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# Why Testes are Hyperpigmentated?

## Reproductive System: Male

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Description

### Introduction

As is well known, the **pigmentation of the skin** is principally function of production of melanin by [melanocytes](#), whose enzymatic apparatus is regulated by melanocyte stimulating hormone (MSH) in consequence of UV that increase the expression in the skin of both MSH and its receptor ([Mechanisms of skin tanning in different racial/ethnic groups in response to ultraviolet radiation, 2005](#); [Melanocortin-1 receptor structure and functional regulation, 2005](#)).

**MSH** is produced in the pituitary gland, but not only ([Proopiomelanocortin gene is expressed in many normal human tissues and in tumors not associated with ectopic adrenocorticotropin syndrome, 1988](#); [Melanocortin-1 receptor structure and functional regulation, 2005](#)). It is produced also by many different **periferic tissues** such as skin and testis. MSH is the result of the cleavage of a “pre-pro-hormone”, the proopiomelanocrotin ([POMC](#)). So there is three type of MSH:  $\alpha$ ,  $\beta$  and  $\gamma$  which have different affinity for the different receptors. Furthermore the adrenocorticotrop hormone (ACTH), that also derive from POMC, shares part of the aminoacidic sequence with  $\gamma$ -MSH. This complicate the signalling pathway of the melanocortins. Collectively  $\alpha,\beta,\gamma$ -MSH and ACTH are called melanocortines (MCs).

Another complication is due to the receptors, that are five. MCR-1/5 ([Melanocortins and their receptors and antagonists, 2003](#)).

	MC1R	MC2R	MC3R	MC4R	MC5R
main expression	Melanocytes, Testis	Adrenal cortex	Brain, Testis	Brain	Ubiquitary
main function	Pigmentation	Steroidogenesis	Energy homeostasis, Sexual behaviour	Appetite regulation	Exocrine function
agonist	$\alpha$ -MSH	ACTH	$\alpha,\beta,\gamma$ -MSH	ACTH, $\alpha,\beta$ -MSH	ACTH, $\alpha$ -MSH

This table can summarize the relationship between the MCs and their [MCRs](#), with their expression and function. Note that alpha-MSH can bind almost all MCRs; MC2R is bound only by ACTH, gamma-MSH binds only MC3R.

## The Role of MSH in Testes Pigmentation

A simplistic hypothesis is that evolutionism has selected the hyperpigmentation of the testes for the protection of the germ line from mutations caused by UV. But if this hypothesis were true, we should have hyperpigmentation since the birth; moreover are hyperpigmentates the external genitals in general, and a little also those female. In fact the **pigmentation of testes starts to increase in puberty** ([Human genital melanocytes as androgen target cells, 1997](#)). Moreover the stimulation of melanocytes is not the only function of MSH, indeed the **MCs play an important role** in the regulation of food intake, in the energetic homeostasis, **in sexual behaviour and sexual function** ([Melanocortins and their receptors and antagonists, 2003](#); [Estradiol and plasminogen activator secretion by cultured rat Sertoli cells in response to melanocyte-stimulating hormones, 1989](#)).

For these two reasons my hypothesis is that the **hyperpigmentation is only a collateral effect** of the more important role on sexual behaviour and sexual function of MCs.

A similar collateral effect occurs in “tanning from happiness” ([MSH effects, 2010](#)).

Actually the role of MCs on sexual behaviour, appetite regulation and energy homeostasis are carried out in the Central Nervous System ([Discovery that a melanocortin regulates sexual functions in male and female humans, 2005](#); [Brain effects of melanocortins, 2009](#)) and not have interaction with testes. Although these functions are the most investigated, there are some researches that shows some possible intrinsic loops in testis.

The unusual pattern of expression of MCRs has already been mentioned, in particular in testis are expressed all types of MCRs, except for MC2R, ([Distribution of cDNA for melanocortin receptor subtypes in human tissues, 1996](#)). Moreover MCs are not simply expressed by melanocytes: POMC transcripts was detected in **Leydig cells**, interstitial macrophages and, at lower levels, in spermatogonia and spermatocytes ([Localization of mRNAs in mouse testes by in situ hybridization: distribution of alpha-tubulin and developmental stage specificity of pro-opiomelanocortin transcripts, 1985](#); [Pro-opiomelanocortin \(POMC\) gene expression, as identified by in situ hybridization, in purified populations of interstitial macrophages and Leydig cells of the adult rat testis, 1993](#)).

Another study shows that MCs have an effect on **Sertoli cells**: an increase of some enzymes, such as **aromatase** ([Estradiol and plasminogen activator secretion by cultured rat Sertoli cells in response to melanocyte-stimulating hormones, 1989](#)). Aromatase is an important enzyme in the metabolism of Testosterone, it converts Testosterone in Estradiol. In general this can have various functional significance, such as some effects of Testosterone on some target tissues require its conversion in Estradiol. Anyway, independently from role of aromatase, these studies show how is very plausible that MCs play a role in **paracrine regulation of testis function**, so to affect also the color of the nearby skin.

Another mechanism is involved in genital pigmentation, it is an androgens-dependent mechanism: it was shown that melanocytes of the genitals skin have a major expression of the Androgen Receptor (AR) than other melanocytes and respond to androgens with an increase of pigmentation ([Human genital melanocytes as androgen target cells, 1997](#)). Although the meanings is unknown, this can explain the increase in pigmentation in coincidence with puberty.

In conclusion, why testes are hyperpigmentated remains unknown, but it is caused by at least two mechanisms: an increase of MCs, probably for a paracrine regulation of sexual function of the testes; and an increase of androgens during puberty.

### Pathways

[Melanocortin \(MSH\)](#)

### Comments

2013-07-25T13:09:58 - [Emanuele Di Vita](#)

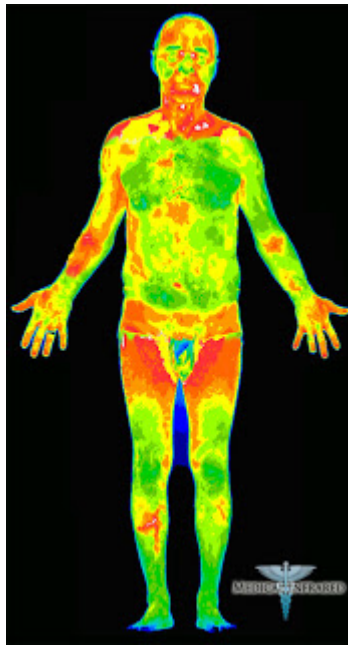
[Linea nigra](#)

Another example in support of my hypothesis that MCs in sexual and other functions have like

collateral effect hyperpigmentation.

2013-03-11T22:52:36 - [Gianpiero Pescarmona](#)

[Thermoregulation](#)



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