converts methylmalonyl coenzyme *A* to succinyl coenzyme *A*.

Methylmalonyl coenzyme *A* is an intermediate in the oxidation of valine, isoleucine and fatty acids containing odd numbers of carbon atoms. The fatty acids and isoleucine form propionyl coenzyme *A* which is carboxylated to methylmalonyl coenzyme *A*. Rosenberg, Lilljeqvist and Hsia (*Science*, **162**, 805; 1968) have now shown that leucocytes from their patient could not oxidize labelled propionate to ^{14}C-carbon dioxide, but could oxidize labelled succinate normally. When the child was given daily intramuscular injections of 1 mg of vitamin B_{12}, his urinary excretion of methylmalonic acid fell from 800–1,200 mg/day to 220–280 mg/day during and shortly after his treatment. In addition, leucocytes from blood taken during and shortly after treatment showed some ability to oxidize propionate. These results suggest that some defect in the methylmalonyl coenzyme *A* isomerase has reduced its affinity for vitamin B_{12}. High concentrations of vitamin B_{12} may produce sufficient active enzyme to enable the body to function normally. Untreated, the ketones which accumulate as a result of the blockage of propionate oxidation produce an acidosis which would eventually prove fatal. This condition has only recently been recognized, and so it is not yet possible to say how common it is. Screening the urine of newborn children for methylmalonic acid might, however, be well worth while, for there are probably other children who need extra vitamin B_{12} to keep them alive and well.

PLANTS

Watering the Plants

from our Botany Correspondent

How to make the best use of available water is a real problem in many hot countries, and it could become serious in the market gardens of Britain—where the word summer is little more than a poet's image. So began Professor A. J. Rutter delivering his inaugural lecture, on plant–water relationships in outdoor environments, at Imperial College, London, on January 21. Plants need a lot of water—a standing oak tree may use more than an average household, and a square yard of lawn may take up a gallon in a summer's day. Water is necessary to maintain the rigidity of plant cells, to take part in synthetic processes and to carry nutrient materials as it flows through the plant. But these functions cannot explain why plants are so sensitive to reductions of their normal water content of about 90 per cent. Professor Rutter, who, apart from time spent setting up an ecology department at the University of Lahore, has spent most of his working life at Imperial College, is interested in finding out why plants need so much water, and what controls its uptake.

Water flows from the soil into the roots, across the root cortex to the hollow vessels of the xylem, through which it passes up the stem to the leaves, and eventually to the stomata, the openings through which water vapour passes out in the process known as transpiration. The factors controlling water content can be analysed in terms of potentials, that is the difference between the free energies of water in the plant and pure water at atmospheric pressure; and in terms of the resistance to the flow of water and the rate of transpiration. The analysis can be simply expressed as

$$\psi_{\text{leaf}} = \psi_{\text{soil}} - E_t(R_s + R_p)$$

where R_s is resistance to the flow of water in the soil, R_p is resistance to the flow of water in the plant, ψ is potential and E_t is the rate of transpiration. Resistance to the flow of water within the plant is apparently greatest in the roots, and transpiration is clearly an important factor in determining leaf water potential and content. Professor Rutter believes that the full answer to the puzzlingly high water content of plants must now be sought in molecular biology, in processes such as the hydration of enzymes.

He has been working on various aspects of the water relations of forests for ten years and has found that in a year a forest can evaporate 10 to 20 per cent more water than an equivalent open water surface. He is now engaged, with the Natural Environment Research Council's Hydrological Research Unit, on an investigation of the effect of land use on the evaporation from catchment areas. His team has recently used a computer to work out a model to predict the course of events through a storm—how much rainfall is intercepted by the trees and how much falls through to the forest floor. The model agrees well with observed rainfall and throughfall, and the next step is to try to predict, using data from the Meteorological Office, what will be the interception of forests in different parts of the British Isles in the future.

NUCLEIC ACIDS

RNA Chain Growth Rate

from our Cell Biology Correspondent

How fast does a bacterial RNA molecule grow? In the latest issue of the *Journal of Molecular Biology* (**39**, 1; 1969) Manor, Goodman and Stent report some sophisticated pulse labelling experiments with *E. coli*, backed by equally sophisticated mathematical analysis of the incorporation data, from which they have calculated the nucleotide step times for the four RNA nucleotides. The nucleotide step time is the average time that elapses during the addition of the next nucleotide to the 3′ end of a growing RNA chain occupied by one of the four nucleotides. They find that the step time depends not only on the net rate of RNA synthesis in various physiological conditions but also on which of the four nucleotides happens to be at the 3′ end of the growing molecule.

In essence, the experiment they carried out consists of exposing *E. coli* to pulses of labelled nucleotide base—they used tritiated uracil or tritiated guanine, for up to 16 seconds. Samples are taken after 6, 10, 15 and 16 seconds, and the RNA is isolated and then hydrolysed with alkali. On hydrolysis, each RNA chain yields many nucleotides from internal positions but only one nucleoside from the 3′ terminus. From the proportion of nucleotides and nucleosides containing the labelled base fed in the pulse, and the labelling time, it is possible to derive the nucleotide step time.

In *E. coli* growing in a rich medium at 29° C and doubling about once every hour, the step time for uridylic acid (U) was 42 ms, for guanylic acid (G) 20 ms, and for cytidylic acid (C) at most 67 ms. Assuming that adenylic acid (A) has about the same step time as the