This technique has given good results with other dipterous larvae such as the rat-tailed maggot (*Eristalis* sp.) and has rendered visible the muscles of the head of mosquito larvae through the head capsule. It has also proved applicable for the study of the relationship of some of the thoracic muscles of an adult homopteran insect (*Ceresa bubalus*) and was particularly useful for delineating the muscles of the small labium. It is possible that the staining and optical properties of this technique, with various modifications, may be useful for the study of the musculature of other insects and soft-bodied invertebrates.

References

1. Guyer, M. F. *Animal micrology.* (4th rev. ed.) Chicago: Univ. Chicago Press, 1936.
2. Lee, A. B. *The microtomist's vade-mecum.* (10th ed.) Philadelphia: Blakiston, 1937.

A Practical Method for the Illumination of Biological Material With Ultraviolet Rays

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The study of self-fluorescence in tissues and vital staining with fluorescent dyes in the living body requires a source of ultraviolet light that is intense and at the same time constant. Until recently we had been unable to find a source of ultraviolet light embodying all these features. The arc light was usually used when a source of ultraviolet light was needed in a laboratory. However, it always had three major drawbacks: (1) it gave off an intense amount of heat which made the operator rather uncomfortable; (2) the automatic carbon feeder never worked properly; and (3) the carbons never lasted more than 30–45 min, usually extinguishing themselves just when something of interest was visualized. Then, also, there had to be a short delay for the lamp housing to cool off so that the operator could change the carbons. This caused the investigator who was studying the movement of fluorescent solutions in the living body to miss a part of the action taking place during this interval. After much trial and error it was found that certain microscope lamps available on the market could be easily converted into a very efficient source of constant and intense ultraviolet light.

For general all-round efficiency, the Bausch & Lomb spherical lamp housing was found to be the best in the low-priced field. The B & L research lamp housing can be used with one minor change. The Spencer lamp housing (#370-A) is also readily converted, but in our experience it was found to have some disadvantages.

In converting the B & L spherical lamp housing, we removed the bayonet type socket and substituted a porcelain-shelled admedium socket (GE #3280). To hold this socket in place and to enable regulation of its vertical movements, a special holder was constructed along the lines of the original holder for the bayonet type socket. This holder was made in the form of a ring to encircle the admedium socket, a lip being made on each end so that the ring could be tightened around the socket. On opposite sides of the ring were brazed two slotted upright pieces which would fit under the thumb screws of the lamp housing provided for this purpose. These thumb screws

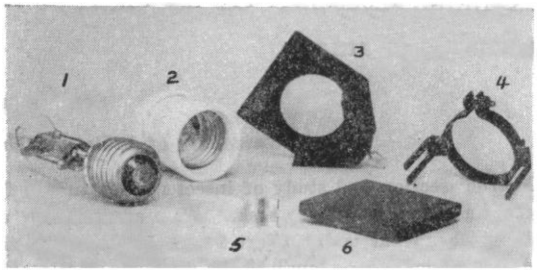

Fig. 1. Accessories: 1, AH-4 mercury vapor lamp; 2, admedium lamp socket; 3, filter holder; 4, socket holder; 5, slotted holder for filter holder; 6, ultraviolet filter.

hold the socket stationary after the vertical centering of the lamp is accomplished. To complete the lamp housing we used a B & L filter holder, which was placed in front of the iris diaphragm. To hold it in place a piece of metal was slotted on both ends and bent in such a manner that the opening of the filter holder was centered with respect to the condenser. One slotted end of the metal strip is slipped under the thumb screw holding the iris diaphragm in place, while the opposite end is used to hold the filter holder in place by its thumb screw. Fig. 1 shows the individual parts of the ultraviolet lamp and in Fig. 2 the completely assembled lamp is seen.

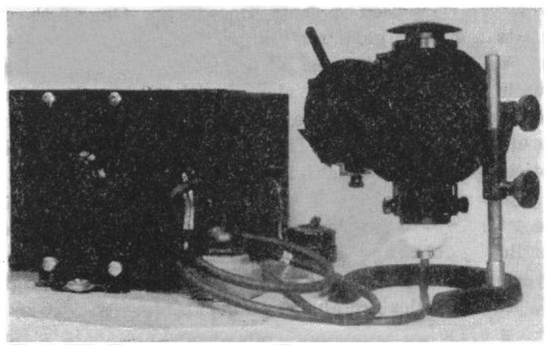

Fig. 2. Assembled ultraviolet lamp including transformer and lamp housing.

The constant and intense source of ultraviolet light we use is the General Electric AH-4 100-watt mercury vapor lamp. To operate this lamp a General Electric Autotransformer No. 59G22 is absolutely necessary.[1]

For filtering out the visible light a number of glass filters are available. We have found that those most suited for ultraviolet light are the Corning glass filters

[1] Our AH-4 mercury vapor lamp, porcelain admedium socket, and autotransformer were obtained from G. W. Gates & Co., Franklin Square, Long Island, New York.

numbered 5860, 5840, 5874, 9863.[2] When the lamp is used for fluorescent microscopy, it is necessary to place in the ocular(s) a 20-mm circular Corning glass absorption filter (No. 3060) to prevent injury to the eye from ultraviolet rays passing through the objective.[3]

Where a greater amount of ultraviolet light is required, we had the surface of the B & L spherical lamp housing reflector aluminized by the Alzak process and then substituted two spherical quartz condensers in place of those originally supplied. This, however, is not necessarily required for all work.

For greater efficiency in fluorescent microscopy, the microscope condenser was replaced by one made of quartz. An aluminum-surfaced disc placed over the microscope mirror or resurfacing of the mirror with aluminum by the Alzak process is also required for fluorescent microscopy.

For ultraviolet rays below 3,650 A the outer glass envelope was removed from the lamp.

The above method is the one used by us in work in this field which has been reported recently (*1*).

Reference

1. Pisha, B. V., and Keller, R. *Anat. Rec.*, 1947, **98**, 39; *Rev. Gastroenterology,* 1947, **14**, 495; *Clin. Med.*, 1947, **54**, 394.

A New Tool for Infrared Studies

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During the last 10 years the writer has studied in infrared light the optical properties of many minerals which are opaque in visible light. The wave length used was 9,000 A (*1*).

By substituting a photoelectric ocular, sensitive to infrared light, for the ordinary eyepiece of a polarizing microscope or other optical apparatus used in mineralogical studies, it is possible to study the optical properties of many opaque minerals, using the same techniques as for nonopaque minerals. The photoelectric current produced by the optical phenomena studied is amplified and measured by the use of a sensitive galvanometer.

This method gives a high degree of precision. For example, during the measurement of refractive index, the maximum deflection of the galvanometer can be accurately noted. When using index oils, different persons estimate the point at which the index of the oil and the mineral match with slightly different degrees of precision.

During the last war, the American and German armies improved and used the sniperscope and snooperscope for night fighting.

The field one wishes to observe is illuminated by a beam of infrared invisible light. By the use of a telescope containing an electronic infrared image tube, the observation of the field is about as simple as it is in daylight.

The invisible image produced by the lens of the telescope is projected on the front half-transparent cathode of the image tube. Inside the tube, the electrons pulled out of the cathode are focused by a set of electronic lenses and hit the rear fluorescent screen of the tube, producing a visible image of the observed field. The resolution is very high—nearly the same as for a television tube.

With the help of the Electronics, Physics, and Geology Departments of Washington University, the writer obtained an image tube and adapted it to a polarizing microscope (Fig. 1).

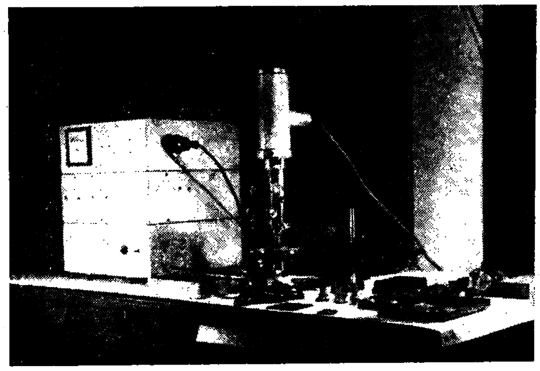

Fig. 1

The results are extraordinary. It is possible to study in infrared light a section of molybdenite (MoS_2) about ½ mm thick, as are ordinary transparent minerals. In visible light, sections of molybdenite, 1/100 mm thick are opaque. Stibnite (Sb_2S_3) is transparent in sections 3 or 4 mm thick. Natural pure antimony can be studied in sections up to about 1 mm thick.

Interference figures can be observed as in visible light.

The sensitivity of the image tube is great. The manipulation of this new infrared microscope is exactly the same as for an ordinary polarizing microscope. The only difference is the green color of the image, which is produced by the fluorescent screen.

The image tube can be adapted to the ocular of a refractometer, goniometer, and other apparatus used in mineralogy and petrology. Thin sections used in paleontology and paleobotany are particularly interesting to study in infrared light. Internal structures of Foraminifera and other small animals can be discerned. With the infrared image tube, the long, tedious study by photography with the use of special plates is eliminated.

Observation with infrared light, with this new technique, should be very useful for medicine, biology, chemistry, and allied sciences.

Reference

1. Bailly, René. *Bull. Soc. Française Minéral.*, 1947, **70**, No. 1–6; *Amer. Mineral.*, in press.

[2] Corning glass filter No. 9863 passes ultraviolet light down to 2,500 A but passes a trace of red and violet.

[3] These filters were obtained from the Corning Glass Works, Corning, New York.