birth . . ." When, therefore, the foregoing complete explanation was furnished Professor Lewis he generously replied: "The chief interest in anatomical publications is in the observations they record; and as to the interpretation of the unusual specimens which you described so clearly, we seem to be in entire agreement."

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SCIENTIFIC BOOKS

Reptiles of the World. By RAYMOND DITMARS. New York, The Macmillan Company, 1922. pp. xi plus 373; 90 plates, 1 colored.

This book is a reprint of the first edition (1910), the only change being in the arrangement of plates. I believe now, as I did in 1911 (SCIENCE, N. S., XXXIV, pp. 54-55), that it is an excellent popular account of a group that has been neglected by writers on natural history, that it is rather well proportioned, and that it contains much of interest to professional zoologists and herpetologists.

I made a few rather unimportant criticisms in the review of the first edition, viz., a few typographical errors, absence of plate references, too few headings, the amount of space devoted to the habits of captive specimens, and an antiquated nomenclature. Unfortunately, since the text is an exact reprint, these criticisms still apply, and it must now be added that the book is decidedly out-of-date. Twelve years see many additions to our knowledge of even those groups which receive relatively little attention, of which the Reptilia is one: more forms are known, more information upon habits and distribution is available, and the accepted nomenclature is different than in 1910. Much of the new information might well find a place even in a popular book.

It is not because I am interested in systematic herpetology that I protest against the retention in works of this kind of an obsolete nomenclature. Admittedly it is not important in itself to the amateur naturalist whether the racers are called *Bascanion, Zamenis* or *Coluber,* and it may be granted that the use of the latest accepted names would often confuse the amateur naturalist or beginning student who has become familiar with the forms under other names. However, it must also be admitted that the retention of old names in recent popular natural histories and text-books makes it equally difficult for the student to read the modern literature on particular groups. In 1910 there was some excuse for retaining an out-of-date nomenclature, since there was not at that time a recent check-list of the North American reptiles; but the present edition would be much more valuable if the nomenclature were based upon the excellent check-list of Stejneger and Barbour, with the names used in the earlier edition given as synonyms.

In one respect the book is decidedly improved. The total number of pages, including plates, has been reduced from 463 to 419 by printing the plates on both sides of the page. The first edition was too bulky, and the present one would be improved by the use of a thinner text paper.

As I pointed out in 1911, there is a distinct need for a general book upon the natural history of reptiles. This one goes a long way towards meeting this need; but it is sincerely to be hoped that before another printing the old plates will be discarded and the subject matter brought up to date.

ALEXANDER G. RUTHVEN

SPECIAL ARTICLES

THE MEASUREMENT OF EXTREMELY SMALL CAPACITIES AND INDUCTANCES

HYSLOP and Carman[1] have recently described an undamped wave method of measuring small changes of capacity such as are obtained by introducing liquids as the dielectrics in the capacity of an oscillating circuit. Thomas[2] has applied this same beat-note oscillating circuit method to the measurement of the capacity of transmission line insulators.

The authors described[3] a method of using the hot-cathode Braun tube as the detector of

[1] *Phys. Rev.*, XV, p. 243, 1920.

[2] *Electrical Journal*, XVIII, p. 349, 1921.

[3] *Phys. Rev.*, XVIII, p. 331.

frequency change, indicating that the method is sufficiently sensitive to afford a means of detecting such small changes of capacity as are caused by introducing a gas as the dielectric instead of vacuum.

The method is particularly applicable to the determination of the dielectric constants of gases as it will be seen from the following that only the difference between the constant and unity is measured.

Since the authors started the above investigation L. M. Hull of the Bureau of Standards has described[4] the use of the hot-cathode Braun tube to determine frequency ratios.

Two oscillating circuits are made to deflect a cathode beam in two directions at right angles to each other. The combined deflections produce one of the well-known Lissajous' figures. If the two circuits are of exactly the same frequency, say 500,000 cycles, the resulting figure will in general be an ellipse. A change of capacity sufficient to cause a frequency change of 5 cycles per second will cause the ellipse to revolve 5 times per second. The change of frequency, if small, may thus be counted directly. The frequency of the master circuit must be kept constant during the time of observation. This can be done.

Let C_1 be a portion of the capacity in the one oscillating circuit and let it be so arranged that the dielectric may be either vacuum or a gas of dielectric constant K.

Then

$$F = \frac{1}{2\pi\sqrt{L(C + C_1)}}$$

where F is the frequency and C is the capacity of the remainder of the circuit, distributed capacity included. If the introduction of a gas in the condenser C_1 causes a change f in the frequency due to additional capacity ΔC, we shall have

$$F - f = \frac{1}{2\pi\sqrt{L(C + C_1 + \Delta C)}}$$

Eliminating L and solving for ΔC

$$\Delta C = \frac{f(2F - f)(C + C_1)}{(F - f)^2}$$

Neglecting f as small compared with F

$$\Delta C = \frac{2f(C + C_1)}{F}$$

Since

$$\Delta C = C_1(K - 1)$$

$$K - 1 = \frac{2f(C + C_1)}{C_1 F}$$

It is readily seen that the largest error is in the determination of the initial capacities. The preceding equation also indicates that only the excess of the dielectric constant over unity is measured. Should it be found possible to surround the entire capacity with the gas the above equation reduces to

$$K - 1 = \frac{2f}{F}$$

and the method would then be one of quite remarkable accuracy.

If the capacity be kept constant and the inductance varied, the first two equations may be written

$$F = \frac{1}{2\pi\sqrt{LC}}$$

$$F - f = \frac{}{2\pi\sqrt{(L + \Delta L)C}}$$

where C is the entire capacity of the circuit.

Eliminating C we have

$$\Delta L = \frac{2fL}{F}$$

If the master circuit can be kept constant for 60 seconds, and such has already been accomplished, a change of inductance of the order of 1 part in 10^8 can be detected.

The ability to detect so small a change in an inductance makes it now possible to use the inductance as the basis of an ether-drift experiment similar to that of Trouton and Noble.[5] Even though the experiment be doomed to null effect it is nevertheless necessary that it be carried out.

The above method may also be applied to the determination of the magnetic permeabilities of gases.

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[4] *Proc. Inst. Radio Engr.*, 9, p. 130.

[5] *Proc. Roy. Soc.*, 72 (1903), p. 132.