Letters

Adenine and Plant Growth

The provocative article entitled "Chemical basis for adaptation in plants," by E. B. Kurtz, Jr., which appeared in the 7 November issue of *Science* [**128**, 1115 (1958)] carries a brief description of some work which I did some years ago at the California Institute of Technology. I believe that Kurtz has unintentionally attributed much greater significance to this work than I myself would, and I am eager to have the situation set straight before other individuals draw unduly optimistic conclusions from the brief description in the article.

Some years ago the late Margery Hand and I found that subapical sections of etiolated pea epicotyls grew increasingly well up to temperatures of about 30°C but suffered a sharp thermal inactivation of their growth mechanism at about 35°C. Knowing that certain strains of *Neurospora* were temperature-sensitive adenineless mutants, we decided to apply adenine to these sections in an attempt to reverse the thermal inactivation of growth. This was partially successful, and, in fact, in certain experiments the presence in the culture medium of as little as 5 μg of adenine per milliliter was the difference between life and death for these little etiolated pea sections in an overnight growth test.

In subsequent experiments, described in chapter 25 of *The Experimental Control of Plant Growth* by F. W. Went (Chronica Botanica, Waltham, Mass., 1957), we attempted to extend these findings to green growing pea plants in the phytotron at Pasadena. We did find that at the higher temperatures adenine consistently increased the area and fresh weight of the leaves but had no effect on survival, or on the stem length or total dry-weight deposition. Adenine did *not* cure the entire plant of the symptoms of high-temperature injury.

There does, of course, exist a distinct possibility, fortified by the data of Highkin, as cited by Kurtz, that in more properly conducted experiments the adenine effects would show up more dramatically. For instance, we gave the high-temperature treatment only during the dark period, on the supposition that pea growth followed the general pattern of nocturnal growth, as outlined by Went for the tomato. However, it is now clear that the thermal effects on growth of peas could be expected to be great during the light period. We were also unable, in our experiments, to grow the plants at a high enough temperature, since the phytotron at that time had no chambers at temperatures over 30°C.

Certainly the chemical cure of climatic lesions is an attractive concept as well as a catchy phrase, and research in this area is very promising. One should also remember that adenine is only one of many substances which may prove to be of some aid in combating the thermal inactivation of growth. There are many temperature-sensitive genes in *Neurospora,* and indeed many probably exist in higher plants as well. One could reasonably expect that in particular plants specific amino acids, purines, pyrimidines, vitamins, and still other compounds would be effective in extending the temperature and perhaps geographic range of the plants.

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Teaching and Research

In their book *The Academic Market Place* (Basic Books, New York), two sociologists, Theodore Caplow and Reece McGee, report the results of a survey of 371 college professors and administrators. Only 4 percent believe that the test of a college teacher's ability lies in the way he teaches; about 33 percent consider the worth of a professor by the number of papers he publishes, and the remaining 63 percent give confusing answers. This survey evidently reflects a general opinion among many professors and administrators, especially in graduate schools, where the publication of papers is often considered of more importance than the clarification of ideas, which is the quintessence of teaching.

Many papers are of great value in scholarly investigations, but unfortunately some are only of use to obtain promotions for their authors. One cynic has observed that papers of this type are abstracted, quoted, and cited in a stream of other papers which in turn are abstracted, quoted, and cited. A faculty member whose chief interest is teaching often remains unknown and unsung except among a relatively limited group of students. During his academic life-time of perhaps 40 years he may reach 10,000 young people. But in a journal of international circulation a larger audience than this is obtained with the publication of only one significant paper—an audience composed of many readers of understanding and influence in the author's chosen field. This presents a temptation and one explanation of the widespread desire to become an author rather than a teacher.

To be sure, some are so gifted and energetic that they are able to publish brilliant papers, deliver inspiring lec-

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