

these later chapters are "XI., Biology of Bacteria, Yeast and Moulds; XII., Classification—the 'Worms,' Mollusca and Arthropods; XIII., The Plant Kingdom; XIV., Some Biological Adaptations; XV., Some Biological Factors in Disease; XVI., Evolution; XVII., Variation-heredity; XVIII., Animal Behavior and Its Relation to Mind." From this outline it will be seen that the author maps out a very extensive program and it is not surprising that consideration of many topics is very brief, and, almost necessarily, inadequate many times. An account of "The Plant Kingdom" in 23 pages can not be very satisfying.

The style of the book is readable, but unfortunately is marred by many loose statements and faulty definitions. The cell is stated to be composed of the "nucleus" and "cytoplasm"—a structure and a substance, instead of nucleus and cytosome—structural subdivisions. Many examples of such definitions appear throughout the book. Physiology is defined as "the work that an organism does or the work of its parts"; metamorphosis as "a name given to the life-history of insects, frogs, etc."; symbiosis as "the living together of dissimilar plants or animals or a plant and an animal." The illustrations are good and are properly chosen to represent other forms than the ones used in the laboratory. No laboratory outlines are given and the brief and very general chapter headings, called "Laboratory Studies," would be of no service to a competent teacher and are far too general to help an untrained one. They could properly be omitted.

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### SPECIAL ARTICLES

#### THE CAUSE OF THE DISAPPEARANCE OF CUMARIN, VANILLIN, PYRIDINE AND QUINOLINE IN THE SOIL

##### PRELIMINARY NOTE

CONSIDERABLE attention has been devoted recently to the fact that organic substances which are toxic to higher plants in water culture lose their toxicity when added to the soil.<sup>1</sup>

<sup>1</sup> Davidson, J., *Jour. Am. Soc. Agr.*, 7: 145-158, 221-238 (1915). Upson, F. W., and Powell, A. R., *Jour. Ind. and Engin. Chem.*, 7: 420-422 (1915). Fraps, G. S., Texas Ag. Ex. Sta. Bul., 174 (1915).

This depends, however, on the soil.<sup>2</sup> This loss of toxicity would seem to be due to the fact that the substances, as such, disappear in the soil.<sup>3</sup> Funchess<sup>4</sup> has also found that many of the organic nitrogenous compounds toxic to plants in water culture are apparently nitrified in the soil. This would point to their disappearance as being due to biological causes. Some observations made by the writer during the past year on the cause of the disappearance of four of these compounds may prove suggestive to those who are investigating this problem.

Cumarin, vanillin, pyridine and quinoline were added separately at a concentration of 1,000 parts per million to soil in pots. This soil was similar to that used by Funchess,<sup>5</sup> in which the organic toxins were found to lose their toxicity or even become beneficial to plant growth. The number of microorganisms developing in the treated pots and in the check pots was determined at intervals over a period of about three months. In each case the numbers of microorganisms increased enormously in the treated pots, after, in some cases, an initial depression in numbers. The phenomenon appeared entirely analogous to that found in partial sterilization.

In order to determine whether microorganisms are concerned in the destruction of the substances named above, the compounds were added to sterile soil in two liter bottles. Part of each set of bottles, treated with one of the four substances mentioned above, was inoculated with an infusion from normal soil. The bottles were incubated about two months at room temperature. At the end of that time sterile wheat grains were planted in the bottles. The growth of the wheat plants showed that in the inoculated soil the toxic properties of the vanillin, cumarin, pyridine and quinoline had largely disappeared, but were still very evident in the bottles containing sterile soil. This seemed to indicate that Funchess, M. J., Alabama Ag. Ex. Sta. Tech. Bul., 1 (1916).

<sup>2</sup> Skinner, J. J., U. S. Dep't Agr. Bul. 164 (1915).

<sup>3</sup> Fraps, *loc. cit.*

<sup>4</sup> Unpublished data.

<sup>5</sup> *Loc. cit.*

the disappearance of the compounds was chiefly due to biological causes.

From the bottles or pots three species of bacteria were isolated, one of which uses pyridine as a source of nitrogen, one vanillin as a source of carbon and one cumarin as a source of carbon. An organism acting on quinoline has not yet been found.

This would seem to show that the enormous increase in numbers of organisms noted in the treated pots and the disappearance of the four substances in the soil depend on the fact that they (the compounds) serve as food sources to definite species of bacteria.

The significance of these facts to the soil toxin theory of soil fertility is evident. The persistence of vanillin, for example, in some soils and not in others may be due to the fact that the vanillin organism is absent or to the fact that conditions are not suitable for its development or for the use of the vanillin. If we should be able to improve a soil containing vanillin by treating it with the vanillin organism the results should be a strong argument for the soil-toxin theory of soil fertility. This of course is a step into the future.

The results are also suggestive in explaining some of the phenomena accompanying "partial sterilization." They would suggest that in "partial sterilization" (at least that caused by these four compounds) we do not have a large increase in the numbers of microorganisms because the less resistant are killed and the resistant forms given opportunity to develop; or because voracious protozoa are eliminated; but because the sterilizing agent used serves directly<sup>6</sup> as a food source. In the case of steam, and perhaps carbon bisulphide, unavailable food supplies are probably made available.

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## SOCIETIES AND ACADEMIES

### THE AMERICAN PHYSICAL SOCIETY

The eighty-fifth regular meeting of the American Physical Society was held in the Ryerson Lab-

<sup>6</sup> This has been suggested for pyridine. See Buddin, W., *Jour. Agr. Sci.*, 6, 416-451 (1914).

oratory of the University of Chicago on Saturday, December 2.

The following papers were presented:

"On the Velocity of Sound in Metal Tubes," by Karl K. Darrow, University of Chicago.

"Collapse of Thin Tubes Shorter than the Critical Length," by A. P. Carman, University of Illinois.

"An Acoustical Thermometer," by F. R. Watson and H. T. Booth, University of Illinois.

"A General Method of producing the Stroboscopic Effect, and its Application in the Tono-deik," by L. E. Dodd, State University of Iowa.

"The Intensity-factor in Binaural Localization and an Extension of Weber's Law," by G. W. Stewart and O. Hovda, State University of Iowa.

"An Apparatus for the Demonstration to an Audience of Simple Harmonic Motion," by Paul E. Klopsteg, University of Minnesota.

"Report of Progress on the Measurement of Earth Rigidity," by A. A. Michelson and Henry G. Gale, University of Chicago.

"The Accuracy with which Gravity may be predicted at any Point in the United States," by John F. Hayford, Northwestern University.

"A Proposed New Method for the Determination of the Acceleration due to Gravity," by Herbert Bell, University of Michigan.

"On Some Very Large Variations in the Adsorption of certain specimens of Charcoal," by Harvey B. Lemon, University of Chicago.

"The Principle of Similitude," by C. S. Frazel, University of Illinois.

"Preliminary Notes on the Torsional Elasticity of Drawn Tungsten Wires," by L. P. Sieg, State University of Iowa.

"A Precision Calorimeter for measuring Heats of Dilution," by D. A. MacInnes and J. M. Braham, University of Illinois.

"Note on the Amount of Error in applying to Non-Parallel Plates the Formula for Electrical Capacity of Parallel Plates," by L. E. Dodd, State University of Iowa.

"The Kinetic Theory of Non-Spherical Rigid Molecules," by Yoshio Ishida, University of Chicago.

"The Photo-electric Emission from Crystals of Selenium," by F. C. Brown, State University of Iowa.

"The Production of Light by Cathode Rays in Air," by Gordon S. Fulcher, University of Wisconsin.

"The Optical Constants of Liquid Alloys," by Carleton V. Kent, University of Michigan.

"The Single-lined and the Many-lined Spec-