pressed growth. It appears from the evidence in figure 3 that after exposure to heat the TPP is not restored or reformed by this addition, but that for the accelerated growth the supplements must continually be added to the medium. Since the role of TPP is partially replaced by the supplements, it seems plausible that the role of TPP is involved in the normal supply or synthesis of the required components present in the supplement.

When IAA is in the medium, during and after thermal stress, the tissue will slowly overcome the deficit in growth and return to the growth pattern exhibited prior to heating. IAA then appears to be a part of the causative factor responsible for the autonomous nature of tumor tissue. The TPP may be formed as a result of the influence or presence of IAA with certain other substances which are easily degraded by heat or whose synthesis is impaired by heat. These substances are ordinarily synthesized by tumor tissue along with auxin. If this synthesis is altered or the substances destroyed, tissue growth is retarded.

SUMMARY

The growth of sunflower tumor and habituated tissues on several media was observed. Tumor tissue growth was found to be more retarded at 33 to 34° C on medium lacking supplements, than when they were grown at this same temperature on medium containing supplements. The autonomous nature of tumor tissue is altered at temperatures above the normal for growth. The presence of supplements in the medium offers a partial replacement for a naturally occurring factor (TPP) in tumor tissue which is wholly or partly responsible for its autonomous nature. IAA is essential to the recovery of growth of the tissue.

Habituated tissues are unaffected by the temperature change when grown on the complete medium, GBA + IAA.

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THE KINETICS OF POTASSIUM ACCUMULATION BY CORN ROOTS AS A FUNCTION OF CELL MATURITY[1]

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Brown and Cartwright (1), using serial sections of corn roots, have reported that as cells vacuolate and mature, their capacity to accumulate potassium on a cell or protein basis increases. This finding raises the question as to what changes have occurred during growth that enable the cell to be more effective in ion accumulation. Brown and Cartwright have suggested that vacuolation is important, in that it introduces the tonoplast and provides a depository for absorbed ions. However, they also note that once the vacuole is established the increase must be partially attributed to a differentiation of the cytoplasm such that the absorption per unit protein increases. This last observation is of considerable importance in the study of the carrier mechanism of potassium accumulation, for the mature cells must possess a more extensive or more efficient carrier mechanism than immature cells.

In order to obtain further information about these changes in ion accumulation with cell maturation, we have investigated the kinetics of potassium accumulation in serial corn root sections representing different mean levels of cell maturity. The techniques and solutions were those described in a previous report (2). Vigorous roots from corn seedlings germinated in the dark for 4 days were cut into a 5-mm tip section (including the root cap) and 3 subsequent-10 mm sections. Treatments were carried out in quadruplicate, with 10 sections per flask shaken for 3 hours in 15 ml of a KCl-KH_2PO_4 solution (pH 5.6), labeled with Rb^{86}. Exchangeable ions were removed and accumulated ions determined from the radioactivity of the ashed sections. The effect of calcium was determined by making the uptake solutions 0.0005 *N* with respect to $CaCl_2$. Kinetic constants were calculated as described in the previous report (2). Protein nitrogen content of the sections was determined by homogenizing in 10 % trichloroacetic acid, and analyzing the centrifuged precipitate by digestion and Nesslerization. The data are presented in table I.

The constant K_s, which closely approximates the dissociation constant of the carrier-ion complex (2), varies with the maturity of the root tissue. In the

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TABLE I

KINETIC CONSTANTS OF POTASSIUM ACCUMULATION BY SERIAL CORN ROOT SECTIONS *

ROOT SECTION, MM FROM TIP	K_s, MEQ/L		V_{max}, μEQ K × HR^{-1}			
	− Ca	+ Ca	× GM FRESH WT^{-1}		× MG PROTEIN N^{-1}	
			− Ca	+ Ca	− Ca	+ Ca
0– 5	0.34	0.89	8.73	3.01	1.48	0.51
5–15	0.44	0.44	2.36	0.77	3.60	1.18
15–25	0.47	0.32	1.63	0.71	3.17	1.38
25–35	0.55	0.11	1.77	1.01	2.74	1.57
Entire root	0.51	0.19	2.50	1.99	...	...

* Mean values from 4 expts. Values for entire primary roots were taken from a previous report (2) and inserted here for purpose of comparison.

absence of calcium it rises with increasing cell maturity; conversely, in the presence of calcium it falls. In the tip section calcium decreases the affinity between potassium and its carrier; in the more basal sections the affinity is increased.

On a fresh weight basis, V_{max}—the maximum velocity at which the tissue can accumulate potassium under these conditions—is maximal in the tip region and minimal in the 15 to 25 mm region. On a protein nitrogen basis, V_{max} is maximal in the 5 to 15 mm region in the absence of calcium and in the 25 to 35 mm region in its presence. Both with and without calcium the minimum velocity occurs in the root tip. Calcium depresses V_{max} less in the basal sections than in the tip section. Although these sections are larger and encompass a greater root length than those used by Brown and Cartwright, the data verify their observation that on a protein basis the immature cells are not as effective in potassium accumulation.

The changes in the kinetic constants and in their response to calcium with cell maturation can be explained in various ways. A number of carrier systems can be operative in potassium accumulation, each with different characteristics, the measured kinetic values being but the mean of the contribution to accumulation made by each carrier. During the ontogeny of the root cell the proportion or activity of the several carriers may change—and perhaps new carriers are introduced—with a resultant alteration of the constants of accumulation. On the other hand, a single carrier system with sequential steps may be altered in its biochemical and biophysical properties by the alteration of one or more of the steps. Kinetic studies are of limited value in deciding between these or other alternatives as they give only the overall characteristics of the individual reactions involved, and are insufficient to determine the complexity and diversity of the individual steps. We can only guess as to the steps occurring between the initial and the final phase, with the sole knowledge that the complex reaction has to obey the Michaelis-Menten kinetics. A similar difficulty involving the adenosine triphosphate activation of myosin has been reviewed by Morales, Botts, Blum and Hill (3).

SUMMARY

The kinetics of potassium accumulation by serial sections from corn root tips have been investigated. The kinetic constants, K_m and V_m, change with growth and maturation, and the nature and extent of the change is conditioned by the presence or absence of calcium ion. The velocity of potassium accumulation per unit protein nitrogen is least in the meristematic region. It is deduced that K is accumulated by a complex of carriers operating independently or sequentially, and that elements of the complex are changed during growth and maturation.

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OXIDATION OF MALONATE BY PEANUT MITOCHONDRIA[1]

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For many years malonate was considered a classical competitive inhibitor of succinic dehydrogenase (1). The assumption was made that it is a metabolically inert substance. However, the utilization of malonate by microorganisms (2–6), mammals (7–9), and fishes (10) suggests that this acid may play a role in organic acid metabolism. Studies with a partially purified enzyme obtained from *Pseudomonas* sp. (6) and mitochondria from rat kidney (9) suggest that malonate degradation proceeds by way of malonyl CoA, which is then decarboxylated to acetyl CoA and CO_2.

Malonate has been reported in the leaves of a

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