

Edw.), *Greya*, Busck (not *Graya*, Guenth.), *Guerinius*, Ashmead (not *Guerinia*, Bate), *Imeria*, Cameron (not *Imera*, Pascoe), *Ivela*, Swinhoe (not *Ivella*, Lubbock), *Nisia*, Melichar (not *Nisa*, Casey), *Occia*, Tosquinet (not *Occa*, Jord. & Everm.), *Reuterella*, Enderlein (not *Reuteriella*, Signoret).

A few generic and subgeneric names have been omitted; I notice the following: *Crewella* (*An. Mag. N. Hist.*, XII., 202), *Martinella* (*An. Mag. N. Hist.*, XII., 450), *Gueriniella* (Fernald, 'Cat. Coccidæ,' 331), *Kuwanina* (*t. c.*, 32), *Kuwanina* (*t. c.*, 121).

It is worth while to say something about the importation of the *Record*. It used to come promptly by mail, but the 1902 volume was just overweight. It was mailed, nevertheless, by the Zoological Society, with the understanding that it would be delivered as before. The British postal authorities took it out of the mails, and turned it over to the American Express Company, with whom they have a contract for the carriage of parcels too heavy for the transatlantic mails. The volume arrived in New York, but was not forwarded until considerable delay had occurred and I had been obliged to pay extra express charges and a heavy import tax. This year, by using lighter paper, I believe, the book was kept just within the specified weight, and it came promptly by mail, with no trouble and no customs dues. It is an outrage to charge duty on a book of this sort, published at a loss, and one would like to know why the charge was made in one case when it was not found necessary in the other.

It is proper to add, that whereas the *Zoological Record* was formerly to be had only as a complete volume, the several subjects may now be purchased separately at moderate prices.

T. D. A. COCKERELL.

Les Lois Naturelles: Réflexions d'un Biologiste sur les Sciences. By F. LE DANTEC. Paris, F. Alcan. 1904. Pp. xvi + 308.

M. Le Dantec has two motives in view: to determine the meaning of the words 'natural law,' and, on the basis of this determination, to define or to revise the main scientific conceptions in use to-day. The meaning of

'natural law' is investigated from a standpoint due to the teachings of biology, with a resulting definition which resembles those of Pearson, Mach, Ostwald, Poincaré and others, and is in substantial accord with the general 'humanistic' philosophy. The author then discusses the meaning of such conceptions as straight line, plane, continuum, mass, force, entropy, absolute zero, inertia, conservation of energy, atom, ether, living matter, thought. With so broad a field to cover, the treatment of each conception must needs be brief; but it is at least direct, systematic and clear.

In the introduction (16 pp.) the general considerations are laid down which will determine the author's definition of natural law. Of the external world we know only the ways in which it affects us, the relations it bears to us. These ways or relations come to us through several gateways—namely, the senses—which the author calls the 'sensorial cantons' (sight, touch, temperature, smell, taste, etc.). Of these there are, we are told, many more than physiology admits, though we are not given a complete list of them. They are each irreducible, inexpressible in terms of any other sense. What we see has form and color, but is not loud nor hot; temperature has no color nor sweetness, tastes are not square nor round. What is revealed to one sense can not properly be described in terms of any other sense. Now science is first of all a record of these quite different classes of sense-impressions.

The subject is continued in Book I., 'The Sensorial Cantons and Monism.' Man is not only passive toward the external world. He reacts upon his environment; and in order to do so he makes hypotheses about the constitution of that environment. In the early stages of man's development these are quite as likely to be useless as not, but natural selection preserves the useful and weeds out the useless, till in the course of ages the former become instinctive. Thus our instinctive belief that arithmetic is infallibly correct, or that unsupported bodies fall, is the 'hereditary résumé of ancestral experience' (p. 3). We regard it as an *a priori* truth because the belief has been so long perpetuated by natural selection.

This is the meaning of natural law, and the extent of its validity and the validity of all our reasoning must be judged in the light of this meaning. Our elementary laws of motion can not be assumed to hold of bodies too small for observation, or too remote in space. Science is not absolute in any sense (p. 8). But not only do we react on our environment in accord with many acquired beliefs; we seek economy in our reactions and our beliefs. We find it easier to indicate what will happen in the various sensorial cantons by using the terms of one sense, namely, sight. Because sight gives greater precision and covers a wider field of phenomena than any other sense, we find it most convenient to frame our hypotheses in regard to the constitution of the other cantons in terms of what sight reveals—namely, the motion of bodies. Thus we describe sound, heat, light as wave-motion. It is the hope of covering all the phenomena of the other cantons by the terminology of sight that leads to monism. Yet what is vouchsafed by the various senses remains really disparate, *sui generis* in each canton.

In Book II. we consider the sciences of the 'optical canton'—more familiarly known as the exact sciences. The language of mathematics is the language of vision. It is based directly on sense-impressions. There is no 'free creation by the mind' of the fundamental mathematical conceptions. The straight line is given in the thread suspending a weight, the plane in the surface of a liquid, the continuum in any body in which we see no gaps. These sense-impressions may turn out later to be illusions, but are none the less really given. Arithmetic, algebra and geometry detail the properties of such data omitting the element of time; kinematics and mechanics include the latter. The infinite and infinitesimal are not picturable, therefore they are figures of speech. Nor could we tell what laws they would obey, since logic is based on what we have experienced, and can not be assumed to hold of regions beyond our senses. Just so, atoms may not obey the laws which larger bodies obey, and the ether may not be impenetrable.

How do we come to use other conceptions

here besides those of space and motion? Because these are found insufficient for the prediction of the behavior of bodies. Thus we find it convenient to speak of mass, which the author defines as 'that coefficient found in one and the same body, in all the systems of which it forms a part' (p. 87). Velocity is that which corresponds to the intensity of our sensation of motion (p. 94). Force is not a cause of motion; for such a conception imports the muscular sense into the visual field, which is not allowed. Quantity does not apply beyond the visual field. Incidentally, Fechner's law is declared impossible, since it attributes quantity to other cantons besides the visual. What we really measure is not force as an existing quantity of something, but only $m \times a$, a numerical product. That force is a fiction is shown also when we remember that in statics any one force may be replaced by an infinity of others equivalent to it. Since all these can not be really present, there is no reason for saying any one is more real than the rest. The law of action and reaction is the experimental fact that in an isolated system the algebraic sum of the partial energies is *nil*. The conservation of mass has become so well known as to be almost an *a priori* law.

In Book III., 'The Other Cantons,' the discussion is confined to sound and heat, principally to heat. Temperature can be studied scientifically because it alters the shape of bodies. The conservation of heat is simply a definition of a complete system: a complete system is one in which the algebraic sum of the quantities of heat gained by the parts is *nil* (p. 148). 'Source of heat' and 'absolute zero,' like force, are fictions. Equivalence of heat and mechanical energy does not mean preservation of a permanent something; it is only a useful device for correlating heat with visual phenomena. The conservation of energy is only such a correlation made general; it is an empirical truth at most, and even if radium creates energy *de novo* it need not disturb us (pp. 207-9).

Book IV., 'Explanations,' resumes the general position of the author in regard to the meaning of scientific law. Atomic models do

not explain; they simply enable us to take points of view fertile for discovery of new properties. Thus atomism is to be preferred to energetics, the latter, though nearer to fact and less liable to dangerous hypotheses, does not stimulate the mind to discovery. Better danger than the precision of sterility! (p. 229).

Biology (Book V., 'The Place of Biology among the Sciences') the author would regard as underlying zoology, botany, physiology, etc., even as theoretical mechanics underlies physics. As theoretical mechanics defines the motion of bodies, biology defines life, leaving to the detailed sciences the description of different forms of life. Life itself is defined as a localized process, like the flame, not a specific substance or energy, but a locus of points where certain reactions are accomplished. The characteristic property of life is assimilation (p. 288). Thought and other psychoses are described as a special sensorial canton 'le canton intime.'

The general position of the author, that sense-impressions are all we know, and that the sources of heat, light, sound, etc., are not *in themselves* describable in visual terms, is an extreme one and is open to all the objections which are being urged, rightly or wrongly, against 'humanism.' But further, it is quite dogmatic to say that quantity does not apply beyond the visual field, or that mathematics is the language of vision; what is needed is a more exhaustive account of the conceptions involved. It is also to be regretted that M. Le Dantec, as a biologist, has not made use of the discoveries of Mendel, De Vries and others, which inevitably suggest that the fundamental law of science is not mere determinism, as he says (p. 213), but chance (in the mathematical sense) as well. Nevertheless, the attempt of M. Le Dantec to give clear and concise definition of the principal scientific conceptions should be welcomed by scientists and philosophers alike, and should lead to further work in the same direction.

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SOCIETIES AND ACADEMIES.

THE NEW YORK SECTION OF THE AMERICAN CHEMICAL SOCIETY.

THE section held its fifth regular meeting of the season at the Chemists' Club, Friday evening, February 10.

The president of the American Chemical Society, Dr. Francis P. Venable, presented to Professor Charles Lathrop Parsons, of the New Hampshire College, Durham, N. H., the Nichols medal, which was awarded to him for his paper entitled 'A Revision of the Atomic Weight of Beryllium,' read before the section in May, 1904. Mr. W. H. Nichols, the donor of the medal, was also present and made a few appropriate remarks.

The regular program of the evening was then taken up and the following papers presented:

The Accumulation and Utilization of Atmospheric Nitrogen in the Soil: E. B. VOORHEES and J. G. LIPMAN.

The experiments planned included, first, a study of the question of the sources of nitrogen to leguminous plants on soils to which no nitrogen had been applied, and to which nitrogen in various forms and amounts had been applied; second, the availability of cow pea nitrogen, as compared with the different forms of nitrogen for the growth of non-legumes; and third, the possibility of the accumulation of nitrogen in cultivated but uncropped soils.

The soils used were light in character, poor in nitrogen and supplied with an abundance of the mineral elements.

Briefly, the results show that the cow pea crop accumulated large quantities of nitrogen, and that the greatest accumulation was where no nitrogenous materials had been applied. Or, in other words, that the addition of the nitrogen decreased rather than increased the content of soil nitrogen, indicating that the leguminous crop will accumulate proportionately larger quantities of nitrogen upon soils relatively free from this element.

Millet was then grown two seasons, both upon the soils upon which the cow pea had grown, and upon which no crops had been