carboxylic groups of the latter into —CH_2OH groups and thus to transform the uronic acid into a simple monose.

This has now been accomplished in the case of *2:3:4-trimethyl α-methyl-d-galacturonide methyl ester,* which was reduced to 2:3:4-trimethyl α-methyl-d-galactoside. The reaction has been accomplished both by the methods of classical organic chemistry (described by P. A. Levene and L. C. Kreider in an article now in press) and also by the catalytic method, with the aid of copper chromite catalyst in an atmosphere of hydrogen.

The reduction was practically complete. The distilled product (a syrup which crystallized) had the following composition:

Found C 50.98, H 8.6, OCH_3 52.75. ($C_{10}H_{20}O_6$ requires C 50.81, H 8.6, OCH_3 52.55.)

It had $[\alpha]_D^{25} = +198.4°$ (in water); $n_D^{25} = 1.4626$ and m.p. $\simeq 30°$.

On hydrolysis the substance yielded 2:3:4-trimethyl d-galactose having m.p. 78–79° and $[\alpha]_D^{25} = +147°$ (initial, in water); +120.4° (equilibrium).

Work in the same direction on aldobionic acids is now in progress.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE PRESERVATION OF BIOLOGICAL SPECIMENS BY MEANS OF TRANSPARENT PLASTICS

IN the September 10 issue of SCIENCE, on page 247, Dr. J. H. Hibben published a brief paper on the preservation of biological specimens by means of transparent plastics, in which he disclosed that the idea of imbedding various specimens in methyl methacrylate occurred to him some months before the submission of his manuscript for publication.

In view of the appearance of Dr. Hibben's paper and of certain statements contained therein, it seems desirable to point out that the Bureau of Chemistry and Soils, U. S. Department of Agriculture, has under way a Bankhead-Jones Special Research Fund Project dealing with the preservation of agricultural specimens in as natural a condition as possible. This project, which is under the direct supervision of Dr. Charles E. Sando, senior biochemist in the Food Research Division, consists of studies on the preservation of fresh plant materials such as roots, stalks, stems, leaves and flowers, and studies on the preservation of plant and entomological specimens in polymerized methyl methacrylate.

One process has been studied for many years by Mr. G. R. Fessenden and its further development and improvement are being continued by him in this bureau. It consists essentially in chemically treating fresh plant materials in such a manner as to toughen the tissues and set the natural color, after which the specimens are preserved in transparent mountings. Specimens so treated retain practically the same size, shape and color of fresh material and are therefore to be considered more or less permanent, although considerable research is necessary to make the process reasonably inexpensive and universally applicable. Mr. Fessenden's finished specimens have been exhibited at the Harvard Botanical Museum, the New York Botanical Garden, the American Museum of Natural History, the Buffalo Museum of Science, the Pennsylvania State Museum, Morton Arboretum and other museums, libraries and horticultural organizations, where they have created marked interest and much favorable comment.

The second phase of the special project dealing with the preservation of agricultural specimens, namely, that dealing with the imbedding in methyl methacrylate, was first begun in November, 1936, by Mr. F. L. Goll, of the Bureau of Plant Industry, at the request of Dr. F. W. Parker, of E. I. du Pont de Nemours and Company, Wilmington, Delaware, and was later modified and improved by Dr. Sando, working in close cooperation with the Bureau of Plant Industry and with Dr. D. S. Frederick, of Rohm and Haas Company, Philadelphia, Pa. The most intensive research on the methyl methacrylate method has been in progress since May, 1937. As a result of such work many difficulties have been overcome, and nearly forty unusually fine specimens have been prepared, including seeds, certain flowers, beetles and iridescent butterflies. The largest of these specimens is an ear of corn which in its imbedded state measures $2\frac{1}{4}'' \times 3'' \times 7''$ and weighs approximately $1\frac{3}{4}$ pounds. These specimens have all been machined and polished and are therefore finished mounts.

One is apt to draw the conclusion from Dr. Hibben's paper that mounting biological materials in methyl methacrylate is a relatively simple and easy matter and that polymerization will take place in a matter of hours. The results of our work have shown, however,

that the detailed manipulations of the process require infinite care and patience and that there are still many difficulties to be overcome before the process can be labeled "fool-proof." It may be possible to polymerize small-sized samples in several hours, just as it is possible to polymerize a thin film within a matter of minutes, but when dealing with larger, more practical specimens successful polymerization will often require a period of weeks, during which time the process becomes increasingly more difficult. So far, we have also found that only relatively dry materials can be successfully mounted in methyl methacrylate. In some cases where the water content is not excessive it is possible to coat the specimen with gelatin before imbedding, but our results using gelatin for this purpose have not been entirely satisfactory. Attempts to imbed fresh flowers and leaves in methyl methacrylate, using either benzoyl peroxide or sulfur trioxide as the catalyst, have resulted in color loss. Furthermore, iridescent butterflies do not lend themselves readily to the imbedding process, at least not without some sort of protective coating, since such specimens lose their iridescent effect, owing to the fact that this phenomenon is caused by a structural or grating effect and not to the presence of actual pigment. However, unusually attractive and pleasing mounts in methyl methacrylate have been made of such butterflies, by a process which prevents actual contact between the methyl methacrylate and the specimen.

We anticipate that both the Fessenden and the methacrylate mounts of biological materials will possess considerable value for exhibit and other educational purposes and as permanent records of healthy and abnormal specimens. It is highly important, therefore, that the imbedded specimen retain its natural shape, size and color and that the finished mount be free of imperfections, including cloudiness, bubbles, color deterioration and alterations such as "crazing" in the plastic itself.

Until now, the Bureau of Chemistry and Soils has considered premature any announcement as to methods and results of this research project, since many undetermined factors and problems connected with the work remain to be studied and overcome. When the final details and directions for the successful mounting of biological specimens in plastics are worked out, a full and comprehensive report will be forthcoming.

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A HYDRO-AGITATOR FOR SOLUTIONS

SUITABLE agitation of a solution over a period of days for decalcification of bone, etc., is effected by securing a cylindrical half-liter bottle three fourths full of the solution on the hooks in the illustration, so that half the bottle is below the pivotal center. A stream of water at the rate of four gallons an hour tips the pans alternately twice a minute, which we find sufficient to decalcify bone tissue embedded in nitrocellulose blocks, and placed first in a solution of nitric acid followed by a 3 per cent. solution of alum.

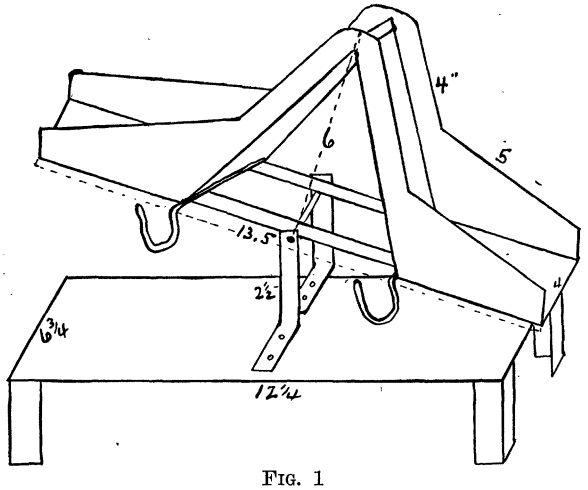

FIG. 1

The table is wood with steel legs, the upright supports for the pivot are steel, and the pans are copper, all scrap material from our shop, constructed in a half day. The apparatus may be made to any scale desired, or the height of the pivot may be increased so as to extend the arc of rotation of the pans. The figures are dimensions in inches.

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BOOKS RECEIVED

FEIGL, FRITZ. *Qualitative Analysis by Spot Tests.* Translated from the German by Janet W. Matthews. Pp. ix + 400. Nordemann. $7.00.

FINDLAY, ALEXANDER. *A Hundred Years of Chemistry.* Pp. 352. Macmillan. $4.25.

GEIST, OTTO W. and FROELICH G. RAINEY. *Archaeological Excavations at Kukulik, St. Lawrence Island, Alaska.* Pp. 391. 45 figures. 78 plates. U. S. Government Printing Office, Washington.

GLOCK, WALDO S. *Principles and Methods of Tree-Ring Analysis.* Pp. viii + 100. 44 figures. 14 plates. Carnegie Institution of Washington.

KESTELMAN, H. *Modern Theories of Integration.* Pp. viii + 252. Oxford University Press. $5.50.

MELLON, M. G. *Methods of Quantitative Chemical Analysis.* Pp. ix + 456. 76 figures. Macmillan. $3.00.

SARTON, GEORGE. *The History of Science and the New Humanism.* Pp. xx + 196. Harvard University Press. $2.00.

WHITE, E. GRACE. *A Textbook of General Biology.* Second edition, revised. Pp. 667. 336 figures. Mosby. $3.00.