spring of 1929 to the spring of 1930. The most favorable area found for the study of the large liver fluke of cattle, *Fasciola magna,* was in the region of the swampy plains of southern Texas, and the writer spent part of the winter at Houston investigating the life history of this parasite. In this study he had the use of a laboratory and other facilities at the Rice Institute through the courtesy of Dr. Asa C. Chandler, of the institute faculty. The results of the investigation on the life history of *F. magna* may be summarized as follows.

*F. magna,* unlike *F. hepatica,* has nothing to do with the bile system of cattle, apparently, as it lives in the liver tissues, or sometimes as an erratic parasite in the lungs, enclosed in the liver in an encapsulated cyst which does not appear to have any connection with the bile ducts. The eggs of *F. magna* were never observed in the bile of a cow infested with that worm, as they would be in the case of *F. hepatica,* but they were found rather abundantly in cases of heavy infestations in the cysts and in the contents of the digestive tract. This suggests that the eggs of *F. magna* may use the blood system for getting out of the infested animal, but positive confirmation of this idea was not obtained.

Neither in size nor shape do the eggs of *F. magna* differ from those of *F. hepatica,* but they are furnished with an appendage, a sort of filament, by which they can be easily identified. Besides this, the eggs of *F. magna* develop much slower than do those of *F. hepatica;* the first miracidia begin to appear on the thirty-third day, while in the case of *F. hepatica,* under the same conditions, miracidia appear on the eleventh day.

The miracidium of *F. magna* is very like that of *F. hepatica,* but it can be distinguished from the latter by the peculiar shape of its head papilla, by the ratio of its body parts and by the size of its germ-cells. In the writer's experiments, the miracidia of *F. magna* readily attacked *Galba bulimoides techella* Hald., in which snails they developed successfully and produced their first generation of rediae. It was necessary to stop the experiments on the forty-fifth day of their development, and the cercariae had not appeared at that time, but the cercaria phase was studied in snails that were infested naturally, and in this case the redia, which differs from that of *F. hepatica,* made it possible to identify the species definitely.

The cercaria of *F. magna* is very much like that of *F. hepatica.* The specific characters by which it can be recognized are its size, about three fifths that of *F. hepatica,* and its excretory system; in *F. magna* the large excretory ducts are not yet fused in this stage to form a common stem or excretory vesicle as in the case of *F. hepatica.* Like the cercaria of *F. hepatica,* it encysts on everything that it happens to come in contact with while swimming around, and the cysts, superficially, do not differ from those of *F. hepatica.*

*Galba bulimoides techella* Hald. is a very common snail in the area investigated, and is also the only limnaeid species that is widely distributed there. It keeps to the muddy borders of ditches, pools or other collections of water, all of which are abundant in that part of Texas.

It is worth mention, in this connection, that *Galba bulimoides techella,* as was proved experimentally,[1] is also the intermediate host for the common liver fluke, *F. hepatica,* which is widely distributed through the Southern states. As for the Western states, where, save for the southern part of California, *Galba bulimoides techella* is absent, another snail, *Galba bulimoides* Lea, appears to be responsible for the spread of liver fluke disease, as was experimentally proved by Simms and Shaw for Oregon and by the writer for California.

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# SCIENTIFIC BOOKS

*Plant Hybridization Before Mendel.* By H. F. ROBERTS, the University of Manitoba. Princeton University Press. $4.

THE growing recognition of the importance of hybridism in the breeding of plants and animals and in the races of men should receive a further impetus from the publication of this well-balanced, adequate and extraordinarily interesting book. The only inadequacy noted is in the title, for it would be difficult to find anywhere also such an excellent account (the reviewer knows of none) of the events and personalities connected with the recovery of Mendel's long unrecognized work, and the launching of that Mendelism which has so richly transformed biology and also the associated -ologies during the elapsed thirty years of our auspicious century.

The discussion begins with the earliest known cases of the cross fertilization of plants by hand, in the culture of dates, in that region wherein had been

[1] *Jour. of Parasitology,* October 20, 1928.

located the traditional "Garden of Eden," and proceeds with commensurate accounts of the results of German, English, French and other hybridizers, until 1902. The author's ability to translate the several languages—he is an accomplished linguist—immeasurably facilitated his thorough search of the literature, which extended over several years and through many libraries in a number of countries. Many of the pertinent facts are stated in lucid translations from, or if in English in, the actual words of the hybridizers themselves. These quotations are introduced with an adroitness and smoothness that would do credit even to the literati.

As already indicated, the work greatly transcends its title in giving a succinct account, probably the best extant, of the rediscovery in 1900 of Mendel's paper, independently by DeVries, Correns and von Tschermak, and the contribution of the late Wm. Bateson in the introduction of Mendelism to the world. The author was aided in the preparation of this account as well as in the production of the rest of the book by a mutually cordial friendship with DeVries, who spent more than two weeks in 1906 in Professor Roberts's home in Manhattan, Kansas, while preparing and revising lectures. The author also spent some time in DeVries's home in Holland. The latter as well as both Correns and von Tschermak have contributed valuable and interesting special letters of personal reminiscences which are included.

The amount of material in the book exceeds the expectations of the only vii + 374 pages, because of the fine, clear print of the extensive though very apposite quotations. This book should go into the hands of all persons interested in either pure or applied biology. The language, including the translated quotations, is such that the general reader may peruse it with facility and keen interest.

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# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## A SIMPLE METHOD FOR STAINING SPIROCHETES

THE methods usually employed for the staining of spirochetes in many cases require specially prepared solutions and a mastery of expert technique. A simple, rapid and effective stain based on the method proposed by Kliewe[1] has been used in this laboratory for two years. The solutions are easily prepared in any laboratory and do not deteriorate. The modified method is as follows.

A film of the material to be examined is prepared as usual, air-dried and fixed by passing several times through a Bunsen flame. It is mordanted with a 0.5 to 1 per cent. aqueous solution of potassium permanganate, washed in water, stained with a 2 per cent. aqueous solution of methyl violet and finally washed in water. The time allowed for the action of the mordant is from eight to ten minutes, while the stain is permitted to act for the same period. In staining *Treponema pallidum* it is often desirable to warm the mordant gently on the slide. It is never necessary to warm the stain. For the coarser more easily stained spirochetes a shorter staining time is required, two to three minutes being quite sufficient. The longer period is preferred for the more delicate organisms. With this method the spirochetes are stained bluish-black and the delicate forms stand out clearly. There is a marked contrast on the slide, and the organisms stained by this method have been photographed without difficulty. Good stained specimens have been obtained of various spirochetes, including *Treponema pallidum, Spironema novyi, Spironema obermeieri, Spironema duttoni, Leptospira icterohemmorhagiae, Treponema vincenti,* water leptospira and spirochetes from birds.

[1] *Centralbl. f. Bakt.*, 1924, Ref. 76, 232.

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## ARCUATE MOUNTAINS PRODUCED BY MODIFICATION OF STONE'S STRUCTURE MACHINE

THE machine described by Stone, in the accompanying article, lends itself to certain modifications. In addition to its use in producing thrust normal to the face of the thrust block it can easily be modified so as to transmit a thrust by means of a thrust block the face of which may be at any angle to the direction of thrust. This can be accomplished by using an additional board ($X$) separated from the movable

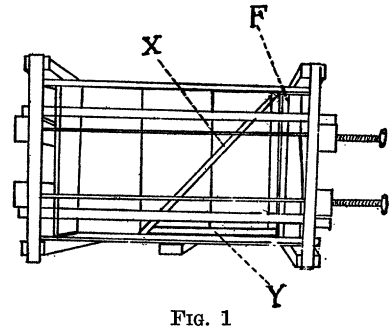


FIG. 1