the undertaking is possible but that it is very widely welcomed.

Biological science does not have back of it extensive, well-organized and highly paying commercial organizations dependent on the progress of the science and contributing to its development and support, such as exist in the case of chemistry, for instance. Although the applied aspects of biology in medicine, in agriculture and fisheries are of at least equal human significance they are not organized as commercial enterprises, and hence can not contribute directly to the support of *Biological Abstracts*, as can the commercially organized chemical industries to *Chemical Abstracts*. For a long time to come, then, *Biological Abstracts*, if it is to continue, must depend on the support of enlightened philanthropy. At present its earned income from subscriptions and other sources is sufficient to pay manufacturing costs only. This agrees with the original estimates drawn up before the project was under way. But the great items of cost, consisting of editorial, indexing, bibliographic, secretarial and clerical services, which make up from two thirds to three quarters of any adequate operating budget, must be specially provided. This constitutes an enormous "overhead" which exists whether the subscription list be large or small. It is estimated to amount to over $100,000 for 1931. This is obviously a situation in which every biologist can help, by his subscription. It is, however, not expected that even with the largest list of subscriptions practically possible, the overhead charges can be paid by the receipts of the journal.

The whole enterprise of biological research is, however, so vast and its human usefulness so inestimably great that such a sum seems to be only a small tax upon it; indeed, almost vanishingly small compared with the immense sums required for primary costs of the research and original publication. If the journal should acquire still more of an international character, the tax on American biologists and American philanthropy might be correspondingly reduced; but it seems to the writer that American biologists and philanthropists who have the advancement of science at heart should not withdraw their support until the future of this comprehensive abstracting service is adequately safeguarded.

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TWISTED TREES

I HAVE read with interest the notes in SCIENCE for February 13 and March 27 dealing with trees with twisted bark. My observations covering a large part of the province of Ontario, Canada, may be of interest in this connection. In this region I have often noted the twist of evergreens, especially of the cedar (*Thuja occidentalis*), white pine (*Pinus strobus*), Norway pine (*Pinus resinosa*) and Jack pine (*Pinus divaricata*). I have never noted it on a "hardwood" in the region. In the cedar the twist is very common, straight-grained trees being far less abundant than twisted-grained. Last summer I camped on an island in Lake Kahnipiminanikok, and my party amused itself one rainy day noting this twist on cedars, some one having discovered the predominance of right-handed twists. We counted (from my notes) 312 cedars on the island; of these 219 were twisted; of these 187 were right-handed twists. Later an Indian emphasized the need of straight-grained cedars in the hewing of paddles, and the difficulty of obtaining such grains in that vicinity. He also pointed out the fact that the twist is more common in large trees than in young ones, indicating that this character is acquired by some environmental factor. This twist is not alone in the bark, but in the wood as well. It is frequently so extreme as to be a spiral. Among the white and Norway pines the twist is far more common in trees exposed to severe weather conditions, especially to strong winds. Thus I noted that twisted trees occurred more commonly on exposed rocky cliffs and small, open islands, where they receive the full brunt of winter gales. A twisted tree in the heart of the forest is quite rare. But why do they twist so predominantly to the right?

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THE MECHANISM OF CROSSING-OVER

DR. SAX[1] has recently put forward a theory that crossing-over is due to the breaking of chiasmata in the course of terminalization. This theory is based on a suggestion of mine[2] that "crossing-over is occasioned by breaking of chiasmata." Moreover, Sax uses diagrams and terminology that are borrowed from my studies and therefore imply an interpretation in accordance with my findings.

I should like to point out therefore that I do not consider the original conjecture in any way supported by Sax's observations. I discarded the idea a year ago for reasons that are described in the accounts of studies conducted in this laboratory by Erlanson,[3] Philp and Huskins[4] and myself.[5,6,7,8,9] Briefly, the

[1] K. Sax, "Chromosome Structure and the Mechanism of Crossing-over," *J. Arnold Arboretum*, 11: 193–220, 1930.

[2] C. D. Darlington, "Meiosis in Polyploids, II. Aneuploid Hyacinths," *J. Genet.*, 21: 17–56 (see p. 52), 1929.

[3] E. W. Erlanson, "Chromosome Organisation in *Rosa*." *Cytologia*, 2 (in the press).

[4] J. Philp and C. L. Huskins, "The Cytology of *Matthiola incana* R. Br.," (especially in relation to the inheritance of double flowers), *J. Genet.*, 24 (in the press).