

seed ripening has been found to produce partially vernalized seeds.

A detailed report of this work is being published in a forthcoming number of the *Indian Journal of Agricultural Science*. Expenses of the investigation have been met by grants from the Elmgrant Trust of Dartington, Totnes, and the Imperial Council of Agricultural Research, New Delhi.

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¹ Sen, B., and Chakravarti, S. C., *Ind. J. Agric. Sci.*, 8, 245 (1938).

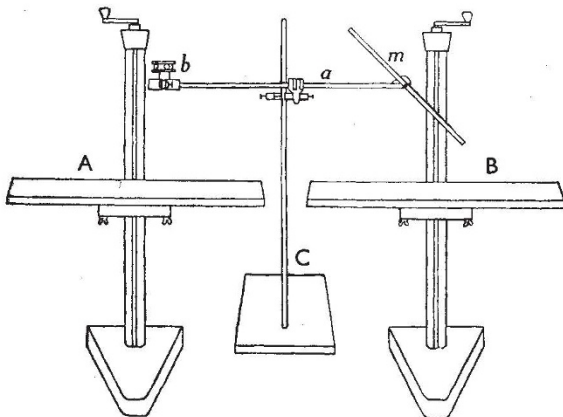
² Lojkin, M., *Contr. Boyce Thompson Inst.*, 8, 237 (1936).

³ Gregory, F. G., and Purvis, O. N., *Ann. Bot.*, N.S., 2, 237 (1938).

⁴ Bulletin 17, Imperial Bureau of Plant Genetics (1935).

Use of the Camera Lucida for Transcribing Diagrams

INTERESTING modifications of the camera lucida for making larger drawings were recently described in these columns¹. A novel use to which I have put this apparatus may also assist biologists in their work. Teachers and research workers in biology who regularly abstract information from the original literature must have felt the need for obtaining accurate copies of diagrams and figures which accompany the text of publications. Various methods of transcription are known; but apart from tracings, which leave much to be desired, they call for apparatus which is rarely available. The following method of using an ordinary camera lucida of the Abbe type for transcribing diagrams has the advantage of permitting enlargement or reduction of the original.



Two small drawing boards are provided on their lower surfaces each with a U-shaped support of $\frac{3}{8}$ in. iron rod having two projecting lugs which will fit into the clamps of a pillar stand such as is used in physiological experiments. The stands to which the boards have been clamped are placed to the left and the right (A and B in accompanying figure) of an ordinary retort stand (C) the clamp of which grips the arm (a) of the camera lucida so that the prism and light filters (b) of the apparatus overhang the left board (A)

while the mirror (m) overhangs the right board (B). The distance apart of the pillar stands is determined by the length of the arm (a), the vertical level of which is in turn determined by the work in hand. Each board can be raised or lowered separately by rackwork through a vertical distance of approximately eighteen inches.

The figure which is to be copied is placed upon board A and covered with a sheet of plate-glass, and the paper on which the copy is to be made is pinned in position upon board B. The drawing is made exactly as if the camera lucida were being used for microscopic work, that is, the object is viewed through the perforated prism at b (as is the image of a microscopic object) and is seen in relation to the image of the paper which is superimposed upon it as a result of light reflexion from the mirror and the prism.

When the boards A and B are set at the same horizontal level the copy will be enlarged (my apparatus gives a ratio of approximately 4/3), but by setting the boards at different levels various amounts of reduction or enlargement can be achieved. The lowering of board A and the raising of board B favour reduction and vice versa. With ordinary equipment I obtained at the two extremes a reduction by one half and an enlargement of five diameters respectively. The methods advocated by Harding for enlarging drawings may be used to increase this range.

The ordinary light screens with which the camera lucida is provided also serve when the apparatus is used for the transcription of diagrams, but modification of the lighting arrangements to suit individual needs is advantageous. Manipulation of bench lamps will remove any lighting difficulties.

The alternate focusing of the eye on the diagram and the copy may involve strain, especially when the apparatus is being used for reduction or enlargement. This can be avoided by placing a biconvex spectacle lens above the prism of the camera lucida. When preparing enlarged or reduced copies of the original diagram, I use lenses of 13 in., 18 in. and 20 in. focal length, with the alleviation of eye strain and with greater ease of working.

Some difficulty might be experienced when the figures which are to be copied occur in large volumes or manuscripts. This can be overcome by the use of a sliding mirror (m) on an appropriately lengthened arm (a).

This arrangement of ordinary laboratory equipment may be used for preparing graphical records of published diagrams in original papers and for accurate diagrammatization of complex figures for teaching purposes. I have used it for transcribing unequal original diagrams of related Trematoda to the same size in the copy². This means of cancelling out absolute size differences revealed *relative* differences which are of some taxonomic importance, but which were obscure in the originals.

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Jan. 5.

¹ Harding, *NATURE*, 148, 754 (1941).

² Dawes, *Parasitology*, 1942 (in the press).