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Melanogenesis Connection with Innate Immunity and Toll-Like Receptors

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Abstract

The epidermis is located in the outermost layer of the living body and is the place where external stimuli such as ultraviolet rays and microorganisms first come into contact. Melanocytes and melanin play a wide range of roles such as adsorption of metals, thermoregulation, and protection from foreign enemies by camouflage. Pigmentary disorders are observed in diseases associated with immunodeficiency such as Griscelli syndrome, indicating molecular sharing between immune systems and the machineries of pigment formation. Melanocytes express functional toll-like receptors (TLRs), and innate immune stimulation via TLRs affects melanin synthesis and melanosome transport to modulate skin pigmentation. TLR2 enhances melanogenetic gene expression to augment melanogenesis. In contrast, TLR3 increases melanosome transport to transfer to keratinocytes through Rab27A, the responsible molecule of Griscelli syndrome. TLR4 and TLR9 enhance tyrosinase expression and melanogenesis through p38 MAPK (mitogen-activated protein kinase) and NFκB signaling pathway, respectively. TLR7 suppresses microphthalmia-associated transcription factor (MITF), and MITF reduction leads to melanocyte apoptosis. Accumulating knowledge of the TLRs function of melanocytes has enlightened the link between melanogenesis and innate immune system.

Keywords: Griscelli syndrome; Hermansky–Pudlak syndrome; RAB; innate immunity; melanogenesis; melanosome; microphthalmia-associated transcription factor; toll-like receptor; tyrosinase.

Conflict of interest statement

The authors declare no conflict of interest.

Figures

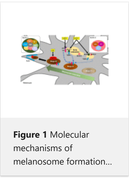

Figure 1 Molecular mechanisms of melanosome formation...

Figure 2 TLR1/2 and TLR2 induce melanin...

Figure 3 TLR3 promotes melanosome transfer. TLR3...

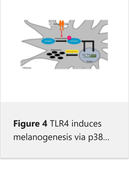

Figure 4 TLR4 induces melanogenesis via p38...

Figure 5 TLR7 inhibits melanogenesis and induces...

Figure 6 TLR9 promotes melanogenesis via NFκB...

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