

SECTION 3: BIOSYNTHESIS

INTRODUCTORY REMARKS BY THE HONORARY PRESIDENT OF THE SECTION

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It is an honour and a great pleasure for me to open this meeting of the section on Biosynthesis. The enormous development in the chemistry of natural products in the last twenty years has been combined with a major development in the biochemistry of these substances. Besides the new methods of preparing and analysing traces of compounds, the introduction of isotopes in feeding experiments helped to clear up relations between precursors and products of metabolism, and also clarified supposed reaction steps.

Probably the most important success of this new period of biochemistry may be seen in the fact that the fundamental metabolism of all known organisms is in principle the same: respiration, fermentation, protein synthesis, *etc.* This is the contribution of biochemistry to a general biology. The living world is a great unity.

There is, however, an enormous number of secondary products, which are not found in all organisms and which are, in the main, not necessary for life; they mostly have the character of excreted and are accumulated especially in plants, because this type of organism has no regularly working apparatus for clearing away the end products of metabolism. In the last ten years the biosynthesis of such secondary plant substances has been investigated with enormous success.

Feeding experiments with labelled compounds show what the plant is able to do but not always what it is doing within a normal metabolism. This means that those precursors with a good result are only possible precursors and not always natural ones. The plants have much more chemical potencies than they demonstrate under normal conditions. Queer relations may exist. There are, for instance, poppy species which change thebaine into codeine and morphine. Other papaver species are not able to do so. But there are fungi and tobacco species which easily reduce and demethylate thebaine to morphine.

The molecules are distinct forms of architecture. The investigations of biosynthesis will show us, without speculation, in which way nature constructs such molecules as distinct steric isomers. In his famous doctrine

about metamorphosis of plants Johann Wolfgang Goethe has endeavoured to visualize the manifold forms of higher plants as manifestations of a general type of a proto-plant. Were Goethe still alive he would found a more concrete field of comparative morphology. In the primary metabolism there seems to be realized only what is useful. But in the secondary plant substances nature realizes chemical ideas, changed a hundredfold, manifesting themselves in numerous different ways and yet remaining the same. The creation of secondary plant substances has, in general, nothing to do with usefulness. It rather is something to delight scientists, and sometimes to be used by man. For example, there are more than three hundred indole-alkaloids in the order of *Gentianales* which only consist of two building-stones: tryptophane and a terpene. This simple principle is repeatedly realized in an admirable manner.

Till now it was only possible to compare all these molecules formally, but now we begin to understand that this grand variety is ruled by a general law, by a congruency in biosynthesis. These two building stones can be found also in other combinations, for example in ergolines and emetines. One cannot but admire how few elements of construction Nature needs to develop the huge world of secondary products. Nature works as a great artist: simple in her means but inexhaustibly rich in imagination and application.

One of the scientists, who successfully elucidated these relations, not only with high chemical knowledge but also with a nature-inquiring imagination is Professor Battersby, who will give us a summary of some of his recent investigations. It is an honour and a great pleasure for me to introduce the first main speaker, Professor Battersby, on biosynthesis.