Melanin biosynthesis

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29/05/2020
Introduction

Reactome is open-source, open access, manually curated and peer-reviewed pathway database. Pathway annotations are authored by expert biologists, in collaboration with Reactome editorial staff and cross-referenced to many bioinformatics databases. A system of evidence tracking ensures that all assertions are backed up by the primary literature. Reactome is used by clinicians, geneticists, genomics researchers, and molecular biologists to interpret the results of high-throughput experimental studies, by bioinformaticians seeking to develop novel algorithms for mining knowledge from genomic studies, and by systems biologists building predictive models of normal and disease variant pathways.

The development of Reactome is supported by grants from the US National Institutes of Health (P41 HG003751), University of Toronto (CFREF Medicine by Design), European Union (EU STRP, EMI-CD), and the European Molecular Biology Laboratory (EBI Industry program).

Literature references


Reactome database release: 72

This document contains 1 pathway and 11 reactions (see Table of Contents)
Melanin biosynthesis takes place in specialized cells called melanocytes, within membrane-bound organelles referred to as melanosomes. Melanosomes are transferred via dendrites to surrounding keratinocytes. Keratinocytes and melanocytes are collectively known as 'the epidermal melanin unit'. Each melanocyte is in contact with approximately 40 keratinocytes in the basal and suprabasal layers (Cichorek et al. 2013). Melanocytes are distributed in the epidermis, hair follicles, the inner ear and the eye (Yamaguchi et al. 2007, Tolleson 2005).

Melanocytes in mammals and birds produce two chemically distinct types of melanin, black to brown eumelanin and yellow to reddish-brown pheomelanin (Ito & Wakamatsu 2008, Simon et al. 2009, d’Ischia et al. 2013). These differ in their responses to UV radiation; eumelanin has the ability to convert absorbed light energy into heat energy (Meredith & Riesz 2004) and to detoxify reactive oxygen species (ROS) (Bustamante et al. 1993), while pheomelanin is a phototoxic pro-oxidant (Samokhvalov 2005). Most natural melanin pigments contain eumelanin and pheomelanin (Ito & Wakamatsu 2003) and are termed 'mixed' melamins. Neuromelansins are mixed melanin-like pigments which are mainly found in neurons of the substantia nigra and locus coeruleus (Fedorow et al. 2005). Synthesis of NM may prevent the accumulation of toxic catechol derivatives (Zecca et al. 2003). NM can sequester a variety of potentially damaging molecules such as beta-carbolines, heavy metal ions and 1-methyl-4-phenylpyridinium (MPP+) (D’Amato et al. 1986), a drug which causes Parkinson's Disease-like symptoms. Models suggest that mixed melanogenesis occurs in three stages (Ito et al. 2000). The initial stage of melanin biosynthesis is the production of cysteinyldopas, which continues while sufficient cysteine is available. The second stage is the oxidation of cysteinyldopas to produce pheomelanin, which continues while cysteinyldopa concentration is sufficiently high. The last stage is the production of eumelanin, which begins when cysteinyldopas and cysteine are depleted. The ratio of eumelanin to pheomelanin is determined by tyrosinase activity and the availability of tyrosine and cysteine (Land et al. 2003).

**Literature references**

Tyrosinase oxidises tyrosine to dopaquinone

Location: Melanin biosynthesis

Stable identifier: R-HSA-5662662