to be transferred to the shoots. The extent of this microbial participation in the apparent absorption of phosphate by the plants is influenced by several factors: first, it is of importance only at low concentrations; secondly, because of the known sensitivity of bacteria to hydrogen ion concentra-

tion, it increases with increasing pH; and thirdly, it is affected by the exudation of organic substances from the root.

These findings will be discussed in relation to the possible influence of the rhizosphere flora on the absorption of inorganic nutrients by plants.

COMMUNICATIONS

Threonine Deaminase and Acetolactate Synthetase in *Anabaena variabilis*

By W. HOOD and N. G. CARR (*Department of Biochemistry, University of Liverpool*)

Recent work has indicated that species of blue-green algae hitherto considered to be strict autotrophs will incorporate and metabolize carbon compounds other than carbon dioxide; ^{14}C -labelled sugars, carboxylic acids and amino acids were assimilated into *Anabaena variabilis* and *Anacystis nidulans*. However, Pearce & Carr (1967) have found no evidence of repression or de-repression of enzymes concerned in acetate metabolism after growth in the presence of this substrate. This communication describes the initial attempts to estimate the extent of metabolic control by either repression or feed-back inhibition in amino acid biosynthesis. This has been only briefly examined in the blue-green algae: Hoare & Hoare (1966) demonstrated feed-back control in arginine formation.

Anabaena variabilis was grown (Pearce & Carr, 1967) autotrophically and in the presence (100 mg./l.) of L-valine or L-valine, L-leucine and L-isoleucine; L- ^{14}C valine was shown to be assimilated by the significant uptake of ^{14}C into cell material during growth. Cell-free extracts from each type of culture were prepared by ultrasonic treatment and the activities of enzymes concerned in branched-chain amino acid biosynthesis were examined. Acetolactate formation from pyruvate was measured by conversion into acetoin and spectrophotometric determination of this product (Westerfield, 1945). Acetolactate synthetase activity had a broad pH range with two optima, indicative of two isoenzymes, as found in *Escherichia coli* (Radhakrishnan & Snell, 1960). Variations in the growth conditions quoted above did not alter the specific activities of this enzyme in extracts at any pH value, but valine exerted 50% inhibition on activity in extracts assayed at pH 8.0. A lack of repression was also observed when threonine deaminase was examined in extracts from organisms grown autotrophically (0.17 $\mu\text{mole/mg. of protein/hr.}$) and in the presence of isoleucine (0.16 $\mu\text{mole/mg./hr.}$) or valine, leucine and iso-

leucine (0.19 $\mu\text{mole/mg./hr.}$). In contrast with the failure to exhibit enzyme repression, threonine deaminase was competitively inhibited by its end product, isoleucine, and this action was relieved by valine. In this respect threonine deaminase in blue-green algae is similar to that in other organisms.

The lack of enzymic repression in *Anabaena variabilis* contrasts with results obtained with other procaryotic organisms and indeed with *Anacystis nidulans*, preliminary results with which indicate slight repression of acetolactate synthetase by growth in the presence of valine.

W.H. was supported by a Medical Research Council studentship.

Pearce, J. & Carr, N. G. (1967). *J. gen. Microbiol.* **49**, 301.
Hoare, D. S. & Hoare, S. L. (1966). *J. Bact.* **92**, 375.
Westerfield, W. W. (1945). *J. biol. Chem.* **161**, 495.
Radhakrishnan, A. N. & Snell, E. E. (1960). *J. biol. Chem.* **235**, 2316.

Reduced Nicotinamide-Adenine Dinucleotide Phosphate Oxidase in the Autotrophic Blue-Green Alga *Anabaena variabilis*

By C. K. LEACH and N. G. CARR (*Department of Biochemistry, University of Liverpool*)

The observation that there is significant assimilation of reduced ^{14}C -labelled carbon compounds by strict autotrophs has renewed interest in the causative reasons of obligate autotrophic metabolism. The earlier view that such organisms were generally impermeable to organic compounds is now unlikely to be correct. An incomplete tricarboxylic acid cycle has been observed by several groups and its role in autotrophy discussed. Smith, London & Stanier (1967) suggest that the absence of α -oxoglutarate dehydrogenase and, more crucially, NADH oxidase, are the essential features of obligate autotrophy in both blue-green algae and the chemosynthetic bacteria, and have suggested certain evolutionary implications of these deletions.

This communication reports that in extracts of several blue-green algae an NADPH oxidase is