stars. If the companion were an independent star, vastly more remote, it would almost certainly have no appreciable proper motion and the angular distance between it and *Mira* would therefore have been approximately 4″ in 1903, 7″ in 1890, and 10″ in 1877. At this distance it is at least improbable that it should have escaped detection by me in 1903 and it is incredible that it should have been overlooked by Burnham in the two earlier years. Still earlier the angular separation would have been greater, and the variable has been under observation for several centuries.

It follows that the companion is much fainter than the average star of its spectral class, but it does not follow that we may have to revise our theories of stellar size on this account. These are derived, in the sense of the statements under discussion, from the relations that have been established between luminosity and spectral class in what we may designate as normal stars, and can be applied only to such stars. Unquestionably, very nearly all the stars that have been brought under observation are normal, but there are a few exceptions. The companion to *Sirius* is one example, the double companion to 0^2 *Eridani* is another, the novae are especially in point. Apparently the companion to *Mira* is also an abnormal star, indeed, this might have been predicated simply from its association with such a star as *Mira*. As such it offers many interesting problems, but it does not affect our theories either of the size or of the distribution of the stars in general.

ROBERT G. AITKEN

LICK OBSERVATORY

BOOKS FOR THE UNIVERSITY OF TOKYO

THE recent burning of the great Library of the Imperial University of Tokyo (with 500,000 to 700,000 volumes) is in itself a world calamity. I learn that the American Universities, Law Schools and many City Libraries have given very generously of their publications and of duplicates. Much has also been received from private sources. The chief deficiencies, at present, are in scientific lines—medicine, physics, chemistry, biology, mathematics and engineering. At the request of Japanese friends, I make a special appeal to associations and workers in science for donations of books and serials of scientific value.

Shipments will be received and transported free at the following addresses:

Toyo Kisen Kaisha (T. Komatsu), 557 Market St., San Francisco, Cal.

Mr. Aneha, care Hopkins Company, 18 Old Slip, New York.

Nippon Yusen Kaisha, Colman Building, Seattle, Washington.

Osaka Shosen Kaisha, Steel Steamship Co., Whitney Building, New Orleans.

DAVID STARR JORDAN

RECLAIMING ALKALI SOILS

MY attention has been called to a note published in a recent number of SCIENCE[1] in which reference is made to an experiment in applying alum to an alkali soil to improve its physical condition and its permeability to water. In this note the authors say:

"In connection with the study of treating alkali soils with sulfur several cultures were also made up applying alum at the rate of 40 tons of the crude material per acre as suggested by Scofield. The results seem to indicate that alum does not ameliorate the condition, since the colloids, after being precipitated, come back, leaving the soil practically in the same condition as in the checks."

In view of the fact that I have published some observations concerning the effect of aluminum sulphate on impermeable alkali soils, it might be inferred from the statement quoted that I had suggested the application of 40 tons of alum per acre and also that the beneficial effects of alum, if any, are very temporary and of no practical significance.

With respect to the first point, I do not recall having suggested that alum be used at the rate of 40 tons per acre. Since aluminum sulphate costs about $30 per ton f. o. b. factory, the land to be reclaimed by its use at the rate mentioned would have to be potentially very valuable to justify the expense. It is quite possible, however, that the authors quoted did not intend to imply that I had suggested this rate of application but merely that I had suggested the use of alum.

With respect to the second point, "that alum does not ameliorate the condition," it may be remarked that this does not seem strange if it was applied at the rate of 40 tons to two million pounds of soil which is to be inferred is what the authors regard as equivalent to an acre. The ratio of 40 tons to two million pounds is the same as the ratio of 4 to 100, in other words, the authors appear to have added 4 parts of alum to 100 parts of soil. The soil used is described as a sandy loam and it is probable that when saturated as for leaching it might hold 50 per cent. of water. The solution of 4 parts of alum in 50 parts of water would give a concentration of 8 per cent. in the soil solution and it would be a very alkaline soil that would neutralize the acidity of an 8 per cent. solution of alum.

As a matter of fact, a soil may be made impermeable to water by an excessive treatment with aluminum sulphate when it shows a strong acid reaction. With soils that are naturally neutral or slightly acid in reaction, a very light application of aluminum sulphate may induce impermeability. With alkaline soils, on the other hand, it has been found that the

[1] Joffe, J. S., and McLean, H. C., "The Biochemical Sulfur Oxidation as a Means of Improving Alkali Soils." SCIENCE, Vol. 58, p. 53, 1923.

use of aluminum sulphate in quantities sufficient to reduce the alkalinity nearly to the neutral point has resulted in marked improvement in the physical condition of the soil, particularly with respect to its permeability to water. This improvement in condition is certanly not temporary. With some soils that have been under observation for two years it still continues.

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SIREN, A HERBIVOROUS SALAMANDER?

THE correlation of structure and habits is of great philosophical interest, and, if for correlation one read causation, of still greater interest. The study of form apart from function is a noted source of error, and the study of function apart from form, while not so productive of error, is frequently an unnoted waste of time.

These observations apply particularly well to the food preferences of Amphibians, which are in general comparable to the tolerably famous Ophidia of Iceland. In brief, Amphibians have no food preferences. Much careful work, very productive of negative results, has been done on the food of adult Salientia. These animals, as might be expected from their uniform dentition and digestive apparatus, are carnivorous and undiscriminating. What they eat is determined by its size and its propinquity. The food of the same species in different localities differs much more than does the food of different species in the same locality.

Larval Salientia differ considerably from adults in structure of mouth and of intestines, and in correlation with their long, convoluted digestive tract, their horny beaks and fringing rows of keratinous "teeth," they are herbivorous in the same fashion that the adults are carnivorous, and the food of tadpoles of different species is more alike than is the food of larva and adult of the same species.

Larval salamanders apparently do not differ in their food from adults, as is indicated by the similar structure of mouth and intestines in both. Nor do salamanders in general vary much from a uniform structure, or from an undiscriminating and carnivorous diet.

Siren and *Pseudobranchus*, of course, differ notably from the other salamanders in their mouth structures. Teeth are present only on the prevomers, and the dentary and the premaxilla are furnished with horny beaks, strangely reminiscent of those of tadpoles.

I had occasion recently to examine specimens of *Siren lacertina* from Gainesville, Florida. I found their stomachs and intestines packed with filamentous algae. The intestine was noticeably long and convoluted. Comparison with *Amphiuma*, a beast of similar shape and habitat, brought out a great difference in the proportionate lengths of the digestive tract. *Amphiuma* is carnivorous and the stomach of the specimen examined contained fragments of crawfish. The intestine extended almost straight through the body cavity and was of nearly the same length. The algae-crammed intestine of a *Siren* measured 1270 mm from mouth to anus, while the animal itself measured only 480 mm from mouth to anus.

Little has been published on the food of *Siren* from Linnaeus's original supposition that it ate serpents, to Hurter's remark, "Sirens feed on worms and minnows. Most of those in my possession were caught with hook and line baited with worms."[1]

Garman, indeed, says "LeConte found nothing but mud in the stomachs of those he examined."[2] This seems to be the only record of stomach examination, and the "mud" was very probably a black, semi-digested mass of algae.

Barton in his letter to Schneider in 1821 says that he fed his specimens on angleworms, pieces of meat, etc. This and Hurter's remarks may be compared with the well-known habits of tadpoles in aquaria, where they will eat decomposing animal matter, although their ordinary food is diatoms and algae.

E. R. DUNN
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SCIENTIFIC BOOKS

The Domain of Natural Science. The Gifford Lectures delivered in the University of Aberdeen in 1921 and 1922. By E. W. HOBSON. The Macmillan Company, 1923. xvi + 510 pages.

THE purpose of this book is to set forth and maintain by cogent argument the author's theory of the true character of natural science and by means of a strict delineation of this domain of knowledge "to vindicate the perfect freedom of religious and philosophical thought from any fear of destructive interference from the side of natural science, subject to the sole condition that no encroachment is made upon the autonomy of natural science in its own proper domain." In its implications concerning the problem of forming a general philosophy of life and the world these lectures take their place with a body of literature which has recently grown up and which has shown the rise among scientists of a saner attitude towards the place and importance of natural science in the construction of our total view of phenomena and life and character. It affords further evidence of the growing tendency to recognize and emphasize the limitations of natural science as regards certain fundamental problems of thought and philosophy not

[1] Trans. Acad. Sci. St. Louis, XX, 5, p. 67, 1911.
[2] Bull. Illinois State Lab. Nat. Hist., III, p. 385, 1892.