

first rank among poisonous plants. Like cicuta, it grows in damp soil and produces a fascicle of fleshy roots (see Fig. 3852). Its leaves bear a strong general resemblance to those of celery, and it is free from disagreeable or warning taste. The symptoms of poisoning are only in a minor degree similar to those resulting from cicuta, and the nature of the poison is probably quite different. The symptoms develop very rapidly, death frequently occurring within an hour or two. Dryness of the mouth, with great thirst, vomiting, then dizziness, slow and weak pulse, pale and cold skin, reduced blood pressure, pupils greatly dilated and failing respiration, inducing convulsions, result. Death occurs apparently from heart failure. Judging from these symptoms, it would appear that the administration of digitalis would constitute a rational line of treatment.

Sambucus or Elder (fam. *Caprifoliaceae*). (See Fig. 3853.)—Apparently closely related to cicuta as a poison, is the root of the common elder, and probably of other species of the genus. These roots (or more properly rhizomes) are elongated, cylindrical, crooked, somewhat branched, whitish, and possessed of a rather thick, juicy bark. Commonly, some small shoots can be seen upon them, and these are usually of a bluish-purple color at the place where the young leaves are forming. When bruised, these roots exhale a rather disagreeable odor, and the after-taste is acrid. Coniine is said to have been extracted from some of the elders. The symptoms of poisoning are much like those from cicuta, and promptly fatal results have been recorded.

Iris or *Blue Flag* rhizome (fam. *Iridaceae*), growing commonly in swamps or low ground, along with calamus or sweet flag, is liable to be mistaken for the latter. The distinctions between the two, once known, are sufficiently easy for recognition. *Iris* grows in small or only moderately large clumps, while calamus covers large patches, almost to the exclusion of other growth, and usually in wetter situations. Its leaves are longer, narrower, less thick and fleshy, and are greener, lacking the bluish-green tinge of *iris*. The plant is also taller. The rhizome of calamus is long and rather uniform in thickness for a considerable distance. That of *iris* is much thickened at short intervals. Calamus is bitter and somewhat acrid, so that the acridity of *iris*, though greater, is apt to be endured by the heroic calamus chewer, thinking that he has the rhizome of the latter. The properties of *iris* have already been considered (see Fig. 3854). The fresh rhizome is much more irritant and violently emetic and cathartic than the dry drug.

Veratrum (fam. *Melanthaceae*).—Growing in the same swamps with *iris*, though usually in more wooded or shaded situations, *veratrum* is often found. Although a mistake is here not easy, such a possibility should not be overlooked, as the rhizome is fleshy and succulent. Beyond referring to our illustration and to our account of the drug (see Fig. 3856) this subject requires no discussion.

Camas.—Various western species of the genus *Zygadenus* Mx., of the same family with *Veratrum*, are known by this name, and several of them are recognized poisons, especially *Z. venenosus* Watson, or Death camas, a name which has been applied to a polymorphous species,

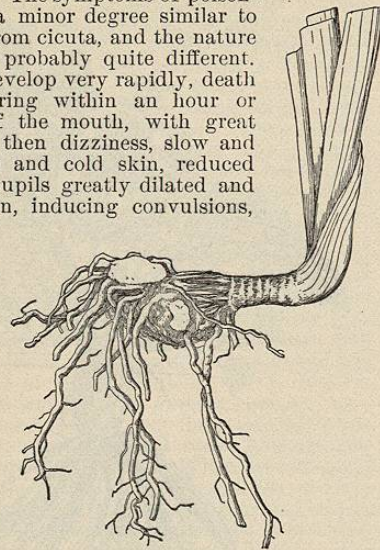


FIG. 3854.—*Iris versicolor*. (One-half natural size.)

or a group of very similar species, according to the varying views of different botanists. In all probability most, if not all, of the species of this genus are poisonous, but only the death camas has produced serious results. The genus is characterized as follows: Plants smooth, perennial, from rhizomes or bulbous bases, the stem bearing linear, somewhat succulent leaves, and terminating in a raceme or panicle of yellowish-white or greenish-white marcescent flowers, the perigone six-parted, its segments gland-bearing near the base. Stamens six, borne at the base of the perigone but free from it, the anthers cordate or reniform. Ovary three-celled with three styles. Pod completely dehiscent and containing narrow, angular seeds. The genus is closely related to *veratrum*. *Z. venenosus* is here figured (see Fig. 3855). It is extremely common and abundant in Montana and other Northwestern grazing regions, and is very destructive to stock. All parts of the plant appear to be poisonous. The bulb, which is especially so, is recognized among the Indians as dangerous to man because of its close resemblance to several edible species. It appears to be bitter at times, quite free from bitterness at other times. It is considered fatal to about twenty per cent. of the sheep poisoned by it. The symptoms are said to be uneasiness followed by incoordination, then muscular paralysis, especially of the posterior limbs. There are dizziness, disordered vision, regurgitation of frothy matter, salivation and weak respiration, with little cerebral disorder. The nature of the poison is unknown, though the indications are those of one or more glucosides. They are extracted both by alcohol and by water. Potassium permanganate appears to be a very efficient antidote.

Closely related to *Zygadenus*, and by some botanists regarded as pertaining to it, is *Chrosperma muscaloricum* (Walt.) Kuntze (*Melanthium m.* Walt.; *Amianthium m.* Gray) the Fly poison, Crow poison, or Fall poison, a common bulbiferous perennial of sandy soil of the Eastern United States, especially near the coast, and in parts of the Southern Central States. It reaches a height of two to three feet, bears long, linear grass-like leaves, nearly an inch in breadth at the base, and large, much-branched panicles of greenish-white flowers, about a half inch broad. The perigone consists of six distinct parts, without glands, and is marcescent. The stamens are six in number, and borne upon the base of the perigone segments. Ovary and pod are three-celled, the latter splitting only at its upper portion, the styles persistent upon the valves. The ovoid brown seeds are



FIG. 3855.—Death Camas. (One-fourth natural size.) (After United States Department of Agriculture.)

few and are apparently more poisonous than any other part of the plant. As its names indicate, this plant, especially the seeds, is in use as an insecticide, and it is poisonous to birds. Little is known about the nature and treatment of the poisoning, but it appears to be in a general way quite closely related to *veratrum*.

More or less closely allied to the above-named bulbs, as well as to colchicum, are those of various species of *Narcissus*, *Hippeastrum*, and *Amaryllis*, which are severely poisonous. A number of species of agave, pertaining to this family (the *Amaryllidaceae*), as well as of *Liliaceae*, yield so-called soap roots, used for their detergent properties on account of their large content of saponin, and for the same reason actively poisonous.

Other similar articles, poisonous if eaten, but not likely to be eaten except through mistake, are podophyllum, sanguinaria, leptandra, arum, and actaea, all elsewhere considered, and all so strongly acrid and disagreeable, or even painful, that no considerable amount could be consumed by a sane individual.

With convallaria, aconite, Solomon's seal, and apocynum the case is somewhat different. *Convallaria* (see *Lily of the Valley*) rhizome is sweetish and not unpleasant except in the after-taste; and it is so highly poisonous that it would not be improbable for a child to eat enough to produce poisonous symptoms. So common an ornamental plant requires no description.

Aconite.—The fresh tuber of this highly ornamental garden flower is said not infrequently to have been mistaken for horseradish, incredible as this may seem. Its biting taste is even exceeded by that of the horseradish, so is not apt to excite suspicion, but it even more closely resembles other roots which might grow in the garden beside it. It is to be regarded as an exceptionally dangerous article. Its toxicology has been sufficiently described under the title of the drug.

Apocynum or *Dogbane* possesses a long cylindrical rhizome, running horizontally at a short distance below the surface, and fleshy and milky-juiced. It has an amylaceous taste, only slightly acrid, and might be eaten. Its properties have already been discussed.

Violet.—The roots of pansies and all other violets, though not likely to be eaten, should be remembered as possessing emetico-cathartic poisonous properties, almost identical with those of ipecac.

Euphorbia.—The large, fleshy, and milky-juiced roots of *E. corollata*, *E. ipeacuanha*, and other euphorbias, have been well-known and much used cathartics.

E. corollata is known as the Blooming, White, Purslane, or Large-flowered spurge, Apple root or Wild hippo, and is abundant in Eastern and Central North America. It reaches a height of about three feet, is slender, widely branched and smooth, and the flower clusters which terminate its branches are subtended by showy and petallike white involucres, each bract of which bears a green gland at its base. The root is cylindrical, an inch or more in thickness, and one and a half or two feet long, of a very dark or blackish-brown externally when dried, much lighter brown when fresh. It has a thick white bark in cross section and a radiate spongy central cylinder. Its taste is at first sweetish and pleasant, though the after-taste is a little acrid. Its active constituent is a resin. Overdoses are very powerfully emetico-cathartic, the action being much like that of ipecac.

E. ipeacuanha is known as the White, Wild, North American, Milk, or Spurge ipecac or Ipecac spurge, and is very abundant in sandy soil along the Atlantic coast. Its very slender, much-branched stems are numerous and prostrate, so as to form a sort of a mat-like growth. The leaves are of most diverse forms on different plants, ranging from narrowly linear to broadly oval. The herbage and inflorescence may be light green or more or less purple. The root itself is vertical, much longer and more slender than that of the last, rather lighter in color, but the woody centre more yellowish. Its properties, as well as its uses, are identical with those of the last.

Potato.—Our consideration of poisonous roots may well

close with a few words concerning the poisonous properties of the tuber, and more especially of the sprouts, of the common potato. The potato at all times contains traces of the highly poisonous alkaloid solanine, and probably others, but ordinarily the percentage is too slight to produce perceptible effects. Since the greater portion of this poison exists in the external layer, the peeling of potatoes which contain it in excess, may easily prevent trouble. The substance appears to exist in greatest amount in the rhizome of the potato, upon the end of which the tuber develops. It is therefore much more likely to be present in the young ("unripe") potato than when it is fully developed. Similarly, when the sprouts (young rhizomes) develop upon potatoes in storage, the solanine becomes present in them in considerable quantity. When the sprouts are first forming and of a lurid purple color, the percentage of poison is large, gradually decreasing as they elongate, thicken, and whiten, and especially as they put forth green leaves. Wholesale poisoning has resulted when, in times of scarcity, an attempt has been made to eke out the potato supply by consuming the young sprouts. Potato tubers which form above ground or at its surface, so that they are exposed to the atmosphere and develop a purplish-green color, also contain larger amounts of solanine. Finally, it may be mentioned that very serious results have followed the eating of potatoes containing black fungus spots, the solanine percentage being greatly increased in and just about the spots themselves.

Similar to the potato, in that it is perfectly wholesome under some conditions and highly poisonous under others, is the cassava, manihot, or tapioca root (fam. *Euphorbiaceae*), so largely used as a food in tropical America. Of this root there are two varieties—the one sweet, the other, bitter. The former is in general not poisonous, or not so much so but that thorough cooking renders it wholesome. Nevertheless, a small percentage of hydrocyanic acid is almost always contained in or to be yielded by its bark or the tissues near it. In the bitter variety an important amount of this deadly poison is always found, so that it is not safe to employ it, even for the manufacture of tapioca, without a thorough preliminary maceration and perfect cleansing. There are certain species of yams eaten in the East Indies which also have to be treated by thorough washing in order to remove a poisonous bitter constituent, although not in this case hydrocyanic acid.

The poisonous nature of the roots of belladonna, bryonia, spigelia, caulophyllum, colchicum, squill, and hellebore, will be found discussed under those respective titles, as drugs.

POISONOUS HERBAGE.

In the nature of the case poisonous herbage is far less likely to be eaten by human beings than are fruits, seeds, or roots, and similar organs. Nevertheless, the use of leaves as salads and potherbs, especially in times of scarcity of food, as during famines or in the course of explorations, renders necessary a careful attention to some of them. Furthermore, the frequency of stock poisoning through their use is greater than that resulting from any other portion of the plant; and a reference to the more serious stock-poisoning agents is not out of place in an article of this kind.

As human poisons, tansy, aconite, chelidonium, lobelia, henbane, conium, belladonna, and viola, may be dismissed with the statement that they are scarcely likely to become effective except through accidents attending their use as drugs, which subject will be found discussed under their respective titles in that connection. Tobacco may poison, partly in this way and partly through its use as a popular narcotic, or during its application for parasites infesting plants and domestic animals, under which circumstances it has frequently caused poisoning by its entrance to the system through wounds or other openings in the skin. The symptoms and treatment of tobacco poisoning are elsewhere fully described. Absinthium is a well-known poison, either acute, through overdosage,

or chronic, through the use of beverages containing it. Both forms of poisoning are described under its title. A sufficient reference to poisoning by the foliage of the cedars, pines, hemlock, and other Coniferae of the savin



FIG. 3856.—*Veratrum Viride*. (One-fourth natural size.)

or arbor vitae type will be found under the poisonous family Pinaceae. Related to these, but acting through its poisonous alkaloid, is the yew or taxus, which subject has been presented in speaking of its fruit. Poisoning by any of these is extremely unlikely to occur. The same is true of poisoning by the buttercups, clematis, etc., of the Pulsatilla type, in the poisonous family Ranunculaceae. The foliage of the elder has already been stated as open to the same suspicions as those affecting its bark and root, and it need not be further considered. The foliage and flowers of lily of the valley, or convallaria, contain the same poisonous constituents as those of its rhizome, and there is the same slight possibility of poisoning accidents being caused by it. The occasional use of the stem and herbage of cicuta, mistaken for angelica, has already been mentioned. It contains the same constituents as the roots, and the symptoms and treatment are identical. Poisoning by the herbage of the black nightshade (see the section on Fruits and Seeds) is said to have occurred, although it is claimed that this herbage has been used as a potherb, after cooking, without injury. It is certainly open to grave suspicion. Should poisoning by it occur, it would doubtless be found identical with that of solanine from other sources. Another plant whose herbage has not been recorded as causing poisoning, but which, for obvious reasons, is to be regarded with caution, is the pokeberry, or phytolacca. Watercresses, though commonly regarded as quite innocent, are capable, when eaten in large excess, of producing dangerous and extremely painful symptoms. In one case seen by the writer, a painful, severe cystitis was established in this way. The possi-

bility of an abortion being produced by this article, as well as by horseradish, is worthy of consideration.

Probably the two most dangerous leaf poisons in existence, all things considered, are stramonium and veratrum. The former has been fully discussed as a drug, and under poisonous seeds. It possesses the peculiarity of flourishing in periods of drought, resulting in famine conditions. The whole aspect of the plant is luxuriant and succulent, and a temptation to consume it under such circumstances may often be great. As a matter of history, numerous poisoning cases have occurred in this way, especially in India. Other cases are recorded in which travelers destitute of food have ignorantly eaten it. Veratrum (fam. *Melanthaceae*) is a plant which grows in swamps in the vicinity of caltha, or American cowslip, the herbage of which is eagerly sought in many sections for cooking purposes, appearing as it does in early spring when fresh vegetables are scarce. Various cases are on record in which the foliage of veratrum has thus been mistaken and eaten with serious consequences. Veratrum poisoning has already been fully discussed (see Fig. 3856).

The young shoots of *Tamus communis* (see the section on Fruits) have been eaten like asparagus in the Old World with serious results.

Sorrel.—This name has been applied to two groups of plants, very different from a botanical standpoint, but agreeing in their sensible properties, constituents, and toxicology. The name *Wood Sorrel* has been applied to the common *Oxalis acetosella* L. (fam. *Oxalidaceae*), which is very common in cool woodlands in both the Old and the New World, and bearing white or pinkish tinged and veined flowers. The trifoliolate leaves closely resemble a small clover leaf, but are somewhat fleshy, and the whole herbage is strongly acid. Oxalic acid, free and combined, is the poisonous constituent, and is said to have been first derived from this source. A number of very slender, branching species, with smaller and yellow flowers and smaller leaves, grow commonly as garden and roadside weeds and are known as ladies' sorrel or ladies' sour-grass. In tropical regions hundreds of species occur, some of them very large. Many species are favorites among household flowers. All have the same composition and properties.

The other group represents the sheep sorrels or field sorrels, namely, *Rumex acetosa* L. and *R. acetosella* L. (fam. *Polygonaceae*), pernicious weeds growing in poor, gravelly, or sandy soil throughout the northern hemisphere. They are used to some extent as ingredients of salads. These also contain oxalic acid and have, like oxalis, caused fatal poisoning of both children and adults. The treatment and symptoms may be inferred from the above statement that oxalic acid is the active agent. It may be added that very large quantities of either are required to produce dangerous effects.

Ailanthus or *Tree of Heaven* (fam. *Simarubaceae*).—These nasty-smelling leaves are not at all likely to be eaten either by human beings or by domestic animals. It is said even that flies will not visit decayed meat when hung in the branches of these trees. The leaves have been utilized for the manufacture of substances both odious and toxic to flies. They have also, like the bark, been somewhat utilized in medicine; they contain a peculiar nauseous green oil, as well as an amaroid. This oil has been indefinitely stated as possessing poisonous properties. The bitter substance, though stomachic in medicinal doses, is a gastric irritant in larger doses. Chronic gastritis of a rather serious type is reported as having occurred in all members of a family, as the result of having drunk the water of a well in the vicinity of these trees. The roots extended into the water in great numbers and probably the leaves also had blown into and accumulated in the water.

Kalmia.—The members of this genus, the American laurels (fam. *Ericaceae*), are distinctly poisonous, being frequently fatal to sheep, though not at all likely to be eaten by man, since the foliage is very bitter and disagreeable. The large species (*K. latifolia* L.) is the well-

known mountain laurel or calico bush, spoon wood, or ivy bush, so common throughout Eastern North America. The smaller species of common occurrence is *K. angustifolia* L., the small, dwarf, or sheep laurel, lamb-kill, calkkill, or kidkill. It grows in more open situations, on dry hillsides, and rarely exceeds three feet in height. Its leaves are mostly in whorls of three, its flowers less than half as large as those of the other, and of a deep rose color. Other small species are more rare. The poisonous constituent of the laurels is the amaroid *andromedotoxin* (C₂₁H₃₁O₁₀), a neutral crystallizable substance, rather soluble in both alcohol and water. Mineral acids color its solution bright red. It is an extremely poisonous substance, and has been said to be, in the pure state, more emetic than either emetine or apomorphine, and more toxic than aconitine. Animals are



FIG. 3857.—*Pieris Mariana*. (Two-thirds natural size.)

not fond of laurel, eating it only when other food is scarce. The common symptom of poisoning by laurel is narcosis with muscular weakness. Animals become quiescent and stupid. In the early stages a staring glassy eye is notable, with great disorder of vision, objects being apparently distorted. A staggering gait progressively develops, and finally the animal lies down and goes into a condition of stupor. There is no disposition either to eat or to drink, the reappearance of such desire being a pretty sure indication of recovery. A thin liquid frequently flows from the mouth. Stomach digestion is apparently com-

pletely paralyzed. There are faint convulsive movements of the limbs, and death finally ensues from general weakness, specially of the respiration.

The poisonous constituent described above occurs commonly in this family, other members of which have poisonous records by reason thereof. The most important of these is *Pieris Mariana* (L.) B. et H. (*Andromeda M. L.*), which bears the suggestive name of stagger bush (see Fig. 3857). It grows throughout the Atlantic region as far north as New England, preferring shrubbery along the salt marshes. It is a shrub, from three to five or six feet high, and its profuse flowers are whitish or purplish and of a waxy appearance. A flowering branch is here figured. The symptoms of poisoning by stagger bush are identical with those resulting from laurel. In this connection the *Rhododendrons* may be mentioned as having precisely similar poisonous properties.

Ledum or *Labrador Tea*, *Marsh*, *Sicamp*, *Continental* or *James tea*, and *Marsh rosemary*, are names applied to the two species (fam. *Ericaceae*) *Ledum Groenlandicum* Oeder. (*L. latifolium* Ait.), the broad-leaved and *L. palustre* L., the narrow leaved (see Fig. 3858). They are marsh shrubs, the former ranging from Greenland through Northern North America, the latter extending also

through Northern Europe and Asia. The broad-leaved species has been a much used substitute for tea among British-American voyagers, and is only moderately narcotic. The narrow-leaved species is much more active. Both are somewhat used medicinally in domestic practice. The narrow-leaved species is distinctly narcotic, the symptoms closely resembling those of laurel poisoning. If, as claimed, andromedotoxin is not a constituent, some very similar body must be present. A flowering branch of *ledum* is here figured. The leaves are well distinguished by their somewhat thick and leathery texture and their smooth upper and brown woolly lower surfaces. The flowers are white.

The leaves of such plants as the cherry, peach, plum, etc. (fam. *Drupaceae* or *Rosaceae*) yield appreciable amounts of hydrocyanic acid. Although the consumption of injurious quantities by human beings is not at all likely to occur, yet the leaves of the common wild cherry constitute a well-known and much-dreaded stock poison. The branches, trimmed out for fence rows or broken down by boys in search of the fruit, have very frequently been recorded as poisoning cattle, often fatally (see Fig. 3859). An unexplained but well-established fact is that



FIG. 3858.—*Ledum latifolium*. (Two-thirds natural size.)

cattle will eat them from the living trees without ill effects, but will be poisoned upon eating them in a wilted condition. That the effects are due to the hydrocyanic acid liberated is fully evidenced by the effects.



FIG. 3859.—*Prunus serotina*. (One-half natural size.)

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Delphinium or *Larkspur* (fam. *Ranunculaceae*).—The general subject of larkspur, as to constituents and activity, has been considered under the title of *Stavesacre Seed*. So well known a garden flower scarcely requires description. The accompanying illustration of *D. glaucum*, the tall larkspur, often miscalled aconite, gives a sufficiently good idea of the genus in general (see Fig. 3860). Some of the species are larger, many much smaller. The flowers are usually of some shade of blue, sometimes pur-

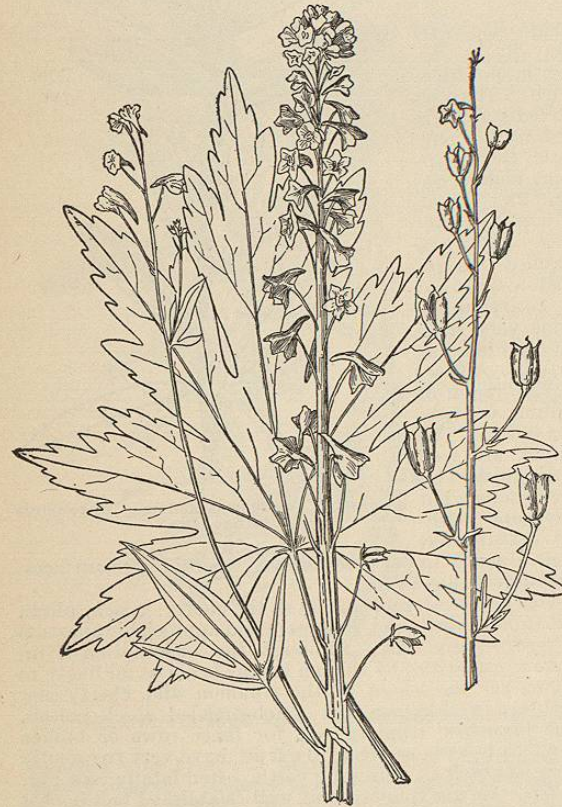


FIG. 3860.—*Delphinium glaucum*. (One-third natural size.) (After United States Department of Agriculture.)

plish. Many species abound in the grazing regions of Western North America, and they are much dreaded as stock poisons by herders, though the poisoning of human beings is not recorded, and is not likely to occur. These poisons are to be classed partly with aconite, to a lesser extent with stavesacre, as to the nature of their effects. The symptoms are muscular incoordination, motor paralysis, beginning at the posterior extremities, great cardiac and arterial weakness, and hypersensitive skin, with the special senses not affected. Convulsive tremors, especially of the posterior limbs, come on early and are followed by convulsions which increase in violence, and in one of which the animal usually dies. Death appears to be due chiefly to failure of the circulation. Atropine has been found a fairly good antidote, and potassium permanganate has also been found useful.

Loco Weeds (fam. *Leguminosae*).—Although poisoning by this famous group is confined practically to stock, especially horses and sheep, yet no article on poisonous plants could be considered complete without reference to it, particularly as it represents a very large and varied class of leguminous poisons which more or less affect the human system as well. The loco weeds pertain to the two genera *Astragalus* and *Aragalus* (*Oxytropis*), and knowledge as to their specific identity is in a number of cases indefinite and uncertain. They are perennial herbs,

growing mostly in tufts or hummocks, with a dense rosette of radical leaves and papilionaceous, mostly purple or purplish flowers in spikes or racemes. The leaves are elongated and pinnate, the leaflets mostly numerous and more or less oblong or varying from ovate to obovate. The fruits are constructed like small pea pods, the seeds mostly resembling small peas and often rattling loosely in the dry pod. The herbage is without disagreeable taste. Animals are not naturally disposed to eat it; but having once done so, in case of scarcity of other food, they become ravenously fond of it and forsake all else in order to eat it. The poisonous constituents are not known, though great efforts have been made to isolate them. All indications point to their being of the nature of toxalbumins. Whatever they are they are excreted in the milk of the mother, since suckling lambs are frequently fatally poisoned together with the mother. Poisoning may be either acute or chronic, the latter being much more common. The symptoms are chiefly cerebral. There are incoordination and remarkable disorders of vision, though rarely blindness, and this usually in acute poisoning. The effect upon the vision seems to be that of causing objects to appear distorted. A similar effect upon hearing is observed. There are great and progressive disorders of nutrition, and these are especially referable to the skin and its appendages, sheep frequently losing the whole or part of their fleece and the teeth becoming loosened. Death, in cases of long duration, is usually from malnutrition. Very often the animal dies as a result of accidents, incurred either through frenzy or through weakness incident to the poisoning, such as falling into the water while drinking, and being unable to rise again. There is no known treatment for this form of poisoning other than to remove the cause and apply general restorative treatment.

Henry H. Rusby.

POISONOUS REPTILES.—All poisonous reptiles, with the single exception of the lizard *Heloderma*, belong to the order Ophidia—snakes. It is a popular error that snakes are easily divided into harmless and poisonous ones by readily recognized characteristics. Such division, however, is by no means a simple affair. The usual classification into Colubridæ—comprising all harmless snakes,—Colubridæ venosæ, and Viperidæ indicates the close anatomical relationship between harmless and venomous snakes, and in external appearance mimicry is so frequently displayed that no one at a hasty glance is able to distinguish a harmless snake from its venomous relation. Thus, even experts have been subject to fatal mistakes. Indeed, nothing but a close inspection of the dentition can determine the nature of a specimen in question.

Distribution of Snakes.—It is but natural that the popular mind and imagination should have been occupied since time immemorial with poisonous snakes. The frequent and almost mysterious deaths after snake-bite have surrounded the whole class with a halo of fear and reverence which has not been confined to a few localities, but, in fact, has spread throughout the whole inhabited world, for poisonous snakes are found in all countries of the temperate, and more so, of the tropical zone. Numerous genera of the Hydrophids, elegant swimmers with a laterally compressed tail, swarm throughout the whole inter-tropical part of the Pacific Ocean. Their bite is justly dreaded. The tropical islands, however, and the tropical countries of the old continent are haunted by the worst kind of snakes, the Elapidæ. A large number of genera and innumerable types of every genus render parts of those countries, and especially of the islands, almost uninhabitable. The chief representatives of this genus are the Cobra di capello (*Naja tripudians*) and the somewhat smaller, though not less dangerous Krait (*Bungarus fasciatus*), both living throughout the whole of East India. The most formidable is the King-Cobra or Hamadryas (*Ophiophagus elaps*), the largest of all poisonous snakes; it attains the length of fourteen feet and it alone enjoys the reputation of attacking and even pur-

suaging man. Its nearest relative, the Aspis of Cleopatra (*Naja haje*), the symbol of the Egyptian kings, lives throughout almost the whole of Africa. In the Western world this genus is represented by the beautiful coral snakes alone; one of them, *Elaps fulvius*, lives in our Southern States, where it is little feared on account of its alleged good nature, or rather its lack of irritability; its poison is, however, as active as that of its East Indian congener. Snakes are very numerous in Australia. Two-thirds of these are poisonous, and they belong exclusively to the family Elapidæ; the Tiger snake (*Hoplocephalus curtus*) and the black snake (*Pseudechis porphyriacus*) have a fearful reputation. Europe has none but various species of vipers; the well-known common viper (*Pelias berus*) lives in England, Germany, and chiefly in France. In the departments of Vendée and Loire Inférieure alone were reported 321 cases of bites with 62 deaths in six years, in Auvergne 14 cases with 6 deaths; in the South around the Mediterranean the more dreaded sand viper (*Vipera ammodytes*) is found. East India again has one of the most formidable vipers, the chain viper (*Daboia Russellii*), and in Africa there is the sluggish but very poisonous puff-adder (*Crotalaria*). The greatest number of species of vipers are found in America, all of them belonging to the sub-family of the Crotalidæ or pit-vipers, so called from a deep pit lying between the nostril and the eye.*

The chief representatives of the pit vipers in the United States are the rattlesnakes. The banded rattlesnake (*Crotalus horridus*) is present throughout the whole territory from the Atlantic to the Rocky Mountains and far into Canada. Of the remaining six species of rattlesnakes we have to note the largest of all North American snakes—the diamond back (*Crotalus adamanteus*) of Florida and the South, and the swift prairie rattler (*Crotalus confluentus*) in the Mississippi Valley, and in the great Western basin; finally the smallest of all, the massasauga or ground-rattler. To the same sub-family belong the Southern water-snakes, the moccasin (*Ankistrodon piscivorus*)—animals so sluggish that they do not try to escape from an approaching man, and hence are not a little dreaded by the negroes working in the rice-fields; and finally, the beautiful copper head (*Ankistrodon contortrix*), which is not at all rare in the whole East—in fact, lives almost in the same expanse as the banded rattlesnake. In the Tropics almost all species grow to a larger size; thus the copper head is repeated in the larger *fer de lance* (*Bothrops lanceolatus*) of the West Indies; the rattlesnakes of Central America grow larger, as does

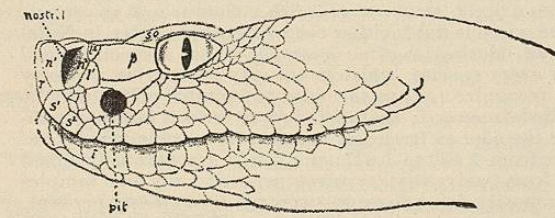


FIG. 3861.—Head of Rattlesnake.

the *Crotalus durissus*; and in the Orinoco Valley there lives the bushmaster of the Dutch settlers (*Lachesis mutus*), about as large as the Hamadryas of India.

*The object of this pit, which sinks into a cavity of the maxilla—as it were, a reversed maxillary sinus—is unknown. Leydig calls it the seat of a sixth sense, which means nothing else but that he has no explanation. At closer inspection I found the bottom of the pit not lined, but overspread by a thin membrane, the continuation of the external integument. Under this membrane, showing abundant ramifications of nerves, we find a cavity which opens by a duct at the anterior margin of the orbit. According to the careful investigations of Dr. Pollitzer, who followed it up by serial sections, the nerve connects with the auditory nerve. Pricking or any other irritation did not produce any reaction, nor did the destruction of one or both membranes have any effect upon the movements or the hearing of the snake. The hearing capacity of snakes is still a mooted subject with authorities in natural history.

Poison Apparatus.—Snakes are provided with numerous teeth—solid, pointed, recurved hooks, which serve rather to drag the prey down into the œsophagus than for purposes of attack and defence.

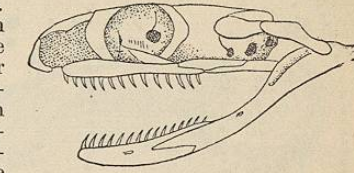


FIG. 3862.—Skull of Harmless Snake.

While the teeth stand in a single row along either branch of the mandibula, they seem to be almost indiscriminately scattered all over the maxilla and palate; nevertheless, two rows of larger maxillary with two nearly parallel rows of palatine teeth are readily distinguished. These are the functionary teeth which, after being shed,—a frequent occurrence,—are replaced by the numerous succedaneous teeth scattered throughout the mucous membrane of the palate. A poisonous snake exhibits the same arrangement of palatine teeth. Almost the entire row of maxillary teeth, however, is wanting, and its strength, as it were, is concentrated into one powerful tooth, the poison fang, which projects at the anterior end of the maxilla. It is true, we often find two or three teeth at this point; these are the functional fangs with one or two

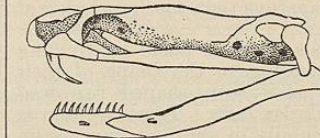


FIG. 3863.—Skull of Cobra (Elaps).

succedaneous ones which replace the primary functionary whenever lost by accident or shedding. Only the Elapidæ exhibit one or two ordinary conical teeth which are situated directly behind the grooved fang. The fangs are in all cases firmly inserted in the maxilla, immovable, almost erect, in one family, the Colubridæ venosæ (comprising the cobras and hydrophids); in the Viperidæ, however (including the true vipers and pit-vipers), the

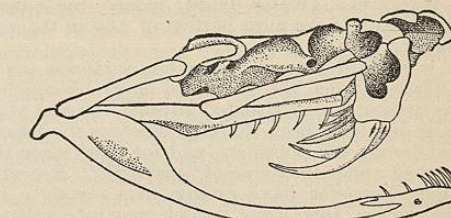


FIG. 3864.—Skull of Rattlesnake.

movable fangs are only erected for biting, and otherwise in the resting they are folded back toward the palate like the blade of a pocket-knife in a plica of mucous membrane. The maxilla of the Colubridæ venosæ is rather elongated and horizontal like that of the harmless snakes, but it is considerably shortened and placed almost vertically in the vipers. This short jaw bone, bearing at its lower end the firmly socketed fang, articulates at its upper end with the lachrymal bone, around which it rotates by the action of the pterygoid muscle.

Some writers are of the opinion that, by looking at a wound inflicted by a snake, the species of the animal can be ascertained, and from the foregoing description it can readily be understood how from the

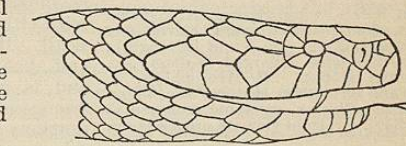


FIG. 3865.—Head of Cobra.