

## Rattlesnakes and Zoos

TO GET THE REAL FEEL OF THE PROBLEM, I CONJURE UP A MAN OF SOME FAR FUTURE TIME, WALKING IN A LAST WOODS LYING UNRUINED AMONG LAUNCHING PADS OF A PLANETARY MISSILE TERMINAL, AND COMING ASTOUNDED UPON THE LAST OF ALL LIVING INDIVIDUALS OF *CROTALUS ADAMANTEUS*, THE GREAT UNRULY DIAMONDBACK RATTLESNAKE. IT IS A FULL-GROWN FEMALE SNAKE THAT I SEE, TWO YARDS LONG, STERN OF FACE, AND ALL MARKED OFF IN GEOMETRIC VELVET. IT IS THE SORT OF BEING THAT ALWAYS, INADVERTENTLY AND WITHOUT MALICE, HAS BEEN A THORN IN THE FLESH OF AMERICANS, ONE OF THE NOVEL TERRORS THE LAND HELD FOR MEN WHETHER THEY CAME IN CARAVELS OR WANDERED DOWN INTO THE NEW WORLD OUT OF THE SNAKE-FREE SIBERIAN COLD. SEEING THE MAN, THIS LAST DIAMONDBACK BEGINS READYING THE STEEL OF ITS COILS, AND THEY EBB AND FLOW BEHIND THE THIN NECK HOLDING THE BROAD HEAD STEADY AND STILL, EXCEPT FOR THE LONG TONGUE WAVING. BY THE GIRTH OF HER I JUDGE THAT THIS IS A PREGNANT SNAKE, HEAVY WITH SOME DOZENS OF PREHATCHED PERFECT LITTLE SNAKES THE SAME AS HERSELF, ALL VENOMOUS AND INDIGNANT FROM THE START, ALL INTRACTABLE AND, LIKE THEIR MOTHER, UNABLE TO LIVE EXCEPT AS FREE SNAKES.

THE SNAKE THAT CONFRONTS THE IMAGINED MAN IS A MOVING THING TO SEE. IT IS NOT EASY TO UNDERSTAND ALL THE FEELINGS AROUSED BY SUCH A SIGHT, AND THE SNAKE I THINK FORWARD TO IS THE LAST IN ALL THE PABLUM AGAR CULTURE OF THE PURIFIED WORLD. THE COILS OF HER BODY RISE AND FALL IN SLOW SPIRALS, THE KEEN SINGING OF HER RATTLE SOUNDS, AND SHE WAITS THERE, TESTING WITH THE FORKS OF HER TONGUE THE WHOLE FUTURE OF HER KIND. IN MY THOUGHTS THE MAN THEN STOOPS WITH AN OLD URGE AND PICKS UP A STICK. IT IS ALMOST THE ONLY STICK LEFT LYING IN THE EASTERN HALF OF NORTH AMERICA, AND THE MAN TAKES IT UP AND MOVES IN CLOSER TO THE WONDERING SNAKE. HE RAISES THE STICK, THEN SOMEHOW LOWERS IT AS IF IN THOUGHT, THEN HALFWAY BRINGS IT UP AGAIN. AND THEN THE CONJURING FAILS FOR ME, AND THE SNAKE SONG FALLS AWAY, LIKE THE SONG OF CICADAS LOSING HEART, ONE BY ONE. THE WOODS GROW DARK AND FADE OFF INTO DISTANT TIMES.

—THE REPTILES BY ARCHIE CARR, 1963, p. 176

Archie Carr vividly summarized the state of rattlesnakes in a future world and his conclusions are pretty depressing. Is it any wonder that rattlesnakes have both charmed and confused biologists and herpetologists throughout the centuries? Rattlesnakes are surrounded by myths, misconceptions, folklore, and tall tales.

### MY FIRST AND ONLY RATTLESNAKE ROUNDUP

When I started working at Dallas Zoo in 1966, I traveled to Sweetwater, Texas, to view my first Jaycees (United States Junior Chamber) rattlesnake roundup. At this event, I watched Texas good ol' boys from a club called "Venomaires" drop dozens of live rattlesnakes on one of their brethren lying in a bathtub, stuff rattlers in a sleeping bag with a human inside (one variation has rattlesnakes already in bag and handler crawls in head-first),

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place coiled rattlesnakes on a human's head by forcing the snakes to strike many times until exhausted, sponsoring the National Rattlesnake Sacking Championship and Annual Peace Officers Rattlesnake Shoot, rattlesnake races where a person continually whips the snake, stomping contest, spit chewing tobacco into the pit, or use their mouths to dangle living snakes by their tails.

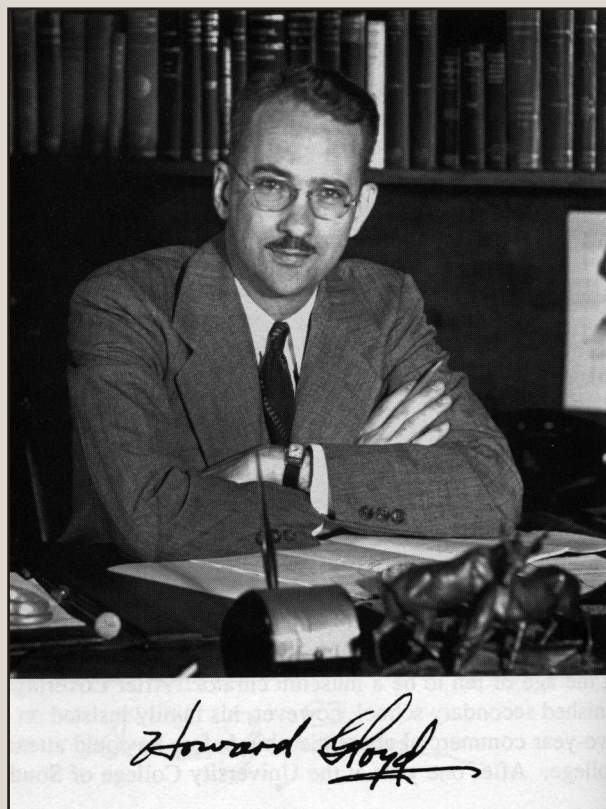


FIG. 1. Portrait of Howard K. Gloyd

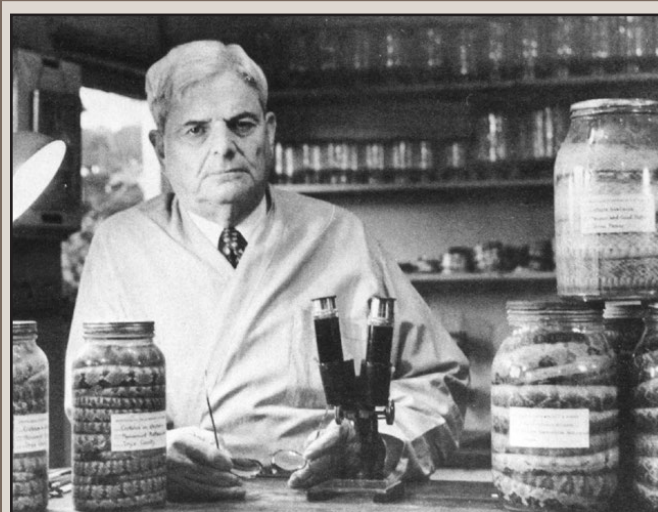


FIG. 2. Portrait of Laurence M. Klauber in his private home laboratory.

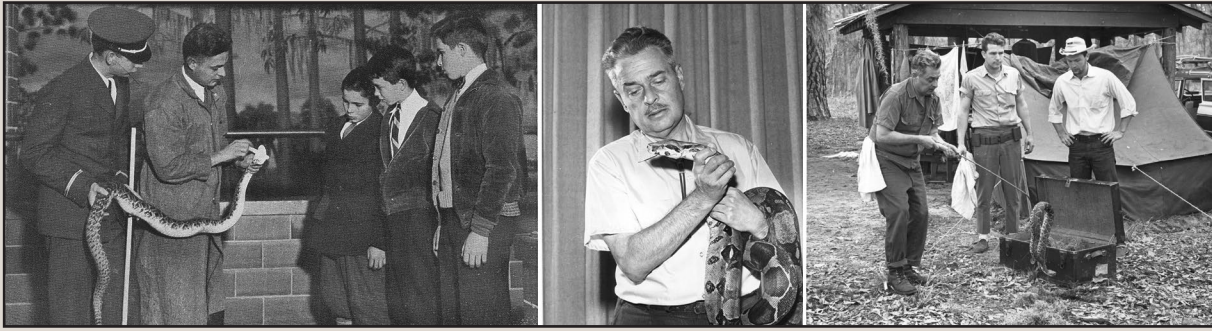


FIG. 3. *Left.* Carl F. Kauffeld (holding snake head) pictured in *News Bulletin of the Staten Island Zoological Society* in March 1937. Each issue cost 5 cents. *Middle.* Carl F. Kauffeld and boa constrictor “Blondie,” taken at Staten Island Zoo in October 1967. *Right.* Carl F. Kauffeld (left), Robert T. Zappalorti (center), and Jim Bockowski (right) place Eastern Diamondback Rattlesnake (*Crotalus adamanteus*) collected at Duck Pond, Okeetee, Jasper County, South Carolina in trunk to transport to Staten Island Zoo on 7 April 1965.

PHOTO CREDITS: LEFT: STATEN ISLAND ZOOLOGICAL SOCIETY, COURTESY OF KEN KAWATA. MIDDLE: PHOTO BY JACK MUNTZER, COURTESY OF ROBERT ZAPPALORTI. RIGHT: PHOTO BY MANNY RUBIO, COURTESY OF ROBERT ZAPPALORTI

I hoped that they would use the other end. Children were invited to pet a loosely restrained snake and hold balloons into the pit to elicit strikes. The annual beauty contest could only be entered if the contestants agreed to slaughter a snake. A demonstration by Miss Snake Charmer (also Miss Teen Snake Charmer) included killing and skinning a Western Diamondback Rattlesnake (*Crotalus atrox*). She dropped the severed head into a bucket bright red with blood with dozens of other snake heads; this bucket was surrounded by gawkers, including young children. Snakes require little oxygen to survive, and so their body parts can remain alive for several hours. One of the handlers said that severed heads have been known to retain consciousness for slightly over an hour after decapitation. Some handlers even pull out and display the snakes' still-beating hearts for the crowd. The announcer claimed that all of these activities served the common good—to offer rattler meat to the attendees as well as offering an educational message about safety around venomous animals.

Organizers proclaimed that a critically important medical purpose was addressed—to provide accurate snakebite treatment information and venom for antivenin production. Roundup organizers often tried to legitimize roundups by claiming that collected venom provides a supply for antivenin (=antivenom) production, but their venom collection methods almost certainly do not meet the strict guidelines for antivenin production required by the U.S. Food and Drug Administration. Collection procedures must follow strict protocols, and labs and other antivenin producers will only obtain venom from reputable sources. Although my search was not statistically robust, I could only find two reports of *Crotalus atrox* venom that was collected at a roundup (the 1985 Big Springs, Texas, Rattlesnake Roundup) for research on venom composition and responses to bites in various mammals. Rather than add to the nation's supply of antivenin, roundups deplete it by encouraging behavior that leads to human envenomation. Two University of Kansas herpetologists, Henry S. Fitch and George R. Pisani, have published a number of papers on roundups (Fitch 1998, 2003, Fitch and Pisani 1988, 1993, Pisani and Fitch 1993). In one (1993), they made the following observations, “One or more bites are sustained during a typical roundup. An ambulance and physician are kept on standby. Victims are rushed to the local hospital and treated with antivenin, and most recover without lasting debilitation. Some have survived multiple bites and proudly display scars and amputations.”

After all this foolishness, the snakes were beheaded with a rusty axe, skinned, and either cooked on a grill for the crowd, or

examples for sale at tables scattered around the grounds included hatbands, belts, rattlers hatching from eggs, full body taxidermy mounts or stuffed heads with mouths open and fangs showing. What was incomprehensible to me was that attendees could pay a fee to be the executioner and I was stunned to see young children as well as adults in line to chop off heads and eviscerate and skin their prize. After this grim exercise, their clothing was often covered in blood. I saw an adolescent girl wearing a pretty party dress covered with blood head to toe—even her shoes left bloody footprints on the floor.

The snakes which provided meat sold for human consumption were typically killed under unhygienic conditions, and this meat, often improperly prepared, may be contaminated with *Salmonella* or other bacteria. The snakes are often dropped in a plywood, Plexiglas, or concrete pit by the hundreds and many were already dead, suffocated by the weight of the snakes above (sometimes four deep). Many snakes were gasping with mouths open and crawled weakly and abnormally. I learned that most of the snakes were collected in the field by pouring gasoline through a tube into the hibernating sites to drive them from these dens. Sharp hooks were used to snare them if the gasoline was not effective.

Rattlesnakes have endured horrific treatment by what are supposed to be civilized human beings. There are barbaric and bizarre practices on display at these annual rattlesnake roundups that at one time were prevalent in the United States. When I left this venue in 1970, my impression was that I had just witnessed a group of primitive macho tribesmen, laden with snake tattoos, some with missing body parts, strutting with bravado. Katie Morell wrote in 2017, “Activities at many of these events (some of which include beauty pageants and a variety of vendors) range from skinning snakes alive and chopping their heads off, to lighting pits of live snakes on fire and shooting them in the heads with nail guns. The largest rattlesnake roundup happens every March in Sweetwater, Texas and at the event, small children dip their hands in the blood from freshly killed snakes to make artwork.”

I naively believed then that other humans would be outraged by this spectacle and would actively work toward closing them forever. Five decades later, these displays of cruelty still exist and the silence of political indifference is disheartening. As an example, the Texas Parks and Wildlife Commission sent out this message on 24 October 2016: *The TPW Commission has decided that, at this time, there is insufficient support from legislative oversight or the potentially regulated community for the department to move forward with regulating the use of gasoline*



FIG. 4. Rattlesnakes from *Locupletissimi rerum naturalium thesauri accurata descriptio, et iconibus artificiosissimis expressio, per universam physices historiam : Opus, cui, in hoc rerum genere, nullum par exstitit // Ex toto terrarum orbe collegit, digessit, descripsit, et depingendum curavit Albertus Seba ...* by Albertus Seba, 1734–1765.

to collect rattlesnakes. The TPWD staff still believe that there are better options for collecting snakes that do not adversely impact non-target species, and we will continue to work with the snake collecting community to develop and implement best practices that reduce potential impacts to these species. Conspicuously, there is no mention of inhumane practices or the terrible reputation ascribed to the citizens of Texas throughout the world about cruelty, barbarism, and ignoring animal welfare issues!

Consult Burghardt et al. (2009) for reasons detailing ophiphobia and Campbell et al. (1989) for description of collateral damage caused by gassing to mammals, other herpetofauna, and invertebrate inhabitants of dens.

#### SEMINAL RATTLESNAKE PUBLICATIONS (1790–1830)

In reality, these ophidians are extraordinary and captivating animals, and I wish to share my fascination with them by showing a few early accounts and reproducing some of the finest published rattlesnake illustrations (Figs. 4–17). I begin with what may be the earliest illustration (1628) and continue through the beginning of the twentieth century with drawings from a variety of sources.



FIG. 5. Pygmy rattlesnake (*Sistrurus m. miliarius*) from *The Natural History* by Mark Catesby, 1743. A splendid book was recently published— *The Curious Mister Catesby: A “Truly Ingenious” Naturalist Explores New Worlds* (2015).



FIG. 6. Neotropical Rattlesnake (*Crotalus durissus*) from *Regnum Animale* by Arnout Vosmaer, 1766–1787.

In 1851 a series of biological surveys and explorations of the western United States started to be published and began to show descriptions and illustrations. Due to their extensive geographic ranges and dense populations near human settlements, the three serpents most often portrayed are Timber Rattlesnake (*Crotalus horridus*), Western Diamondback Rattlesnake (*C. atrox*), and Neotropical Rattlesnake (*C. durissus* [sensu lato]).

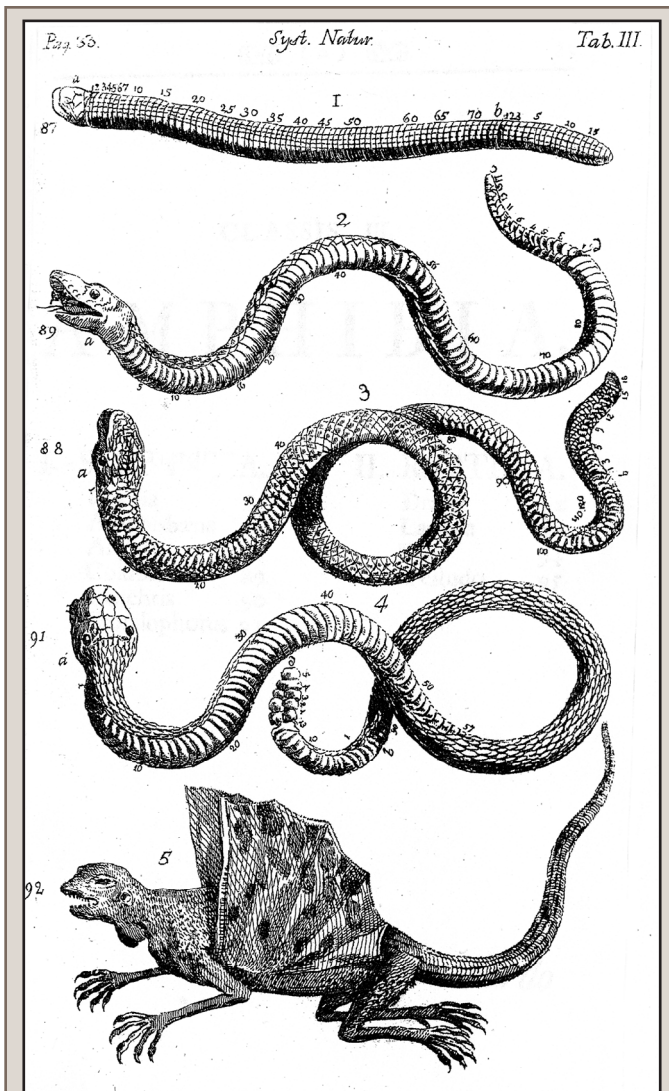


FIG. 7. Rattlesnake from *Systema Naturae* by Carl Linnaeus (Carl von Linné). Linnaeus lists four species of rattlesnake in the 13<sup>th</sup> edition (vol. 1, pt. 1, p. 372, 1767–1770): *miliarius*, *horridus*, *Dryinus* and *Duriffus* [= *durissus*]. Based on its prominent head plates, the snake pictured here (#4), from the 6<sup>th</sup> edition (1748), is almost certainly the Pygmy Rattlesnake (*Sistrurus miliarius*). The lizard with unusual wings is a species of *Draco*.

“AS TO RATTLESNAKES, ALL ACCOUNTS AGREE THAT BY KEEPING THEIR EYES FIXED ON ANY SMALL ANIMAL, AS A SQUIRREL, BIRD, OR SUCH LIKE, THOUGH SITTING ON THE BRANCH OF A TREE OF A CONSIDERABLE HEIGHT, IT SHALL, BY SUCH STEDFAST [sic] OR EARNEST LOOKING, BE MADE TO FALL DEAD INTO THEIR MOUTHS.

SIR HANS SLOANE HAD A RATTLE-SNAKE GIVEN HIM. IT HAD LIVED 3 MONTHS BEFORE WITHOUT ANY SUSTENANCE, AND HAD IN THAT TIME PARTED WITH ITS OUTER COAT OR EXUVIAE, WHICH WAS FOUND AMONG THE GRAVEL. CAPTAIN HALL, A VERY UNDERSTANDING AND OBSERVANT PERSON, WHO HAD LIVED MANY YEARS IN VIRGINIA, VENTURED TO TAKE THE SNAKE OUT OF THE BOX, THOUGH THE POISON FROM ITS BITE IS ALMOST INSTANT DEATH; FOR, HE GAVE AN INSTANCE OF A PERSON BITTEN, WHO WAS FOUND DEAD AT THE RETURN OF A MESSENGER GOING TO THE NEXT HOUSE TO FETCH A REMEDY, THOUGH HE WAS NOT GONE ABOVE HALF AN HOUR. NAY, SO CERTAIN ARE THE MORTAL EFFECTS OF THIS POISON, THAT SOMETIMES THE WAITING TILL AN IRON CAN BE HEATED, IN ORDER TO BURN THE WOUND, IS SAID TO HAVE PROVED FATAL. THIS GENTLEMAN THEREFORE THOUGHT THE

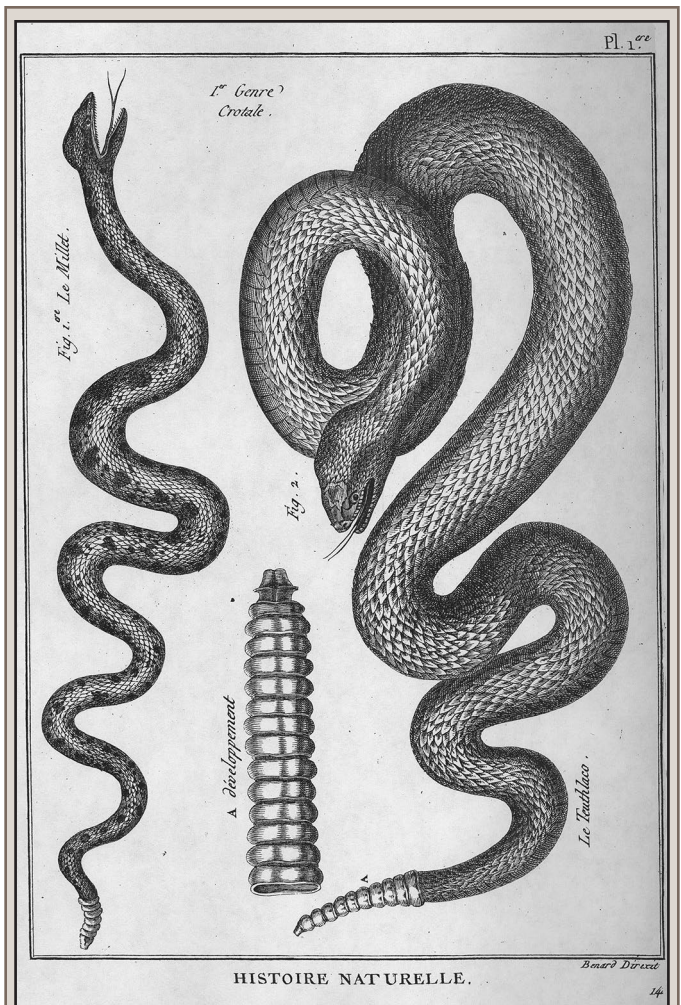


FIG. 8. Rattlesnakes from abbé (Pierre Joseph) Bonnatere's *Tableau encyclopédique et méthodique des trois règnes de la nature : dédié et présenté à M. Necker, ministre d'État, & directeur général des Finances. Erpétologie*. 1789.

SECUREST WAY WAS IMMEDIATELY TO CUT OUT THE PART WHERE THE WOUND WAS MADE; FOR HE HAD SEEN SEVERAL, WHO CARRIED THESE HOLLOW SCARS ABOUT THEM, AS MARKS OF THE NARROW ESCAPE THEY HAD HAD, AND NEVER FELT ANY INCONVENIENCE AFTERWARDS.”

—CONJECTURES ON THE CHARMING OR FASCINATING POWER ATTRIBUTED TO THE RATTLE-SNAKE, GROUNDED ON CREDIBLE ACCOUNTS, EXPERIMENTS AND OBSERVATIONS. SIR HANS SLOANE, BART. P.R.S. NO 433, P.321; PHILOSOPHICAL TRANSACTIONS. PP. 655–656.

“BUT LET US AGAIN RESUME THE SUBJECT OF THE RATTLE SNAKE; A WONDERFUL CREATURE, WHEN WE CONSIDER HIS FORM, NATURE AND DISPOSITION, IT IS CERTAIN THAT HE IS CAPABLE BY A PUNCTURE OR SCRATCH OF ONE OF HIS FANGS, NOT ONLY TO KILL THE LARGEST ANIMAL IN AMERICA, AND THAT IN A FEW MINUTES TIME, BUT TO TURN THE WHOLE BODY INTO CORRUPTION; BUT SUCH IS THE NATURE OF THIS DREADED REPTILE, THAT HE CANNOT RUN OR CREEP FASTER THAN A MAN OR CHILD CAN WALK, AND IS NEVER KNOWN TO STRIKE UNTIL HE IS FIRST ASSAULTED OR FEARS HIMSELF IN DANGER, AND EVEN THEN ALWAYS GIVES THE EARLIEST WARNING BY THE RATTLES AT THE EXTREMITY OF HIS TAIL. I HAVE IN THE COURSE OF MY TRAVELS IN THE SOUTHERN STATES (WHERE THEY ARE THE LARGEST, MOST NUMEROUS AND SUPPOSED TO BE THE MOST VENOMOUS [sic] AND VINDICTIVE) STEPT [sic] UNKNOWINGLY SO CLOSE AS TO ALMOST TOUCH ONE OF THEM WITH MY FEET, AND WHEN I PERCEIVED HIM HE WAS ALREADY DRAWN



FIG. 9. Cascabel (*Crotalus durissus*) from Georges-Louis Leclerc Buffon in *Buffon's Natural History Abridged*, 1791.

UP IN CIRCULAR COILS READY FOR A BLOW. BUT HOWEVER INCREDIBLE IT MAY APPEAR, THE GENEROUS, I MAY SAY MAGNANIMOUS CREATURE LAY AS STILL AND MOTIONLESS AS IF INANIMATE, HIS HEAD CROUCHED IN, HIS EYES ALMOST SHUT, I PRECIPITATELY WITHDREW, UNLESS WHEN I HAVE BEEN SO SHOCKED WITH SURPRISE AND HORROR AS TO BE IN A MANNER RIVETED TO THE SPOT, FOR A SHORT TIME NOT HAVING STRENGTH TO GO AWAY, WHEN HE OFTEN SLOWLY EXTENDS HIMSELF AND QUIETLY MOVES OFF IN A DIRECT LINE, UNLESS PURSUED WHEN HE ERECTS HIS TAIL AS FAR AS THE RATTLES EXTEND, AND GIVES THE WARNING ALARM BY INTERVALS, BUT IF YOU PURSUE AND OVERTAKE HIM WITH A SHEW [sic] OF ENMITY, HE INSTANTLY THROWS HIMSELF INTO THE SPIRAL COIL, HIS TAIL BY THE RAPIDITY OF ITS MOTION APPEARS LIKE A VAPOUR [sic], MAKING A QUICK TREMULOUS SOUND, HIS WHOLE BODY SWELLS THROUGH RAGE, CONTINUALLY RISING AND FALLING AS A BELLOWS; HIS BEAUTIFUL PARTICOLOURED SKIN BECOMES SPECKLED AND ROUGH BY DILATION, HIS HEAD AND NECK ARE FLATTENED, HIS CHEEKS SWOLLEN AND HIS LIPS CONSTRICTED, DISCOVERING HIS MORTAL FANGS; HIS EYES RED AS BURNING COALS, AND HIS BRANDISHING FORKED TONGUE OF THE COLOUR OF THE HOTTEST FLAME, CONTINUALLY MENACES DEATH AND DESTRUCTION, YET NEVER STRIKES UNLESS SURE OF HIS MARK."

—OBSERVATIONS ON REPTILES AND AMPHIBIANS BY WILLIAM BARTRAM (CHAP. X., TRAVELS, 1791)

"THE RATTLESNAKES (CROTALUS OF LINNAEUS) APPEARING TO ME THE MOST INTERESTING, AND OFFERING THE GREATEST NUMBER OF CURIOUS PHENOMENA (NOTWITHSTANDING THE DANGERS, TOO MUCH EXAGGERATED HOWEVER, TO WHICH THOSE WHO GIVE THEMSELVES UP TO SUCH INVESTIGATIONS ARE EXPOSED) WILL FORM THE PRINCIPAL OBJECTS OF THIS MEMOIR.

BEFORE I ENTER INTO THE DETAIL OF MY OBSERVATIONS, IT IS NECESSARY TO PRESENT AND DISCUSS SUCCINCTLY, WHAT HAS BEEN SAID AND WRITTEN ON THESE ANIMALS, AND TO EXAMINE WHAT WE KNOW CONCERNING THEM.

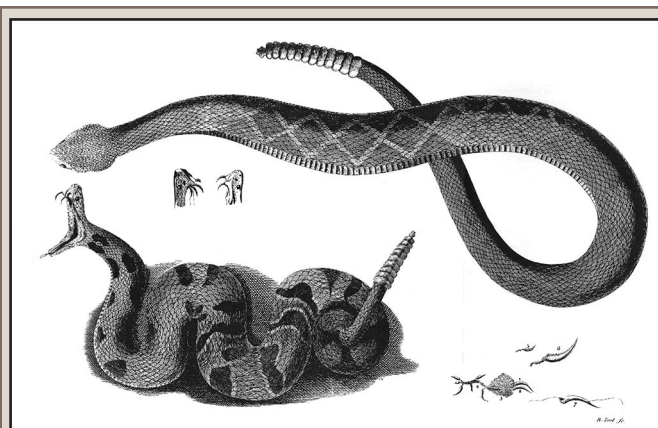


FIG. 10. Eastern Diamondback Rattlesnake (*Crotalus adamanteus*) from *Memoir on Amphibia* by Ambroise Marie-François Joseph de Palisot de Beavois, 1799.

THE MANNER IN WHICH THESE AMPHIBIA [REPTILES WERE PLACED IN AMPHIBIA AT THAT TIME] ATTACK THE ANIMALS DESTINED FOR THEIR FOOD IS ONE OF THOSE PROBLEMS IN NATURAL HISTORY WHICH ARE YET TO BE RESOLVED. THE MEANS THEY EMPLOY, AS WELL AS THE REAL CAUSES OF MANY SURPRISING EFFECTS, NOT YET WELL OR UNANIMOUSLY STATED, ARE UNKNOWN TO US. ACCORDING TO SOME, THE CROTALI AND SEVERAL OTHER SERPENTS HAVE THE FACULTY OF ENCHANTING AND ATTRACTING BIRDS, SQUIRRELS, RABBITS, FROGS, &c. (AVES SCIUROSQUE EX ARBORIBUS IN SAUCES REVOCANT. LINN. SYST. NAT.) ACCORDING TO OTHERS THEY INSPIRE THEM WITH TERROR, TO SUCH A DEGREE, THAT IF WE CAN PUT FAITH IN THE EFFECTS RELATED, WE SHOULD BE TEMPTED TO BELIEVE THAT THEY ARE FROM THAT MOMENT DEPRIVED OF THEIR SENSES, AND, AS IT WERE, ATTACKED WITH INSANITY. ACCORDING TO OTHERS, IN FINE, THESE ANIMALS ARE VIOLENTLY AFFECTED AND SUFFOCATED BY A VAPOUR, AND FETID EMANATION, WHICH THE REPTILE DIFFUSES UPON EVERYTHING AROUND IT.

IT IS SAID THAT WHEN THE SERPENT WISHES TO SEIZE A BIRD, A SQUIRREL, &c. HE REMAINS MOTIONLESS, HIS EYES CONSTANTLY FIXED UPON HIS PREY, AND THAT THEN THE UNHAPPY VICTIM, ACTED UPON BY A SUPERNATURAL POWER, LOSES ALL ITS FACULTIES, AND CANNOT EVEN HAVE RECOURSE TO FLIGHT: IT AGITATES ITSELF, THROWING OUT LAMENTABLE CRIES, GOES, RETURNS, ADVANCES, RETREATS, APPROACHES, RETIRES, COMES AND GOES AGAIN, TILL AT LAST EXHAUSTED BY FATIGUE, IT VOLUNTARILY DELIVERS ITSELF UP TO ITS ENEMY, WHO DELAYS NOT TO DEVOUR IT. SUCH ARE THE EFFECTS ATTRIBUTED TO ENCHANTMENT, TERROR, OR THE SUFFOCATING VAPOUR WHICH THOSE SERPENTS, IT IS SAID, HAVE THE POWER OF CASTING ROUND THEM, AND WHICH AFFECTS EVERY ANIMAL WHICH IS FOUND WITHIN ITS ATMOSPHERE. LET US EXAMINE THESE THREE PRETENDED CAUSES, AND COMPARE THEM WITH THEIR SUPPOSED EFFECTS.

—MEMOIR ON AMPHIBIA. SERPENTS. BY AMBROISE MARIE FRANCOIS JOSEPH PALISOT DE BEAUVOIS. PP. 362–363; READ, FEB. 1797.

"THE POWER OF FASCINATION GRATUITOUSLY ASCRIBED TO MOST SNAKES BY THEORETICAL NATURALISTS, HAS SO LONG RIVETTED [sic] THE ATTENTION OF ALL PERSONS INCLINED TO THINK ON THE SUBJECT, BUT WITHOUT THE MEANS OF JUDGING FOR THEMSELVES, THAT THE FOLLOWING FRUITS OF MANY YEARS' OBSERVATION, IN COUNTRIES WHERE SNAKES ABOUND, WILL NOT, I HOPE, THOUGH ADVERSE TO THE SUPPOSED POWER OF FASCINATING, WILL BE LOOKED UPON AS DESTITUTE OF INTEREST.

RATTLESNAKES IN PARTICULAR, APPEAR TO HAVE ACQUIRED THEIR CHIEF FAME FROM THIS SUPPOSED CHARM. I SHALL, THEREFORE, DRAW YOUR ATTENTION MORE DIRECTLY TO THE HABITS OF THAT SPECIES, AND BEGIN BY ENUMERATING THE MANY REAL AND EXTRAORDINARY FACULTIES BESTOWED UPON IT. THESE CONSIST IN SWIFTNES; IN POWERS OF EXTENSION AND



FIG. 11. Pygmy Rattlesnake (*Sistrurus miliarius*) from *Herrn de la Cépède's Naturgeschichte der Amphibien, oder der enerlegenden vierfussigen Thiere und der Schlangen* by La Cépède, Bechstein, and Buffon, 1800–1802 [volume 5, p. 106].

DIMINUTION OF ALMOST ALL THEIR PARTS; IN QUICKNESS OF SIGHT; IN BEING AMPHIBIOUS, IN POSSESSING THAT WONDERFUL AND EXTRAORDINARY BENEFIT OF TORPIDITY DURING WINTER; AND LONG CONTINUED ABSTINENCE AT OTHER PERIODS, WITHOUT, HOWEVER, IN THE MEAN TIME LOSING THE VENOMOUS FACULTY, THE PRINCIPAL MEANS OF THEIR DEFENSE. I SHALL PROCEED TO ELUCIDATE, BY WELL AUTHENTICATED EXAMPLES, ALL THOSE DIFFERENT FACULTIES."

—NOTES ON THE RATTLESNAKE (*CROTALUS HORRIDUS*); IN A LETTER ADDRESSED TO THOMAS STUART TRAILL, M.D. & C. BY JOHN JAMES AUDUBON, F.R.S.E.M.W.S. & C\*. COMMUNICATED BY THE AUTHOR.

\*READ BEFORE THE WERNERIAN NATURAL HISTORY SOCIETY, 24TH FEBRUARY 1827].

More than 100 Timber Rattlesnakes (*C. horridus*) survived a transoceanic journey from the New World and were kept in the Royal Menagerie at the Tower of London.



FIG. 12. Timber Rattlesnake (*Crotalus horridus*) preying upon Northern Mockingbirds (*Mimus polyglottus*) from *Birds of America* by John James Audubon, 1827–1830.

"IT WAS LONG BELIEVED, AND THE NOTION IS STILL POPULARLY CURRENT, THAT THEY POSSESSED THE POWER OF FASCINATING THEIR VICTIMS, WHICH WERE THOUGHT TO BE SO COMPLETELY UNDER THE INFLUENCE OF THEIR GLANCE AS TO PRECIPITATE THEMSELVES OF THEIR OWN ACCORD INTO THE OPEN THROAT OF THEIR ENEMY; BUT THE TRUTH APPEARS TO BE THAT THEY ACTUALLY INSPIRE SO GREAT A DEGREE OF TERROR THAT THE ANIMALS SELECTED FOR THEIR ATTACKS ARE COMMONLY RENDERED INCAPABLE OF OFFERING SUCH RESISTANCE AS MIGHT OTHERWISE BE IN THEIR POWER, OR EVEN OF ATTEMPTING TO ESCAPE FROM THEIR PURSUIT."

—E. T. BENNETT, 1829. *THE TOWER MENAGERIE*.

#### RATTLESNAKE PUBLICATIONS IN THE 20<sup>TH</sup> CENTURY

In what follows, I highlight the seminal publications on rattlesnakes by five herpetologists.

**Howard Kay Gloyd** (1902–1978) was an American herpetologist credited with describing several new species of reptiles, such as the Florida Cottonmouth, *Agkistrodon piscivorus conanti* (Fig. 1). He was honored by having named after him the following taxa: a genus of Asian pit vipers, *Gloydia*; two species of non-venomous snakes, the Eastern Fox Snake, *Pantherophis gloydii*, and the Dusty Hognose Snake, *Heterodon nasicus gloydii*; and two subspecies of Central American pitvipers, *Agkistrodon bilineatus howardgloydii* and *Crotalus intermedius gloydii*.

He was director of the Chicago Academy of Sciences from 1936 until 1958. In 1939, he became the vice president of the

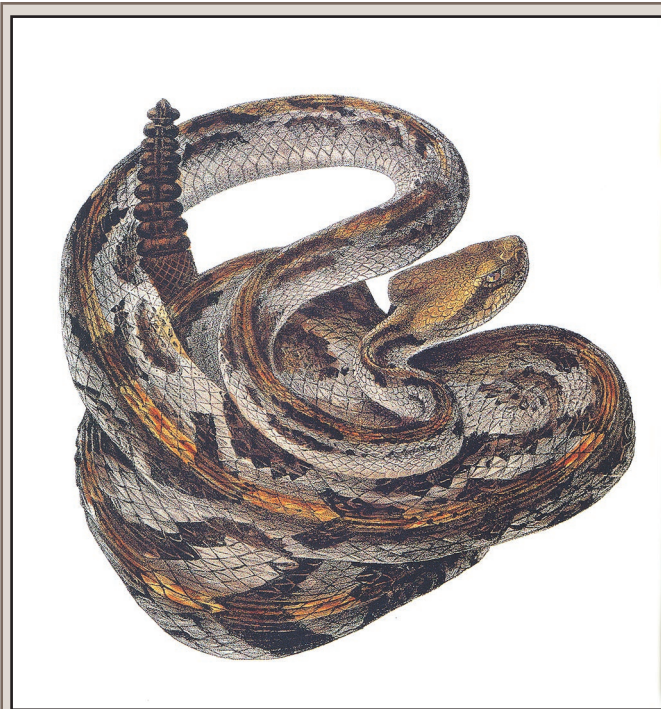


FIG. 13. John Edwards Holbrook published *North American Herpetology* beginning in 1836, and he included all amphibians and reptiles found east of the Mississippi River at that time. The Timber Rattlesnake (*Crotalus horridus*) is depicted here.

American Society of Ichthyologists and Herpetologists, and in 1940 he published his monograph, *The Rattlesnakes, Genera Sistrurus and Crotalus*. He organized numerous expeditions to Arizona to collect specimens for the Academy. In 1958 he moved to Arizona to become a lecturer and research associate in the zoology department of the University of Arizona in Tucson, until retirement in 1974.

When I was in high school (1953–1957) in a suburb outside Chicago, I often visited the Lincoln Park Zoo and nearby Chicago Academy of Sciences where I met Gloyd on several occasions. Later, when I was at the Dallas Zoo and his son was working in the city, he annually visited the zoo with his grandchild. Since our rattlesnake collection had many rare forms, he often said that he was seeing many as living examples for the first time. I was touched when he said that the Totonacan Rattlesnake (*Crotalus totonacus*), which he had described with Carl Kauffeld in 1940, was his first view of a living example of this snake. He said that his favorite was the Mexican Lance-headed Rattlesnake (*Crotalus polystictus*), a species so poorly known that when Klauber published his epic treatment of rattlesnakes in 1956 a photo of that species was not included.

**Laurence Monroe Klauber** (1883–1968) was president and chairman of San Diego Gas and Electric Company (1946–1954) (Fig. 2). At San Diego Zoo, Klauber was the first curator of reptiles in the 1920s, consulting curator beginning in 1931, and served on the Board of Trustees from 1943 to 1968. He kept a large collection of preserved rattlesnakes (35,000 specimens) in his basement where Charles Shaw and Paul Breese were paid to count scales and record meristic information. [Shaw went on to become Curator of Herpetology at the San Diego Zoo, and Breese eventually became Director at the Honolulu Zoo.] When Klauber began writing his two-volume rattlesnake book in 1946, he compiled an extraordinary amount of information concerning

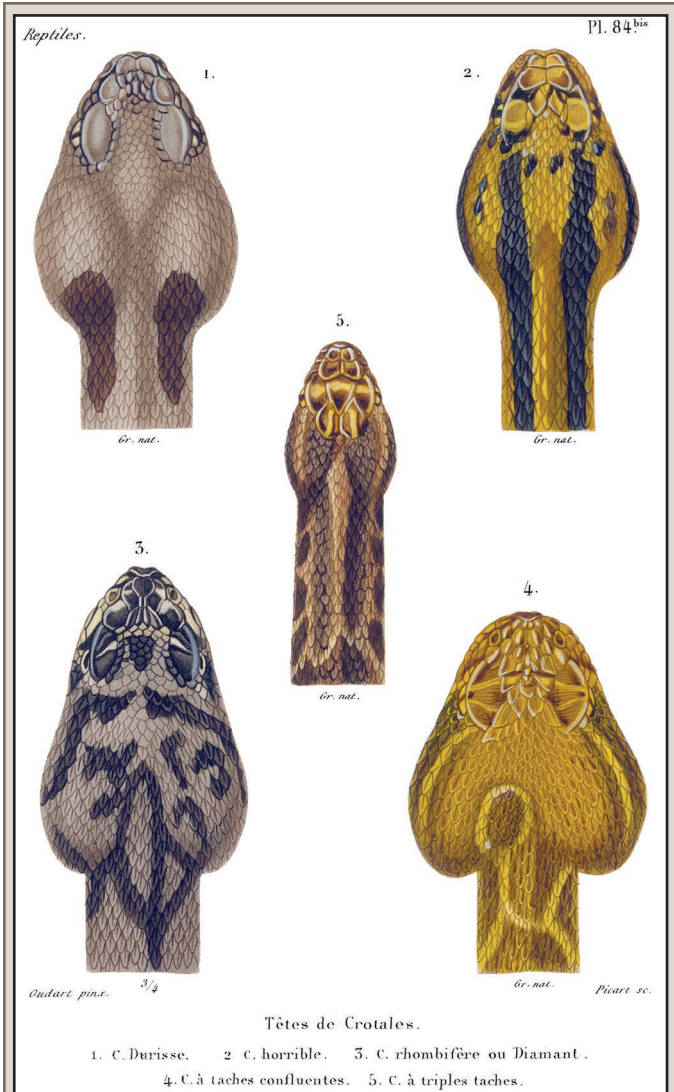


FIG. 14. Rattlesnake heads from Duméril, A. M. C., G. Bibron, and A. H. A. Duméril, *Erpétologie Générale ou Histoire Naturelle Complète des Reptiles*, 1839.

venom, snakebite, charming prey, feeding, folklore remedies, protective methods and devices, queer actions and attributes, and other topics that fill entire chapters in his seminal book, *Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind* (1956, revised 1972).

Upon Klauber's death, his rattlesnake collection and library were donated to the San Diego Natural History Museum. Years ago, I spent several days in the Klauber Herpetological Library looking at many notebooks, some with his handwriting, compiled for his books and his preserved collection. I also went to the Zoo to see some unusual herps kept in a series of small buildings named in honor of Klauber (depicted in Murphy 2007).

**Carl F. Kauffeld** (1911–1974), Curator at the Staten Island Zoo, was a pioneer in the captive management of rattlesnakes. As ideas, protocols and technologies improved for keeping reptiles in zoos, one of the most important persons contributing to our discipline was Kauffeld (Fig. 3). His observational skills were so acute that many of the husbandry practices in common use today were pioneered by him many years earlier. His publications covered a range of topics: feeding captive snakes, treatment of mouthrot in snakes, removal of abnormal snake eggs by

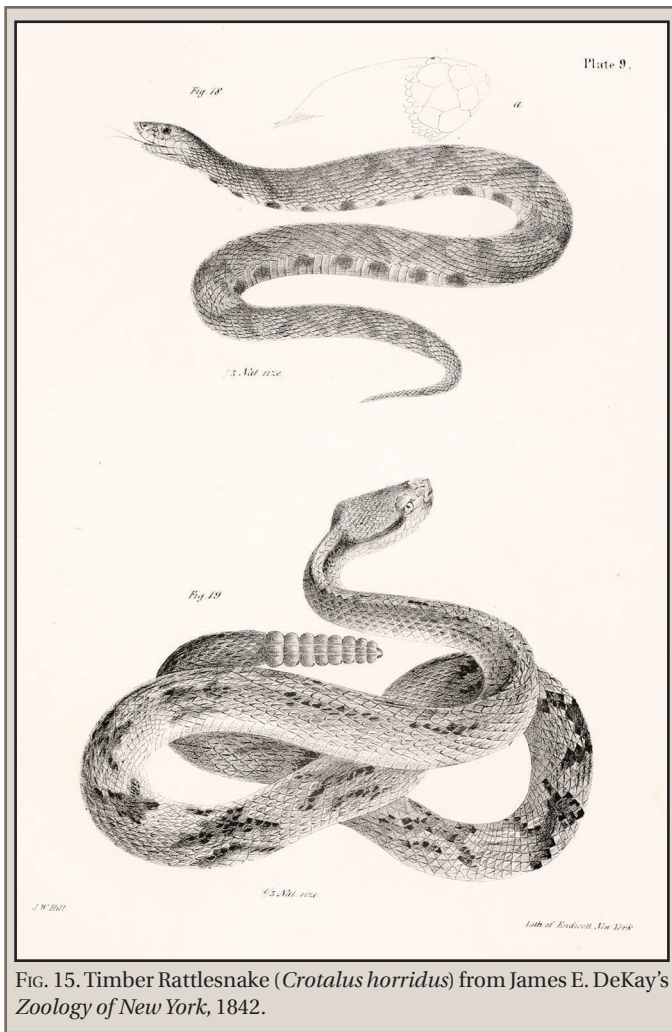


FIG. 15. Timber Rattlesnake (*Crotalus horridus*) from James E. DeKay's *Zoology of New York*, 1842.

sectioning, controlling mites and ticks with remarks on cage sanitation, growth and feeding of newborn Twin-spotted and Banded Rock rattlesnakes using feed lizards frozen in ice cube trays and thawed later, manipulation of odor as an aid in feeding captive snakes, the effect of altitude, ultraviolet light, and humidity on captive reptiles, shedding, and the importance of environmental factors such as temperature. For snakes, he stressed the need for security, maintaining them singly, and offering pre-killed food. In my experience, some snakes tend to thrive better in groups.

His inspirational writings of collecting adventures throughout the United States motivated scores of his readers to travel to his favorite sites such as Okeetee preserve in South Carolina, Ajo Road and Ramsey Canyon in Arizona, and Lake Okechobee and Payne's Prairie in Florida. These places were often overrun with collectors. In one instance in Okeetee, I saw a busload disembark like lemmings where he had provided specific localities. I went to all of the places listed above and collectors were everywhere at each place. At Payne's Prairie, scores of cars were slowly traveling back and forth on the road at night to collect specimens, as snake densities were incredible. Hundreds had been killed on the road by heavy traffic, mostly various watersnakes (genus *Nerodia*) and North Florida Swamp Snakes (*Liodytes* = *Seminatrix pygaea*.)

Kauffeld arrived at the zoo as Curator of Reptiles in 1936. The next year, he published a book with C. H. Curran called *Snakes and Their Ways*, which included information on rattlesnakes. He displayed all U.S. forms of rattlesnakes, as he believed that his

small zoo could not compete with the larger Bronx Zoo (Kauffeld 1965). With this approach, an impressive list of longevity records resulted, especially for snakes. He was named Zoo Director in 1963 and retired a decade later.

Many of Kauffeld's reflections were initially published in the quarterly zoo outlet "Animaland" and later incorporated into his two books: *Snakes and Snake Hunting* and *Snakes: The Keeper and the Kept*. See Carl E. Kauffeld memorial issue. *HERP* 18(1) 1984. [collection of Kauffeld articles from various publications]. See also Ken Kawata's book and article (2003, 2004). Biographies of Klauber and Kauffeld are covered by Card and Murphy (2000) and Murphy (2007). Adler (1989) covered Gloyd, Klauber, and Kauffeld in his remarkable series on deceased herpetologists. However, it was a bit unsettling when one of Adler's books arrived at my doorstep with the inscription, "To my friend and colleague James B. Murphy—In the hope that you do not end up in volume 3! Kraig Adler, July 2007." He is working on volume 4 and I am still here.

My two friends for over 50 years, **Jonathan A. Campbell** and **William W. Lamar**, published two impressive books that treated rattlesnakes in considerable detail: *The Venomous Reptiles of Latin America* (1989) and the more expansive *The Venomous Reptiles of the Western Hemisphere* (2004). Many of the color photos were taken at Dallas Zoo, including the spectacular pitviper on the dust jacket of the first volume. Their books have garnered rave reviews from the scientific community. When I planned to meet Jon for our bi-weekly oyster dinner, I went first to his lab where he was working hard on the rattlesnake accounts for the first book. I was amazed that he was not referring to any notes, but rather had memorized data sets.

Other publications of note include symposium or edited volumes, snakebite treatment, and single-taxon works: Ernst (1992), Campbell and Brodie (1992), Mattison (1996), Rubio (1998), Schuett et al. (2002), Hayes et al. (2008), Rubio (2010), Ernst and Ernst (2012), Rubio and Keyler (2013), Levin (2016), Schuett et al. (2016, 2017), Dreslik et al. (2017), and Means (2017).

#### RATTLESNAKE COLLECTION AT DALLAS ZOO (1966–1995)

In 1966, I arrived at the Dallas Zoo to work in the new Pierre A. Fontaine Reptile Building, named in honor of its director. To avoid potential conflict of interest issues, I donated my personal rattlesnake collection—about fifteen representatives—to the zoo, which formed the basis of a rapidly expanding pitviper collection. A short time thereafter, Barry Armstrong and Jon Campbell started traveling to mainland Mexico and northern Central America, eventually resulting in collecting most taxa of rattlesnakes except the strikingly beautiful Autlán Long-tailed Rattlesnake (*Crotalus lannomi*), known only at the time from a single DOR (dead-on-road) specimen. Many other species were brought back to Dallas alive and placed on loan to us. When they died, most were accessioned in the vertebrate collections at either University of Texas at Arlington or University of Kansas. These places were chosen because Campbell was hired at the former and had been a graduate student at the latter. See my gratitude to and thoughts about Barry and Jon in my paper (Murphy 2014). Two monographs covered these early days (Murphy and Armstrong 1978; Armstrong and Murphy 1979). To honor Barry, Campbell described a new rattlesnake from Jalisco, Mexico in 1979—Armstrong's Dusky Rattlesnake (*Crotalus triseriatus armstrongi*, now *C. armstrongi*). Campbell, not to be outdone by Barry, now has his own rattlesnake—Campbell's Rattlesnake



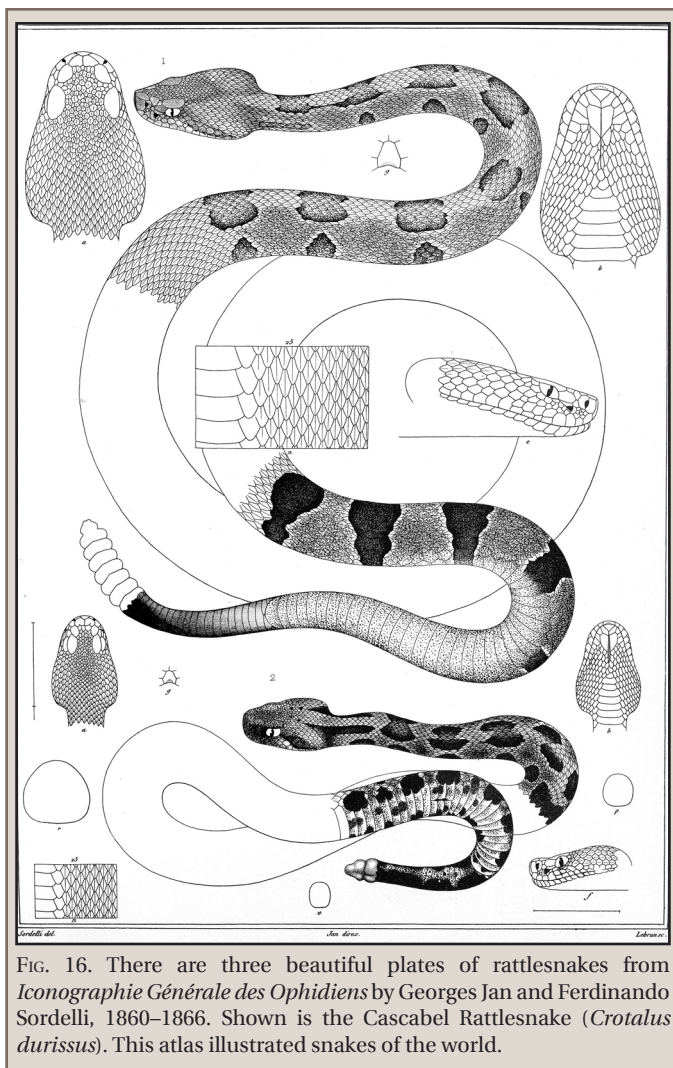


FIG. 16. There are three beautiful plates of rattlesnakes from *Iconographie Générale des Ophidiens* by Georges Jan and Ferdinando Sordelli, 1860–1866. Shown is the Cascabel Rattlesnake (*Crotalus durissus*). This atlas illustrated snakes of the world.

(*Crotalus campbelli*), described by Bryson et al. (2014). In the late 1960s, I planned to travel to Arizona to collect ridge-nosed rattlesnakes for the Zoo collection. I wrote a long letter to Carl Kauffeld asking advice about these pitvipers. I was sure that he would gladly help me although we had never met. To my dismay, he promptly answered that I was not worthy to either see them in the field or collect specimens for our zoo!

The staff started collaborating on behavioral studies, mostly with four academic herpetologists—Charles (Chuck) Carpenter from University of Oklahoma, his graduate student Jim Gillingham, and David Chiszar and Hobart Smith from University of Colorado. These associations were wonderful, productive, and resulted in numerous studies, much improved by collaboration (Murphy 1971; Murphy et al. 1975; Carpenter et al. 1976; Murphy 1976; Murphy and Shaddock 1976; Rappolt et al. 1978; Murphy and Mitchell 1979; Shaddock and Murphy 1979; Murphy 1981; Gillingham et al. 1983; Radcliffe and Murphy 1983; Murphy and Campbell 1987; Murphy et al. 1987; Murphy and Chiszar 1989; Barker 1992; Chiszar et al. 1993; McCrady et al. 1993; Young and Brown 1993; Hutchins et al. 2003; Murphy 2006; Petzold 2008). Our philosophy was to invite outside researchers, including students on the graduate level and competent photographers, to use the collection to add important data for a more complete understanding of the biology of amphibians and reptiles (see Garrett 2005 for description of the Dallas Zoo program). There

were only a few requirements. The first was to ensure that no animals were at risk from the protocol. The second was to send a written description of the project to several outside reviewers to assess quality and evaluate suitability. The third was to produce a manuscript of high quality and send it to outside reviewers before submission. The last and most important element was to work well with the staff since these staffers often assisted with a project (particularly photographing venomous snakes); in two cases, interns were demanding, arrogant, and uncooperative, and were told to go elsewhere. We sent a number of rattlesnakes and other pitvipers on permanent loan to Chiszar for use in studies at University of Colorado on feeding and other behaviors (Chiszar 1979; Chiszar et al. 1983; Chiszar and Smith 2005). See Murphy and Smith's obituary for Chiszar (2013) to gain an appreciation for his incredible productivity.

In the 1970s, we decided to breed two amelanotic Western Diamondback Rattlesnakes (*Crotalus atrox*) to follow genetics and inheritance (Murphy et al. 1987; McCrady et al. 1994). Captive breedings over six generations produced neonates that possessed anomalous polarity of scale orientation on various parts of the body. The extent and nature of the anomalies was much greater than anything previously described. A paper is in preparation detailing these phenomena.

In 1979, Paul Weldon and Gordon Burghardt published a paper concerning defensive responses of crotaline snakes to ophiophagous snakes. Weldon tested rattlesnakes and kingsnakes at our zoo by rubbing swabs on *Lampropeltis* skin and presenting these to rattlesnakes and other pitvipers. Many rattlesnakes responded to the swab with body bridging. Some researchers thought that rattlesnakes use the bridge to disorient a predatory snake. David Chiszar suggested that the behavior was actually used to wedge the rattlesnake's body in a rodent or other mammalian burrow, thus inhibiting predation.

We had the privilege at Dallas Zoo of working with 69 varieties of rattlesnakes over the years. As a rule, rattlesnakes adapt well to captivity. We were awash in baby snakes, both from gravid females collected in the wild or bred at the zoo. Rows of gallon jars each held a newborn until they began feeding. The two most difficult to feed were the Isla Angel Rattlesnake (*Crotalus angelensis*) and Cross-banded Mountain Rattlesnake (*C. transversus*). Many young were distributed to other zoos. In summary, zoos and aquariums are the perfect setting to study snakes, and rattlesnakes are perfect candidates for this purpose (Chiszar et al. 1993).

#### MORE ABOUT RATTLESNAKE ROUNDUPS

An excellent overview has been written by Clark E. Adams and John K. Thomas called *Texas Rattlesnake Roundups* (2008), showing the history, carnival atmosphere, and photos of the weird handlers. Fitzgerald and Painter (2000) noted that, "Rattlesnakes are commercially exploited to supply an international trade in skins, meat, gall bladders, and curios. Five species are used in 8 states: Western Diamondback Rattlesnakes (*Crotalus atrox*) in Texas, Oklahoma, and New Mexico; Eastern Diamondback Rattlesnakes (*C. adamanteus*) in Alabama, Florida, and Georgia; Prairie Rattlesnakes (*C. viridis*) in Kansas, Texas, Oklahoma, and New Mexico; and Timber Rattlesnakes (*C. horridus*) in Pennsylvania, Georgia, Alabama, and Florida. Blacktail rattlesnakes (*C. molossus*) occasionally appear in the trade in New Mexico and Texas. The trade is linked to rattlesnake roundups, which are economically important to local communities. We estimated that 15% of the Western Diamondback and Eastern

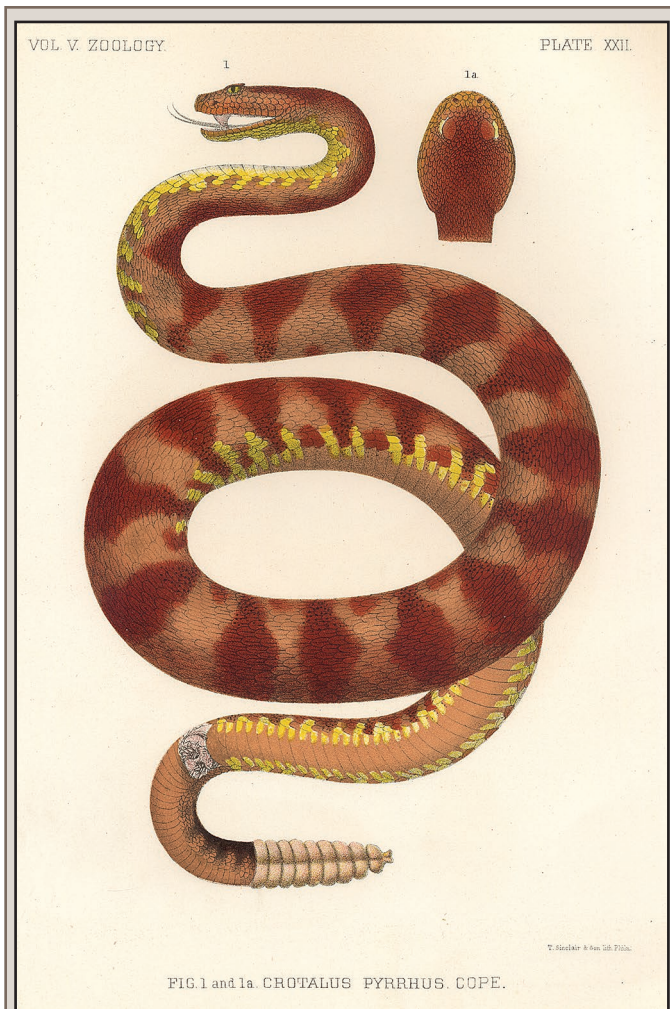


FIG. 17. Illustration of variable Southwestern Speckled Rattlesnake (*Crotalus pyrrhus*) in *Synopsis of the Reptiles and Batrachians of Arizona; with critical and field notes, and an extensive synonymy* by Elliott Coues, 1875.

Diamondback rattlesnakes entering the trade originate from roundups. In the 1990s, probably <125,000 rattlesnakes of all species entered the trade yearly.”

Arena et al. (1995) addressed the animal welfare issue, “Little attention has been given to the acts of brutality and cruelty associated with rattlesnake round-ups. From the point of initial capture procedures to their death, the rattlesnakes’ welfare is a matter of indifference and disregard. Where gassing and excavation prove unsuccessful, some form of grappling hook is employed to pull snakes from their dens. This frequently results in physical injury; in some cases the skin and underlying tissues are torn and in many cases the spinal cord and ribs are damaged as the animals are lifted without adequate support for the weight of their bodies.” See also Warrick (1990) and Warrick et al. (1991).

Cleveland Amory was an American author, reporter, commentator, and animal rights activist. He joined the board of directors of the Humane Society of the United States (HSUS) in 1962, remaining there until 1970. He also served as president of the New England Anti-Vivisection Society (NEAVS) from 1987 until his death in 1998. In 1967, Amory founded the Fund for Animals, focusing on protecting animals from hunters and creating animal sanctuaries. In 2005, HSUS formed a corporate combination with the Fund for Animals.

In 1970, Amory came to Dallas to solicit donations for his organizations and see our zoo. I asked him why his animal rights organizations and state wildlife departments were not helping to stop roundups. He said that nobody really cared about snakes, particularly rattlesnakes, and he had no interest, as well. I was truly amazed when I realized that in his view, reptiles, especially snakes, were not worthy of protection because he assumed they could not experience pain. He also said that ectotherms should be ignored, but domestic mammals (horses, cows, rabbits, hamsters, dogs, cats, and so on) and caged birds (love birds, canaries, cockatiels, parakeets, Java rice birds, finches, and others available in pet shops) deserved protection by animal rights organizations. I tried to change his mind but my efforts were futile.

In response to overall indifference by humans, we created a graphic exhibit at Dallas Zoo using photographs by Dave Barker of snakes being gassed from dens, dumped in pits, molested by handlers, beheaded by children, and prepared as curios. The title was “Diamondbacks Can’t Scream,” referring to the fact that snakes do not vocalize pain. We were prepared for public outrage because the images were so unsettling, but surprisingly, the overwhelming response was that people appeared to be appalled by the practice and felt that it was important to treat snakes humanely. Unfortunately, these ghastly roundups still exist.

Murphy and Chiszar (1989) recommended the installation in a zoo of a “Fear Room,” conceived as follows, “Consultation with psychiatrists as well as architects would be an important preliminary in designing a facility which is non-threatening to the visitor; guidance from experts on what colors are pleasing, what shapes and textures are soothing, what background music is relaxing could make a valuable contribution. We envisioned a circular structure with eight separate rooms around its perimeter. In each room, a myth or question about snakes is addressed: can snakes ‘outrun’ humans and how fast can they move; are they carriers of disease; do they hypnotize prey; where do they live; how dangerous are they to humans; can snakes feel pain; should snakes be killed and what are the consequences of killing them; why should they be protected. Each of these topics would be covered by using appropriate video presentations, interactive displays, computers or current audio-visual technology. The visitor who has viewed all eight presentations could be given a choice of options, either to leave the building or to meet an employee who is holding a live snake and is offering the opportunity to touch the reptile and ask questions.” This approach has been incorporated in the remodeled reptile building at Staten Island Zoo, including a recreation of Carl Kauffeld’s office (Eser and Kawata 2010).

How can zoo outreach programs be improved to spread the word about snakes to a broader audience and encourage the public to value snakes? Burghardt et al. (2009) suggested different approaches such as the Internet, television, traveling exhibits, temporary exhibits, unusual venues such as shopping malls, casinos, libraries, and schools. Several decades ago, we used living snakes, artwork and artifacts depicting snakes, interactive modules, and hourly lectures describing snake biology and conservation, for a temporary exhibit in the Dallas public library. It generated the highest attendance rate of any exhibit ever held in that setting. Zoo Atlanta, Dallas Zoo, and National Zoo developed a successful interactive exhibit, as described by Marcellini and Murphy (1998).

It is apparent that an appreciation for snakes can be encouraged and reinforced in a zoo or aquarium environment. The

Association of Zoos & Aquariums (AZA) shared the opinion of its members in March 1999—*The AZA condemns the cruel and ecologically destructive practice of rattlesnake roundups and encourages its member institutions to actively oppose such activity through public information and the support of relevant legislation*. A far more proactive approach is needed by zoo workers, as it is clear that lawmakers are disinterested in protecting venomous snakes by using legislative tools. **I suggest here that all AZA institutions put together a display similar to that produced by Dallas Zoo, stressing that these dreadful roundups should no longer be tolerated, and using images—the more unsettling, graphic and disturbing the better—to penetrate political indifference and ophiophobia.** Can these approaches appreciably change the overall negative view of snakes held by humans quickly enough to make a difference for their protection and long-term survival? Sadly, I think not, but it is worth a try. The excellent field and captive program established by Alan Kardon at San Antonio Zoo, with emphasis on Mexican pitvipers, is a worthy example but saving these taxa is an uphill struggle. In 2013, Kardon showed aerial photographs of the extensive habitat changes due to human activities throughout Mexico; the images were staggering and sobering. Virtually all of the high-elevation ecosystems are at risk, particularly at places where montane rattlesnakes are found.

*Acknowledgments.*—This contribution is dedicated to William S. Brown, William H. (Marty) Martin, Howard K. Reinert, and Robert T. Zappalorti, who have spent their entire professional lives studying the ecology and natural history of the Timber Rattlesnake in the field and trying to conserve that species for future generations.

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