS PROGRESSIVA (*Progressive Actinomycosis*)
Plate XCIII, Fig. 116.

Actinomycosis is a chronic infective disease caused by a fungus (*actinomyces*), which is called the ray-fungus on account of the radiating arrangement of its mycelium. Actinomycosis was first described by *Langenbeck*, and later by *Bollinger*, in the form of new growths in the lower jaw of cattle and horses. In 1878 *Israel* found yellow bodies in the pus from a patient who was supposed to have died of chronic pyæmia; the yellow bodies were found to be actinomyces. Later researches have shown that there are different forms of actinomyces. The fungus is best stained with *Levaditi's* silver nitrate method.

The fungus is found in corn, straw and flour. In countrymen who have the habit of chewing corn the mouth may become infected; either through a carious tooth, leading to infection of the bone, or through the parotid duct, leading to infection of the cheek. In the great majority of cases, therefore, we find actinomycosis in the mucous membrane of the cheek, the tongue, the jaw, the pharynx and the neck. It forms a stringy, nodular infiltration which, by becoming confluent, causes a swelling of wooden hardness. Acute inflammatory symptoms are absent. The skin becomes bluish red when the infiltration extends through the cheek or into the neck (Figs.

115 and 116). The infiltration extends gradually into the neighboring tissues, and by its unlimited progress resembles a malignant tumor. At the same time there is softening in the center of the infiltration with the formation of an abscess which discharges through several ramifying and anastomosing fistulas. The pus contains the characteristic yellow bodies, about the size of a pin's head. There is much induration around the fistulas which often prevents the discharge escaping. Granulation tissue is scanty, yellowish red in color, and rapidly disintegrated. The formation of abscesses is accompanied by a slight rise of temperature. Large abscesses may result from mixed infection; the yellow bodies are then often absent, the fungus being destroyed by the pus cocci.

In actinomycosis of the cheek a fistula is formed externally. If the infiltration is situated in the masticatory muscles there is trismus. The fungus may extend to the bones and give rise to enormous tumors. If the upper maxilla is invaded it may extend to the base of the skull and lead to meningitis or cerebral abscess. If the tongue is infiltrated it cannot be moved. When actinomycosis extends to the root of the tongue or to the pharynx there is difficulty in swallowing and later on in breathing. In these cases abscesses form which generally discharge through fistulas in the neck, and give rise to secondary actinomycosis of the skin. Primary actinomycosis of the skin has been observed through infection through lesions of the skin (*von Bergmann*).

The prognosis of actinomycosis of the buccal cavity is comparatively favorable, and by appropriate treatment two-thirds of the cases recover. On the other hand, by extension to the retropharyngeal tissue it may descend to the thorax or abdomen. Inspiration of secretion containing the fungus may infect the lungs. Invasion of the large veins of the neck resulting in metastatic foci has also been observed. From this circumstance the affection was formerly regarded

as chronic pyæmia especially as actinomycotic general infection gives rise to similar clinical appearances and eventually causes death by cachexia.

Actinomycosis of the lungs may occur from direct inspiration of substances carrying the fungus, besides infection from actinomycosis of the mouth. The prognosis is very bad. The symptoms are those of commencing phthisis. The lung becomes indurated and the pleura infiltrated, and abscesses discharge through the skin of the thorax. The disease may spread from the pleura to the pericardium, the vertebræ, the diaphragm and the abdominal cavity The patient becomes exhausted from empyema and multiple burrowing abscesses. The fistulas are difficult to follow owing to the hardness of their walls, so that relapses are common after incision, and the cases are usually fatal. Cases of recovery from actinomycosis of the lung have, however, been observed. Infiltration of wooden hardness between the ribs is always suggestive of actinomycosis.

The intestine may also be the seat of actinomycosis when material containing the fungus is swallowed. The ileo cæcal region is the part most often affected, in the form of hard tumor-like infiltration which may be so extensive as to prevent the passage of fæces. The disease may spread to the vertebræ, pelvic bones, abdominal organs, and may extend through the diaphragm to the thorax. There is often secondary actinomycosis of the skin. A fistula often forms near the umbilicus, discharging pus and sometimes fæces. The prognosis is somewhat more favorable than that of actinomycosis of the lung, but cases are often fatal from general infection.

When actinomycosis is visible externally the diagnosis is not usually difficult; the wooden infiltration, the multiple fistulas, the yellow granulations, and the yellow bodies mixed with the pus are characteristic. The diagnosis should always be confirmed by microscopic examination.

Differential Diagnosis. Actinomycosis of the cheek may, at first suggest lupus; but when the nodules have broken through, this mistake is no longer possible. Extensive infiltration of the cheek may be mistaken for tumors, especially when the jaw and the tongue are also affected; but the history of the formation of a cord extending often from a carious tooth, followed by swelling of the cheek will lead to the diagnosis. Actinomycosis of the tongue is distinguished from abscess or gumma by extending to the base of the tongue and causing immobility; also, in actinomycotic abscess the pus contains the characteristic yellow bodies. Actinomycosis of the neck may be mistaken for "wooden phlegmon," but the latter is generally unilateral and uniform, and does not form fistulas; actinomycotic infiltration extends round the whole neck, at first as a narrow zone, later on as several zones in the form of terraces one above another; the infiltration is also irregular. Actinomycosis of the lungs and pleura may be mistaken for tuberculosis, but the more advanced cases with fistulas are unmistakable. Actinomycosis of the intestine may be mistaken for tuberculosis or malignant growths, especially when it forms a tumor-like mass in the ileo-cæcal region.

Treatment. In extensive cases of antinomycosis of the buccal cavity attempts at total extirpation are useless, but healing may take place after free incision of abscesses and laying open all fistulas. Granulation tissue must be scraped away, and indurated tissue removed as far as possible. The incisions should be kept open for a long time by tampons. Carious teeth must be removed. In actinomycosis of the lung extensive resection of ribs is often necessary. In actinomycosis of the ileo-cæcal region resection of the gut may be necessary on account of intestinal obstruction or fistula. In other cases intestinal actinomycosis comes to the surface and then only requires

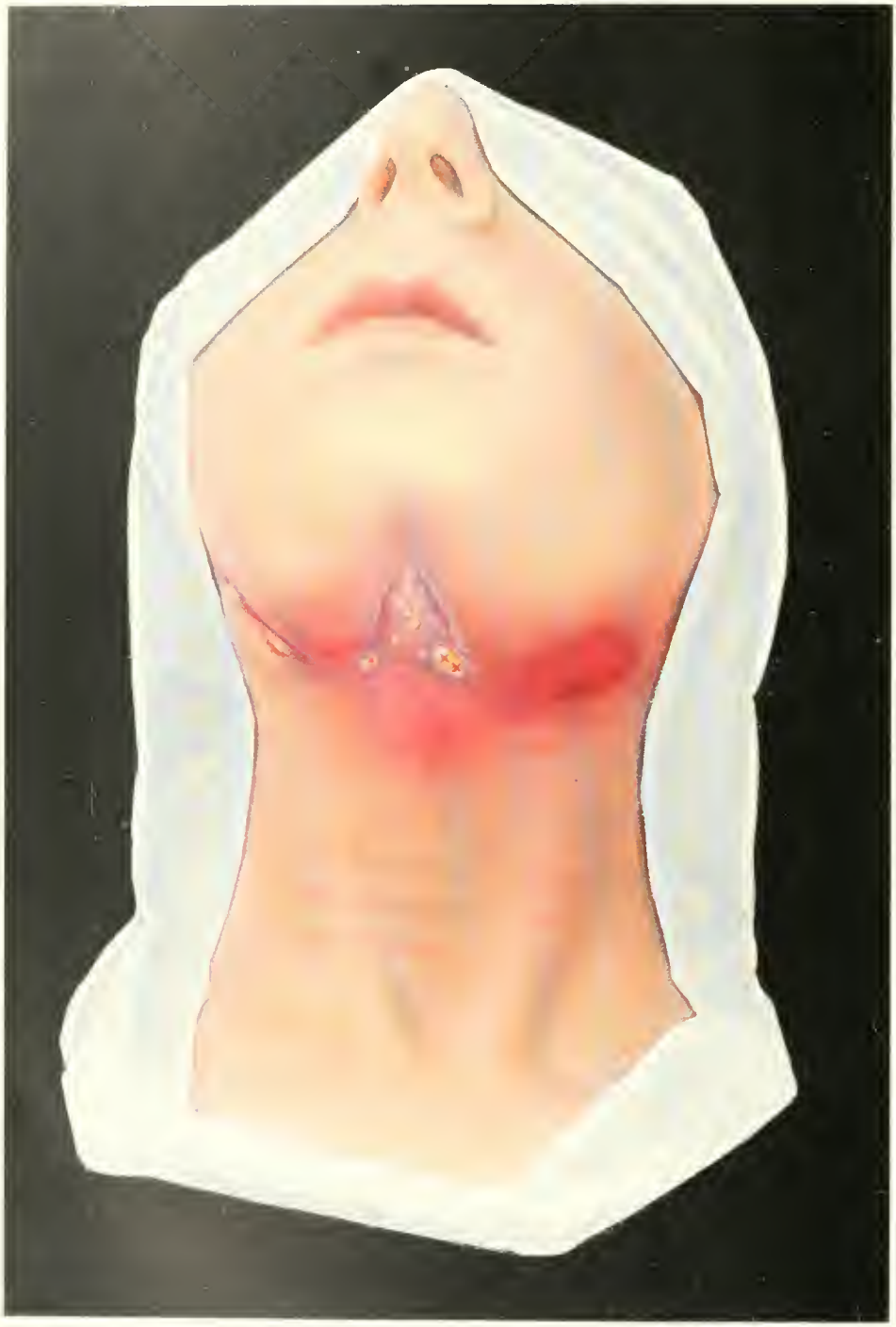

Fig. 116. Aktinomykosis progressiva.

free incisions. Metastatic deposits in the bones (which can be detected by the X-rays) may require resection. General treatment consists in nourishing diet and the administration of iodide of potassium and arsenic.

Fig. 115 shows a case of actinomycosis of the cheek in an old countrywoman. Infection took place from a carious molar tooth. A cord-like growth extended from the root of the tooth to the gum, and thence to the mucous membrane and muscles of the cheek, giving rise to diffuse infiltration. The skin became bluish red and several small fistulas developed which discharged pus containing yellow bodies. The latter were found by microscopical examination to be actinomyces. A circumscribed patch of gangrene was caused over the malar bone by pressure of the infiltration. There was no fever and little trouble except a slight degree of trismus. Treatment by free incision and plugging.

Fig. 116 shows a case of extensive actinomycosis of the neck in a young countryman. The point of infection was not ascertained, and no changes were present in the mouth or pharynx. Hard, painless infiltration extended from one angle of the jaw to the other, finally spreading over the whole region of the neck. The skin was at first unaltered, but afterwards became dark red. A circumscribed abscess formed in the submaxillary region, which discharged pus mixed with yellow bodies through several fistulas, with yellow granulation tissue at their orifices. Both actinomyces and cocci were found in the pus, showing it to be a case of mixed infection.

The patient suffered from difficulty in breathing and in swallowing. Free incisions were made in the infiltration, the abscess was evacuated and the fistulas scraped.

LINGUA GEOGRAPHICA

(Marginate Glossitis—Geographical Tongue)

Plate XCIV, Fig. 117.

This affection is chiefly of interest on account of the possibility of its being mistaken for other affections of the tongue. The dorsal surface of the tongue is covered with segments of circles of a gray color, arranged irregularly and of various sizes. The intersection of these segments gives rise to an irregular polycyclic or "geographical" pattern. The condition is caused by patches of hyperkeratosis of the filiform papillæ which spread at the periphery and become normal in the center. The peripheral parts form the segments of circles and consist of an accumulation of desquamated epithelium. The condition occurs most commonly in infants, but also in young adults. It runs a benign course, and its cause is unknown. It has been attributed to a syphilitic origin by *Kaposi*, but this is doubtful.

Differential Diagnosis. Marginate glossitis must not be mistaken for leucoplakia. The two conditions have entirely different appearances. (Cf. Fig. 9.)

Treatment. No special treatment is required beyond mouth washes, painting with tincture of myrrh and avoidance of spicy foods.

Fig. 117 shows a case of marginate glossitis affecting the anterior two-thirds of the tongue. The whole tongue is divided into a series of projecting areas of a yellowish-white color. Between these areas are the gray segments filled with the secretions of the mouth. At the back of the tongue the surface is normal.

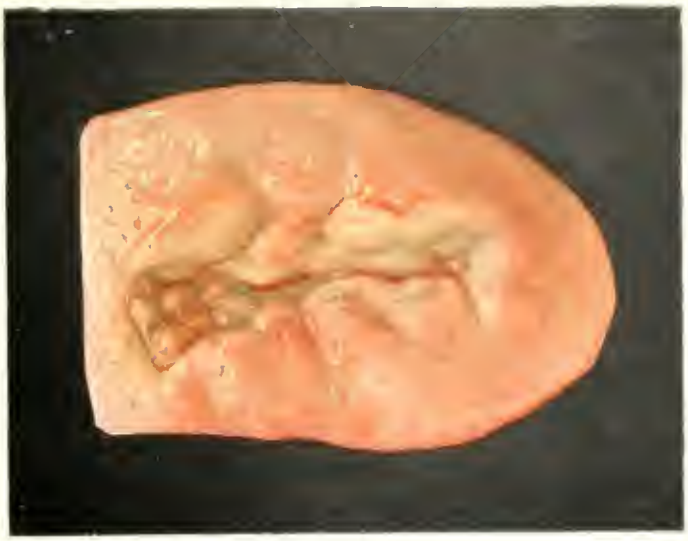

Fig. 110. Gumma linguae — Lingua bifida.

Fig. 118. Sklerosis syphilitica linguae.

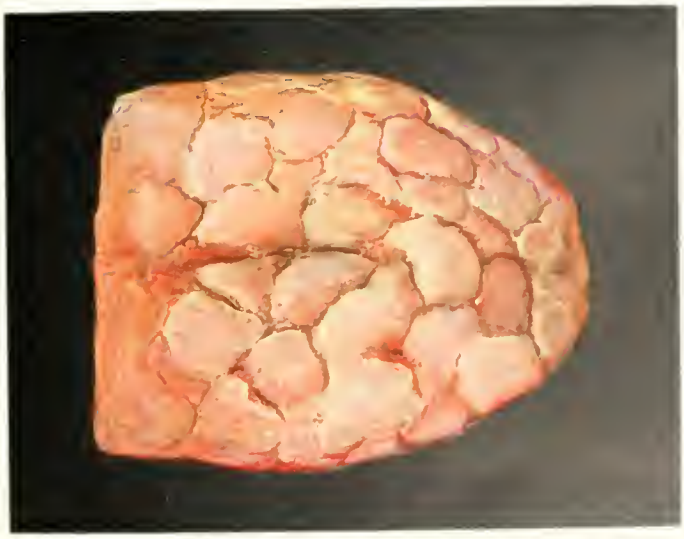

Fig. 117. Lingua geographica.

Syphilis

SCLEROSIS SYPHILITICA LINGUÆ
(*Syphilitic Chancre of tongue*)
Plate XCIV, Fig. 118.

GUMMA LINGUÆ—LINGUA BIFIDA (*Gumma of tongue*)
Plate XCIV, Fig. 119.

GUMMA LABII SUPERIORIS ET NASI
(*Gumma of upper lip and nose*)
Plate XCV, Fig. 120.

ABSCESSUS GUMMOSI (*Gummatous Abscess*)
Plate XCV, Fig. 121.

OSTITIS GUMMOSA (*Gummatous Osteitis*)
Plate XCVI, Fig. 122.

ULCUS GUMMOSUM (*Gummatous Ulcer*)
Plate XCVII, Fig. 123.

Syphilis is a specific infectious disease which, in the great majority of cases, is contracted by sexual intercourse between human beings. It is probably caused by the *spirochaeta pallida*, which was discovered in 1905 by *Schaudinn* and *Hoffmann*, and has since been found in all the products, and also in the blood, in both acquired and hereditary syphilis. The *spirochaeta pallida* is a delicate, thin organism with corkscrew-like spirals, only visible under high magnification. It is best stained by *Giemsa's* stain or *Levaditi's* silver nitrate method.

Syphilitic infection takes place through slight excoriations or fissures of the skin or mucous membrane. In this way extragenital infection may occur in various parts of the body (lips, eyelids, tongue, nipple, fingers, etc.). Indirect contagion may also be caused by contaminated towels, linen, drinking-glasses, cigars, tobacco-pipes, shaving brushes, etc. Congenital or hereditary syphilis is the result of

syphilis in one or both of the parents. This often causes abortions or stillbirths.

In acquired syphilis, after an incubation period of three to five weeks, a circumscribed, hard, painless infiltration of the skin or mucous membrane develops at the point of infection, called the initial sclerosis or hard chancre. This forms a flat erosion with a smooth, dark-red surface, regular smooth borders and an indurated base. The chancre forms a hard nodule movable over the subjacent tissues. In genital infection it occurs on the prepuce, glans penis and labia, more rarely in the urethra; in extragenital infection it occurs at the part of the body inoculated.

In about ten per cent. of cases the chancre is not discovered, but in the genital organs of women it is often overlooked. The chancre generally heals in a few weeks (with or without treatment) and leaves a white scar which usually disappears in course of time. Suppuration only takes place when the chancre is infected by pus cocci. Sometimes the chancre becomes gangrenous (phagedenic chancre). Mixed chancre is due to simultaneous infection with syphilis and soft chancre; in these cases the soft chancre appears first and becomes indurated later on. The induration of hard chancre is due to round-celled infiltration chiefly arising in and around the walls of the small blood-vessels.

The diagnosis of chancre is usually easy when it is situated in the genital organs, but extragenital chancres are often overlooked. Chancre of the fingers often resembles a chronic whitlow or paronychia (Figs. 93 and 98); but the sore has hard borders and a smooth surface and the acute inflammatory symptoms of whitlow are absent. About a week after the appearance of the chancre the regional lymphatic glands become enlarged, forming hard, painless, movable swellings (indolent bubo). In chancre of the genitals the inguinal glands are affected; in extragenital chancre the regional glands corresponding to

the part infected. Suppuration may occur in the glands if the chancre is infected with pus cocci.

Secondary symptoms appear after a second incubation period of six to twelve weeks. They often begin with malaise, headache and pains in the joints, accompanied by a rise of temperature. A rose-red macular rash (syphilitic roseola) develops on the abdomen and thorax. Later on various syphilitic eruptions develop (secondary syphilides), the most common of which is an eruption of flat, rounded, reddish-brown or ham-colored papules situated on the trunk, face and limbs. On the forehead these papules form the so-called "corona veneris." On the genital organs and around the anus these papules become sodden and white, and are known as *condylomata lata*, which are liable to ulcerate. In some cases pustular eruptions form, and in severe or neglected cases the pustules become ulcers covered with limpet-shaped crusts (syphilitic rupia). Acneiform eruptions are common on the scalp, and scaly or psoriasiform syphilides on the palms and soles. Most secondary eruptions disappear without leaving any trace, but the ulcerative forms (rupia) leave pigmented scars, which later on become white in the center. Syphilitic eruptions are characterized by their reddish-brown or ham color, their polymorphous tendency and the absence of itching.

The mucous membranes, especially of the mouth, are affected by papular, erosive or ulcerative syphilides which are known as *mucous patches*. These develop on the tonsils, fauces, tongue, and inside the lips and cheeks, in the form of grayish-white patches or streaks, with a red border. Later on they may become eroded or ulcerated in their central parts, and then appear as red erosions with a gray border. In early secondary syphilis the tonsils and fauces may be acutely swollen (syphilitic angina), but more often there is dark-red coloration of the tonsils, fauces and soft palate. In secondary syphilis there is often loss

of hair, sometimes due to acneiform syphilides of the scalp, but more often appearing without any apparent lesion. The nails are sometimes affected with onychia or paronychia.

Secondary syphilis may last several years, and is liable to recurrences. The most contagious lesions are condylomata and mucous patches, even more contagious than the chancre.

Tertiary syphilis occurs in about twenty per cent. of cases, usually before the fifth year, sometimes later, even up to the thirtieth year after infection. The chief causes of tertiary syphilis, apart from specially virulent forms of the virus, are absence of or insufficient treatment, and abuse of alcohol.

The characteristic feature of tertiary syphilis is the formation of circumscribed or diffuse infiltrations called *gummata*. The gumma is formed of round cells, epithelioid cells and giant cells, and contains blood-vessels thickened by syphilitic arteritis. Owing to the changes in these vessels, the nutrition of the gumma is interfered with and the central parts undergo fatty degeneration or caseation. A mature gumma shows on section three zones—a central zone of caseation, a middle zone of round cells and an outer zone of fibrous tissue. Gummata may cicatrize by the formation of fibrous tissue, or they may suppurate and form an abscess. If the abscess is superficial, it breaks through the skin and gives rise to a gummatous ulcer.

It must be borne in mind that the secretion from gummatous ulcers may be contagious. (The *spirochaeta pallida* has been found in gummata, and any lesion containing this organism is contagious).

Gummata develop in the skin and subcutaneous tissue in the form of circumscribed nodules. The skin becomes reddened and may suggest a furuncle, especially in the case of a single gumma. When the gumma breaks through the skin the resulting gummatous ulcer is characteristic. The borders are hard,

smooth, not undermined but circular and sharply cut, as if punched out; the surface is covered by a tough, tenacious, yellowish deposit, or core. In the skin several gummata usually occur close together; these break down in some places and heal in others, thus giving rise to an irregular or serpiginous appearance which is characteristic of tertiary syphilitic ulceration. Gummata sometimes occur on the penis and may somewhat resemble chancres, but there is no enlargement of the lymphatic glands in gummata. Gummatous ulcers generally emit a disagreeable odor, especially when they are situated in the pharynx or nose (ozaena).

Gummata of the skin may be secondary to extension from gummata in the muscles or bones. On the other hand gumma of the skin may extend to the deeper tissues. Diffuse gummatous infiltration of the skin and subcutaneous tissue gives rise to multiple fistulas which discharge a scanty secretion. Gummata may cause extensive deformity by destruction of tissue, especially in the face (Fig. 120). Gummata of the scalp leave deep, smooth, glistening scars. Gumma of the tongue is usually situated in the center, and may divide the tongue into two parts (Fig. 119). Gummata and gummatous infiltration often affect the soft palate and pharynx, giving rise to considerable destruction of tissue and cicatricial stenosis. The larynx is also often affected. Gummatous infiltration of the rectum gives rise to stricture.

Gumma of the bones may develop in the periosteum, cortex or medulla, in the form of circumscribed growths or diffuse infiltration. Generally, all three parts of the bone are affected with simultaneous bone destruction and bone proliferation, causing an irregular, corroded appearance. Gumma of bone may undergo fibrous transformation, or may suppurate and cause necrosis. Necrosis of the cranial bones often leaves circular cavities to which the smooth, glistening skin is firmly adherent.

The nose and hard palate are often extensively destroyed by gummatous infiltration, suppuration and necrosis. The sternum and clavicle are sometimes affected. In extensive disease of the long bones curvature may result, especially outward curvature of the tibia from the weight of the body. There is also brittleness of the bones. Examination by X-rays shows irregular shadows in the periosteal region, while the cortex and medulla cannot be distinguished from one another. The whole bone is thickened and irregular.

Patients often complain of pain in the bones (osteocopic pains) before any changes are visible. Palpitation of the anterior surface of the tibia often reveals an irregular, uneven surface. The ulna, radius and fibula may also be the seat of syphilitic osteitis.

Serous effusion may occur in the joints and bursæ in the course of syphilis. Extensive disease of the joints may also arise from gummatous infiltration of the perisynovial tissue, or from gummatous osteitis of the articular ends of the bones. If a gumma of the bone breaks into the joint, suppurative arthritis generally follows. The knee joints are most often affected by syphilitic arthritis.

Gummata may occur in the muscles, and may be mistaken for tumors. They usually occur in the tongue, calf muscles and sterno-mastoid. Gumma in the brain gives rise to symptoms of cerebral tumor. Gummata are common in the liver and testicles, and may occur in the lungs, heart and other organs.

The blood-vessels are affected in all three stages of syphilis (syphilitic arteritis). The changes affect both the inner and outer coats of the vessels (endarteritis and periarteritis). Extensive proliferation of the intima may cause complete occlusion of the vessel; this occurs especially in the vessels of the brain and leads to foci of softening. Syphilitic arteritis of the aorta and other large arteries causes

aneurism. Syphilitic arteritis of the cerebral arteries causes cerebral hemorrhage.

Each of the three stages of syphilis may be absent. The chancre is undiscovered in ten per cent. of cases, and may sometimes be absent. Tertiary syphilis is said to occur in only twenty per cent. of cases; at any rate it is frequently absent. The secondary stage may also be absent in cases of severe infection in which tertiary lesions appear soon after infection (malignant syphilis). It is also possible that some cases of syphilis undergo spontaneous abortion after the chancre.

In some cases of congenital syphilis the symptoms do not appear till the eighth to sixteenth year. This is known as late or delayed hereditary syphilis, to distinguish it from early hereditary syphilis which appears at or soon after birth.

Among the characteristic signs of early hereditary syphilis are bullous syphilides of the palms and soles (syphilitic pemphigus), and epiphysitis. The latter consists in a form of osteochondritis affecting the epiphyses of the long bones, and causing thickening. It is more common in the arm and gives rise to paralysis of the limb. Epiphysitis may cause interference with growth of the limb.

In late hereditary syphilis the bones are frequently affected with gummatous processes identical with those of acquired syphilis. The tibias are often curved forwards and outwards owing to osteoplastic periostitis. This condition is known as "saber blade tibia," and is a characteristic sign of late hereditary syphilis. The skin over the bones is often ulcerated.

Syphilitic dactylitis may occur in both early and late hereditary syphilis. It causes thickening of the phalanges, usually the basal ones. It is generally multiple, sometimes bilateral, and tends to spontaneous resolution without suppuration.

The bones in hereditary syphilis are often very

brittle. Other signs of hereditary syphilis are interstitial keratitis, deafness due to disease of the internal ear, notching of the incisor teeth (*Hutchinson's* teeth). These three signs have been called the "Triad of *Hutchinson*." Radiating scars round the mouth left by former ulcerations are also characteristic.

Acquired syphilis may also occur in infants, but differs in the absence of the characteristic features mentioned above.

Differential Diagnosis. Syphilis is so widespread among all classes of society that it must always be borne in mind in cases of doubtful diagnosis. Although the disease is fairly characteristic in all three stages, it is possible to mistake it for other affections, especially as the history can never be relied upon.

Hard chancre, when ulcerated, may be mistaken for soft chancre, but diagnosis can be established by finding the *spirochaeta pallida* in scrapings. Extragenital chancres may be mistaken for epithelioma, especially in the tongue and nipple, but the smooth surface of the chancre differs from the irregular ulcerated surface of epithelioma (cf. Fig. 1); the regional lymphatic glands are affected early in chancre. Chancre of the fingers is often mistaken for whitlow, but differs in its chronic character and absence of acute inflammatory symptoms. Secondary syphilis of the skin and mucous membranes may be mistaken for various affections, and the diagnosis often depends on the situation and general course of the lesions, and on the presence of other signs of syphilis. Gummatous ulcerations of the skin may be mistaken for tuberculous ulcers or for furuncle, but differ in the characters mentioned above. Diffuse gummatous infiltration of the skin with fungoid proliferation may suggest sarcoma (cf. Figs. 24 and 26), but differs in the absence of any tendency to bleeding, in the presence of circular scars

and brown pigmentation in the surrounding skin, and in the presence of other signs of syphilis, especially changes in the bones. Gumma in a muscle is often at first indistinguishable from a tumor. Gumma in the testicle may be mistaken for tuberculosis, but the former begins in the testicle while tubercle begins in the epididymis. The diagnosis is easy when the skin of the scrotum is perforated.

In the brain, liver, spleen and other organs the diagnosis of gumma depends on other signs of syphilis. Central gumma of bone may resemble central sarcoma or bone cyst, and may give the same appearance on X-ray examination, but gummatous changes in bone are characterized by implication of the periosteum. In doubtful cases antisyphilitic treatment should be tried. If the diagnosis hesitates between gumma and malignant tumor antisyphilitic treatment should not be continued too long, as a malignant tumor may thus become inoperable. In such cases an exploratory incision with microscopical examination is to be preferred. It must, however, be borne in mind that long-standing gumma of the skin may develop into carcinoma.

The earlier the diagnosis and the sooner the commencement of treatment, the quicker is the cure of syphilis. On the whole it may be assumed that the majority of cases become cured, but the marriage of syphilitics should not be allowed before five years after infection, and then only after thorough and prolonged treatment, with an additional course of treatment shortly before marriage. The danger of transmission to the children is diminished by time and treatment.

The disease generally runs a chronic course, and cases of acute malignant syphilis are rare except in persons who are broken down in health from other causes (tuberculosis, alcohol, etc.). In the tropics, however, syphilis is more severe and often fatal. It is also more severe in races who are attacked for the

first time and whose ancestors have been free from the disease.

In a certain number of cases syphilis causes death by gummatous disease of the internal organs, or by diseases of the nervous system, such as tabes and general paralysis, which, according to the latest researches, are always of syphilitic origin.

[Reinfection in syphilis is rare, but may sometimes occur after both the acquired and hereditary disease. Immunity in hereditary syphilis does not appear to last much beyond the age of puberty, after which acquired syphilis may be contracted, usually in an attenuated form. No doubt a soft chancre in a syphilitic subject may become indurated by the syphilitic process and be mistaken for reinfection; so may a chancriform gumma of the penis; but a considerable number of cases have been recorded in which patients passed through two distinct attacks of secondary syphilis, separated by an interval of several years. These cases must of course be distinguished from cases of relapsing secondary syphilis due to the primary infection.

Treatment. Infection can often be avoided by cleanliness—by using ointment before coitus and soap and water afterwards. Any abrasion of the epithelium of the penis, caused by balanitis, etc., may lead to infection. Antisyphilitic treatment should be commenced as soon as primary syphilis is diagnosed; it should only be delayed till secondary symptoms appear in cases of doubtful chancre. Excision of the chancre has been often tried, but it cannot prevent constitutional infection which is already present; moreover, an ulceration may occur at the place of excision. The chancre must be kept clean and dressed with iodoform, xeroform or mercurial ointment. Phagedenic chancre should be treated by prolonged immersion in mild antiseptic baths.

Treatment by mercurial inunction is one of the

best methods, and can be carried out by the patient himself. From three to five grammes (about a drachm) of *unguentum cinereum* is rubbed into the skin for about twenty minutes daily, varying the seat of inunction from day to day (inner side of arms and thighs and sides of body). This is best done at night, the patient sleeping in a flannel nightshirt and taking a hot bath in the morning. On the seventh day the patient omits the inunction. The whole course lasts six weeks. In the first year two energetic courses of inunction should be taken; in the second year two milder courses; and in the third year one course.

Treatment by intramuscular injections may be employed instead of inunction. For instance, injections of one cubic centimeter of a two to five per cent. solution of perchloride of mercury with sodium chloride every two or three days. [Injections of perchloride of mercury are painful and have been replaced by other preparations of mercury, those most generally used being the biniodide and gray oil. Biniodide is a soluble injection given in daily injections of one-third grain. Gray oil is a preparation of metallic mercury suspended in liquid paraffin and lanolin, and is given in weekly injections of one to one and one-half grains. Injections are usually made in the gluteal muscles, but some inject into the subcutaneous tissue of the back. The treatment of average cases of syphilis can also be carried out perfectly well by internal medication in the form of pills—blue pill, proto-iodide, etc.]

Erosions and ulcerated mucous patches in the mouth may be painted with chromic acid (five to ten per cent.). To avoid mercurial stomatitis the teeth should be cleansed with carbolic tooth powder, and chlorate of potash mouth washes used.

In the tertiary stage iodide of potassium is indicated for the treatment of gummatous formations (thirty to sixty grains daily). It may be given in milk. If iodism occurs the drug should be discon-

tinued, and fifteen to thirty grains of antipyrin given daily (*Jadassohn*). If iodide cannot be borne, *Zittmann's* decoction may be tried. Hot baths and vapor baths are useful in improving metabolism, and favor the elimination of large doses of mercury.

Gummatous ulcers may be treated with iodoform, calomel ointment, or gray ointment. Gummatous abscesses may be incised and scraped. Deformities of the lips, nose, etc., caused by gummata require plastic operations. Extensive stricture of the rectum may necessitate resection of the gut. Cases of cerebral gumma, which do not yield to energetic treatment with mercurial inunction or injection and large doses of iodide of potassium, may be treated by trephining, when they cause symptoms of a circumscribed cerebral tumor. Extensive gummatous disease of the testicle may require castration. Gummata in muscles may be incised, scraped and treated locally with mercurial ointment, if they do not yield to general antisyphilitic treatment. The same applies to gummata in the bones, especially when they cause severe pain. Gummatous periostitis and osteitis often heal under energetic antisyphilitic treatment, but sometimes require operative treatment for the removal of sequestra. In cases of delayed union of fractures, iodide of potassium is often useful when there is a history of previous syphilis. The same applies to all badly healing wounds in syphilitic patients, especially operation wounds. In hereditary syphilis, osteochondritis can be treated by splints, and gummatous osteitis may eventually require operative interference.*

* For further information on this subject the reader is referred to *Marshall's* "Syphilology and Venereal Disease," London. Balliére, Tindall and Cox; *Marshall's* "Golden Rules of Venereal Disease," Bristol. John Wright and Co.; *Marshall's* translation of *Fournier's* "Treatment and Prophylaxis of Syphilis," New York. Rebman Co.

SCLEROSIS SYPHILITICA LINGUÆ

(Syphilitic chancre of the tongue)

Plate XCIV, Fig. 118.

This is a case of extragenital chancre affecting the tongue. The sore is slightly raised above the surface; it has a round form with hard, slightly raised not undermined borders, and a smooth, varnished surface. The lymphatic glands in the submaxillary and occipital regions were hard and movable. Carcinoma of the tongue differs from this in its irregular surface, from which epithelial plugs can be expressed, and in the glandular affection occurring later.

As already mentioned, syphilitic contagion may take place through intermediate objects. *Von Bergmann* has observed a case in which contagion was due to smoking the fag end of a cigarette thrown away by a syphilitic person.

GUMMA LINGUÆ—LINGUA BIFIDA (*Gumma of the tongue*)
Plate XCIV, Fig. 119.

Gumma of the tongue is usually situated in the center of the tongue, while carcinoma generally affects the posterior part of the side of the tongue (Fig. 9). A breaking-down gumma may divide the tongue into two parts (bifid tongue). The figure shows a broken-down gumma with its characteristic tenacious, yellowish-brown deposit. Syphilitic infection was denied in this case, but it was cured by antisyphilitic treatment.

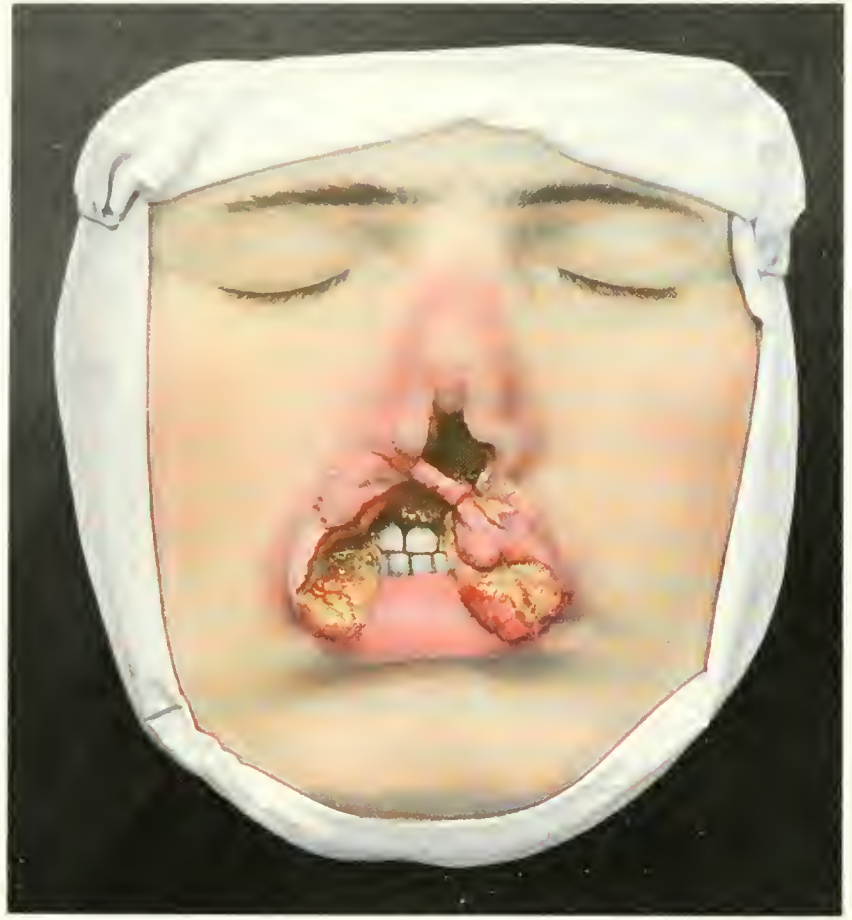

Fig. 120. Gumma labii superioris et nasi.

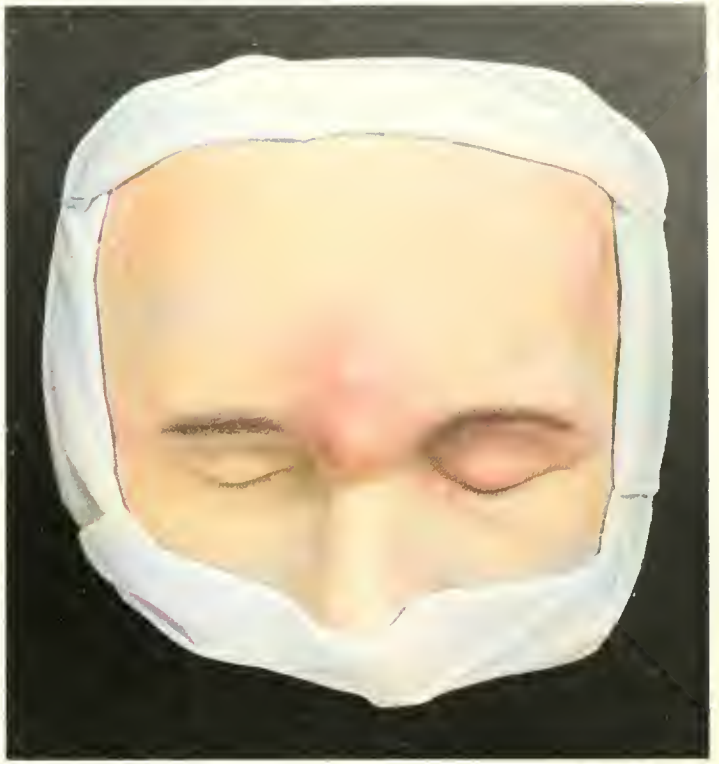

Fig. 121. Abscessus gummosi.

GUMMA LABII SUPERIORIS ET NASI

(*Gumma of the upper lip and nose*)

Plate XCV, Fig. 120.

This case shows extensive destruction of the upper lip, the cartilaginous portion of the nose, the nasal septum, and the bony framework of the nose, due to gummatous ulceration. There is also perforation of the hard palate. The upper lip shows the characteristic yellow, tenacious deposit, which can be removed without bleeding. The surface of the ulceration is fairly smooth and the borders soft, as compared with the irregular surface and hard borders of carcinomatous ulceration. The patient had syphilis ten years previously.

The patient was treated with iodide internally and mercurial ointment locally. After the ulcerated surface had become clean, the borders were excised and united by sutures. The defect in the nose was repaired by a plastic operation, and an obturator was worn for the perforation in the palate.

ABSCESSUS GUMMOSI (*Gummatous Abscess*)
Plate XCV, Fig. 121.

This is a case of multiple gummata in the skin of the face, situated at the root of the nose, in the left eyelid and in the temporal region. The skin is thin and red. Fluctuation was felt on palpation. The patient could not remember contracting syphilis, but his wife had had frequent abortions and several syphilitic children. There were gummatous processes in the skin of various parts of the body; also limitation of movement in the elbow joint due to previous gumma of the bone. The surface of both tibias was irregular, and there were circular scars on the legs. The patient also suffered from severe headache and attacks of giddiness, due to syphilitic disease of the cerebral arteries.

The abscesses were incised and scraped, and healed under antisyphilitic treatment. The cerebral symptoms also improved.

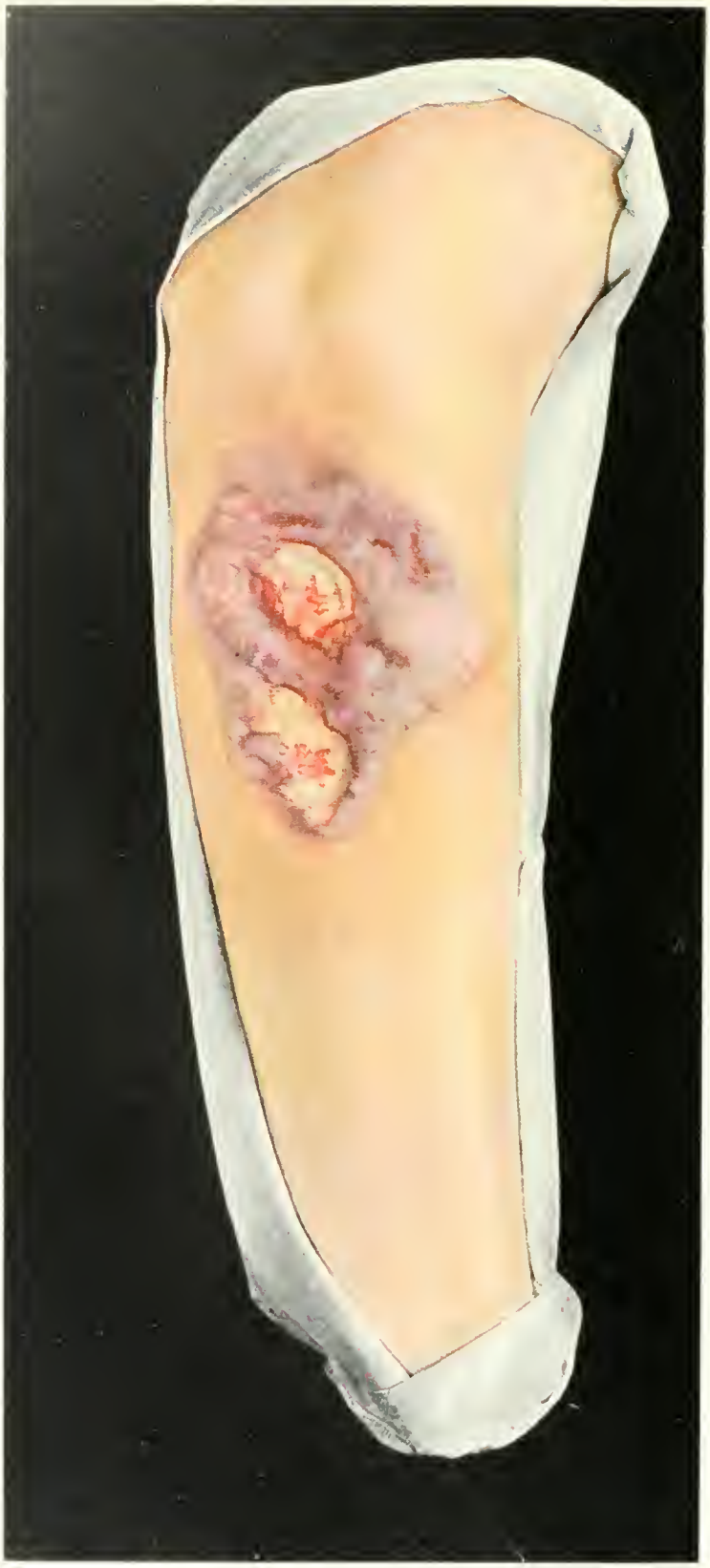

Fig. 122. Ostitis gummosa.

Rebman Company, New York

OSTITIS GUMMOSA (*Gummatous Osteitis*)
Plate XCVI, Fig. 122.

This patient acquired syphilis twenty years ago, and suffered for some years from pain in the right forearm, especially at night. The bones of the forearm gradually became thickened, and the skin red and swollen. Two irregular ulcers developed, covered with yellow, tenacious deposit. Round the ulcers soft proliferations formed resembling sarcomatous tissue. There were several small fistulas leading to the bones, in which the X-rays showed irregular proliferation of the periosteum and irregular thickening of the cortex. Healing gradually took place under treatment by iodide internally and mercurial ointment locally. There were no other signs of syphilis.

ULCUS GUMMOSUM (*Gummatous Ulcer*)
Plate XCVII. Fig. 123.

In this case a gumma occurred in the skin over the internal malleolus after a kick (trauma is sometimes an exciting cause of gumma). The skin became infiltrated, swollen and red, and gradually broke down, forming an ulcer with sharply cut edges and a base covered with tenacious, yellow deposit. The patient contracted a sore on the penis some years previously, which was diagnosed as a soft chancre, and received no specific treatment. Three years after infection a gumma developed in this situation and was treated for a long time with poultices, but was afterwards healed by iodide of potassium internally and mercurial ointment locally. The patient was recommended further treatment by mercurial inunction or injections.

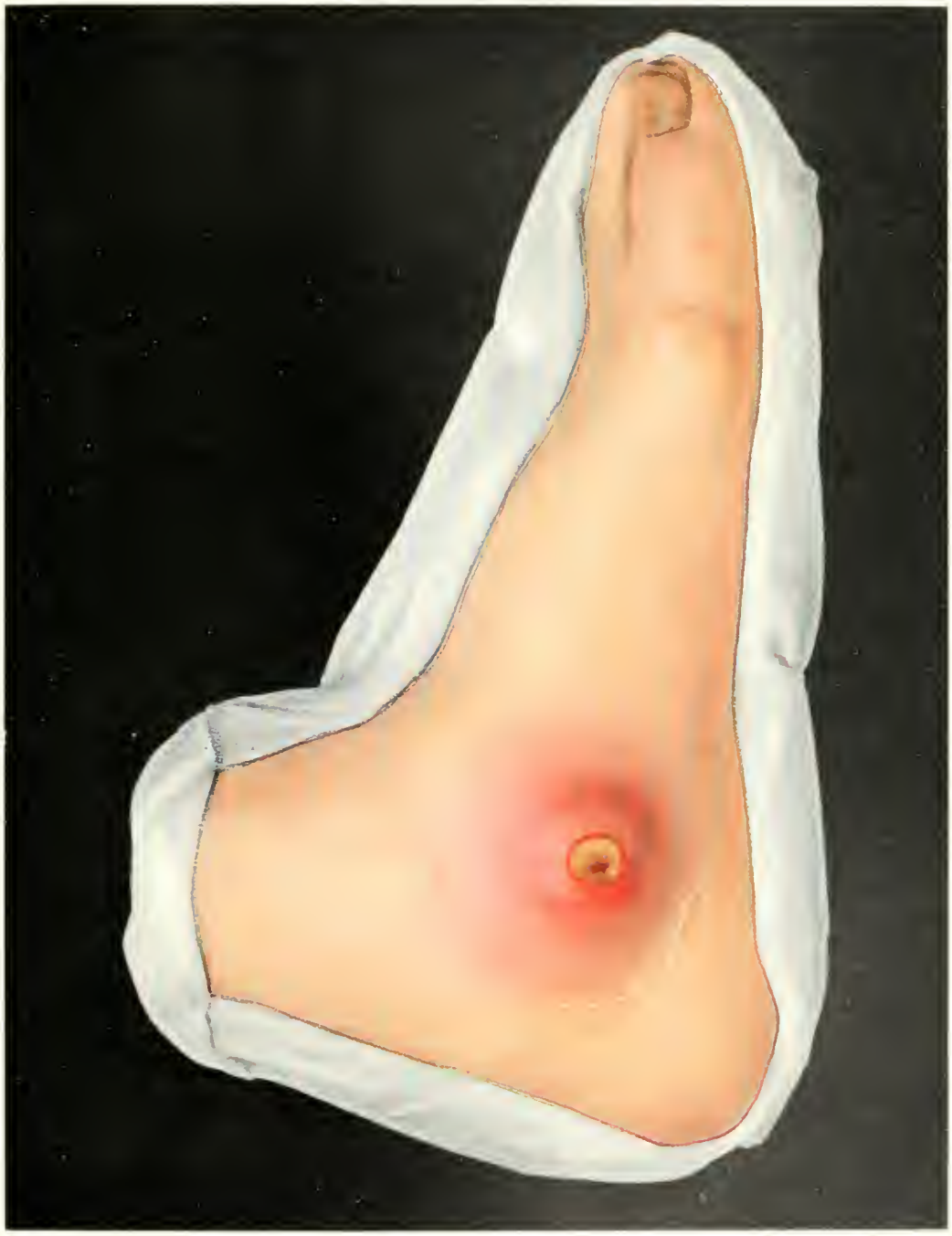

Fig. 123. Ulcus gummosum.

Rebman Company, New-York

Tuberculosis

LYMPHOMATA COLLI TUBERCULOSA
(*Tuberculous lymphoma of the Neck*)
Plate XCVIII, Fig. 124.

ARTHRITIS TUBERCULOSA FUNGOSA
(*Fungating Tuberculous Arthritis*)

ANKYLOSIS GENUS FIBROSA
ABSCESSUS FRIGIDUS
(*Fibrous Anchylosis of the Knee—Cold Abscess*)
Plate XCIX, Fig. 125.

ARTHRITIS TUBERCULOSA PURULENTA
(*Purulent Tuberculous Arthritis*)
Plate C, Fig. 126.

ARTHRITIS TUBERCULOSA FIBROSA
(*Fibrous Tuberculous Arthritis*)

ANKYLOSIS OSSEA—SUBLAXATIO
(*Bony Anchylosis—Subluxation*)
Plate C, Fig. 127.

ARTHRITIS TUBERCULOSA FIBROSA
(*Fibrous Tubereulous Arthritis*)

TUMOR ALBUS (*White swelling*)
Plate CI, Fig. 128.

TUBERCULOSIS TESTIS (*Tubereulous Testiele*)
Plate CII, Fig. 129.

TUBERCULOSIS MANUS (*Tuberculosis of the Hand*)
Plate CIII, Fig. 130.

OSTITIS TUBERCULOSA (*Tubereulous Osteitis*)
SPINA VENTOSA (*Spina ventosa*)
Plate CIV, Fig. 131.

GANGRÆNA PEDIS HUMIDA (*Moist Gangrene of the Foot*)
Plate CIV, Fig. 132.

Since the discovery of the tubercle bacillus by *Robert Koch*, in 1881, it is known that tubereulous affections are solely due to the invasion of these bacilli; although tubereulosis was regarded as an infective disease by several investigators before the time of *Koch*. *Baumgarten* also discovered the tuberele bacillus almost at the same time as *Koch*.

The tubercle bacilli are straight or slightly curved rods. They are easily stained by the *Ziehl-Neelsen* method, or by *Gram's* method, and are not decolorized by nitric acid solution (acid fast bacilli). The bacilli retain their virulence for a long time in the dry state, but are destroyed by boiling and by sunlight. Besides microscopic examination and culture of the bacilli, inoculation of the guinea pig is useful for establishing diagnosis. Recent researches by *Friedrich* have shown that tubercle bacilli in cultures assume the form of club-shaped radiating filaments similar to actinomyces; so that the bacillary nature of the tubercle bacillus is doubtful, and it may belong to the hyphomycetes. In any case tuberculosis and actinomycotic affections are often very similar.

Tubercle bacilli are present in dust and on the walls of rooms. Patients with tuberculosis of the lungs infect the air with small vesicles of fluid containing tubercle bacilli. Tubercle bacilli may also penetrate the unbroken skin and mucous membrane and cause infection of the lymphatic glands; but this form of infection is comparatively rare. Wounds are easily infected with tubercle bacilli, especially when the sputum of a tuberculous subject comes in contact with a wound (*e.g.* tattooing). Although, according to *Koch*, there may be a distinction between human and bovine tuberculosis, the latter may be transmitted to man, and infection may occur from the meat and milk of animals infected with bovine tuberculosis; [especially by milk from cows with tuberculous udders].

As regards the hereditary transmission of tuberculosis, it is certain that the children of tuberculous parents are more predisposed to tuberculosis than the children of healthy parents; but, whether the bacilli can be transmitted from the mother to the fetus and remain for a long time latent in the tissues of the child, and whether transmission can take place through the semen of the father, are points which are

still unsettled. In distinction to hereditary predisposition, there is acquired predisposition; after certain diseases, such as influenza, measles, bronchial catarrh and glandular swellings. The stronger the body at the time of infection, the more it is able to resist the disease. It is said that signs of former tuberculosis can be found in almost ninety per cent. of all men, in a great many of these cases the tuberculous foci having become encapsuled or calcified. Bad feeding, unhealthy dwellings, sedentary occupations and alcoholism predispose to infection.

In the great majority of cases primary tuberculosis affects the lungs, either by direct inhalation of bacilli, or by bacillary infection of the lymphatic glands (tonsils, bronchial glands, nasopharyngeal glands). If the bacilli remain in the lungs they give rise to phthisis. Tuberculosis of the mouth, pharynx, larynx, trachea, bones and all other tissues, is in most cases due to secondary metastatic infection by the blood. Tuberculous embolism may be caused by a tuberculous focus breaking through a large vessel.

Tuberculous lesions which interest the surgeon are in the majority of cases secondary. Tuberculosis may attack any of the tissues, but has a predilection for certain ones—primary tuberculosis for the lymphatic glands and lungs; secondary tuberculosis for the bones and joints. Tuberculosis of the intestine, which generally affects the small intestine and ileocæcal region, is rarely primary but generally secondary to tuberculosis of the lung (by swallowing phthisical sputum) or the mesenteric glands. Tuberculosis may occur at any age.

The tubercle bacilli give rise to small nodular infiltrations known as tubercles or granulomas. The granuloma is characterized by the presence of several forms of cells, the majority of which are round cells, a smaller number epithelioid cells, in fresh tubercles; while in older tubercles giant cells are present,

especially in tubercles with a tendency to heal. The giant cells of tubercle differ from other giant cells in the fact that the nuclei are situated at the periphery of the cell round a central homogeneous mass, and that in some parts of the circumference of the cell there is a double arrangement of nuclei. Owing to the absence of blood-vessels in the center of the tubercle there is caseous degeneration of the central cells. The giant cells often contain tubercle bacilli and are believed to take part in the process of healing, by acting as phagocytes.

The tubercle sets up inflammatory reaction in the surrounding tissues, resulting in the formation of granulation tissue and pus, the latter being discharged by a fistula, or forming an ulcer when the process is in the skin. In most cases the body tries to expel the tuberculous focus, but in some cases the latter becomes encapsuled by connective tissue. This connective-tissue capsule may at any time be ruptured, by trauma, etc., and give rise to fresh tuberculous infection. The majority of cases of tuberculosis following an injury are explained by the setting free of encapsuled foci of tubercle; this not only causes a fresh outbreak of tubercle at the seat of the injury, but also spread of the previously encapsuled focus of disease to other organs.

Surgical cases of tuberculosis are generally characterized by the formation of typical granulations, fistulas and specific pus. The granulations are pale and vitreous. The fistulas run an irregular course, and, in cases of tuberculous bone disease, open at more or less distant points in the skin; the walls of the fistula are soft and bleed easily. The pus is thin and mixed with fibrin, caseous masses and shreds of tissue. The tuberculous ulcer is characterized by thin, soft, ragged, undermined borders, and a base covered with yellow caseous masses, or pale-red or gray granulations. Tuberculous granulations may destroy all the surrounding tissues (bones, cartilage

and muscles) and the necrosed parts are expelled from the body. In the majority of cases there is a formation of soft, spongy granulations, and little fibrous tissue formation. Tuberculous processes often continue for years before an abscess forms, or a cavity from destruction of the tubercle.

Tuberculosis affects the different tissues in characteristic ways, which we shall describe later when dealing with the different cases. As a rule it runs a chronic course with intermittent fever, without acute inflammatory symptoms. The diagnosis can often be made from the appearance of the ulcer, fistula, pus or granulation tissue, and by the X-rays in the case of bone disease. In many cases tuberculosis of the lung leads to tuberculous disease of other tissues. Diagnosis can be confirmed by microscopic examination; or by inoculation of suspected tissue into the peritoneum of the guinea-pig, which gives rise to tuberculosis of the mesenteric glands in a few weeks. The walls of tuberculous abscesses are very suitable for inoculation, as they contain many tubercle bacilli.

The prognosis depends on the situation and extent of the disease. Small, circumscribed foci can be radically removed by operation—for instance, circumscribed tuberculosis of the skin, or tuberculous glands in the neck which are common in children. However, as tubercle is generally present in the lungs, many patients succumb to this sooner or later. In tuberculosis of bones and joints, complete restitution is seldom possible, owing to the extensive destruction of tissue. Long-standing disease of bones and joints, which may occur at an advanced age, is often fatal from exacerbation of tuberculosis of the lungs.

Treatment. The spread of the disease should be checked by prophylactic measures. Tuberculous patients should be warned against spitting into handkerchiefs or on the ground, and should use spitting-cups. Meat and milk from tuberculous cattle should

not be consumed. The general treatment of tuberculous patients consists in nourishing diet (plenty of milk, meat and butter), cod-liver oil and extract of malt; administration of preparations such as creosote and guiacol; residence at high altitudes; sea baths; sanatorium treatment. Inunction of the whole body with green soap, which is allowed to remain on the skin for half an hour, is said to be beneficial. Brine baths and sulphur baths are useful. Tuberculin treatment has not been successful, and cannot be recommended in practice.*

As regards local treatment, the object of modern surgery is to remove the focus of disease when it is within reach. By this means not only is the local disease often cured, but the primary lung disease is often improved. In some cases a whole organ, such as the kidney or testicle, must be removed when it is extensively diseased. A ten per cent. emulsion of iodoform in glycerin is useful for application to tuberculous ulcers and fistulas, and for injection into tuberculous joints and abscesses. In the treatment of tuberculous bone and joint disease immobilization is essential.

Tuberculosis of the Skin. This has already been mentioned in the case of lupus. (Plate III.) Local tuberculosis of the skin may occur from infection from dead bodies affected with tuberculosis. This form is common on the fingers in doctors and hospital attendants after post-mortem examinations, and in butchers from handling tuberculous meat. It is known as cadaveric tubercle or post-mortem wart. It commences as a small red spot which develops into a raised nodule with slight sanious discharge. Several nodules may develop close together and form a warty growth. A more extensive

* Sir Almroth Wright's method by injection of the new tuberculin, under control of the opsonic index, is apparently successful in suitable cases.

form of warty cutaneous tuberculosis is known as *tuberculosis verrucosa*, and is common in the poorer classes. In these cases the tubercles have little tendency to break down and undergo caseous degeneration, but become warty by cornification of the epidermis.

The treatment of these forms of cutaneous tuberculosis is the same as for lupus; *viz.* excision of small lesions; scraping with sharp spoon, cauterization, or treatment by *Finsen's* light in the case of larger growths.

Another form of cutaneous tuberculosis commences in the subcutaneous tissue, and gradually extends to the skin in the form of red nodules resembling furunculous abscesses. The skin becomes thin, the nodules suppurate and discharge pus on the surface. This condition is common in the neck in tuberculous children. Before the skin breaks down the nodules may be mistaken for gummata, but afterwards typical tuberculous ulcers are formed. This condition has been called scrofuloderma, but is due to the action of tubercle bacilli. The treatment consists in scraping and iodoform dressings.

Tuberculous Lymphangitis and Lymphadenitis. Tuberculous lymphangitis is rare, and only occurs in connection with tuberculosis of the skin and lymphatic glands, in the form of nodular cords. Tuberculous lymphadenitis, on the other hand, is very common (Fig. 124). It occurs especially in children in the glands of the neck, the tubercle bacilli easily penetrating the soft walls of the lymphatic vessels. The glands may be affected by way of the blood or lymph, after eczema, ulcers or tuberculosis of the neighboring tissues. Through slight lesions of the mucous membrane of the mouth or pharynx, the tubercle bacilli enter the lymphatics, and infect the glands of the neck and submaxillary region. Some authorities maintain that tuberculosis

of the lungs is secondary to tuberculous disease of the bronchial glands, and intestinal tuberculosis to disease of the mesenteric glands. The tubercle bacilli cause inflammatory swelling, and the formation of miliary tubercles in the glands. Several miliary tubercles become confluent and form larger nodules which undergo caseous degeneration and softening, and finally suppurate. The tuberculous process is not usually limited to a single gland, but extends through the capsule to the surrounding tissue, and finally to the skin. The glandular tumor, at first circumscribed and covered with intact skin, soon implicates the skin and breaks through it in one or more places, forming fistulas which discharge thin, greenish pus. The pus often burrows under the skin and breaks through in more or less remote places. The axillary and inguinal glands are seldom the seat of primary tuberculosis.

Differential Diagnosis. Tuberculous glands are characterized by the variation in their consistence; some glands being soft and fluctuating, others hard. In the absence of fistulas or other signs of tuberculosis, an isolated tuberculous gland may be mistaken for a suppurating sebaceous cyst or dermoid. The differential diagnosis from malignant tumors has already been described (Fig. 24). In doubtful cases microscopic examination, or inoculation in the guinea pig will establish the diagnosis.

Treatment. The primary cause (eczema, ulcers, etc.), must, of course, be treated. Circumscribed glandular abscesses may be evacuated by puncture and injected with ten per cent. iodoform emulsion. Larger groups of glands should be freely laid open and removed. Removal of tuberculous glands in the neck requires an accurate knowledge of anatomy, as these glands are often situated around the large

vessels from the mastoid process to the supraclavicular fossa, and lie behind the sterno-mastoid muscle and sometimes under the trapezius. After extirpation, the wound should be plugged with iodoform gauze and the wound closed, leaving a small space for drainage. In children especially, there is a rise of temperature for the first few days after extensive removal of glands, which is probably due to the entrance of tubercle bacilli into the blood. Miliary tuberculosis may develop after extensive removal of tuberculous glands. It is, therefore, better in extensive glandular disease, occurring in feeble patients, to limit operative interference to incision and scraping.

Tuberculous lymphadenitis of the neck, especially when associated with eczema of the eyelids, otitis media and ulcers of the cornea, is often wrongly called scrofula. Staphylococci are often found along with tubercle bacilli. In cases where no tubercle bacilli are found it is possible that they have been destroyed by the pus cocci. The term scrofula should, therefore, be avoided, especially when typical tuberculous disease is present in other parts of the body. Predisposing causes of tuberculous lymphadenitis are—measles, influenza, whooping-cough, uncleanliness and improper feeding. General treatment consists in the measures already mentioned, especially sea and sulphur baths.

Tuberculosis of Bone. Tuberculous disease of bones is secondary, and caused by the spread of tuberculous material by way of the blood. For this reason the bones are generally affected in certain places corresponding to the distribution of their blood-vessels. *Lexer* found, by X-ray examination after injection of the vessels of bones with mercury, that the nutrient artery of the long bones terminated in the epiphyses. This explains the frequency with which the epiphyses of the long bones are affected

with tuberculous deposits, by plugging the terminal branches of the nutrient artery in the epiphysis with tuberculous infarcts. In the short bones the nutrient artery terminates soon after its entrance in the middle of the diaphysis; hence tuberculous disease of these bones affects the diaphysis. Tuberculosis also affects the vertebræ, the bones of the hand and foot, the cranial bones, the sternum, ribs and ilium.

In most cases there is circumscribed disease in the form of a caseous sequestrum. Around this form granulation tissue and pus, which seeks a way to the surface by the formation of a fistula. Small sequestra often give rise to large abscesses which become visible under the skin, often at some distance; these are known as "cold abscesses" (Fig. 125). Tuberculosis of the vertebræ may thus cause abscesses which appear in the thigh. In tuberculous bone disease there is little tendency to the formation of new bone. In some cases the focus of disease may become encapsuled in the bone, but is always liable to recrudescence, especially after an injury. More commonly the sequestrum is discharged piecemeal through a fistula, thus differing from the large sequestrum of pyogenic osteomyelitis. Multiple foci of disease often occur in one or more bones. When the bone is exposed by incision, irregular, caseous fragments are seen, together with pus. When the disease occurs in the epiphyses of the long bones it may break into the joint, giving rise to suppurative arthritis.

Although the foci of disease are usually small, and there is seldom the necrosis of large portions of bone which occurs in pyogenic osteomyelitis, there may be extensive disease of the medullary cavity when tuberculous disease of a joint extends to the bones. The phalanges may also be extensively diseased. Sometimes no changes are found in the bone, and the disease is confined to the periosteum, giving rise to subperiosteal abscess, especially in the ribs.

Differential Diagnosis. In some cases tuberculosis of bone may be mistaken for the chronic forms of pyogenic osteomyelitis. However, tuberculous bone disease can nearly always be recognized by its typical situations, its characteristic pus, its small sequestra, its slight tendency to new bone formation, and by the presence of tuberculosis of the lungs. In many cases the diagnosis is assisted by the X-rays. Some cases may be mistaken for syphilitic bone disease. In doubtful cases diagnosis can be settled by incision.

Treatment. As soon as tuberculous disease of bone is diagnosed (by the X-rays early diagnosis can be made), the disease must be radically removed, without interfering too much with function. The bone must be freely exposed, the diseased parts removed by the gouge or sharp spoon, and the wound plugged for some time with iodoform gauze. In the extremities immobilization is necessary. Later on, iodoform-glycerin emulsion may be injected into the bone cavity. Tuberculous foci can be treated in this way in the bones of the face, the cranial bones, the sternum and the ilium.

In cases of tuberculous disease of the vertebræ (tuberculous spondylitis or *Pott's* disease) operative interference should be limited to the evacuation of abscesses, which often point on the inner side of the thigh below *Poupart's* ligament, and injection of iodoform-glycerin emulsion. Operation on the vertebræ themselves is likely to injure the spinal cord or nerves. These cases often undergo spontaneous cure by sinking of the bodies of the vertebræ, resulting in kyphosis. These cases require immobilization by extension splints and later on by plaster of Paris jackets. Extensive bone disease of the extremities in old people may require amputation to save the patient from death by pulmonary tuberculosis; on which amputation often has a favorable influence.

Treatment of tuberculous bone disease by passive hyperæmia is only of use when combined with other methods of treatment. In cases of pain and fatigue in the limbs of young people, occurring without apparent cause, the possibility of commencing tuberculous disease of the bones or joints must always be borne in mind. Early cases often recover after prolonged immobilization without operation. Bones which have been affected by tuberculosis must be protected from injury, which may start the disease afresh.

Tuberculosis of Joints. The joints are often affected with tuberculosis, generally by extension from tuberculosis of the bones. Infection of the joints may also take place through the blood, but primary tuberculosis of joints is rare. In most cases both the synovial membrane and the articular ends of the bones are affected. The knee and hip joints are most often attacked; after these the wrist and elbow. Tuberculous joint disease is most common before puberty, but it also occurs at an advanced age.

The tubercle bacilli give rise to the formation of granulation tissue and effusion in the joint. In the mildest forms there may be only serous effusion (hydrops), but more commonly the effusion is serofibrinous. The fibrin forms villous deposits on the synovial membrane and cartilage, and the so-called "rice bodies," which are lumps of loose fibrin in the joint. These milder forms of joint disease may be included under the name of *articular hydrops*.

The second form of tuberculous arthritis is known as *fungoid arthritis*, owing to the formation of fungoid or spongy granulation tissue, which gives rise to globular swelling of the joint. In these cases the whole joint is filled with grayish-red or yellowish-white granulations, and there is only slight exudation. The fungous granulations tend towards caseous degeneration, and after a time to suppuration. This

form of tuberculous arthritis does not remain limited to the joint but soon extends to the ligaments and periarticular tissue, and eventually to the subcutaneous tissue and skin (Figs. 125 and 126).

A third form is *fibrous arthritis*, in which there is a formation of hard fibrous tissue in the joint. This form is called *caries sicca* by *Volkmann*. It is common in the shoulder and hip joints, and is characterized by a great tendency to cause atrophy, of the articular end of the bone, giving rise to dislocations and also to muscular atrophy.

In distinction to the above atrophic form, there is another form of fibrous arthritis causing globular swelling of the joint from the abundant formation of fibrous tissue. This is especially common in the knee joint and may be mistaken for bone tumor. It is known as "white swelling" or *tumor albus*, owing to the white anæmic appearance caused by pressure of the fibrous tissue on the skin.

A fourth form of tuberculous joint disease is *purulent arthritis*. This is often due to mixed infection of one of the above-mentioned forms with staphylococci—for example, through a fistula in the skin. However, purulent arthritis sometimes occurs quite suddenly, especially in children.

In all these forms of tuberculous arthritis the cartilage may be destroyed by the fibrinous exudation. In cases of fibrinous hydrops, and in caries sicca, the destructive action is generally limited to the cartilage; but in the fungoid and purulent forms of arthritis the whole epiphysis may be destroyed, and the infection may spread to the diaphysis. Besides this, multiple abscesses often develop at some distance from the joint. The greater the destruction of the joint the more abnormal are the positions of the affected limb. The affected joint assumes the position in which its capsule has the greatest capacity (*i.e.* the position in which the capsule is fully distended). For this reason the knee joint is in the position of flexion, the hip

joint in the position of abduction and flexion, the elbow joint in the position of flexion, and the shoulder joint in the position of external rotation. Fibrous or bony anchylosis may occur in these positions; also in positions of subluxation or dislocation.

Tuberculous arthritis generally begins with pain, which is often remote from the affected joint; *e.g.* in disease of the hip joint pain is referred to the inner side of the knee. This is followed by slight rises of temperature and pain in the region of the affected joint. Movement of the joint is avoided, the whole joint becomes swollen, and characteristic positions are assumed by the different joints. In hydrops there is fluctuation. In fungoid arthritis the whole joint is filled with soft, spongy tissue, causing balloon-like swelling of the joint (ballooning); this spongy tissue extends to the periarticular tissue and reaches the skin, which becomes reddish blue, and later on breaks down into tuberculous ulcers and fistulas (Fig. 125).

Diagnosis is generally easy in cases with a fistula discharging characteristic thin tuberculous pus mixed with caseous débris and fragments of sequestrum. In other cases there is evidence of tuberculosis in the lungs or other organs. The fibrous forms (caries sicca) are characterized by the marked atrophy of the joint, the abnormal positions, and the muscular atrophy and complete loss of function. White swelling is recognized by the extensive tumor-like swelling covered by white skin (Fig. 128). In purulent arthritis there is redness and swelling of the skin with high temperature. In doubtful cases an incision will make the diagnosis clear.

Differential Diagnosis. Tuberculous hydrops may be mistaken for traumatic effusion, gonorrheal arthritis or syphilitic arthritis. The diagnosis depends on the history of the case and thorough examination of the whole body. In doubtful cases the joint may be punctured, or inoculation of the

guinea pig may be performed. Acute forms of fungoid tuberculous arthritis can hardly be mistaken for other affections. In cases where complete healing of the joint has taken place, with bony anchylosis, it is sometimes impossible to distinguish tuberculous cases from joint disease secondary to pyogenic osteomyelitis of the diaphysis. In old people healed tuberculous joints may be mistaken for arthritis deformans or chronic rheumatism. Purulent tuberculous arthritis often resembles acute pyogenic osteomyelitis. In young children especially, when the disease begins with rigors, high fever and constitutional disturbance, diagnosis is often only made after incision.

The prognosis of tuberculous arthritis is more favorable in young individuals than in old people. Chronic tuberculous arthritis may give rise to miliary tuberculosis, or to amyloid degeneration of the internal organs.

Treatment. In its early stages tuberculous arthritis may be cured by immobilization by means of extension splints or plaster of Paris casings. Conservative treatment should always be adopted in the early stages. Hydrops may be treated by repeated puncture, injection of iodoform-glycerin emulsion or alcohol and immobilization of the joint. Recurrence is common, and complete restoration of function seldom occurs. The joints should, therefore, be allowed to anchylose in the most useful position. When abscesses and fistulas form, and when an extensive focus of bone disease is shown by the X-rays, conservative treatment must be abandoned.

In fibrous arthritis, caries sicca and white swelling, resection of the joint should be performed as early as possible, to prevent muscular atrophy. In the shoulder joint resection gives good results; but in the knee joint, bony anchylosis in the straight position is the only possible result. In fungous arthritis,

especially in young patients, operation may be limited to opening the joint and carefully removing all tuberculous disease (arthrectomy). The capsule of the joint must be excised wherever it is diseased, and tuberculous foci in the cartilage and bone removed with the gouge. In young subjects a typical resection of the joint is to be avoided, owing to interference with the growth of the limb by extensive removal of the epiphyses.

In adults, on the other hand, the joint may be resected and all diseased parts carefully removed. If the medullary cavity is found to be diseased, after resection of the epiphysis, it must be scraped out. Abscesses and fistulas require incision and scraping. In purulent arthritis the joint must be freely opened; in advanced cases resection is necessary. In extensive tuberculous arthritis with tuberculous disease of the neighboring bones and soft parts, amputation may be necessary, especially in old people (Fig. 130).

After operation the joint must be plugged with iodoform gauze, drained, and immobilized. Joints which have become healed in abnormal positions may be forcibly corrected under an anæsthetic when the anchylosis is fibrous; but there is danger of rupture of the vessels and consequent gangrene (Fig. 132). It is better to treat fibrous anchylosis by gradual extension; while bony anchylosis in a bad position may require resection.

After operations on joints, these should be protected by light splints (*e.g.* poroplastic casings) till the end of the period of growth in children, and for some years in adults. The disadvantage of this apparatus is the causation of muscular atrophy. On the other hand, after resection of the knee joint in young subjects, the knee often becomes flexed, even after bony anchylosis, requiring further resection.

Tuberculosis of other Tissues. Tuberculosis of the mucous membranes occurs in the buccal cavity, the tongue, lips, larynx, small intestine and rectum,

and is generally secondary to tuberculosis of the lungs. *Von Bergmann* has observed a case of tubercular infection of the mouth, from a culture of tubercle bacilli, which was cured by excision. Tuberculosis of the mucous membranes develops in the form of small, reddish-gray nodules, which break down into small easily bleeding ulcers with ragged edges and a yellow caseous surface. These are best treated by cauterization with strong lactic acid. Fistula of the rectum, which is common in intestinal tuberculosis, requires incision. Tuberculosis of the ileo-cæcal region, causing fibrous stricture, may require resection of the gut.

Tuberculous peritonitis, which gives rise to exudation and the formation of extensive adhesions, is improved by laparotomy and removal of the exudation. Purulent tuberculous effusion into the pleural cavity should be evacuated by resection of the ribs. Tuberculosis of the testicles and kidneys necessitates removal of these organs. Tuberculosis of the bladder should be treated by irrigation and the internal administration of guiacol. It has been attempted to remove isolated foci of tuberculosis in the lungs by operation.

Treatment of the general condition of the patient is necessary in all forms of tuberculous disease.

Miliary tuberculosis, which may develop after extensive operations, such as removal of tuberculous glands in the neck, or after breaking down joint adhesions, is due to dissemination of tubercle bacilli in the blood, and may take the form of a typhoid condition, pulmonary disease or meningitis. It is not amenable to surgical treatment.

LYMPHOMATA COLLI TUBERCULOSA

(*Tuberculous Lymphoma of the Neck*)

Plate XCVIII, Fig. 124.

This is a case of tuberculosis of the submaxillary and cervical glands. The patient suffered since youth from eczema of the face and inflammation of the eyelids. A swelling gradually formed in the neck over which the skin became livid. A series of swellings of different sizes were felt under the skin, which was movable over them. Some of these were hard, others soft and fluctuating. There was no sign of pulmonary tuberculosis. The glands were removed through an incision aloug the inner border of the sterno-mastoid. In removing glands with suppuration in their interior, care must be taken not to break into them and thus infect the wound. The wound was plugged with iodoform gauze and sutured, leaving a space for drainage at the lower end.

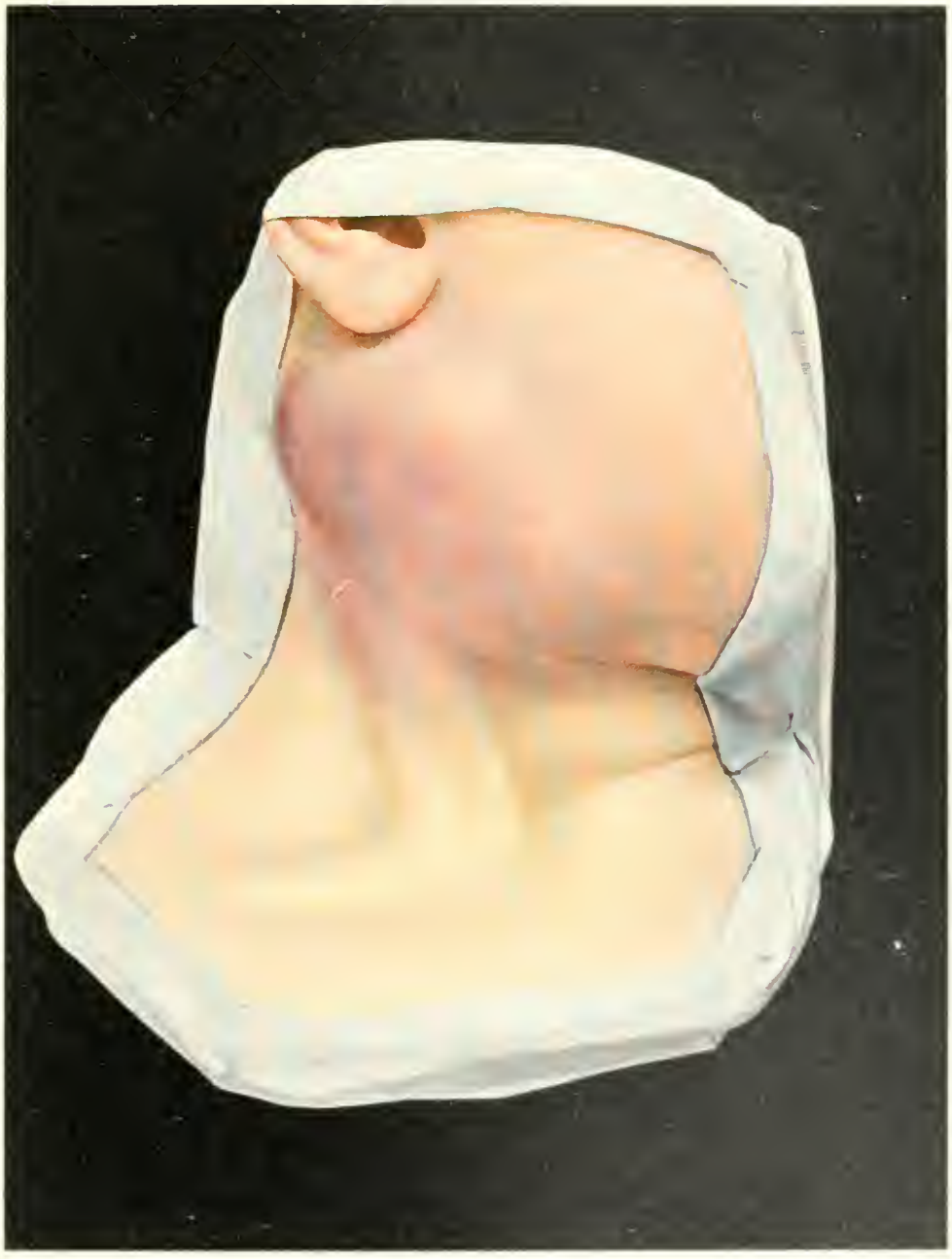

Fig. 124. Lymphomata colli tuberculosa.

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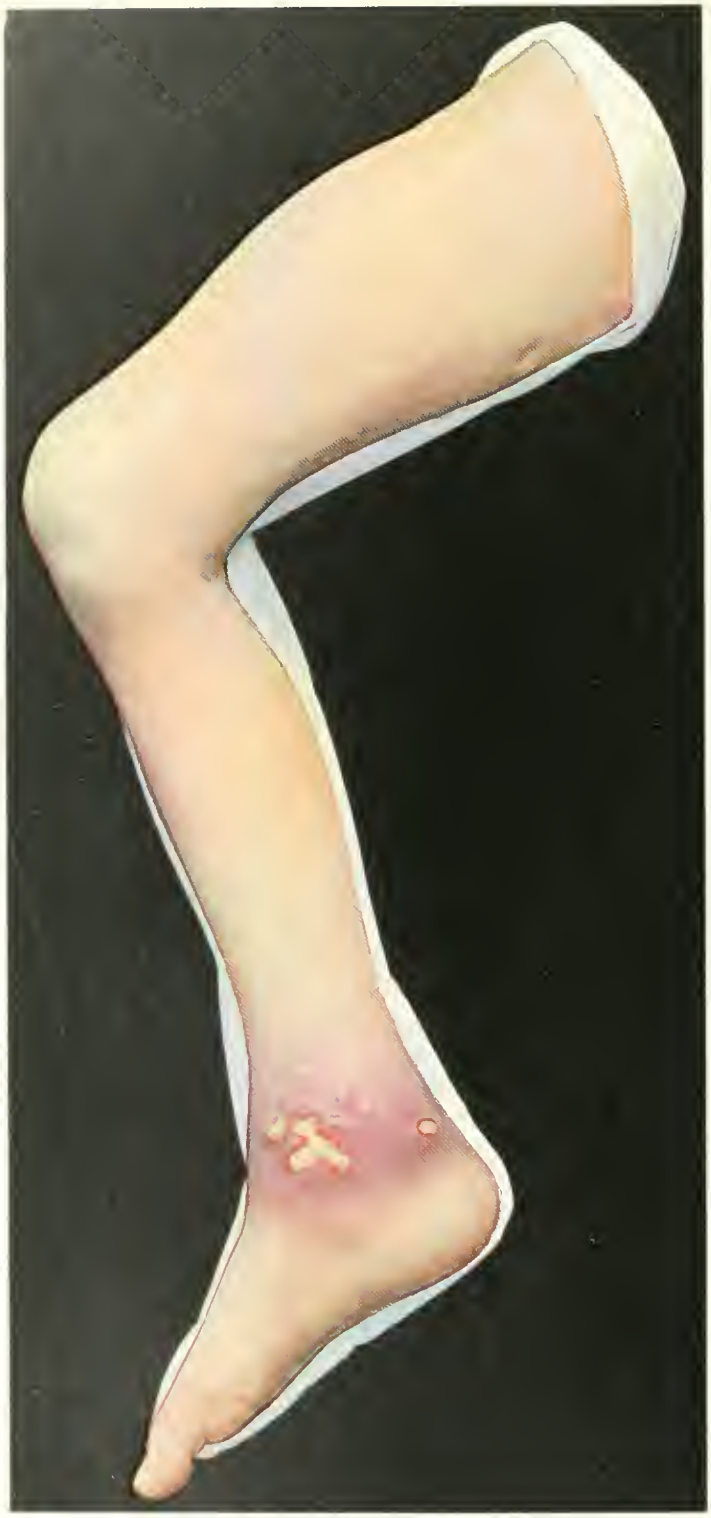

Fig. 125. Arthritis tuberculosa fungosa — Ankylosis genus fibrosa — Abscessus frigidus.

ARTHRITIS TUBERCULOSA FUNGOSA
(*Fungoid tuberculous arthritis*)
ANKYLOSIS GENUS FIBROSA (*Fibrous anchylosis*)
ABSCESSUS FRIGIDUS (*Cold Abscess*)
Plate XCIX, Fig. 125.

This is a case of multiple tuberculosis of the joints, bones and soft parts, together with pulmonary tuberculosis, occurring in a young individual. The right leg was useless owing to extensive disease of the hip joint. The thigh was flexed, and X-ray examination showed destruction of the upper margin of the acetabulum and displacement of the head of the femur onto the ilium. In the middle of the flexor surface of the thigh is a healed fistula due to a burrowing abscess. In the middle of the extensor surface of the thigh is a clearly visible swelling due to a burrowing abscess, which is common in this situation in tuberculous arthritis of the hip joint, and in tuberculous disease of the vertebræ; in the latter case the abscess burrows along the psoas muscle. Fluctuation was present, but the skin was intact (cold abscess). The abscess was evacuated by puncture and injected with iodoform-glycerin. Resection of the hip joint was postponed till the general condition of the patient was improved.

The knee joint was also the seat of old tuberculous arthritis of the fibrous type, which had led to anchylosis at right angles. This was corrected under an anæsthetic by forced movement and an extension splint.

On the inner side of the ankle joint are characteristic tuberculous ulcers, with irregular undermined borders and yellow caseous surface. Thin, greenish pus was discharged by pressure. The X-rays showed

a focus of tuberculous disease in the astragalus, which had broken into the joint. Tuberculous arthritis of the ankle joint more often breaks through on the outer side. Hydrops is rare in this situation. The joint is usually filled with fungoid tuberculous tissue which extends to the periarticular tissues. In Fig. 125 the foot was in the position of equinus owing to absence of function and neglect of treatment. Owing to the extensive nature of the disease conservative treatment was out of the question. The joint was freely laid open and all tuberculous matter removed (arthrectomy). The limb was immobilized by plaster of Paris bandages and extension applied.

Fig. 126. Arthritis tuberculosa-purulenta.

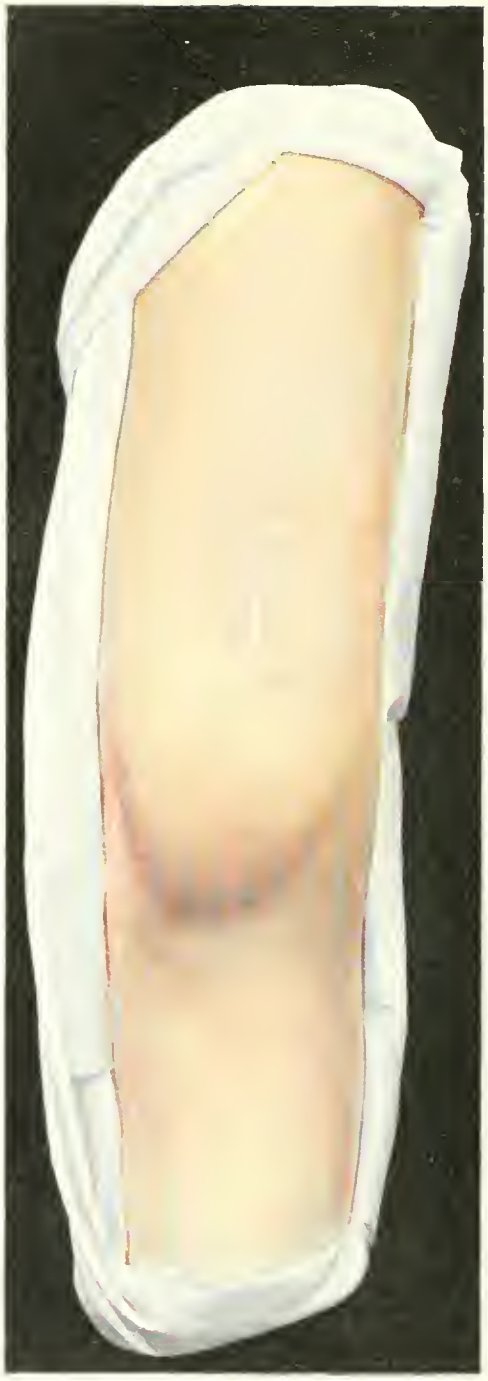

Fig. 127. Arthritis tuberculosa fibrosa — Ankylosis ossea — Subluxatio.

ARTHRITIS TUBERCULOSA PURULENTA

(*Purulent Tuberculous Arthritis*)

Plate C, Fig. 126.

This figure shows a case of purulent tuberculous arthritis of the ankle joint. This form of arthritis is common in children, more often affecting the knee-joint. It begins with fever and rigors, and the rapid formation of abscess, and may be mistaken for arthritis due to staphylococci or other pus cocci. Two incisions were made on the outer and inner sides of the joint, and characteristic thin pus mixed with fibrin was evacuated. The joint was then put up in plaster of Paris. Purulent tuberculous arthritis in children often recovers after early incision; but there is generally some stiffness in the joints, so that these must be put up in the most suitable position for future use.

ARTHRITIS TUBERCULOSA FIBROSA
(*Fibrous Tuberculous Arthritis*)
ANKYLOSIS OSSEA (*Bony Anchylosis*)
SUBLUXATIO (*Sub-luxation*)
Plate C, Fig. 127.

This is a case of old-standing fibrous tuberculous arthritis of the knee joint with bony anchylosis, as shown by the X-rays. Owing to neglect of prolonged fixation of the joint in the straight position, flexion contracture with backward displacement of the tibia has taken place. This was corrected by cuneiform osteotomy, plaster of Paris bandages, and later on a celluloid casing.

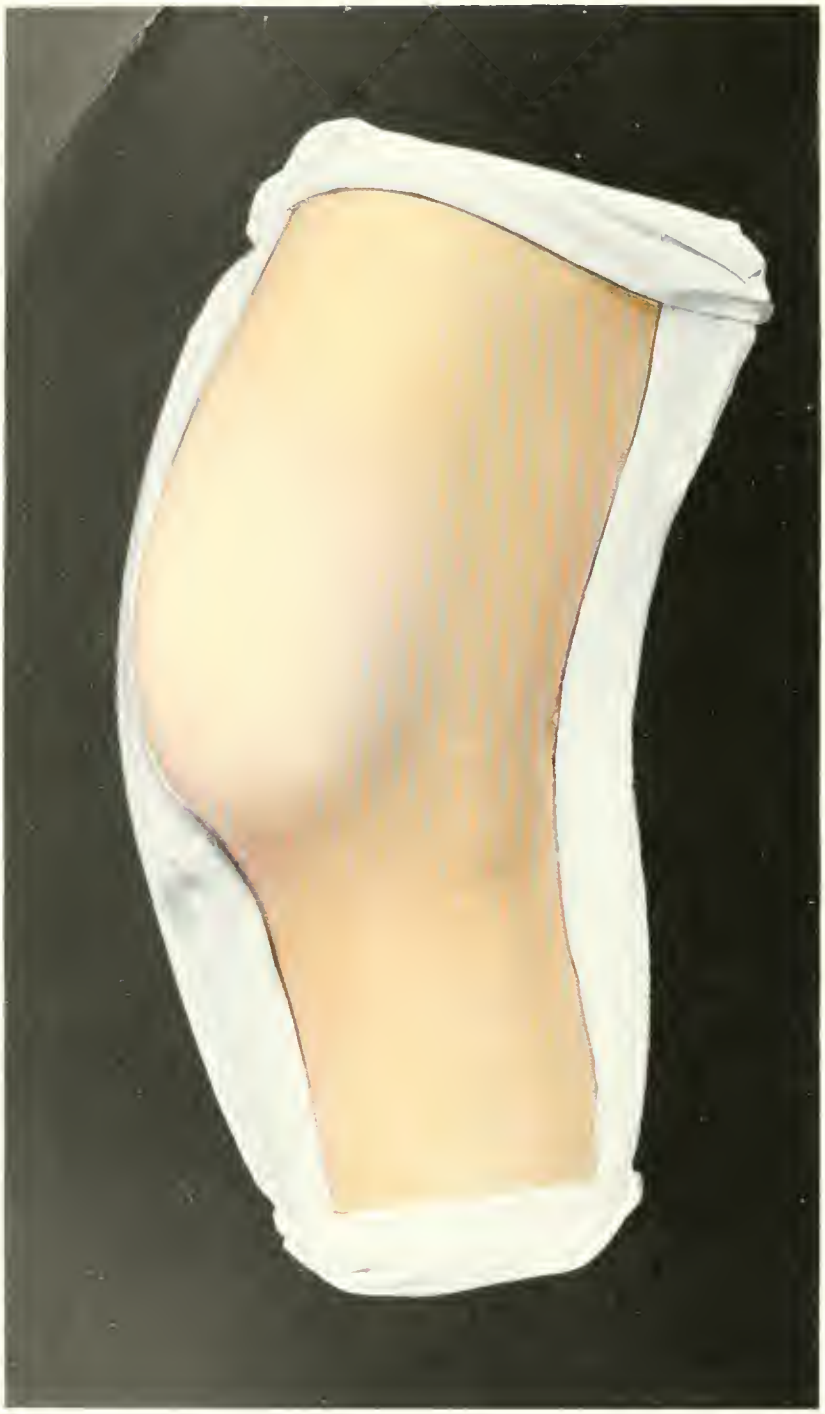

Fig. 128. Arthritis tuberculosa Tumor albus.

ARTHRITIS TUBERCULOSA FIBROSA

(*Fibrous Tuberculous Arthritis*)

TUMOR ALBUS (*White Swelling*)

Plate CI. Fig. 128.

This form of tuberculous arthritis is common in the knee joint in adults. It consists in the formation of hard, fibrous tissue in the joint and periarticular tissue, and gives rise to a tumor-like swelling of the knee and adjacent parts. The skin is white from pressure of the subjacent mass; hence the name white swelling, or *tumor albus*. In Fig. 128 the disease was of several months' duration, and was associated with tuberculosis of the lungs. The patient attributed the affection of the knee to an injury. The X-rays showed tuberculosis of the bones, as well as of the synovial membrane—a common combination in tubercle of the knee joint. Similar swelling occurs in tuberculous hydrops, the simplest form of tuberculous joint disease. Effusion into the joint often precedes the arthritis and is recognized by *balottement* of the patella, which is raised from the femoral condyles by the fluid in the joint. The fluid is generally sero-fibrinous, with numerous free "rice bodies." More common than the fibrous form is fungoid arthritis, which may go on to suppuration and cause much destruction in and around the joint. In all forms of tuberculous arthritis of the knee, the joint is in a position of flexion and valgus. The muscles of the leg become atrophied, and there is retarded growth of the leg.

In Fig. 128, the joint was resected and all tuberculous tissue removed. The articular ends of both

bones were extensively diseased and the cartilages destroyed. In resection of the articular surfaces it is necessary to saw the bones so that the limb can be brought into a straight position.

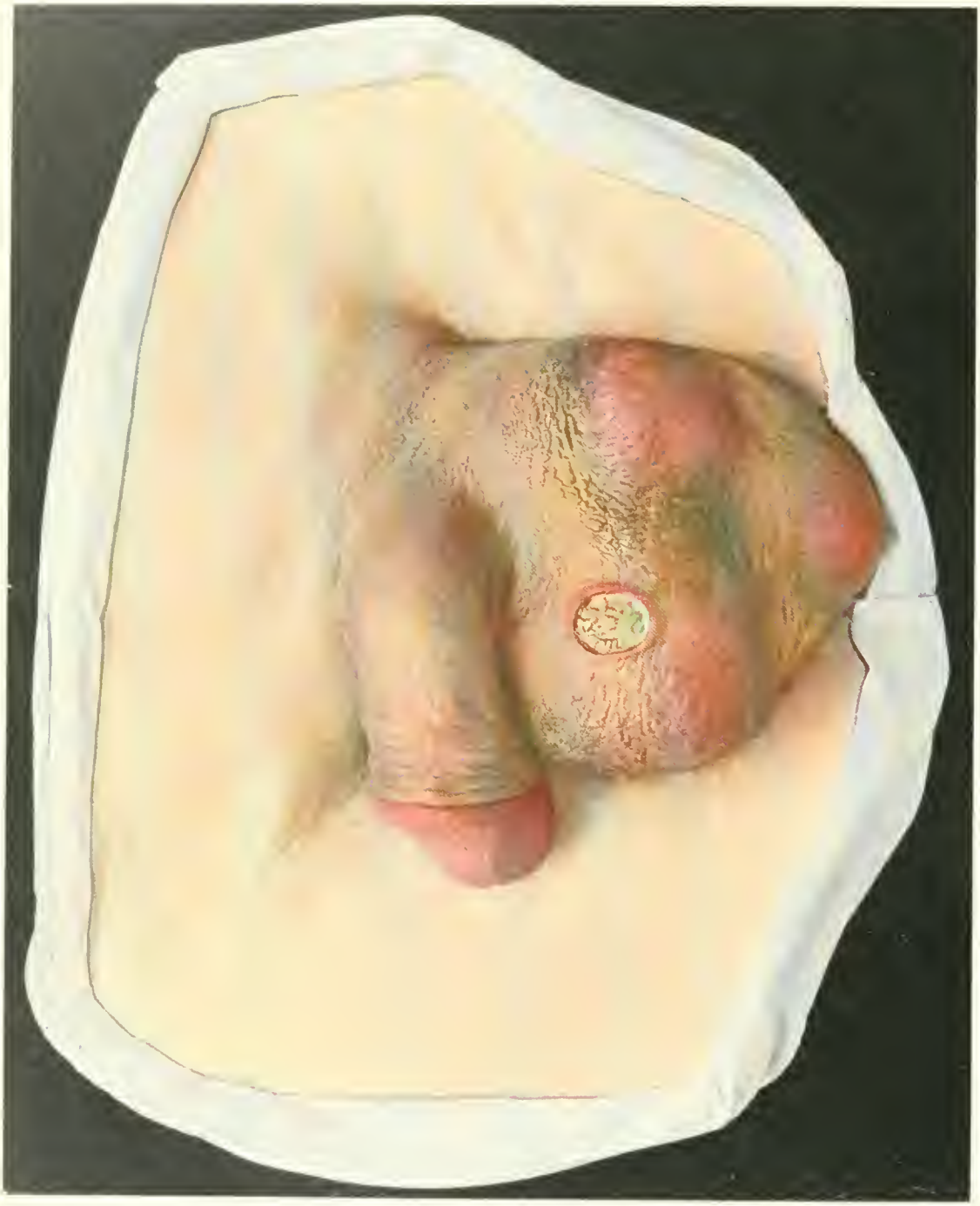

Fig. 129. Tuberculosis testis.

TUBERCULOSIS TESTIS (*Tuberculosis of the Testicle*)

Plate CII, Fig. 129.

Tuberculosis of the testicle begins in the epididymis and extends to the testicle. It often affects both testicles. There is often tuberculosis of the bladder, kidneys and seminal vesicles, and nearly always pulmonary tuberculosis. In the early stages of the disease hard nodules are felt in the testicle. Later on these nodules become soft and fixed to the skin, which breaks down and forms a typical tuberculous ulcer (Fig. 129). In advanced cases there may be several ulcers and fistulas in the scrotum, discharging caseous pus. The spermatic cord is usually thickened, and the seminal vesicles can sometimes be felt enlarged by rectal examination. The prostate is seldom affected by tuberculosis.

Fig. 129 shows extensive disease of the left testicle and epididymis. The skin is thin in several places, and ulcerated in one place. The spermatic cord was thickened, but no disease was found in the bladder, seminal vesicles, prostate or kidneys. There was advanced tuberculosis of the lungs. In the early stages of the disease the tuberculous foci may be incised and scraped, but more advanced cases require castration (Fig. 129). The testicle when removed showed miliary nodules in some parts, abscesses and caseous foci in other parts.

In its early stage tuberculous testicle may be mistaken for gumma, but the latter begins in the testicle, and takes a long time to break through the skin. Malignant growths cause more rapid enlargement of the testicle.

TUBERCULOSIS MANUS (*Tuberculosis of the Hand*)
Plate CIII, Fig. 130.

In an old woman, who suffered from advaneed pulmonary tuberculosis, a swelling gradually developed over the left wrist, causing pain on movement. The swelling gradually extended over the baek of the hand, preventing movement of the fingers. Two typical tuberculous ulcers discharging thin pus and caseous matter developed on the back of the hand. Passive movement at the wrist joint was very limited and caused crepitation. The X-rays showed tuberculous disease of the carpal and metacarpal bones. Tuberculosis of the wrist joint in old people is often so extensive as to require amputation. In this ease the joint was resected, the cavity filled with iodoform glycerin, and the limb put up in plaster of Paris.

The operation showed the presence of tuberculosis of the tendon-sheaths (tendovaginitis), the tendons being imbedded in granulation tissue. Tuberculous tendovaginitis is more common in the upper extremity, and occurs apart from bone disease. It may take the form of tuberculous hygroma, with serofibrinous fluid and crepitation on movement of the tendons; or a fungoid form in which the tendons are imbedded in spongy granulations. Tuberculous disease of the tendon-sheaths is most extensive when it is secondary to old-standing tuberculous joint disease, as in the above ease. The treatment consists in removing the diseased tissue without injuring the tendons; a difficult operation in the case of flexor tendons, on account of the vessels and nerves.

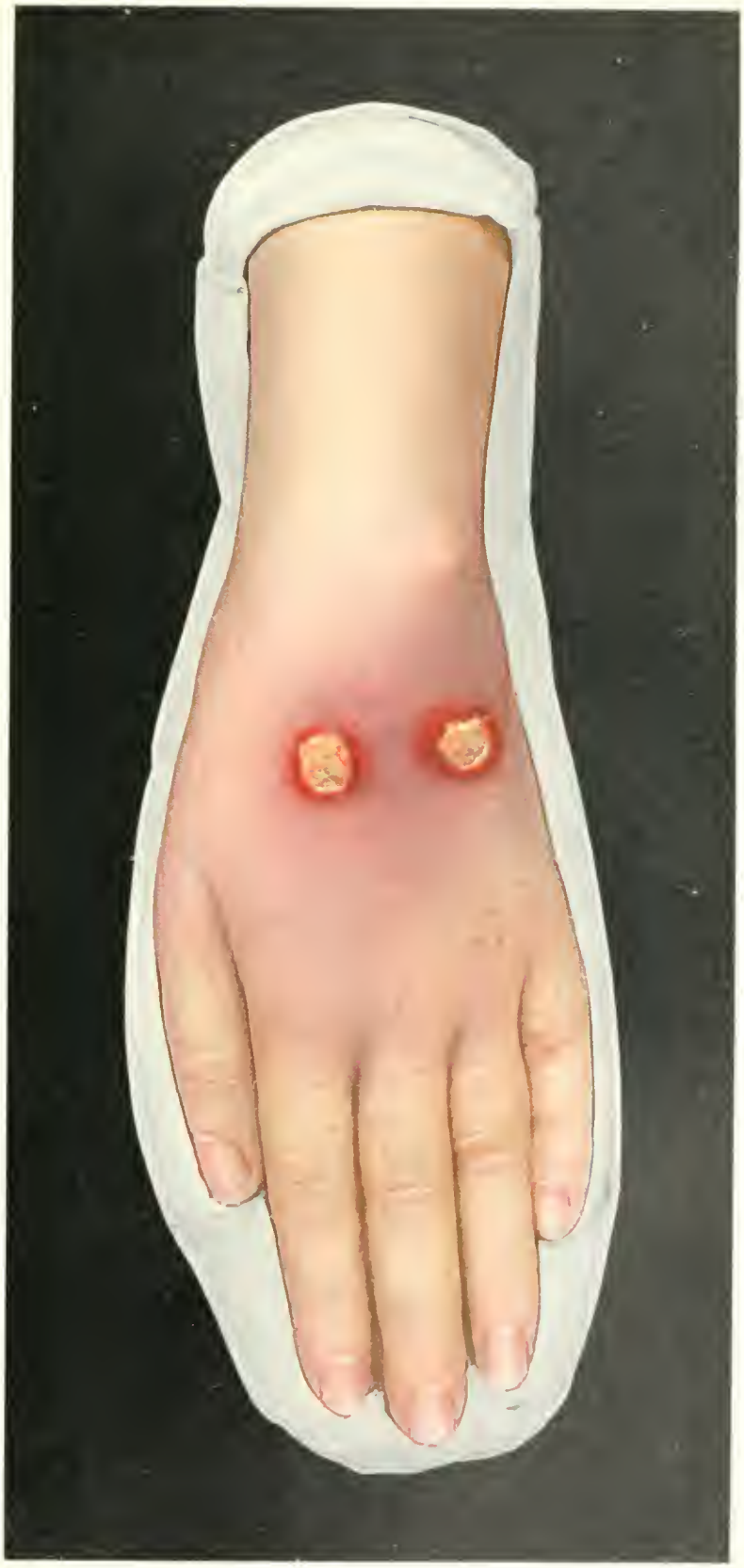

Fig. 130. Tuberculosis cutis.

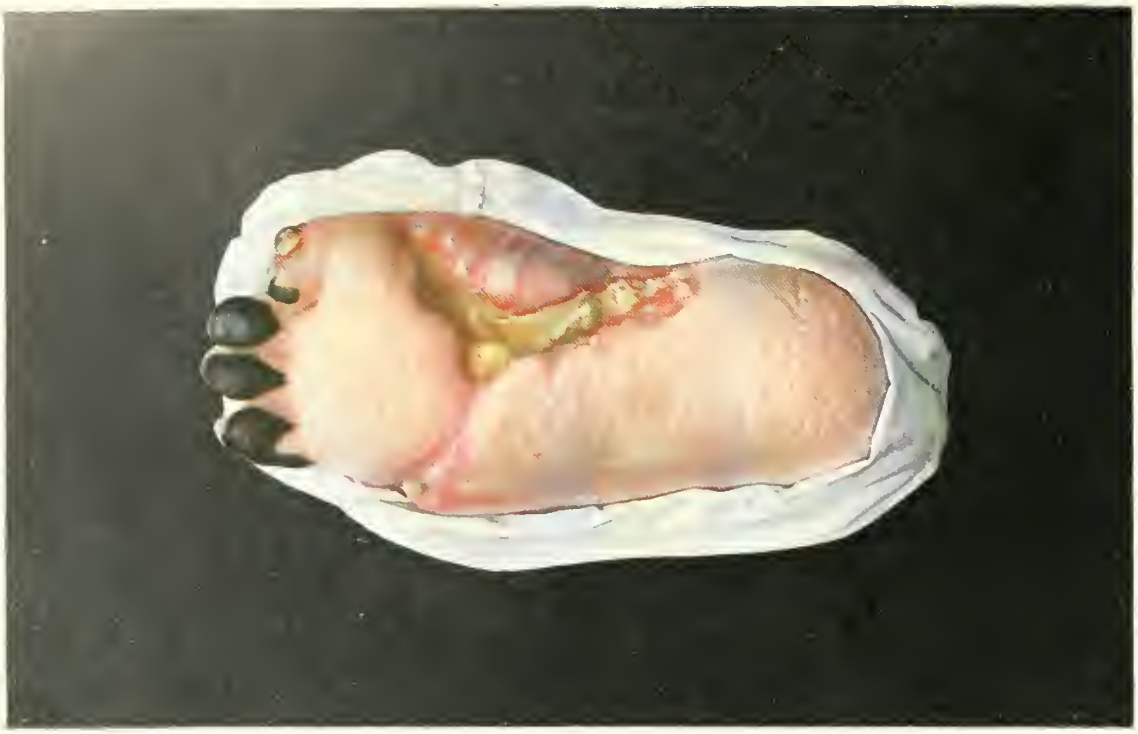

Fig. 132. Gangraena humida pedis.

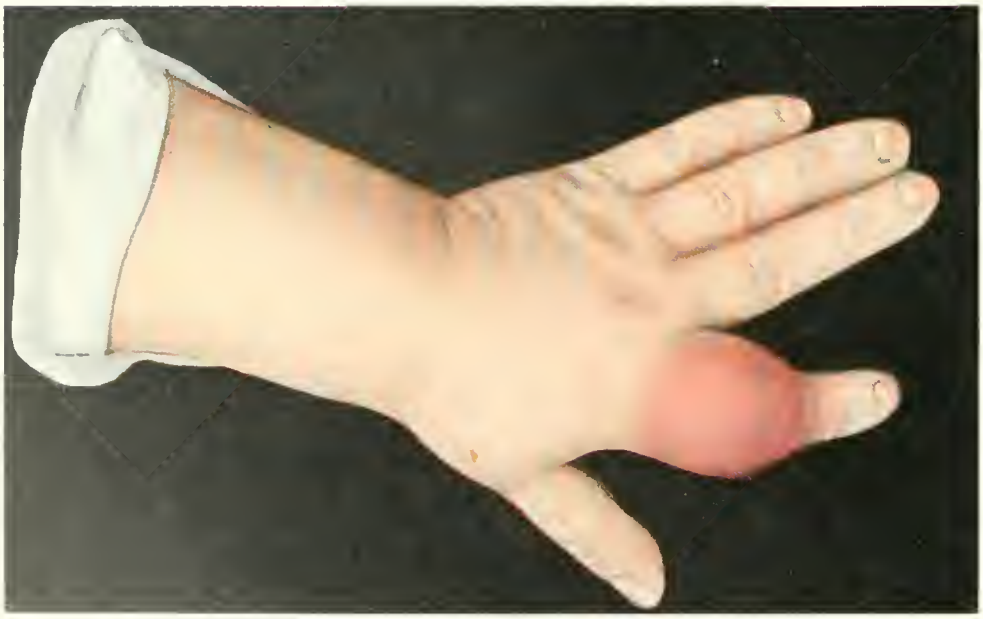

Fig. 131. Ostitis tuberculosa — Spina ventosa.

OSTITIS TUBERCULOSA (*Tuberculous Osteitis*)
SPINA VENTOSA (*Dactylitis*)

Plate CIV, Fig. 131.

Tuberculosis of the phalanges begins in the medulla and extends to the cortex and periosteum. The whole diaphysis may be destroyed by suppuration and caseation, while the periosteum forms a thin shell of new bone. The bone then appears swollen, as if inflated (spina ventosa). The disease generally affects several phalanges of several fingers on both hands, and is often found in the children of tuberculous parents. The destructive process is more severe than in any other form of tuberculous osteitis, several phalanges being often completely destroyed. Fistulas form in the œdematous skin and discharge caseous matter. Growth of the fingers is interfered with, so that they often form deformed stumps after the disease has healed. The disease is often overlooked as it is at first painless; but early diagnosis can be made by the X-rays which show the changes in the bone.

Syphilitic dactylitis differs in causing less destruction of bone, and in the usual absence of suppuration and necrosis; but the diagnosis often depends on other signs and history of syphilis or tuberculosis.

Treatment consists in early incision, scraping, and plugging with iodoform gauze.

GANGRÆNA PEDIS HUMIDA (*Moist Gangrene of the Foot*)
Plate CIV, Fig. 132.

This case is of special interest, gangrene of the foot having developed after forcible correction of flexion contracture due to tuberculosis of the hip joint. Soon after this operation the toes became cold, blue and flexed, and finally black. As the gangrene was limited to the anterior portion of the foot, it is probable that the injury was to the intima only and not a complete rupture of the femoral artery, and that gangrene was due to thrombosis of the vessel.

The figure shows gangrene gradually involving the anterior part of the foot. In the first and fifth toes necrotic bone emerges from fistulas in the skin. In the sole of the foot a wide zone of demarcation is seen, covered with granulations, and separating the gangrenous part from the healthy tissues behind. When the line of demarcation has extended all round the foot, the gangrenous part can be removed, and the wound can be repaired by an osteoplastic operation. The different forms of gangrene will be described with the next plate.

Fig. 133. Gangraena sicca brachii — Mumificatio.

GANGRÆNA SICCA BRACHII—MUMMIFICATIO

(*Dry Gangrene of the Arm*)—(*Mummification*)

Plate CV, Fig. 133.

The term gangrene is applied to extensive, progressive death of the superficial tissues of the body; the term necrosis to death of the deeper structures (fascia, muscle and bone). The bones have a greater power of resistance than the skin, which may become gangrenous after slight disturbance in the circulation. Under certain conditions, *e.g.* after cutting off the blood supply, the whole peripheral part of a limb may become destroyed; but, as the death of the tissues is first noticed in the skin, it is spoken of as gangrene. When the process consists in desiccation of the tissues it is called dry gangrene; when it ends in liquefaction from the invasion of putrefactive bacteria, it is called moist or infective gangrene. Dry gangrene may change to moist gangrene, and both processes may occur simultaneously in different parts of the same limb, when one part becomes infected and the other does not.

The extent of the gangrene varies according to the cause; it may be circumscribed (after local applications, such as carbolic acid), or progressive (after embolism). In both forms the dead tissue becomes separated from the living by a zone of demarcation. The zone of demarcation forms a groove filled with granulation tissue (Fig. 132). It may be circular (Fig. 135) or irregular (Figs. 133 and 134).

In the early stage of dry gangrene the condition resembles that of ischæmic muscular contracture (Fig. 63), especially when the condition is due to plugging of the blood-vessels. The skin becomes

dry, shrunken and parchment-like. In the extremities the peripheral parts are flexed and immovable. The skin becomes gradually yellowish brown and finally black (Fig. 133). All the subjacent structures may undergo dry atrophy. The dead tissue is gradually separated by the zone of demarcation, and the whole of an extremity may undergo spontaneous separation.

While in dry gangrene there is diminution in volume and charring of the affected part; in moist gangrene there is increase in volume, due to preceding œdema. In moist gangrene there is more or less liquefaction, decomposition or putrefaction, due to putrefactive bacteria. The skin is cool and moist, and the epidermis becomes raised in bullæ containing blood-stained fluid. After rupture of the bullæ the skin is reddish brown (Fig. 109). Finally the tissues become disintegrated and smell horribly; lymphangitis, lymphadenitis and general infection then follow.

In both forms of gangrene the skin is at first pale and cold, and then shows bluish patches in various places, often without any direct connection. Contractures and loss of movement indicate the occurrence of total gangrene, whether moist or dry. However, the difference in volume between the two forms is apparent from the beginning.

A deep groove of demarcation also forms in moist gangrene, separating the dead from the living tissue, and spontaneous separation may occur if the patient does not succumb to general infection. In less extensive cases of moist gangrene we can wait for the line of demarcation to form; but the gangrenous part must be removed if there are rigors and high temperature.

The etiology of gangrene is complex, but it is always due to disturbance of the circulation. The blood-vessels may be affected directly or indirectly. Senile gangrene in old people is due to arteriosclerosis. The loosened intima of the small terminal

vessels (also in the larger vessels) gives rise to thrombosis, causing death of the peripheral tissues supplied by these vessels, especially when the vessels which carry on collateral circulation are themselves diseased. In this way the toes or the whole leg may become gangrenous. In these cases the typical changes of gangrene are preceded by pain. Gangrene of the lower extremities in diabetic subjects is generally caused by disease of the vessels.

In younger people gangrene of the peripheral parts of the extremities may be caused by disease of the intima of the smaller vessels (endarteritis obliterans). This is usually of syphilitic origin. In these cases there are severe intermittent pains, causing the patient to limp (intermittent claudication). Both feet are usually affected, and become bluish red. After some years gangrene gradually supervenes, often taking months to develop (angiosclerotic gangrene). The patients suffer severe pain, especially on contact or exposure to cold.

Embolism of the main arteries (*e.g.* from heart disease) causes sudden and extensive gangrene of the upper or lower extremities. (Embolic gangrene). Sudden gangrene may also be caused by rupture or ligation of a main artery. Certain nervous diseases may cause gangrene by vaso-motor constriction of the vessels (angio-neurotic gangrene). The latter affection occurs symmetrically in both feet and is known in its early stages as *Raynaud's* disease. It is generally preceded by paræsthesias and diminution in the sense of temperature.

Gangrene may also occur after extensive burns and frostbite; after local application of carbolic acid, lysol and alcohol; after injection of adrenalin into the tissues, and after the internal administration of ergotin (hands, feet and ears). In all these cases gangrene is caused by thrombosis of the vessels. In the same way erysipelas and phlegmonous inflammation may cause gangrene of the skin and deeper

tissues. Gangrene of the skin may also be caused by the X-rays and by radium.

Differential Diagnosis. The appearance of gangrene, when fully developed, is so characteristic that it can hardly be mistaken for any other condition. The two forms of gangrene are also sharply defined from each other. Dry gangrene might be mistaken for burns of the third or fourth degrees, if signs of the first and second degree of burn were not always present in the neighborhood. Moist gangrene might be mistaken for putrefactive phlegmon, especially with progressive gaseous phlegmon (Fig. 109), if the signs of general infection were not present at an early stage. The history and a thorough examination will not only establish the diagnosis, but in most cases will decide the cause of the gangrene.

The prognosis naturally depends on the cause and on the extent of the gangrene. Angiosclerotic gangrene extends very slowly; it may remain stationary; or parts which appeared to be affected may recover. Plugging of a large vessel causes extensive gangrene of the part supplied by the vessel. Diabetic gangrene and senile gangrene are characterized by their progressive course. Gangrene is more extensive when there is much œdema.

Treatment. Extensive gangrenous parts should be removed after a zone of demarcation has formed. Before this takes place the part should be dressed with aseptic dressings or ointments. In moist gangrene of an extremity early removal may be indicated in order to prevent general infection. In gangrene due to syphilitic endarteritis, iodide of potassium and mercury should be given; the limb should be raised and enveloped in wool; hot-air treatment is useful for the pains; alcohol should be avoided: after demarcation has formed, amputation should be performed in the most conservative way possible.

In embolic and in diabetic gangrene high amputation is often necessary.

In amputation the elastic tourniquet is to be omitted in cases where the gangrene is due to changes in the vessels, as it may cause further gangrene above the point of amputation. If the vessels in the stump only bleed slightly, this shows that they are already affected and that the gangrene will probably extend further. The veins in the amputation-stump bleed freely, owing to the absence of the *vis a tergo* due to narrowing of the arteries. After amputation any pressure of the dressings is to be avoided.

Fig. 132 shows a typical case of dry gangrene or mummification of the arm, affecting all the tissues. The fingers are contracted and blackish brown in color. The skin is hard. In the forearm commencing gangrene is seen in the yellow leathery skin. The line of demarcation is seen as a red zone formed of granulation tissue, separating the dead from the healthy parts. After the line of demarcation had extended all round the limb, amputation through the arm was performed.

In this case gangrene was due to rupture of the axillary artery during an operation for reduction of an old dislocation. In old dislocations at the shoulder joint bloodless reduction is generally impossible and may cause rupture of the artery. But this disadvantage also applies to reduction by open operation, for the displaced vessels are liable to become damaged by pressure of the dislocated head of the humerus and are easily ruptured during reduction of the dislocation. This accident may be avoided by resection of the head of the humerus, after carefully separating the artery, which is generally united to it. The incision for the operation is the same as for ligation of the axillary artery.

This case also shows the importance of early diagnosis of dislocation of the humerus, which is easily made by the X-rays.

GANGRÆNA CUTIS HUMIDA—NECROSIS FASCIÆ

(Moist Gangrene of the Skin)

ULCUS DECUBITALE *(Decubital Ulcer—Bedsore)*

Plate CVI, Fig. 134.

The skin, being the most superficial part of the body, is most liable to injuries which may cause gangrene. It has also less power of resistance than other tissues. Long-continued pressure, especially in places situated over the bones, may cause gangrene of the skin. In this way gangrene may be caused by the pressure of tight bandages or splints; also by a displaced piece of bone in fractures; by pressure on the outer side of the foot in pes varus; by tight sutures, *e.g.* after amputation of the breast, leaving a wide space to be closed.

Uncleanliness, loss of consciousness, nervous diseases (trophoneuroses, syringomyelia, hemiplegia, paraplegia, tabes), cachexia, diabetes, typhoid fever, osteomyelitis, phlegmonous inflammation, general infection and comatose conditions, all predispose to gangrene, which, in emaciated persons, may become very extensive. Gangrene of the skin caused by the pressure of œdema and gaseous formation in the tissues has already been mentioned (Figs. 91 and 109). After operations, gangrene of the skin (bedsores) may occur over the heels, buttocks, spinous processes, shoulder blades and back of the head, if care is not taken to change the position of the patient and apply soft, smooth, protective coverings.

Gangrene of the mucous membranes may occur from the pressure of foreign bodies; for instance, in the esophagus, from the passage of bougies; in the intestine, from the pressure of *Murphy's* buttons; in

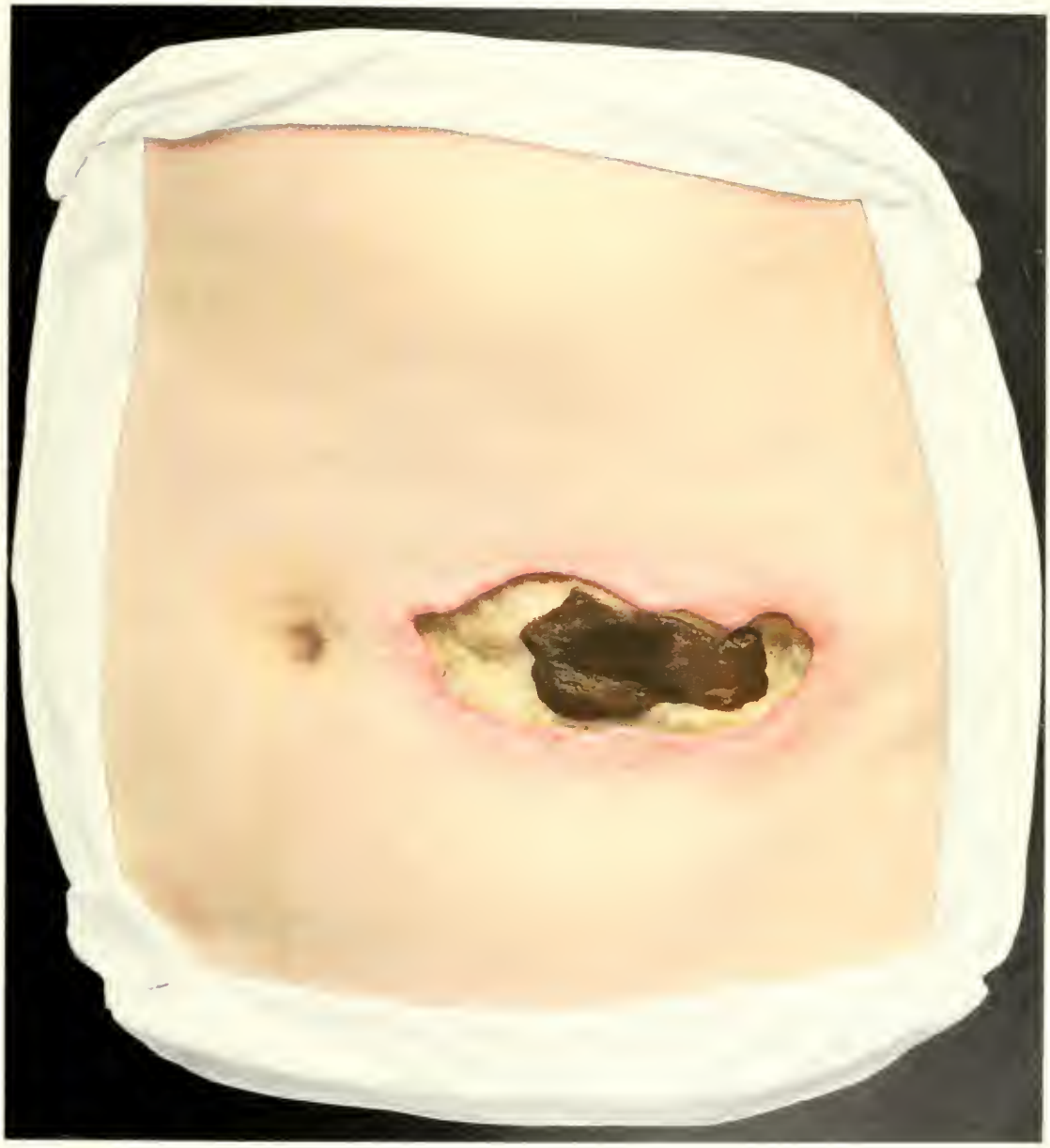

Fig. 134. Gangraena humida cutis — Necrosis fasciae — Ulcus decubitale.

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the larynx, after intubation; also after resection of the intestine or esophagus when the united ends are under great tension.

Gangrene of the skin begins with pain and redness; then slight swelling and blue coloration; finally, raising of the epidermis in bullæ. The epidermis then separates leaving the corium exposed; this is at first greenish yellow, afterwards blackish brown and leathery. At the edge of the gangrenous part the skin becomes inflamed, and by the formation of pus and granulation tissue a gutter-shaped, often circular space is gradually formed—the zone of demarcation. The more severe the injury the deeper is the gangrene so that subcutaneous tissue, fascia (Fig. 134), muscles and bone may become necrosed and cast off.

After separation of the gangrenous part an ulcer is left, called decubital ulcer, which is covered with slimy, greenish-yellow connective-tissue shreds and fetid pus. A neglected decubital ulcer may give rise to extensive putrid inflammation or gaseous phlegmon, as the pus always contains putrefactive bacteria, especially in decubital ulcer over the sacrum which is infected from the fæces. Erysipelas may also occur in decubital ulcer. In neglected cases the gangrene may also extend deeply and cause extensive destruction.

Pressure-necrosis in the internal organs (larynx, esophagus, intestine) is dangerous from perforating ulceration or hemorrhage; also from stenosis after healing.

Treatment. Gangrene of the skin may, in many cases, be prevented, or, at any rate limited, by prophylactic treatment. Decubital ulcers (bedsores) may be prevented by applications of spirit of camphor to the skin of the parts exposed to pressure, by air cushions and frequently changing the patient's position. If the skin is discolored an ointment dressing should be applied, and this should be changed if

the patient complains of pain. As the pain also subsides in a few days under continuous pressure of a dressing, its removal is often neglected, and then when it is removed there may be gangrene down to the bone. In emaciated patients the bony prominences should, therefore, be well padded, and the skin disinfected before applying the dressing.

If gangrene has developed the skin must be protected against infection by a dressing. Separation of the gangrenous part may be hastened by moist dressings with two per cent. boric acid lotion, three per cent. peroxide lotion, or camphor liniment, applied several times daily. Forcible removal of the gangrenous parts while they are firmly attached is not advisable; they should be removed by scissors when almost completely loose. The ulcer may be treated with moist dressings or ointments, and with caustics when granulations have sprung up. After extensive gangrene of the skin the space may be closed by undermining the skin and suturing; or, if this is impossible, by a plastic operation by means of pedunculated flaps.

Fig. 134 shows a case of moist gangrene of the skin with necrosis of the abdominal fascia. Part of the skin is separated from the healthy, somewhat reddened and inflamed skin around it, by a zone of demarcation. The gangrenous part is still firmly attached to the subjacent structures. In some places the skin has separated, exposing the abdominal fascia, the yellowish color of which shows that it has already undergone necrosis. The borders of the ulcer were undermined, and it discharged fetid pus.

In this case the gangrene was caused by a subcutaneous injection of salt solution, performed on a patient in a state of collapse. Gangrene of the skin may occur after injection of large quantities of salt solution when the injection is made intracutaneously

instead of subcutaneously; also when the fluid is too hot, or not sterilized.

The ulcer became clean under dressings of peroxide lotion; the gangrenous skin and necrotic fascia separated; the edges of the fascia and the skin were sutured separately, and primary union took place. As sutures in fascia often do not hold, the patient was ordered an abdominal belt to prevent abdominal hernia.

GANGRÆNA CARBOLICA (*Carbolic gangrene*)
Plate CVII, Fig. 135.

In this case carbolic acid dressings were applied to a wound in the finger. The end of the finger became white and the epidermis was destroyed as far as the carbolic acid dressing extended, exposing the corium. The patient had no feeling in the tip of the finger and suffered from severe pain. The tip of the finger gradually became black and shrunken (dry gangrene).

The figure shows gangrene of the terminal phalanx. The greenish-yellow color at the junction of the terminal with the middle phalanx indicates commencing gangrene. In the middle of the second phalanx there is a wide zone of granulation tissue indicating the line of demarcation. Severe pain in the finger was due to thrombosis of the terminal arteries caused by the action of carbolic acid. Later on there was loss of sensation in the finger from paralysis of the sensory nerves.

Moist dressings were applied, and in a few weeks a groove of demarcation extended down to the bone. In the peripheral part gangrene extended to the fascia, muscles, tendons and bone. Healing took place after disarticulation at the interphalangeal joint.

It must be borne in mind that even one per cent. carbolic lotion, after a few hours' application only, may cause gangrene of the skin and deep necrosis by thrombosis of the vessels. Certain individuals appear to be predisposed to gangrene after fomentations with carbolic acid, and sometimes lysol or alcohol; especially when gutta percha tissue is placed over them, preventing evaporation. After a short application the skin may recover. Acetic acid dressings hasten recovery.

Fig. 135. Gangraena carbolica

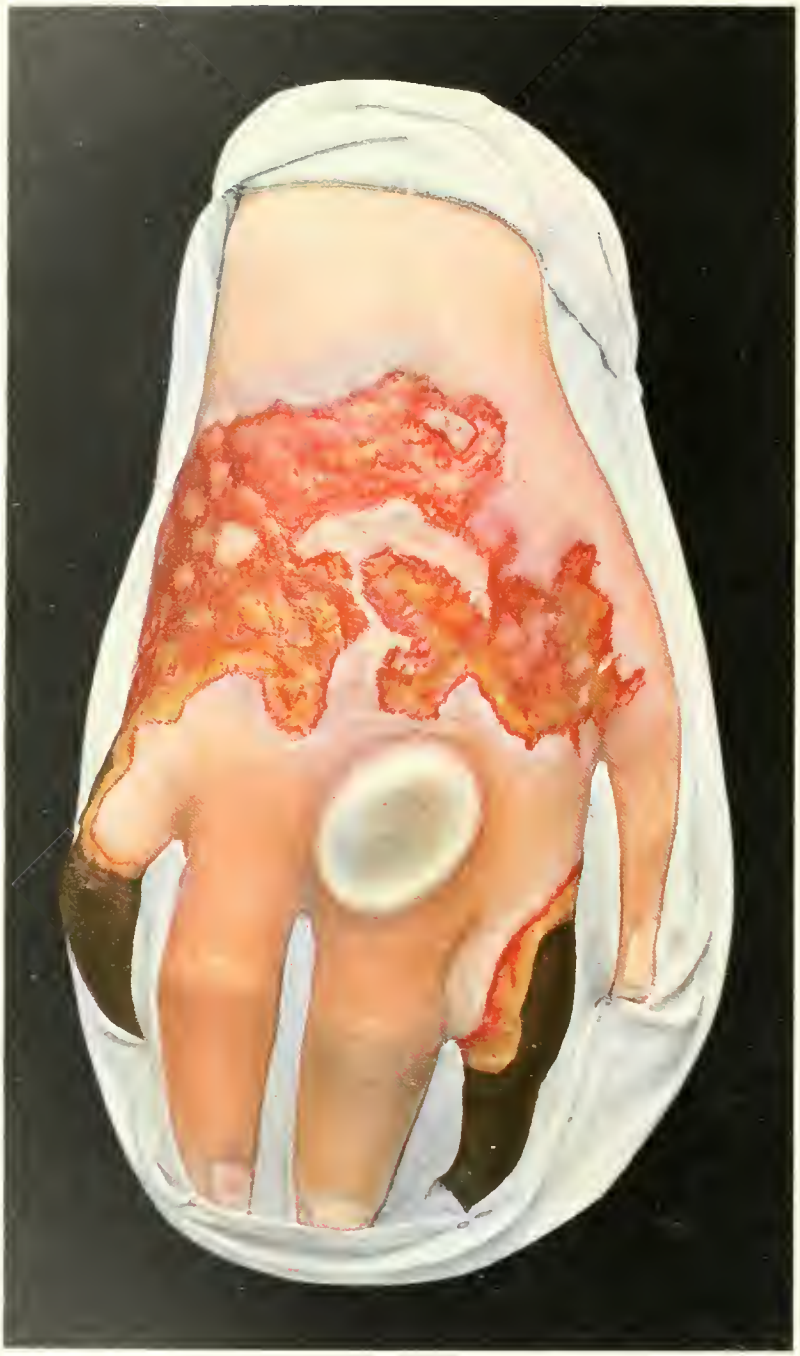

Fig. 136. Combustio erythematosa – bullosa – escharotica.

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COMBUSTIO ERYTHEMATOSA—BULLOSA—ESCHAROTICA

(*Burns*)

Plate CVIII, Fig. 136.

Burns may be caused by the action of radiant heat; *e.g.* prolonged exposure to hot sun or a hot fire. The heat may arise from solids, liquids or gases. Electricity (lightning stroke) and the X-rays may also cause burns; also strong acids and alkalis (sulphuric and nitric acids, caustic potash and soda).

Burns of the mucous membrane of the mouth, tongue, pharynx, esophagus and intestine are caused by certain chemicals swallowed as poisons. These may cause death by œdema of the glottis, or later on by perforating ulceration of the gut and peritonitis. If the ulcers heal, they lead to stenosis of the gut.

Burns of the skin may be caused by strong caustics; such as trichloracetic acid, for removal of warts; Vienna paste, tartar emetic ointment, etc.

Tender skins (*e.g.* children) react to slight degrees of heat; *e.g.* after the application of poultices, fomentations.

The mildest degree of burn—also called the first degree—consists in arterial hyperæmia, causing redness and slight swelling of the skin. There is more or less pain or tenderness, itching and tension of the skin. In this form there is early and complete restitution to normal, sometimes after desquamation of the epidermis.

The second degree of burn is characterized by the formation of bullæ. Besides redness caused by the first degree, the epidermis is raised in blisters by exudation of lymph between the epidermis and the corium. The blisters contain yellowish fluid or gelatinous masses, and may develop twenty-four

hours after the injury. In severe burns of the second degree some of the blisters rupture, exposing the red corium, which is very painful to touch. This form of burn is common after boiler explosions, gas explosions, and scalding with steam or hot water. Healing by epidermization of the corium takes two or three weeks, but the skin is restored to the normal condition without scarring, provided the process has not been complicated by suppuration.

In the third degree of burn the epidermis and corium are destroyed, to a greater or less extent according to the severity of the injury. The resulting gangrene of the tissues is due to three factors; loss of water from the tissues; loss of blood supply from acute thrombosis of the vessels; and coagulation of albumen in the tissues. The skin becomes black and gangrenous. Sensation is lost at this part; but there is always pain due to burns of the first and second degrees in the surrounding parts.

In severe burns the fascia, muscles and bones may undergo necrosis, as well as the skin. The separation of the necrosed parts takes place in the usual way by an inflammatory zone of demarcation. Burns of the third degree are liable to infection of the exposed tissues by pyogenic and putrefactive bacteria, so that the wounds take months to heal, with hypertrophic scars which cause contractures of the joints and form adhesions with neighboring parts. The scars of burns of the third degree are easily lacerated and may give rise to carcinoma (Fig. 20). In burns of the third degree there is also the danger of general infection from prolonged suppuration. These cases may also be fatal from exhaustion, hemorrhage from erosion of vessels, or amyloid disease of the kidney, liver, etc.

In burns of the fourth degree there is complete charring of all the tissues, which fall to ashes when touched.

It is obvious that the effect of a burn on the organ-

ism depends on the degree of the burn, the extent of surface involved, the part of the body affected, and the condition of the patient beforehand. Burns of the first and second degrees when they are not very extensive are not serious; but if a third of the body is affected, even in burns of the first degree, there is fatal constitutional disturbance, especially in children. Apart from the severe pain, rapid collapse sets in. The skin becomes cold, pale and covered with sweat; the pulse is small and rapid; the patient complains of thirst; consciousness is retained till death occurs in two or three days. As the patients are fully conscious and in good spirits, and do not complain of any more pain, it is necessary to explain to the relatives and friends that death after extensive burns is almost inevitable.

In these severe cases the temperature is subnormal. There is sometimes delirium and coma. In extensive burns of the second degree, complicated by general infection, there is high temperature, delirium, diarrhea and fetid discharge from the wounds. Duodenal ulcer may also occur. Death may occur from uræmic coma following anuria. The autopsy shows ecchymoses and thromboses in all the organs, parenchymatous nephritis, etc.

In extensive burns death may be caused by shock, which may be due to great pain, sudden cooling of the skin, or overheating of the blood, as in heat-stroke. Accumulation of poisonous substances in the blood may also cause death.

Burns of the third degree, when affecting certain regions, give rise to various disfigurements and contractures. The eyelids and mouth may be disfigured by contracting scars (ectropion). The head may be flexed on the thorax; the fingers may become united, etc.

Differential Diagnosis. Burns may be confounded with frostbite, in the absence of history.

Treatment. In burns of the first degree the surrounding healthy skin should be disinfected, and ointment applied to the burnt part. In burns of the second degree small blisters can be left to dry up; large blisters should be opened at the base, the lymph evacuated and the epidermis replaced. The loosened epidermis then generally becomes attached. If the blisters are already broken, the loose epidermis should be removed and the exposed corium powdered with rice powder, talc or flour. Bismuth dressings are useful; but oil and lime water applications should not be employed, as they favor infection. Antiseptic gauze is to be avoided, on account of the danger of poisoning.

Morphia may be required if there is much pain, especially when the dressings are changed. The latter should be covered with plenty of wool.

The more infection of the surface is prevented by careful treatment, the less is the scar tissue. If there is much scar tissue this may be excised and the wound covered by skin flaps. Injection of ten per cent. thiosinamin solution may be tried to absorb scar tissue.

In the extremities, resection of joints, amputation or disarticulation may be necessary when the limbs are useless, or the seat of exhausting suppuration, or when there is threatening general infection. Such operations should not be performed till the patient has somewhat recovered from shock. Burns of the neck and mouth may require tracheotomy. In extensive burns of the second and third degrees with much discharge permanent baths are useful.

In all severe burns the general condition of the patient requires attention. To support the heart, digitalis, camphor injections, subcutaneous injections of salt solution may be indicated. The whole body must be well protected by wool. The function of the kidneys should be stimulated by diuretics (caffein, acetate of potash, etc.).

Burns caused by acids require neutralization by the application of alkalis (*e.g.* soap); while burns caused by alkalis require neutralization by weak acids (acetic acid, vinegar). Internal burns caused by swallowing chemicals may require special surgical treatment for the resulting stenosis.

In lightning-stroke treatment is generally useless. In heat-stroke and sunstroke, the overheated body must be cooled by applying ice bags to the head and over the heart, and by drinking large quantities of water.

Fig. 136 shows all four degrees of burns. In this case the injury was caused by red-hot metal. The first degree is shown by reddening of the epidermis; the second degree by the formation of blisters containing yellow fluid; the third degree (on the back of the hand) by the destruction of epidermis, exposing the corium, and in some places the bones; the fourth degree by charring of the ends of the second and fifth fingers. The first phalanges of these fingers also show burns of the third degree. The different degrees of burn are due to the differences in the length of time during which the heat was acting in the different places. The second and fifth fingers were disarticulated; the rest of the hand recovered, with moderate function, after treatment by the permanent water bath.

CONGELATIO ERYTHEMATOSA—BULLOSA (*Frostbite*)

Plate CIX, Fig. 137

Extreme degrees of cold may cause destruction of the tissues, in the same way as burns. Here again, the extent of injury depends on the degree of cold, the duration of its action, and the condition of the patient. Dry cold is better borne than moist cold. Certain individuals are especially liable to the effects of cold—persons in a state of alcoholic intoxication, anæmic individuals, children and old people, cooks and others who are exposed to rapid changes of temperature. Frostbite may be caused by the action of snow, ice or liquid air.

Pernio or chilblain may be regarded as a chronic form of frostbite, affecting the fingers, toes and ears. It is especially common in chlorotic individuals and causes swelling and blueness of the skin with numerous bluish-red nodules. These often cause unbearable itching and burning sensations, and, when scratched, give rise to intractable ulcers.

Acute frostbite appears in different degrees according to the degree of cold, in the same way as burns. The parts of the body usually affected are the fingers, ears, nose and toes. In the first degree of frostbite there is redness of the skin from hyperæmia (erythematous congelation). This is usually followed in a short time by the formation of a blister. The redness increases when the patient comes into a warm room, or takes alcoholic drinks. It is accompanied by burning and itching pains, which may continue for a long time. The redness may even last for life after a single frostbite of the first degree; for instance in the nose of a chlorotic woman. In most cases of

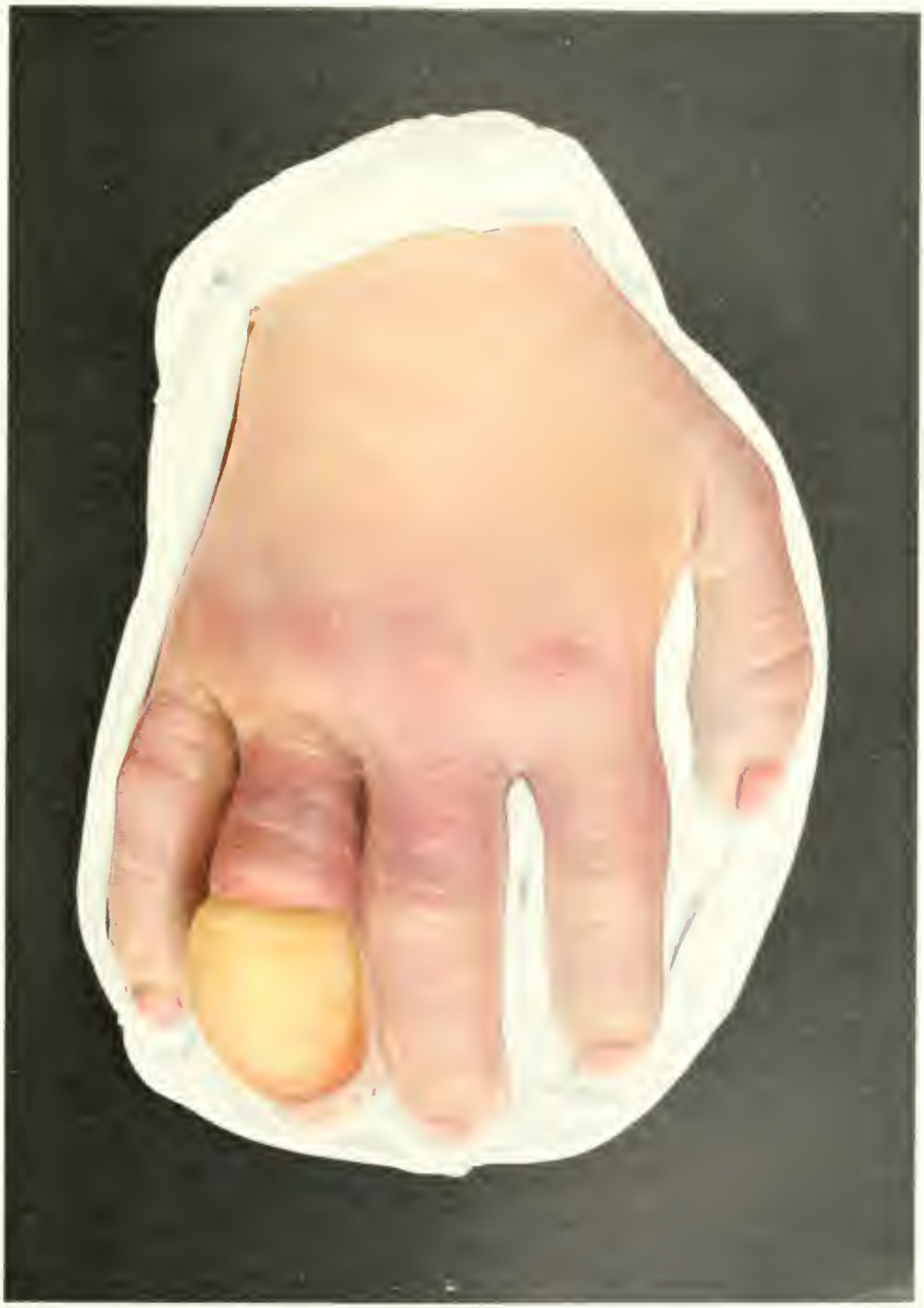

Fig. 137. Congelatio erythematosa — bullosa.

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frostbite of the first degree, however, there is complete recovery.

Longer exposure to cold, or exposure to more severe cold, causes venous congestion, œdema, and the formation of blisters. The skin becomes blue or white, cold and insensitive, and is often covered with numerous blisters, with bluish-black contents; after their rupture the exposed corium is dark in color and very painful. Infection is liable to occur, causing extensive ulceration with little tendency to heal, and leading to cicatricial contraction. Pain is more severe and continuous in frostbite of the second degree.

In frostbite of the third degree, in the same way as in burns of the third degree, there is gangrene of the skin and necrosis of the deeper tissues, due to thrombosis of the vessels. The skin is at first bluish black, cold and insensitive, later on quite black. Separation of the frozen tissues may take place either by dry or moist gangrene. The zone of demarcation has often a putrid character. Progressive phlegmonous inflammation may spread from the borders of the frozen area, and may lead to general infection. Along with frostbite of the third degree the neighboring parts are affected in the first and second degrees, and other parts are ulcerated; so that the clinical picture is variegated. The gangrenous and necrotic parts, after some months, are cast off spontaneously. The nails soon fall off in frostbite of the hand. In frostbite of the third degree, parts which at first showed signs of the second degree only, may afterwards become gangrenous.

Healing eventually takes place by the formation of very unsightly hypertrophic scars, which may cause contractures. Contractures may also be caused by paralysis of nerves, or by waxy degeneration of muscle fibres. Frostbite is said to cause changes in the blood-vessels which may lead to secondary gangrene. The general condition of the patient is little impaired in acute local frostbite of circumscribed regions.

The period of healing varies according to the degree of the frostbite, but is usually longer than in burns and causes more severe after effects.

General frostbite is common in severe winters among weary wayfarers who weaken their power of resistance to cold by alcoholic drinks. After the preliminary feeling of cold they become overcome by fatigue, fall down and become frostbitten. People may even fall unconscious without any previous symptoms. The body, lying on the ground, becomes cooled to below 20° C. (68° F.). Exposed parts may even become frostbitten by slight degrees of cold, acting continuously on the recumbent body. The nose, ears and hands then become frozen to ice and fall off when touched, while the blood becomes decomposed and contains ice crystals. This condition may last for days before death takes place. Only early attempts at resuscitation can do any good in these cases. The heart is, however, so weakened that, even if the patients recover consciousness, they succumb some days later with delirium, coma and heart failure. The prolonged action of intense cold may freeze not only the external parts of the body but may convert all the fluid parts to ice. The expansion caused by the conversion of liquids to ice then ruptures the surface of the body.

Patients who have been exposed to general frostbite must not be suddenly warmed, as this may cause death from shock. The stronger the patient's constitution the better is the chance of recovery; but the prognosis of general frostbite is very unfavorable. Extensive paralysis (hemiplegia and paraplegia) may remain after recovery from the immediate effects, and the patients may suffer for years from headache, pains in the joints, and a tendency to local frostbite due to changes in the arteries. [These secondary phenomena may be due to frostbite acting as an exciting cause on pre-existing latent disease, especially disease of the arteries.

Differential Diagnosis. Frostbite may be mistaken for burns in the absence of any history.

Treatment. Chilblains may be treated by hot air apparatus or hot sandbaths, together with general treatment of chlorosis by iron and arsenic. The irritation may be relieved by painting with tincture of iodine, balsam of Peru, or by inunction with bromocoll ointment. Ulcers are best treated with *Hebra's* diachylon ointment. Recurrence can be limited by prophylactic measures.

In acute local frostbite the parts must be warmed gradually—by rubbing with snow or cold applications. Early treatment in this way may restore the frozen skin. In frostbite of the second degree, large blisters should be opened and broken blisters removed. Ulcers should be treated with strict asepsis, and dressed with sterile gauze or ointment. The extremities should be suspended on splints, avoiding all pressure.

In cases with moist gangrene and putrefactive phlegmonous inflammation, early amputation is often necessary to prevent general infection. In dry gangrene, amputation may be deferred till a zone of demarcation has formed. Plastic operations are often required after spontaneous separation of gangrenous parts of the fingers or toes. Morphia injections may be necessary for the severe pain in the early stages of frostbite. Paralysis may be improved by electricity, and contractures by massage; but the latter more often require a secondary operation.

In general frostbite the body must be very gradually warmed. The patient is placed in a cool room and rubbed down with cold water. He is then put in a tepid bath the temperature of which is gradually raised in the course of several hours. If respiration has stopped, artificial respiration must be performed. Injections of camphor and subcutaneous infusion of salt solution is useful to stimulate the action of the

heart. When the patient recovers consciousness hot alcoholic drinks should be given. Local gangrene resulting from general frostbite is identical with that occurring in severe local frostbite, and requires the same treatment.

Fig. 137 shows a case of frostbite of the first and second degrees in a workman who had had repeated milder attacks in the winter, after exposure of his hands to cold water during his work. The hands were permanently blue, and in the winter painful chilblains developed on the fingers, especially on the extensor surface. He finally developed frostbite of the second degree, which is shown by the whiteness of the ends of the fingers, and other changes in the fourth finger. The skin over the first joint of the fourth finger is blue, and a large blister containing yellow lymph has developed on the extensor surface of the last joint. The patient complained of severe burning pains in the tips of the fingers, especially in the fourth. The blister was opened and the epidermis replaced on the corium, the hand was dressed with ointment and put on a splint. Under this treatment the skin quickly recovered.

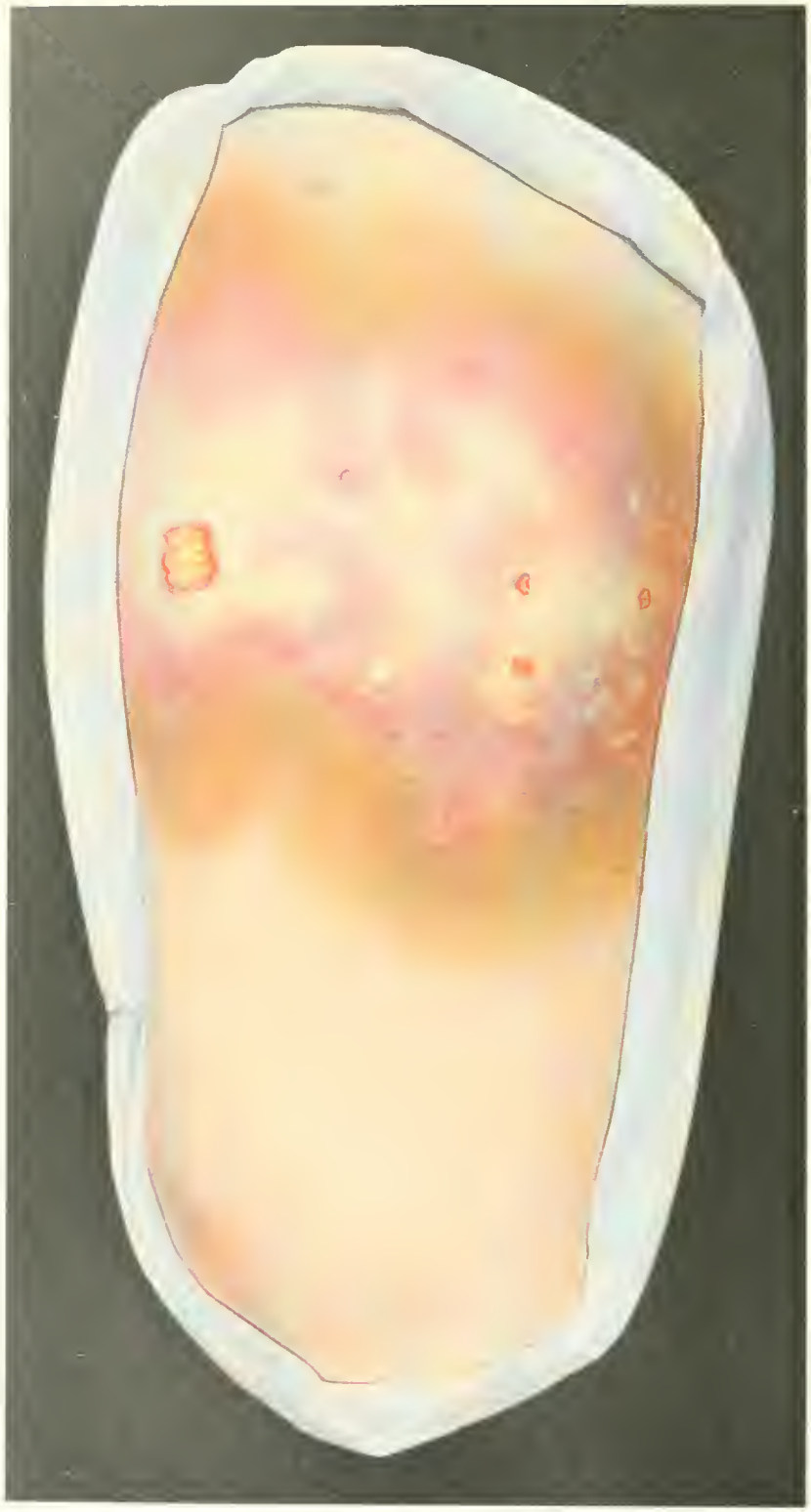

Fig. 138. Combustio (X-Rays).

X-Ray Burn

Plate CX, Fig. 138.

The X-rays have been used for the treatment of various diseases; sometimes with good results, as in lupus, chronic eczema, etc.; sometimes with no result, as in malignant tumors. A single exposure, properly performed, causes no injury to the skin; but repeated exposures sometimes give rise to changes in the skin, especially when the tubes are placed nearer than thirty centimeters from the skin, and when the exposures are too long or too frequent. The changes produced take the form of a dermatitis, and certain individuals appear to be predisposed to it.

The first signs are redness, swelling and tension of the skin, accompanied by itching and burning sensations. This condition is followed by fissures in the skin and finally ulceration, which is characterized by its chronic and progressive nature. Workers in X-ray laboratories are subject to a chronic form of dermatitis of the hands, unless they protect themselves with gloves, lead-foil, etc. The skin becomes dry, cracked and fissured; the nails become brittle and are often shed. Some cases become gangrenous, and the necrotic tissue is separated by a zone of demarcation. Other cases develop into carcinoma and require amputation of the hand. Some cases are fatal from exhaustion.

X-ray dermatitis can be prevented by placing the tube not less than thirty centimeters from the skin, and by avoiding too long or too frequent exposures.

Workers in X-ray laboratories should take all possible precautions, by the use of lead-foil, gloves, etc. The mode of action of the rays is still not quite clear. Cases have been observed in which exposure to X-ray has caused atrophy of the testicles, interruption of pregnancy, etc.

Treatment. In mild cases, due to the action of a single exposure on a sensitive skin, the action of sea air is said to be beneficial. Chronic X-ray dermatitis is very rebellious to all the usual form of treatment.

Fig. 138 shows an X-ray burn which followed a long exposure made for a swelling of the thigh. The skin became red, then white, and finally ulcerated in several places. The brown coloration indicates healing of the less-affected parts. The ulcers healed after the application of simple dusting powder.

This case is interesting because the X-rays, which were applied to a peripheral sarcoma of the femur, not only caused no improvement but aggravated the tumor. This shows the danger of the treatment of malignant tumors by the X-rays, for, as operative treatment is postponed, more extensive operation becomes necessary later on. In this case X-ray examination showed the presence of sarcomatous masses in the soft parts (by bony spicules) necessitating high amputation through the thigh.

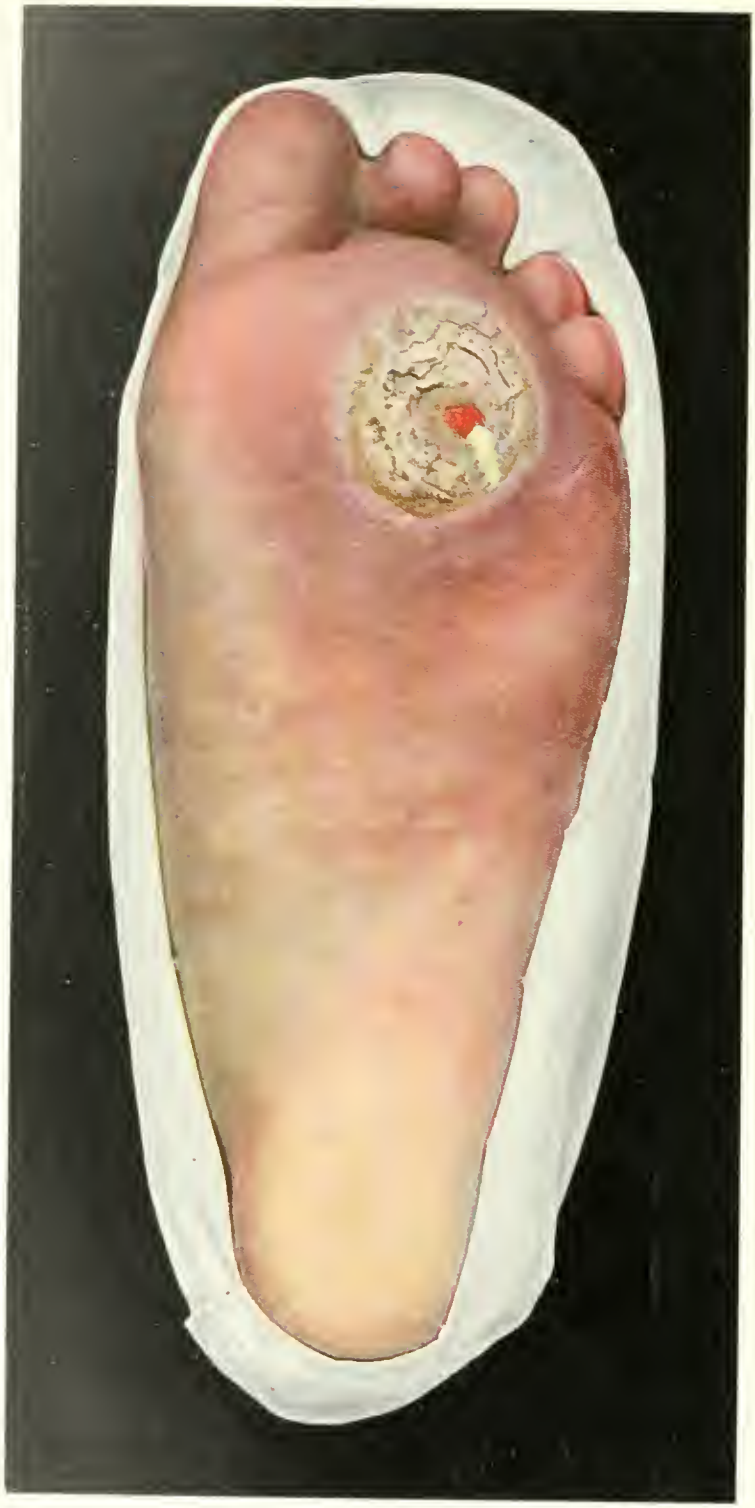

Fig. 130 Mal perforant du pied — Gangraena Raynaud.

MALUM PERFORANS PEDIS (*Perforating Ulcer of the Foot*)
GANGRÆNA RAYNAUD (*Raynaud's gangrene*)
Plate CXI, Fig. 139.

Perforating ulcer of the foot commences as a hard horny thickening of the epidermis over the heads of the third and fifth metatarsal bones, somewhat resembling a clavus but much more extensive. The epidermis becomes fissured and finally ulcerated in the center. The ulcer is characterized by its tendency to extend deeply, and by its persistence in spite of all kinds of treatment. The disease is essentially chronic and leads to destruction of muscles, tendon-sheaths, bones and joints, by continuous crateriform extension of the ulcer into the deeper tissues. The epidermis always remains thickened at the border of the ulcer, and is sometimes undermined. The visible surface of the ulcer is small and is covered with flabby granulation tissue. Necrotic shreds often protrude, indicating extensive necrosis of the fascia and tendons. There is often loss of sensation in the skin for some distance round the ulcer. As a rule there is little pain, but sometimes paræsthesia. The general health may suffer from prolonged suppuration, or the condition may be aggravated by acute progressive phlegmonous inflammation.

Perforating ulcer is of trophoneurotic origin and due to disease of the nervous system. It occurs in tabes, syringomyelia, certain forms of spina bifida (Figs. 143 and 144), and also in diseases where sensation is lost in the lower extremities. Owing to the loss of sensation the patient does not notice the injury to the sole of the foot caused by pressure, and in this way a trophoneurotic ulcer develops, charac-

terized by hard borders due to the horny epidermis which is normally present in the sole of the foot. These ulcers may also develop on the outer border of the foot in cases of paralytic pes varus (Fig. 143). Some authors attribute the condition to disease of the blood-vessels (arteriosclerosis, endarteritis obliterans) as well as to trophoneurotic disorder, and in many cases both conditions are probably present. That the blood-vessels play a part in the pathology of perforating ulcer is supported by the fact that this condition is often met with in syphilitics and alcoholics with vascular disease.

Raynaud's gangrene—which is better called local asphyxia, as it only consists in the first stage of gangrene—is usually symmetrical, and affects the feet more often than the hands. After a short premonitory stage during which the digits become cold and white (vaso-motor constriction), the tips of the fingers or toes become dark-purple and the proximal parts red (vaso-motor paralysis). The disease is due to vaso-motor disturbance depending on disease of the peripheral or central nervous systems. The symptoms consist in paræsthesias and disturbance in the temperature sense, and pain on changes of temperature.

Differential Diagnosis. A commencing perforating ulcer may be mistaken for a clavus complicated by a mucous bursa and central fistula; but the latter does not extend so deeply.

Raynaud's disease may be confounded with the early stages of other forms of gangrene (Figs. 132, 133 and 140), or frostbite; but the changes in Raynaud's disease are diffuse and symmetrical.

Treatment. Even in the early stage of perforating ulcer, removal of the callosity and necrosed tissue gives little result. In the later stages no treatment is of any use. The wound must be protected from

infection by aseptic dressings. In some cases partial amputation of the foot is necessary, especially when there is extensive necrosis of the plantar fascia (*Lisfranc's*, *Chopart's* or *Pirogoff's* amputations). If there is phlegmonous inflammation free incisions must be made down to the bone. Amputation through the leg may be necessary in cases of progressive phlegmon or general infection. Internally iodide of potassium should be administered, and other treatment for arteriosclerosis (Fig. 140).

In *Raynaud's* disease exposure to cold must be avoided. Treatment by hot air, hot sand-baths and massage is useful.

Fig. 139 shows a case of perforating ulcer of the foot in a typical position, over the head of the third metatarsal bone. The epidermis is fissured and thickened round the small ulcer, which is covered with granulations. A piece of necrosed fascia is seen protruding from the ulcer. The peripheral part of the foot shows diffuse bluish-red coloration, which was also present symmetrically on the other foot (*Raynaud's* disease). The ulcer showed no tendency to heal under treatment by aseptic dressings and rest in bed, so amputation was performed at the tarso-metatarsal joint.

GANGRÆNA DIABETICA (*Diabetic gangrene*) ARTERIOSCLEROSIS

Plate CXII, Fig. 140.

Diabetes mellitus greatly diminishes the power of resistance of the body against infection. Various pyogenic affections, such as furuncle, carbuncle, abscesses (*e.g.* mammary abscess, Plate V) or extensive phlegmons may develop in diabetic patients after comparatively slight causes, especially in the lower extremities. The dry, irritable skin of diabetics is liable to infection through scratches. Moreover, the sugar-containing tissues are favorable to the growth of bacteria, which are thus able to cause progressive phlegmonous inflammation. Putrefactive phlegmon is more common than pyogenic phlegmon in diabetics, and gives rise to moist gangrene of the skin, necrosis of the deeper tissues, and often general infection. Dry gangrene may also develop suddenly in the lower extremities in diabetics affected with arteriosclerosis. In this way, the whole leg may be affected with dry gangrene from thrombosis of the popliteal artery. The first symptoms are pain, numbness and tingling sensations in the toes. One or more toes then become bluish black and cold, later on bluish gray (Fig. 140); while the skin on the dorsum of the foot is red and œdematous. In this stage there are often severe neuralgic pains, while the general condition of the patient is impaired by increase of sugar in the urine, sleeplessness, headache and exhaustion. In old diabetics with dry gangrene of the toes demarcation may take several months to develop. Dry gangrene may always change to moist, the latter progressing more rapidly.

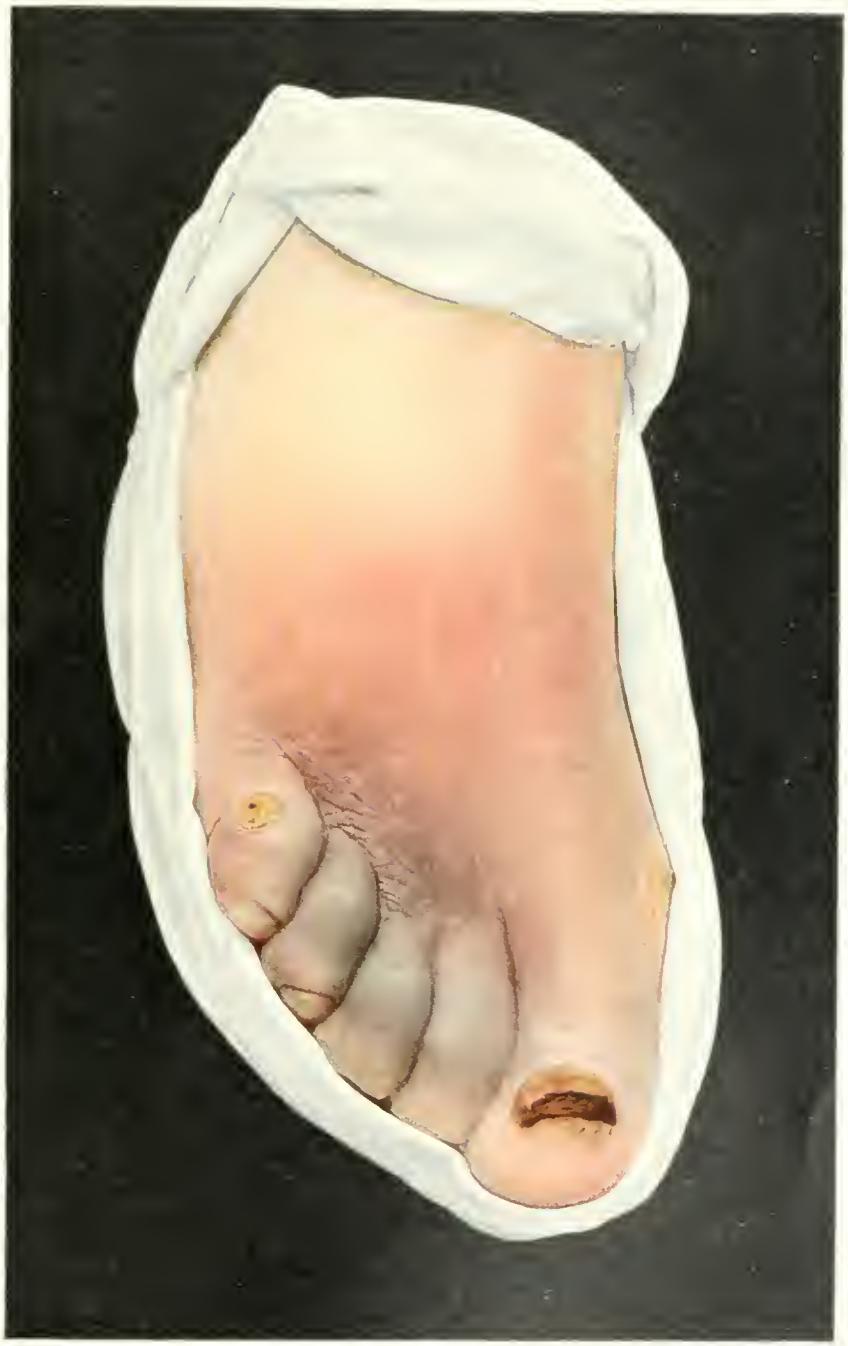

Fig. 140. Gangraena diabetica — Arteriosklerosis.

Rebman Company, New York

The prognosis in these cases is bad, especially when there is much sugar in the urine. Death may occur from heart failure, general infection or diabetic coma. When the general treatment of diabetes fails to act, the gangrene usually extends, and leads to death.

Prophylaxis consists in the early diagnosis and treatment of diabetes. It is, therefore, important to examine the urine for sugar in all cases of pyogenic and putrefactive infections. Diabetic patients should pay strict attention to bodily cleanliness and try to avoid all kinds of infection. They should also avoid the causes which lead to arteriosclerosis.

Differential Diagnosis. Diabetic gangrene is distinguished from other forms of gangrene by examination of the urine. Extensive calcification of the arteries can sometimes be seen by X-ray examination.

Treatment. In dry gangrene it is best to wait for demarcation, unless extensive arteriosclerosis is present. If, however, the popliteal artery is pulseless, amputation of the leg is the only remedy. If there is no arteriosclerosis the gangrene may slowly extend for months. When demarcation is complete amputation may be performed directly above the line of demarcation. Before demarcation the parts should be treated with dry aseptic dressings (moist dressings cause putrefaction), and be suspended. In slowly extending moist gangrene demarcation may be waited for if the temperature does not remain high. In rapidly extending moist gangrene with high temperature early amputation is indicated some distance above the gangrene. In gangrene of the lower extremity with arteriosclerosis it is better to amputate through the thigh; for the flaps after amputation through the leg are badly nourished even in healthy individuals, and in diabetics they are liable to become gangrenous. Amputation through the thigh is best performed above

the condyles (supracondylar amputation), or through the epiphyseal line. Epiphyseal stumps have considerable supporting power. As a rule, amputation may be conservative in slowly progressing cases which are not complicated by phlegmonous inflammation, arteriosclerosis or high temperature. On the other hand, rapidly extending gangrene complicated by arteriosclerosis and phlegmon always requires high amputation.

It is best to give an injection of scopomorphine (*Riedel's* preparation) before the operation; less quantities of chloroform or ether are then required. In these cases both general anæsthesia and lumbar anæsthesia are badly borne, and infiltration anæsthesia is contra-indicated, as it causes inflammation of the weakened tissues. When the vessels are affected with arteriosclerosis they should be compressed by the fingers of assistants during the operation, as the application of the elastic tourniquet may cause thrombosis. The wound should be dressed with sterile gauze; iodoform is contra-indicated on account of the danger of iodoform poisoning. Primary suture of the flaps should not be attempted, and these should, therefore, be made larger than usual. Secondary suture of the flaps may be performed after a few days if the progress of the case is satisfactory. Ligatures must not be applied too tightly to vessels affected with arteriosclerosis, as the coats of the vessel may give way and cause secondary hemorrhage. The operation must be performed under the strictest aseptic precautions, as the diabetic tissues are easily infected, and osteomyelitis may occur in the bone stump or phlegmonous inflammation in the soft parts.

After the wound has healed ulceration is common in the amputation stump. This must be treated with aseptic dressings to avoid fresh phlegmonous inflammation. In some cases amputation of both legs may be necessary for gangrene of both the feet. Only about fifty per cent. of cases of diabetic gangrene

recover after amputation, a great many cases succumbing to diabetic coma. Whenever possible the amount of sugar should, therefore, be reduced by general treatment of the diabetes before operation. Cases where acetone is present, and which give a positive result with the perchloride of iron reaction, have an unfavorable prognosis. The general condition requires treatment by strict diet and the administration of salicylate or bicarbonate of soda in large doses. Subcutaneous injection of saline solution may be tried in diabetic coma. Thirst may be relieved by tincture of opium or by *von Bergmann's* diabetic drink (citric acid 10; glycerin, 100; distilled water, 1,000).

ARTERIOSCLEROSIS (*Atheroma*)

This disease consists in the thickening of the walls of the vessels by connective tissue formation, with subsequent fatty degeneration of the inner and middle coats (atheroma) and the deposition of calcareous plates, causing roughening of the inner surface of the vessel and leading to thrombosis. The disease is more common in the male sex. Central and peripheral nervous affections, especially those causing vaso-motor disturbances; infective diseases, including typhoid, malaria, syphilis, general infection, leprosy, gout and diabetes; the action of alcohol, nicotin and lead; overexertion and sudden exposure to cold have all been cited as causes of arteriosclerosis. [The term *arteriosclerosis* is here used to describe what is generally known in England as *atheroma*. The fundamental cause of this is generally considered to be syphilis, though other causes mentioned above probably contribute. General arteriosclerosis, characterized by a general fibroid thickening of all the arteries, is of more complex etiology, the chief factors being probably syphilis, chronic alcoholism, infective fevers, gout, and microbial toxæmias].

A tortuous condition of the temporal and radial arteries is often present in arteriosclerosis, along with differences in the pulse in different arteries. Extensive calcification is sometimes visible by X-ray examination.

The symptoms begin with pains of a rheumatic character. The feet, in which the disease often begins, are blue, cold and dry. Sensations of numbness and tingling are often present. There may be severe pain in the heels, preventing the patient from

walking (*Charcot's* intermittent claudication). Extensive arteriosclerosis may cause gangrene of the lower extremities. In women arteriosclerosis more often affects the hands causing great pain and loss of function; but gangrene in the hands is very rare. Arteriosclerosis of the cerebral arteries causes severe headaches, attacks of loss of consciousness, or cerebral hemorrhage.

Differential Diagnosis. Commencing arteriosclerosis of the extremities with no visible change in the vessels may be mistaken for gout or rheumatism, etc. In advanced cases the diagnosis is easy, owing to the hardness of the vessels.

Treatment. Prophylactic treatment consists in avoiding, as far as possible, the causes which may lead to arteriosclerosis. The best therapeutic measures are those which promote metabolism and strengthen the heart; for instance, light gymnastics, massage, mud baths, sand baths, Wiesbaden hot springs, etc. Internally iodide of potassium should be administered. Hot air treatment and hot potash baths are useful for the pains in the heel. In severe cases morphia may be necessary.

Fig. 140 shows commencing gangrene of the right foot in a man of fifty-six, suffering from diabetes for some years. The toes are bluish red in some parts, grayish black in others, while the dorsum of the foot is red. The skin was pale and cold. The discoloration appeared in the course of a few hours, and in a few days extended to the ankle joint. Moist gangrene spread rapidly from the toes, and lymphangitis extended up the leg.

The X-rays showed numerous calcareous deposits in the anterior and posterior tibial arteries. Amputation was performed above the knee joint, after the sugar had been reduced from five to two per cent. by

three days' treatment of the diabetes. After operation the sugar diminished still further, and the temperature fell—two favorable signs. Secondary suture of the stump was performed on the fifth day and the wound healed in four weeks. After general treatment of the diabetes the sugar disappeared from the urine.

The figure also shows other changes. On the inner side of the foot over the metatarsophalangeal joint is a large clavus, and another on the fifth toe. The nail of the great toe is affected with onychogryposis, a common condition in old people who neglect their feet. As the nail caused trouble in walking, it was removed under local anæsthesia.

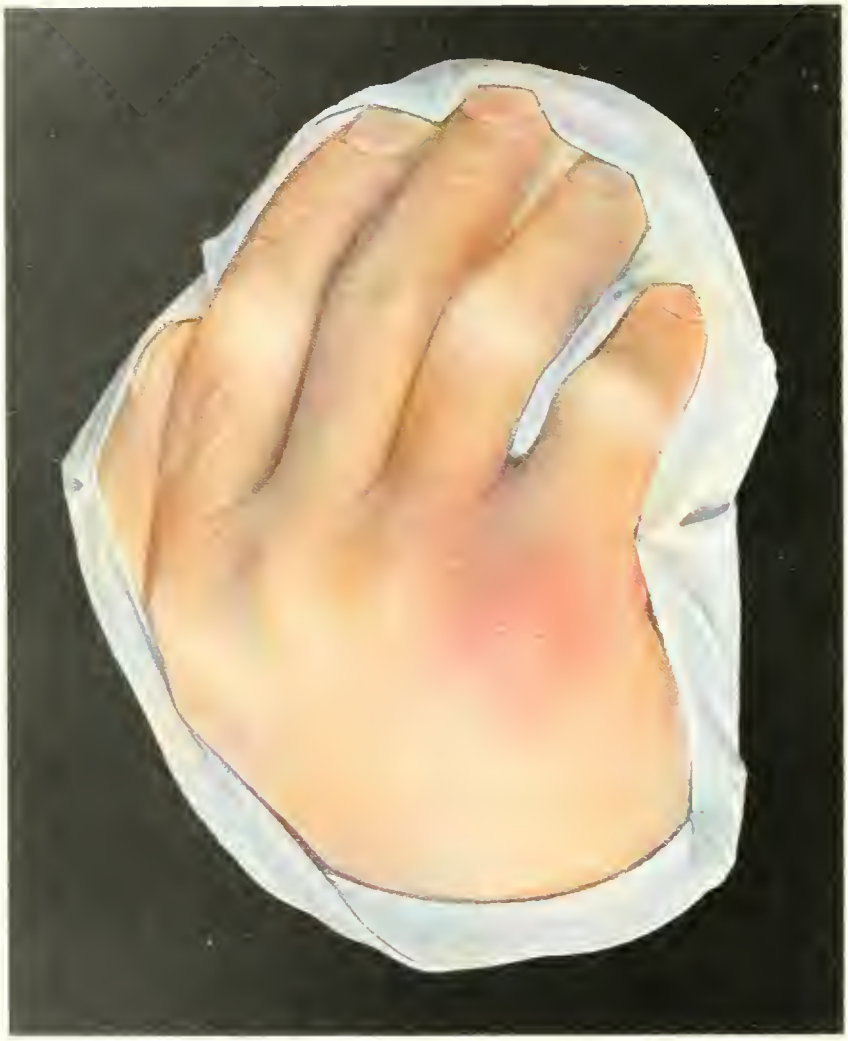

Fig. 141. Arthritis urica.

ARTHRITIS URICA (*Gouty Arthritis*)

Plate CXIII, Fig. 141.

Gout is a disorder of metabolism which is often transmitted from father to son for generations. It therefore usually occurs among people with a hereditary predisposition. It most often affects middle-aged men who indulge in high living and who take too little exercise.

The disease is due to the deposit of urate of soda in various places, especially in the cartilages of the joints. According to *Pfeiffer* there is no increase in the formation of urate of soda, but only deficient elimination. The urate of soda deposits form yellowish-white masses in the cartilage, synovial membrane, tendons, subcutaneous and periarticular tissue, bursæ, bronchi, intestinal mucous membrane and kidneys—in fact, in all the tissues and organs of the body. An acute attack of gout is caused by deposit of urate of soda in a joint, usually the metatarso-phalangeal joint of the great toe (*Podagra*). The symptoms are great pain in the affected joint, slight rise of temperature and a certain amount of constitutional disturbance (gastric pain, nervous phenomena, rheumatic pains, etc.). The first attack is sometimes excited by an injury to the foot. The region of the joint is swollen and œdematous, and the skin shows erysipelatous reddening and phlegmonous infiltration. The slightest touch or movement causes intense pain. There is slight effusion in the joint. After some hours the pain subsides, but generally recurs on the second night; and so on for about two weeks, till the attacks gradually become less painful and finally disappear. Slight swelling of

the affected joint remains. Later on fresh attacks may occur, often after many years. During the attacks there is always a heavy sediment in the urine. Repeated attacks may give rise to a permanent nodular swelling of the joint, and slight trauma may bring on another acute attack (*e.g.* hand pressure on gouty fingers).

Chronic gout, which is rarely primary and generally results from the acute form, is observed also among the poorer classes. It often affects the joints, but is less painful. The frequency with which the metatarso-phalangeal joint is attacked is perhaps due to bad circulation of the blood, owing to its peripheral position. This joint is also affected by arthritis deformans in old people. Large deposits of urate of soda give rise to gouty nodules or tophi, which occur in the joints of the fingers, hand, foot and elbow. They also occur in the cartilages of the ear, nose and eyelids in the form of small, yellowish nodules, which become hard and painful. In advanced cases of gout these nodules may be found in all the joints and cartilages, joint capsules, tendon-sheaths, cartilages of the ribs, and in other tissues.

Microscopic examination of gouty deposits shows the presence of crystals of urate of soda. These crystals act on the tissues like foreign bodies, and cause not only pain but gradual necrosis by pressure. The necrosed tissues are expelled by the formation of fistulas, and through the latter infection of the joints may take place. Joint infection may also occur by way of the blood (staphylococcal or streptococcal infection), without communication with the exterior. Suppuration in a gouty joint is always serious, as it easily leads to general infection. The cartilages of the joint may be destroyed by the gouty deposits, without the occurrence of suppuration, and lead to subluxation and anchylosis. Tophi, especially when situated in the subcutaneous tissue, may give rise to ulceration, venous thrombosis and phlebitis, espe-

cially in the lower extremities. Eczema of the skin is common in gouty subjects.

Although in most cases of gout the joints are affected, and the symptoms are those of joint inflammation, gouty deposits in other tissues and organs may give rise to the most diverse symptoms. Deposits in the tendo Achillis causes achylodynia with pain in the heel; deposits in other places may cause sciatica and lumbago, asthma and bronchitis, iritis and other affections of the eye, disorders of the intestine, etc.

In all long-standing cases of gout there is a danger of complications affecting the internal organs. The chief of these is chronic interstitial nephritis, in which numerous deposits of urate of soda are found in the kidneys, which may give rise to renal calculus. Gouty subjects are also liable to emphysema of the lungs. The prognosis in cases of pronounced gout is always doubtful.

Differential Diagnosis. Gouty arthritis is most often confounded with chronic rheumatism, but in the latter the skin over the joints is unchanged. In purulent arthritis there is high temperature and rigors while the temperature in gout does not exceed 38° C. (100° F.) provided no suppuration is present. Enchondromas of the fingers (Fig. 50) differ from gouty deposits by the absence of pain. Gout of other organs must be diagnosed by the history of the case. Large deposits of urate of soda can be seen by X-ray examination; *e.g.* in bursæ.

Treatment. Persons who are predisposed to gout should try to avoid it by careful living, exercise, etc. In acute gout, tincture of colchicum should be given in large doses (fifty to one hundred drops daily). The affected joint should be wrapped in wool and suspended on a splint. Hot air treatment is also useful. If suppuration occurs in the joint (with high

temperature and rigors) arthrotomy must be performed under strict aseptic precautions. In some cases resection of the joint may be necessary. General infection is common in such cases.

During the acute attack the patient should avoid meat, eggs and alcohol, and drink plenty of alkaline waters. Purgatives are also indicated.

Ice bags and moist fomentations should be avoided, as the former may cause necrosis of the skin and the latter maceration. Massage is contra-indicated. Internally, ten to twenty drops of hydrochloric acid may be given daily; salicylate of soda, aspirin and iodide of potassium are also useful. Phenacetin may be given for the pains, or morphia in severe cases.

When there are frequent attacks of gout treatment at the various springs is useful (Wiesbaden, Karlsbad, etc.). The diet should be carefully regulated—plenty of vegetables, especially celery; little carbohydrates, little meat, little alcohol and no beer.

Fig. 104 shows a case of acute gouty arthritis affecting the metacarpo-phalangeal joint of the second finger. The whole joint is swollen and very painful to touch and on movement. Tophi are present on the other metacarpo-phalangeal joints and on the interphalangeal joints of the second to the fifth fingers. The skin over the tophi is white from pressure. The patient, whose grandfather was gouty, had suffered for years from gouty arthritis in the joints of both hands.

Malformations

ENCEPHALOCELE OCCIPITALIS (*Occipital Encephalocele*)
RHACHISCHISIS
Plate CXIV, Fig. 142.

MYELOCELE—PES VARUS
Plate CXV, Fig. 143.

MYELOCYSTOCELE—MYXOLIPOMA
Plate CXVI, Fig. 144.

LYMPHANGIOMA (*Congenital multiple*)
Plate CXVI, Fig. 145.

TERATOMA MONOGERMINALE (*Monogerminal Teratoma*)
Plate CXVII, Fig. 146.

DUCTUS OMPHALO-MESENTERICUS PERSISTENS
(*Persistent omphalo-mesenteric duct*)
Plate CXVIII, Fig. 147.

HERNIA FUNICULI UMBILICALIS CONGENITA
(*Congenital Umbilical Hernia*)
Plate CXVIII, Fig. 148.

AMPUTATIONES AMNIOTICÆ (*Amniotic Amputations*)
Plate CXIX, Fig. 149.

AKROMEGALIA (*Acromegaly*)
MAKROMELIA
MAKROGLOSSIA
Plate CXX, Fig. 150.

The study of malformations (teratology) is of great interest to the surgeon, because many of these can be improved by surgical intervention. A knowledge of embryology is necessary in order to understand malformations. We distinguish between primary malformations which affect the embryo in its early stages of development, and secondary malformations which affect a part already formed, by some influence acting on it during intra-uterine life. The latter are spoken of as arrested development. Slight disturbances in development are called anomalies; greater deformities, malformations. The greater the mal-

formation, the earlier was its origin. The causes which lead to malformation may be already present in the embryo, or arrested development may be due to external causes. Experimental observations on animals have shown that malformations may be caused by injury. In the lower extremities malformations may be caused by pressure or by abnormal positions of the fetus in the uterus (various forms of talipes—pes varus, pes valgus, pes calcaneus). Pressure on the fetus may be caused by a uterine tumor or by deficiency in the liquor amnii, and signs of such pressure can often be seen after birth of the child. Many malformations are due to anomalies in the membranes; *e.g.* amniotic adhesions. All malformations caused in this way are cases of arrested development. These amniotic adhesions or bands may prevent the union of parts which should normally become united (branchial clefts) or may cause duplication of parts, or partial or complete separation (amniotic amputations, aberrant glands).

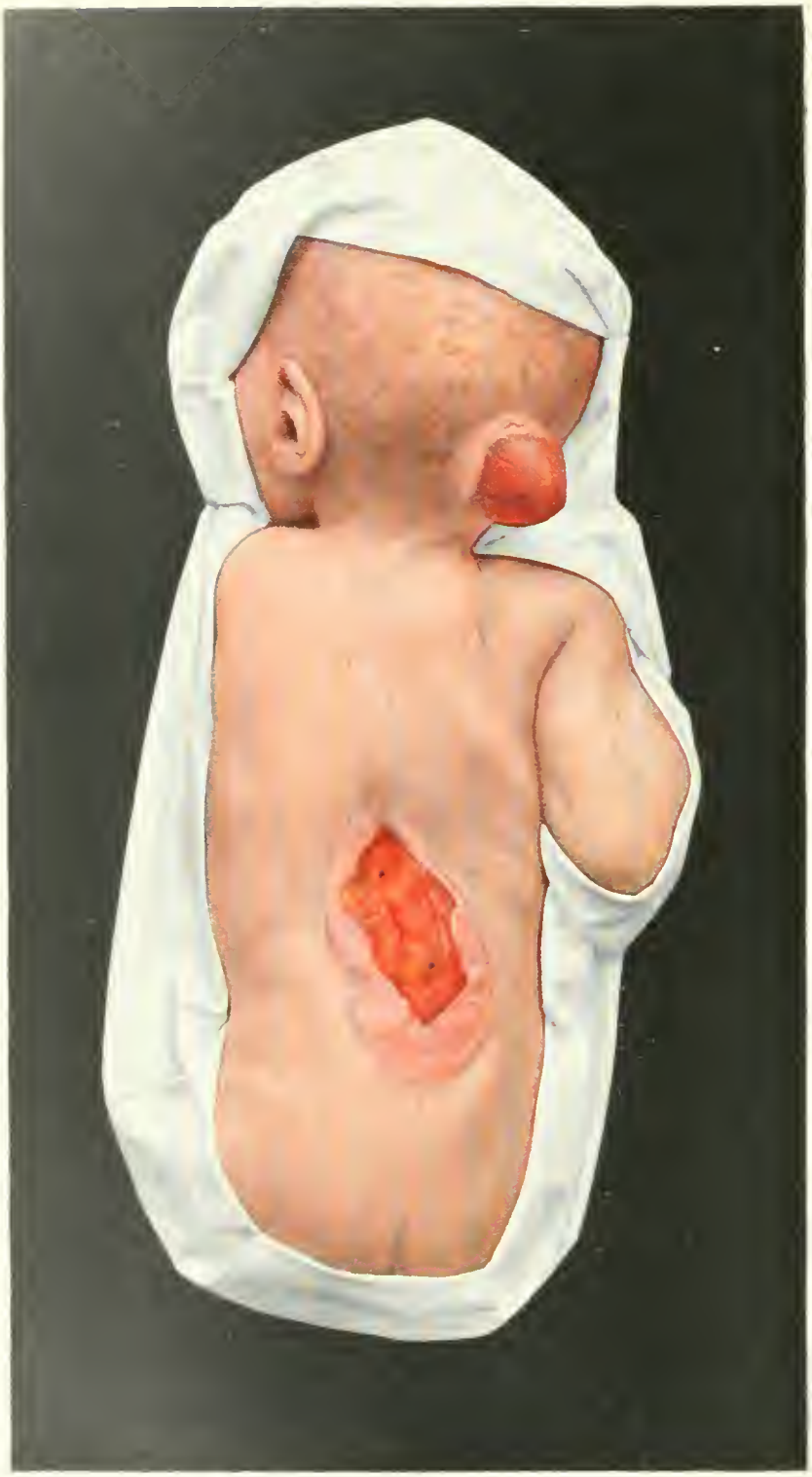

Fig. 142. Encephalocele occipitalis — Rachischisis.

ENCEPHALOCELE OCCIPITALIS (*Occipital Encephalocele*) RHACHISCHISIS

Plate CXIV Fig. 142.

Encephalocele, or cephalocele, is a malformation due to arrested development, and occurs in two regions—the region of the nose (sincipital encephalocele) and the occipital region (occipital encephaloeele). The former is subdivided into naso-ethmoidal, naso-frontal and naso-orbital; the latter into superior and inferior occipital encephalocele, according as it is situated above or below the occipital protuberance. According to *Müller*, one case of encephalocele occurs in thirty-six hundred births. The deformity is due to more or less extensive deficiency in the closure of the cerebro-spinal canal, caused by trauma or by amniotic bands. The earlier this occurs in fetal life the more extensive is the cleft in the cerebro-spinal canal. In extensive cases there may be acrania or anencephalus, while in slighter degrees there is only a defect in the bone and dura mater. Owing to the defect in the dura mater there may be prolapse of the brain through the bone, generally a hernial protrusion of one of the ventricles. According to *von Bergmann* the existence of a true congenital meningoeele in which the dura is intact, and there is only a hernial protrusion of the membranes through the gap in the bone, must be regarded as doubtful. The author's observations on myelocele (Fig. 134) have also shown that the inner covering of the protrusion, which is said to be dura, often consists of connective tissue only, and that the inner wall is often formed of ciliated columnar epithelium, and, therefore, represents the degenerated ventricle

of the brain. Hence the so-called meningocele is a true encephalocele or myelocystocele (Fig. 144).

As the subdivision of the different forms into meningoceles, encephaloceles, encephalomeningoceles encephalocystoceles and encephalocysto-meningoceles depends on pathological anatomy, and cannot be distinguished clinically, it is sufficient for all practical purposes to use the term encephalocele or cephalocele for all hernial protrusions through the skull, especially as they mostly contain a protrusion of the ventricle. For instance, the so-called encephalomeningocele has been shown to be not a true meningocele, but a cystic formation which has become gradually cut off from a primary hernia cerebri or encephalocele.

Cephaloceles occurring at the sagittal suture, the fontanelles or other parts of the skull are, according to *von Bergmann*, either dermoids or caused by trauma after birth (spurious traumatic acquired cephalocele). Congenital cephaloceles are either syncipital or occipital. Syncipital cephaloceles have generally a wide base, while occipital cephaloceles are pedunculated. Occipital cephaloceles may attain a large size—as large as the child's head. The skin at the base of the tumor is thickened and covered with radially arranged hair. The tumor may be covered with normal skin, but more commonly most of the surface resembles fresh scar tissue; or, when ulceration is present, it resembles the mucous membrane of the intestine. Vascular anomalies—telangiectases and angiomas—are often present. The tumor is diminished by pressure, and can be completely emptied in cases when it apparently consisted of a collection of fluid only. After the tumor has been emptied by pressure the hole in the skull can be felt, situated symmetrically in the middle line. It is generally small and circular, and can sometimes be shown by X-ray examination. As the tumor can be diminished by external pressure, so is it increased

by internal pressure; *e.g.* when the child cries. Cystic cephaloceles may be translucent. In other cases there is little diminution on pressure. Irregular partitions can then be felt in the interior of the sac. Firm pressure then usually causes bulging of the fontanelle, or sometimes convulsions. Sometimes pulsation is observed in cephaloceles. The skull in these cases is generally very small, and often flattened. Other malformations are often present. The infants are weakly and have a subnormal temperature. The prognosis is generally unfavorable, but is better in cases where the cephalocele can be completely emptied of fluid by pressure, and when no brain substance can be felt in the sac after evacuation of the fluid. Cases of occipital cephalocele with a large gap in the bone, often extending to the vertebræ of the neck, and protrusion of both occipital lobes and the whole of the cerebellum, are soon fatal.

Differential Diagnosis. Syncipital cephalocele may be mistaken for dermoid or lipoma. Diagnosis depends on the presence of a gap in the bone, diminution of the tumor on pressure and the presence of other deformities. Occipital cephalocele may be mistaken for cephalhematoma, which sometimes occurs on the occipital bone, especially as cephalhematoma may be surrounded by a hard ring at its base caused by the raised periosteum. Cephalhematoma is not diminished by pressure. However, diminution by pressure may be absent in cephalocele if the gap in the bone is occluded. In doubtful cases an operation will settle the diagnosis.

Treatment. Puncture and injection is useless and dangerous in cephalocele. The only rational treatment is a radical operation. The sac is exposed by incision through the skin, separated down to the bone, ligatured and removed. The defect in the bone may be covered in by suturing the periosteum over

it, by a pedunculated bone flap, or by a celluloid plate. In cases where brain substance is present in the sac, the operation can only be performed when the brain substance can be reduced through the gap in the bone without producing symptoms of cerebral compression. Removal of portions of brain still possessed of function may cause dangerous symptoms, but a functionless dropsical protrusion may be removed without danger. Cases of large defect in the skull, with defect in the cervical vertebræ, or cases combined with other extensive malformations, are inoperable. The after-treatment is complicated by the escape of cerebro-spinal fluid, which is always abundant, even after the most careful closure of the bone defect. The dressings therefore require changing several times daily to prevent infection of the wound.

Fig. 142 shows a cephalocele situated symmetrically in the middle line under the occipital protuberance. The skin at the base of the tumor was thickened; over the greater part of the surface it resembled fresh scar tissue, and presented numerous fine ramifying vessels. The tumor could be completely emptied of its fluid contents by pressure, without causing symptoms of cerebral pressure. After this a circular hole in the bone could be felt about one-half centimeter in diameter. This cephalocele could have been completely removed by radical operation, but for the presence of another malformation of the spine which made the condition of the infant hopeless.

In the dorso-lumbar region from the twelfth dorsal to the third lumbar vertebra is a condition known as rhachischisis (spina bifida). This is a condition of arrested development of the spine in which there is absence of closure of the embryonic medullary canal affecting the bones, soft parts, spinal cord and membranes. This malformation may extend the whole length of the spine, and is then known as total pos-

terior rhachischisis; or it may be limited to one portion only.

Rhachischisis represents the most extreme degree of spina bifida (Figs. 143 and 144). It is most common in the lumbo-sacral region, because the medullary groove closes last in this region to form the neural canal. Rhachischisis is usually associated with other extensive malformations such as anencephalus, acrania, absence of vertebral bodies, etc. Three typical zones can be distinguished situated symmetrically on each side of the vertebral column: (1) a circular, peripheral zone of thickened skin, often covered with abundant hair; (2) a middle zone which resembles fresh cutaneous scar tissue, or the serous coat of the intestine, and has hence been called the epithelio-serous zone; a central zone of flabby granulations with a depression at the upper and lower ends, which represents the open and exposed spinal cord. The depressions at each end of the central zone lead to the central canal of the spinal cord. In cases where the spinal cord is much exposed, death soon occurs from meningitis.

Spina Bifida

MYELOCELE—PEDES VARI
Plate CXV, Fig. 143.
MYELOCYSTOCELE—MYXOLIPOMA
Plate CXVI, Fig. 144.

As already mentioned, rhachischisis represents the most extreme degree of spina bifida. If the arrest of development is limited to one, two or three vertebral arches, the cleft spinal cord is not exposed in the vertebral groove as in rhachischisis, but projects in the form of a tumor through the small cleft in the vertebræ, owing to pressure of fluid on its ventral surface. It thus forms a symmetrical tumor in the middle line, with the same three characteristic zones as in rhachischitis, and is known as a *myelocele* (Fig. 143).

There are four kinds of spina bifida, differing in degree according to the date of their appearance in embryonic life. The first and most extensive form is *rhachischisis*, which has already been mentioned. The second form (*myelocele*) appears later and is limited to a smaller extent of the spine, although it may include the soft parts, bones and spinal cord; this forms a tumor-like swelling. The third form (*myelocystocele*) occurs still later in embryonic life, at a time when the spinal cord and the skin have already closed on the dorsal surface of the embryo, but the dura mater and bone have not yet united. The fourth form (*meningocele*) only occurs in the lumbo sacral region where the spinal cord has become the *filum terminale*. Spina bifida occulta, which also

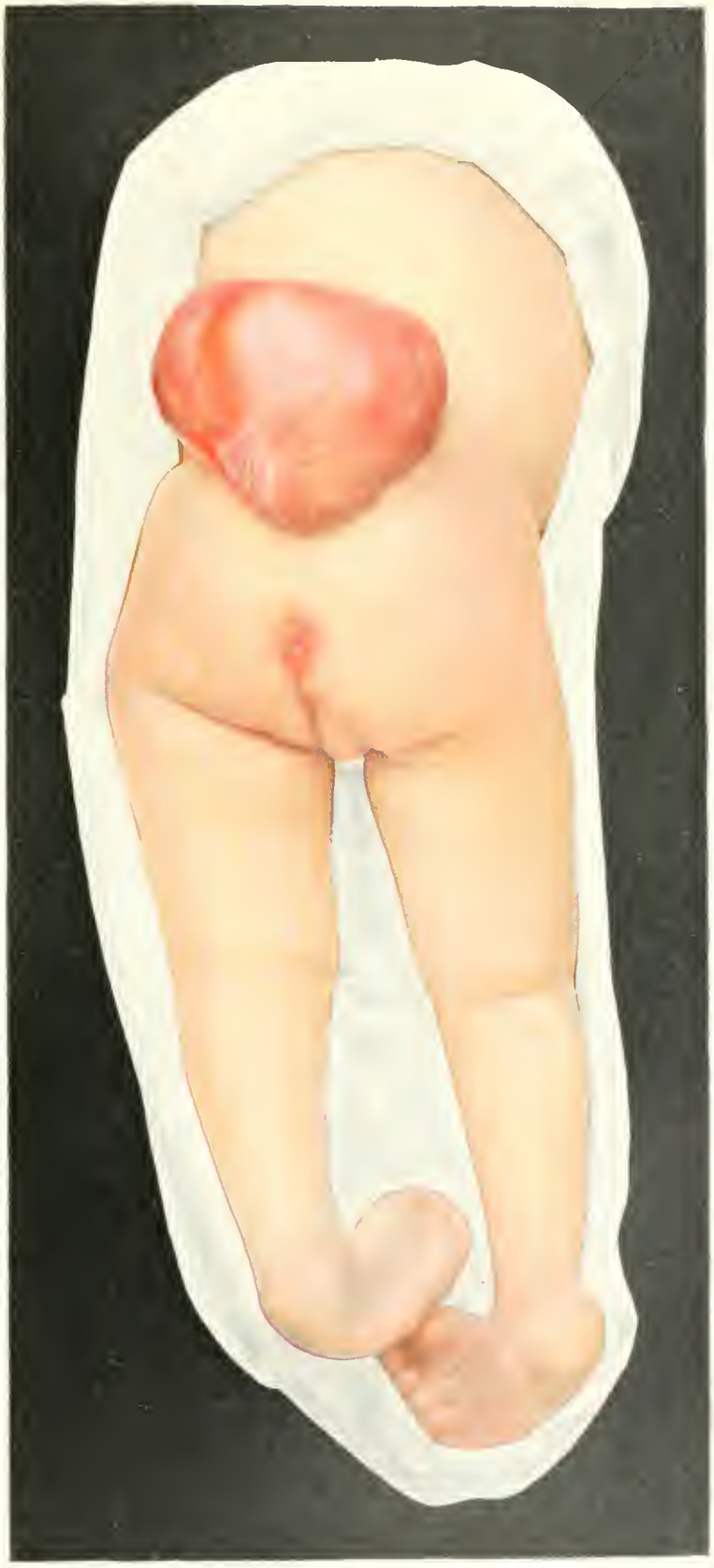

Fig. 143. Myelocele — Pedes vari.

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occurs at the lower extremity of the vertebral column, is not to be regarded as a special form, but as a meningocele.

The subdivision of spina bifida into the three chief forms—myelocele, myelocystocele and meningocele—is the most suitable for practical purposes. Spina bifida is a comparatively rare malformation, occurring in one or one and five-tenths out of one thousand infants.

1. *Myelocele.* By far the most common form is myelocele. According to *von Recklinghausen* this occurs before the twelfth day of embryonic life, as after this time the medullary groove closes to form the neural canal. The arrest of development concerns the dorsal part of the spinal cord and membranes, the vertebral arches, the muscles and the skin. A tumor-like swelling is then formed by the formation of hydrops on the ventral side of the spinal cord which continually pushes the cord out of the vertebral canal through the preformed cleft. According to *von Bergmann* the occurrence of hydrops is due to the absence of dura mater.

Myelocele forms a characteristic swelling with a wide base, situated symmetrically in the middle line, with the three zones already mentioned in the case of rhachischisis; *viz.* an outer zone of thickened skin with abundant hair, and often telangiectases; a second zone of a pink color resembling new scar tissue, with a deep network of ramifying vessels; a third zone of an oval form at the summit of the swelling, red and tumid like intestinal mucous membrane, very vascular, and covered with pus a few days after birth. This third or central zone represents the remains of the cleft spinal cord, and is called the vasculo-medullary zone in distinction to the epithelio-serous or second zone. At the upper and lower ends of the third zone is a depression through which a probe can be passed into the central canal of the spinal cord. These cases generally die from

meningitis through infection of the vasculo-medullary zone. Operative treatment is useless. The spinal nerves become dragged upon by the formation of the protruding myelocele, causing motor paralysis of the lower extremities, bladder and rectum (paralysis of the upper extremities when the myelocele is situated in the upper part of the spine).

The common occurrence of pes varus in these cases (Fig. 143) is due to the myelocele being usually situated at the junction of the lumbar vertebræ with the sacrum where the nerves arise which supply the anterior and posterior tibial muscles; *viz.* the fourth and fifth lumbar and the first and second sacral nerves. Sensory disorders are rare in myelocele, but trophoneurotic disorders occur in the form of extensive eczema and decubital ulcers, especially on the feet; in pes varus on the outer border of the foot.

Diagnosis is easily made by the characteristic appearance, the presence of fluctuation and the cleft in the bone. There is no diminution in the swelling by pressure owing to the absence of communication with the subarachnoid space. Myelocele is most common in the lumbo-sacral region; after this in the cervical and thoracic. It is often associated with other malformations, such as umbilical hernia, etc., and the infants seldom survive.

2. *Myelocystocele.* This form consists in arrested development of the vertebral arches and dura mater. It appears in the third week of embryonic life, at a time when the medullary groove has closed to form the neural tube, and the epiblast has grown over it. Hydrops of the central canal causes bulging of the posterior part of the spinal cord through the gap in the vertebral arches, giving rise to a tumor-like swelling of the spinal cord covered by the soft parts. The substance of the spinal cord soon undergoes degeneration and can only be identified by the presence of ciliated cylindrical epithelium on the inner surface of the cavity (the remains of the ciliated epithelium

of the central canal of the spinal cord). In the external coverings of myelocystocele there is often lipoma, myxoma, lymphangioma or teratoma. The tumor has a wide base and is covered with normal skin, which is thickened at the base of the tumor. Sometimes small depressions are present in the skin caused by the remains of amniotic bands (Fig. 144). The tumor is of soft consistence, and fluctuation is always present. The fluid contents of the tumor can be completely reduced by pressure, as there is direct communication with the central canal, and also with the subarachnoid space. By pressing on the tumor the transmission of fluid pressure can be felt at the fontanelle.

Myelocystocele is often combined with hydrocephalus. Paralyses are rare, as the motor nerves are not displaced by the malformation; at the most there may be pes varus or valgus on one side, due to the tumor being situated unsymmetrically more to one side of the middle line, and thus dragging on a motor nerve. However, extensive myelocystocele of the lumbo-sacral region may cause paralysis of the bladder and rectum. Trophoneurotic disorders are common. Sometimes paralysis occurs at a later age, the tumor increasing gradually in size and dragging on the spinal cord and nerves. Defective bone formation is often associated with myelocystocele—absence of vertebral bodies, unilateral defects in the vertebral laminæ, absence of ribs or patella, scoliosis, etc.

3. *Meningocele.* According to recent observations meningocele can only occur in places where the spinal cord is absent (*von Bergmann*). In this condition there is defective formation of the vertebræ and dura mater, so that the pia mater protrudes posteriorly, inclosing the filum terminale. In this way a pedunculated swelling is formed, covered by normal skin, which may attain the size of a child's head as the amount of cerebro-spinal fluid in the sac increases.

Paralysis only occurs when the meningocele is large, and is then generally of limited extent. There is sometimes abundant hair on the summit of the swelling. Fluctuation is always present, but there is only slight diminution on pressure. The space in the bone is generally smaller than in myelocele. Meningocele occurs most often in the sacral region.

Spina Bifida Occulta, according to the most recent observations, is a form of meningocele which becomes ruptured and undergoes spontaneous healing under the skin. The pressure of the cicatrix may cause disturbances which are not noticed till the child grows older.

Differential Diagnosis. Myelocele, when the vasculo-medullary zone is very extensive, may sometimes be mistaken for cavernoma. In rare cases where epidermization of the second zone leads to cicatrization of the third zone, myelocele may be mistaken for a myelocystocele in which the skin has become cicatrized after ulceration. In such cases diminution of the tumor on pressure points to myelocystocele. In lipoma, lymphangioma and teratoma there is no diminution in the tumor on pressure unless there is a myelocystocele underneath it; which, however, is often the case. Meningocele may be mistaken for myelocystocele when it is not situated in the sacral region (where the spinal cord is absent). It may also be mistaken for sacral tumors, dermoids and teratomata.

The prognosis is not unfavorable in myelocystocele and meningocele provided other malformations are absent and the infant has a strong constitution.

Treatment. In myelocele a radical operation is useless, because by removal of the cystic sac the spinal cord is divided and unites with the cicatrix. Reduction of the infected vasculo-medullary zone by operation always leads to meningitis. Palliative

treatment, by puncture of the sac, is all that can be done in these cases.

Myelocystocele, owing to its covering of intact skin, is more suitable for operation. In this case the operation is similar to that for hernia. The sac, consisting of degenerated spinal cord, is exposed by an incision through the skin, dissected down to the bone, ligatured and removed. The cleft in the bone is repaired by a plastic operation. The sac is often covered by a fatty tumor which also requires removal. Removal of the sac after ligature is not dangerous in these cases, as it consists only of functionless degenerated spinal cord. Meningitis sometimes follows these operations, but most cases recover and may grow up.

Meningocele offers the best chances for operation. The sac is opened and the nerves replaced in the vertebral canal. The sac is then ligatured and removed and the space in the bone closed by suture of the soft parts, or by bone grafting. The prognosis is good after these operations.

In spina bifida occulta with disturbances due to pressure of the cicatrix, the latter may be removed and the space in the bone repaired.

The development of hydrocephalus, which may occur after operation on all forms, is an unfavorable sign.

Fig. 143 shows a myelocele of the lumbo-sacral region. The tumor is situated symmetrically in the middle line and has a wide base. At the base the skin is thickened (first zone); the second zone (epithelio-serous) shows numerous ramifying vessels; the third zone (vasculo-medullary) is not typical and resembles the second zone, owing to epidermization of the latter (cf. Fig. 142). It only differs from the second zone in its bluish color. The diagnosis of myelocele depended on the absence of diminution on pressure, and the presence of paralysis of the bladder

and rectum, and pronounced pes varus of both feet. Death occurred soon after birth.

Fig. 144 shows a myelocystocele situated in the lumbar region, and covered with normal skin. A small depression in the surface is due to amniotic adhesions. Under the skin is a mass of fatty tissue, while a deep cystic tumor could be felt more deeply situated. The latter could be almost completely emptied by pressure. There were no motor or sensory disorders present, and no other malformations. The X-rays showed a small cleft in one of the vertebral arches situated a little to one side of the middle line. The superficial fatty tumor was removed and found to be a myxolipoma. The myelocystocele was then separated down to the bone, ligatured and removed. The gap in the vertebra was closed by transplantation of a piece of bone from the iliac crest. Microscopic examination showed the pressure of cylindrical epithelium in the inner wall of the cyst, thus confirming the diagnosis.

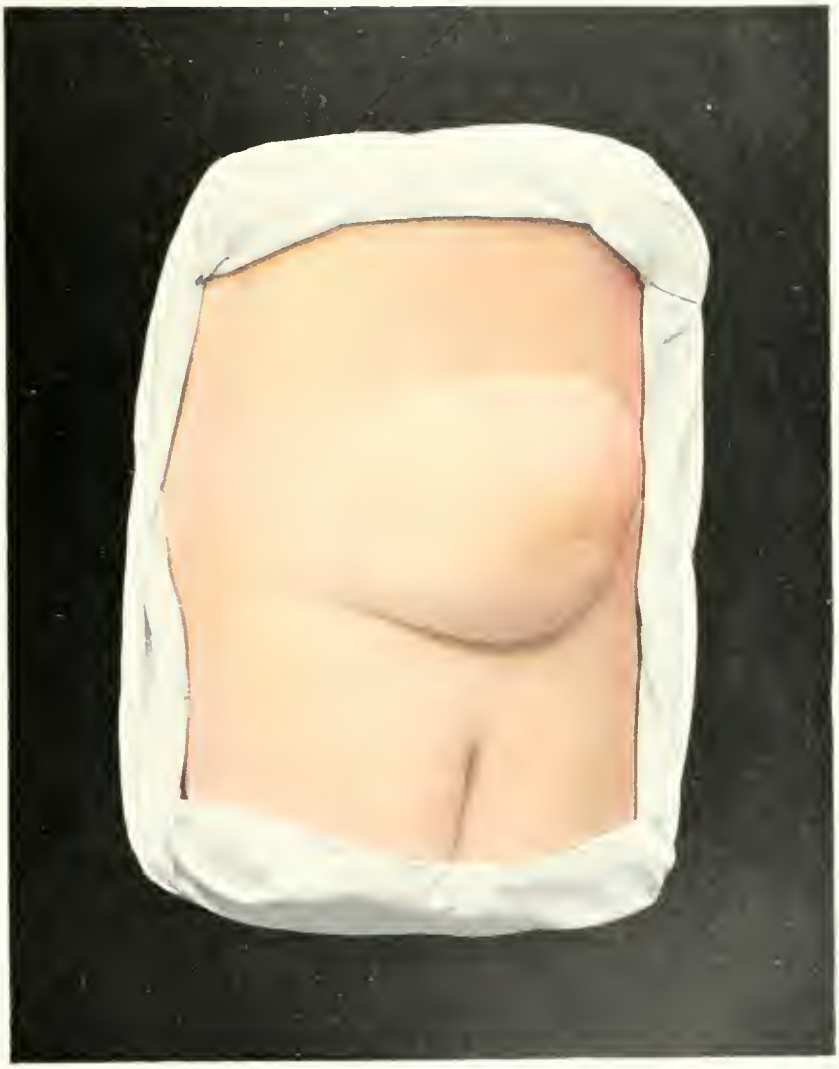

Fig. 144. Myelocystocele Myxolipoma.

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PES VARUS

Pes varus may be congenital or acquired. The congenital form may be caused by arrested development, or may be secondary to pressure caused by amniotic adhesions, etc. Congenital pes varus is common in connection with myelocele, and is due to paralysis of the nerves, as already explained. Acquired pes varus occurs in rickets, and as the result of poliomyelitis which causes paralysis of the pronators and dorsal flexors of the foot. The chief effect takes place at the midtarsal joint and consists in supination, plantar flexion, internal rotation and adduction. Changes also occur in the astragalus and os calcis, especially in long-standing cases. These changes can be seen by the X-rays. There is also shortening of the muscles, tendons, fascia and ligaments, especially shortening of the tendo Achillis (talipes equino-varus). Decubital ulcers may form on the outer border of the foot.

Treatment. In congenital clubfoot treatment should be begun as early as possible, by repeated manual correction to the normal position, followed by fixation in an over-corrected position by means of plaster of Paris bandages. In sucklings, thin strips of cotton bandages soaked in mastic solution (turpentine 15, mastic 12, resin 28, alcohol (90 per cent.) 180, ether 20) may be used, applied to the foot and leg so that the foot is fixed in the over-corrected position. This treatment should be kept up for six months, after which elastic traction may be applied to the foot for another six months. In older children manipulation must be performed under an anæs-

thetic. After the ninth month preliminary tenotomy of the tendo Achillis is necessary, before the foot can be brought into the proper position. To prevent relapse boots should be worn with the sole raised on the outer side, but care must be taken to avoid producing flat foot. In pes varus due to poliomyelitis tendon transplantation may be performed. Old-standing cases of clubfoot in adults require osteotomy, or sometimes more extensive operations such as disarticulation.

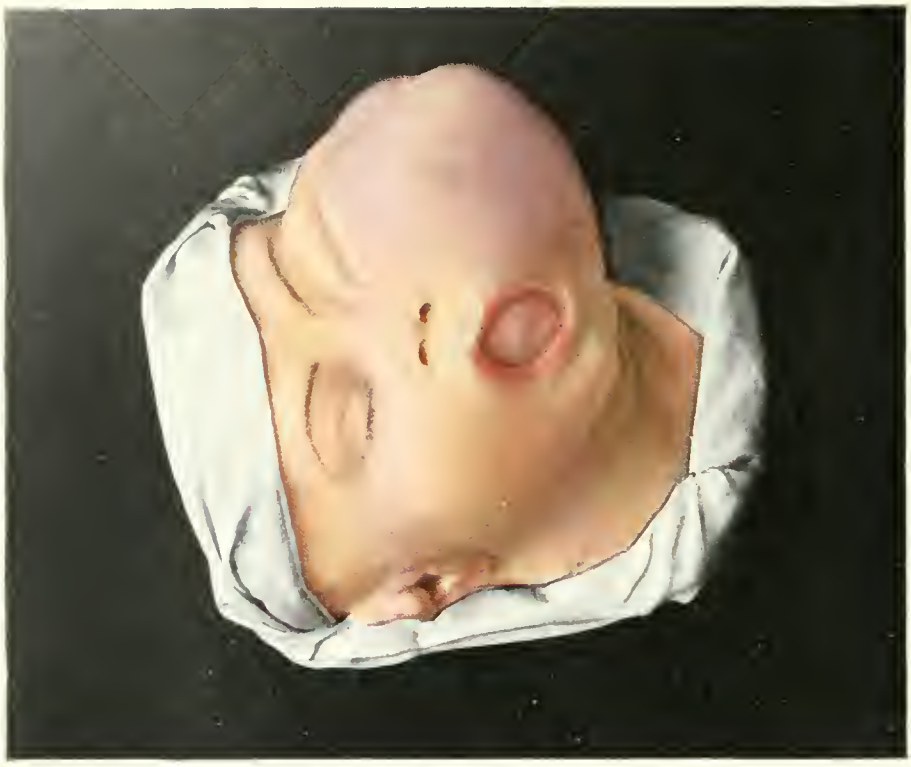

Fig. 146. Teratoma monogerminale.

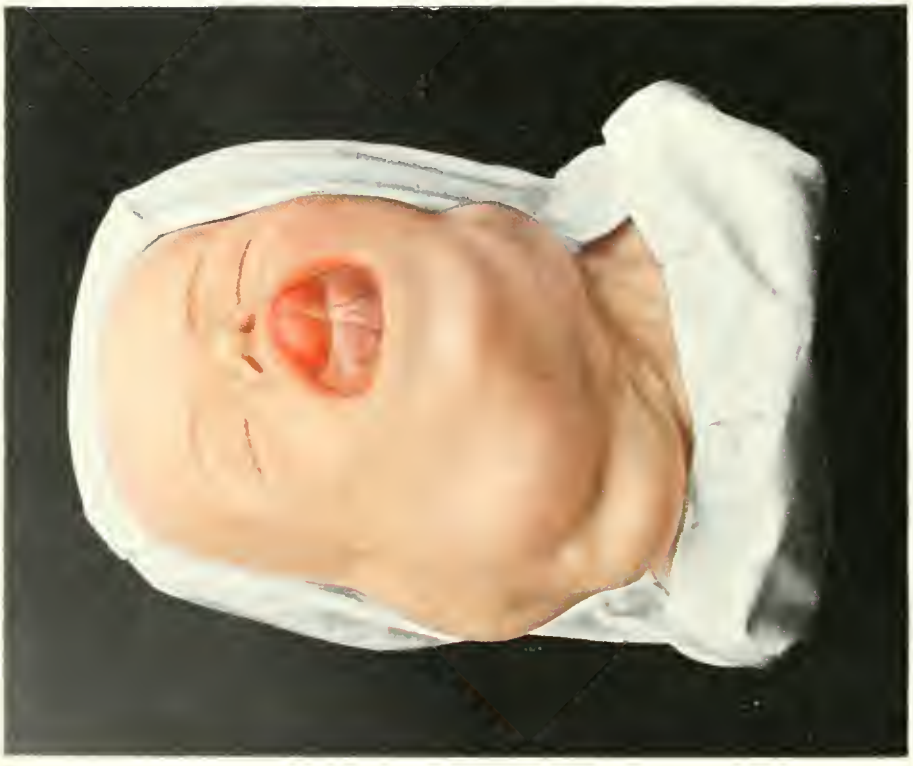

Fig. 145. Lymphangioma congenitum multiplex.

Lymphangioma

LYMPHANGIOMA CONGENITUM CYSTICUM MULTIPLEX

(*Congenital Multiple cystic lymphangioma*)

Plate CXVII, Fig. 145.

The term lymphangioma should be limited to those tumors in which there is a new formation of lymphatic vessels. A number of growths have been included in the term lymphangioma which are only formed of dilated lymphatics, without any new lymphatic vessels. Microscopic examination is therefore important in these cases. Clinically, we distinguish simple, cavernous and cystic lymphangiomas; also single and multiple. In the great majority of cases the growths are congenital. All three forms are often present in the same patient. Lymphangiomas may occur in the skin, but more often in the subcutaneous tissue; also between the muscles and in the subserous tissue. The term simple lymphangioma is wrongly applied to lymphangiectases, which form lobulated growths covered by thickened skin and occur on the head, trunk and extremities. Simple lymphangioma occurs most commonly in the tongue or lips as a circumscribed growth. The skin or mucous membrane is always somewhat thickened and adherent to the growth. The isolated circumscribed form of simple lymphangioma may be mistaken for other kinds of tumor, but transitional stages to cavernous lymphangioma are often found, the diagnosis of which is easier.

Cavernous lymphangioma is always a diffuse for-

mation, of soft consistence and always united with the skin or mucous membrane over it. The tumor can be gradually diminished by pressure, as the cavernous spaces, filled with lymph and lined with epithelium, communicate with the neighboring lymphatic vessels. Cavernous lymphangioma forms a painless, diffuse, slow-growing tumor with a smooth surface and irregular borders. When they are visible under the skin or mucous membrane they have a pale-green color, in distinction to the reddish-blue color of cavernous hemangioma. They occur most often in the cheeks, tongue and lips, giving rise to enlargement of these parts, known as macromelia, macroglossia and macrocheilia. They are generally congenital, or appear soon after birth. Cavernous lymphangiomas also occur in the neck, causing a dimpled swelling of the skin by their numerous processes, which extend in all directions (Fig. 145). As already mentioned, lymphangiomas may be situated over encephaloceles or myelocystoceles. Gradual atrophy of the bones may be caused by the pressure of extensively progressing lymphangiomas.

Cystic lymphangioma occurs in the subcutaneous or intermuscular tissue, most often in the side of the neck (Fig. 145). It is composed of large, cystic cavities lined by epithelium and containing whitish or brownish fluid (cystic hygroma). Cystic lymphangioma is almost always congenital and is characterized by its slow growth, which may cease after some years. The skin is unchanged and can be raised from the tumor. Fluctuation is present, but there is no diminution of the tumor on pressure. Extensive lymphangioma of the neck may be dangerous from pressure on the trachea. Besides the neck, the growths may also occur in the axilla, the popliteal space, the bend of the elbow, the groin and the sacral region. Infants with congenital lymphangioma sometimes show other malformations, and are often incapable of life.

Differential Diagnosis. Simple lymphangioma which occurs in the form of a small, soft, circumscribed tumor, may be mistaken for fibroma, lipoma or hemangioma. Cavernous lymphangioma can only be mistaken for hemangioma, as no other tumor diminishes on pressure. It differs from hemangioma in its greenish color and in the nature of its contents. Cystic lymphangioma, when it occurs in the form of an isolated unilocular cyst, may be mistaken for various tumors; in the neck, for blood cyst, branchial cyst, lipoma or dermoid.

The prognosis of lymphangioma is, on the whole, not unfavorable, on account of its limited growth and occasional spontaneous resolution.

Treatment. Circumscribed lymphangioma can be excised. In diffuse cavernous lymphangiomas (macrocheilia, macroglossia, macromelia) cuneiform excision may be performed. The introduction of magnesium may be tried, to cause thrombosis and shrinking of the tumor. After this extirpation is easier and infection through a lymph fistula, which so often occurs after the usual operation, is avoided. Cystic hygroma is best treated in this way. Radical operations should not be performed unless the child is in good condition. Puncture and injection of tincture of iodine are unsafe measures, while lymph fistula often remains after incision and plugging. Lymph fistulas must always be removed by a radical operation, on account of the danger of infection through them. Lymph fistulas, which occur from injury to the thoracic duct after extensive extirpation of the breast, can be healed by plugging with acetate of aluminium.

Fig. 145 shows a congenital tumor involving the lower part of the right cheek, the whole of the right side of the neck and the greater part of the left side of the neck. The skin was unchanged and

movable over the tumor. On examination, it was found to be a multilocular cystic tumor. There was no diminution on pressure. The tumor also extended to the floor of the mouth, so that the tongue, which also contained a lymphangioma (macroglossia), was displaced upwards. The greenish surface of the cyst was visible under the mucous membrane of the mouth, so that the diagnosis of congenital multiple cystic lymphangioma was made. On account of the situation of the tumor on both sides of the neck in the submaxillary, submental and parotid regions, the case might be mistaken for an affection first described by *Mikulicz*, in which there is symmetrical enlargement of all the salivary glands and glands of similar structure in the head and neck. In this case, however, there was no change in the lachrymal glands, which are usually affected in *Mikulicz's* disease; also there was a characteristic lymphangioma in the tongue, which is absent in *Mikulicz's* disease. The swelling of the floor of the mouth on each side of the froenum of the tongue resembles a ranula. The latter is a cystic formation arising most commonly in the duct of the sublingual gland, more rarely from the incisive gland situated on the inner surface of the lower jaw in the middle line.

Teratomata

TERATOMA MONOGERMINALE (*Monogerminal teratoma*)
Plate CXVII, Fig. 146.

Teratomas may be bigerminal or monogerminal. In bigerminal teratoma there is a true double formation —a fetus within a fetus. In monogerminal teratoma there is perverted development in one embryo, and all the tissues are derived from one embryo only. The latter includes all kinds of mixed tumors which are formed of all three embryonic layers (epiblast, mesoblast and hypoblast). Dermoid cysts, which are formed by all three embryonic layers, belong to the teratomata. A distinction between monogerminal and bigerminal teratomata is not always possible, and is of little clinical importance. Teratomas are rare on the whole, and are always congenital. They are most often found in the buccal cavity, where they may be mistaken for naso-pharyngeal polypi (Fig. 25). They also occur in the face, neck and coccygeal region, and have been observed in the mediastinum and abdominal cavity. They may attain enormous dimensions, and have then an irregular, uneven surface. The consistence also varies, some parts being cystic, others soft and others hard. Teratomas often form encapsuled tumors. They may cause extensive destruction by pressure on the neighboring parts. A distinction between teratomata and teratoid mixed tumors is clinically impossible. Diagnosis in many cases is only made after examination of the extirpated tumor.

Differential Diagnosis. Teratomas which appear as large, congenital tumors can generally be recognized by the above-mentioned characteristics, especially by their situation in the embryonic fissures. Diagnosis is assisted by the X-rays which may reveal bones and teeth, which are often present in teratomas. Teratomas occurring in the thorax, abdomen and pelvis, especially when they do not assume a tumor growth till later years, can often only be diagnosed by operation.

Treatment. Teratomas have been successfully removed both in children and in adults. Extensive teratomas (Fig. 146) cannot be removed by operation. The presence of other deformities, such as spina bifida, and the feeble condition of the infants often renders operative treatment impossible.

Fig. 146 shows a teratoma of the left side of the face, almost as large as the fist, involving the left orbit and almost the whole of the buccal cavity, and covered by livid, movable skin. It was covered by a connective-tissue capsule. Further examination showed that it arose from the base of the skull, but did not communicate with the cranial cavity. The tumor was soft and fluctuating in some places, hard in others. Examination by the X-rays showed the presence of a piece of bone, which was afterwards found to be part of the upper jaw. Further examination showed that the tumor consisted of neuroglia, neuroepithelium and cysts lined with epithelium. As it consisted of epiblastic products only it must be regarded as a monogerminal tumor which, in this case, originated from a separated portion of the epiblast. This view is supported by the fact that the tumor developed in a region (base of the skull) where separation of the epiblast is possible. On the other hand, it appears far-fetched to consider the tumor as a bigerminal teratoma (fetus within

fetus by inclusion) simply because of its large size at birth.

There were no other malformations present except mutilation of the right ear. Death occurred soon after birth.

DUCTUS OMPHALO-MESENTERICUS PERSISTENS

(Persistent Omphalo-mesenteric Duct)

Plate CXVIII, Fig. 147.

The omphalo-mesenteric duct, or vitelline duct, is the communication between the alimentary canal and the umbilical vesicle or yolk-sac. It usually disappears about the eighth week of fetal life. In some cases this duct may persist and is then known as *Meckel's* diverticulum, which arises from the small intestine about ten inches above the ileocæcal valve. This diverticulum may lie free in the abdominal cavity, where it may cause intestinal obstruction by becoming entangled with the intestines; or it may become attached to the umbilicus, or extend a short distance into the umbilical cord. In the latter case it may become opened after birth when the umbilical cord has separated, thus giving rise to an umbilical fistula, discharging fæces from the umbilicus when the whole length of the duct is open as far as the intestine. When the intestinal end of the duct is closed, the remainder may persist as a small fistula discharging mucoid secretion; or it may become dilated into cystic formations.

In umbilical fistula there is a red globular swelling with a small depression at its apex, situated at the navel. The surface of the swelling is formed by mucous membrane. A probe can be passed through the depression as far as the small intestine, and the greater part of the fæces are discharged through the fistula, causing inflammation of the skin surrounding the navel. Death often occurs from prolapse of the small intestine.

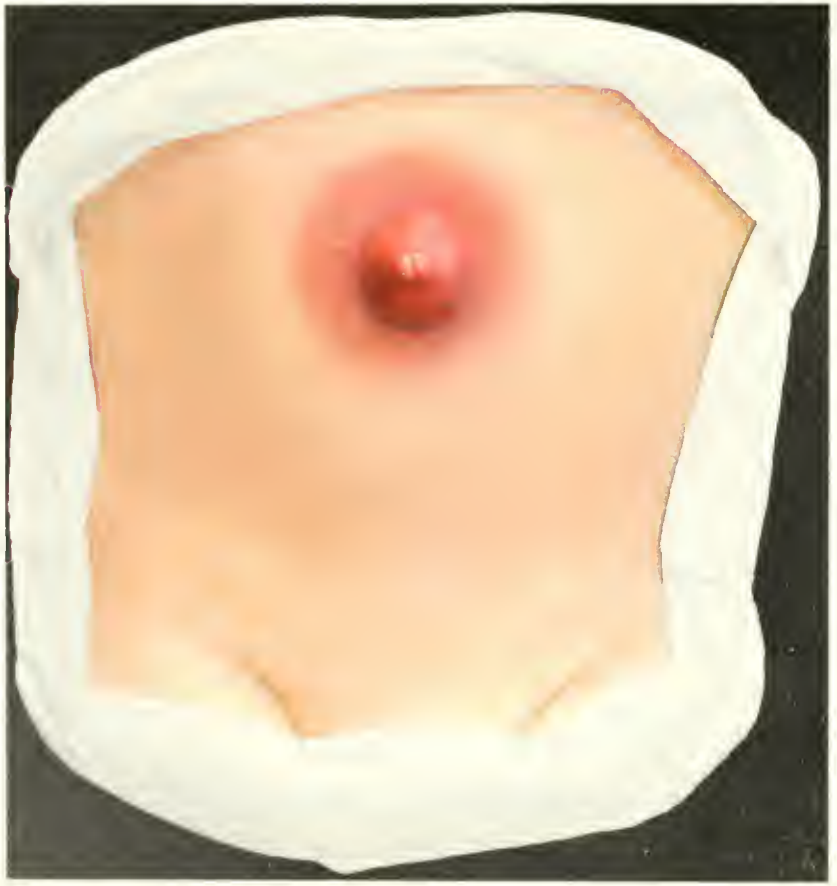

Fig. 147. Ductus omphalo-mesentericus persistens.

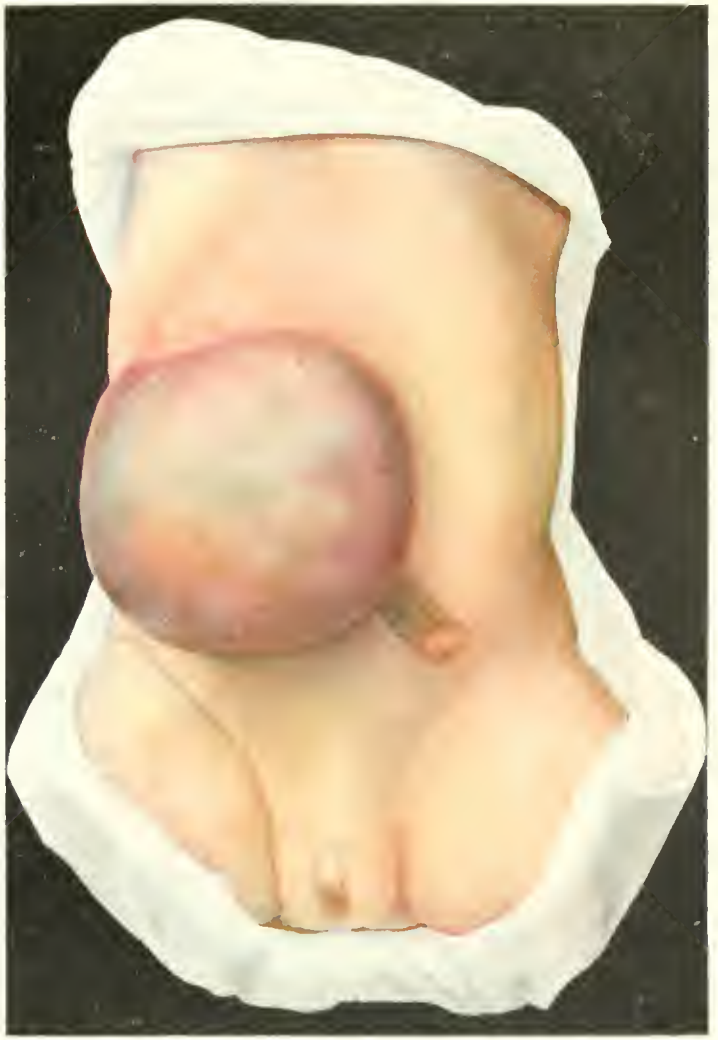

Fig. 148. Hernia funiculi umbilicalis congenita.

Differential Diagnosis. Infection of the navel with the formation of granulation tissue may resemble the above condition. Other fistulas may also occur in the umbilicus. The urachus, which represents the remains of the communication between the bladder and the allantois in fetal life, may remain open and form a fistula at the umbilicus. Normally the urachus becomes obliterated and forms the median ligament of the bladder. Fistula of the urachus is diagnosed by discharging urine. Like fistula of the vitelline duct, fistula of the urachus usually appears after separation of the umbilical cord. The nature of the fistula is not always determined by probing; a more certain method of diagnosing fistula of the vitelline duct is by feeding with powdered charcoal, which then appears at the navel. The diagnosis can sometimes be made by chemical and microscopical examination of the secretion. Tuberculosis of the intestine, actinomycosis, peritonitis, empyema of the gall bladder, injuries of the bladder, and dermoids may all give rise to fistula at the navel.

Treatment. Fistula of the vitelline duct can sometimes be prevented by discovering the condition before tying the umbilical cord. The cord is then thicker than usual at its base. The end of the duct can then be reduced and the cord tied further away from the navel.

In cases of complete fistula leading to the intestine laparotomy is necessary, with resection of the diverticulum and suture of the intestine. Fistula of the urachus must be separated down to the bladder and removed, and the bladder sutured.

Fig. 147 shows a case of complete fistula of the vitelline duct. The infant was in a bad condition from prolapse of the gut, evacuation of fæces from the navel, and inflammation of the surrounding skin. Laparotomy was performed but the operation was unsuccessful.

HERNIA FUNICULI UMBILICALIS CONGENITA

(Congenital Umbilical Hernia)

Plate CXVIII, Fig. 148.

Congenital umbilical hernia must be regarded as a malformation, and forms a large tumor, containing intestine and often also the liver. It is often associated with various forms of spina bifida, or with ectopia of the bladder. Cases of extensive umbilical hernia are due to arrested development causing incomplete closure of the abdominal walls. Umbilical hernia may also be acquired. In this case the abdominal walls are closed, the umbilical ring is small, the hernia is smaller and more cylindrical, and the contents consist of small intestine. Acquired hernia may be so small as to be overlooked at birth, and may then be included in the ligature of the umbilical cord. The base of the cord should, therefore, always be examined to see if it contains intestine.

Congenital umbilical hernia forms a large globular swelling in the region of the navel (Fig. 148). The surface is destitute of cutaneous covering and shows the greenish-yellow remains of the amnion. The remains of the umbilical cord is generally seen at one side of the swelling. In rare cases epidermization takes place at the borders; more commonly the swelling ruptures from pressure, with consequent prolapse of the viscera and death from peritonitis.

Differential Diagnosis. Both the congenital and the acquired forms of umbilical hernia are so characteristic that they cannot be mistaken for any other condition.

Treatment. The occurrence of symptoms of intestinal obstruction, or threatening perforation of the sac indicate immediate laparotomy, with excision of the sac, reduction of its contents and closure of the abdominal walls. In some cases the viscera are adherent to the sac and require separation. Reduction of the visceral contents is sometimes difficult or even impossible, especially when the liver is contained in the sac. If operation is not urgent it may be postponed till the child is stronger, the sac being supported by bandaging in the meantime.

Acquired umbilical hernia may occur during the first month after birth, as the umbilical ring takes several weeks to close completely. Anything which causes the infant to cry may be an exciting cause for hernia, also straining from phimosis, etc. Many cases become cured without treatment. Non-operative treatment consists in placing a metal disk wrapped in plaster over the umbilical ring, after reduction of the hernia, and bringing the skin of the abdomen together over it by means of plaster. The disk must be larger than the hernial opening. Small openings may be closed in this way after nine months' treatment. Larger openings with separation of the recti muscles above the umbilical ring require laparotomy. In older children, especially girls, this should always be performed. The operation consists in extirpation of the whole umbilical ring and suture of the abdominal walls with wire.

In Fig. 148 the hernial sac contained the intestine and liver, which were reduced with great difficulty, so that the abdominal walls when sutured were under great tension. The infant died soon after the operation.

AMPUTATIONES AMNIOTICÆ (*Amniotic Amputations*)
Plate CXIX, Fig. 149.

Malformations of the extremities include *amelus* and *phocomelus*. In amelus the extremities are absent or only represented by stumps. This condition may affect all four extremities, both arms or legs, or one arm or leg. In phocomelus there is arrested development of the proximal segments of the arms or legs, or of all four extremities. The hands or feet are then situated directly on the trunk. Some of these cases attain adult age, and one has been known to live to sixty-two. [Several such cases were among *Barnum's* freaks.]

The so-called spontaneous amputations of various parts of the extremities are caused by pressure of amniotic bands or the umbilical cord. The ends of the amputations are then pointed. In other cases there is not complete amputation but constriction, resulting in deep, circular grooves extending to the bone (Fig. 149). In spite of the depth of the grooves, the circulation remains normal, but there is often elephantiasic thickening from lymphatic congestion. In some cases the bones are constricted, as shown by the X-rays. The remains of the amniotic bands are often present in the constricted places.

Other malformations, also due to tightness of the embryonic membranes, are synechia of the fingers (webbed fingers), hare-lip, cleft-palate, transverse fissure of the cheek, and fissure of the tongue.

Treatment. When the constricted parts are functionless they should be amputated. Elephantiasis may be treated by cuneiform excision.

Fig. 149. Amputationes amnioticae.

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In Fig. 149 the function of the fingers was normal so that no operation was necessary. In this case there was also hare-lip and cleft-palate, which were operated upon.

AKROMEGALIA (*Acromegaly*)
MAKROMELIA (*Macromelia*)
MAKROGLOSSIA (*Macroglossia*)
Plate CXX, Fig. 150.

The term Acromegaly is applied to a condition in which there is enlargement of the terminal portions of the body—the hands, feet, nose, cheeks, tongue and ears. The enlargement affects all the tissues (true giantism) and does not appear till after the termination of the period of growth, thus differing from congenital giantism. In some cases there is increased growth of hair, and curvature of the vertebral column. The disease causes considerable disfigurement of the face. It generally appears between the twentieth and fortieth years and may remain stationary. In many cases there is, first of all, hypertrophy of the bones of the hands, feet and face.

The disease has been attributed to changes in the pituitary body (hypertrophy, adenoma, sarcoma, cyst); to changes in the thyroid gland, pancreas, genital glands; to persistence of the thymus; to nervous influence, since nervous disorders have been observed in the hypertrophied extremities; also to a congenital condition. The most probable of these is enlargement of the pituitary body, which can be demonstrated by widening of the sella turcica, shown by the X-rays. Large tumors of the pituitary body may press on the optic nerve and nerves of the ocular muscles.

The prognosis is not unfavorable, as severe disturbances only occur after the disease has existed for many years.

Differential Diagnosis. Partial giantism, which also begins in the hands and feet, differs from acro-

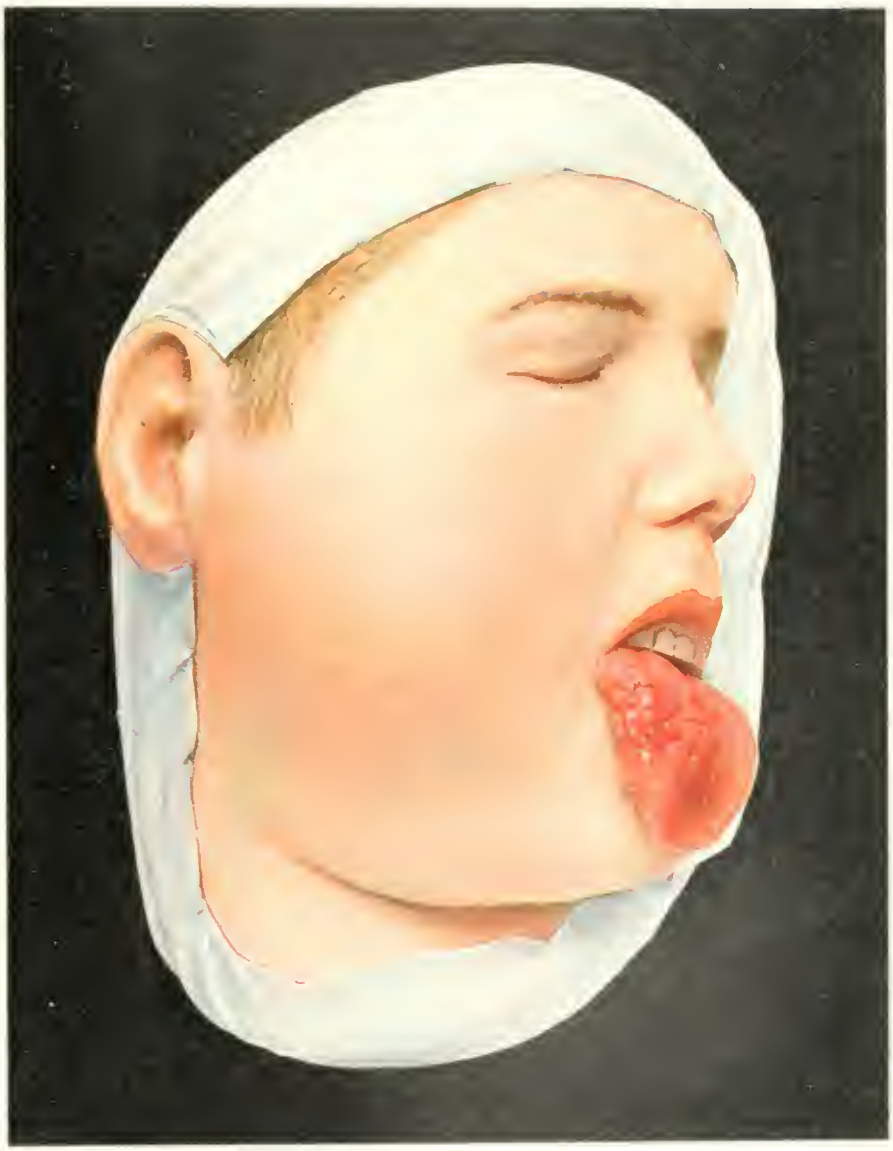

Fig. 150. Akromegalia Makromelia Makroglossia.

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megaly by being congenital. In leontiasis ossea there is enlargement of the bones, while the soft parts are more often atrophied. Acromegaly affecting one extremity only might be mistaken for osteitis deformans, or for chronic osteomyelitis, as there may be lengthening of the bone in both these diseases. Acromegaly differs from elephantiasis in the presence of enlargement of the bones, which can be shown by the X-rays. Acromegaly commencing in the face might possibly be mistaken for tumor of the upper maxilla, but there is usually early hypertrophy of the cheeks (macromelia), lips and tongue (macroglossia), and of the hands and feet.

Treatment. Thyroid extract and extract of pituitary gland have been recommended. Tumor of the pituitary gland may be removed by operation. Extensive enlargement of the soft parts may be diminished by cuneiform excision.

Fig. 150 shows marked hypertrophy of the right side of the face. The right ear is considerably larger than the left, and there is hypertrophy of all the tissues of the cheek. The right side of the tongue is enlarged, somewhat resembling cavernous lymphangioma, but differing in being unilateral. X-ray examination showed unilateral enlargement of the upper and lower maxillary bones. The fingers and toes on the right side had increased in size for some years. The X-rays showed widening of the sella turcica indicating the presence of a tumor of the pituitary body. As the patient suffered no trouble from the disease, he refused operation.

Complete Index

Abscess, 19
  bone, 189
  burrowing, 191
  cold, 189, 335
  embolic, 190
  epidural, 257
  gummatous, 299, 314
  hot, 189
  lymphadenitis, 189
  milk, 193
  metastatic, 190
  paramammillary, 189
  subcutaneous, 189
  subperiosteal, 256
  thrombo-phlebitis, 186
Achylodynia, 378
Acne rosacea, 140
Acrania, 384
Acromegaly, 381, 410
Actinomycosis, 40, 293
Adenoids, 44
Adenoma, 72
  malignant, 72
  sebaceous, 72
Adenophlegmon, 237
Amelus, 408
Amniotic amputation, 381, 408
Anchylosis, fibrous, 335
  osseous, 338
  tuberculous, 329
Anencephalus, 381
Aneurism, 57, 87
  arterio-venous, 169
  cirsoid, 137
  consecutive, 170
  false, 169
  pulsating, 172
  racemose, 171
  traumatic, 170
  true, 169
  varicose, 170
Angina *Ludovici*, 237
Angina, syphilitic, 301
Angiolipoma, 104
Angioma, cavernous, 8, 152
  fissural, 152
  hypertrophic, 152
  neuropathic, 153
  plexiform, 152
  racemose, 152
Angiosarcoma, 34, 74
  cutaneous, 46, 74
  plexiform, 74
Animal baths, 284
Anthrax, 202, 287
Anti-streptococcus serum, 271
Antitetanin, 162
Anus, hemorrhoids of, 102
Arteritis, syphilitic, 304
Arterioselerosis, 370, 374
Arthritis, 82, 337
  fibrinous, 283, 329, 338
  fungoid, 328, 335
  gonorrhœal, 282
  gouty, 377
  phlegmonous, 282
  purulent, 283, 329, 337
  rheumatic, 283
  tuberculous, 284, 335, 337
  urica, 377
Asphyxia, local, 368
Atheroma, 24, 374
  carcinoma, 24

Bacteriaemia, 261
Balanitis, 92
Ballottement of patella, 339
Balsam of Peru, 146
Barlow's disease, 157
Basal-celled cancer, 4, 74
Basedow's disease, 87
Birth marks, 134
Boil, 196
Bone plugging, 253
Botriomycosis, 46
Breast cancer, 16
Bronchocele, 85
Bubo, indolent, 300
  inguinal, 278
Bullet wounds, 162
Burn, X-ray, 365
Burns, 30, 355
  internal, 359
Bursitis, 82
  prepatellar, 82, 84

Cadaveric tubercle, 322
Cancer en cuirasse, 23
Cancroid, 3
Capsule, sequestral, 248
Caput medusæ, 174
Carbolic gangrene, 345, 354
Carcinoma, branchial, 40
Carbuncle, 202
  diabetic, 202
  facial, 202
  buccal, 10
  disseminated, 22

Carbuncle, glandular, 16
inoperable, 4, 20
metastatic, 40, 58
nævus, 24
papillary, 30
paramammary, 18
of basal cell, 5
of breast, 16
of cicatrix, 30
of connective tissue, 20
of face, 1
of forehead, 1
of hand, 31
of lip, 6
of mamma, 16, 22
of nipple, 16
of nose, 1
of penis, 27
of skin, 4, 6, 24, 30
of tongue, 6, 13
Caries sicca, 329
Cattle fever, 287
Cavernoma, 66
of tongue, 66
Cephalhematoma, 161
Cephalocele, 383
Cephalocele, *see* Encephalocele
Chancre, phagedenic, 300
syphilitic, 299
tongue, 311
Chilblains, 362
Chimney-sweep's cancer, 30
Chiragra, 377
Chondrofibroma, 69
Chondro-lipoma, 99, 104
myxoma, 99
sarcoma, 99
Chondroma, 35, 99
Chondromyxoma, 99
Chondromyxosarcoma, 62
Chondrosarcoma, 57, 62
Claudication, intermittent, 375
Clavus, 232
Claw-hand, 120
Combustio, 355
Compression of ulnar nerve, 120
Condylomata, 302
Condylomata lata, 301
Congelatio, 360
Contracture, of arm, 122
arthrogenous, 126
cicatricial, 116
dermatogenous, 118
Dupuytren's, 115
ischaemic, 122
hysterical, 120
myogenous, 123
neurogenous, 120
palmar, 115
paralytic, 120
tendogenous, 118
Corn, 232
Corona veneris, 301
Corpus cavernosum, 28
Coxa vara, 129
Craniotabes, 128
Crédé, unguentum, 188
Cretinism, 88
Cutaneous cancer, 72
fibroma, 136
horn, 72
Cystadenoma, 69
Cysts, bone, 19
branchial, 92
dermoid, 92
Cystic goitre, 85
hygroma, 84
Cysto-sarcoma (of breast), 49

Dactylitis, syphilitic, 305, 317, 343
Decollement de la peau, 148
Decubital ulcer, 350
Delirium, 209
Dermoid cysts, 92
recurrent, 92
Detachment of skin, 148
Diabetes, 370
Diathesis, hemorrhagic, 156
Diffuse hematoma, 156
Dislocation of shoulder, 259
Dislocation with fracture of leg, 132
Dissemination, cancerous, 22
Duct, persistent omphalo-mesenteric, 387, 404
Dupuytren's contracture, 115

Ecchondroma, 99
Ecchondroses, 99
Ecchymoses, 160
Eczema of nipple, 16, 22
Elephantiasis, 142, 145
acquired, 142
hard, 142
lymphangiectatic, 142
nervorum, 137, 139
penis, 142
soft, 142
Embolism, tuberculous, 319
Empyema, 179
of antrum, 241
Encephalocele, 94, 381, 383
Encephalomalacia, 41
Enchondroma, 99
Endarteritis, 304, 347
Endocarditis, ulcerative, 266
Endothelioma, 32, 74
of parotid, 77
Endothelial cancer, 77
sarcoma, 77
English disease, 128
Ephelides, 134
Epidermoids, 92
Epithelial cysts, 92
Epithelioma, 21
Epulis, 34, 64
Erysipelas, 204
bulbous, 205
chronic, 211
curative, 206
erythematous, 204
gangrenous, 204
hemorrhagic, 208
migrating, 204
phlegmonous, 204
recurrent, 204
Erysipeloid, 211

Exostoses, cartilaginous, 62
malignant, 62
subungual, 126

False joints, 132
Fibro-adenoma, 19, 49, 69
cystic, 69
Fibrolipoma, 97, 104
pendulous, 104
Fibroma, 96, 116
cutaneous, 136
intracanalicular, 69
melanodes, 134
vaginae tendinis, 96
Fibromata ani, 102
mollusca, 136, 139
Fibromatosis, 137, 142
Fibrolipoma, 104
Fibromyoma, 96
Fibromyxoma, 96
Fibrosarcoma, 36, 60, 64
Fistula, lymph, 399
from foreign body, 109
of neck, 110
mammary, 195
osteomyelitic, 259
rectal, 333
umbilical, 404
vesical, 294
Flatfoot, 174, 177
Folliculitis, 196
Fracture, treatment of, 128
pathological, 57
rickety, 128
Fracture-dislocation, 132
Framboesia, 46
Freckles, 134
Frost-bite, 360
Furuncle, 196
Furunculosis, 82, 196

Ganglion of wrist, 80
Gangrene, angioneurotic, 347
angiosclerotic, 348
carbolic, 345, 354
diabetic, 350, 370
dry, 345, 370
embolic, 347
infective, 350
moist, 317, 344, 350
progressive, 345
Raynaud's, 347, 367
senile, 346
spontaneous, 350
Gaseous phlegmon, 274
General infection, 261
Genu valgum, 129
Geographical tongue, 298
Giantism, 64, 143, 410
Glanders, 287
Glands, tuberculous, 324
Gliosarcoma, 35
Glossitis, 298
Glossy skin, 220
Glottis, œdema of, 239
Goitre, 85
exophthalmic, 87
Gonococcal metastases, 282
Gonorrhœal arthritis, 282
Gout, 377
Grafting, 108
Granulations, 108
Grave's disease, 87
Greenstick, 128
Gumma, 299, 302
of lip and nose, 299, 313
of tongue, 299, 312
Gummatous abscess, 314
osteitis, 315
ulcer, 316

Hallux valgus, 126
Hammer-toe, 126
Hebra's ointment, 146
Heat stroke, 359
Hemangio-endothelioma, 152
Hemangioma, cavernous, 66, 150, 166
simple, 152
subcutaneous, 166, 168
Hemarthrosis, 120, 158
Hematoma, diffuse, 156
ear, 150
pulsating, 160
subcutaneous, 156, 160
Hemophilia, 156
Hemorrhage from compression, 164
Hemorrhoids, 102
Hernia, abdominal, 406
umbilical, 381, 406
Hodgkin's disease, 40
Hordeolum, 196
Horn, cutaneous, 72
Hospital gangrene, 345
Housemaid's knee, 82
Hutchinson's teeth, 306
Hydrocephalus, 393
Hydrops, tuberculous, 328, 330, 389
Hygroma, 82
cystic, 399
multilocular, 84
tuberculous, 342
Hyperkeratosis, 10

Icterus, hematogenous, 267
Implantation carcinoma, 6
Infection, generalized, 261
pyogenic, 179
Infective diseases, 350
Inflammation, 90
Interdigital whitlow, 227
Intestine, actinomycosis of, 293
anthrax of, 287
tuberculosis of, 341
Iodoform bone plugs, 253
Ischaemic contracture of arm, 122

Joint effusion, 248

Keloid, after laparotomy, 113
after vaccination, 113
Keratitis, parenchymatous, 306
Keratoma, senile, 72
Knee, hygroma of, 84
Kyphosis, 129

Lassar's zinc paste, 146
Laparotomy keloids, 113

Leg, fracture of, 128, 132
varicose ulcer, 145
Lentigines, 134
Leontiasis ossea, 410
Leucoplakia, 11
preputial, 27
Lightning stroke, 355
Lingua bifida, 312
Lingua geographica, 298
Lipoma, diffuse, 104
symmetrical, 94, 104
Lipomatosis, 106
Lung, actinomycosis of, 293
anthrax of, 289
cavitation of, 268
tuberculosis of, 323
Lupus, 8
exfoliating, 10
exulcerans, 10
hypertrophic, 10
of face, 9
ulcerative, 10
Lupus-carcinoma, 9
Luxatio, 132
Lymphadenitis, acute, 278, 323
axillary, 286
cervical, 279, 325
chronic, 280
circumscribed, 281, 292
diffuse, 278
inguinal, 278
neck, 325
tuberculous, 280, 325
Lymphangio-endothelioma, 74
Lymphangio-fibroma, 134
Lymphangioma, cavernous, 67, 397
circumscribed, 399
cystic, 67, 397
multiple, 381, 397
simple, 67, 397
Lymphangitis, 196, 200, 213, 223
carcinomatous, 16
chronic, 23
tuberculous, 323
Lymphatic glandular abscess, 281
phlegmon, 278
tuberculosis, 334
Lymph fistulas, 399
Lymphoma, carcinomatous, 16
leukaemic, 40
malignant, 39
sarcomatous, 34, 39, 48
syphilitic, 39
tuberculous, 317, 334
Lymphosarcoma, 34, 39, 40, 48
Lymphvarix, 142

Macrocheilia, 410
Macroglossia, 381, 410
Macromelia, 381, 410
Malformations, 381
Malignant œdema, 274
pustule, 287
Marginate glossitis, 298
Malum perforans, 367
Mastitis, 192
carcinomatous, 23
chronic cystic, 70
Mastitis, interstitial, 70, 193
neonatorum, 192
phlegmonous, 192
puerperal, 192
superficial, 193
tuberculous, 193
Meckel's diverticulum, 404
Median fistula of neck, 110
Mediastinitis, 87
Melanocarcinoma, 32, 39, 48
Melanoma, 32
Melanosarcoma, 32, 48
Meningitis, 392
Meningocele, 390
Meningococcus serum, 285
Mesenteric tuberculosis, 381, 404
Metastases, 58
Mikulicz's disease, 94, 399
Miliary tuberculosis, 333
Milk fistula, 195
Miner's elbow, 82
Mixed infection, 181
Mixed tumor, 19, 77
Mucous membrane, erysipelas of, 204
carcinoma of, 13
papilloma of, 11
tuberculosis of, 332
Mucous patch, 301
Multilocular hygroma of knee, 84
Mummification, 345
Myelocele, 381, 388
Myelocystocele, 381, 388
Myeloma, 57
Myxœdema, 88
Myxolipoma, 104, 381, 388
Myxosarcoma, 60

Nævi, 134
Nævus carcinoma, 24
hairy, 134
lymphangiectatic, 134
neuromatous, 136
pigmentary, 134
vascular, 134, 155
verrucosus, 135
vinous, 155
warty, 24
Nasopharyngeal polypi, 42, 45
Necrosis of bone, 287, 371
fascia, 350
Neck, fistulas of, 110
phlegmon of, 237
Nephritis, 265
Nerve, elephantiasis, 139
compression of, 120
Neurasthenia, traumatic, 214
Neurofibroma, 136
Neurogenous contracture, 120
Neuroma, 137, 139

Œdema, acute, 274
malignant, 209, 274
Omphalo-mesenteric duct, 381
Onychogryposis, 376
Osteitis, deformans, 251
fibrous, 56
gummatous, 299, 315
purulent, 250

Osteitis, tuberculous, 317, 343
Osteochondritis, syphilitic, 305
Osteocopic pains, 304
Osteomalacia, 129
Osteomyelitis, 58, 244, 250, 259, 327
acute, 244, 252, 257
chronic, 253, 259
of humerus, 259
of jaw, 255
of lower maxilla, 255
of scapula, 257
of tibia, 244, 260
Osteosarcoma, 55
Othematoma, 150
Otitis media, 245
Ozoena, 303

Pachydermia, 142
acquired, 145
lymphangiectatic, 145
Paget's disease of nipple, 16, 22
Panaritium (*see* whitlow), 213
Papilloma, inflammatory of skin, 90
of tongue, 6, 111
malignant, 91
Paramammillary abscess, 189
Parotid, endothelioma of, 77
Paronychia, 228
Parulis, 241
Payr's magnesium, 68
Pediculosis, 292
Pelvis, rickety, 128
Pemphigus, 305
Pendulous fibrolipoma, 97, 104
Penis, elephantiasis, 142
carcinoma, 27
Perforating ulcer of foot, 367
Periadenitis, 278
Periarteritis, 304
Pericarditis, 350
Periostitis, albuminous, 249
alveolar, 241
gummatous, 241
ossifying, 248
purulent, 241
Periphlebitis, 186
Peritoneal tuberculosis, 333
Pernio, 360
Pes planus, 177
valgus, 129, 174, 177
varus, 381, 388, 395
Petechiæ, 160, 164
Phagocytosis, 179
Phimosis, 92
Phlebectasis, 174
Phlebitis, thrombo, 186
Phleboliths, 130
Phlegmasia alba dolens, 187
Phlegmon, 234, 274
emphysematous, 274
gaseous, 274
gangrenous, 274
neck, 237
putrefactive, 234
submaxillary, 237
wooden, 238
Phocomelus, 408
Phosphorous necrosis, 256
Pigmentary nævi, 134
carcinoma, 25
Plague, Siberian, 289
Pleuritis, 350
tuberculous, 333
Podagra, 377
Polypus, malignant nasal, 42, 45
Polyvalent serum, 271
Pott's disease, 327
Prepatellar bursitis, 82, 84
Pseudarthrosis, 132
Pseudoleukaemia, 40
Psoriasis, 301
buccal, 9
lingual, 9
Puerperal mastitis, 192
Purpura hemorrhagica, 157
Pustule, malignant, 202, 287
Pyæmia, 261
chronic, 294
Pyogenic infections, 179, 200, 262

Quinsy, 245

Rag-sorters' disease, 287
Raynaud's disease, 367
Recklinghausen's disease, 389
Rhachischisis, 381, 383, 387, 388
Rhachitis, 128
Rheumatism, 282
Rhinitis, atrophic, 43
Rhinophyma, 140
Rhinoscleroma, 140
Rickets, 128
Rider's bone, 169
Riedel's preparation, 372
Rinderpest, 287
Rœntgen-ray burn, 365
Rosary, rickety, 128
Roseola, 301
Round-celled sarcoma, 35, 46
Rupia, syphilitic, 301

Saber blade tibia, 305
Sand baths, 284
Sarcocele, 34
Sarcoma, cavernous, 46
central, 53
cutaneous, 34, 52
endothelial, 74
epipharyngeal, 34, 42
fascial, 34, 60
fungoid, 34, 46
giant-celled, 35, 64
hemorrhagic, 52
inoperable, 58
mammary, 34, 49
myeloid, 158
multiple, 52
osteo, 58
parosteal, 57
peripheral (of humerus), 34, 55
phyllodes, 69
pigmentary, 53
round-celled, 35, 46
Sarcomata, 34
Scars, hypertrophic, 114
Scleroderma, 122

Sclerosis, 299, 311
Scoliosis, 129
Scrofula, 321
Scrofuloderma, 319
Scurvy—rickets, 157
Sebaceous adenoma, 72
furuncle, 196
Seborrhœa, senile, 1
Sepsis, 261
Septicæmia, 261
Septico-pyæmia, 261
Sequestrotomy, 247
Serous effusion, 246
Serum, polyvalent, 271
Silver, colloidal, 271
Skin, carcinoma of, 30
detachment of, 148
endothelioma, 74
gangrene of, 345
grafting of, 108
horns of, 72
papilloma of, 90
sarcoma of, 53
tuberculosis of, 322
Snowball crunching, 120, 157, 160
Spina bifida, 388
occulta, 389
ventosa, 343
Spindle-celled sarcoma, 35, 46
Spirochaeta pallida, 299
Splenic fever, 287
Spondylitis, tuberculous, 327
Spontaneous gangrene, 350
Staphylococcal infection, 182
mycosis, 262
phlegmon, 204
serum, 221
Staphylolysin, 249
Stomatitis, 309
Streptococcal infection, 263
mycoses, 263
osteomyelitis, 250
phlegmon, 276
Strictures, 303
Struma cystica, 85
Subcutaneous hemangioma, 166, 168
hematoma, 160
Subluxation, 338
Suffusions, 160
Suggillations, 160
Sunstroke, 359
Sweat-gland abscess, 189
furuncle, 196
Syphilide, macular, 301
papular, 301
Syphilis, acquired, 299
congenital, 305
malignant, 305

Teeth, syphilitic, 306
Telangiectases, 152, 155
Tendon, contraction, 118
whitlow, 218
sheath, fibroma of, 96, 116, 118
Tendovaginitis, tuberculous, 342
Teno-synovitis, 81
Teratology, 381
Teratoma, 44, 381, 401
Testicle, tuberculosis, 317, 341
Tetania, strumipriva, 88
Thiersch's grafts, 108
Thrombo-phlebitis, 186
Toe-nails, ingrowing, 230
Tonsillar hypertrophy, 44
Tongue, abscess of, 12
actinomycosis of, 293
bifid, 312
carcinoma of, 6, 13
chancre of, 299
geographical, 298
gumma of, 299
syphilis, 311
Tophi, 378
Toxinæmia, 263
Triad of *Hutchinson*, 306
Tuberculin, 322
Tuberculosis, 317
of bladder, 333, 341
of bones, 325, 335
of glands, 324
of hand, 317, 342
of joints, 328
of neck, 317
of prostate, 341
milliary, 333
of skin, 322
surgical, 320
of testicle, 317, 341
Tumor albus, 329, 339
mixed, 77
retromaxillary, 42
Typhoid, 270

Ulcer, decubital, 350
gangrenous, 350
gummatous, 299, 316
molle, 299
phagedenic, 28
rodent, 1
varicose, 145
Ulcus rodens, 1
Umbilical hernia, 381
Unguis incarnatus, 230
Unna's zinc gelatin, 145
Urachal fistula, 382
Urinary phlegmon, 277

Vaccination keloids, 113
Vagina, fibroma of, 96
Valgus, pes, 174, 177
Varicocele, 174
Varicose ulcer of leg, 145
Varix, 174
aneurismal, 170
cirsoid, 174
submucous, 174
Vascular nævus, 155
Villous cancer, 90
polypus, 90
Von Recklinghausen's disease, 389
V-phlegmon, 215

Wart, 30
White leg, 187
White swelling, 329, 339

Whitlow, 213
articular, 224
chronic, 229
interdigital, 227
osteal, 224
periosteal, 224
peri-ungual, 228
subcutaneous, 223
subepidermal, 222
sub-ungual, 228
Whitlow, tendinous, 226
Wooden phlegmon, 238
Wound diphtheria, 234
Wounds, treatment of, 235
Wrist, ganglion of, 80

Xeroderma pigmentosum, 1, 33
X-ray burns, 365

Yaws, 46