An Example of Active Transport of Water Through Plants

The existence of active transport of water through plants has long been debated. LEVITT[1-3], in a series of papers, has maintained that such a possibility does not exist. Others[4,5] take the view that under certain conditions active transport of water does take place. In the authors' opinion the diversity of views is mainly the result of the absence of any uniform and precise definition of the term active transport. SPANNER[6], by providing a physical meaning to the term active transport, has considerably clarified the situation. Making use of the thermodynamic theory of irreversible processes, the linear phenomenological relations for transport of water and salts across cell membranes can be written thus:

$$J_v = L_{pp} \Delta P + L_{pd} \Delta \Pi \quad (1)$$

and

$$J_s = L_{dp} \Delta P + L_{dd} \Delta \Pi, \quad (2)$$

where J_v stands for the total volume flow and J_s stands for solute flow. ΔP and $\Delta \Pi$ are the hydrostatic and osmotic pressure differences across the membrane, L_{pp}, L_{dp}, L_{pd} and L_{dd} are the phenomenological constants. From equation (1) it is clear that the flow J_v is the result of a sum of 2 terms viz. $L_{pp} \Delta P$ and $L_{pd} \Delta \Pi$, the former representing flow of water due to hydrostatic pressure difference and the latter the flux of water due to difference in solute concentration. Similarly, in equation (2) the term $L_{dp} \Delta P$ and $L_{dd} \Delta \Pi$ represent the solute flux due to differences in hydrostatic pressure and salt concentration respectively.

On account of Onsager's reciprocity relations, we have

$$L_{dp} = L_{pd} \quad (3)$$

Because of equality (3), in equations (1) and (2) we are left with 3 phenomenological constants viz. L_{pp}, L_{dd} and $L_{dp} = L_{pd}$. SPANNER[6] asserts that only those transport processes must be considered as active where the cross coefficients (e.g. L_{dp} or L_{pd}) are important. In physical terms the transport of a species must be considered active only when the driving force is other than the usual chemical or electrochemical potential gradient of the species. Such a definition would exclude the use of such ambiguous terms like 'pumping system', etc. (LEVITT[3]).

Data of one of the authors[7] are presented in the Table to support the contention that active transport of water in plants is possible and may be important under certain conditions.

During the period of these experiments, the moisture % in the placenta remained practically constant at 95%. It is obvious from the data that during the period 25–35 days there is a reduction in the water content and an increase in the osmotic pressure of seeds. At all times the osmotic pressure of seeds remained higher than that of the placental juice. Considering moisture content as a function of moisture potential, it is clear that there is a net water flux against the water and osmotic pressure gradients, suggesting a driving force other than those for the transport of water from seeds. There appears no alternative to the conclusion that a process such as the one described above, where transport of water takes place due to a force (metabolic in this instance) other than water potential must fall under the category of active transport.

Water content and osmotic pressure of seeds and placental juice of tomatoes associated with development

Seed age days	Water content/seed[a] mg	Osmotic pressure[b] Seeds	Placental juice
25	14.2 (82.1)	11.79	8.22
30	7.8 (69.0)	14.36	8.18
35	5.9 (61.4)	19.98	7.88

[a] Each value represents a mean of seeds from 10 fruits. Figures in parenthesis give the moisture % in seeds. [b] Values are means of biological triplicates.

Zusammenfassung. Am Beispiel des Wassertransports aus Samen der Tomate wird das Vorkommen eines aktiven Wassertransportmechanismus in Pflanzen nachgewiesen.

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TERMINOLOGIA

Difficulties in Vitamin B_6 Nomenclature

Vitamin B_6 is of appreciable interest in a wide variety of fields. Unfortunately, however, the name vitamin B_6 has disadvantages. For one thing, a term of the form 'vitamin such-and-such' is not suitable for all purposes. Now that a good deal is known concerning the chemical natures and biochemical functions of vitamins, authors are generally careful to avoid an expression like vitamin B_1 when thiamine will do at least as well. Furthermore, a two-word expression will not fit into certain contexts as comfortably as a single word. Such a term as hypothiaminosis presents no linguistic problems; but the structurally parallel term 'hypovitamin B_6-osis' can hardly be viewed with complete seriousness, and even the structure of the less embarrassing term 'B_6 hypovitaminosis' leaves something to be desired.

In 1939, 2 groups of investigators[1,2] identified vitamin B_6 as 3-hydroxy-2-methyl-4, 5-pyridinedimethanol. That same year, GYÖRGY and ECKHARDT[3] proposed the name pyridoxine for this compound. Five years later, SNELL[4] and his associates[5] showed that vitamin B_6 exists not only as the trihydroxy compound just mentioned, but also as 3-hydroxy-5-(hydroxymethyl)-2-methyl-4-pyridinecarboxaldehyde and 3-hydroxy-5-(hydroxymethyl)-2-methyl-4-pyridinemethylamine. Further studies[6,7] indicated that vitamin B_6 likewise exists as the 5-phosphates of these latter 2 compounds.

Since at least 5 compounds of more or less different principal chemical functions exhibit vitamin B_6 activity, it is evident that the vitamin cannot be adequately indicated by a single ordinary chemical name. One approach to the problem was offered by LARDY[8] when he adopted the term pyridoximers for the 3 unesterified forms of vitamin B_6. This term, however, although of special value in suggesting the chemical interrelationships among these 3 forms, does not satisfy all present needs: pyridoximers can be applied only to individual forms of vitamin B_6; what is still lacking is a one-word term that can be employed, without discrimination, for any and all forms of the vitamin.

Rule V-7 of the 'Definitive Rules for the Nomenclature of the Vitamins' of the International Union of Pure and Applied Chemistry[9] provides the name pyridoxol for the trihydroxy compound, the names pyridoxal and pyridoxamine being used for the aldehyde and the amine, respectively. The same rule also provides that pyridoxine may be used as a group name representing all of these compounds, including 5-phosphates. Regrettably, this second provision tends to aggravate existing ambiguity, since pyridoxine has often been used as a group name, but it also continues in extensive use as a synonym for pyridoxol alone. A proposed revision of this rule[10] would allow pyridoxol and pyridoxine to be used interchangeably, but no generally acceptable one-word equivalent for vitamin B_6 has yet been introduced.

The previously non-independent term pyridox might perhaps be appropriate as a single word representing every naturally occurring pyridine derivative with vitamin B_6 activity. Although this term has never before been used by itself, it has obviously been used countless times as a linguistic structure shared by all words containing it. Unlike most chemical names, the name pyridox has no ending that indicates any specific principal chemical function; but that fact is in this instance an advantage instead of a disadvantage, since the purpose of the name is to suggest vitamin B_6 function in general rather than any chemical function in particular.

Regardless of whether our term pyridox is eventually adopted, we strongly urge that the ambiguous term pyridoxine be used only where there is no significant danger of confusion. Where absolute clarity is essential, pyridoxol can be used for the trihydroxy compound and pyridox can be used as a one-word synonym for vitamin B_6 as long as no better suggestion is made.

Our proposals may not be the best possible solution to the nomenclature problem outlined here. Nevertheless, these proposals are so simple and straightforward that they ought to be useful at least as an initial step towards a final solution to the problem. Thus we offer our proposals not only for consideration as a possible solution to a nomenclature problem that we have sometimes found fairly vexing, but also as a stimulus for further thinking on the subject[11].

Zusammenfassung. Der Name Vitamin B_6 hat Nachteile. Ein Ausdruck, der das Wort Vitamin enthält, ist nicht in allen Fällen zutreffend, und ein zweiwörtiger Ausdruck passt schlecht in gewissen Zusammenhängen. Da wenigstens 5 verwandte, aber verschiedene Verbindungen Vitamin-B_6-Aktivität besitzen, ist ein einziger, gewöhnlicher chemischer Name unzulänglich. Frühere Vorschläge weisen mehrere Mängel auf. Wir schlagen Pyridox vor.

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PRO EXPERIMENTIS

Zur Frage der Markierung einzelner Nervenzellen durch Mikroelektroden

Bei Ableitungen von bioelektrischen Potentialen von Nervenzellen wird häufig die Mikroelektrodentechnik angewendet. Die Markierung und Identifizierung dieser Zellen in histologischen Präparaten ist immer problematisch, ein Umstand, der besonders beim Studium eines so heterogenen Gewebes wie des Nervengewebes ins Gewicht fällt.

Eine Markierung von Nervenzellen lässt sich auf verschiedene Weise durchführen. So kann etwa der Ort der Mikroelektrodenspitze durch eine Läsion gekennzeichnet werden, und zwar durch einen Hochfrequenzstrom bei metallischen Mikroelektroden[1] oder, bei Glasmikroelektroden, elektrolytisch durch Gleichstrom[2]. Die dadurch

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