liaison between dental and medical personnel by developing a group of men for the interpretation of diseases of the teeth and their relationship to the functioning of the human organism as a whole.

Dr. M. C. Winternitz, dean of the Yale University School of Medicine, spoke on the dental project at a dinner meeting of the group. Subjects relating to dental education were further discussed by Dr. George R. Moore, of Ann Arbor, and Dr. Frank S. Cartwright and Dr. Stanley A. Mackenzie, of Detroit.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

LITHOTYPING IN MINIATURE AS A MEANS OF SCIENTIFIC PUBLICATION

THIS is a further note on a method of inexpensively publishing research reports, which Dr. Seidell and Dr. Visscher discussed in earlier numbers of SCIENCE (July 20 and September 14, 1934).

During the past three years we have developed in the School of Education at the Pennsylvania State College a scheme of lithotyping in miniature doctors' dissertations and abstracts of theses. We have so far issued three numbers of such publications and shall issue three more this year. In the case of a doctor's dissertation we prepare an abstract eight or ten pages in length giving a summary of the procedures and findings, lithotyping this in a size of type that can be easily read without a magnifying glass. Then we lithotype in miniature the whole dissertation, including unabridged tables, graphs, etc. The miniatured pages are 1.9 by 2.4 inches, and eight of then fit into a five- by eight-inch book page. It is the intention to have this miniatured material read by the aid of a magnifying glass, although it is feasible to read it without such aid. Two very suitable reading glasses for this purpose are available: one is a binocular reading glass developed by the author from a stereoscope, the cost of which is only $3; the other is the "electrolens," manufactured by the American Optical Company, containing a small electric light for illuminating the page, and selling at wholesale for $5.

A doctor's dissertation, consisting originally of 120 typed pages, put up in this form made a booklet of 24 lithotyped pages—a nine-page large-type abstract, twelve pages of miniatured material, and one inside and one outside cover page blank. The cost of lithotyping, assembling and stitching these was $42 for an edition of 500. The booklets could be sent through the mail at one-cent postage.

Our abstracts of masters' and doctors' theses are put up in the following manner: each abstract occupies the front and the back surfaces of a single sheet, five by eight inches in size; on the front face a brief abstract of the whole thesis is given in type large enough to be read by the unaided eye; on the back surface occur eight miniatured pages for which a reading glass should be used. Thus each abstract contains the equivalent of an eight- or nine-page journal article, although it occupies but a single sheet five by eight inches. Each abstract carries a filing number according to the system of the *Loyola Educational Digest*. For libraries we have these sheets bound into booklets with a spiral wire coil. Those not to be used on library shelves are left unbound and are trimmed to fit into a standard filing system so that they may be kept classified by topic.

An edition of seven hundred copies of these abstracts containing eighty pages costs us about $127 for the lithotyping and in addition $50 or $75 for overhead.

Not only is this an inexpensive way to publish research reports, but there is the further advantage that the miniatured material occupies only a small amount of shelf space in libraries, as compared with ordinary print. This is an important factor if we are to come to the policy of publishing large numbers of research reports. And, when a suitable glass is used, miniatured print can be read approximately as easily as regular type.

CHARLES C. PETERS

ATTACHING REFRACTORY PARAFFINE SECTIONS TO THE GLASS SLIP

IT often happens that a protective, permeable covering for sectioned tissue on the slip is needed to prevent possible transposition of certain structures, the loss of refractory sections, or to permit drastic manipulations, such as blotting sections or passing them from aqueous stains to 95 per cent. alcohol. By following the suggestion of Barron[1] that amyl acetate is a practical solvent of both paraffine and celloidin, a protective membrane meeting the above requirements has been devised. By this method fine cytological, as well as very difficult material, such as cross-sectioned rabbit fur and vibrissae, may be securely fastened to the slip, successfully stained and covered.

Two solutions are made as follows:

(A) To equal parts of absolute alcohol and ether add enough liquid collodion (U. S. P., Baker) to make a solution so thin that when a glass slip is flooded and the solution permitted to coagulate, the mark of a sharp needle is scarcely visible to the unaided eye. (Thicker solutions may be used on thick sections or on those not intended for study under oil immersion.)

(B) Add one volume of amyl acetate ("purified," Baker) to four of solution A. (In practice the propor-

[1] D. H. Barron, *Anat. Rec.*, 59: 1–3, 1934.

tions may be estimated and the solution made in a 10 ml. vial.)

Because of the small quantity used and the highly volatile nature of solution A and the relatively wide range in strength which may be employed in either solution, an exact formula is not necessary. The tendency is to make the solutions too thick. Best results are obtained with freshly prepared solutions. It should be remembered that solutions A and B are soluble in 95 per cent. alcohol. Whether Mayer's albumin or water alone is used in stretching the sections is immaterial.

After the stretched sections have been thoroughly dried each slip is flooded with solution B and placed face up on a level surface for half an hour, or until the sections are sufficiently free of paraffine to appear nearly clear. Then, two or more layers of fine filter paper (Munktell's No. 3 is excellent) are placed over the tissue and rolled vigorously with a smooth bottle to absorb the surplus solution and flatten any sections which may have buckled. The sections are immediately flooded with solution A and the slip stood on end against a staining jar until the celloidin attains a glistening surface and toughened texture. The slip is then placed in 70 per cent. alcohol for several minutes, then passed rapidly (to prevent loss of the celloidin) through 95 per cent. alcohol and into carboxylol, where it should remain several hours, or be placed into xylol, to remove the paraffine. The slip is passed from carboxylol through 95, 70 or 50 per cent. alcohol to water and stained. After being stained and cleared in carboxylol the sections should remain in xylol sufficiently long (24 hours is not injurious) to insure removal of all remaining paraffine.

By replenishing, and thus prolonging, the application of solution B the sections may be passed from 70 per cent. alcohol to water and stained, instead of going to carboxylol before being stained. In general this shorter method is not recommended, for staining is often faulty due to incomplete removal of paraffine from the sections.

This method lends itself admirably to routine work in preparing numbers of slides. To facilitate handling a considerable number of slips the writer uses $1 \times 4 \times 12$-inch soft pine boards, each of which easily accommodates ten slips. Such a board of slips is placed upon an empty board, which raises the slips nearly two inches above the table top, and each slip is then flooded with solution B. Five of the ten are blotted at one time, hastily flooded with solution A and slanted against the two boards to allow the solution to drain and evaporate to the proper consistency before the slip is placed in 70 per cent. alcohol.

The celloidin film employed in this method does not retain stains as does that to which clove oil has been added. Preliminary experiments showed that with iron hematoxylin three-hour mordanting and three-hour staining, or three-hour mordanting and twenty-hour staining, the stain in the film was removed by iron alum solution before sections of striated muscle were properly destained. Mann's eosin-methyl blue was retained by the celloidin nearly as readily as by the sections of nerve trunk tissue, but the depth of the stain was not great enough to be objectionable. Mallory's phosphotungstic acid hematein ammonium staining method did not discolor the celloidin in over a hundred slides of rat tissues.

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SPECIAL ARTICLES

LAKE VEGETATION AS A POSSIBLE SOURCE OF FORAGE*

THE past summer, with its high temperatures and low rainfall, has accentuated the drought conditions which for the past several years have been more or less prevalent over considerable portions of the Great Plains Region. The ground water table has been generally greatly lowered throughout the region. Many lakes and streams have either disappeared or have dwindled to a remnant of their former size, and in many areas there is insufficient forage to maintain through the winter even the reduced number of live stock which remain in the area. In certain areas all local forage of every kind has already been consumed.

In the glaciated area of this region there exist tens of thousands of lakes. Many of these under the influence of deficient rainfall have become shallow and large areas of them are literally choked with masses of lake vegetation. Other deeper lakes have large shallow encircling areas or bays in which a rank growth of lake "weeds" is present.

It occurred to the writer that perhaps such lake vegetation might be utilized as a source of forage in the present emergency and, in fact, might represent a new natural resource which could contribute to the future agricultural wealth of the region. Accordingly, samples of the dominant vegetation types were collected during September and early October from representative Minnesota lakes, including both those with sand and mud bottoms. Those samples were analyzed with the results shown in Table I. In Table

* Paper No. 1313, Journal Series, Minnesota Agricultural Experiment Station.