child's drawing of a man is rated only as A or B, although Dr. Goodenough has recently demonstrated[1] that by the use of a refined scoring technique this test, used with unselected children of four or five years, can be made to yield a correlation of .70 with Stanford Binet mental ages. Something like this may be true of many of the other tests.

Probably the greatest technological weakness of medical diagnosis is the play it gives to the subjectivity of judgment. Dr. Gesell's methods will be, or at least should be, widely used by physicians; it is unfortunate that his treatment of the subject does not set the medical practitioner a better example of objectivity. Detailed standardization and statistical evaluation will of course be carried out by others, and the danger is that it will be done by investigators who lack the extraordinarily rich clinical experience which Dr. Gesell has had.

But the reviewer has already devoted too much space to what he regards as a defect. If defect it be—and one may admit that the question is debatable—it is heavily overshadowed by the merits of the work as a whole. The author has staked out new territory of great promise in one of the richest of the border-line fields between psychology and medicine. His treatment is original and suggestive in highest degree. The clinical comparisons between typical subjects of adjacent age groups are little short of dramatic. The fifteen or more brief chapters devoted to the larger aspects of early mental diagnosis are admirable in substance and form. The reviewer predicts that the book will bring about a renaissance of interest in observational and experimental work with young children. It ought to have a wide distribution not only among physicians and psychologists, but also among parents and teachers. Its delightful literary style, its freedom from technical jargon and its wealth of illustrations (there are 227 figures) make it a book for every intelligent person who is not too stupid or too unimaginative to take an interest in this most dramatic and fascinating of all the "ages of man."

LEWIS M. TERMAN
STANFORD UNIVERSITY

Antics of the Ants and *Ingenious Insects.* Two volumes bound in one. By ALFRED MARK SALYER, Glendale, California. New York, Laplante and Dunklin.

THIS superbly printed volume may be described as a rollicking book of science. Following quotations from leading entomologists, it is adorned by humorous cartoons, and conclusions of students of insects are expanded into verse, often reminiscent of Mother Goose and at other times rising almost to seriousness.

While the wisdom of the ants and their genius for cooperation is highly extolled, our author quizzically warns us against other insects, with whom "a desperate war" must be waged, in which "man's civilization, his very life, are at stake," and the victorious insect "hosts will be swarming throughout the smouldering ruins of his last handiwork."

DAVID STARR JORDAN
STANFORD UNIVERSITY

The Romance of the Holes in Bread. A Plea for Recognition of the Scientific Laboratory as the Testing Place for Truth. By I. K. RUSSELL, member American Chemical Society; Author of "Hidden Heroes of the Rockies," and "Frontier Tales of the Townsend House." Easton, Pennsylvania, The Chemical Publishing Company.

A MODEST but thoroughly wholesome bit of popular science is Isaac Russell's "Romance of the Holes in Bread." Beginning with the common and apparently commonplace process of bread-baking, Mr. Russell takes up the nature and functions of the yeast-plant, and from it the general qualities of bacteria, incidentally at the same time describing the obstacles encountered by men who in earlier ages realized that we know nothing whatever of the universe, save that which through the ages we have found out, not thought out, to be true.

All this leads to a record of the life and work of Louis Pasteur, greatest of Frenchmen and one of the noblest figures of all time. Phases of the work of Pasteur and of his disciples are indicated graphically in chapter headings: "Finding the source of plagues"; "From ferments to sanitation"; "Bake oven to bandages"; "From poultry to vaccination"; "The conquest of hydrophobia"; "Back to the bakery."

DAVID STARR JORDAN

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A FIELD TRIP AID

DURING the writer's observation of birds and nests he has found the contrivance described and sketched below to be an invaluable addition to the equipment (see Fig. 1).

This small bit of apparatus consists of an ordinary circular pocket mirror two and one half inches in diameter, around which is twisted about twenty inches of eighteen gauge copper wire. The wire is put on in such a manner that by bending it at a right angle to the plane of the mirror and by bending the lower loop backward parallel to the mirror, an ordinary

[1] In a doctor's dissertation not yet published.

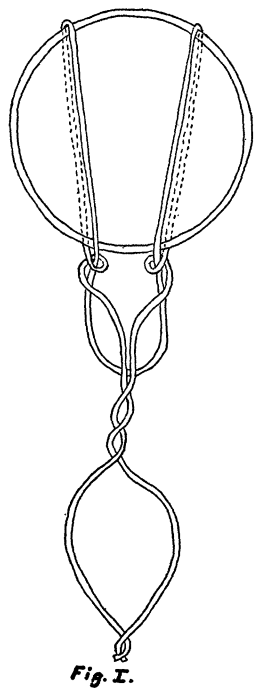

Fig. I.

stick can be pushed up through both loops. With the mirror placed thus, one is able to see the contents of many nests which are out of reach and which could not be looked into without the aid of a ladder or support of some kind. It is especially valuable to observe contents of nests which are located in bushes or small saplings six to ten feet from the ground. It also may save the observer a useless climb into a larger tree.

By bending the wire in the same general plane as the mirror, it can be conveniently carried in the pocket or handbag.

Sticks of varying lengths are always available in the woods and the writer has made use of a broom on several occasions where the nests were located in trees near a house.

This device is also quite valuable when there are a number of people in the party, a bird class, for instance, as it gives all a chance to see the eggs, young or empty nest practically at the same time, and thus disturb the nest for but a short time.

HARRY C. FORTNER

UNIVERSITY OF VERMONT

SPECIAL ARTICLES

THE RELATION OF EXERCISE TO RICKETS IN WHITE RATS[1]

IT has been observed by Paton, Findlay and Watson in their experiments on dogs that those kept in the country and freely exercised in the open air, although they had actually a smaller amount of milk fat than those kept in the laboratory, remained free of rickets, while those kept in the laboratory became rachitic. This supported their belief that diet alone was not the sole factor in producing rickets—that exercise and sunlight were both instrumental in the prevention of rickets. It was on the basis of such observations that this experiment was started to determine, if possible, whether exercise (as well as sunlight) tends to prevent rickets.

Litter No. 123 (from a mother kept away from ultraviolet light and fed a diet low in antirachitic vitamine), consisting of eight albino rats (four females and four males), were placed on a diet March 14 which in previous experiments had proved to be rickets-producing, with the exception of one rat. This rat was given a diet containing "red dog" flour high in phosphorus, thus serving as a control since such a diet would normally not produce rickets.

The apparatus consisted of a series of individual wire-netting tread-mills of the squirrel cage form, the end pieces of which have a diameter of about 16 inches and are mounted on a two-tier rack. Each cage is equipped with a counter so that the number of revolutions made by the animal is registered. Each cage is equipped with a receptacle for food or water.

Diet No. 341, low in phosphorus, and containing relatively much calcium, was made according to the following formula:

NaCl	2 per cent.
Plaster of Paris	2 " "
Lactalbumin	8 " "
Yeast	1 " "
Flour (high patent)	87 " "

The phosphorus content was determined to be about 138 mg per 100 gms of food. This diet is also lacking in antirachitic vitamine and vitamine A. During the last week, one gram alfalfa meal daily was given each rat to cure xerophthalmia which had developed. Rat VIII was fed on the same diet with the substitution of red dog flour as a control.

Each animal was kept well supplied with the diet and distilled water; weighings were taken every week, and note was made of abnormalities, such as sore eyes. Rats Nos. I, II and III were given the greatest amount of exercise for two hours between the hours of 5 and 7 P.M. Rats Nos. IV, V and VI received one hour of the same exercise. Rats VII and VIII received no special exercise at all. At the end of a week, rats Nos. I, II and III were exercised from 8 P.M. to 7:30 A.M. (except Sunday), and an average of 1,000 revolutions per night was quite constantly maintained. This would equal a distance of

[1] From the Laboratory of Physiological Chemistry, University of Minnesota.