far strongly support the view that many seeds gain in vitamin content during germination. Of considerable importance for animal and human nutrition is the fact that the vitamins which appear to be synthesized in sprouting seeds are preserved during subsequent dehydration.

PAUL R. BURKHOLDER
OSBORN BOTANICAL LABORATORY,
YALE UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE CONSTRUCTION OF TISELIUS ELECTROPHORESIS CELLS

INASMUCH as the attention of manufacturers of optical equipment is at present directed almost exclusively toward war production, the procurement of suitable cells for the electrophoresis apparatus of Tiselius has become a rather difficult problem. Because of the wide application of the Tiselius instrument to problems of biological and colloid chemistry it was thought that the experiences of the authors in constructing these cells might prove to be of general interest. The methods should also prove applicable to the construction of other types of glass cells.

The cells have been constructed of one eighth inch thick color-clear plate glass. After a little practice no difficulty was encountered in grinding the glass parts to the proper size on the face of a rotating iron disc fed with carborundum and water in the usual way. The rectangular holes in the horizontal plates were cut by grinding through the faces of the plates from both sides with the edge of a small iron disc mounted in a lathe and fed with carborundum. In this operation the glass was mounted on a plate hinged to the compound tool rest of the lathe. The holes were then squared up by hand with carborundum and a strip of metal. The horizontal sliding surfaces were ground flat on plate glass after the sections were assembled. The center sliding section was of the double length design described by Longsworth, Cannan and MacInnes.[1] It was assembled in two steps. First, the rectangular tubes were cemented and ground on the ends until square and of equal length. During the grinding the tubes were temporarily fastened together with beeswax. Second, the tubes and horizontal plates were assembled and cemented. The top and bottom sections were each cemented in a single operation.

The principal difficulty was, of course, the cementing of the glass parts. Numerous cements of various types were tried without success until a low-melting glass-like material described by von Angerer[2] was used. The cement is made by fusing together 5 parts of washed silicic acid, 16 parts of red lead (minium, Pb_3O_4) and 4 parts of calcined borax, using a blast lamp furnace. While still molten, the material was poured out into water, dried, ground fine in a Mullite mortar and put through a 500-mesh screen. The powder was mixed with water to form a thin paste, which was applied evenly with a brush to the surfaces to be cemented. After the cement dried the parts were assembled in a suitable steel jig, using weights to apply pressure to the joints, placed in an electric muffle furnace, and heated to about 500° C—approximately one hour was required for the furnace to reach this temperature. The proper temperature imparts a slight glow to the furnace, perceptible only in a darkened room. After three hours the furnace was turned off and allowed to cool, about six hours being required for it to reach room temperature. In designing the jig it was found that any metal part which touches the glass over any considerable area should be in contact with the entire glass surface, otherwise the metal conducts heat to local areas and cracks the glass. The joints frequently contain numerous small bubbles, but seem to be essentially as strong as the glass itself. If the cement has been applied evenly a tight seal is obtained.

Although no further polishing of the optical surfaces was attempted, the optical properties of the tubes have been found to be quite satisfactory. No irregularities could be observed in the base lines produced by the cells even though the Tiselius apparatus in use in this laboratory is a rather sensitive one. The joints have been found to be permanent and substantial. Preliminary experiments have indicated that pyrex glass may also be cemented by the same method.

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GEORGE G. WRIGHT[3]
STANLEY M. SWINGLE
THE CALIFORNIA INSTITUTE OF TECHNOLOGY

[1] L. G. Longsworth, R. K. Cannan and D. A. MacInnes, *Jour. Am. Chem. Soc.*, 62: 2580, 1940.

[2] Ernst von Angerer, "Technische Kunstgriffe bei physikalischen Untersuchungen," p. 48. Friedr. Vieweg und Sohn, Braunschweig, 1936.

[3] Fellow of the National Research Council.

BOOKS RECEIVED

George Gascoigne's A Hundreth Sundrie Flowres. Edited with an Introduction and Notes by C. T. PROUTY. Pp. 305. University of Missouri. $2.50.

HRDLIČKA, ALEŠ. *Alaska Diary.* Illustrated. Pp. xv + 414. Jaques Cattell Press. $5.00.

POST, HOWARD W. *The Chemistry of the Aliphatic Orthoesters.* Illustrated. Pp. 188. Reinhold Publishing Corporation. $4.00.

WALLING, S. A. and J. C. HILL. *Aircraft Mathematics.* Illustrated. Pp. 186. Macmillan. $1.75.

WHITE, PHILLIP R. *A Handbook of Plant Tissue Culture.* Illustrated. Pp. xiii + 277. Jaques Cattell Press. $3.75.