

on the back of the hand to the sound of the metronome. After a few times it was not necessary to drop the ball. The person would feel the touch by pure hallucination.

Similar experiments were made on taste. Of six bottles two contained pure water and the other four a series of solutions of pure cane sugar—the first one-half per cent., the second ten per cent, the third two per cent. and the fourth four per cent. sugar, according to weight. A block was placed in front of them so that the observer could not see them, although he was aware that they stood near him, because he saw them when he received his instructions. It was required of him to tell how weak a solution of sugar he could positively detect.

The experimenter took a glass dropper and deposited drops on his tongue, drawing first from the two water bottles, and then from the sugar solutions, in order of increasing strength. The sugar in the solutions was detected in the first trial. Proposing to repeat the test, the experimenter proceeded as before, but drew from the first water bottle every time. The result was that when the pure water had been tasted from two to ten times the observer almost without exception thought he detected sugar.

A test on olfactory hallucinations was conducted similarly, with the result that about three-fourths of the persons experimented upon perceived the smell of oil of cloves from a pure water bottle.

In another set of experiments the subject was told to walk slowly forward till he could detect a spot within a white ring. As soon as he did so, he read off the distance on a tape measure at his side. The spot was a small blue bead. The experiment was repeated a number of times. Thereafter the bead was removed, but the suggestion of having previously traversed a certain distance was sufficient to produce a hallucination of the bead.

The investigation was carried out in various problems of hallucination and suggestion; in each problem the work was kept up till the appropriate method of producing hallucinations was found. I cannot here go into the details of Dr. Seashore's experiments, but the fundamental idea is, I hope, clear.

The surrounding and internal conditions *P* were of a given character in the first experiment, namely, definite place, apparatus, expectation, etc. The sensation *S* resulted from *R*. Each repetition of the experiment produced a change in the attitude of expectation; *P* was consequently changing. Finally, the production of a given value of *P* was sufficient to entirely replace *R* in producing the sensation.

It is to be clearly understood that the persons experimented upon were perfectly sane and normal. They were friends or students, generally in total ignorance of the subject, who supposed themselves to be undergoing some tests for sensation. One case was found, however, of a suspicious observer who expected deception and who declared that he had waited every time till he was sure of the sensations; the results were just as hallucinatory as usual.

The value of the method and the experiments lies mainly, I think, 1, in pointing out a method of determining the portion of a sensation due to the suggestion of circumstances rather than to the stimulus; 2, in application to mental pathology; 3, in beginning a scientific treatment of hypnotism and suggestion. E. W. SCRIPTURE.

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LIFE HABITS OF *PHRYNOSOMA*.

IN a recent number of the 'Zoölogischen Anzeiger' Prof. Charles L. Edwards, of the University of Cincinnati, gives the following interesting notes upon the habits of the horned lizard of Texas:

While living in Austin, Texas, from

May, 1892, to July, 1894, I had abundant opportunity of verifying previous observations upon the life of *Phrynosoma*, and of adding some notes that, so far as I can find, have not been given before this paper.

Phrynosoma cornutum Harlan, in Texan parlance the 'horny frog,' is easily approached under the natural conditions of its habitat, and with a plentiful supply of live flies I have had no difficulty in keeping from fifty to one hundred of them confined in vivaria for many weeks at a time. Six months of the hot, dry, Texas summer, with long days under the glaring sun, and the ground covered with a layer of fine, limestone dust, gives this species of *Phrynosoma* an ideal environment.

A review of the principal points concerning the biology of this familiar genus as brought out in the literature appended, and confirmed by myself, may be first presented. Not to go back to the original systematic descriptions of Wiegmann, Girard, Harlan, Hallowell, Bell, Gray and Blainville, or to mention the synonymy from the various catalogues of reptiles, the taxonomic needs of this paper may be served by reference to Gentry's review of the genus *Phrynosoma*.

This cunning little Iguanid is harmless, never biting its captor, and soon becoming so tame that it may be trained to work in harness pulling a toy wagon, or to eat insects from one's hand. When gently rubbed it puffs itself out, but when in fear it becomes flattened to the ground. *Phrynosoma* chiefly enjoys a dust heap, where with tail and feet flirting the warm calcareous powder over its body, or with alternate sawing motions of its sides, it quickly buries all of itself save the head, and sometimes even this part, in the dirt. While built after an awkward pattern for a lizard, and generally moving slowly, yet it can, when alarmed, run rapidly. It is very clever at 'playing possum' and, aided by

its protective coloring, often escapes from an enemy.

The food of *Phrynosoma* always consists of live animals—spiders, flies and especially ants. In Texas the agricultural ant (*Pogonomyrmex barbatus*) furnishes almost exclusively the diet of the horned frog. If, however, a quantity of ants are placed with the latter in a vivarium, they soon find thin places on the apparently tough, horny armor of their enemies, and by stinging they drive the horned frogs crazy and frequently to death. While having an abundant supply of water in the vivarium, I have never seen these lizards drink, although they are said to lap up drops of dew when in natural environment. The molting and the curious habit of ejecting blood from the eyes are phenomena often observed. The statement of Böttger that a voice is absent in *Phrynosoma* must be modified, for under certain conditions of excitement it utters a sharp squeak.

This lizard has always been given as viviparous. On the contrary, it builds a nest and lays eggs therein. The only time I observed the nest-building was on June 25, 1894. The location was on a stony clay bank at the side of an Austin street. When first seen, 6 p. m., the female was excavating a tunnel at an angle of about 75° to the surface of the ground, and wide and high enough to comfortably work in. She dug with her front feet, pushing back the loose earth and bits of stone with her hind feet until this débris was quite clear of the entrance. So absorbed was she in her work that my presence did not cause any alarm. The next morning I found the tunnel neatly filled again and the lizard gone.

After carefully removing the replaced débris, the tunnel was found to be seven inches deep. At the bottom, forming an L with this tunnel, was a narrow entrance leading into a chamber three and one-half inches in diameter and two inches high,

which was quite round, except for two projecting stones. Here perfectly packed in with loose earth were twenty-five eggs, while again in a hole one and one-half inches deep, at the bottom of the tunnel, were fifteen more. Since the embryos of one of these sets were at a considerably more advanced stage, this female must have taken advantage of the excavation of another. At the time of ovulation the embryo, while at an advanced stage, is still not ready to hatch by probably some days or even weeks. This stage will be considered in detail in a later paper on the embryology of *Phrynosoma*.

Authors give the period of gestation as high as one hundred days in females kept in confinement, but while I have not complete data from coition to ovulation I believe that under natural conditions the time of carrying the eggs is much shorter. A female which had laid eggs in captivity in August, 1864, became very restless after the eggs were taken away. She tried constantly for two or three days to get out of the vivarium at the place where the wire screen had been raised to remove the eggs. Lockwood gives an instance of this maternal anxiety where a female attempts to distract the attention of an observer from her young.

LORD KELVIN ON THE METRIC SYSTEM.

THE chief objection urged in the recent debates in Congress against the adoption of the metric system in the United States was the fact that Great Britain, with whom our commerce is the largest, does not use the system. It seems, however, certain that the adoption of the system by both nations is only a matter of time, and as the question is now being considered, both by the British Parliament and our Congress, it would be highly desirable if an International Commission could be arranged so that unity of action could be secured by the two nations.

The London *Times*, whose influence has been said to be as great as that of Parliament, has recently given much space to discussion of the metric system. Of the large number of letters addressed to the editor we quote the following from Lord Kelvin as of special interest:

"In your very interesting leading article on the metric system in *The Times* of yesterday you treat, in what seems to me a thoroughly clear and fair manner, the question at issue in respect to the demand for legislation on the subject.

"While not ignoring the preference or merchants and manufacturers and scientific men for the metric system, you rightly give prominence to consideration for the convenience of the poorer classes, 'who have no great power to make their voices heard—at least in such discussions as these.' If it were true that the adoption of the metric system would be hurtful, or even seriously inconvenient, to them, that would be a strong reason against its being adopted in England. But in this respect we have, happily, a very large experience, and I believe it is quite certain that among the Germans, Italians, Portuguese, and other European peoples who have had the practical wisdom to follow the French in the metric system, all classes are thoroughly contented with it, and find it much more convenient for every-day use than the systems which they abandoned in adopting it.

"You rightly brush aside the duodecimal system as 'an ingenious mathematical exercise, but one whose figures must be read back into a decimal system before they can convey any meaning.' It seems to me, however, that you are quite right in maintaining that in ordinary every-day reckonings the shopkeeper and his customers must have halves and quarters; but I cannot go so far with you as to say 'halves, quarters and thirds.' Was any poor child ever sent to buy a third of a pound of tea? Did any