College, has identified sixty-eight different varieties of plants, and the study is by no means completed. Not counted in this number are many specimens of wood and bark, some microscopic, others several feet long.

Heading the list of trees so far identified are Douglas fir, Monterey pine, Monterey cypress and alder. Manzanita, snow berry and poison oak are among the shrub species, and yerba buena and wild blackberry are two species of vines present. The list of smaller plants, representing the common wildflowers such as red maids and miner's lettuce, include grasses, sedges and rushes. One fossil bulb has been found. Added to all these items is one equisetum (scouring rush or horsetail), and one or more mosses.

There are also more than twenty-five specimens of insects and closely related animals. The green, scarab-like iridescence of a beetle's wing was the first evidence of prehistoric insects to be discovered. The collection now includes several kinds of beetles, ants, grasshoppers and one or more millipeds. Numerous specimens of what appear to be insect and spider eggs have been found.

It is impossible at present to say of what value this fossil discovery may prove to be, nor which part of it may be of greatest significance. It does at least afford an opportunity for an authentic reproduction of a period of prehistoric life in this area. The specimens are still under study at San Mateo Junior College, San Mateo, California.

FRANK M. STANGER

SCIENTIFIC BOOKS

ARGASIDAE

The Argasidae of North America, Central America and Cuba. By R. A. COOLEY and GLEN M. KOHLS. iii + 152 pp. 57 figures. 14 plates. (The American Midland Naturalist Monograph No. 1.) Notre Dame, Ind.: The University Press. 1944.

THIS monograph is the third in a series of monographs of the ticks of North America. The first, appearing in 1938, monographed the genera *Dermacentor* and *Octocentor;* the second, in February, 1944, treated the genus *Amblyomma;* the present one is more ambitious and treats of the family Argasidae not only of North America but includes Central America and Cuba. This beautiful volume is not only well illustrated but contains a wealth of information about the soft ticks of the region under discussion. Like the preceding numbers it is a model of exactness and clarity. As certain species are important vectors of diseases this work will prove of great value not only to the taxonomists but also to the medical and veterinary profession.

The authors first present a general account of the family, followed by a detailed explanation of the various terms used in the text. A brief account of methods of handling, studying and rearing ticks is also given, and the reviewer wishes this could have been more detailed and illustrated. There is also a brief statement of the medical and veterinary importance of the Argasidae. The authors point out that at least five species of *Ornithodoros* (*hermsi, turicata, parkeri, talaje* and *rudis*) are proved vectors of relapsing fever spirochaetes; one species (*O. parkeri*) has been proved experimentally to be a vector of Rocky Mountain spotted fever and American Q fever. *Argas persicus,* of world-wide distribution in warm climates, is a notorious pest of poultry and is the vector of avian spirochaetosis and is also reported as a probable vector of fowl paralysis. Other species are important pests of various animals, including man.

The main part of the volume is devoted to a detailed account, with numerous illustrations, of the various species. The authors recognize four genera and twenty-four species in the restricted area. These are *Argas,* with two species; *Octobius,* with two species; *Ornithodoros,* with 18 species; and *Antricola,* with two species. In general the following information is given for each species: a list of synonyms; detailed description of the adult; brief descriptions of the larval and nymphal stages when known; line drawings of significant details; photographs of dorsal and ventral views of many of them; host data; biological notes; distribution records with spot maps. Closely related species are treated in great detail and the important differences between them stressed. Keys to genera and species are provided.

The monograph concludes with a classified list of hosts and their ticks; a geographical distribution summary; and an excellent bibliography. This volume will prove of great value to the parasitologists and medical entomologists; the members of the medical and veterinary professions will also find much in it that is of importance to them.

ROBERT MATHESON

THEORY OF FUNCTIONS

The Theory of Functions. By J. E. LITTLEWOOD. 243 pp., Oxford University Press. $5.50.

A BOOK by the noted English mathematician, J. E. Littlewood, is sure to arouse widespread interest. The present volume, two thirds of which was printed in 1931, deals largely with conformal mapping, harmonic and subharmonic functions of two real variables,

"Picard" and schlicht functions and other related topics.

It is written for the research worker in complex variable theory. Emphasis is placed on "best possible" results, on the comparison between alternative methods of proof, on establishing "existence theorems" with a maximum of generality and on precise inequalities. Informal comments such as "this theorem is difficult (and the reader may ignore it if he wishes)" enliven the reading. Though the non-specialist will find the standard treatises of Titchmarsh and Copson sufficiently detailed and perhaps better balanced, the specialist will want Professor Littlewood's book for the intimate and critical perspective which it gives into the structure of complex variable theory.

GARRETT BIRKHOFF

SPECIAL ARTICLES

GLUCURONIC ACID AS A MEASURE OF THE ABSORPTION OF PENICILLIN

THE coupling of such compounds as resist the oxidative processes of the body, with normal metabolic compounds, constitute a primary defense mechanism. The animal organism utilizes a variety of substances for conjugation, principally glycine, glucoronic acid, sulfuric acid, cysteine, glutamine, acetic acid, ornithine and the methyl group. The main source of glucuronic acid is the carbohydrate store in the body, but it can also be derived from glucogenetic amino acids.[1, 2]

That organic compounds can be conjugated in the mammalian body is a fact first recognized by Baumann.[3] Since his early recognition of this fact, it has since been demonstrated by Deichmann *et al.*[4] that many other compounds undergo conjugation in this manner.

Enklewitz[5] demonstrated that the reducing substance found in the urine after the ingestion of amidopyrine is a conjugated glucuronic acid complex. Tsunoo[6] did extensive work with ethynal and found that the body hydrolyzes it to furylacrylic acid, which it conjugated with glycine, and p-hydroxy-phenylurea, which it combines with glucuronic acid. Horn[7] reported that dimethylanaline in the rabbit is converted to p(mono)-methylamino-phenol and is excreted in combination with glucuronic acid. In dogs, Horn found that the same compound is changed to o-aminophenol.

In view of these reported findings this investigation was undertaken to determine whether a similar conjugation takes place between penicillin and glucuronic acid and if so whether the glucuronic acid determination in urine may be used as a measure of the absorption of penicillin. It was further hoped this study would offer additional information in determining the mode of action of penicillin.

EXPERIMENTAL

Male New Zealand rabbits were employed weighing approximately 2,400 to 3,200 grams. They were maintained on a diet consisting chiefly of a standard dry commercial feed (Purina rabbit pellets) and small daily portions of fresh carrots and cabbage. The treated animals received intravenous doses of penicillin sodium varying from 50,000 to 200,000 Oxford units (300 μ/mg penicillin salt) and were placed in metabolism cages for the collection of urine. The cages were designed to avoid the contamination of feces with the excreted urine. Urine was collected for control over 24-hour periods for one week prior to treatment. Glucuronic acid and organic sulfate determinations were made daily.

Fig. 1 demonstrates the influence of penicillin on

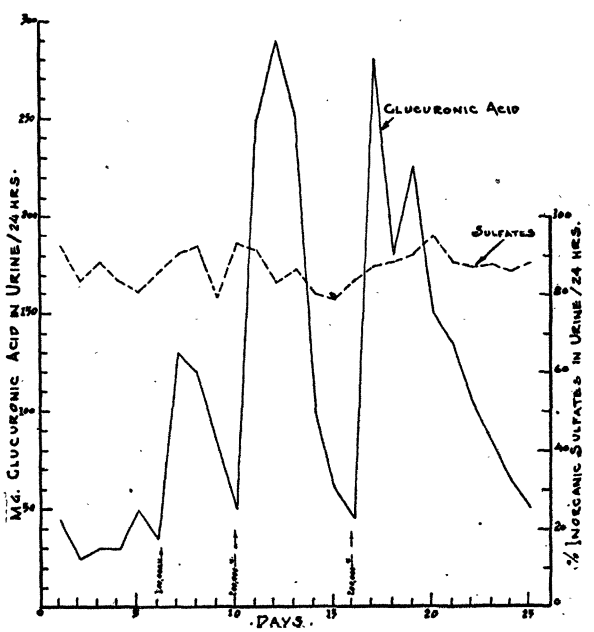

FIG. 1. Effect of penicillin on the excretion of glucuronic acid and inorganic sulfates in the urine.

[1] Anthony Ambrose and Carl P. Sherwin, "Detoxication Mechanisms," Vol. 2, p. 377, 1933.

[2] Benjamin Harrow and Carl P. Sherwin, "Detoxication Mechanisms," Vol. 4, p. 263, 1935.

[3] E. Baumann, "Weber Gepaarte Schwefelsauren im Oganismus," *Arch. f. d. ges. Physiologie*, 13: 285, 1876.

[4] Wm. Deichmann and G. Thomas, *Jour. of Ind. Hygiene and Toxicology*, 25: 286, 1943.

[5] M. Enklewitz and M. Lasker, *Jour. Biol. Chem.*, 110: 443–56, 1935.

[6] S. Tsunoo, *Jour. Biochem.* (Japan), 21: 409–16, 1935.

[7] F. Horn, *Z. f. Physiol. Chem.*, 242: 23–28, 1936.