woolly root-louse (Figure 59) and that of the Japanese beetle grub (Figure 62).

It is an interesting thing to see how different people go at practically the same thing in different ways. When Dr. H. T. Fernald five years ago wrote his "Applied Entomology, an Introductory Textbook of Insects in their Relation to Man," he filled an interesting volume of nearly four hundred pages with economic facts about insects and he arranged his material according to the zoological grouping of the insects. This was also the method used by Herbert Osborn in his admirable "Agricultural Entomology" published in 1916. In 1921 a somewhat larger work by Sanderson and Peairs was published, but here the material was arranged according to the crops affected by the injurious insects or by the classification of the other damage that they do. This method reflects the organization of the federal Bureau of Entomology, which has divided its work largely on ecological lines.

In the present book Professor Herrick has in the main adopted the method of treatment used by the latter authors. The title of the Sanderson and Peairs book is "Insect Pests of Farm, Garden and Orchard," whereas that of Herrick is "Manual of Injurious Insects." The latter title, while short and to the point, is a bit misleading, since the title itself has no geographical limitation and the insects treated are solely those of the United States. Moreover, in the book there is no consideration of the insects that damage forests and shade trees (with the exception of a short appendix on the gipsy and brown-tail moths), and one looking, possibly with some confidence, in the books for shade-tree pests or forest pests will be disappointed.

It is interesting to note that nearly a third of the volume is devoted to the consideration of insects injurious to fruits, large and small, whereas the space devoted to insects affecting cereal and forage crops covers less than half that, and the space devoted to insects affecting vegetables is also about half as great as that devoted to fruits. This does not necessarily mean that Professor Herrick considers the fruit industry more important than the real food crops of man and animals, but, as it happens, there seem to be more different kinds of insects that attack fruits.

The book is dedicated to the memory of Ezra Cornell, and in the dedication a sentence is quoted from Cornell's address at the founding of Cornell University in which he brought out strikingly the necessity for the study of economic entomology. The dedicatory words would lead one to think that work in this direction must have been started immediately after the university opened its doors, but as a matter of fact it was not started until about six years later, when J. H. Comstock appeared on the scene. The reading of this dedicatory note has given me a surprise. I knew Ezra Cornell when I was a boy in Ithaca. I had the honor of being driven out of his orchard once by the old gentleman himself. His tall hat and his heavy cane were enough to frighten any small boy. He never told me on this and other occasions that he was interested in economic entomology, but now I know that perhaps he was indirectly responsible for my own method of getting a livelihood.

Professor Herrick succeeded Professor Comstock in a part of his important work in building up a great department of entomology at Cornell, and in this book he has shown his sure competence.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD OF DEMONSTRATING THE EMBRYONIC MEMBRANES OF THE CHICK

IT is of considerable advantage to the teacher of embryology to be able to show the relations of developing fetal membranes by demonstration of the actual material rather than by use of the customary diagrams alone. The method described here gives excellent results for the membranes of the incubating chick and depends upon the absorption of a one per cent. solution of trypan blue (vital stain) by the allantois. A similar technique is being used in this laboratory for the study of fetal absorption.

The incubating egg (White Leghorn) is candled and the position of the allantoic cavity, which shows as a comparatively clear area surrounding the shadow of the chick, noted. The allantoic position may be detected as early as the beginning of the fifth day, although at this early stage the allantois does not completely cover the embryo. A small hole is made through the shell into the allantoic cavity by means of a sharp dissecting needle. A slightly larger hole is made through the shell at the top of the air sac to relieve the pressure caused by injection into the allantoic cavity.

The dye is made up fresh in distilled water and does not need to be warmed to body temperature. It is injected with a hypodermic syringe equipped with a twenty-seven gauge needle. The amount injected depends upon the stage of development and may easily be determined by holding the egg before the candle during the process of injection. During the fifth and sixth days of incubation a few drops of dye are sufficient. In the later stages not more than one half cc is required. The needle holes are sealed each with a drop of wax (Clark's method)[1] and returned to the

[1] Clark, Eliot R., SCIENCE, 1920, li, 1319.

incubator, operated side down, to be further incubated for six to twelve hours.

For demonstrating the membranes, the shell is broken at the air sac and the entire egg immersed in a suitable dish of cold water. Enough of the shell is then removed to allow the contents to gravitate free into the dish. With a reasonable amount of care this may be accomplished without injury to either the yolk or allantoic membranes. Small tears in the stained allantois will not damage the preparation and dye escaping from the allantoic cavity may be washed away.

After the intact egg membranes have been viewed by the students the allantois is grasped about a quarter of an inch from its edge by means of smooth forceps and slightly tensed to bring into view the chorionic membrane as it stretches across from the allantoic sac to the yolk sac. With small scissors the chorion is cut along the edge of the allantoic sac without injury to other membranes. This allows the allantois to float free, except for attachments at its stalk and sero-amniotic connection, both of which are plainly seen. The freeing of the allantoic sac brings to view the vitally stained[2] embryo surrounded by the amniotic sac resting on the yolk sac. The amniotic fluid is clear. While the embryo is alive filter paper tests are negative for traces of the dye in this fluid. The yellow colored yolk sac, the slate blue embryo in the clear amniotic fluid and the intensely stained allantois give a very beautiful and complete picture of the development and relations of the membranes.

If it is desired to preserve these demonstrations, a piece of glass suitable for mounting in a specimen jar should be placed in the bottom of the dish prior to removing the egg from its shell. The egg contents are oriented upon it and the water replaced with a solution of 10 per cent. formalin and 1 per cent. HCl; fixing for twenty-four hours. The albumen hardens and sticks to the glass, after which the preparation may be mounted in a solution of 4 per cent. formalin and 1 per cent. HCl.

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DEMONSTRATING THE ASKENASY EXPERIMENT

AT the Kansas City meeting of the association a method of repeating the Askenasy experiment to show the raising of a column of mercury by evaporation from a water film as a classroom demonstration was described by Dr. B. E. Livingston. A similar method which has given superior results had been used for four years by me to demonstrate this principle to the classes in plant physiology at the University of Pennsylvania. The important requirements for success are:

(1) To boil the porous porcelain cylinder for several hours to remove all air.
(2) A perfectly clean glass tube which is filled with boiled water.
(3) A tightly seated rubber stopper.
(4) Clean mercury.

The glass tube is filled with boiled water by suction and it is attached to the clay cylinder while the latter is in the cooled boiled water. The water is held in the glass tube by closing with a clamp a piece of rubber tubing previously placed on the upper end (*i. e.,* before inversion) of the glass tubing.

Rises of over ten inches have been secured in an hour. The greatest total height recorded was twenty-eight inches after fifteen hours. A rise of twenty inches in several hours was not unusual when conditions favored rapid evaporation.

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SPECIAL ARTICLES

DEWBOWS BY MOONLIGHT

DEWBOWS formed at night when light from a street lamp fell on small fog particles which had settled to the ground and retained their spherical form were observed by Knott and Lundie.[1] When the source of light was a gas lamp the bow was white, but when a more powerful electric lamp was used the rainbow tints were observed. The bows changed shape when either the horizontal distance from the observer to the source of light or the elevation of the observer's eye above the ground was changed, because the light from the lamp was divergent.

Maxwell[2] described a bow, seen at noon on an ice surface. This bow he attributed to water drops resting on the ice surface. Colors were present.

A. E. Heath[3] described a bow in the shape of a hyperbola produced by the sunlight on dew. This dew had settled on gossamer which covered a cricket field.

Several times during the past year, the writer has observed on the campus of the Rice Institute dewbows which differ from those described in the literature in that they were formed by moonlight shining on dew on a grassy surface. When the bows were seen the moon was always shining brightly from a position well above the horizon and the grass was wet with

[2] The capricious staining of the embryo by absorption of the dye from the allantoic fluid is still under investigation.

[1] Proc. Roy Soc., Edinburgh, 1898.

[2] Proc. Roy. Soc., Edinburgh, 1870.

[3] *Nature,* 97, p. 5, 1916.