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

$$P = Mg = 4\pi Rp = 4\pi R\gamma \qquad (1)$$

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).