Research Institute" at Honolulu, needs a word of correction. In case the hopeful project develops as expected, I may become for a time honorary president. In this case my chief duty would be to assist in finding a suitable young man as director. This may involve visits to Honolulu, but not continuous residence.

DAVID STARR JORDAN

SCIENTIFIC BOOKS

ANIMALS OF THE YOSEMITE

ONE of the most complete of local faunas, a monumental model of accuracy, fullness, clear expression and typographical excellence, has been lately issued by the University of California under the title of "Animal life in the Yosemite." The authors are Dr. Joseph Grinnell, curator of the Museum of Vertebrate Zoology, and his associate, Tracy Irwin Storer. This contains all that is known of the life history and habits of the 331 species of animals found in the Yosemite. This list includes 95 mammals, 54 of them being rodents, 231 birds, 22 reptiles and 13 amphibians. Each is accompanied by a compact description of "field characters," color, measurements and traits not demanding dissection, and a full record of all traits of behavior, distribution and relative abundance, together with excellent photographs and paintings. Nothing as satisfactory of its kind has ever been accomplished before. The authors observe that "every precaution has been taken to insure accuracy of fact and correctness of inference. No sacrifice of precision has been made consciously with the end merely to afford attractive reading. . . . Ideally we have tried to present our science, perfectly good science, in attractive form."

A single example may serve to show the method. The Tahoe Chipmunk (*Eutamias speciosus frater*) is one of seven species of these dainty little squirrels found in the Yosemite district. Seven pages are devoted to its behavior and distribution. From this I quote a single paragraph:

> The fact that the Tahoe Chipmunk is the only one of seven local species which habitually climbs high in the trees is a point of evidence that restriction to a particular type of habitat or mode of behavior does not always rest upon the possession of conspicuous special structural features of an adaptive nature. So far as can be seen by an examination of specimens in hand, none of the other species of chipmunks is physically incapacitated for tree climbing; in fact, individuals of these others are occasionally observed well up in the trees. There doubtless *are* minor features of structure, associated with a different psychology, which account for the differing traits indicated. Age-long segregation, in separate areas of differentiation, of the several stocks may be the basis of this divergence of habitat preference. The shifting of climatic barriers, with the resulting migrations of populations, has thrown the species together as very near neighbors or as actual companions. Fatal competition is prevented as a result of these initial predilections, whereby *frater* favors the trees, *alpinus* the rocks, and *senex* and *quadrimaculatus* the brush patches and logs.

The introduction closes with a fine plea for the study of living organisms, not as a substitute for anatomy, cytology, genetics and the like, but as a worthy end in itself and as the natural beginning for the development of naturalists. In the present "dry rot of academic biology," it is well to realize that animals and plants exist in nature and through knowing them students find their most attractive introduction to the study of biology.

Dr. Grinnell remarks:

> The study of natural history should develop the power of insight, keenness, not only in seeing what animals do, but in determining why these things are done.
>
> The interrelations between any animal and its environment are exceedingly manifold and vital. To understand these brings into play a superior type of intellectual activity, and, we believe, leads to enhanced powers of perceiving and solving human problems.

The authors may be sincerely congratulated on a noble piece of constructive work, and the university they represent on the far-sighted generosity which has permitted its completion, the Museum of Zoology itself being built up chiefly on the appreciative gifts of Miss Annie Alexander.

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SPECIAL ARTICLES

A TENTATIVE INTERPRETATION OF THE RADIOMETRIC DATA ON VENUS

IN a recent communication in this journal were given the results of new radiometric measurements on Mars and Venus. For the sake of brevity no interpretation was then given to these data. It now seems desirable to add a few comments on our results, which, as previously stated, show that the unilluminated surface of Venus emits a relatively intense infra red radiation, that the southern hemisphere is hotter than the northern, and that the radiation emitted is highly selective. How are we to account for this condition? Water vapor is supposed to be absent; and if it were present it probably could not strongly emit radiation of wave lengths 8–15μ. Of the gases present only CO_2 and ozone could emit strongly in the region of 10.5μ. The rest must emanate from the solid surface of the planet.

If the rotation period is long then it seems necessary to assume that the surface of Venus is still highly heated and emits its own proper radiation.

If the rotation period is short then, owing to the relatively dense atmosphere, the heat would be retained for some hours after sunset, as obtains on this earth, which is less highly heated owing to its greater distance from the sun.

The fact that the southern hemisphere (the bright cusp as well as the adjoining dark region) is hotter than the northern (cusp and contiguous dark area) might be owing to a difference in surface conditions as observed on Mars. This difference in temperature may be owing to a tilting of the axis of rotation, a variation in insolation, and a consequent change in the seasons, as observed on the earth and on Mars. If this is the case then, in the course of time, temperature conditions should be reversed and the northern hemisphere should become the hotter. This, as well as several other questions, can not be answered without further observations extending over a long period.

W. W. COBLENTZ
C. O. LAMPLAND

A NOTE ON THE RING METHOD OF MEASURING SURFACE TENSION

WHEN one consults tables of physical constants for the values of the surface tension of water in contact with air at a given temperature, one is struck by the variety of values given, depending upon the method used. The ring method has been criticized because the values given (Weinberg, duNoüy) although consistent among themselves, differ considerably from the values obtained by other methods. The average of values by the ring method at 15° is 76.6 dynes per centimeter, whereas a probable average of values by other methods at the same temperature is 73.4 dynes per centimeter. The difference of 3.2 dynes remains to be explained.

Fahrenwald[1] attempts an explanation of the high values obtained by the ring and similar methods, in stating that in addition to the true surface tension there is a force due to a column of liquid beneath the edge (ring) to which the liquid adheres; and that this column is supported, not by the surface tension, but by attraction between the edge (ring) and the liquid molecules. Although the explanation is correct for the equilibrium condition when the upward pull on the ring is much below that attained at the instant of rupture, it does not apply in the latter instance.

In our analysis of methods used in measuring surface tension we may logically assume that in any simple liquid, such as water, surface tension is a definite physical property which, under fixed conditions, should be quantitatively expressible with a degree of accuracy limited only by the experimental conditions. The outstanding difference of 3.2 dynes is a strong indication that a source of constant error, either in the ring method or in the other methods, must have been overlooked by the experimenters. Recently, in making measurements with the apparatus of duNoüy, the writer had occasion to determine if possible whether the difference might be attributable to the ring method or merely to the technique by which the measurements are made. That Fahrenwald's explanation is probably incorrect is shown by the fact that as the ring is pulled up out of the surface by the application of increasing force, there is a point at which the liquid adhering to the ring is suddenly drawn out into a thin annular film, several millimeters long, yet retaining stability. As the force is gradually increased the point is finally reached at which the film breaks. This film is so thin at the instant of rupture that an error of 3 dynes certainly can not be attributed to it. It is found further that after the ring has been pulled away, droplets adhere to it. DuNoüy has found (private communication) that the weight of these droplets for a given size of wire in the ring is very constant indeed, their weight amounting to about .24 dyne per centimeter length of wire for the size used in the duNoüy tensiometer. This value increases with increasing thickness of wire. Obviously the amount of liquid pulled away with the ring does not account for the difference of three dynes.

The following explanation is believed to be the correct one. As the ring is drawn out of the liquid the upward force on the ring, measured by the torsion of the wire, is just balanced by the weight of liquid elevated above the normal surface. It is important to note that the scale readings of the instrument are taken with reference to the scale zero, and that the scale zero corresponds with the actual zero of torsion only when the arm which carries the ring is in its position of zero-balance. As the ring is pulled higher with increasing force, the true zero on the scale, with reference to which readings should be taken, shifts upward from the scale zero by an amount which corresponds to the position of the arm. Consequently, at the instant the film ruptures, the scale reading will be too high.

A new technique has been devised whereby the vessel containing the liquid is gradually lowered, by means of the screw adjustment on the support, while the increasing force is being applied, all the while maintaining the arm in its position of zero-balance. Thus the scale zero remains the true zero, and therefore readings of the scale will correctly represent the force at the instant of rupture. The error due to the droplets adhering to the ring is easily corrected by

[1] J. O. S. A. and R. S. I., 6, 722, 1922.