50 per cent. alcohol	90	cc.
Commercial formalin	5	cc.
Glycerine	2.5	cc.
Glacial acetic acid	2.5	cc.
Copper chloride	10	gm.
Uranium nitrate	1.5	gm.

No particular care is necessary in making up this solution, as the salts dissolve fairly readily in the colorless fluid formed by the first four reagents. Incidentally, it may be mentioned that this colorless solution has been found useful in preserving several of the larger basidiomycetes, providing they were preserved fresh and carefully cleaned of adhering earth and other foreign materials. Other uses of this combination will undoubtedly suggest themselves. For the blue-green algae ten grams of copper acetate has been substituted for the copper chloride and uranium nitrate. Yellowish green plant forms permit of a reduction of the amount of copper chloride by half. This is particularly applicable to forms like Spirogyra, young corn plants, the young needle clusters of the larch and the like.

For general laboratory use materials are merely dropped into this fluid and stored until needed. Some delicate forms are ready for study in forty-eight hours. Generally speaking, however, the color change in most plants is less rapid, and from three to ten days are necessary for complete preservation. The gymnosperms do not readily yield to this treatment. The only success thus far obtained has been with very young and delicate needles.

Herbarium mounts made from forms preserved in this fluid have withstood fading, although exposed on a south window, for the last eight months and give evidence of continuing to hold their color.

Although some experiments have been made in that direction, no variation of this fluid has been found which will preserve the color of flowers for more than a very few days. The anthocyan pigments seem to be too unstable to produce satisfactory results.

Our present lack of definite knowledge as to the exact nature of chlorophyll prevents an adequate explanation of the process here described. From the behavior of specimens in this solution it may be supposed that there is possibly a reorganization of the chlorophyll molecule and the formation of copper and uranium derivatives in the chloroplasts.

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A BINOCULAR MAGNIFIER FOR THE DETERMINATION OF OPAQUE MINERALS

THE use of reflected light has found a definite place in the identification and genesis of opaque minerals, but so far as the writer can ascertain, determination is made with a petrographic or metallographic microscope. While this equipment is satisfactory for laboratory study, there are certain valid objections raised to its use by the man in the field.

The adjustment of the vertical illuminator requires considerable time and care, and such an adjustment must be made when the microscope is taken from its case for use, and when oblique illumination is desired. The polished surface of the specimen must be normal to the vertical light rays and if this condition is changed, as it frequently is during the washing and rubbing operations, the surface must again be made normal to the light rays. In addition, the field of vision is limited and on account of the short working distance, it is usually necessary to remove the specimen each time a reaction is completed and the operator frequently has difficulty in locating the exact spot for reexamination. If these conditions were remedied, considerable time could be saved during the determination.

The microchemical tests are by far the most important means of identification, yet these tests are often obscured because the drop of reagent stands with a distinctly convex surface. Only those light rays striking the central portion of the drop are reflected into the microscope tube, thus cutting down the observable area and obscuring the reaction.

Field instruments must be compact, portable and of sturdy construction. An additional important feature is simplicity of operation. Neither the petrographic nor the metallographic microscope fulfils these requirements and their use is therefore impractical for the man in the field.

A series of experiments with a binocular magnifier was conducted in an effort to find a practical method of obviating these difficulties. A Leitz binocular magnifier with a BSM-A type prism body, mounted on a sliding column, was used, which with 15x oculars gives a magnification of forty-five diameters. The binocular was clamped to the table and the specimen, mounted with its polished surface roughly horizontal to keep the reagents from running off, was placed on the table in front of it. In order to obtain the most brilliant illumination, the prism body was tilted until the light from the polished surface was reflected into the binocular tube. This feature eliminates any attachment for illumination.

In operation, it is not necessary to have the surface of the specimen exactly horizontal, as the specimen can be shifted and the prism body quickly tilted to receive the reflected rays of light from the polished surface. The binocular has a long working distance and therefore a large field of vision, which permits two and sometimes three reactions to be observed simultaneously. This feature considerably reduces the time required for determination. The long working distance also allows greater freedom of movement between the objectives and the specimen and permits speedier determination.

The portion of the specimen covered by the reagents is clearly visible, in contrast to the obscured vision under the microscope, for with oblique daylight illumination the rays approach from all angles instead of one direction as in vertical illumination. The formation of a tarnish is more readily noted in oblique than in vertical illumination. Effervescence along cracks and fractures is more clearly observed because the reagent drop does not obscure the points of effervescence.

The binocular magnifier is well made, sturdy and compact. It fits rigidly in its case and is portable. The cost of such an outfit is from $100 to $125 as compared with $350 to $400 for a petrographic microscope. Aside from its use with opaque minerals, the binocular is exceedingly valuable for field study of fossils and rocks.

The chief disadvantages in the uses of the binocular are the inability to use magnifications greater than 45x and the absence of polarizing attachments.

In conclusion, the use of the binocular magnifier eliminates many of the objectionable features of the petrographic microscope for field study, beside increasing the speed and accuracy of many of the observations.

The writer has not had the opportunity of using one of the Leitz pocket microscopes, but is of the opinion that it could serve in place of the more expensive binocular magnifier. In this case, it is recommended that oblique daylight be used for illumination, following the system outlined for the binocular magnifier.

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THE USE OF PLASTICINE MODELS IN TEACHING MITOSIS

DURING the past few years we have used the following method of teaching mitosis to students of elementary botany. Instead of making the customary series of drawings from prepared slides, the modeling wax is substituted for the pencil. Upon small cards about three by four inches, with a slightly roughened surface, outline drawings are made by the student of the cell wall, nuclear membrane, spindle fibers, etc., according to the stage being studied. On this diagram the chromatin granules, nucleoli or chromosomes, modeled from the wax, are placed. A little pressure is sufficient to make the wax adhere to the card.

Our students take great interest in making these models. They grasp the idea more vividly than when only drawings are made and are quick to shift the cards in their proper sequence. Less time is required in making a series of models than in making complete drawings. The models will stand ordinary handling and may be made somewhat permanent by coating with shellac.

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SPECIAL ARTICLES

THE RING METHOD FOR THE DETERMINATION OF SURFACE TENSION

THE methods most often used for the determination of surface tension are known as the drop weight and the ring method, respectively. Of these the former is at present much the more exact, and by careful manipulation and the use of the proper functional relation may be made to give correct results to within 0.1 per cent. New technique recently developed in this laboratory makes this method even more precise.

While an approximate theory of the ring method has been developed by Cantor,[1] Tichanowsky,[2] MacDougall,[3] and others, the theory holds well only for rings of dimensions which are usually not employed in practice, so that the uncertainty which remains in the results amounts to 12 per cent. or even more. On account of the incompleteness of the theory most workers adopt as the basis of their calculations an equation entirely analogous to that used with the capillary height method, or they consider that the total pull on the ring (P) is represented by

$$P = Mg = 4\pi Rp = 4\pi R\gamma \tag{1}$$

The significance of the symbols is represented below:

γ = surface tension in dynes per centimeter.
a = square root of the capillary constant.
M = weight in grams used in balancing the maximum pull of the film.
P = total maximum pull on the ring in dynes.
p = P divided by $4\pi R$.
R = radius of the ring measured to the center of the circular wire.
r = radius of the circular cross-section of the wire.

[1] Cantor, *Wied. Ann.* *47*, 399–423 (1892).
[2] Tichanowsky, *Physikal. Z.* Various papers, 1923–25.
[3] MacDougall, SCIENCE, n. s., 62, 290 (Sept. 25, 1925).