and substantial, which has an independent existence and, whatever it consists of, depends upon nothing else. Whence we conclude, that any given vis viva is of determinate quantity of which none can disappear except it reappear in the effect produced. Hence it follows at once, that vis viva is always preserved, and so perfectly that what inhered in one or many bodies before action is now, after action, necessarily found in another or in several others excepting what remained in the first system. And this we call the *conservationem* virium vivarum.

Compare this with the modern statement: In any system the variation of energy is equal to the external work done by the system less the work done by external forces upon the system.

John Bernoulli was under no misapprehension as to the importance of the principles he had stated. He says in substance: Whether bodies are regarded as communicating motion to one another or whether one considers the various modifications of the motion of one and the same body depending on its own force (where nothing can vanish without an equivalent effect), "pro fundamento et principio universali poni debet conservatio virium vivarum, hoc est illius *facultatis agendi*."

GEORGE F. BECKER

SERPENT DREAD IN THE PRIMATE FAMILY

APROPOS of the discussion which has been appearing in SCIENCE relative to fear of snakes, I am impelled to observe how unfamiliar some writers on an evolutionary topic appear to be with what Darwin, himself, the fountain head of evolution, may have had to say on the subject.

Darwin, in his "Descent of Man," second edition, Appleton, 1892, page 72, calls attention to this primal instinct in man and monkeys, and gives an account of how his experiments with monkeys in the zoological gardens confirmed the previous experiments of Brehm, in establishing its presence in the whole primate family.

While not agreeing with Mr. Dabney in his conclusions that India is pointed to as the place where a snake-fearing creature would most likely originate because of the abundance of poisonous snakes there (serpents of the constrictor class would be even more of a menace to those "long tailed, pointed eared ancestors" of ours if Huxley's further deduction be accepted that "they were probably arboreal in their habits"), it seems to me that the evidence is overwhelming in favor of "serpent dread" being a vestigial instinct—exceptions to its presence in persons like Mr. McClellan to the contrary notwithstanding.

In my own case, though for years a teacher of zoology, and accustomed to the handling of snakes, I confess to never having been able to entirely overcome a certain shuddering dread of them, and am convinced that my repugnance is not due to early teaching on the subject. I am sure that this is the normal attitude of the members of the human family, and the rest of the primates as well, toward snakes.

That very young children may not have as yet developed in them this fear is no argument against its being an inherited instinct.

There are many such instincts that do not appear until the period in life when the exercise of them would operate most strongly for the protection of the species.

It is a well-known fact that the young of the primates are quite helpless for a relatively long period, and during this stage of their existence are carried about and cared for exclusively by the mother. There would ordinarily be no protective service performed by the exercise of "serpent dread" in the young during this period.

Nor is it a matter of much weight against the instinctive character of the fear that it is not always very discriminating zoologically. It is enough that there is some suggestive resemblance or association in the object which arouses it.

A shadow made by an old hat shied over a flock of young chickens will be just as effective in sending them scurrying to cover, as that of the hawk itself, and will evoke from the mother hen just as surely the characteristic warning cry. Also a crooked stick met with

785) in 1864 defined the potential of one or more forces as "leur pouvoir moteur total." B. Peirce in his great work on analytical mechanics, 1865, always uses "power" instead of "energy."

in the woodland path, or a rustle in the dry grass beside it, will startle a person fully as much as the sight of the snake itself seen a short time before.

As very strong evidence in favor of the universality of the serpent dread instinct is the solution it affords to the familiar serpent nature-myth in Genesis. Scholars are pretty well agreed that the true interpretation of primitive legends lies in the attempts of primitive peoples by them to explain the origin of fundamental institutions, universal customs, innate impulses.

As Gunkle in his "Legends of Genesis" observes:

> They [the legends] are attempts to answer such questions as, Whence came the heavens and the earth? Whence the language of man? Why the love of the sexes? Why does the serpent go on his belly, and why does the "seed of woman" continue so relentlessly to "bruise its head"?

Such a legend speaks eloquently of the universality in the human family of the fear and hatred of snakes, and of the instinctive character of these emotions.

ARTHUR M. MILLER

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TO THE EDITOR OF SCIENCE: The disputants regarding our instinctive fear of snakes may "all be right and all be wrong." It is not necessary that the whole human race should have the same instinct. The feeling of repulsion for snakes and worms, and that for many-legged things such as spiders and centipedes, are rarely felt by the same person. I have the latter to an uncontrollable degree, and I do not believe that I learned it from any one. I can not remember that either of my parents felt about spiders as I do. I do not feel about snakes and worms in the same way at all. It is therefore possible that one person may have a congenital repulsion for snakes and that another may have been free from such a repulsion from childhood.

As for establishing a connection between such facts and "the cradle of the human race," I leave that to the mythical philologist who derived Middletown from Moses "by dropping the 'oses' and adding 'iddletown.'"

ARTHUR E. BOSTWICK

SCIENTIFIC BOOKS

Laboratory Manual for the Detection of Poisons and Powerful Drugs. By WILHELM AUTENRIETH. Translated by WILLIAM H. WARREN. Second American edition from the Fourth German edition. 8°. P. Blakiston's Son and Co., Philadelphia, 1915. Pp. xv + 320; Figs. 25. $2.00.

The fourth German edition of this well-known laboratory text-book has been sufficiently revised, enlarged and extended in scope to warrant the term "manual" as it appears upon the title page. Former editions were so incomplete in every subject covered as to lead the reader to wonder whether the title was not a misleading one.

In this last edition the author has presented his subject in the same order, chapter by chapter, as in former editions. The book being strictly a laboratory guide, the chapters dealing with the various noxious substances discussed, have naturally been arranged with reference to the sequence of steps taken by the chemist in his search for the presence of a poison.

Chapter I. treats of poisons which may be volatilized in a current of steam and thus separated from organic material. Chapter II. discusses the Stas-Otto method for the extraction of vegetable poisons and powerful drugs and describes the special reactions by which these substances may be identified. Chapter III. treats of the inorganic (metallic) poisons. Chapter IV. discusses corrosives, several poisonous anhydrides of organic acids; a number of powerful synthetic drugs; toxalbumins and matters of importance to physician and analyst. Under Chapter V. are grouped a selection of special methods for the qualitative detection and quantitative determination of arsenic, phosphorus, a number of important alkaloids, and salicylic acid. In this chapter is also given a brief outline of Mauch's very ingenious chloral hydrate method for the separation and identification of the active principles of plants. Chapter VI. is devoted to crude drug assay and evaluation according to the official methods of the German pharmacopœia. Chapter VII. discusses the forensic chemistry of blood and blood stains.