If nothing more, they point out a promising method of detecting and measuring associational preferences among animals which may be readily trapped.

The evolutionary theories of Darwin and Wallace were largely founded upon personal observations of geographical distribution. The modern student of genetics, on the contrary, carries on his studies for the most part in the laboratory and the breeding pen. It is significant, therefore, that Bateson,[3] perhaps the foremost living Mendelian, devotes a considerable portion of a recent volume to the problems of geographic variation. And one can hardly read that volume attentively without being convinced that the field naturalist holds the key to some of the most important secrets of nature. It is not improbable, therefore, that works of the sort here reviewed will come to receive more serious consideration from those who are concerned primarily with the problems of organic evolution.

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Chemical Technology and Analysis of Oils, Fats and Waxes. By DR. J. LEWKOWITSCH. Edited by GEORGE H. WARBURTON. Vol. II. 1914. Pp. 994. $6.50.

The first volume of this work appeared in this country while the author lay dead. While the death of an eminent chemist is always to be regretted, in this case there was an additional reason for regret—the delay, or worse yet, the possible non-appearance of the remainder of the treatise. The delay has been so slight as not to be noticed and the editorial work has been most satisfactorily performed by Mr. Warburton, who for seventeen years was associated with Dr. Lewkowitsch in his analytical practise.

This volume has been increased in size by thirteen per cent.; important additions have been made in the articles on linseed, tung, soy bean, cocoanut oils and candelilla wax, as well as minor additions to other portions to bring them thoroughly up to date.

The work may fairly be described as monumental; nothing would seem to have escaped attention. Even the toxicity of the different chlorides with two atoms of carbon has been given, as having a bearing on their technological uses.

Notwithstanding the very full table of contents, the reviewer misses, and must wait a year perhaps for, an index which it would seem advisable to include in each volume. Similarly the reviewer is inclined to question the advisability of including the large amount of statistical matter about the commercial side. That, it would seem, might well form the subject of a single volume, like the author's "Laboratory Guide to the Fat and Oil Industry" and be revised and brought up to date more frequently. If the work continues to grow as it has in the past, it would seem worth while to consider its publication by some society, as its compeer "Beilstein" has been taken over by the German Chemical Society.

A. H. GILL

[3] *Op. cit.*

SPECIAL ARTICLES

THE NITROGEN NUTRITION OF GREEN PLANTS

IT is the teaching of botanists that green plants obtain their nitrogen chiefly in the form of nitrates, though ammonium salts may be utilized to some extent by certain plants at least. Exceptions to this general rule are those plants provided with root-tubercles (and bog plants and others which have mycorrhiza?). These plants obtain their nitrogen in the form of organic compounds made for them by the bacteria growing in the tubercles.

That nitrogen circulates throughout the structures of plants in organic combination is certain. There does not appear to be any reason why similar compounds which are soluble and diffusible (amino acids?) should not be taken up through the roots of plants and utilized as such. It appears to the writer that this must very probably be the case. Arguments in favor of this view are:

1. The nitrogen nutrition of the leguminous

plants and others with root-tubercles is of this character.

2. The close symbiosis between "Azotobacter" and similar nitrogen-absorbing bacteria and many species of algæ is well known.

3. The increased production of timothy and other grasses when sown *along with clover,* not merely following, has been demonstrated.

4. The vigorous growth of plants in soils very rich in organic matter. Such material inhibits the growth of the nitrous-nitric bacteria when grown in culture, and may do so in soil, so that nitrates may not account for this vigorous growth.

5. As a general rule the most fertile soils contain the most bacteria.

6. The doctrine that nitrates furnish the nitrogen to plants was established before the activities of bacteria in the soil were suspected and should be re-investigated under conditions absolutely controlled as to sterility. It is probably true in large part, but may not be the exclusive method.

It would seem that one of the chief functions of bacteria in the soil is to prepare soluble organic compounds of nitrogen for the use of green plants. It does not appear to be really necessary that organic nitrogen compounds decomposing in the soil must be "ammonified," "nitrited" and "nitrated," as is now generally held since Winogradsky demonstrated the activities of bacteria in these lines to account for the presence of nitrates in the soil.

Experiments have been made by various observers in growing seedling plants of different kinds in water culture with one, or in some cases, several of the amino acids as sources of nitrogen. Most of these experiments have been disappointing. Plant proteins are not so different from animal proteins, nor plant protoplasm (apart from the chlorophyll-containing portions) from animal protoplasm as to lead one to suppose that it could be built up from one or two amino acids any more than animal protoplasm can. The writer is strongly convinced from investigations on this subject for several years that it should be thoroughly investigated. It will require careful experimentation and possibly rather large funds to provide the amounts of amino acids that would probably be needed, but might result in a decided change in current ideas of soil fertility and in the use of nitrogen fertilizers.

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THE PHILADELPHIA MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The sixty-sixth meeting of the American Association for the Advancement of Science and of the affiliated national scientific societies was held in Philadelphia, December 28, 1914, to January 2, 1915. Houston Hall at the University of Pennsylvania was the headquarters and most of the meetings of the sections and affiliated societies were held in the various buildings of the university.

The registered number of members in attendance was one of the largest in the history of the association, being 1,086. The number for the affiliated societies could not be definitely ascertained. A number of institutions sent delegates to the meeting and ten foreign associates were elected for the meeting. The following affiliated societies met during the week:

American Physical Society.
The Geological Society of America.
Paleontological Society of America.
American Alpine Club.
American Society of Zoologists.
American Society of Naturalists.
American Association of Entomologists.
Entomological Society of America.
Botanical Society of America.
American Phytopathological Society.
Society for Horticultural Science.
Sullivant Moss Society.
American Microscopical Society.
American Fern Society.
American Anthropological Association.
American Folk-Lore Society.
American Psychological Association.
Southern Society for Philosophy and Psychology.
Society of American Bacteriologists.
American Federation of Teachers of the Mathematical and the Natural Sciences.