

## AN EXPEDIENT FOR USE IN DIFFICULT RESOLUTION.

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The resolution of difficult objects, or the effort to decide whether unknown objects are resolvable or not, is often so tedious and even so uncertain in its results, that any plan promising real assistance is interesting. Looking intently through the microscope at a highly magnified object of extremely fine structure, in order to note the effects while experimenting with changes in the illumination, is extremely wearing to the eye and is perhaps the worst way of accomplishing anything that can be done otherwise.

The appearances presented when looking down the tube of the microscope, the ocular having been removed, while sending through the objective illuminating cones of light having various qualities, are familiar as optical curiosities, and they have long been used by makers and others as a means of testing the corrections of the objective and of the illumination; but they have scarcely been employed, certainly not adequately, as a practical assistance in manipulation for the examination of objects. Using an immersion decentering substage condenser and light from an ordinary library table lamp, the illuminated portion of the objective should appear as an intensely bright, white or reddish disc occupying a small portion (perhaps one-fourth to one-tenth of the diameter) of the otherwise perfectly dark back-lens of the objective. The whole field should be perfectly free from diffuse light, or with only a trace of blue at the edge opposite the disc. The disc should be sharply defined, and of such size (by graduating diaphragm) and eccentricity (by decentered condenser) as have been found most successful with the optical combination employed; and of course it should be located at a



point at right angles to the lines, if any are to be seen. For extreme resolution the illuminating disc should be located at the edge of the field or even partly beyond it, the visible and acting portion then appearing like a half-moon or like the edge-view of a biconvex lens, as shown in the cut.

The writer lately saw this method employed by Mr. Charles Beach of the Catskill Mt. House, in demonstrating, with moderately capable apparatus, *Amphipleura pellucida* and other fine objects. Without focussing on the object, or seeing it at all, the illumination was thus adjusted until the remark was made, "That will show it now," and it did at first glance and every time. It is in remarkable contrast to the tedious work often done, by the really expert, in making the adjustments while intently studying the unresolved object through the microscope.

How far this method would be helpful in the study of objects whose structure is unknown, by enabling the observer to be always certain that he is working his lens at its maximum of resolving power, is an interesting and presumably important field for experiment.

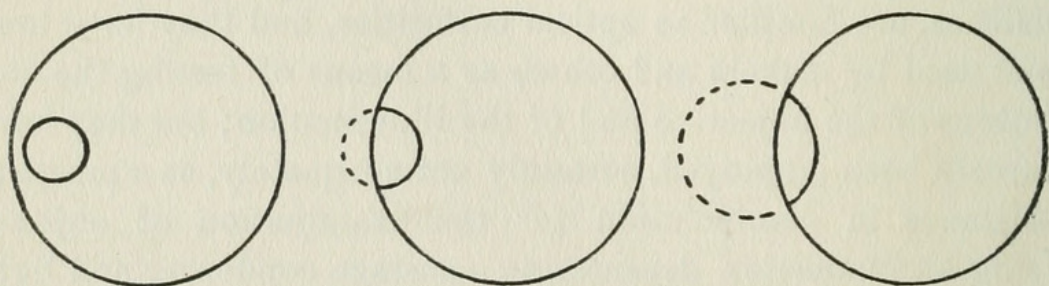


Figure. Oblique illumination by decentered condenser.



Ward, R. H. 1900. "An Expedient for Use in Difficult Resolution." *Transactions* 21, 111–112.

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