A modification to the Huxley ultramicrotome

By S. M. McGEE-RUSSELL, F. H. ROBERTS, and J. K. JACOBS

(From Birkbeck College, University of London)

With one plate (fig. 1)

Summary
The mechanism of advance of the Huxley ultramicrotome was modified by the addition of appropriate gearing to facilitate the routine preparation of $\frac{1}{2}$ to $2 \mu$ sections for phase contrast or interference microscopy as an adjunct to the study of thin adjacent sections by electron microscopy. The plate depicts the nature of the modification.

Introduction
The ultramicrotome designed by A. F. Huxley (Huxley, 1957) possesses a number of considerable advantages which include the ease with which unskilled personnel can be trained to cut satisfactory silver (interference colour) sections and the complete separation of the cutting pass from the vagaries of the hand of the operator. We were fortunate enough to obtain a prototype of this instrument, manufactured in the Engineering Laboratory, Department of Engineering, University of Cambridge, through the kindness of Mr. J. H. Brooks, before commercial production of this instrument was begun by the Cambridge Instrument Company. This prototype has been in steady use for the past 3 years, has proved remarkably stable under difficult conditions, and simple to use.

It was found, however, that the mechanism for taking a serial ‘thick’ ($\frac{1}{2}$–$2 \mu$) section for optical microscopy, after obtaining a ribbon of thin silver or grey sections, was not entirely convenient or satisfactory; and that a fine approach of knife to block face by means of the knife-holder vernier advance could not be achieved with sufficient delicacy and was often vitiated by firming of the knife-holder stage clamp. The advance mechanism of the microtome was modified to circumvent these difficulties. The modification in no way impairs the ability of the instrument to cut satisfactory sections.

Description of the modification
Two gears (48 D.P. spur) were cut in duralumin. One, of length $\frac{1}{8}$ in. ($a$ in fig. 1), was mounted on the travelling barrel of the micrometer. The other, a long gear ($b$) $1\frac{1}{8}$ in., was mounted on a freely rotating shaft between two posts $c$ and $d$. The gears were 1:1 with 54 teeth, and the length of the gear $b$ permitted the full extent of the normal advance to be obtained. On the end of the shaft, a right-angle mitre bevel gear (Spencer Components, 5 High

Street, King's Heath, Birmingham) of 22 teeth was mounted, and engaged with a similar gear 1:1, mounted on a shaft between two posts e and f. This second rotating shaft was of sufficient length to protrude through a slot cut in the perspex box with which the instrument is enclosed during operation. On to the end of this shaft was fitted a milled ebonite knob g, with a small freely revolving metal handle h, which acts as a useful marker, and greatly facilitates reproducible movement of the advance mechanism. As geared up, rotation of the knob towards the operator sitting in front of the instrument produces advance of the block towards the knife; rotation of the knob away from the operator withdraws the block from the knife. One is therefore unlikely to produce unintended contact between knife and block by the use of this mechanism, for the former movement is much less automatic than the latter. One complete revolution produces a 2μ section which is excellent for general survey work and orientation by phase-contrast microscopy. Thinner sections are easily obtained for phase contrast or interference photomicrography by appropriate use of this control, with considerable reproducibility. By means of this modification a very delicate approach of block face to knife may be achieved.

The first author (S. M. M.-R.) wishes to thank Professor W. S. Bullough for the facilities afforded to him within his department, the Central Research Fund of the University of London for providing the money to make the prototype instrument, and Mrs. Hannah Diol for the exercise of her considerable photographic skill.

Reference

HUXLEY, A. F., 1957. J. Physiol., 137, 73P.

Fig. 1 (plate). Photograph of the advance mechanism of the Huxley ultramicrotome showing the additional elements (a to h, see text) which comprise the modification.
S. M. McGee-Russell, F. H. Roberts, and J. K. Jacobs