tion of thiamin had no effect on the growth of any of these strains. They all grew rapidly in the solutions with potato extract, agar extract or pure biotin. S_1 and S_9 grown together produced abundant conidia and perithecia in these solutions. Mature ascospores were observed in the solutions with potato extract and agar extract but not in those with the pure biotin. 56_2 and 56_6, non-conidial races, produced perithecia and mature ascospores in all these solutions. C_4 and C_8 together produced abundant conidia and perithecia, but no ascospores were formed, which is normal for a mating of these recessive lethal races. J_1 formed conidia and abundant perithecia. A small number of ascospores matured in cultures of this lethal. The Bermuda strain was unisexual and produced abundant conidia. Protoperithecia formed in the solutions with biotin and potato extract. The presence of biotin in potato extract[4] and agar extract[2] has been reported.

The effect of biotin on S_1 and C_8 was studied in agar cultures containing the basal solution solidified with 1 per cent. purified agar. Tubes were inoculated with one drop of a suspension of conidia in distilled water. Both strains grew very little on the purified agar but grew rapidly with the production of abundant conidia when pure biotin, agar extract or neopeptone was added. Higher concentrations of biotin, 0.05 microgram per culture, or agar extract equivalent to 5 per cent. agar, caused a larger number and more rapid development of the protoperithecia. Cultures of C_8 lost their typical lethal appearance and grew like normal *N. tetrasperma* when agar extract, equivalent to 1 per cent. agar, was added, but showed all the features characteristic of the lethal form when agar extract equivalent to 5 per cent. agar was added.

Although all the strains tested were biotin-deficient and grew little or not at all without the addition of that growth substance to the medium, a synthetic medium containing biotin as the sole growth substance was entirely satisfactory for the 56_2 and 56_6 races only. Additional factors of some type appear to be necessary for free production of ascospores by the combinations S_1 and S_9, C_4 and C_8 and the bisexual J_1 race. A detailed report of this work will be published.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A PRECISION FINE ADUSTMENT FOR STANDARD MICROSCOPES

EXPERIENCED microscopists have long maintained that correct interpretation of three-dimensional structures, particularly of biological materials, can only be obtained by continual refocusing. For illustration purposes drawing can suggest the third dimension, but this is not real evidence, since interpretation is involved.

Single photomicrographs involve interpretation since the third dimension is not indicated. However, series of photomicrographs taken with constant differences of focus can show all the changes in appearance that the microscopist sees. Though such series can not be made with the unmodified standard microscope, they can be made with the Graton[1] microscope and with the standard microscope fitted with a lever and a tangent screw. Illustrations made with such a microscope are shown in a paper now in press by Hamly and Watson.[2]

The instrument used in making the above-mentioned illustrations was designed some three years ago, and since then many series of photomicrographs have been made with it. The figure shows part of the Zeiss microscope model #1c (1906) and the modifications made. Most modern microscopes could be so changed; the microscope must have a rigid stand and a fine motion with low lag, smooth operation and low friction.

While the scale indicates 0.1μ divisions, springiness and lag can make small movements meaningless unless certain precautions are taken. They are: (a) the microscope must be moved upward rather than downward by the tangent screw; (b) the microscope should not even be touched during focusing; (c) preliminary visual adjustments should be made carefully until the operator is certain that the principal optical cross section is included in the series. Good series are made with differences of 0.2μ, but this is close to the practical limit caused by residual springiness and lag.

All photographs of the series should be made on the same plate or film, so that all peculiarities of emulsion, development and fixation will be common. Variable exposures can be eliminated by the use of an automatic shutter, or stop watch, provided the source of light does not vary. Series of exposures on one plate or film are easily made in a camera fitted for a sliding plate holder such as the Zeiss Multiplex which the author uses.

The precision motion is not much help in ordinary visual work except in making measurements. How-

[4] Wm. J. Robbins, *Bot. Gaz.*, 102: 520–535, 1941.
[1] L. C. Graton and E. B. Dane, *Jour. Opt. Soc. Amer.*, 27: 355–376, 1937.
[2] D. H. Hamly and J. H. L. Watson, *Trans. Roy. Soc. Canada.* In press, 1941.

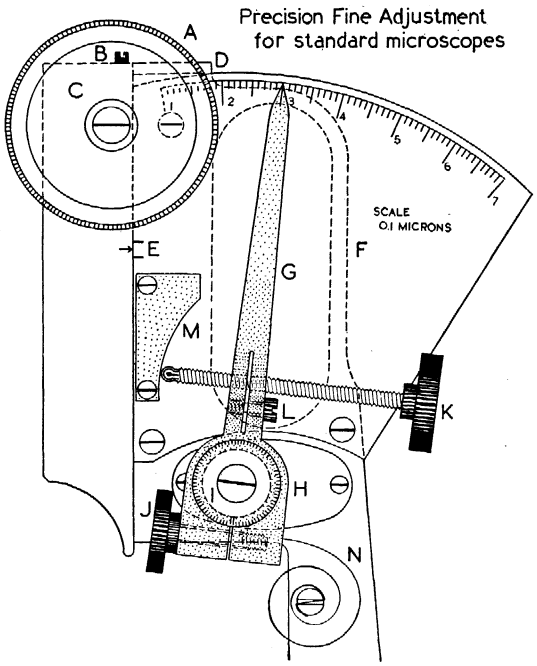

FIG. 1. A—Coarse adjustment; B—Friction regulating screw for coarse adjustment; C—Coarse motion slide bar; D—Cover plate for fine motion; E—Fine motion limit marks; F—Back of microscope limb; G—Lever and scale indicator; H—Thick split sleeve; I—Free end of fine motion knob; J—Locking screw; K—Precision fine motion adjustment screw; L—Friction controlling screw for K; M—Tangential thrust block; N—No lag spring. Scale engraved with 0.1μ divisions. Motion adapted to Zeiss Microscope Model 1c (1906).

ever, the normal use of the fine motion[1] is not handicapped and whenever desired the precision motion can be engaged by locking with screw. The "feel" of the fine motion is not changed by the precision modification.

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CARRIAGE FOR A LARGE NUMBER OF SPECIMENS DURING PARAFFIN INFILTRATION

THE effort usually involved in the simultaneous handling of a considerable number of specimens during paraffin infiltration can be materially reduced by means of the following device. The dimensions given here (Fig. 1) are adapted to the usual staining vessels, but can of course be adjusted to individual requirements. The carriage is constructed of fine-meshed copper milk screen. The partition strips are notched and fitted together like the separators in an ordinary egg carton, and drops of solder applied to a few of the joints where necessary. A suitably bent piece of copper window screen placed in the paraffin

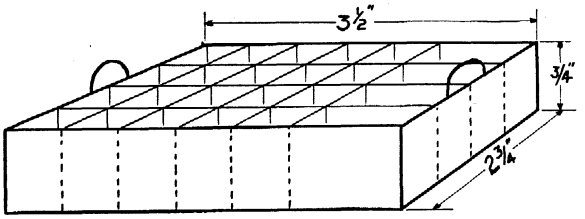

FIG. 1. Tissue carrier made of copper milk screen.

vessel is desirable in order to support the carriage a short distance from the bottom. The entire carriage is immersed in the paraffin bath and can be transferred through as many changes as the size of the tissues may require. The same series of paraffins can be used repeatedly.

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DRAINAGE IN THE LITTLE-WELLS APPARATUS FOR GAS ANALYSIS

LITTLE and Wells[1] have described an apparatus for student use in the analysis of samples of respiratory air. Two burettes of the type described have been tested in this laboratory. As noted by the authors, great care was taken to insure complete drainage, but because of the narrow bore of the stopcock excessive shaking was required which resulted in the breakage of one piece of apparatus. The addition of ½ per cent. isopropyl alcohol to the saline solution used for leveling, and modification of the technique so that the absorbent solutions were washed down each time with approximately one cc of saline solution have eliminated this difficulty. The accuracy of the technique in the hands of student operators remains unchanged.

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[1] J. Max Little and Herbert S. Wells, SCIENCE, 2340, 425, 1939.

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