people knew less Greek and Latin," and I suggest that, if the epidemiologists will leave their experimental animals for a few moments we might take "epizootiology" from the sick bed to the lethal chamber. Their studies could then be resumed in peace, free from the disturbing thought that much of their epidemiological research is in reality epizootiology.

VETERINARY LABORATORY, E. L. TAYLOR
MINISTRY OF AGRICULTURE AND FISHERIES,
WEYBRIDGE, SURREY

# SPECIAL CORRESPONDENCE

## EUROPEAN EXCURSIONS IN 1932

Two cooperative excursions through Europe are being organized for the summer of 1932, the programs of which present some unusually attractive features and the costs of which will be moderate. While intended primarily for entomologists attending the Fifth International Congress of Entomology at Paris in July, and for their families and friends, other scientific men, up to certain limits, will be welcome.

The first group will sail from New York on the *Leviathan* on June 11, visiting (among other places) Copenhagen, the Gota Canal in Sweden, which will be partly traversed on midsummer night when all the village folk hold festival and dance all night in the open air; Stockholm, Uppsala, the summer home of Linnaeus at Hammarby, and thence by rail northward to the Swedish National Park in Lapland, where a stay of some days will be made on the Arctic tundra at Abisko with views of the midnight sun. Those who wish will have time to continue by excursion steamer to the North Cape and back. Returning to the Continent, some days will be spent in Holland and Belgium before going to Paris for the congress. After that event there will be a week's excursion in the Pyrenees, arranged by the French local committee of the congress. Then Avignon will be visited, with an excursion to Orange and the home of Fabre at Serignan. Continuing to Grenoble, the party will traverse the Savoyan Alps by motor coach to Argentières at the foot of Mount Blanc, and after some days will continue by motor coach to St. Jeanne de Maurienne, and thence into Italy, where Turin, Genoa, Pisa, Naples, Rome, Assissi, Perugia, Florence, Bologna and Venice will each be visited. Continuing over the Brenner Pass, a short stay will be made on the Eibsee in the Bavarian Alps, with opportunity to ascend the Zugspitze, Germany's highest peak. Munich, and the three beautifully preserved medieval cities, Dinkelsbühl, Rothenburg and Nuremburg, will be visited, also Leipzig during the autumn fair, Dresden, the Spreewald and Berlin. After a final few days in England the party will sail for home on September 17 from Southampton.

The second group will sail from New York on the *Olympic* on July 1, joining the first group in Holland and remaining with them until the Alps are reached. They will omit Italy, and make a somewhat swifter tour of Germany, with also a few days in England before sailing on August 27, on the luxurious new liner *Manhattan*. Those wishing to go directly to the congress will sail on the *Majestic* on July 8.

These are not conducted tours in the usual sense, but are organized for pecuniary benefit of individuals comprising a group. Members will be free to follow their own inclinations at the stopping places, and in the larger cities in most cases may take their meals at restaurants of their own choosing. While many of the points to be visited were selected because of their importance as entomological centers, all will be full of interest from other points of view.

Estimates are based upon tourist class (former second class) at sea, second-class railway, unpretentious but thoroughly comfortable and clean hotels and inexpensive restaurants, with an allowance for side-trips and for incidental and personal expenses. They have been kept as low as possible, consistent with comfort, in order to make the trips available for students of limited means, who may look upon them as part of their educational equipment.

Readers of this notice, who may be going to Europe, even though not as members of one of the groups, are welcome to share in certain advantageous arrangements which the committee has been able to make, provided they request the committee to obtain their steamship reservations for them.

For complete circulars and information address the undersigned, who is chairman of the Joint Committee of the Entomological Society of America and Association of Economic Entomologists on Transportation to Europe.

O. A. JOHANNSEN
ROBERTS HALL,
ITHACA, N. Y.

# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## A MICROSCOPE FOR OBSERVATION OF FLUORESCENCE IN LIVING TISSUES

FLUORESCENCE, the phenomenon which makes possible the technique described below, has been utilized in microscopic work, but principally in relation to the study of inanimate organic compounds. It may be defined as the property possessed by certain substances to generate light which is different in color

from the light thrown upon them. For example, in the path of invisible ultra-violet rays, aesculine has a brilliant blue fluorescence. There is a twofold specificity in the property, first in the length of the wave to which the substance will respond, and, second, in the color of the induced light. The fluorescence microscope has made use of this specificity to identify substances which are similar morphologically but different chemically (Lehmann, '13, Wasicky, '14, Heller, '16, Merritt, '26).[1] The study has been applied to the animal body, and fluorescence has been found to be of general occurrence, but it is very slight except in the case of certain special tissues, the lens of the eye, for example.

For this reason the characteristic, inherent fluorescences of the individual tissues could not be made the basis for observation of the living animal. Instead, a highly fluorescent and non-toxic solution, such as uranine or aesculine, was injected into the animal and as it was taken up by the blood plasma, it transformed the latter into what may be pictured as a circulating source of light. The different elements of the tissues were brought into visibility by their varying degrees of opacity to the induced light or their power to refract it, by their opacity to the incident light or by absorption of the fluorescent substance itself.

Although the ordinary fluorescence microscope employs transmitted light, this type of illumination had to be abandoned in observation of the organs or tissues of the intact animal (frog, rat, mouse, etc.) because of their opacity. Oblique illumination sufficed for primary magnifications up to 30 diameters, but for higher magnification vertical illumination was used. In the latter case, the rays of light were reflected through the objective by means of a vertical illuminator similar to the instrument used in metallurgical investigations (Fig. 1). In order to obtain a uniform illumination of the object, it was necessary to have the back lens of the objective as near to the glass plate reflector as possible (Fig. 1 D). The magnifications obtained varied from 300 to 1,200 diameters. The focusing collar (manufactured by the Bausch and Lomb Company) illustrated in Fig. 1 G, was designed to accomplish two things: (1) to hold the object at the proper place of focus, and (2) to permit the surface of the lens to be washed

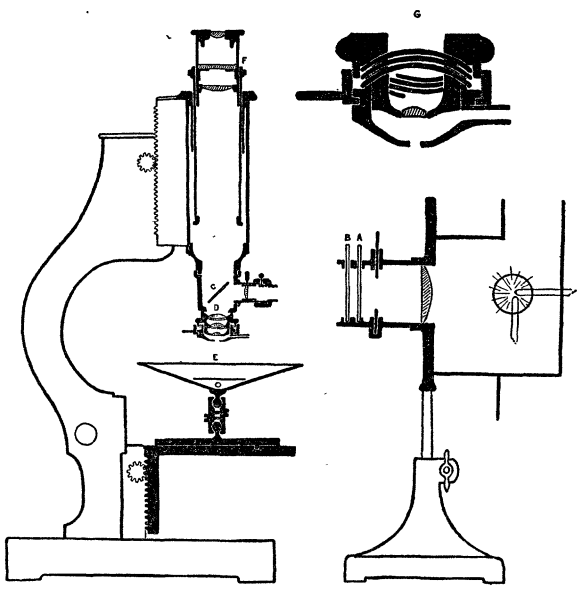

FIG. 1. The microscope and the illumination apparatus. (A) Heat-absorbing filter; (B) main absorbing filter; (C) planoparallel slide of the vertical illuminator; (D) lens with focusing apparatus; (E) adjustable operating board and mechanical stage; (F) eyepiece with complementary absorbing filter; (G) lens with focusing apparatus, original size.

free of blood and débris by a perfusing fluid such as physiological salt solution. Without this device, continuous observation was almost impossible.

The therapeutic sunshine carbon arc of the National Carbon Company was usually employed as a source of light, although any light source rich in ultra-violet, such as an iron, carbon or mercury arc, proved satisfactory. The band of spectrum reflected by the planoparallel glass slide of the vertical illuminator was controlled by selective filters. The injurious infra-red rays were eliminated by 3 mm of heat-absorbing glass (Fig. 1 A). Although this filter allowed but 64 per cent. of the radiant energy from the arc to pass, it did not make an appreciable reduction in the brightness of the light.

The main absorbing filter (Fig. 1 B) was varied to select the band of spectrum most effective for the fluorescent compound in use. The optimum conditions were obtained when rays which were not effective in inducing fluorescence were eliminated because the reflection of diffuse light by the tissues interfered with visibility. With aesculine, the Red Purple Ultra (Corning Glass Works) was used. It transmitted 365 μ ultraviolet, 405 μ violet and 435 μ blue as well as extreme red, but the latter was unimportant since it had already been eliminated by the heat filter.

It was not always possible to obtain the exact combination of wave-lengths required for a particular

[1] R. Heller, "Fluorescence of Alkaloids and Its Application in Toxicological Investigation," *Intern. Zeitsch. phys. Chem. and Biol.*, Vol. 2, pp. 297–411; *Intern. Chemical Soc.*, Vol. 110, ii, p. 502, 1916; Lehmann, "Luminescence Microscope," *Ztschr. f. wiss. Mikr.*, Vol. 30, p. 449, 1913; Merritt, "The Form of the Absorption Bands in Solutions of Organic Dyes and a Relation between Absorption and Fluorescence," *Phys. Rev.*, Vol. 28, pp. 684–94, 1926; R. Wasicky, "The Fluorescence Microscope in Pharmacognosy," *Pharm. Post* (Vienna), Vol. 46, pp. 877–8, 1914.

fluorescent substance by means of the main filter alone. When this was the case, the desired bands were added by the introduction of a supplementary light source and appropriate filters (Fig. $2_4$).

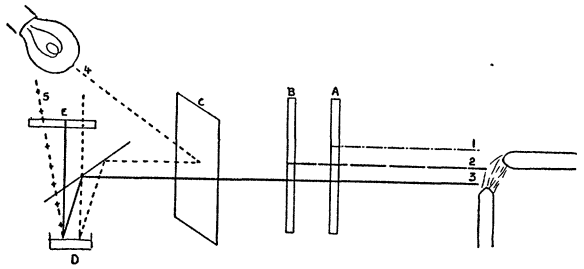


FIG. 2. The path of the rays. (1) Infra-red rays; (2) visible rays; (3) ultra-violet rays; (4) rays of the supplementary illumination; (5) fluorescent rays. (A) Heat-absorbing filter; (B) main absorbing filter; (C) reflector (Corex D Glass 2.10 mm thick); (D) tissue and fluorescence fluid; (E) complementary absorbing filter.

In order to make the outlines of the objects clearer, a complementary absorbing filter was inserted in the tube of the microscope between the eyepiece and the vertical illuminator. Different filters were required for different colored fluorescent light. With aesculine, which gives a blue light, a green filter (Nultra, Corning Glass Works) was used. Green required a yellow complementary filter, while violet fluorescence required none.

The important and difficult part of the technique deals with the light source and lens equipment. The procedure for making observations can be given briefly. Aesculine will be given as an example because it gives a brilliant fluorescence. The experimental animal (frogs, rats and mice have been used) was anesthetized and fixed to the adjustable operating board (Flg. 1 E). After the desired tissue or organ was exposed, it was brought into focus with ordinary white light. A concentrated aqueous solution of the fluorescent substance was injected subcutaneously. The filters (Figs. 1 A and B) were inserted and observation made through the microscope until fluorescence appeared.

This technique not only gives us a new application of a method (Thiel, '26, Ellinger and Hirt, '29)[2] for observing the interior of the living organism, a subject of interest in itself, but it has opened up a new experimental approach to other problems. It has given some unexpected information concerning the penetration of the layers of the skin by different wave-lengths of light. The excretion of aesculine by the liver and kidney causes the bile capillaries and uriniferous tubules to become brilliantly illuminated, and this is being used as the basis for physiological studies of these organs.

EDWARD SINGER
COLUMBIA UNIVERSITY

[2] Thiel, "Contribution to the Slit Lamp Microscopy of the Eye in Ultra-violet Light," *Ztschr. f. Augenheilk.*, Vol. 58, p. 56, 1926; Ellinger and Hirt, "Microscopical Observation on Living Organs," *Zschr. f. Anat. u. Entw.*, Abt. i, 90: 791–802, 1929.

## AN IMPROVED PROSPECTING PICK

GEOLOGISTS and fossil collectors have long felt the need of an accurately adjusted light prospecting pick, but heretofore only hand-made tools of this description have been obtainable.

After years of experience the American Museum of Natural History has developed what is considered a perfect tool of the kind, of drop-forged highest grade 85 carbon tool steel, with a perfect eye extended so as to secure the full purchase power of the

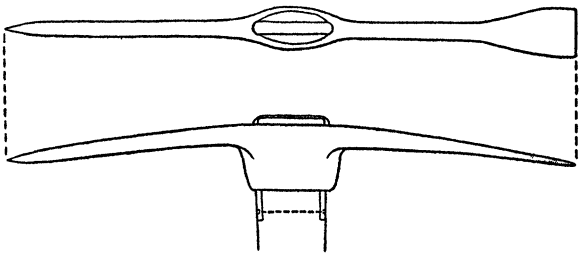

FIG. 1

handle. A metal bar inset over the head of the handle and riveted insures a perfect fit during the life of the tool regardless of shrinkage or number of times the pick is removed from the handle. Length of metal head fifteen inches, length of handle twenty-one and one half inches, total weight one pound and ten ounces.

These picks can be obtained from the Department of Vertebrate Paleontology, American Museum of Natural History, New York City.

BARNUM BROWN

JANUARY 26, 1932

## A QUICK METHOD OF EMBEDDING SOFT MATERIAL IN CELLOIDIN

AT the suggestion of Dr. A. F. Hemenway some experiments were made with celloidin dissolved in acetone for embedding green material that requires no softening. The blocks of material were prepared for cutting in three days by ordinary laboratory methods. Under reduced pressure leaf and soft stem material of *Hedera helix* and *Olea europea* were prepared in 50 minutes from the time the fresh material was gathered until the sections were mounted in balsam on the slides. There was little or no plasmolysis, no alteration of the natural color of the material, but it was necessary to bleach with 95 per cent. alcohol when staining was desired.