

breeder in cotton investigations at the Texas Station, and has been succeeded by Rupert L. Stewart.

DR. F. J. E. WOODBRIDGE, Johnsonian professor of philosophy in Columbia University and dean of the graduate faculties, has been appointed lecturer in philosophy on the Mills Foundation in the University of California, from January 31 to June 30, 1917.

DR. WILLIAM F. ALLEN, instructor in anatomy, University of Minnesota, has accepted a position as professor of anatomy in the medical department of the University of Oregon.

DR. ALFRED L. GRAY, professor of physiology in the University of Virginia, has been transferred to the chair of roentgenology and has been succeeded by Dr. Charles H. Lewis.

PROFESSOR W. H. TWENHOFEL, of the University of Kansas, has been appointed associate professor of geology at the University of Wisconsin, to succeed Professor Eliot Blackwelder.

FRANK H. PROBERT, a graduate of the Royal School of Mines, London, and for the past twenty years engaged in consulting mining engineering practise, has been appointed professor of mining in the University of California, as successor to the late Professor Samuel Benedict Christy.

DR. JEAN FELIX PICCARD, of the University of Lausanne, Switzerland, has accepted an invitation of the University of Chicago to spend next year at the university as assistant professor of organic chemistry. Dr. Piccard, who has worked with Professor Willstaetter and been research assistant of Professor v. Baeyer, will devote himself exclusively to graduate work and to directing research in organic chemistry.

DISCUSSION AND CORRESPONDENCE

CONSERVATIO VIRIUM VIVARUM

TO THE EDITOR OF SCIENCE: The term energy was introduced by Thomas Young in 1807 to denote MV^2 , or twice what is now known as kinetic energy. Rankine extended its use to cover potential and total energy. But though the name was new the concept was not. This was known long before under the term *facultas*

agendi, which is in some respects more appropriate, for if our word energy is to be translated into Greek it must be rendered *δύναμις* not *ενέργεια*.

The following extract from an old paper contains a part of the early history of the idea of energy.¹

There seems to be a general impression that the natural philosophers of the last century, when they used the quantities now known as kinetic, potential and total energy at all, regarded them from a purely algebraical or geometrical point of view, failing to perceive their great physical significance. In this respect these physicists seem to have been underrated: as some passages from the first John Bernoulli, Euler's teacher and D. Bernoulli's father, will show. In a paper on the true conception of living forces² he generalizes the idea of *vis viva* and defines it as equivalent to capacity for doing work, or *facultas agendi*, which is simply a Latin equivalent of the Greek energy [as Young understood it]. In Section I. of this paper he says (translated):

Vis viva does not consist in the actual exertion, but in the capacity for doing work; for it subsists even when it does no work nor has any object whereon it could act; so for example a strained spring, or again a body in motion, has in itself the capacity of doing work, so that if nothing external to itself comes in its way upon which it may exert itself, and so long as there is no object present with which it can come in contact, it infallibly retains it all undiminished by time, and does not do the work which it would be capable of doing if it had the opportunity.

This seems a clear and even a vivid statement of the law:

When a system is subjected to no external forces, its energy remains constant.

In Section III. he takes a further step.

Vis viva (which would be more aptly named *facultas agendi*, *gallieé le pouvoir*)³ is something real

¹ *Amer. Jour. Sci.*, Vol. 45, 1893, p. 97. See also *idem.*, Vol. 46, 1893, p. 151.

² "De vera notione virium vivarum," *Acta Eruditorum*, Leipzig, 1735, p. 210.

³ The term power is now rarely used for energy, but it is scarcely a generation since this meaning was common enough. Saint-Venant (*op. cit.*, p.

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 inhaled 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

APROPÓS 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 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."

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