SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE USE OF MICRO-MANIPULATORS

SOME interesting variations in the use of the micro-manipulator have induced me to call attention to a point in its historical development. I developed a micro-manipulator in 1905[1] at the University of Pennsylvania for the purpose of dissecting the egg cases of certain animals and orienting the eggs in such a way as to be able to work out the cell lineage; and used the same apparatus for removing chromosomes from eggs. Since these eggs are heavy and would fall to the air-water surface of a hanging drop and be burst by surface tension effects, it was necessary to work from above even though the air-water surface might produce optical distortions while making the observations. A slightly modified micro-manipulator was used in cutting and stimulating protozoa.[2] This work was done entirely independently of the Barber pipette holder which was developed in Kansas simultaneously. I did not hear of the Barber pipette holder until many years later when it was developed by Chambers and others, who found it preferable to work in hanging drops. More recently Richards[3] has developed an instrument for working above the slide and McNeil and Gullberg[4] have described a similar instrument. As to the virtues of these different types, the rack and pinion used by myself gives very rapid manipulation at low powers of the binocular microscope. I used also a micrometer screw, working against a spring. This type gives a slower motion but if it guides a square tube sliding upon a square rod, there is liable to be some lost motion at right angles to the action of the spring unless further springs are used to tighten the bearings. This micrometer arrangement, as well as rack and pinion for rapid motion, is used by Richards. McNeil and Gullberg used the hinged joint as developed by Chambers. It seems possible that the hinged joint acting against a spring may be preferable for movements of short distances. More extensive movements would be complicated by the fact that the movement is in the arc of a circle and not in a straight line.

In my micro-manipulator, movement in the three dimensions was obtained by actuating three knurled heads side by side in the same plane and it was intended to develop reflexes by which movement in any direction could be performed by the fingers of one hand. A long period of education is necessary and it seems probable that a micro-manipulator made on the principle of the pantograph would be preferable in that time required to develop these reflexes would be saved.

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[1] *Biological Bulletin*, 12: 141, 1907.
[2] *Journal of Experimental Zoology*, 6: 87, 1909.
[3] *Journal of Biological Chemistry*, 87: 463, 1930
[4] SCIENCE, 74: 460, 1931.

RAPIDLY RIPENED HAEMATOXYLIN AND ITS USES

KOHL and James[1] have recently presented a rapid method for the ripening of haematoxylin in solutions by exposure to a powerful quartz mercury vapor light. The writer for several years has been using, with considerable success, another method suggested by Miss Ethel Thomas, of the Thomas Biological Supply Company, Charleston, Ill. The method applies principally to the ripening of the haematoxylin for Haidenhain's iron-alum stain, but may be adapted to other haematoxylin stains. It consists of merely adding the haematoxylin crystals (sufficient to make a one half per cent solution) to boiling distilled water. In making the solution the writer has found it best to bring the water to a vigorous boil. The fire is turned off and the crystals added before bubbling completely ceases. A sufficiently large container should be used so that the solution does not overflow during the effervescence accompanying mixing. The solution may be used as soon as cool, but is a little better if permitted to stand a few hours. It changes but little after several weeks in a flask with only a loose cotton plug.

In use, material to be stained is treated according to the usual Haidenhain method, with the exception that the writer uses intensifiers which have proved to be advantageous, although they may be omitted, the results being comparable to the usual ones with this method.

In intensifying the stain the material is removed from the haematoxylin, rinsed in distilled water and destained in 2 per cent, iron-alum until all undesirable precipitates are removed and the intensity of the stain is below that desired in the finished preparation. The material is then rinsed for one to three hours or even longer in two to six changes of distilled water. After the material is thoroughly rinsed to remove all traces of iron-alum, the stain is then intensified by immersion in a weak solution of sodium acid carbonate, magnesium carbonate, or lithium carbonate, until it assumes the desired intensity. In this way a greater degree of differentiation is attained than by the ordinary method. The writer has found lithium carbonate more satisfactory than sodium acid carbonate. Magnesium carbonate has not been used on a sufficient variety of material for its value to be estimated, al-

[1] E. J. Kohl, C. M. James, "A Method for Ripening Haemotoxylin Solutions Rapidly," SCIENCE, 74: 247, 1931.