# WHAT WOULD A RATTLESNAKE DO TO YOU—BITE OR STAB?

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ALTHOUGH for centuries rattlesnakes have been biting human beings with painful or even fatal results, their exact manner of doing so remains unknown. The reason is not far to seek: The snake is much too quick for the eye. We do know that a successful bite injects specialized saliva, commonly called venom, into the flesh of the victim.

It should be remarked parenthetically that the forked tongue of the snake has no part in the injection, which is accomplished solely by the fangs, two long, hollow teeth

ONE SNAKE—NOT THREE

Three positions in one strike of a western diamond-back rattlesnake. The flashes were set off by "electric eyes" and the duration of each exposure was about 1-2500th of a second. Photograph by J. B. Leviton.

in the front of the upper jaw. Well concealed by a fleshy sheath, the fangs lie against the roof of the mouth until erected for action. They can be moved either singly or together, and opening the mouth does not necessarily bring them into play, notwithstanding statements in many books.

The method of biting seems to be much the same among Old World vipers and American pit-vipers. Cobras and their relatives use a different method. These snakes, found chiefly in the Old World, do not strike at all (as, for example, the coral snakes) or do so by a simple forward and downward thrust of the elevated head, neck, and forebody, which are kept straight all the while. Seizure is often followed by a chewing movement of the jaws. In contrast, the rattlers and other vipers hold neck and forebody in an "S" curve until the strike is made by a lightning-quick straightening of the curved parts. Release is usually instantaneous.

### IMPORTANT IN TREATMENT

Is this problem of how a snake bites an important one? It is for several reasons. The most practical of these is the matter of telling whether a person has been bitten by a harmless or a venomous species. The treatment of snake-bite is at best drastic, at worst exceedingly dangerous; therefore its avoidance is truly desirable. Another reason, concerned with evolution, is of interest to the theorist: Have vipers, highly evolved among snakes, developed a new way of biting, or have they merely modified the old one of most snakes? Then there is a third reason, the satisfaction of plain, old-fashioned curiosity answering the perennial question, "How does it work?" This third reason should not be taken too lightly since it reflects the attitude responsible for the development of modern science and its technology. At least we like to talk a lot about "pure science" and how it has revolutionized our lives during the past century.

There are two theories as to how a rattlesnake bites. One might be called the "stab" theory and the other the "bite" theory. The former conceives of the act simply as a stab with the fangs alone. The result would be a pair of punctures, since the jaws and other teeth would not normally touch the victim. When you watch a snake strike, this is what it appears to do; so the origin of this conception is obvious. Just as obvious is the origin of the usual statement that the bite of a venomous snake can thus be recognized at once; there is no question that a harmless species leaves some six rows of punctures when it bites.

The other theory sees the act as a complex rather than a simple one. According to it, the snake actually seizes the object with the ordinary teeth of both jaws before or simultaneously with the embedding of the fangs, which are withdrawn before or just as the teeth release their grip. When you watch a strike it seems impossible that so much action could escape the eye, and this probably explains why the theory is not widely held. But a bitten clay model always has four rows of punctures as well as the two fang marks, a fact that cannot be laughed off no matter what the eye records. Therefore the facts seem to me to prove that the second theory is correct.

### BITE VERSUS STAB

A comparative examination of these two methods brings out some pertinent points. It is hard to see how a snake could gauge a stab-like thrust so accurately that the fangs would stop at the right split-second time and split-millimeter place for efficient ejection. The presence of fur or feathers greatly increases the difficulty. If the thrust went too far, the resistance of a large victim would cause injury to the snake and a small victim would be knocked away. Actually a large rattler can strike a relatively small animal without even causing it to lose balance. A stab would bring the tips of the fangs into play in advance of everything and might mean injury to their delicate tips, whereas a bite would get the fangs into action last and so conserve them. The bite would prevent the escape of the prey no matter how alert or quick it might be.

Broadly speaking there are three ways of finding out exactly how a rattler bites. You can watch one bite. If this method worked, the answer would have been known for centuries. You can experiment, let us say, with materials such as modeling clay, allowing the snake to bite cylinders and studying the marks left by the teeth. R. Marlin Perkins, director of Lincoln Park Zoo, and I have used this method, even going as far as to include a gelatin replica

THE VENOM IS INJECTED

Culmination of a strike by a diamond-back rattlesnake. Method and time of exposure as in other photograph by J. B. Leviton (light area on snake's body is result of second flash).

of a human hand. The results of our investigation, published in the *Archives of Surgery* (1944), apparently have not convinced everyone interested. Finally, you can use photography, a method that would seem to be final. Modern photography includes many techniques, but those used to date are still unconvincing: Two persons can look at the same photograph and come to opposite conclusions.

In March, 1950, *Natural History*, the magazine of the American Museum of Natural History, New York, published an article by Walker Van Riper entitled, "How a Rattlesnake Strikes." The article began with a sentence discouraging to me: "That the strike of the rattlesnake culminates in a stab rather than a bite is shown in the accompanying pictures." The article has three speed-photographs of stages of the strike of a rattler. The object is a balloon and the duration of exposure was on the order of one ten-thousandth of a second. Mr. Van Riper had rigged up an extremely clever device that made the snake photograph itself, the target and the snake being part of an electric circuit closed by the first contact of any part of the snake with the balloon. The disappearance of the balloon when punctured kept the snake from following through with a natural bite

and greatly detracted from the scientific value of the picture.

Again some light was shed on the problem, but plenty of loopholes for skeptics remained. I have learned through correspondence with Mr. Van Riper that he has made many other interesting photographs of strikes and has thus advanced our knowledge without, as far as I can tell, finally solving the problem. I believe that he might do so by placing a small conducting object within a rubber bulb not itself a conductor. The snake would be forced to compress the bulb before closing the circuit and thus produce a conclusive photograph.

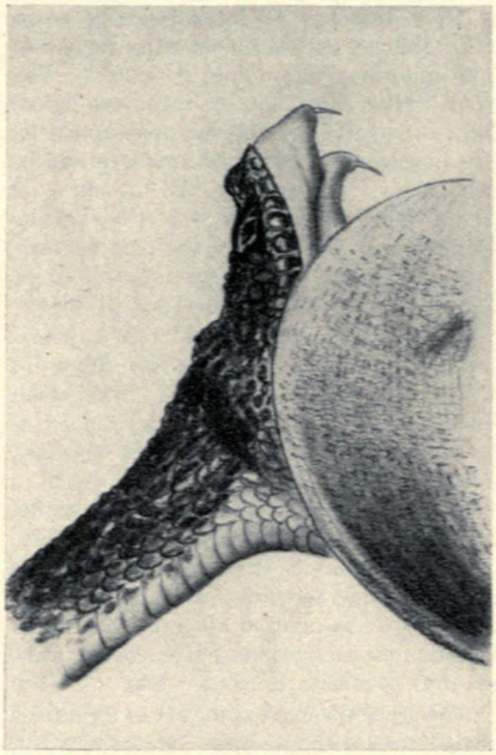
### OTHER EXPERIMENTS

A short article published by *Life* magazine on August 12, 1947, with exactly the same title as the one just discussed emphasizes another aspect of the problem: the value of the heat-sensitive facial pits of the rattlesnake in the aiming of the strike. Although this question of the use of the pit of pit-vipers (rattlesnakes, copperheads, water moccasins, and so on) is very interesting in itself, it is beyond our scope. *Life's* article includes two speed-photographs, one that supports the bite theory and one that might be taken as a boost to its opposite.

My first attempt to study the strike of a rattlesnake by photography was made about three years ago in Virginia at Mountain Lake Biological Station. I had the indispensable aid of Dr. A. M. Winchester, who is a biologist as well as a photographer. Dr. Winchester generously offered to handle his camera if I would provide and take entire charge of the snake. His plan was to set the camera up on a small table and depend on the quickness of his eye to catch the snake at the crucial instant with his high-speed flash. Fortunately, Mrs. Winchester watched us in a state of extreme nervousness, for the room was small and she had to be perilously near the snake. She had every appearance of being totally unaccustomed to such a relationship. Although Dr. Winchester believes it was the quickness of his eye that got the result, I am convinced the air-rending scream of his wife, uttered just before the strike, startled him into pressing the trigger at the proper split second.

The photograph has been copied in ink because the artist was able to bring out certain important details. The copy is reproduced here. The wad of cotton wrapped in gauze is clearly seen in the jaws of the snake, a fact that certainly suggests a bite rather than a stab. Any skeptic can point out that such a picture does not offer final proof because the fangs are not shown imbedded in the wad. Nevertheless, the Winchesters should be congratulated on a splendid bit of co-operation.

In the autumn of 1950, Lt. Jay B. Leviton next offered to help with a roomful of equipment that included photo-electric cells. Two rattlers were borrowed from Lincoln Park Zoo and Lt. Leviton arranged several "electric eyes" so that the strike of a snake would interrupt their beams and set off lights to expose the film. A snake was confined to a big carton with a glass window in one side for passage of the beams. The equipment seemed to be about as unpredictable as the snake; so two days of hard



THIS COULD HAVE MEANT DEATH

**Banded rattlesnake striking a wad of cotton wrapped in cloth. Presumably the fangs are about to sink into the wad, although it is possible that they are being withdrawn. From photograph by A. M. Winchester.**

work and the aid of several persons were required. When one snake decided that the game was not worth the candle, to it, at least, and refused to strike, it was persuaded to change its mind by a slight electric shock. The great difficulty of preventing the snake from missing a beam on the forward motion but intercepting it on the return was never overcome.

Of the many shots made, only a few were revealing. One of these has been printed in color in *Collier's* magazine (March 31, 1951) and two are shown with this article. The results of this last effort add evidence in support of the bite theory but still do not give us a series of pictures of a complete strike. Perhaps nothing but moving pictures will do this. The difficulty with such a method is the great amount of heat generated by the very powerful lights required for this sort of high-speed cinematography. Such heat would be too much for even a snake.

This account has its moral: The apparently simple problems of life and of science often turn out to be the hardest. If the moving pictures settle the strike dilemma, the stumbling blocks that were surmounted will be forgotten and few will recall how much time and effort were spent in getting a solution

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*Memo for Museum visitors: Rattlesnakes are well represented among the exhibits in Albert W. Harris Hall (Hall 18).*

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## FIFTY YEARS AGO AT THE MUSEUM

Compiled by MARGARET J. BAUER

From the *Annual Report of the Director* for the year 1902:

"*The Library.*—It was mentioned in the last Report that several books and pamphlets were missing. Careful search has resulted in the restoration of all those that were missing with the exception of one book and eight pamphlets. This is a satisfactory showing when it was considered that this was the first inventory taken since the opening of the library. The most important work done during the year, aside from the regular routine duties, was on the shelf list, subject and author catalogues. Over 2,400 new cards have been written . . ." [This may be compared to the 18,777 new cards written for 1951.]

"*Departmental Inventorying, Cataloguing and Labeling.*—It is highly gratifying to be able to report that the Department of Ornithology has completed the inventory of the study collection which approximates 27,000 specimens. A card catalogue has been prepared showing the number of specimens in each species, from whence obtained, the sex, month and locality in which they were taken and the case and tray in which they may be found." [The Division of Birds estimates the number of study specimens at the end of 1951 as about 220,000.]

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### Audubon Society to Present Sunday Afternoon Lecture

Fourth of the Illinois Audubon Society's current series of lectures in the James Simpson Theatre of the Museum will be given on Sunday afternoon, March 16, at 2:30 P.M. Olin Sewall Pettingill, noted ornithologist of Carleton College, will present "Athabaska Sojourn," illustrated with color motion-pictures. The lecture is free and the public is invited. Members of the Museum or of the Audubon Society are entitled to seats in the reserved section of the theatre upon presentation of their membership cards to the ushers. The final lecture of the season will be given in April.

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Free movies for children—*see page 7.*