INTERNATIONAL ASSOCIATION OF WOOD ANATOMISTS

NEWS BULLETIN 1959 / 1

Edited by the Secretary Treasurer Zürich, Switzerland

Office: Laboratorium für Holzforschung E.T.H, Universitätstrasse 2

EDITORIAL

This Bulletin aims at inviting as many of our members as possible to attend the IX International Botanical Congress from August 19 to 29, 1959 at McGill University and Sir George Williams College in Montreal (Canada). Our negotiations succeeded in including two special symposia on wood anatomy in Forest Botany, which is covered by section 14 of the Congress. The program of this section as well as that of our symposia is reproduced below. I have the pleasure of circulating the abstracts of the papers so far announced which will be read. I wish to thank the authors for their obliging co-operation. It is still possible to submit suggestions for additional items to be treated in our domestic meeting.

As indicated in the program, joint sessions of Forest Botany with Mycology and Physiology are planned. Unfortunately the exact dates have not yet been fixed by the organizing committee. But those who register for the Congress will receive the detailed schedule in due course from the Secretariat to the IX International Botanical Congress, Science Service Building, Ottawa, Canada.

SCIENTIFIC REVIEWS

The members are invited to co-operate with us in these "reviews" by submitting short communications regarding their personal research work.

Phloem Translocation in Trees *

By Dr. Martin H. Zimmermann, Lecturer in Tree Physiology, Harvard University, Cabot Foundation, Petersham, Massachusetts, U.S.A.

Phloem translocation is an important factor of tree growth. Organic substances are manufactured in the leaves and travel down to stem and roots, the sites of utilization, over great distances. The rate at which this transport takes place is most puzzling. It has been shown to be many thousand times greater than the rate of diffusion of the same substances in water (3). There is little doubt that the energy which is necessary for this acceleration is in some way derived from the plant's metabolism. The best hypothesis explaining the mechanism of phloem translocation has been put forth

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*) A detailed review, covering the latest literature of this field, is being prepared for Volume 11 (1960) of the "Annual Review of Plant Physiology" (9).

by Münch (5), although certain modifications of his view are nece sary. Münch's basic idea was that the vacuoles of all living pla cells are connected by permeable plasmodesmata, this whole "symplast" being separated from the "apoplast" - the dead, water-conducting tissues - by semipermeable cytoplasm. Production of organic substances by photosynthesis in one part of the plant and utilization by respiration, growth and storage in another part would result in a turgor difference along which a solute flow coul occur. This flow would have to go along the path of least resistance, that is, through the sieve tubes of the phloem.

It soon became clear that Münch's hypothesis had to be restricted to the sieve tubes. The movement from the leaf parenchyma cells, the site of photosynthesis, to the phloem takes place against a concentration gradient (6). However, molar concentrations within the sieve tubes meet Münch's requirements, that is, they are decreasing in the downward direction of the tree during the summer months (2,7,8). Furthermore, after the defoliation of a tree, either artificial defoliation in summer or natural leaf-fall in autumn, the molar gradients of the individual substances all add u to a total molar concentration gradient of zero. In other words, the difference in total molar concentrations in different parts of the tree disappear after defoliation while the concentration differences of individual substances either remain or reverse (7,8). This does not only hold for whole trees, but also for the defoliated side of partly defoliated trees.

These concentration measurements have been made with samples of exudate obtained from trees, mainly Fraxinus americana L. There is good evidence that the exudate from an incision into the inner bark (a) does come from the sieve tubes, and (b) is translocated material (for a discussion of this see (7)). Exudate from an incision cannot be obtained with conifers and not always with hardwoods. In many cases a failure of visible exudation may be due to a loss of the solution to the apoplast. Crafts found a method for the demonstration of exudation in a wide variety of plants: on the cut end of a shoot, dipped into water, one can observe strings of a liquid of high refraction emerging from the phloem (1). More recently, exudate has been collected over periods of several days from the cut-off stylets of aphids which were feeding on the phloem (4). This has been done successfully with willow, the pea plant and spruce. These observations give evidence of the longitudinal permeability of the sieve tubes.

Although the sieve tubes are easily permeable in the longitudinal direction, the cytoplasm lining the side walls is highly semipermeable. Sieve tubes are not "leaking". They are quite turgescent even far from the leaves and many days after defoliatio (7,8). Secretion of organic molecules into and removal from the sieve tubes seem to be enzymatic processes which are controlled by a leaf stimulus. The direction of the process (entry or exit) is determinded by the presence or absence of the leaves (7). The last step of entry, the actual release into the sieve tube vacuole, and the first step of removal, have to take place in the sieve element where cytoplasm and vacuole are in contact. Other steps may take place in the companion cells. Just where and how the leaf stimulus acts, we do not know.

Summarizing, we may say that Münch's hypothesis appears to be valid within the sieve tube system. A reversible secretion mechanism along the sieve tubes acts like a series of metabolic pumps. During a normal summer day, for instance, there would be vivid secretion of sugars into the sieve tubes in the leaves, and removal along trunk and roots. This would result in an osmotic water uptake of the sieve tubes in the leaves and loss in trunk and roots, and thus in a turgor gradient, along which a passive downward flow could occur.

References

(1) Crafts, A.S. The relation between structure and function of the phloem. Am. J. Bot. 26: 172-177. 1939.

(2) Huber, B., E. Schmidt, and H. Jahnel. Untersuchungen über den Assimilatstrom. Tharandter forstl. Jahrb. 88: 1017 - 1049. 1937.

(3) Mason, T.G., and E.J. Maskell. Studies on the transport of carbohydrates in the cotton plant II. Ann. Bot. 42: 571 - 636. 1928.

(4) Mittler, T.E. Sieve-tube sap via aphid stylets. In: The Physiology of Forest Trees. K.V. Thimann ed., Ronald Press, New York. 1958.

(5) Münch, E. Die Stoffbewegungen in der Pflanze. Gustav Fischer, Jena. 1930.

(6) Röckl, B. Nachweis eines Konzentrationshubs zwischen Palisadenzellen und Siebröhren. Planta 36: 530 - 550. 1949.

(7) Zimmermann, M.H. Translocation of organic substances in trees I - III. Plant Physiol. 32: 288 - 291. 399 - 404. 1957. 33: 213 - 217. 1958.

(8) Zimmermann, M.H. Translocation of organic substances in the phloem of trees. In: The Physiology of Forest Trees. K.V. Thimann, ed. Ronald Press, New York. 1958.

(9) Zimmermann, M.H. Transport in the phloem. Ann. Rev. Plant Physiol. Vol. 11. 1960. (In preparation).

The Transition of Earlywood to Latewood in Pinus resinosa Seedlings

By Dr. Philip R. Larson, Physiologist, United States Department of Agriculture Forest Service, Rhinelander, Wisconsin.

The development of earlywood and latewood cell types in Pinus resinosa seedlings was studied under various green-house treatments. Seedlings grown under long-day conditions continued to produce earlywood-like cells for an extended period of time. Latewood-like cells could be induced to form either by short-day treatment or by decapitation. When seedlings were transferred from short-day to long-day conditions, earlywood-like cell production was resumed, but only in seedlings with an intact bud.

The production of earlywood-like cells was also induced in decapi-
ted, short-day seedlings by the exogenous application of indole-
acetic acid (IAA). In both cases, long-day treatment and IAA ap-
plication, the newly-induced cells of the earlywood type followi
the short-day latewood cells, formed a definite and conspicuous
false ring.

Based on the experimental evidence of this investigation, the hypothesis originally proposed may be restated in more specific terms: Large-diameter, earlywood cells will be produced during th period of active elongation growth and high auxin synthesis. Nar-row-diameter, latewood cells will be produced following the ces-sation of terminal growth and the consequent reduction in auxin synthesis; a growth-inhibiting system may also become more prominently active at this time. Any factor that causes terminal elongation growth prematurely to begin or cease will bring about a respective increase or decrease in cell diameter. The extent t which a change in terminal activity will register a concomitant change in xylem tracheid development will be dependent upon the intensity of the apical stimulus. Thus, a false ring originating from a "second flush" of growth may be evident only in the upper-most parts of the stem. The increase in latewood cell wall thick-ness is due to a physiological process that is separate from the decrease in cell diameter although the two phenomena occur more or less simultaneously in normal latewood development. Further investigations of the physiological mechanisms of the earlywood-latewood transition are now under way.

(Author's summary of a publication in press)

MONTREAL BOTANICAL CONGRESS

August 19 - 29, 1959

The organizing committee of the Botanical Congress has made ef-forts to convene an international meeting representing a most complete spectrum of pure and applied botany. The members of I.A.W.A. will certainly be interested in section 14, Forest Botan of which we cite the main items of the program and the names of the chairmen as far as appointed:

__Symposia:__ 1. Problems in forest tree breeding. 2. The influence of forest vegetation on the degradation and amelioration of soils. S.A. Wilde. 3. Definitions and classification of forest ecosystem I. Hustich. 4. The anatomy and physiology of wood. (Arranged in co operation with the International Association of Wood Anatomists.) A. Frey-Wyssling. 5. Mycorrhiza. E. Björkman. 6. The ecology and physiology of tree diseases. J.R. Hansborough. 7. The taxonomy of the Hymenomycetes with special reference to the modern concepts of order, family, and genus. (Jointly with Mycology). A.H. Smith. 8. Long-distance translocation in living tissues. (Jointly with Physiology). B. Huber.

__Colloquium:__ 1. Problems related to tree physiology. (Jointly with Physiology). P.F. Wareing.

__Lecture:__ 1. Tree physiology in relation to forest research. P.J. Kramer.

Our Association has planned two half-day symposia dealing with:

__Anatomy and Physiology of Wood__

First Symposium:

__SAPWOOD/HEARTWOOD RELATIONS__

Chairman: B.J. Rendle

Cytology of Heartwood Ray-cells	A. Frey-Wyssling
Change of Vitality of Parenchyma Cells as a Physiological Basis of Heartwood Formation	V. Necessany
On the Origin and Development of Tyloses	L. Jurasek

Expected contributions by H.E. Dadswell and by K.A. Chowdhury are not yet fixed.

Second Symposium:

__PHYSICAL PROPERTIES OF WOOD DEPENDING ON ANATOMICAL FEATURES__

Chairman: Prof. Dr. A. Frey-Wyssling

Some Factors Influencing Cell Size in Conifer Cambium	M.W. Bannan
Changes in Anatomical Structure with Age	B.J. Rendle
Density Determinations in Wood	E.W.J. Phillips and B.J. Rendle
Influence of Microscopic and Sub-microscopic Structure on the Anisotropic Shrinkage of Wood	H.H. Bosshard
The Definition of Normal Characteristics of Variable Timber Species	J.D. Hale

The Secretary Treasurer wishes to invite members of our Association attending the Congress for a domestic meeting. He proposes the fol-lowing tentative agenda for that session:

__I.A.W.A. Business Meeting:__

1. Secretary Treasurer's Report
2. Honorary Members (Proposal: Frey-Wyssling)
3. International Glossary of Terms used in Wood Anatomy (Proposal: Rendle)
   a) Addenda and Corrigenda
   b) Illustrations
   c) Translations

4. Publication of Abstracts in the News Bulletin (Proposal: Milanez)
5. Tree Ring Society Tucson / Arizona (Proposal: Huber)
6. Miscellaneous.

Abstracts of Papers as far as received:

Cytology of heartwood ray cells

The cytology of ray cells has been studied in material obtained using an increment borer which permitted wood samples from the whole sapwood, through the band of intermediate wood, to deep in the heartwood to be tested. Living ray parenchyma is found in the sapwood whilst the ray cells appear to have lost their protoplasm in the heartwood. The nucleus has an oblong shape in the outer sapwood, rounds off more and more in the transition zone, decays into two or three pieces and becomes pycnotic at the heartwood boundary. Starch grains, if present, persist throughout the whole sapwood and disappear only in the narrow intermediate zone. The same is true for the mitochondria whose reducing power can be clearly demonstrated in the sapwood near the cambial zone. Heartwood formation is intimately related to the cytological breakdown of the ray cells. (Investigated European timbers: pine, larch and jew with heartwood, spruce without heartwood, beech and ash with facultative heartwood).

(A. Frey-Wyssling)

Some factors influencing cell size in conifer cambium

During the growth of the first few years certain changes are observable in cambial behaviour. The anticlinal divisions involved in cambial cell multiplication tend to decrease relative to radial increment, and the rate of gain of new initials falls off. Cell length gradually increases. In the peripheral growth of mature trees much variation exists from tree to tree. In some cases there is relative cambial stability, while in others anticlinal divisions follow in rapid sequence and there is continued replacement of old initials by new ones. As a rule cell length is somewhat less in vigorous than in slow growing trees. In fluted stems cell length is appreciably less in the grooves than in the neighboring convex sectors. No consistent differences in cell size have been detected between trees in wet and dry sites.

(M.W. Bannan)

Changes in anatomical structure with age

The gradual changes that have been observed in the anatomical structure of wood in passing from the centre of the tree outwards have been regarded as an age effect. These changes tend to be especially marked in wood near the pith, which has been referred to as juvenile wood. Some species normally exhibit a fairly rapid change over a limited number of growth rings and thereafter show only minor variations presumably due to the influence of external factors. In others the pattern of development is quite different.

Changes in anatomical structure with age or distance from the pith may have an important effect on the technical properties of the wood. The factors responsible for these changes in structure are discussed and the possibilities of control are considered.

(Bernhard J. Rendle)

A new approach to the study of density variation in wood

Density is widely used as a convenient index of quality and is of special significance in current investigations aimed at improving timber quality by selection and breeding. It is usually determined on sizable specimens in which the wood substance may be distributed with varying degrees of uniformity depending on the characteristic anatomical pattern of the species and on the effects of age, environment and genetic constitution. The technical properties of timber depend on the distribution as well as the amount of wood substance, and the present paper deals with the development of a method of studying variation in both these features by means of density determination on a semi-micro scale using a collimated beam of beta particles from a strontium^{90} and yttrium^{90} source. A radial strip of wood prepared from an increment core is scanned in 0.5 mm steps to show variation in density within individual rings. Comparative gravimetric determinations agree within 2.5 per cent. The method leads on to a new conception of the problem of measuring the proportion of late wood. Certain fundamental considerations underlying the method are discussed as well as possible sources of error and suggestions for further refinement.

(E.W.J. Phillips)

Influence of the microscopic and submicroscopic structure on the anisotropic shrinkage of wood

The coefficient of anisotropic shrinkage ε varies within a fairly wide range from 1.2. to 3.7., depending on the density of timbers. Considering the high heterogeneity of wood it is obvious that its microscopic and submicroscopic structure influences the shrinkage mechanism. The correlation of shrinkage data of some timbers with measurements of their specific micro-structure points to the high importance of the ray system. The rays cross the timber body normally to the grain. Their shrinkage, e.g. in a tangential section, cannot be the same as for the longitudinal tissues, but is significantly higher. Thus the tangential shrinkage of a wooden block is the result of the shrinking of the longitudinal cells plus that one of the ray system. - As to the submicroscopic structure, it may be attributed to the influence of the different chemical components on wood shrinking. The pectin and the hemicellulosic substances swell and shrink, the lignin remains more or less immovable. A high lignin content inhibits the shrinkage, and a different lignin content in radial and tangential cell walls raises to an anisotropic behaviour of shrinkage. Taking account of that fact, it is possible to discover another reason for the phenomenon of anisotropic shrinkage.

(H.H. Bosshard)

The definition of normal characteristics of variable timber speci

In sampling trees to appraise wood quality, anatomists of the Forest Products Laboratories of Canada suggest a method that reveals average technological properties of variable species in t form of graphs indicating the normal patterns of variation brough about in wood by age and environment. Species are sampled in area of recognizable ecological type (i.e. site) so as to obtain tree representing the range of diameters in each significant age-class in the forest area.

Properties of wood (e.g. specific gravity, cell dimensions, etc. are traced throughout the trunk by stem analysis so that trends o variation may be charted by position in the tree. Average propert representing whole stems may also be plotted as ordinates against diameter-classes in order of magnitude as abscissae.

Every species may, therefore, have a group of curves as "norms" for each site, each curve representing variation in S.G. among sma to large diameters in the same age-class. Trees having significan high or low S.G. for their class become conspicuously noted for anatomical observation to determine whether exceptional qualities result primarily from exceptional environment or exceptional inheritable characteristics.

Use of such analysis is suggested to distinguish trees with super characteristics propagable by inheritance.

(J.D. Hale)

OFFICE OF THE SECRETARY TREASURER

1. Financial

a) Statement of receipts and expenditures

Receipts	SFrs.	Expenditures	SFrs.
Subscriptions	840.81	News Bulletin	538.60
for Glossary of Terms	20.65	Stationery	169.70
Bank interest	81.15	Office	216.--
		Postage	320.25
Loss 1958	320.14	Sundry expenses	18.20
	1.262.75		1.262.75

b) Balance

Balance brought forward	SFrs.	4.389.91	
Loss for the year 1958		320.14	
Balance as at Dec. 31, 1958	SFrs.	4.069.77 *)	
*) Deposit book No. 4154 of the Swiss Bank Corporation	SFrs.	3.953.90	
Postal cheque account		95.62	
Cash		20.25	SFrs. 4.069.77

2. Membership

Mr. L.G. Schwegmann, Forest Products Institute, Ketjen Str. Pretoria West, South Africa, wishes to retire as an active member of the Association.

Pursuant to the decision of the council to exclude members who have not paid their membership fees for more than five years, it was necessary to strike the names of 5 non-financial members from the roster of the Association.

We are pleased to announce the nomination of seven new members:

Mr. R.K. Bamber, Forestry Commission of N.S.W., Sydney, Australia

Published work: "A note on the Identification of Plant Remains" (together with J.W. McGarity). Proc. Linn. Soc. N.S.W. 8:59-61 (1956) "Identification of Some Common Imported Species" Tech.Notes. N.S.W. Forestry Commission 10 : 3 (1956), "The Anatomy of the Barks of Five Species of Callitries Vent." (in press)

Dr. W.A. Côté, Assistant Professor, Wood Products Engineering, State University of New York, Syracuse 10, N.Y., USA

Publications: An electron microscope investigation of the organization and fine structure of the secondary cell walls of wood. Doctoral dissertation, June, 1958. State Univ. of New York College of Forestry, Dept. of Wood Technology. - An electron microscope investigation of pit membrane structure in conifers and hardwoods -- its implications in the seasoning and preservation of wood. Journal of the Forest Prod. Res. Soc., Vol. VIII, Oct. 1958, (in Press)

Dr. Philip R. Larson, Northern Institute of Forest Genetics, Rhinelander, Wisc. USA

Discontinuous growth rings in suppressed slash pine. Tropical Woods 104:80-99. 1956. Effect of environment on the percentage of summerwood and specific gravity of slash pine. Yale Univ.School of Forestry Bull. No. 63. 78pp. 1957. Preparation of small wood blocks for photomicrography. Stain Technology (in Press)

Dr. Hans Meier, Holzbiologe, Svenska Träforskningsinstitutet, Träkemiska Avdelningen, Kristinas Väg 61, Stockholm 0, Schweden

The main work of Dr. Meier concerns investigations on the submicroscopic structure of cell walls and cell wall constituens. They can be found in:
Holz als Roh- u. Werkstoff 13 (1955), 323, (Diss. ETH), Svensk Papperstidning 59 (1956) 395, Holzforschung 11 (1957) 41, Proc. Stockholm Conference on Electron Microscopy 1956, p. 298, Svensk Papperstidning 60 (1957) 785, Bioch. Bioph. Acta 28 (1958) 229, Acta Chem. Scand. 12 (1958) 144, Svensk Papperstidning 61 (1958) 633, Acta Chem. Scand. 12 (1958) 1911.

Dr. B. Mosse, East Malling Research Station, East Malling Maidstone, Kent, England.

The pulications by Dr. Mosse include a number of papers on the anatomy of fruit trees, and on endotrophic mycorrhiza in fruit plants. They can be found in:

J.Hort.Sci. XXVI/3, 1951; XXVIII/1 1953, XXIX/1 1954, XXXI/1 195 XXXI/3 1956, XXXIII/3 1958, Ann.Rep.E.M.R.S. for 1951 (1952), An Rep.E.M.R.S. for 1954 (1955), Nature 171, 1953, p.974 and 179, 1957, p. 922-24

Mr. Ken Shimaji, Institute of Forest Botany, University of Tokyo, Tokyo, Japan

His published work contains investigations on the anatomy of Japanese timbers and includes papers on the relationship between anatomical features and physical properties. It can be found in:

Bull.Tokyo Univ. Forests, No. 38 (1950), No. 42 (1952), No. 45(195 No. 46(1954), No. 47(1954), No. 48(1955), No. 53(1957), No. 55(1959) Journ.Jap.Forestry Soc. 32/11(1950), Miscellaneous Inform. Tokyo Univ.Forests, No. 11(1956)

Dr. A.B. Wardrop , C.S.I.R.O., South Melbourne, Australia

Dr. Wardrop's work since 1947 is summarized in the following papers (published under his own authorship or together with coop ators):

Microscopic and submicroscopic structure of cell walls. C.S.I.R. Bulletin 221, Nature 160:911, 162:957, 164:366, 168:610, 170:329 Proc. Leeds Phil.Soc. 5 (Part 2), 128, Biochim. et Biophys. Acta 3:549 and 585, 6:36, 13:306, Aust.J.Sci.Res.B. 3(3):265, 4(4):39 5(2):223, 6:299, Proc.Aust.Pulp and Paper Ind.Tech.Assn. 5:204, 6:243, J. Exper. Bot. 2(1):20, Text.Res.J.22 (4):288, Holzforsch 8:12, Aust.J.Bot. 6:299

Nature of reaction wood
Aust.J.Sci.Res. B.1 (1):3, 3(1):1, 5(4):385, Aust.Forestry B, 22 Aust.J.Bot. 3:177, 4:152, Structure and Properties of Tension Wood 9:97, Proc.Aust.Pulp Paper Techn.Assn.10:30, Nature 178:867 Holzforschung 11:102 and 33.

Physical and chemical properties of cell walls
Proc.Aust.Pulp and Paper Ind.Tech.Assn. 4:198, 9:107, J.Inst.Wood Sci. 1:2

Development and growth of tracheids
Australian Forestry 15(1), 17, Holzforschung 7 (2/3):34, Aust.J. Bot. 2:154 and 165, 3:137, 4:193, 6:89 and 96, Biochim. et Biophys. Acta. 21:200, TAPPI 40:225

Structure of cellulose
Aust.J.Sci.Res.A. 4 (3):412.

Zurich, 30th of April 1959

Secretary Treasurer — Assistant Secretary Treasurer

Frey-Wyssling — [illegible]

INTERNATIONAL ASSOCIATION OF WOOD ANATOMISTS

NEWS BULLETIN 1959/2

Edited by the Secretary Treasurer Zurich, Switzerland

Office: Laboratorium für Holzforschung E.T.H., Universitätstrasse 2

EDITORIAL

Your Secretary Treasurer has the pleasure to report that a joint Council and Member Meeting of the IAWA was held at Sir George Williams College, Montreal (Canada) at 16.15 p.m. on September 25th after a symposium on the anatomy and physiology of wood organized in the section Forest Botany by the IX. International Botanical Congress 1959. The details on these proceedings will be found in a special paragraph of this News Bulletin.

I should here like to mention that pursuant Art. IV of our Constitution the Assembly elected three Honorary Members for their achievements in the advancement of the knowledge of wood anatomy. I am delighted to announce that this honour has been bestowed on

Dr. I.W. Bailey (Harvard University, Herbarium) who has been a member of our Council since the foundation of our Association in 1931 and whose remarkable work relating to our science is collected in the attractive compendium "Contribution to Plant Anatomy" (Chronica Botanica Company) Waltham, Mass., USA, 1954.

Dr. L. Chalk (Lecturer in Wood Anatomy, Imperial Forestry Institute, Oxford, England). His comprehensive experience in and knowledge of the structure of wood made him the predestined chairman of our Committee of Nomenclature, whose activity has been crowned by the "International Glossary of Terms used in Wood Anatomy" (Tropical Woods, Nr. 107, Oct. 1957), which was sent to all our members last year.

Dr. Margareth Chattaway (retiring scientist on the Forest Products Research Laboratories of Australia) whose important contributions to the problem of heart wood formation and bark anatomy as well as her valuable assistance in the administration of our Association 1947 - 1957, when Dr. H.E. Dadswell (Melbourne, Australia) was our Secretary Treasurer, the Assembly wished thus to reward.

On behalf of our Assembly as well as of all our members who were unable to attend the International Botanical Congress in Canada, I wish to congratulate our Honorary Members on their well-deserved election and to thank them for their valuable contributions to our knowledge of Wood Anatomy.

A. Frey-Wyssling
Secretary Treasurer