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M. BÁRÁNY

Institute of Biochemistry, Medical University of Budapest (Hungary)

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The biogenesis of tropane alkaloids

In recent times tracer techniques have been used in research on the biogenesis of alkaloids. No doubt these methods will give new and important facts. The results, however, should be carefully interpreted.

One of the most important reports on this subject comes from LEETE, MARION AND SPENSER[1]. They fed ornithine-2-^{14}C to *Datura stramonium* plants and isolated radio-active hyoscyamine from the whole plant. The isolated scopolamine, however, was inactive. To explain this result they suggested that scopine is synthesized by another mechanism from another precursor, *viz.* hydroxyornithine via hydroxyproline.

Although the existence of two separate synthesizing mechanisms for these alkaloids has been proposed on other grounds[2] it seems to me highly improbable that these two related alkaloids should be synthesized along different pathways. Moreover, another explanation of the above mentioned results—in my view a more likely one—can be given.

LEETE *et al.* placed the plants in 500 ml feeding solution containing 10 mg ornithine with a total activity of $2.9 \cdot 10^6$ dis/min. After 7 days, when the plants were harvested, the activity remaining in the solution was $0.01 \cdot 10^6$ dis/min, corresponding with 0.035 mg ornithine.

Their results may be fully explained when one assumes that scopolamine is the first alkaloid synthesized from ornithine, but is in a short time transformed into hyoscyamine.

At first the active ornithine competes favourably with the present ornithine, due to its concentration and the radio-activity will turn up in scopolamine, as well as in other metabolic products. After some time the radio-activity of the scopolamine produced per unit of time, will decrease as a result of the decrease in the concentration of ornithine in the feeding solution. Now, assuming that the scopolamine is constantly transformed into hyoscyamine, the radio-activity of the scopolamine fraction will gradually decrease and it is quite possible that, at the moment of analysis, practically all the radio-activity of the alkaloid fraction will be found in the hyoscyamine.

An indication that in fact ornithine is a precursor of both alkaloids was obtained in experiments with sterile root cultures of *Atropa belladonna*, which will be published in due time.

Feeding ornithine resulted in an increase in alkaloid content from 0.4 % on dry weight in controls, to 0.8 % and a chromatographic analysis showed that both alkaloids had increased.

Laboratory for Technical Botany, Technical University, Delft (Netherlands)

P. REINOUTS VAN HAGA

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