in connection with a radio amplification circuit. It would appear from this article that this measuring device is original with them.

The cadmium photoelectric cell has been used by Prof. Dorno-Davos since 1914 for the measurement of ultra-violet rays and he especially recommends it in medical practice, since its sensitivity towards different parts of the ultra-violet spectrum is parallel to that of the human skin. Dorno also was the first to suggest an ultra-violet unit based on this cell and to calibrate practical instruments.

The amplification of a small current of a photoelectric cell by a radio amplifier was made as early as 1919 by C. E. Pike, who published his arrangement in *Physical Review*, 13, 102. Many others, such as H. Rosenberg (*Die Naturwissenschaften*, 1921, Heft 19/20), Abraham and Bloch (Comptes Ren., 1919, 168, 1321), E. Meyer and R. Tank, have described such circuits. Practical instruments using such circuits to amplify the small current produced in ionization chambers employed in radiation therapy as well as that of photoelectric cells have been on the market for a number of years and are widely used by the medical profession in this country and abroad. Simple arrangements using the Dorno cadmium cell in connection with the electroscope have been especially designed for the medical profession and have been also on the market for quite some time. There have been a number of publications on the results obtained.

OTTO GLASSER

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NUCLEAR AND DIFFERENTIAL TISSUE STAIN COMBINED

IN the teaching of histology I have always felt that the practical recognition of tissues under the microscope can not be too strongly stressed. With this thought before me I began experimenting with various stains and combinations of stains in an attempt to strike a method that would differentiate tissues and at the same time bring out the structure of the nuclei. After several years of such experimentation I believe that I now have struck a combination stain that will differentiate the nuclei as well as the tissues.

In writing up my staining method for SCIENCE I claim absolutely no credit for a new stain. The only newness in my staining method is the manner of combining and manipulating two old stains, namely, Delafield's hematoxylin and Mallory's connective tissue stain. The successive steps in my staining method follow:

(1) Stain sections in Delafield's hematoxylin for five minutes.

(2) Pass through distilled water to remove excess stain.

(3) Stain in 0.2 per cent. aqueous solution of Acid Fuchsin for one minute.

(4) Pass through distilled water to remove excess stain.

(5) Stain in the following solution for two to three hours:

Anilin blue (water soluble)	0.5 gm.
Orange G	2.0 gm.
Phosphomolybdic Acid (1 per cent. aqueous solution)	100.0 cc.

(6) Pass through distilled water to remove excess stain.

(7) Pass successively (rapidly) through the following grades of alcohol: 35 per cent., 70 per cent. and 95 per cent.

(8) Complete dehydration in absolute alcohol in one-half to one minute. (Water-free acetone may be used in place of the absolute alcohol, with but little or no shrinkage of the cells.)

(9) Clear in xylol.

(10) Mount with cover-glass.

With this stain nuclei will appear a rich red, epithelial cells pink, connective tissue blue, and muscle red. Red blood cells will stain yellowish in veins, reddish in arteries. Colloid and mucus stain blue. Sections stained by this method more than five years ago have not faded. The staining seems to follow any fixation well. The hematoxylin penetrates the nuclei; then the acid fuchsin changes the hematoxylin over to a red color and perhaps aids in intensifying this red. This is my explanation why I get better nuclear differentiation with this method than I do with Mallory's stain alone. As to this I ask others to check me up.

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WATERING POTTED SOIL KEPT UNDER MICROBIOLOGICALLY CONTROLLED CONDITIONS[1]

NUMEROUS forms of apparatus have been devised for growing plants under microbiologically controlled conditions. The issue of SCIENCE for March 30 last contained an apparatus used at Amherst. The pamphlet of Klein and Kisser[2] contains twenty diagrams.

[1] Approved as Scientific Paper No. 55 by the director of West Virginia Agricultural Experiment Station, Morgantown, W. Va.

[2] Klein, G., and J. Kisser, "Die Sterile Kultur der Höheren Pflanzen." Botanische Abhandlungen, Heft 2, 1924.

However, when it was desirable to have some four-gallon pots of soil in which plants could be grown under controlled conditions, several difficulties had to be overcome. The use of Livingston's auto-irrigator cones for supplying water in other pot work[3] suggested the idea that internal watering would be ideal for watering controlled cultures. When soil in large pots is to be used, some method must be found to cover the soil with a cotton seal that will not be wetted by the moist soil. This has been accomplished by placing an inch mulch of very coarse gravel over the soil. Various pieces of apparatus have been devised to work a cotton seal around the stem of a sterile seedling. A number of these are suitable. It has been found that the double cylinder described by Fred[4] can easily be inserted in the large cotton seal covering the pot.

A more complete description of this apparatus appears in the June issue (Vol. 20, No. 6) of the *Journal* of the American Society of Agronomy.

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SPECIAL ARTICLES

THE EFFECTS OF RADIUM IN PRODUCING LETHAL MUTATIONS IN DROSOPHILA MELANOGASTER

MULLER'S[1] recent discovery that X-rays produce gene mutations in fruit flies is one of the most notable events in the field of pure biology in this century.

The experimental modification of the germ-plasm is an old problem. Many investigators have tried their hands at it. All sorts of chemical and physical agents: serums, high and low temperatures, alcohol, continuous and intermittent rotation, ultra-violet light and probably other agents have been imposed upon different species of organisms. But the genes remained stable.

In an attempt to alter the genes in the albino rat the authors administered alcohol fumes daily to ten successive generations of rats. Treatment was begun at twenty days of age and continued until the animals were fully adult. The soma cells were badly injured: nearly all the individuals were rendered blind, they were stunted in growth, hair development was interfered with and numerous other evidences of degeneration appeared. But all these were merely somatic changes. The genes would not play fair. They took the alcohol but refused to alter. The young of ten generations of alcoholic ancestors were both physically and mentally the equals of the controls and in some cases slightly superior. This has been the common experience of all who have tried to modify the gene constitution of either plants or animals.

Now comes the change. The treatment of fruit flies with X-rays brings gene mutations in such bewildering rapidity that it is impossible to breed and study them all. In some of Muller's experiments the rate of mutation among progeny of irradiated parents was 15,000 per cent. greater than among the controls. On one Sunday afternoon forty mutations were found. Prior to the use of the X-ray, if one mutation were found in forty Sunday afternoons the time would have been considered well spent.

Radium is as effective as X-rays in causing mutations and in certain respects has advantages over the latter. Two of these advantages are: (1) Ease of controlling and repeating exact dosages, and (2) the possibility of separating the different rays involved to determine which ones are effective in altering the gene.

Experiment I. Wild type males were exposed to 150 milligrams of radium for six hours.[2] The flies were confined in shell vials 2½ x 1 inches. The vials contained one inch of cooked banana-agar food, and the open ends were covered with two layers of gauze. The radium needles were attached with adhesive tape to the gauze.

Immediately following treatment these males were mated, in pairs, to females having the genes for scute (sc), vermilion (v), forked (f), and bobbed (bb) in one X-chromosome and a gene (C) to prevent crossing over, a lethal gene (1), and the bar gene (B) in the other X-chromosome. The F_1 females were of two classes, bar and not-bar. The bar-eyed females were mated to their brothers, one pair to a tube, to produce the F_2 generation. Due to the presence of the lethal gene half the sons in this generation are killed. If a new lethal mutation arose as the result of the radium treatment the other half of the sons would inherit it and not appear. Hence no males would hatch in that particular tube. To determine the number of lethal mutations occurring as a result of the radium treatment it was only necessary to count the number of tubes in which there were one hundred per cent. females.

The numbers in the first experiment were too small to give a reliable percentage of mutation. There

[3] Deatrick, E. P., "Porous Clay Auto-irrigator Cones for Watering Potted Soil and Plants," Jour. Amer. Soc. Agron., 19, 252–255, 1927.

[4] Fred, E. B., "Laboratory Manual of Soil Bacteriology," p. 161.

[1] Muller, H. J., 1927, "Artificial Transmutation of the Gene," SCIENCE, 66: 84–87.

[2] The radium used in these experiments was loaned by the Barnard Free Skin and Cancer Hospital in St. Louis. Our appreciation of this courtesy is hereby expressed.