auch zum Rundtanz überleitet, bildet er gleichsam ein Schaltstück zwischen den beiden klassischen, von v. FRISCH entdeckten Tanzformen. Es sei im übrigen betont, daß häufig mehrere Tanzformen durcheinander auftreten. In einem Abstand von 30 m wurden z. B. sowohl Ruck-, Rund- und Sicheltanz, als halbe und ganze 8-Tänze beobachtet. Wie die einzelnen Tanzformen, dürften sich auch die abweichenden Verhaltensweisen der von den verschiedenen Forschern beobachteten Bienen durch gleitende Übergänge verbinden lassen[1].

G. HEIN

Institut für vergleichende Physiologie der Universität Utrecht, den 10. Januar 1950.

Summary

In his work on the language of the honey-bees v. FRISCH distinguishes two dances: a round-dance and a tail-wagging dance. The latter one occurs only when the feeding place is situated at a certain distance from the hive (at least 25 m). It indicates the direction of the feeding place. BALTZER and TSCHUMI recently discovered yet another direction-indicating dance, called "sickle-dance" («Sicheltanz»). It occurred at distances of 3 to 17 m.

Our Dutch bees showed this sickle-dance too. At the end of each sickle run the bee performs a short, characteristic "pull-dance", directed in relation to the feeding place. Isolated pull-dances may be observed down to 2 m. Between 20 and 50 m, with growing distance of the feeding place, the sickle-dance gradually changes into a tail-wagging dance. There is some evidence that the indicated direction actually is chosen, even with very short distances of the feeding place.

[1] Vielleicht bedingt die Qualität der künstlichen (samt den natürlichen?) Futterquellen irgendwie die zuletzt erwähnten Unterschiede. Wenigstens konnte ein anderer Schüler (P. TRIEBELS) in einem blütenarmen Gelände und mit *verdünnter* Zuckerlösung (25%) *keine* Sicheltänze und nur wenige Rucktänze feststellen, die ungerichtet waren (Anm. Prof. DIJKGRAAF).

The Role of Intestinal Flora and Body-Tissue in the Biosynthesis of Nicotinamide in Rat and Man

The occurrence of biosynthesis of nicotinamide in the rat was first observed by SHOURIE and SWAMINATHAN[1] and subsequently by ELLINGER and COULSON[2] in man. The latter authors found a discrepancy between intake of nicotinamide and elimination of its metabolites, and suggested that a synthesis of nicotinamide most probably occurs in man; experiments were accordingly planned to determine the site of this synthesis. ELLINGER, COULSON, and BENESCH[3] and ELLINGER, BENESCH and KAY[4] induced a diminution of the urinary output of nicotinamide methochloride in the average by about 70% in several persons by feeding succinyl sulphathiazole with the normal diet and concluded that this reduction was due to a decrease in the number of intestinal bacteria which were involved in the synthesis of nicotinamide.

In 1946 NAJJAR, HOLT, JOHNS, MEDAIRY, and FLEISCHMANN[1] published a paper in which they stated that they "have been able to confirm the finding of ELLINGER *et al.* in regard to the biosynthesis of nicotinamide, but not in regard to the suppression of this phenomenon by sulfasuxidine". This statement has been accepted by HUNDLEY[2] who, therefore, dismisses as unconfirmed findings of ELLINGER and coworkers which do not agree with his views. In view of the fact that NAJJAR[1] *et al.* did not repeat the experiments of ELLINGER and coworkers they were not in a position to either confirm or refute them. NAJJAR[1] *et al.* kept their subjects on a special diet which was quite different from the natural one used by ELLINGER *et al.* Under these circumstances the intestinal flora was certain to change entirely and presumably would lead to a different output of nicotinamide methochloride which in this instance was no more than a mere fraction of that found under normal conditions (ELLINGER and COULSON[3]; PERLZWEIG and HUFF[4]; HOCHBERG, MELNICK, and OSER[5]; ELLINGER, BENESCH and HARDWICK[6]; ELLINGER and HARDWICK[7]; ELLINGER and ABDEL KADER[8] and others). The output of the methochloride was so low that it seems probable that it did not arise from nicotinamide synthesized in the gut and could, therefore, not be diminished by succinylsulphathiazole. These results can be considered to support the views of ELLINGER *et al.* concerning the role of the intestinal flora in the nicotinamide metabolism. In the early experiments no satisfactory examination of the changes of the intestinal flora was carried out when the nicotinamide methochloride output was reduced by succinylsulphathiazole feeding. There are, however, a number of experiments in which the composition of the fæcal flora and the nicotinamide methochloride output were determined simultaneously. The intake of succinylsulphathiazole in man caused the nicotinamide methochloride elimination and the number of coliform bacteria in the fæces to fall simultaneously, both returning to predosing levels when the sulpha drug was discontinued (ELLINGER and EMMANUELOWA[9]). Similarly a simultaneous rise in number of fæcal coliform bacteria and of nicotinamide methochloride output was reported by ELLINGER and EMMANUELOWA[10] after application of ambamide which stimulates growth and nicotinamide synthesis by *B. coli* and inhibits other intestinal bacteria (ELLINGER, ABDEL KADER and EMMANUELOWA[11]). These experiments leave little doubt that in man synthesis and release of nicotinamide by the intestinal flora contribute significantly to the body's requirements. The experiments by NAJJAR *et al.* were carried out under rather artificial conditions, they,

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therefore, cannot be considered to supply satisfactory evidence of the role, under normal conditions, of the intestinal flora in the supply of nicotinamide.

An increased interest in the site of the biosynthesis of nicotinamide followed the discovery that application of tryptophane increased the nicotinamide biosynthesis considerably (KREHL, SARMA, TEPLY and ELVEJEM[1], ROSEN, HUFF and PERLZWEIG[2]) which was observed in numerous species. In the rat, the tryptophan effect seems to take place in the body-tissue (SCHWEIGERT and PEARSON[3] HUNDLEY[4]) as well as in the intestinal flora (ELLINGER and ABDEL KADER[5,6,7]; JUNQUEIRA and SCHWEIGERT[8]). The rat is, however, not an ideal experimental animal for experiments of this kind. Feeding insoluble sulphadrugs to rats causes the coli population and nicotinamide methochloride elimination to fall simultaneously and to a considerable extent, but the latter returns to predosing level in spite of continued sulphathiazole feeding while the coli remain absent (ELLINGER[9]).

The site of the so-called "tryptophan-nicotinamide conversion" in man has been examined recently by SNYDERMAN, KETRON, CARRETERO and HOLT[10]. These workers administered to each of a number of normal infants, 3 to 24 months old, lg. of L-tryptophan, either intravenously or by mouth and examined the rise in nicotinamide methochloride elimination; this was of about the same degree in both cases. The predosing levels were again very low in comparison with those reported by COULSON and STEWART[11] for newborn babies. This might be due to the diet influencing the intestinal flora. From the promptness of the rise of nicotinamide methochloride elimination, which was approximately equal in magnitude after oral and intravenous tryptophan application, SNYDERMAN *et al.* concluded that "the conversion of tryptophan to N^1-methyl nicotinamide in man seems to be mediated by the body-tissues rather than by bacterial synthesis in the gastro-intestinal tract". I consider this conclusion is unwarranted for the following reasons:—

(1) The investigation was not carried out on man under normal conditions, but on children on a special diet. Under these conditions children possess an intestinal flora entirely different from that of adults living on a mixed diet. Conclusions of this kind, arrived at from experiments on infants and based on the intestinal flora cannot be applied to adults.

(2) The findings of SNYDERMAN *et al.*[10] allow an interpretation exactly opposite to the one they draw. If the "conversion of tryptophan into nicotinamide" occurs in the body-tissues it is probable that most of the intravenously injected tryptophan reaches the tissue concerned with the "conversion"! If, however, the tryptophan is given by mouth a considerable portion of it must be lost by destruction by the intestinal flora and only a part of the administered dose reaches the "converting" tissue. A smaller formation and subsequent elimination of nicotinamide methochloride can, therefore, be expected after oral than after intravenous administration. If the elimination is, however, equal in both cases it is very strong support for the view that the intestinal flora is involved in this "conversion" to a considerable extent in these infants.

While biosynthesis of nicotinamide in the gut as well as in the tissues, in the absence or presence of extradietary tryptophan, is proved for the rat, for man evidence of this synthesis is available only for that occurring in the intestinal flora.

P. ELLINGER

Lister Institute of Preventive Medicine, London, S. W. 1, December 31, 1949.

Zusammenfassung

Für die Ratte ist die Synthese von Nikotinsäureamid sowohl im Körpergewebe wie auch in der Darmflora sichergestellt. Die sogenannte «Tryptophan/Nikotinsäureamid-Umwandlung» kann bei dieser Tierart in Körpergewebe und Darmflora erfolgen. Für den Menschen ist die Bildung von Nikotinsäureamid nur durch die Darmflora bewiesen.

Recherches sur la biosynthèse de la biotine dans les méristèmes radiculaires de *Pisum* en culture aseptique

La biotine (vitamine H) est abondamment synthétisée par de nombreux microorganismes[1] ainsi que par les plantes supérieures. Les divers organes de ces dernières en contiennent des quantités appréciables ce qui, cependant, ne nous renseigne pas sur le lieu où les synthèses sont particulièrement intenses. On peut en particulier se demander comment se comporte la racine, privée de ses connections naturelles et cultivée en milieu synthétique stérile. J. BONNER a étudié le comportement de la racine de Lin, de Trèfle, de Luzerne et de Tomate et indique que ces racines sont douées du pouvoir de synthétiser la biotine. Il n'indique cependant que les taux finaux en biotine, après une longue durée de culture et plusieurs repiquages[2].

Des recherches de physiologie, pour lesquelles la racine de *Pisum* sert de test, nous obligent à connaître de quelle manière se comporte le métabolisme de la biotine chez cette espèce.

La racine de *Pisum* (sorte Maikönigin) est cultivée en milieu strictement synthétique constitué par les substances suivantes: milieu I, saccharose, $Ca(NO_3)_2$, KNO_3, KCl, KH_2PO_4, $MgSO_4$, tartrate de fer, vitamine B_1; milieu II, identique au précédent, mais avec de la nicotinamide en plus. Seule la vitamine B_1 est nécessaire. La nicotinamide n'est pas indispensable à la race de *Pisum* utilisée[3].

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