Structure, Chemistry, and Biosynthesis of the Melanins

By G. A. Swan, Newcastle upon Tyne

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I. Introduction

The term "melanin" (μελανί = black) is a purely descriptive one, which conveys no chemical information and merely denotes a black pigment of biological origin, although in fact some melanins are brown or even yellow. Different authors have accepted various definitions of exactly what constitutes a melanin; and melanins are sometimes loosely described as pigments of high molecular weight formed by the enzymic oxidation of phenols. The latter is not however a satisfactory definition. According to THOMSON (149), who has written admirable reviews on the chemistry of melanins (149, 150), the term melanin appears to have been used first with some precision in 1902 by FÜRTH and SCHNEIDER, in respect of the black precipitate they obtained by the action in vitro of insect tyrosinase on tyrosine. The fact that the general properties and the carbon, hydrogen, and nitrogen analyses of this material were in approximate agreement with those reported for natural pigments from animal hair, melanoma, Sepia black, etc., implied that these natural pigments also were products of the tyrosine-tyrosinase reaction. An excellent, comprehensive, and detailed account of these pigments has been given by NICOlaUS (107) in his book, which includes references up to 1967, and in which he has classified the pigments into eumelanins, phaeomelanins, and allomelanins. In the present article, an attempt will be made to give a much briefer, although up-to-date review of the structure, chemistry, and biosynthesis of melanins. A number of other useful reviews on melanin, and on the chemistry and biochemistry of melanogenesis are also available (42, 53, 85, 86, 94, 95, 106, 130, 137, 148).

\[
\begin{align*}
\text{Tyrosine} & \quad \text{Dopa} & \quad \text{Dopamine} \\
\text{(1)} & \quad \text{(2)} & \quad \text{(3)}
\end{align*}
\]

The eumelanins, which are usually black, and which occur especially in the animal kingdom, contain nitrogen, and are derived from tyrosine (1), dopa, i.e. 3,4-dihydroxyphenylalanine (2), and perhaps dopamine, i.e. 3,4-dihydroxyphenethylamine (3), tyramine, etc. Typical examples

References, pp. 575—582