This is the first year in which grants from the Clark Fund have been available. It is founded on a bequest from Joseph H. Clark, '57, who provided that "the income shall be devoted to the encouragement and advancement of original research."

Dr. Frank B. Jewett, electrical engineer, of New York City, and Professor Edwin F. Gay and Professor William M. Wheeler, both of Harvard, make up the committee to advise the president and fellows in selecting purposes for which grants are made.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A MODIFIED FORM OF KUNDT'S TUBE

IN this form of Kundt's tube the air column is set in vibration by a reed from a mouth organ; the reed being actuated by a blast of air. The cork to which the reed is attached is moved back and forth in the glass tube by means of a hollow brass rod which also conducts the compressed air to the reed. At the nodes the vibration of the reed is dampened while

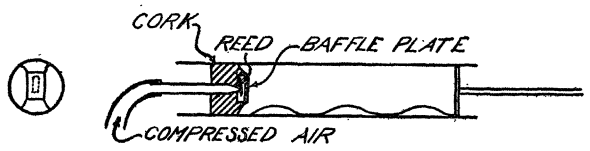

FIG. 1

at the loops, the intensity increases greatly. Thus a large class can listen to the change in intensity. The shadows of the cork particles in vibration may also be projected upon a screen. The success of this instrument is due to the introduction of a baffle plate in front of the reed by Lee Fullmer of our laboratory. This leaves two small rectangular openings in front of the reed, which are actually the sources of the vibrations transmitted to the air column. Therefore as the reed is moved back and forth it never quite ceases its vibration as it would do if unprotected. The cork which holds the reed fits loosely in the glass tube so that air escapes past it when the compressed air is turned on.

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AN INEXPENSIVE GLASS MARKING PENCIL

A VERY satisfactory substitute for the diamond pencil generally used for marking glassware may be easily made from an ordinary file. A six-inch round file is most convenient, but the triangular variety will serve. To make the pencil, the tang of the file is broken off, and the large end of the body is ground to a point. It is then heated to a bright red, and rehardened by plunging into mercury. Triangular points with sharply cut facets have given the best results of the various styles tried. Round points require heavier pressure for marking and appear to be less durable. It is important that the slope be rather short and that the angle between facets at the point be not less than ninety degrees. Long sloping needle-like points have a gouging action that makes neat marking impossible. About an inch of the file should be heated in a Fisher burner, and the cutting point should be kept out of the flame till the portion back of it is red-hot. The hardening operation is best done in a hood to avoid danger of inhaling mercury vapor. A pyrex test-tube is convenient for holding the mercury, and if a number of the pencils are being made, it may be placed in a water or ice bath.

The writer has tested a number of these markers in comparison with a splint diamond and one of the new tungsten carbide pencils, and has found them entirely satisfactory. It is to be expected that the steel pencils will be less durable than the diamond or the tungsten carbide markers, but they will apparently outlast the ordinary carborundum point. One of them has been used for making over five hundred single letters or figures without marked evidence of wear, while another which was not retempered but was ground carefully to maintain the hardness of the file made barely a dozen. The cost is but a fraction of the usual price for the other pencils, and a worn point can be resharpened or a new one made in about ten minutes.

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SPECIAL ARTICLES

THE EFFECTS OF ULTRA-VIOLET LIGHT ON PARAMAECIUM

PROBABLY one of the most interesting problems which has ever presented itself to the physicist and the biologist alike is the effect of ultra-violet light on organisms of all kinds. Little effort seems to have been directed, however, on the well-known infusoria *Paramaecium*. In a series of experiments recently performed by the writer a number of interesting phenomena were observed.

The source of light was a one and a quarter ampere mercury vapor arc lamp with a corex glass bulb containing a window less than two one-thousandths of an inch in thickness. The ultra-violet obtained had a wave length of from 2,500 to 3,650 angstrom units. There was a little visible light given off but practically no heat. The *Paramaecium* were placed in a cavity slide with the water about two millimeters thick and at a distance of about two inches from the window of the tube so that they could be watched through the microscope during the exposures. The following results were noted:

(1) The *Paramaecium* becomes shorter and much thicker. After about half a minute of irradiation under these conditions a limit is reached at which time the *Paramaecium* is about three quarters its original length, the diameter being larger as a result.

(2) The cell wall is shown to be composed of at least two layers which separate to form a sort of blister. This took about one and a half minutes' total exposure. That there is a distinct cell wall between the blister and the interior of the *Paramaecium* may be shown by the fact that the cytoplasm can be seen entering the blisters which before were quite clear and free of all matter.

(3) The proteins of the cytoplasm coagulate. Thus the food vacuoles and contractile vacuoles, etc., which were clear and sharp, become indistinct and undifferentiated.

(4) The outer wall finally breaks, letting the coagulated cytoplasm into the surrounding liquid where it disintegrates.

(5) Perhaps of most interest, the *Paramaecium* fluoresce a pale violet color when living but seem to lose this property when dead. This may best be seen when the field is illuminated with a yellow light at the same time that the ultra-violet is turned on the *Paramaecium*.

(6) After having been exposed for about half a minute, although the *Paramaecium* do not die immediately, they will not live more than two or three hours and will never divide or continue growth—due probably to the fact that the life processes are stopped by the coagulation. It was found that specimens which had partly divided by simple fission stopped at whatever stage they were and died several hours later having been exposed for only half a minute.

(7) Most of the specimens threw out a tremendous number of trichocysts.

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THE NORTH AMERICAN LUNG FLUKE

ALTHOUGH the lung fluke, *Paragonimus,* has been reported from cats, dogs and pigs in this country since 1894 the life history, until the present time, has been unknown. In the course of studies on the parasites of our native mink, *Lutreola vison,* it was found that this fluke is not uncommon and at the suggestion of Dr. W. A. Riley a study of the life history was begun.

A wide variety of aquatic animals serving as food for mink was taken into consideration, but since various species of fresh water crabs and crayfish act as an intermediate host of the Asiatic lung fluke, *P. westermanni,* particular attention was devoted to the native *Astacidae.* These were often found to harbor immature flukes and during the summer of 1930 a single specimen, regarded as possibly *Paragonimus,* was found in a *Cambarus* from a small creek near Minneapolis. On November 11, 1930, large numbers of distome metacercariae agreeing closely with Kobayashi's[1] description of those of the Asiatic lung fluke were found in *Cambarus immunis spinirostris*[2] from the same creek. Since then particular attention has been devoted to these larval forms.

The cysts are spherical and transparent, measuring 2.5 mm to 5 mm in diameter. The enclosed larvae are sometimes folded and sometimes straight. When excysted their length varies from 0.5 mm to 2 mm depending on the degree of contraction. They are covered with minute spines and each possesses a large boring spine on the dorsal side of the oral sucker. The intestinal rami are striking in their similarity to the large convoluted rami of the adult *Paragonimus.* The excretory bladder is a large, conspicuous, unbranched sac extending anterior to the acetabulum and filled with highly refractive globules. A short distance posterior to the acetabulum two small ducts extend laterad from the bladder, each one bifurcating into an anterior and a posterior branch. The characteristic red color noted for the metacercariae of *P. westermanni* is lacking.

Thirty-two per cent. of the crayfish examined from the creek in question were infected. The cysts varied in number from 1 to 8 and without exception were found in the pericardial cavity.

These cysts were fed to two cats, the first cat receiving 35 between November 13 and 17, and the second receiving 30 between November 25 and 27. The animals used were reared on the experimental ranch of a commercial animal food company and had no access to aquatic animals. In the laboratory they were fed a commercial preparation, milk and liver. Frequent fecal examinations over a period of six

[1] Kobayashi, Harujiro, "Studies on the Lung Fluke in Korea. I. On the Life History and Morphology of the Lung Fluke," Mitt. Med. Fachschule zu keijo, 97–115, 1918.

[2] The writer is indebted to Dr. Samuel Eddy for the identification of this crayfish.