Comments and Communications

A Commentary on Structural Variation in Conifer Wood

Sen and Banerjee (*Science*, 1950, **111**, 151) have presented x-ray diagrams of the wood of chir pine, both normal and after attacks by *Lenzites striata*, from which they claim to show that the fungal infection has led to a change in orientation of the cellulose fibrils in the walls of the tracheids. While rightly pointing out the extreme variability of structure in conifer wood, they are apparently unaware of the systematic study that has been given to it in this laboratory during the past twenty years (Preston, R. D. *Phil. Trans.*, 1934, **B 224**, 131; *Proc. Roy. Soc.*, London, 1946, **B 133**, 327; 1947, **B 134**, 202; *Biochem. et Biophys. Acta*, 1948, **2**, 370; Preston, R. D., and Wardrop, A. *Biochem. et Biophys. Acta*, 1949, **3**, 585; Wardrop and Preston, *Nature*, 1947, **160**, 911). This work makes it desirable to utter a word of warning.

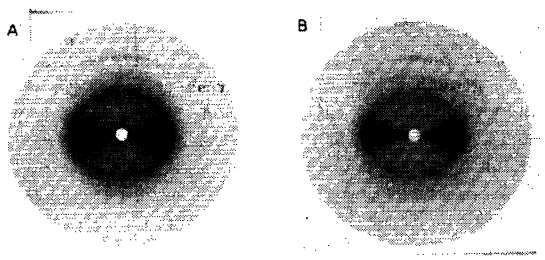

FIG. 1. X-ray diagrams of wood from eleventh annual ring of a specimen of *Pseudotsuga taxifolia*. CuKα radiation, beam perpendicular to grain of wood and along a radius; *a*, early wood; *b*, late wood, at a position about 1.5 mm from *a*. Fig. 1 *a* compares with Fig. 1 *left* of Sen and Banerjee, and *b* with their Fig. 1 *right*.

An unequivocal demonstration of a change in the submicroscopic structure of wood after infection would demand a comparison of a sample of infected wood with the *same sample* before infection, and it is only insofar as the "normal" sample used by Sen and Banerjee duplicates the structure of the "infected" sample before infection that their conclusions can be accepted. It is known that the fine structure of wood varies, not only along the length of a trunk and across the annual rings, but markedly also across a single annual ring. The x-ray diagrams presented here correspond, for instance, to the early wood (Fig. 1, *a*) and late wood (Fig. 1, *b*) of the eleventh annual ring of a sample of *Pseudotsuga taxifolia* taken at breast height and are typical of the behavior of conifer wood generally. The difference between these two diagrams is the same in kind, and of at least the same degree, as that shown in the diagrams of Sen and Banerjee. In a block of sapwood of the size used by Sen and Banerjee (4 in. × 2 in.) there is bound to be considerable structural variation of the kind represented by their illustrations. Unless, therefore, the irradiated samples of normal and infected wood were chosen with meticulous care, the comparison made between them may well be invalid. Unless, indeed, the two diagrams are examples of many other pairs showing the same difference, it is difficult to see how the claim that a small change in structure is induced by infection could in any case be substantiated.

Even if the difference between the diagrams does correspond to a change in infection and not merely to a normal variation from point to point in the wood, then it is still unsafe to associate it a priori with a *change in orientation*, whatever that may, precisely, mean. The possibility should not be ignored, for instance, that the fungus may be removing the more disordered fraction of the cellulose with a consequent improvement of the diagram. It is to be suggested that these alternatives—and other possibilities—could best be distinguished by optical investigation of single cell walls under a polarizing microscope. The genesis of the spiral x-ray diagrams would seem to be much too complex for any results of value to be achieved by their further detailed examination by the methods proposed by Sen and Banerjee.

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Maximal Consumption of Ethyl Alcohol

Evidence has recently been advanced by Newman (*Science*, 1949, **109**, 594) to show that "the maximum daily consumption of alcohol by a man of average weight is represented by a quart of 100-proof liquor, and that estimates greater than this are in error." This statement has been accepted by the press and by medical authorities (*J.A.M.A.*, 1939, **141**, 535) with such a degree of finality that it seems highly desirable to point out certain aspects of this conclusion that have not been previously considered. The establishment of such a figure has many important implications in both medical and legal practice, so that only the most unequivocal evidence should merit such complete acceptance.

It is true, as Newman states, that alcoholics are poor judges of their own alcohol consumption, but there are numerous accounts that indicate that some persons of average weight *can* consume more than a quart of 100-proof liquor in a 24-hr period, and the writer has himself known two persons who consumed substantially twice this amount over extended periods of time. Newman is certainly correct in asserting that high levels of consumption can only be achieved by maintaining the blood alcohol concentration at a high level, and individuals who consume such large amounts of alcohol are invariably "round-the-clock" drinkers. Both enzyme kinetics and

the greater rate of alcohol loss via excretory channels support the belief that the rate of alcohol metabolism is a function of its concentration in the body. Since the blood alcohol levels upon which certain of Newman's calculations are based are frequently exceeded in actual practice, it follows that higher metabolic rates also occur, and that higher levels of alcohol consumption than those deduced by Newman from the rates of alcohol metabolism quoted by him are therefore possible. It should also be pointed out that, in considering the "maximal consumption" of alcohol, cognizance must be taken of the extreme individual variations in alcohol metabolism that are manifest throughout both the purely experimental and the clinical literature.

It has been shown with rats that consumption of 10% alcohol as a sole fluid source may be less than half their consumption of alcohol under conditions of self-selection (Williams *et al. Arch. Biochem.*, 1949, **23**, 275). If this is also true in dogs, as seems likely, then Newman's estimate of the maximum human consumption of alcohol, based on the forced consumption of 10% alcohol by dogs, may be less than half the actual figure. However, many rats on self-selection diets consume amounts of alcohol equivalent to 1,500 ml of absolute alcohol/70 kg man/day without grossly apparent physical effects! This fact suggests grave dangers in assuming that the rate of alcohol metabolism in men and in dogs is the same, for it certainly is not in rats (or in mice). The fact that the basal metabolic rate on a weight basis in dogs is generally about twice that of humans is a reflection of a higher rate of metabolism of many specific substances in dogs, and there is no obvious reason to think that alcohol is not among them. Finally, the fact that the acute oral toxicity of ethyl alcohol for rats (7.4 g/kg) (Welch and Slocum. *J. lab. clin. Med.*, 1943, **28**, 1440) is approximately four times that for humans is indicative of a species difference, which in this case follows closely (and perhaps fortuitously) the reciprocal relationship between species size and basal metabolic rate. A number of practical considerations thus suggest that the *maximum* consumption of alcohol by a man of average weight is at least two quarts of 100-proof liquor, and may even be greater in some cases.

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Textbooks and Courses in General Biology

An unjustifiably harsh review of a textbook of general biology (*The World of Life*, Pauli, W. Houghton Mifflin, 1949) in a recent issue of SCIENCE (1950, **111**, 368) has raised several fundamental issues relative to the teaching of general biology and the subject matter that should be included in a textbook for such a course. The principal criticisms in the review include: (1) that the book does not instruct in the scientific method; (2) that the author assumes the general biology student has no knowledge of chemistry and physics, and consequently he has a "futile" section in the book on elementary chemistry and physics; and (3) that certain subjects such as autocatalysis, growth and morphogenesis in terms of chemical and physical changes, and the physicochemical nature of mutations are omitted. These latter subjects, states the reviewer, should be included in a college student's main reading source in biology.

One wonders immediately how the reviewer has managed to give general biology courses only to advanced students. The writer has taught elementary courses in several colleges and universities and has never encountered a class in which the majority had a working knowledge of chemistry and physics. Very few freshmen students have a good background in both these subjects, and many of them take college chemistry and physics in parallel with general biology. In view of these facts and the relatively high percentage of failures in the first-year courses in these physical sciences, it is believed that any author of a general biology textbook is fully justified in assuming that the background of most elementary students in these subjects is slight.

Admittedly, first-year students should have some exposure to the elements of the scientific method, but to what extent this can be successfully taught is certainly a debatable point. It seems to the writer that the scientific method represents a concept that is gradually acquired as one's training proceeds. It is not something that can be unceremoniously stuffed down untrained gullets by requiring the student to read a section in a textbook. Most teachers do not expect a textbook to do all their teaching for them. Indeed, of what value are lecture and laboratory periods if they are not used to give supplementary material? Any elementary textbook that considers detailed scientific experiments and the many failures attendant thereto will very shortly accumulate dust on the bookshelf.

One unfortunate aspect of many textbooks of general biology is the encyclopedic nature of the contents. Apparently the authors feel that more adoptions can be obtained if all imaginable subjects and minute details are included. The text is often not written in an interesting style, and frequently continuity and organization are sadly lacking. As a consequence the average student is soon floundering in a maze of unrelated facts, while he suffers from a bombardment of technical terms. If the present trend continues, many textbooks will be forced off the market, unless the publishers supply special means of transportation for these overgrown biological hodgepodges.

In the writer's opinion, an acceptable textbook for general biology should have certain definite features. It should be from one-half to two-thirds the length of the average textbook available today. It should consider the most important subjects necessary for a good biological foundation, omitting details and many technical terms. It should be written in a readable style and published in an attractive format. Such a book would be adaptable for a wide variety of courses, for any instructor worth his keep can elaborate in lecture or laboratory upon any specific subject that he feels should be emphasized in his particular course.

There are, to be sure, many different kinds of courses in general biology. There are courses designed for spe-