THE THERAPEUTIC GAZETTE
INCORPORATING MEDICINE AND THE MEDICAL AGE

A MONTHLY JOURNAL OF Practical Therapeutics

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ORIGINAL COMMUNICATIONS.

CONCERNING THE TREATMENT OF VARIOUS FORMS OF OCULAR SYphilis
WITH SALvarsan—A CLINICAL LECTURE DELIVERED IN THE
HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA.

BY G. E. M. SCHWEINITZ, M.D.,
Professor of Ophthalmology.

The happy results of the treatment of constitutional syphilis with salvarsan, ordinarily known as “606,” are well known to you, but it is proper that you should witness the effects of this remedy on syphilitic lesions of the eye, and therefore I shall devote a portion of this hour to a consideration of this agent under these circumstances. While Dr. Laird is preparing his fluids (and he will presently give one of the patients an intravenous injection of salvarsan) I shall call your attention to the clinical history of the patients here presented.

Case 1.—Bilateral parenchymatous keratitis of syphilitic origin; result of salvarsan treatment. The case history of this patient, a man aged thirty-two, is as follows: The patient’s father died at the age of fifty years as the result of a hemorrhage produced by coughing. For two years prior to his death he had been in poor health. The patient’s mother, aged seventy-three, is still living. Ten years ago she broke her arm, and eight months later gangrene set in and the arm was amputated. One year later gangrene developed in one foot, and this member was also amputated. One year ago gangrene appeared in the other foot, and again amputation was required. The patient had eleven brothers, but only two are living, and these are in good health—one, however, is slightly deaf. All those who died perished before they were seven years of age. One sister is living and in good health. The patient is married, and his wife, ordinarily in good health, has been ill during the present spring with rheumatism. He has four children; all are living and in good health. His wife has not had any miscarriages.

The patient’s own health has been singularly good; in point of fact, he never has had any serious illness. He denies syphilis, but acknowledged urethritis twelve or thirteen years ago. About one and one-half years ago the right cornea was injured, and there is now a curved scar extending from the inner end of the right eyebrow along the side of the nose 1½ inches in length. During July of the present year a hot cinder flew into the left eye, and subsequently he thinks he “caught cold,” as he expresses it. Prior to that time this eye had been weak, and he reports that an ocular examination which he underwent indicated that his vision, even with a glass, was only one-half of normal. Since the cinder accident the eye has gradually become more inflamed, but he has suffered little pain, and within the past two weeks the vision of the other or right eye has grown defective, and the eye, to use his own expression, has become quite misty. When he reported for examination he was then examined by my associate, Dr. Thomas B. Holloway.

Vision of the right eye was 5/30; there was slight ciliary injection and a large quadrant of the cornea was steamy and hazy, and through it radiated a number of lines of infiltration which probably repre-
A REVIEW OF THE DANGEROUSLY POISONOUS SNAKES OF THE UNITED STATES.

BY HENRY TUCKER, M.D.,

Curator of the Academy of Natural Sciences of Philadelphia; Fellow of the College of Physicians, etc.

The dangerously poisonous snakes of the United States are representatives of two families, namely:

First, the Elapidae.
Second, the Viperidae.

The subfamily, Elapinae, have permanently erect perforated fangs in the fore part of the upper jaw. These fangs have a well-marked groove on the anterior surface, and excepting the reserve fangs are not followed by other maxillary teeth (Plate II, Fig. 1). The head plates are normal, two nasals, no loreal; scales smooth; subcaudals in two rows; pupil a vertical oval; body cylindrical; head not distinct. Two well-defined species are found in the United States.

The Eastern variety, *Elaps fulvius*, Linn (Plate I, Fig. A), coral or harlequin snake, rarely reaches a length of three feet. The following description is of a specimen in my own collection: Head small, not distinct, snout bluntly rounded, eyes beady; scales smooth, brilliantly colored with vermilion, yellow, and black; the nose and anterior part of the head to the posterior end of the frontal plate, including the orbit, is black; a yellow ring covers the parietal from the posterior part of the orbit, to the angle of the mouth, followed by a black of eight scales width succeeded by narrow yellow of two scales, followed by red of seven scales. The body colors consist of

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### Experiment 5.—Lactating Goat.

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3.00 20 10 grains glucose by vein.

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### Experiment 7.—Goat.

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### Experiment 9.—Lactating Goat.

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3.15 8 1/2 Cc. infundibulin.

### Experiment 10.—Lactating Goat.

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black and red rings separated by narrow yellow; the red spaces on the body are freckled with black; the tail is alternately black and yellow; the rings are complete, but beneath the colors are dull. There are several harmless snakes that mimic the poisonous coral, namely (Plate I): The scarlet snake, *Cemephora coccinea* (Fig. C); the scarlet king snake, *Ophibolus dolius coccineus* (Fig. E); the Southern milk snake, *Ophibolus dolius clericus* (Fig. D); the Arizona ring snake, *Ophibolus zonatus* (Fig. F); Le Conte’s snake, *Rhinochilus lecontei* (Fig. G).

All these species have much the same color scheme as the harlequin, either in half or complete rings, but the arrangement of black bordered by yellow is never found in the harmless varieties. The coral snakes belong to a subfamily which includes the most deadly reptiles of the Old World, as the cobras and their allies of Asia, Africa, and the Malay Archipelago, and the many Australian representatives—the black, the brown, the tiger, and the death adder—and as their poison is similar, they must be ranked as reptiles distinctly dangerous to man. On account of their nocturnal and burrowing habits, sluggish disposition, and their comparatively short fangs, accidents are rare, and they do not receive the respect due them.

The Eastern variety ranges from South Carolina south-westward to Mexico. It is of burrowing habits, frequently found in decaying vegetation and under the bark of fallen trees; the food consists of lizards and smaller snakes.

The Western representative is the Sonoran coral snake (Plate I, Fig. B), *Elaps euryanthus*, Kennicott. It is probably of similar habits, but differs somewhat in the arrangement of its colors; the black of the muzzle extending back over the parietals is followed by a yellow ring, then by a broad red band. The yellow rings on the body are broader than in fulvius, and the red spaces are not mottled with black. Distribution—Central and southern Arizona and northern Mexico.

The last and by far the most important family to be considered are the Viperidae, subfamily Crotalinae, commonly and correctly known as the pit vipers, a most fortunate title, as it indicates their relation to the true vipers and points out a remarkable anatomical peculiarity, which at once distinguishes them from all other reptiles; the serpents can be placed in one of the following genera:

1. Without rattle—Ancistrodon
   - *Ancistrodon*—Top of head with large plates.
2. With rattle
   - *Piscivorus*—Top of head with scales.
   - *Crotalus*—Top of head with scales.

The pit is a deep hole situated between the nostril and the eye, but on a lower plane. It extends well into the maxill bone, is lined with epithelium, and connected with the brain by a thick nerve. The external layer of the lining of the pit is continuous with the skin of the head, but entering the cavity changes to thin, finely nucleated epithelium. Beneath this is a layer of fibrous connective tissue in which the terminal filaments of the nerve end in groups of granular substance containing round pale nuclei. This arrangement suggests a true sense organ, and as the function of the pit cannot be explained, it may be, as suggested, the seat of a sixth sense unknown to man. The pit is of great practical value, as it at once enables us to identify a dangerously poisonous snake.

The poison apparatus of the Crotalidae consists of a large pair of perforated fangs immovably fixed in the anterior portion of the upper jaw. The maxillary bone through its articulation with the lacrimal in front and above and the external pterygoid bone behind and below is freely movable and permits the fangs, when not in use, to be folded back against the roof of the mouth (Plate II, Fig. 3). The mechanism of erection of the fang is briefly as follows:
The sphenopterygoid muscle, which has its origin along the median ridge of the bone of the skull, runs backward and is inserted in the posterior end of the external pterygoid bone, hence when this muscle contr
the bone is drawn forward and pushes against the lower end of the maxilla. As the upper end of the maxilla is held by its articulation with the lacrimal, the tip of the fang must be directed downward and forward. The retractor muscle is the external pterygoid, which arises from the joint between the quadrate bone and the lower jaw. The fibers run forward and are inserted on the outside of the maxilla below its articulation with the external pterygoid, so when this muscle contracts the maxillary bone is drawn back and the point of the fang moves upward and backward (Plate III, Fig. 1).

The fang proper closely resembles an ordinary hypodermic needle (Plate III, Fig. 2); it consists of a sharply pointed curved tooth. The poison canal is situated within the convex side, gaining entrance by a slit-like opening near the base and has its exit by a narrow slit-like opening near the tip. The probable reason for this is to prevent plugging when the fang is embedded, and so not interfere with the flow of venom. As previously stated, the fang is fixed solidly in the jaw; posteriorly the bone is hollowed to hold the tooth sac. In the alveolar process beneath the mucous membrane lie the reserve fangs, each posterior one being smaller and less developed than the one in front; as many as eight to ten pairs of more or less well-developed fangs may exist. When the active fang is normally shed or accidentally lost, its place is taken in the course of a few days by the first reserve. The functional fang at rest is covered by a loosely applied membrane known as the vagina dentis. This is rolled back when the fang is extended.

The venom gland is evolved from the yellow portion of the salivary gland. It is of an almond shape with the point toward the front; is situated below and behind the eye and is connected with the fang by a narrow duct. The duct runs forward; beneath the eye it turns abruptly upward, from which point it follows the posterior wall of the pit and finally passes over the rounded front edge of the maxillary bone; at the base of which it meets but does not enter the upper opening of the canal of the fang.

The gland proper consists of a cavity into which open the ducts of the true poison-secreting glands; it is surrounded and supported by a double layer of fibrous tissue, which is continued posteriorly as a ligament to be inserted on the articulation of the jaw. A short band of tissue attaches it firmly to the skull, while a third one below is attached to the external pterygoid muscle (Plate IV).

The muscles brought into play in the emptying of the gland are the three temporals. The middle temporal arises from the posterior half of the parietal bone, runs down and forward, to be inserted into the lower jaw; the posterior temporal arises from the quadrate bone and is inserted on the inner side of the entire length of the angular bone of the lower jaw.

The anterior temporal, the true muscle of expulsion, arises from the upper posterior portion of the tendinous capsule of the gland, runs backward under the ribbon-like ligament, winds round the joint, and is inserted broadly upon the lower jaw; so it may be seen that the middle and posterior muscles are principally used to close the mouth, while the function of the anterior is to empty the sac. This makes the emission of the venom a voluntary one on the part of the reptile. Dr. Mitchell, to whose work I have so largely referred in the above description, has proved a further safeguard exists. Anterior to the sudden upward turn he has demonstrated a sphincter muscle surrounding the duct.

At the time of the blow the snake is either symmetrically or partially coiled, the neck and forward portion of the body is thrown into a sigmoid position, the head is elevated and drawn slightly back. At the actual time of striking the mouth is widely opened and the fangs thrust forward, but this motion is so rapid as to be hardly discernible and impossible to describe. As the neck and forward portion of the body alone are used in this motion a snake can never strike a greater distance than one-half its length, and in fact cannot strike accurately.
a greater distance than one-quarter, or at most one-third. The quantity of venom ejected varies largely, depending on the size, previous activity, and variety of the snake. It may be said to vary between 2 and 30 minims, though some authorities claim a much larger amount.

Taking this group up as individuals, we will first consider the copperhead, *Acanthophis contortrix*, Linn (Plate V). I will describe from a specimen in my own collection. Head scaleation normal; loreal present; upper labials eight, separated from the eye by four rows of suboculars; dorsal scales carinated in 23 rows; subcaudals undivided. Color, grayish-brown with rich chestnut cross-bands of inverted "Y" shape having darker borders, many alternating on the back. The top of the head is a brighter brown with a distinct coppery tinge, the lips and cheeks are creamy yellow, the line of difference extending from above the nostril and eye to above the angle of the mouth. There are large reddish-brown blotches on the sides and edge of ventrals. Abdomen, dull yellowish; tongue, forks white, base pink; form moderately slender, head distinct. Juvenile markings similar, except tail, the last half of which is greenish-yellow.

Raymond L. Ditmars, whose books I have quoted so freely, suggests that the young copperhead employs its yellow tail to attract frogs, relying on the protective coloration of the body and the similarity of the rapidly wriggled tail to a yellow grub or maggot. This theory seems quite reasonable.

Range—Massachusetts south to Florida line; west to include Texas; in dry, wooded, rocky districts.

The water-moccasin, or cotton-mouth, *Acrisius piscivorus*, Lacépède (Plate VI), is described from a specimen in my own collection. Form stout, head broad and flat on top, no loreal, nasal divided, lower wall of orbit formed by third upper labial, a pair of small plates behind parietals, preoculars two, upper long, extending to postnasal, upper labials large, eight in number, lower ten. Twenty-five rows of heavily carinated scales, subcaudals double in last half. Color, dark greenish-brown with indistinct darker markings, head black, an indistinct brown streak above by yellow from behind the eye above by yellow from behind the eye angle of the mouth above the labials; and chin yellow, with three dark vertical bars on the fourth, sixth, and seventh plates; rest of the head dark-brown; of mouth white; abdomen yellow, brownish blotches. The young are red-brown, with broad dark bands edged white. End of tail, greenish-yellow.

Distribution—same as *Elaps fulvus*, found in the neighborhood of water; prefers low coastal regions with slow streams.

The rattlesnakes, Sistrurus and Crotalus can be immediately told by the unique development on the end of the tail, which is only found in reptiles of this group.

The rattle is a series of thin, horny rings consisting of two or three swellings and constrictions, the free edge being turned to fit loosely into the groove on the preceding segment. The function is unknown, the following theories have been advanced. One, not tenable, is that it is a provision for arrangement to prevent injury to animals and man. Another, to attract birds, by sound mimicking that made by certain insects. The most plausible explanation is that it is used as a call during the mating season.

As a matter of fact, nearly all harmless snakes rapidly vibrate the tail when cited; if this occurs among dry leaves, the sound is startlingly like the whir of a rattle.

The perfect condition of the rattle of freshly captured specimens strongly suggests that it is seldom used by the snake in its natural state; the number of segments is an indication of the age of the reptile, depending on nutrition and the number of times the skin has been shed. Twelve or fourteen rings would represent a rattle of large size in the Academy collection has two and a half, but on close inspection appears made of two and probably three rings snapped one upon the other. It has been calculated that the rattle in action is vibrated about 100 times per minute. The to
Diagram to show the two poisonous Elaps, A and B, and some of the harmless mimics, C, D, E, F, G.

*Therapeutic Gazette. May 15, 1912.*
Fig. 1.—Skull of *Elaps fulvius*. Showing permanently erect perforated fang, not followed by other teeth in upper jaw.

Fig. 2.—Skull of *Python variegata*, a typical harmless snake. Showing all teeth solid, not grooved or perforated.

Fig. 3.—Skull of rattlesnake. Showing large curved fang immovably fixed in the shortened triangular upper jaw and, except the reserve fangs (not drawn), not followed by other maxillary teeth.
Fig. 1.—Diagram to show the elevation of the fang. When the sphenopterygoid contracts it pulls from A to B, thereby pulling forward the external pterygoid bone, thus pushing the lower end of the maxilla forward, the upper end of the maxilla being held by its articulation with the lachrymal; thereby the point of the fang points outward and upward. The ecto-pterigoid, pulling backward from B to A on the maxilla, folds the fang against the roof of the mouth.

Fig. 2.—Diagram to show poison fang of pit vipers. A, opening for entrance of poison duct; A-B, poison canal; B, exit opening of canal near tip of fang; C, pulp cavity; D, dentine.

THERAPEUTIC GAZETTE. MAY 15, 1912.
PLATE IV

A, anterior temporal muscle; B, posterior temporal muscle; C, middle temporal muscle; D, digastricus muscle; E, venom gland; F, venom duct. Diagram to show muscles: A, anterior temporal, the muscle used in emptying the gland; B, C, D, muscles used in opening and shutting the mouth.

THERAPEUTIC GAZETTE, MAY 15, 191
Copperhead—Ancistrodon contortrix, "Linn." Diagram to show color scheme and head scaleation of the copperhead.
Diagnosis: X, loreal scale, not present in the water-moccasin.

THERAPEUTIC GAZETTE. MAY 15, 1912.
Water-moccasin—*Acestrodon piscivorus*. "Lacépède." Diagram to show color scheme and head scaleation of the water-moccasin. Diagnosis: 1B, red scales, occipitals; 1C, upper red, preocular, in contact with post-nasal. lower red, third labial forming the floor of orbit. Arrangement not found in the copperhead.

Therapeutic Gazette. May 15, 1912.
Genus Sistrurus, "Garman." Pigmy rattlesnakes. May be distinguished from other rattlesnakes by their smaller size, diminutive rattle, and having the scales on the top of the head arranged like the harmless snakes. Diagram to show color scheme and head scaleation.

Fig. 1—Sistrurus Catenatus, "Rafinesque." Massasauga. Diagnosis: The massasauga. Light line from nostril to angle of mouth. Dark spot covers center of parietal suture. Preocular in contact with postnasal.

Fig. 2—Sistrurus miliarius, "Linnaeus." Pigmy rattlesnake. Diagnosis: The pigmy rattlesnake. Light line from eye to angle of the mouth. Light band the entire length of parietal suture. Preocular separated from postnasal by a loreal.
Diagram to show color scheme and markings.

**Fig. 1.** *Crotalus adamanteus,* "Beauvais." The Southern diamondback. Diagnosis: Vertical white line in front of nostril; ground color dark; diamond dorsal marking in contact; two loreal scales.

**Fig. 2.** *Crotalus atrox,* "Baird and Girard." The Western diamondback. Diagnosis: White line absent in front of nostril; light color; truncated diamonds; one loreal scale.
Fig. 1.—*Crotalus molossus,* "Baird and Girard." Dog-faced or blacktailed rattlesnake. Diagnosis: Muzzle broad, nose scales larger than other species; snout and tail black. Each scale a single color; the corners of most of the dorsal blotches are open and extend to edge of ventrals.

Fig. 2.—*Crotalus horridus,* "Linn." Banded or timber rattlesnake. Diagnosis: color, roll sulphur or velvety black; a series of chevron-like dorsal markings. Light line from supraocular to angle of mouth, back of which is a dark spot.

*THERAPEUTIC GAZETTE, MAY 15, 1912.*
Diagram to show color scheme and head markings.

Fig. 1. — *Crotalus confluentus.* "Say." Prairie rattlesnake. Diagnosis: A dark oblique band begins at anterior corn of eye, dipping sharply to angle of mouth.

Fig. 2. — *Crotalus Oregonus.* "Holbrook." Western rattlesnake. Diagnosis: The dark oblique band begins posterior to center of orbit and runs directly to angle of the mouth.
Fig. 1.—Crotalus Lepidus, "Kennicott." Smooth or Green rattlesnake. Diagram to show color scheme and head scaleation. Diagnosis: Color greenish; scales on head large; body scales smoother than other members of this genus; dorsal markings serrated; double or single blotch on nape of neck.

Fig. 2.—Crotalus Willardi, "Meek." Willard's rattlesnake. Diagram to show color scheme and markings. Diagnosis: Color chocolate-brown. A white median rostral line to lower jaw, expanding between two dark bars.

THERAPEUTIC GAZETTE, MAY 15, 1912.
PLATE XII

Fig. 1

*Fig. 1.* *Crotalus Cerastes,* "Hallowell." Horned rattlesnake or sidewinder. Diagram to show head scaleation. Diagnosis: Supraocular elongated into a horn-like process directed upward and turned slightly inward on itself.

Fig. 2

*Fig. 2.* *Crotalus Mitchellii,* "Cope." White rattlesnake. Diagram to show head scaleation. Diagnosis: Color pale, dorsal markings indistinct. Rostral plate separated from anterior nasal by small scales.

*Therapeutic Gazette, May 15, 1912.*
of all snakes is a tactile organ, and in no way connected with transference of venom.

Genus *Sistrurus*, Garman (Plate VII), misnamed the ground rattlesnake, may be distinguished from Crotalus by its smaller size, diminutive rattle, and by the arrangement of the scales on the top of the head like that of the harmless snakes. Two species are recognized:

1. *Miliarius*: Preocular separated from postnasal by a loreal. Light line from eye to angle of the mouth. Light band the entire length of the parietal suture.

2. *Catenatus*: Preocular in contact with postnasal. Light line from nostril to angle of the mouth. Dark spot covers the parietal suture. Two species are recognized:

*Sistrurus miliarius*, Linn (Plate VII, Fig. 2), the pigmy rattlesnake, I will describe from No. 7217, Academy collection: Ground color ashy, minutely peppered with black, 38 irregular purplish-black dorsal spots narrowly margined with white, the interspaces of ground color narrower than the spots, the blotches posteriorly tending to form rings. A distinct reddish vertebral line from the neck extends backward in the interspaces, but not involving the spots; three lateral rows of subquadrate alternating blotches, the upper row smaller and less distinct than the two lower; ventrals yellow, marbled with black. A narrow light line extends from lowest part of the orbit to angle of mouth; above this a broader brown stripe margined above with light; a faint light mark crosses the forepart of the supraoculars; from this are two parallel wavy dark bands running back to the first dorsal blotch. Loreal present; scales in 23 rows; tail proportionately long, rattle diminutive. Distribution—North Carolina to include Florida, west of Texas, Mississippi Valley to Illinois.

*Sistrurus Catenatus*, Rafinesque (Plate VII, Fig. 1). The Massasauga is larger and stouter than the pigmy, with a shorter tail and a more fully developed rattle. The usual color is grayish-brown, with from 36 to 45 rich brown dorsal blotches with lighter centers and narrow yellow margins; toward the tail the blotches tend to form transverse bands. A white line extends from the nostril to the angle of the mouth; a white line crosses the anterior part of the supraoculars. A dark spot covers the parietal suture. Two wavy brown parallel stripes margined with white run back from the supraoculars, to the first dorsal blotch. A broad brown band edged with white extends from the rear margin of the eye to the neck. Two small yellow spots diverge from the pit to the lip. Rest of the head a bright chestnut brown. The abdomen is yellow mottled with black. Lateral blotches like Miliarius; scales in 23 to 27 rows, usually 25, preocular in contact with postnasal.

From the Academy's collection I have noted the following color variations: Nos. 7238-9 are nearly black with obscure markings; No. 7240, ventrals black; No. 7241, color pale gray. No. 7243 has 23 rows, 37 spots, and yellow ventrals, while No. 7244, collected in the same locality, has 27 rows and black ventrals.

Distribution—Western New York to Kansas, north to Canada. Subspecies.

*Sistrurus Catenatus*, Edwardsii, or Consors (B. & G.). I include the above names purposely, as after examining a large number of specimens and finding the scale rows and number of spots to vary, the former from 23 to 25, the latter from 37 to 50, I do not believe a second subspecies should be recognized.

I have taken No. 12096 as closely approaching the type. Scales in 25 rows, two outer smooth, small lower loreal, preocular in contact with postnasal; color light brown, with 45 dorsal and 8 caudal blotches, the latter subcircular; ventrals 150, subcaudals 27.

*Crotalus* (Linn): Subcaudals undivided, tail terminating in a rattle. Twelve distinct species are found in the United States.

*Crotalus molossus*, B. & G. (Plate IX, Fig. 1). Dog-faced or blacktailed rattlesnake. No. 15631, Academy collection: Large size, muzzle broad, rostral small triangular; nose scales larger than other species, number eight, all in contact, four rows between the supraoculars; same num-
ber between suboculars and upper labials; dorsal series in 29 rows. Color dull sulphur, plates of muzzle blackish, tail black; on the back a series of chestnut-brown transverse lozenges 10 to 12 scales wide, 4 to 5 long, embracing on each side of the spine a lighter spot; the bordering scales are of a paler color. The exterior corners of the lozenge are mostly open and extended to the edge of the ventrals. A diagnostic character of this species is that each scale is of a uniform color. No. 17897, though otherwise typical, presents but 27 rows of body scales, while No. 16530 has scales in 27 rows. Habitat—Arizona, New Mexico, southward.

*Crotalus adamanteus*, Beauvois (Plate VIII, Fig. 1). The diamondback is the largest North American poisonous snake, and grows to a length of eight feet. A specimen in my collection has the following characters: Color gray-brown, faintly tinged with yellow, a series of diamond-shaped dorsal spots of black enclosing ground color, the black edged with pale yellow borders of one scale width; these cross on the fifth or sixth lateral row to extend to the ventrals, the extended lines enclosing a dark mottled area. The dorsal markings are in contact on the body, toward the tail, which is olive, ringed with black; they tend to become cross-bands. The abdomen is yellow; rattle nine segments and a button. A light line runs from the posterior end of the supraoculars to the row of scales above the mouth; a second line from behind the nostril to including 7, 8, 9 upper labials. There is also a distinct white line in front of the nostril, and two short bars from the pit to and including the labials. Head broad, triangular, rostral high; two small loreals separate two long preoculars from postnasal; supraoculars large, extending well over the eye, eight scales between, four between the suboculars and upper labials. Rest of head covered with small carinated scales; body scales in 27 rows. Habitat—North Carolina southwest to Louisiana; most abundant in low coastal region.

*Crotalus atrox*, B. & G. (Plate VIII, Fig. 2). The Western diamondback is of smaller size but closely resembles Adamanteus. It has the following points of difference: One loreal, ground color lighter, absence of vertical line in front of nostril. The diamond markings are truncated. The tail is light, strongly marked with black half-rings. No. 15165, Academy collection, has six rows between supraoculars, four between suboculars and labials. Scales in 25 rows; ventrals 178; subcaudals 23. Distribution—Northern Mexico, Central Texas, to Arizona.

*Crotalus atrox ruber*, Cope. This subspecies is smaller than Atrox, rostral wider than high; eight rows between supraoculars, five between suboculars and labials. Scales in 27 rows; color, light red or reddish-brown, marked with deep red spots; oval in front, diamond-shaped posteriorly. Dorsal lateral, borders indistinct, separated in the middle line by a single row of yellow-tipped scales. Indefinite red spots in the lateral angles, head without markings except faint line from eye to mouth; tail white, with five black cross-bands.

*Crotalus horridus*, Linn (Plate IX, Fig. 2). The timber or banded rattlesnake. This is the common rattlesnake of the eastern temperate United States. It grows to an extreme length of five feet. The following is a brief description of a specimen in my own collection: Color, roll sulphur, a light yellow line from supraocular to angle of the mouth, back of which is a dark blotch. There is a series of chevron-like saddles on the back three to four scales wide, irregularly bordered with light yellow of one scale width, separated by three to five scales of ground color. Some of the bands are broken and form irregular blotches. The tail is black; the ends of the ventrals between the bands are strongly peppered with black; rattle, seven segments and a button. The marked features of the head are two large internasals followed by a row of five scales, the two external of which are much the larger; the supraoculars are large and ovoid. The rest of the head is covered by small granular scales. Body scales in 27 rows, mark-
edly keeled, except outer two rows, which are only faintly. A jet-black phase occurs. They are usually but not necessarily males. Distribution—Maine to, but not including, Florida.

*Crotalus confluentus*, Say (Plate X, Fig. 1). The prairie rattlesnake is the common rattlesnake of the Central United States, extending from Canada to Mexico. No. 7069, Academy collection, presents the following characters: Rostral high, in contact with prenasal; small plates behind nasals; three rows between supraoculars, four between suboculars and lips; top of muzzle covered with small scales, 27 rows of body scales; ventrals 182, subcaudals 23; color yellow; dorsal spots brown; concave before and behind; corners rounded slightly, convex on the sides; ten scales wide, four or five long, formation posteriorly.tending to rings. These blotches are lighter in the center and are edged with light yellow. Two series of small alternating blotches on the sides, ventrals yellow; a brown oblique band beginning at the anterior corner of the eye, bordered by narrow white, extends to the angle of the jaw; a small vertical line below the pit and a faint one on the outer edge of the rostral. The supraoculars are crossed in the center by a white line which bifurcates internally the anterior arm, crossing to join the fellow of the opposite side.

No. 10745 from Lake Valley, New Mexico, the *C. c. pulverulentus*, type of Cope, has six rows between the supraoculars, with a rather enlarged scale on its posterior inner border, and two symmetrically placed larger scales over the occiput; the color is lighter and more ashy than usually found; these slight differences are its claims for recognition.

*Crotalus oregotius*, Holbrook (Plate X, Fig. 2), Western rattlesnake, is identical with *Crotalus lucifer* of Baird & Girard. No. 7158, Holbrook's type, is so shriveled by alcohol as to be useless for description, so I have taken No. 16986, collected from the same locality. Color and spots like Confluentus, head scales slightly smaller, six rows between supraoculars, three between suboculars and upper labials. Scales in 25 rows; ventrals 170; subcaudals 21. The dark streak bordered by broad white on the side of head begins posterior to the center of the orbit and runs directly to the angle of the mouth, not dipping sharply downward as in Confluentus. The transverse supraocular line is distinct. Habitat—Pacific Coast region, California to British Columbia.

*Crotalus lepidus*, Kennicott (Plate XI, Fig. 1), smooth or green rattlesnake, is one of the smallest of the genus. The characters of No. 17921 are as follows: Color (blue-gray in alcohol), rich dark-green in life, crossed by 17 black bands extending just short of the ventrals; bands 2½ scales wide on dorsum, tapering gradually down the side; the bordering scales are half black and pale green, which gives the edge a serrated outline. Many of the body scales have black tips; the head is without marks. There is a double heart-shaped black blotch with light color between, on neck behind occiput. Tail brown. Rostral low, two preoculars, two loreals; two scales between suboculars and upper labials, ten between supraoculars. Body scales in 23 rows, external two smooth, all less carinated than usual. Ventrals 163, subcaudals 27; rattle, three joints and a button. Head more oval in shape and less distinct than other crotalus. No. 17903 has single crescent on nape of neck. Distribution—Neighborhood of Mexican boundary.

*Crotalus cerastus*, Hallowell (Plate XII, Fig. 1), the horned rattlesnake or side-winder. No. 7097, small slender body, head distinct, rostral wide as high, head scales small, five rows between supraoculars, two between suboculars and labials. Nasal entire; the supraocular is elongated into a horn-like process directed upward and turned slightly inward on itself; body scales in 21 rows strongly and thickly keeled except outer two rows. Ventrals, 145; subcaudals, 20; color, pale yellow, with an indistinct series of pale-brown dorsal blotches, and several rows of indefinite lateral spots. Habitat—Desert regions of southwest. When hurried, its mode of
progression is peculiar, moving away sideways, in this respect resembling several desert species of Old World vipers.

The following species I have not had the opportunity to examine, so will give only a condensed description of each from the type report:

*Crotalus mitchellii*, Cope (Plate XII, Fig. 2), commonly called white rattlesnake, from its pale coloration and indistinct dorsal markings. The rostral plate is separated from the anterior nasal by small scales, a condition not existing in any other member of the group. Distribution—Arizona and South California.

*Crotalus pricei*, Van Denburgh, described from specimens in the Leland Stanford University. Body scales in 21 rows, rostral higher than wide, enlarged plates on muzzle, one to three rows between supraoculurs, one row between subocular and labial; color olive gray, thickly covered with small brown spots; small brown blotches in two series on the back, alternating anteriorly, forming cross-bands posteriorly; laterally two or three small alternating rows; ventrals slate-colored, with whitish ends; outer row of scales white; a dark-brown oblique streak behind the eye; two small brown spots on occiput. Distribution—Arizona to Mexico.

*Crotalus tigris*, Kennicott. Nose blunt, head oval, size small, rostral triangular, postnasal and preorbital short, one or two loreals, two or three scales below orbit, top of muzzle and interorbital space filled with small flat equal sized scales. Supraocular plate divided by a transverse groove, a branch from which more or less completely cuts off a part of the margin. Scales on cheek and back of head keeled. Color gray, with small dorsal blotches and an indistinct lateral series. On the posterior two-thirds of the body the spots form cross-bands. A dark oblique streak behind the eye; ventrals yellow. Habitat—Arizona, South Nevada, and South California.

*Crotalus willardii*, Meek (Plate XI, Fig. 2). Head long, muzzle narrow, somewhat recurved. Rostral higher than wide, nasal in contact with rostral, upper preocular not divided, internasal as long as wide; seven or eight scale rows between supraoculars; two between the eye and lip. Upper labials 14-15, lower 13-15. Body scales 25 rows keeled, except outer two smooth; ventrals 153, anal single, subcaudals 28. Color chocolate, dorsal markings, short, dark cross-bands, shading into a black line anteriorly or posteriorly, bars sometimes in pairs, and then separated by one or two scales; tail brown, with three distinct half rings, brown spots laterally of one to four scales; whole body more or less speckled. Ventrals white anteriorly, posteriorly small spots or blotches. A white median rostral line to lower jaw, expanding between two wide dark bars which extend half-way back on jaw; a white line borders second to fifth labials inclusive, continuing on to lower jaw. A light band extends obliquely from postnasals under eye to cover last four labials; below this across the pit a dark band spreading out on fourth or sixth lower labials. A prominent dark postocular streak about three scales wide, not bordered by white above.

The above is by Frank A. Hartman, U. S. Nat. Museum report.

THE VENOM.

The first recorded reports on this subject were made over 200 years ago by a Charras and a Redi on the common viper of Europe and its poison. This was followed later by the able work of the Italian Felix Fontana, but as organic chemistry was in its infancy little could be accomplished.

Prince Lucien Bonaparte in 1843 attempted a chemical analysis of viper poison, and stated it to be albuminoid or proteid in character. About twenty years later Dr. S. Weir Mitchell of Philadelphia, in a series of analyses of rattlesnake poison, confirmed Bonaparte's theory and called the substance crotaline, since which time all experiments made have proved the correctness of Dr. Mitchell's views.

The next important step was taken by Dr. Mitchell and E. T. Reichert in 1883, when they made a preliminary report, the final result of their experiments being pub-
lished by the Smithsonian Institute in 1886 under the title "Researches upon the Venoms of the Poisonous Serpents."

These investigations demonstrated the fact that crotalus and cobra poison was a complex substance consisting of several proteids, the two chief ones being named globulin and venom peptone.

At about the same time Dr. R. Norris Wolfenden, of England, was conducting a similar series of experiments on the venom of Indian cobra (Naja tripudians) and the Indian viper (Daboia russelli). His results confirmed the discoveries of Mitchell and Reichert. This substance he called syntonin, which is the same as Mitchell's venom peptone. Later studies by Dr. C. J. Martin and J. McGarvie Smith, of Sydney, Australia, on the Australian blacksnake (Pseudechis porphyriacus) proved this poison to contain three proteids, one a non-virulent albumin, and two poisonous albumoses.

In 1888 a Russian, Dr. E. A. Feoktistow, made a communication on the poison of several varieties of vipers and the Crotalus durissus, and its action on the nervous system, blood, and vessels. The same year a Frenchman, M. Kaufmann, reported on the Vipera aspis (the common viper of France), its poison, and the action on the nerves, circulation, and tissues. These investigations confirmed Mitchell's observations as to the difference between rapid and slow poisoning—i.e., if injected directly into a vein there is rapid nervous, circulatory, respiratory, and digestive excitation, followed by drowsiness and death, the mental faculties being the last to be impaired; while hypodermic injection produces the same systemic effects, plus a local lesion, consisting of more or less swelling with marked discoloration due to extravasated blood and serum, death following promptly on the absorption of the poison. Mitchell and Reichert had found potassium permanganate, ferric chloride, iodine, and bromine were destructive locally to the poison, while Kaufmann advised chromic acid 1:100 solution as the best local treatment. Dr. Calmette first suggested chloride of gold to be used locally, but later indorsed chloride of lime solution 1:11. Dr. C. H. Yarrow favored pilocarpine and jaborine. So many drugs had their advocates.

In the Proceedings of the Royal Society for 1894, Sir J. Lauder Brunton, with Sir Joseph Fayer and Dr. Leonard Rodgers, reports a series of experiments (renewed after a lapse of thirty years), proving that the venom of the Indian cobra and Russell's viper is neutralized by potassium permanganate; also describing a lancet devised by Sir J. Lauder Brunton for use in the Indian army, consisting of a half-inch blade with a hollow screw-top handle to hold the crystals of the drug. Directions: Incise deeply the bite and rub in thoroughly the pure crystals.

Feoktistow and Müller had demonstrated that the poison was in part eliminated by the kidneys, while Dr. Konrad Alt showed there was slight elimination by the stomach. Meanwhile internal treatment had not made much progress. Ammonia had been proven valueless; alcohol dangerous, unless carefully and moderately given.

In 1871 Dr. Lanszweert, of San Francisco, Cal., reported five cases successfully treated with arsenate of strychnine. This method was then forgotten until 1888, when Dr. A. Mueller, of Yackandandah, Victoria, formulated and proved the success of the strychnine treatment in a large series of cases of poisoning by Australian snakes.

Preventive inoculation was first demonstrated in 1887 by Prof. Henry Sewall, of the University of Michigan. He reported a series of experiments on pigeons with the poison of the massasauga (Sistrurus catenatus), the conclusion being: "Repeated inoculations with a non-fatal dose produced increased resistance, without affecting the health of the animal."

It is well known that all poisonous snakes are immune to their own venom, as are also many harmless snakes poison-proof: for example, the common king snake, a member of the Ophibolus group, is immune to the poison of the rattlesnake. It has been shown that the blood of harmless immune
snakes, when injected into animals, produces all the symptoms of poisoning. Further investigation has proved this to be due to an internal secretion of the salivary gland of the harmless immune species. These experiments opened the way to producing immunity by giving attenuated doses of venom.

Dr. Calmette was the first to produce an anti-serum to protect against snake poison. He began by injecting rabbits with one-twentieth the fatal dose, gradually increasing the amount until he was able to give 80 times the fatal dose without reaction. Five drops of the serum of the immunized animals neutralized one milligramme of cobra poison. This serum will protect against the neurotoxic and hemolytic properties of other venoms, but not against the hemorrhagin of the rattlesnake. An antiserum for rattlesnake poison can be prepared by immunizing goats with attenuated rattlesnake poison. This serum will protect against hemorrhagin, but is valueless against the poison of the cobra.

The more recent work is that of Keyes and Sachs and Flexner and Noguchi. They have shown that the venom of different species varies greatly in its toxic properties, due to the relative amount of the different constituents. The formula of venom is as follows:

- Neurotoxin
- Hemotoxin
- Agglutinin
- Hemolysin
- Hemorrhagin

Cobra venom has neurotoxin in excess, with less hemotoxin, while the poison of the rattlesnake is chiefly hemorrhagin, with less neurotoxin and hemotoxin. The copperhead and moccasin are intermediate, the poison containing both hemorrhagin, hemotoxin, and neurotoxin in considerable quantities.

The action of the venom is briefly thus: Neurotoxin acts on the cells of the central nervous system, causing death by paralysis of the cardiac and respiratory centers. The hemotoxins, agglutinin and hemolysin, destroy the blood cells. Hemorrhagin acts directly on the endothelial lining of the blood-vessels and causes its destruction.

The latest comprehensive work on this subject is by Noguchi, issued by the Carnegie Institute in 1909, to which I would refer all interested in this topic.

**TREATMENT.**

We will only consider this subject as it applies to bites received in the United States:

1. Do not lose your head. Death from snake bite is extremely rare in this country so much so that if a man is bitten in Texas, it will form a heading in the Philadelphia papers. Remember that most so-called poisonous snakes are harmless, also that the poisonous varieties are now usually found far remote from civilization in thick wooded, barren, rocky desert, or in the low lying coastal regions of the South. More than two punctures at the seat of injury would be a strong indication that the wound was innocent. Always, if possible, keep the head of the snake for identification, and so save future worry.

2. If, as is generally the case, the bite is on an extremity, tie one or more ligatures preferably a broad rubber band, above the injury to prevent the poison gaining entrance to the general circulation.

3. Incise deeply the wound, cutting across the puncture for at least one inch, and well beyond the depth made by the fang. Now wash in running water, manipulating the part to promote free bleeding.

If running water is not available, suck the wound, as there is no danger in taking the poison into the mouth unless some break in the mucous membrane exists. The mouth should be thoroughly rinsed with potassium permanganate solution.

4. Now wash well the wound and use in and around the potassium permanganate, or inject a chromic acid solution 1:100, being careful to completely infiltrate not only the wound but also the surrounding tissues.

5. Do not give ammonia. Stimulate with small doses of whisky, if indicated, but do not overdose, as more persons have been killed by giving large quantities of whisky than by snake bite.
6. Rush the case to a good surgeon.
7. When positively certain that the poison has been removed from the wound, loosen cautiously the ligatures, the one nearest the heart first, but do not remove, so they may be again tightened if symptoms recur. In all cases the victim should have the best surgical care, and the wound kept open by packing with wet antiseptic gauze, as sepsis and local gangrene is very apt to follow the injury.

This article was not written for the specialist, but to help the medical layman in the identification of dangerous snakes, so I have purposely in my drawings from nature made them semidiagrammatic.

SCARLET RED FOR GRANULATION.

BY DR. S. B. KOSITCHEK.
Assistant of Dr. Carl Beck, of North Chicago Hospital Clinic.

Shortly after Schmieden had made the report of this work with scarlet red, it was taken up in the clinic of Dr. C. Beck, at the North Chicago Hospital, in order to ascertain if similar results could be obtained.

Dusting powders, salves, cautery, in fact all known means of promoting fresh granulations, and the production of epidermatization had been tried, some with good, others with little, and still others with no benefits.

Before making any trials with scarlet red on our patients, an attempt was made experimentally to prove that it causes a proliferation of epithelial cells.

This was done by taking 1 part scarlet red powder to 3 parts of olive oil, and injecting this solution hypodermically into the ear of a rabbit (Dr. Moore and Newmann). About one week after injection a tumor was seen on the ear of the rabbit, about the size of a pea. (This can be seen in the accompanying photograph.) Three weeks after injection this growth was removed, and upon sectioning it, was found to be made up of epithelial cells.

Among the first cases upon whom we tried the scarlet red were the following:

Case 1.—H. G., aged eight; nationality, Russian. Was brought to the North Chicago Hospital suffering from a severe tertiary burn, involving the left side of the neck, chest, axilla, and under surface of arm. So severe was the condition of the child that for several weeks his life hung in the balance.

The first dressing applied was the scarlet red salve made up with vaselin and scarlet red 5 per cent, and applied thickly over the burn; this was covered over with gauze and cotton. So healthy did this keep the granulations, and so rapid was the epidermatization along the borders, that no other local treatment was given, so that when the time came to place our skin grafts the surface to be covered was about one-half the original size. Most of the grafts did not "take," so the scarlet red salve application was continued. At the present time the whole surface is healed over.

Since the treatment of this case with the scarlet red we have treated other cases of burns in a similar manner, with similar success.

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1 Read before the German Medical Society, Chicago, Ill., May 4, 1911.