

ANNOTATED LIST OF REFERENCES ON THE PREPARATION
OF WOOD FOR MICROSCOPIC STUDY

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Anonymous

1951. The preparation of wood for microscopic examination. Leaflet No. 40, revised February 1951, 8 pp. Dept. of Sci. and Indus. Research, Forest Products Research Laboratory, Princes Risborough, Aylesbury, Bucks, England.

Methods are presented for the softening, embedding in celloidin, sectioning, staining, and mounting of wood for microscopic study. Two macerating procedures are outlined.

Bailey, A. J.

1935. A new imbedding technique for hard or soft tissue. J. Forestry Vol. 33, No. 7, pp. 688-690.

Use of a colorless commercial lacquer for embedding tissue avoids the difficulties of excessive contraction and affords control of hardness of the embedding medium by mere variation in the temperature during the final drying.

1937. Precision sectioning of wood. Stain Technology Vol. 12, No. 4, pp. 159-166.

Discussion of the relative values of microtome knives and razor blades for cutting precise sections of wood. Sharpening and sectioning techniques are explained.

Buxbaum, F.

1927. An ideal wood-cellulose double-stain. Mikrokosmos Band 20. (Abstr. in Chem. Abstr. Vol. 21, No. 16, p. 2717.)

Differentiation of wood and cellulose in woody sections by means of solutions of (1) hematoxylin and (2) chrysoidin.

¹Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

Chamberlain, C. J.

1932. Methods in plant histology. 5th ed. University of Chicago Press. Chicago.

A standard text. Much of the information on the preparation of wood for microscopic study is still useful.

Chowdhury, K. A.

1934. An improved method of softening hard woody tissues in hydrofluoric acid under pressure. Ann. Bot. Vol. 48, No. 189, pp. 308-310.

Treating wood with hydrofluoric acid under pressure accelerates the softening process. Necessary equipment can be built to specifications. Useful if considerable amount of diagnostic work is to be carried on.

Conn, H. J.

1953. Biological stains. 6th ed. Biotech Publications. Geneva, N. Y. To be pub. in spring, 1953.

An authoritative discussion of stains useful in biological microtechnique.

Crowell, I. H.

1930. Cutting microscopic sections of wood without previous treatment in hydrofluoric acid. Stain Technology Vol. 5, No. 4, pp. 149-150.

How to section wood that has been softened by a jet of steam at atmospheric pressure.

Davenport, H. A. and Swank, R. L.

1934. Embedding with low viscosity nitrocellulose. Stain Technology Vol. 9, No. 4, pp. 137-139.

Advantages and disadvantages of embedding with low viscosity nitrocellulose in comparison with celloidin, and procedure to be followed.

Davis, G. E. and Stover, E. L.

1936. A simple apparatus for the steam method of softening woods for microscope sections. Trans. Ill. Acad. Sci. Vol. 28, p. 87.

Dean, H. L.

1941. An improved schedule for staining plant tissues in Delafield's hematoxylin and safranin. Chron. Botanica Vol. 6, No. 13, pp. 294-295.

Reversing the older method and staining first with hematoxylin to the desired intensity, then with safranin results in an improved schedule, for the hematoxylin remains fixed throughout the entire processing with safranin.

Diemer, M. E. and Gerry, Eloise

1921. Stains for the mycelium of molds and other fungi. *Science* Vol. 54, No. 1408, pp. 629-630.

A solution of silver nitrate in distilled water, applied to thin sections of wood, is effective in differentiating the mycelium of several molds and wood-destroying fungi for microscopic study. Two other solutions proved to be successful for the same purpose.

Foster, A. S.

1949. *Practical plant anatomy*. 2nd ed. D. Van Nostrand Co., Inc., New York.

The appendix contains information about the maceration of wood and the preparation of temporary mounts showing special structures by use of certain stains.

Franklin, G. L.

1937. Permanent preparations of macerated wood fibres. *Trop. Woods* No. 49, pp. 21-22. New Haven, Conn.

How to stain macerated wood with light green in clove oil and absolute alcohol, and procedure for mounting in Canada balsam.

1945. Preparation of thin sections of synthetic resins and wood-resin composites, and a new macerating method for wood. *Nature* Vol. 155, No. 3924, p. 51. (In *Biol. Abstr.* Vol. 20, No. 1: Sect. A., No. 118, 1946.)

The use of glacial acetic acid and hydrogen peroxide for softening and maceration.

1946. A rapid method of softening wood for microtome sectioning. *Trop. Woods* No. 88, pp. 35-36. New Haven, Conn.

A method for softening wood that uses glacial acetic acid and hydrogen peroxide. Effective for some woods.

Freund, Hugo

1951. *Handbuch der mikroskopie in der technik*. Band V, *Mikroskopie des holzes und des papiers*. Teil I and II Umschau Verlag. Frankfurt am Main.

Presents the history of wood anatomy, the techniques of preparing permanent slides of wood, detailed description of structure of certain European woods, and types of microscopy. Well illustrated.

Gatenby, J. B., and Beams, H. W. (Editors)

1950. The microtomeist's vade-mecum (Bolles Lee); a handbook of the methods of animal and plant microscopic technique. 11th ed. The Blakiston Co., Philadelphia.

See: Lee, A. B.

Although primarily a handbook of zoological microscopic technique, chapters 45, 46, and 47 contain valuable information relating to the sectioning, staining, and mounting of wood for microscopic study.

Harlow, W. M.

1944. The chemical softening of wood for microtome sectioning. Bull. New York State College of Forestry at Syracuse University. Vol. 17, No. 2, pp. 1-16. Technical Publication No. 63.

A review of methods for the chemical softening of wood for sectioning, with the conclusion that no substance appears to be better than hydrofluoric acid, although several yield satisfactory results in a shorter time. A bibliography is included.

Hutchinson, W. G.

1936. A method for staining rust mycelium in woody tissues. *Phytopath.* Vol. 26, No. 3, pp. 293-294. (*Plant Science Lit.* Vol. 3, No. 4, p. 25.)

Strassburger's Orseillin BB-anilin-blue-staining procedure, used with freshly cut, unfixed sections of white pine infected with blister rust, stained the mycelium blue, suberized and lignified walls red, parenchyma walls blue, and cytoplasm and nuclei red.

Hyland, Fay

1940. Preventing the curling of wood sections. *Trop. Woods* No. 64, pp. 41-43. New Haven, Conn.

How to prevent curling of wood sections by placing them between two wire screens immediately after sectioning.

Jeffrey, E. C.

1922. The anatomy of woody plants. Univ. Chicago Press. Chicago.

Chapter 32, entitled "Anatomical Technique," presents the fundamentals of wood microtechnique. The material is not new, but much of it is still useful.

1928. Improved method of softening hard tissues. *Bot. Gaz.* Vol. 86, pp. 456-462.

A method for softening very hard wood in dilute hydrofluoric acid in a few days, by first heating the wood in 95 percent alcohol at a temperature of 320° F., using an ordinary dental vulcanizer.

Johansen, D. A.

1940. Plant microtechnique. McGraw-Hill Book Co., Inc. New York.

A standard text in botanical microtechnique. Chapters 7, 8, 11, and 15 contain material useful in the preparation of wood for microscopic study.

Kerr, T.

1934. Action of hydrofluoric acid in softening wood. Trop. Woods No. 40, pp. 37-42. New Haven, Conn.

Describes the effect of hydrofluoric acid upon the walls of lignified cells in attempt to explain why the acid softens wood.

Kisser, J.

1926. Die Dampfmethode ein neues verfahren zum schneiden härtester pflanzlichen objecte. (The steam method for sectioning hard plant material.) Zeitschr. Wiss. Mikrosk. Band 43, pp. 346-354. (In Bot. Abstr Vol. 15, 1926.)

Softening of wood by means of steam directed upon the block as the sections are being cut.

1931. Neue Erfahrungen auf dem Gebiete des Schneidens harter Objekte. (New practices in the field of sectioning hard substances.) Zeitschr. Wiss. Mikrosk. Band 48, pp. 320-342.

1941. Mikroskopische veränderungen der Holzstructure durch mechanische Beanspruchung insbesondere bei der Schnittanfertigung. (Microscopical changes in wood structure caused by mechanical strain especially in sectioning.) Bot. Archives Band 42, Heft 1, pp. 100-148.

A review of the chemical, physical, and mechanical processes used for softening or treating wood. The significance of changes in the cell walls and middle lamella resulting from such treatment, as seen by microscopical examinations of cross sections, is discussed.

1947. Vorschläge zur verbesserung der abziehvorrichtungen für mikrotommesser. (Proposals for improving sharpening apparatus for microtome knives.) Mikroskopie Band 2, Heft 3/4, pp. 90-102. Verlag Rudolf Hans Hammer, Vienna.

Langeron, M.

1949. *Precis de microscopie*. Masson et C^{ie}, Editeurs, Libraires de l'academie de medecine, 120, Boulevard Saint-Germain, Paris, VI^e.

A detailed review of the subject of microscopy, including types of microscopes and lenses, photomicrography, staining, etc. Section 3, Chapter 3 presents information pertaining to the preparation of slides of wood.

Lee, A. B.

1950. *The microtome's vade-mecum: a handbook of the methods of animal and plant microscopic technique*. 11th ed. Edited by J. B. Gatenby and H. W. Beams. The Blakiston Co., Philadelphia.

See: Gatenby, J. B. and Beams, H. W.

Limbach, J. P.

1941. *New woody tissue techniques*. Unpublished thesis submitted for degree of Master of Science, University of Wisconsin.

Presents several methods for use of chemicals in the softening of wood for microscopic study.

Marts, R. O.

1950. Application of fluorescence microscopy and photomicrography to woody tissues. *Stain Technology* Vol. 25, No. 1, pp. 41-44.

The procedure described permits detailed observation of relatively large surface areas of wood under low power, in nearly natural conditions, without sectioning or staining, by means of fluorescence microscopy and photomicrography.

Newby, W. W. and Plummer, P.

1936. Technique for preparing microscopic sections of woody stems and roots. *Bot. Gaz.* Vol. 98, pp. 198-199.

The method described is similar to that used in making slides of petrifications. It is most useful for very hard woods.

Normand, D.

1944. *Dissociation des elements histologiques du bois*. (Separation of the histological elements of wood.) *Bull. Soc. Bot. Fr.* Vol. 91, Nos. 7-8, pp. 180-182. (Rev. in: *For. Abstr* Vol. 8, No. 1, p. 73.)

The use of alcohol and nitric acid for macerating woody tissue.

Peacock, H. Alan

1940. *Elementary microtechnique*. 2nd ed. Edward Arnold and Co., London.

Sass, J. E.

1951. Botanical microtechnique. 2nd ed. Iowa State College Press.
Ames, Iowa.

A good general text. Chapters 8 and 9 present the techniques for the preparation of slides of wood sections. Chapter 10 presents methods for maceration.

Spearin, W. E. and Isenberg, I. H.

1947. Maceration of woody tissue. Science Vol. 105, No. 2721, p. 214.

Describes a nondrastic method for macerating wood by means of acetic acid and sodium chlorite. Disadvantage is that conditions must be adjusted to each species of wood.

Sterling, C.

1942. The use of chloroform in clearing wood sections. J. Forestry Vol. 40, No. 5, pp. 428-429.

A method for clearing wood sections with chloroform rather than with clove oil or xylene. Advantages are less brittleness and curling of sections; disadvantages are volatility and slightly higher cost.

Tunmann, O. and Rosenthaler, L.

1931. Pflanzenmikrochemie. 2nd ed. Verlag von Gebrüder Borntraeger, Berlin.

Contains a section on the methods for the microscopic study of fats, oils, and resins in wood. Maceration methods, sectioning techniques, and mounting of wood are presented also.

Wetmore, R. H.

1932. The use of celloidin in botanical technic. Stain Technology Vol 7, No. 2, pp. 37-62.

Detailed outline of procedure to be followed in embedding wood in celloidin.

Journals with Reviews, Abstracts, or Bibliographies on

Microscopic Research and Methods

Bulletin de Microscopie Appliquee.

Organe mensuel de la societe Francaise de microscopie theorique et appliquee. Editions de la Revue D'Optique Theorique et Instrumentale. L. P. Clerc, Directeur General 165, Rue de Sevres -- 3 & 5, Boulevard Pasteur, Paris, 15^e.

Mikroskopie: Zentralblatt für mikroskopische forschung und methodik.
Verlag Georg Fromme & Co., Vienna.

Stain Technology: A journal for microtechnic and histochemistry. Official
Organ of the Biological Stain Commission. Pub. by Biotech Publications,
Geneva, N. Y.