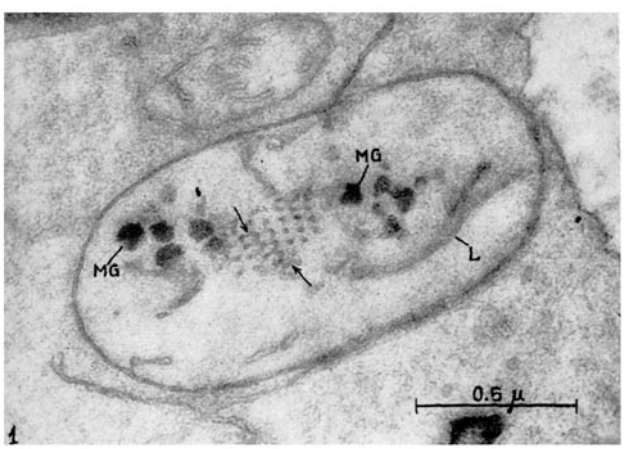
structure of proplastids and leucoplasts in the root meristem of *Pisum*, *Zea* and *Lens*, respectively, could not discover any typical prolamellar structure.

During the course of studies on the development of leucoplasts in the root cells of barley, *Hordeum vulgare* L. var. *hexastichon* Aschers. germinated on moistened filter paper under the light which is strong enough for the normal development of chloroplasts in the leaves, the author found a prolamellar body which is essentially similar to those discovered in the proplastids of chloroplasts. Tips were cut from root of actively growing seedlings, and fixed in 5% aqueous solution of $KMnO_4$ for 10 min. The fixed specimens were then dehydrated through a graded series of ethanol, and embedded in araldite resin.

Proplastids can be easily recognized and distinguished from other cell components by low electron density of their plastoplasm. The Figure illustrates a typical proplastid (1.5 × 0.8 μ) with a prolamellar body, presenting its characteristic crystalline pattern. The proplastid is covered with a double-layered membrane consisting of two electron dense layers 5–6 mμ thick and a less dense space 7–10 mμ wide. The electron density of the membrane is greater than that of mitochondria. In the plastoplasm, which consists of granular substance, are embedded a small number of lamellae, a prolamellar body, and several *manganophilic granules* (80–200 mμ in diameter). The outer and inner diameter of the vesicular elements of the prolamellar body are about 20 mμ and 10 mμ, respectively; thickness of the wall, 4 mμ. The vesicles are regularly arranged to form a crystal lattice-like structure. However, such a crystalline pattern is not always encountered, but there are many proplastids with a prolamellar body, in which vesicles do not arrange regularly.



Proplastid in postmeristematic cell of barley root. Prolamellar body which is composed of small vesicular elements arranged in an apparently crystal-like lattice can be seen in its centre. Besides, lamellae (L) and *manganophilic granules* (MG) will also be seen.

Serial sections which are not presented here indicate that the vesicles in such a prolamellar body are arranged to form a spatial lattice. Not only the structure of the prolamellar body, but also the appearance and dimensions of the vesicles are quite similar to those usually encountered in the proplastids of normal chloroplasts. At scattered points in the prolamellar body (Figure, arrows), can be seen figures suggesting coalescence of the vesicles. In another sections, the relationship between the developing lamellae and vesicles of the prolamellar body can be recognized. The newly developing lamellae and the vesicles coincide in their dimensions, as well as the double-layered structures of this membrane, suggesting that the lamellae are formed by fusion or coalescence of the vesicles of the prolamellar body.

According to the observations described above, the whole sequence of changes occurring during the development of the leucoplast can be summarized as follows: No distinct prolamellar body is discernible in the proplastids of promeristematic cells. The vesicles first appear at the postmeristematic stage of the cell development. These vesicles, irregularly scattered at first, gradually assume a regular lattice arrangement as development progress, to lead finally to the appearance of some lamellar structure, which, however, is less prominent than in the case of ordinary chloroplasts.

From another point of view, the suggested transformation of vesicular to lamellar structure may be regarded as indicating a possible common origin of chloroplasts and leucoplasts.

Zusammenfassung. Ultradünnschnitte durch Wurzelproplastiden von *Hordeum* lassen den Prolamellarkörper erkennen. Struktur und Dimensionen der Elementareinheiten dieses Körpers sind mit dem bei den Chloroplasten-Proplastiden beschriebenen Prolamellarkörper vergleichbar.

S. MURAKAMI

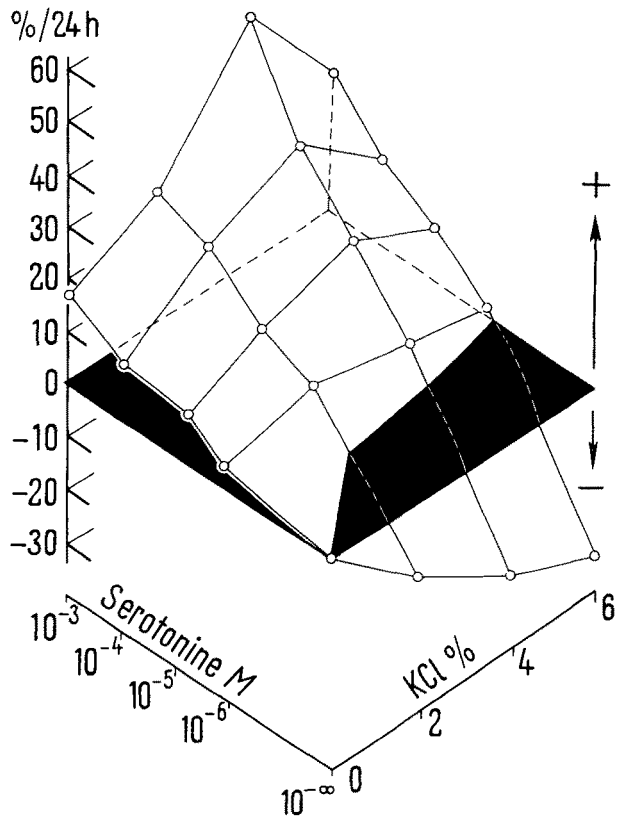
Department of Biophysics and Biochemistry, Faculty of Science, University of Tokyo, Hongo, Tokyo (Japan), November 3, 1961.

Propriétés phytobiologiques de la sérotonine

Si la sérotonine (5-hydroxytryptamine) a déjà donné lieu à d'innombrables applications en neurologie, par exemple[1], le rôle qu'elle joue sur les tissus végétaux est encore fort mal connu. Alors que la tryptamine peut être considérée, à l'image de l'acide β-indolylacétique[2], comme un véritable effecteur de croissance[3], la sérotonine n'a pratiquement aucune activité. En effet, nous avons montré[4] que: (1) sur des tests tige (*Lens*), ce composé est sans effet, ce qui confirme complètement les expériences réalisées à l'aide du test mésocotyle[5], (2) sur des tests racine (*Lens*), cette substance est très légèrement active, observation partiellement en accord avec celles qui furent faites avec le test «racine de maïs»[6]. Pourtant, une série d'essais, qui font l'objet de cette note, ont permis de mettre en évidence une autre propriété de la sérotonine[7] qui pourrait indirectement toucher la croissance des tissus végétaux.

[1] H. COSTA, Int. Rev. Neurobiol. *2*, 175 (1960).
[2] P. E. PILET, *Les phytohormones de croissance* (Masson Ed. Paris 1961).
[3] P. E. PILET et J. ATHANASIADES, Bull. Soc. bot. suisse *69*, 16 (1959).
[4] P. E. PILET, Bull. Soc. vaud. Sci. nat. *67*, sous presse (1962).
[5] J. P. NITSCH et C. NITSCH, Bull. Soc. bot. France *105*, 482 (1958).
[6] P. NIAUSSAT et H. LABORIT, Med. exp. *1*, 207 (1959).
[7] Cette substance, employée sous forme de *sulfate de créatinine*, nous a été aimablement offerte par le Service de recherches chimiques de la Maison Sandoz (Bâle). Dans nos essais, la créatinine s'est révélée être totalement inactive aux concentrations utilisées.

Nous utilisons, en nous inspirant d'une technique précédemment décrite[4,8], des disques de pomme de terre calibrés (diamètre: 15 mm; épaisseur: 4 mm) qu'on dépose sur des supports de verre portant une armature de mousseline et un papier-filtre. Le tout est placé dans des boîtes de Petri (diamètre: 9 mm) contenant 10 ml de solution active (sérotonine et KCl). Au temps 0, et après 24 h (obscurité, 25° ± 0,5), on fait des mesures de poids frais et de poids sec. Les résultats (Figure), qui sont donnés en % d'activité relative (par rapport au lot témoin), permettent de tirer les conclusions suivantes, quant aux variations du poids frais:



% d'accroissement relatif du poids frais de disques de pomme de terre, en présence de sérotonine et de KCl. Mesures après 24 h d'incubation.

(1) seule, la sérotonine est stimulante, et ceci d'autant plus que sa concentration est plus forte;

(2) seul, le KCl se comporte en inhibiteur, d'autant plus efficace qu'il est plus concentré;

(3) mélangées, ces deux substances ont un effet plus qu'additif.

Or il est remarquable de constater que, pour les concentrations où l'on note des stimulations particulièrement caractéristiques, les variations du poids sec sont pratiquement inexistantes:

Sérotonine	$1 \cdot 10^{-3}$ *M*	KCl	4%	Effet	+ 6,1%
	$1 \cdot 10^{-3}$ *M*		6%		− 2,6%
	$1 \cdot 10^{-4}$ *M*		4%		+ 2,5%
	$1 \cdot 10^{-4}$ *M*		6%		+ 5,3%

Ces précédentes observations indiquent donc que la sérotonine et le KCl agissent sur l'entrée de l'eau. Pour expliquer les résultats obtenus, on pourrait imaginer, et cette hypothèse est en accord avec ce que l'on sait de l'action de la sérotonine sur la perméabilité des cellules animales[9], que cette substance faciliterait l'entrée des ions K^+ et modifierait, par conséquent, les caractéristiques osmotiques des tissus végétaux. Or l'importance des échanges d'eau dans les processus métaboliques et dans la croissance des cellules a été démontrée[10].

Summary. The serotonin (5-hydroxytryptamin) which shows a slight influence upon the growth of plant tissues, acts upon water uptake by regulating cellular permeability (latter is activated in the case of K^+).

P. E. PILET

Laboratoire de Physiologie végétale, Université de Lausanne (Suisse), le 16 janvier 1962.

[8] P. D. HACKETT et K. V. THIMANN, Amer. J. Bot. *39*, 553 (1952).
[9] I. H. PAGE, Physiol. Rev. *38*, 277 (1960).
[10] P. E. PILET, *Handbuch der Pflanzenphysiologie* (Springer Verlag, 1961), Bd. 15, p. 784.

Excitation of Betz Cells by Acetylcholine

In a previous report[1], we have described the excitant action on some cortical neurones of acetylcholine applied iontophoretically. These units were found throughout the cortex, though they tended to be present in higher concentrations in the primary afferent areas. Frequently the units occurred in groups, and they were characterised by a rhythmical spontaneous discharge.

This action of acetylcholine has now been tested on Betz cells in the sensory-motor cortex of cats anaesthetised with Dial. The ipsilateral pyramidal tract was activated antidromically by stimulation of the exposed medullary pyramids. Only those neurones which were invaded with a *constant* latency of less than 5 msec, and which could follow repetitive stimulation at a frequency of at least 100/sec were accepted as Betz cells[2–6]. They were found at depths varying between 0.5 and 2.2 mm and most of them discharged impulses spontaneously in a more or less rhythmical fashion[5].

In eight experiments, a total of 86 Betz cells were tested with *L*-glutamate, acetylcholine and various other drugs, applied iontophoretically from five-barrelled micropipettes. A very high proportion were found to be sensitive to acetylcholine. (The amounts of acetylcholine actually released varied, but the ACh current did not exceed 150 nA (10^{-9} A) and the time application was not usually more than 45 sec). In the precruciate motor cortex nearly all the Betz cells (49 out of 53, i.e. 92%) were clearly excited by acetylcholine, while in the postcruciate area the proportion of sensitive cells was somewhat smaller, although still high (21 out of 33, i.e. 64%). By

[1] K. KRNJEVIĆ and J. W. PHILLIS, Exper. *17*, 469 (1961).
[2] C. G. PHILLIPS, Quart. J. exp. Physiol. *41*, 58 (1956).
[3] C. G. PHILLIPS, Quart. J. exp. Physiol. *44*, 1 (1959).
[4] A. L. TOWE and H. D. PATTON, Fed. Proc. *16*, 129 (1957).
[5] A. R. MARTIN and C. L. BRANCH, J. Neurophysiol. *21*, 368 (1958).
[6] H. ASANUMA, Jap. J. Physiol. *9*, 94 (1959).