The differences in chromosome number and gross chromosome morphology between the European and Himalayan forms of *P. verticillatum* can be explained on the assumption that the Himalayan forms are primitive ones and European forms as comparatively recent ones, since it is believed that the centre of origin lies in Eastern Himalayas and Western China. Therefore, one can assume that the chromosome number $2n = 28$, noticed in the European forms has probably been derived from the original chromosome number $2n = 30$. It has been pointed out[3] that the presence of long chromosomes with median constriction is a primitive feature. It is difficult to say definitely at present whether the European forms have evolved from the Himalayan ones by losing the long or short chromosome pair. However, one cannot overlook the possibility of interspecific hybridization with some species of the group Alternifolia and this may have subsequently been followed by introgression. A detailed study on species from Eastern Himalayas is in progress.

The author is most indebted to Dr. M. S. SWAMINATHAN, Cytogeneticist of the Indian Agricultural Research Institute, New Delhi, for his encouragement and valuable suggestions. Sincere thanks are due to Mr. M. M. BEGG, Principal of Delhi College, for providing the necessary facilities and also to the Ministry of Scientific Research and Cultural Affairs for a Grant-in-aid.

VIRENDRA KUMAR

Department of Biology, Delhi College, Delhi University, Delhi (India), June 18, 1959.

Zusammenfassung

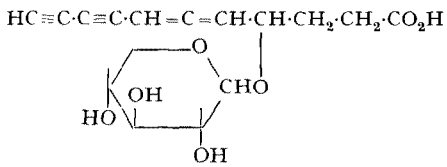
Die Chromosomenzahl und der Karyotypus von *Polygonatum verticillatum* Allioni ($2n = 30, 64$) und *P. cirrifolium* Royle ($2n = 38$), die im Himalaya vorkommen, wurden mit früher untersuchten europäischen Formen verglichen. Die beobachteten Unterschiede lassen sich durch die Annahme erklären, dass die europäischen Formen aus den Himalaya-Formen durch den Vorgang der Chromosomenverminderung und Veränderungen des Karyotypus hervorgingen.

[3] G. L. STEBBINS, JR., *Variation and Evolution in plants* (Oxford University Press, 1950).

Pathways of Sugar Metabolism in Relation to the Biosynthesis of Polyacetylenic Antibiotics

As part of a general programme of research into the biochemistry of antibiotic production we have been especially concerned with the Basidiomycete B-841, which produces polyacetylenic antibiotics with C_{11} (nemotinic acid, nemotin) and C_{12} (odyssic acid, odyssin) chains. Having established the structures of these compounds[1] and their biogenesis from a C_2 unit related to acetate[2] we turned our attention to the general metabolism of the fungus so that this might ultimately be correlated with the special processes of antibiotic formation. In this we were greatly assisted by the discovery that a high proportion of the nemotinic acid produced by B-841 is in the form of the xyloside (I) (in which the stereochemistry of the allene unit, the adjacent $C_{(4)}$, and the glycoside carbon atom remain uncertain). By the isolation of this compound we were enabled to study some aspects of pentose and polyacetylene synthesis simultaneously.

When B-841 is utilising glucose as sole nutrient, labelling from added [1-^{14}C] acetate is efficiently incorporated (15–20%) into the polyacetylenes but not into the xylose moiety of I. However B-841 will also utilise ethanol as sole nutrient; under these circumstances both moieties are labelled by [1-^{14}C] acetate, the ratio of activities in the xylose and C_{11} portions of I being about 1·5/6 (the C_{11} chain contains 6 'active' C atoms[2]). We conclude that in the ethanol cultures, in which all metabolic intermediates are being synthesised from C_2 units, the xylose is produced by way of compounds closely related to glucose; this explains the absence of labelling in the glucose cultures and is of course probable on general grounds.



(I); $[\alpha]_D^{25} + 237°$ ($c = 0{\cdot}1$ in EtOH)

Degradation of the labelled xylose revealed the pattern of labelling shown in II, the activities being relative to that of $C_{(4)}$ of the xylose. Our explanation of this labelling-pattern involves the operation of at least three well-known pathways of sugar metabolism in B-841.

	CH_2OH–CHOH–CHOH–CHOH–CHO				
Activity	27	28	45	100	3

(II)

Labelling from [1-^{14}C] acetate is normally incorporated into sugars by way of conversion into [1-^{14}C] pyruvate or its enol phophate, followed by the reversal of Emden-Meyerhof glycolysis. We have independent evidence for the operation of the Emden-Meyerhof route and citrate cycle in B-841; in the case when ethanol is the only nutrient, a special modification of the citrate cycle must be operative. As is well known, the overall effect of this process will be the synthesis of hexose labelled equally at $C_{(3)}$ and $C_{(4)}$. Now it has been shown that in a variety of systems the principal cause of randomisation of labelling in $C_{(1)}$–$C_{(3)}$ of hexoses is the action of enzymes of the transaldolase-transketolase cycle; the pattern of labelling in our xylose is exactly that which would be expected for $C_{(1)}$–$C_{(5)}$ of a hexose, initially labelled at $C_{(3)}$ and $C_{(4)}$ only, and subsequently randomised in this way[3]. This also implies that the xylose itself is not formed from one of the pentose phosphates intermediate in the transaldolase-transketolase cycle, but from a hexose derivative by loss of $C_{(6)}$. Such a process is involved in a known metabolic route, viz. the conversion of glucose *via* glucuronic acid into pentoses, including xylose[4].

Thus, without having isolated any of the relevant enzymes of intermediates we have circumstantial evidence

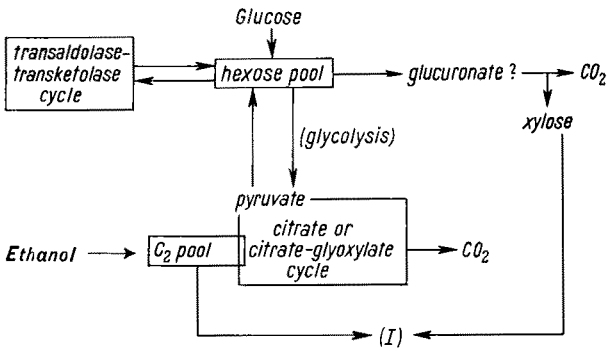
[1] J. D. BU'LOCK, E. R. H. JONES, and P. R. LEEMING, J. chem. Soc. *1955*, 4270; *1957*, 1097.

[2] J. D. BU'LOCK and H. GREGORY, Biochem. J. *72*, 322 (1959).

[3] H. G. WOOD and J. KATZ, J. biol. Chem. *233*, 1279 (1958).

[4] F. EISENBERG, P. G. DAYTON, and J. J. BURNS, J. biol. Chem. *234*, 250 (1959).

for a substantial section of the carbon metabolism of B-841, which can be summarised as shown in the Figure.



In confirmation it may be added that more direct evidence, to be described in detail elsewhere, indicates that most, though not all, of the respiratory carbon dioxide evolved by B-841 is in fact formed by way of glycolysis (from glucose) and the citrate or citrate-glyoxylate cycle (from glucose or ethanol).

J. D. Bu'Lock and H. Gregory

University Chemical Laboratory, Manchester, June 26, 1959.

Zusammenfassung

Der Einbau von [1-^{14}C]-Acetat bei der Biosynthese von Xylose aus Äthanol durch die Basidiomycete B-841 beweist das Vorhandensein von drei verschiedenen Wegen des Zuckerstoffwechsels in diesem Pilz: 1. Glycolyse, 2. Transaldolase-Transketolase-Zyklus, 3. Abbau von Glucose zu Glucuronat und Pentose.

10-Hydroxy-Δ^2-decenoic Acid in the Honeybee *(Apis mellifera)*

10-Hydroxy-Δ^2-decenoic acid has been isolated from 'royal jelly', the food of queen larvae, and is also present in the food of worker-bee larvae[1]. Its absence from nectar and pollen[2] suggested that it must come from the salivary glands of worker bees. Of these, the mandibular pair contain a suspension of liquid globules, soluble in sodium bicarbonate solution and reprecipitated by acids, which, in bees stored in a refrigerator, deposits masses of crystals that do not melt at room temperature[3] (Fig. 1). During work on a related problem, a crystalline fraction was obtained from an extract of the heads of worker bees. The idea that both these crystalline materials were 10-hydroxy-Δ^2-decenoic acid was supported by finding that the contents of fifty worker-bee mandibular glands yielded by solvent extraction and fractionation a crystalline acid, which by the criteria of infrared absorption, rate of flow on a paper chromatogram and rate of travel in a paper electrophoresis, was identical with the material extracted from worker-bees' heads and with authentic 10-hydroxy-Δ^2-decenoic acid extracted by the method of Butenandt and Rembold from 'royal jelly'[1]. Proof that the crystals seen in the contents of a mandibular gland after freezing were identical with 10-hydroxy-Δ^2-decenoic acid was obtained by X-ray powder photographs (Fig. 2).

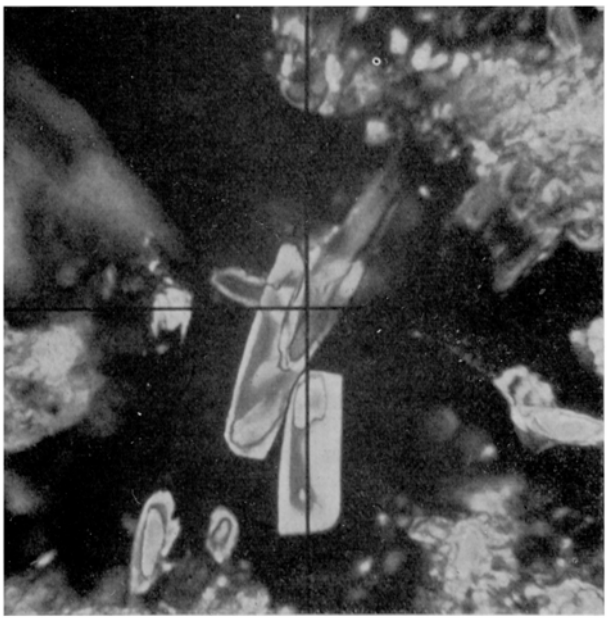
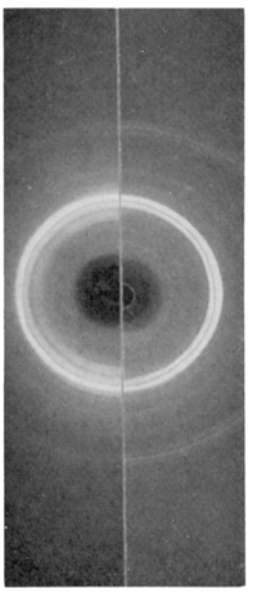


Fig. 1. - Crystals from mandibular gland of the honeybee. Crossed Polaroid. × 540.

It is thus clearly indicated that the 10-hydroxy-Δ^2-decenoic acid in 'royal jelly' comes from the mandibular glands of the worker bee. The contents of these glands contain little protein[4], so the belief, based on strong cir-



a *b*

Fig. 2. – X-ray powder photographs
(*a*) Crystals from mandibular gland.
(*b*) 10-Hydroxy-Δ^2-decenoic acid extracted from royal jelly.

[1] A. Butenandt and H. Rembold, Hoppe-Seylers Z. *308*, 204 (1957).

[2] S. A. Barker, A. B. Foster, D. C. Lamb, and N. Hodgson, Nature *183*, 996 (1959).

[3] J. Simpson, J. ins. Physiol. *4*, (1960), in press.

[4] E. Kratky, Z. wiss. Zool. *139*, 120 (1931).