

Mystery of the Gila Monster's Poison

Exhaustive Scientific Investigation Shows That the Venom Is Deadly to Small Animals, Oozes From the Lower Jaw, Makes Cats Voiceless, Dogs Weep and Mice Bleed at the Eyes

IS the bite of the Gila monster certain death? Or is there no evidence whatever that anybody was ever killed by the poison of this rather mysterious lizard of the Arizona deserts?

Science is perplexed at the wicked reputation of the Gila monster which is not confirmed by the studies of scientific investigators.

Recently a magazine of wide circulation published a statement from Mr. David Ross, of Montana, asserting that while the monster probably was devoid of fangs and poison-glands, his bite was, nevertheless, deadly because of the infection sure to follow.

"The Gila has no proper digestive apparatus," explained Mr. Ross, "wherefore such food as is taken into his system putrefies and this causes blood-poisoning when one is so unfortunate as to become a victim of the lizard."

But scientific research by Professor Leo Loeb, of the Carnegie Institution, and Professor Charles T. Vorhies, of the University of Arizona, makes it plain that the Gila monster is equipped with a good outfit of teeth, and that they are always sharp and ample. The monster has a perfectly good stomach, which functions in a normal way. And besides this, the Gila monster has well-developed poison glands, which secrete a poison which is powerful enough to kill small animals.

In the study of this strange creature of the American desert, it was discovered that there are many things peculiar to the Gila monster which are not found in any other poisonous lizard. In all poisonous snakes the poison glands are located in the upper jaw. The teeth, which are called "poison fangs," which inject the venom, are situated in the front of the upper jaw. In some snakes these fangs are grooved at the back to carry the venom, but in the rattlesnakes and the most deadly snakes the fangs are hollow tubes, which convey the venom with deadly certainty to the extreme tip. A poison gland is situated some distance behind the fang on each side of the jaw. From the gland a duct runs to the base of the hollow fang.

When the snake opens its jaws to bite the fangs are erected and a muscle presses automatically on the poison gland, squeezing the venom into the fang. As the snake bites the poison pours down the hollow fang into the wound.

But the Gila monster's poison machinery is built on a totally different plan. His poison reservoirs are set in the lower jaw instead of the upper, as in the snakes. The poison oozes out in front of the teeth instead of coming from behind the tooth and above, as in the snake. The monster's poison finds its way up a groove in front of the first teeth, and this groove does not extend to the extreme tip, as in the snake's teeth. He does not inject poison as directly as the snake, but he bites tenaciously, like a bulldog, and some of the venom is sure to find its way into the wound.

Professor Leo Loeb, in collaboration with a large corps of other scientists, has conducted an exhaustive study into this subject. They have found out just how the venom is injected, how the biting parts of the monster are constructed, how much venom is needed to kill an animal, how long venom retains its virulence after being extracted, how immunity can be produced and many other interesting matters.

The outcome of the investigation is that the bite of the Gila monster is a thing to be feared and avoided, although it is far from being as deadly as the Indians and some frontiersmen believe. It is not as deadly as the bite of the rattlesnake.

It was found that nine cubic centimetres, which is about nine thimblefuls, of Gila monster venom would kill a medium-sized cat. There is no reason to believe that a Gila monster's bite could kill a man, but a sufficient number of them would undoubtedly do so. The bite is fatal to small animals like rats and guinea pigs but not usually to cats and dogs.

Strange to say, it was ascertained that microbes in the Gila monster's venom

sometimes increased its virulence, but this is far from giving full confirmation to the idea that the creature's poison consists solely of decomposing matter lying in its jaws.

Interest is given to this investigation by the fact that the Gila monster is, with the exception of the snakes, the only vertebrate that is known to secrete venom in its jaws.

There is a poison gland of large size on the outer side of each half of the lower jaw. Each gland is subdivided into three or four lobes in which the venom is produced. From each lobe runs an excretory canal which carries the venom to the base of the teeth.

"These small ducts," says Professor Loeb, "lead from the poison gland into a groove between the lower lip and the teeth of the lower jaw. When the animal bites the secretion gushes into this groove. The ducts open near the bases of the small pointed teeth; consequently the venom is ejected in the neighborhood of the several wounds made by the teeth, the grooves present on the outer side of the teeth carrying the venom into the wound; there is, however, no means by which the Gila monster can inject venom directly into an enemy, as does the rattlesnake."

One of the investigators states that the monster's venom is drawn to the tip of the tooth by capillarity—not forced through a tube to the tip, as in the rattlesnake.

In order to collect venom, the monster was irritated into biting in a piece of soft rubber. The venom was drawn off from the under side with a pipette. The monster usually bit quite fiercely and strenuously, and the venom gushed forth freely. When the animal had bitten several days in succession the venom became exhausted.

Injection of the drug pilocarpine caused a flow of three or four times the usual amount of venom. Lack of food caused a stoppage of the flow.

Boiling for ten minutes did not lessen the poisonous character of the venom. The scientists then used sterilized doses of venom, which eliminated the microbes found, which were often deadly enough to kill guinea pigs.

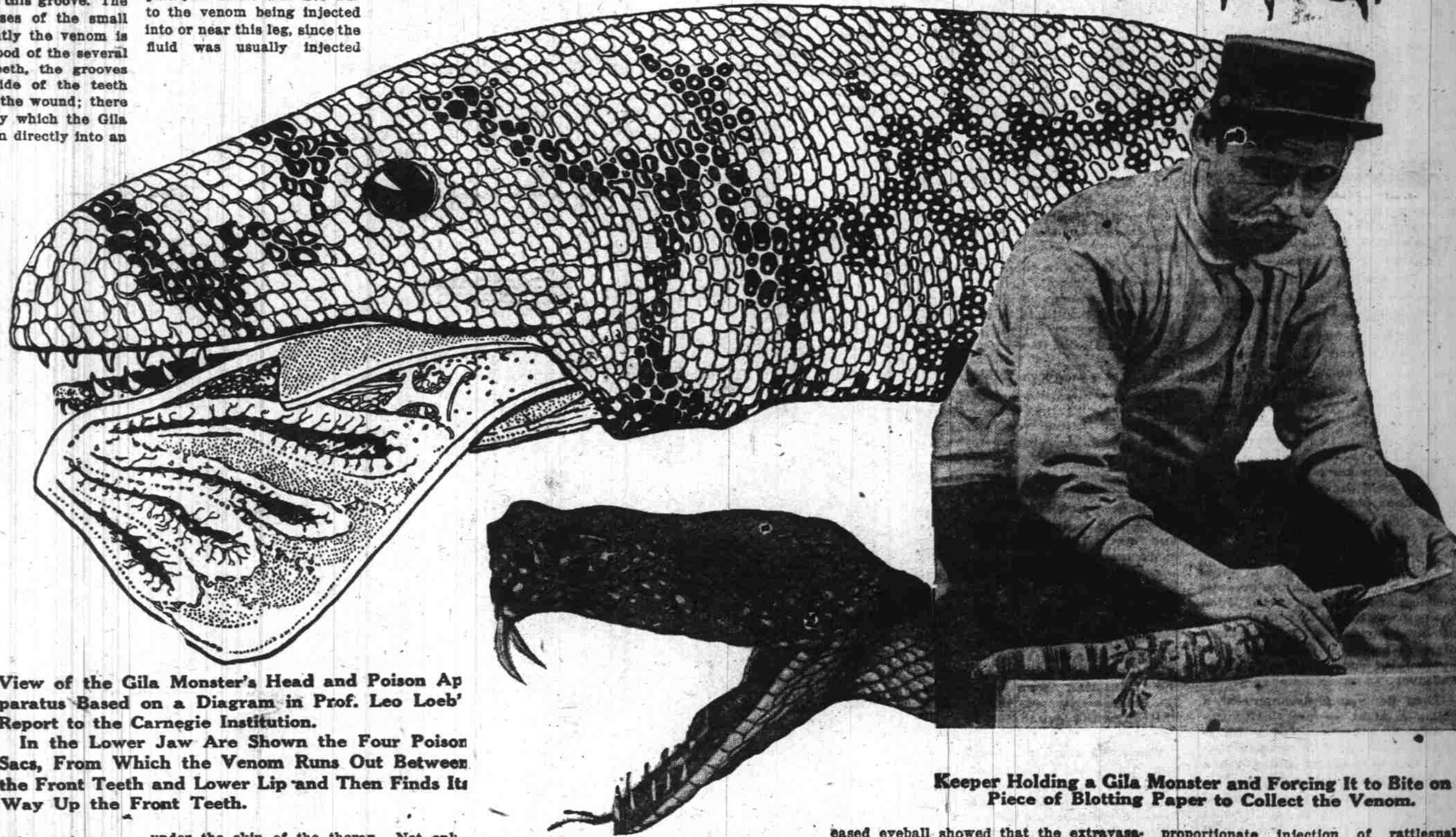
Professor Loeb gives an interesting description of the manner in which the venom produces death. He shows that death is primarily due to suffocation and not to stoppage of the heart's action as many people have believed.

"When a warm-blooded animal receives a lethal dose of heloderma (Gila monster) venom the first conspicuous effect is a disturbance of respiration. The breathing becomes quickened and the respirations are forced. After a time the respiration rate diminishes and the respirations grow shallow; finally they occur only at long intervals, until after a period of respiratory spasm they cease altogether."

"Meanwhile, other symptoms appear. The animal shows weakness and falls down, and frequently, though not as a rule, has acute attacks of convulsions. Reflex irritability becomes increased so that a slight sensory stimulus is able to inaugurate an exaggerated response which resembles the response obtained in an animal poisoned by strychnine. The hind legs

hang as if paralyzed and later the forelegs also appear paralyzed. If the skin of the leg be pinched, however, a response is elicited, and this response may still be obtained very shortly before the last respiration. The corneal reflex (dullness of the eyeball) may be obtained even later than the sensory skin-reflex."

"It was noted that when mice were injected subcutaneously with lethal quantities of venom, one hind leg became completely paralyzed and spastic at a time when complete paralysis was not present in the other hind leg. This unilateral spastic and paralytic effect was not due to the venom being injected into or near this leg, since the fluid was usually injected



View of the Gila Monster's Head and Poison Apparatus Based on a Diagram in Prof. Leo Loeb's Report to the Carnegie Institution.

In the Lower Jaw Are Shown the Four Poison Sacs, From Which the Venom Runs Out Between the Front Teeth and Lower Lip and Then Finds Its Way Up the Front Teeth.

under the skin of the thorax. Not only was the one leg spastic and paralyzed, but sensation was almost completely lost in this leg.

"Pinching the skin or pricking with a pin produced no response; occasionally, however, pressure (pinching the entire leg) would lead to a slight muscular response of the other leg. These symptoms are general for all the mammals which we have used, viz., dog, cat, guinea pig, rabbit, rat, and mouse; but some of them appear more conspicuously in certain species than in others. For instance, the apparent paralysis appeared most marked in rats and mice and the strychnine-like response to stimulus was most evident in guinea pigs. The respiratory disturbances were substantially the same in all animals, and it is to the interference with respiration that we must attribute the immediate cause of death in the warm-blooded animal."

The poison produces extraordinary effects on some animals. In cats a noticeable symptom caused by it is loss of voice. In dogs it causes a copious flow of saliva and tears.

The venom when injected into the bodies of mice produced a very peculiar effect on the eyes. This was most noticeable

Head of the Rattlesnake About to Strike, Showing the Poison Fangs, Which Are Hollow and Through Which the Poison Is Forced From the Gland Above.

when the quantity injected was only sufficient to cause death after many hours, and it also happened when the dose was not fatal. In about six hours after injection the eyeball began to protrude and became opaque.

As this condition progressed the white and the pupil of the eye turned red and gradually assumed a dark-red color. At times the blood which had collected in the tissue about the eyeball would break through and a more or less free oozing of blood about the eye would be the result.

In those cases in which the condition progressed only as far as opacity of the eye, the animal usually regained its sight after several days; but when the condition progressed to the stage of oozing of blood, the eyeball was lost, although the animal might otherwise recover.

A microscopic examination of the dis-

eased eyeball showed that the extravasation of blood occurred in the fatty tissue around the optic nerve.

There were marked changes in the alimentary canal of animals killed by the monster's poison. The serous layer of the stomach and intestines was much congested and the intestines were filled with fluid and gas.

Professor Loeb emphasizes the fact that the mechanical injury caused by the bite of a large and savage Gila monster might increase the effect of the venom.

"The animal has very powerful jaws," he writes, "and its bite would easily bruise a large area of flesh and skin. When the animal bites it clings tenaciously, and in endeavoring to extricate a wounded part the injury might easily be increased."

Rats were most resistant to the deadly effects of the venom in proportion to their weight. Cats, dogs, guinea pigs, rabbits and mice showed resistance to the poison in the order named.

A most interesting fact proved was that the monster enjoyed absolute immunity against its own venom, when injected into its body in large quantity. The reptile, however, showed no immunity against snake poison, and succumbed to the same

proportionate injection of rattlesnake venom that would kill a rat.

Repeated injections of non-fatal doses of the venom produced a certain immunity in rats and other animals.

Concerning the effect of the venom on man the scientists say:

"No death of a human being has come to our knowledge that can be attributed to the bite of a Gila monster. A bite from this animal is in man either followed by no symptoms at all or by a local swelling, perhaps extending to the shoulder if the bite affected the upper extremity."

In all the reports concerning the local effect of the bite of the heloderma in man, mention is made of the rapid appearance of swelling and hemorrhagic discoloration of the skin at the site of injury. After all it must be said that the investigation does not clear up all the mystery which has surrounded the Gila monster in the wild territory where it lives.

The scientists admit that it has real venom and that while as a rule there is little danger that the bite will kill a man it is certainly much more severe in some cases than others and it is impossible to say how dangerous it may be.

There is certainly something uncanny about a lizard that will bite savagely and hold on like a bulldog and the unscientific inhabitants of the desert have some excuse for regarding with terror.