# Comments and Communications

## Are There Vestigial Structures in Plants?[1]

STRUCTURES that have lost their function or have become almost useless are well known in the animal kingdom. For example, there are said to be several score of such structures in man. Their importance in the concept of animal evolution need scarcely be mentioned. The subject has received scant attention in the botanical field and one wonders whether an inquiry into the matter might not prove to be profitable, as well as interesting.

Higher plants have an advantage over most animals in that one finds an alternation of generations in existence, and, furthermore, as one progresses through the several series of the spore-bearing members to the seed plants, there is a decrease in size of the gametophyte and an increase in size of the sporophyte generation. Coupled with this trend is the lessening importance of sex organs (in this discussion the stamens and pistil are not considered to be sex organs). One might look, then, to the spermatophytes for evidences of vestigial organs. It should be stressed at the beginning that facts gleaned from direct observation can seldom be disputed, but hypotheses derived from the observations may be open to question.

If one considers the embryo sac of a typical spermatophyte, one might say that in many cases synergids and antipodals are vestigial. The fact that these structures do function in some species does not invalidate their vestigial nature in other species. It seems to the writer that the entire matter of vestigial organs must be placed upon the species or varietal level. In many plants three of the four megaspores disintegrate and are functionless just prior to their disappearance. The fact that in some species there are no functionless megaspores does not alter the vestigial nature of the megaspores that disintegrate. To draw an analogy from zoology, the caecum with its attached appendix is probably functionless in man, but in birds and some other animals the caecum is of great importance.

Other possible vestigial structures in the higher plants can be mentioned. In many species stipules are clearly reduced and functionless. The stone cells in certain fruits, petiole glands, and abortive carpels in the cherry also belong in this category. Likewise pistils in staminate flowers and stamens in pistillate flowers are vestigial. *Zea mays* shows bisexual initials in both the tassel and the ear.

As one scans the members of the spore-producing groups, one quickly perceives that possible vestigial structures are more difficult to locate. One could mention the glands on fern fronds, the reduced leaves of the horsetail (*Equisetum*), or the paraphyses in the fungi.

Certain tentative principles may be advanced about vestigial organs. One is that the more highly evolved a group is, the more vestigial structures one is likely to encounter. The term "highly evolved" does not mean the oldest geologically but the most diversified and adaptable. The spermatophytes thus display more vestigial structures than the lower groups. The latter are also older geologically and, if selection has operated, useless structures have been culled out to a larger extent than in the seed plants. Vestigial structures seem to be more prevalent among the chordates than in other groups.

No doubt there may be some disagreement with the views herein expressed; but the subject seems to be of too much importance to be ignored, and many fruitful discussions may be initiated in the classroom if the matter of vestigial structures is introduced.

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## A Rapid Method for the Measurement of Carbon 14 in Formamide Solution[1]

THE methods previously used for the determination of carbon 14 in tracer studies have depended on the oxidation of the material to be tested, followed by measurement of the radioactivity of the resulting carbon dioxide, or by direct measurement of the radioactivity of the material in the solid state. The latter method is complicated by self-absorption, which varies with the character of the substance. To avoid this complication many laboratories convert their materials into barium carbonate and measure the activity with a suitable counter. Because of the difficulty of obtaining a uniformly distributed deposit, the counting rate is not always reproducible. Furthermore, the original material is destroyed, and the procedure is laborious.

We wish to report the use of a rapid-counting method for the direct determination of radioactivity of substances containing carbon 14, employing a suitable solvent, namely, formamide.

A circular 1-ml cell, with an inside diameter of 37 mm and a depth of 1.1 mm, was constructed of stainless steel. The radioactive substance was dissolved in 1 ml of formamide and introduced into the cell. The cell was placed into a methane gas-flow proportional counter[2] attached to a scaling device. After methane was passed through the counter for approximately 10 min, in order to remove the last traces of air, the counting rate became constant, even over a period of several days, and was determined over an appropriate period of time. Generally 40,000 counts were recorded, which corresponds to a standard deviation of $\pm 0.5\%$. Measurements were made on formamide solutions in a concentration range of 0.2–5%. Since the depth of the liquid for counting purposes is "infinitely" thick, the

[1] Aided by a grant from the Atomic Energy Commission.

[2] Nucleometer, manufactured by Radiation Counter Laboratories, Chicago, Ill.