



Normal Biosynthesis of Melanin



ALBA (2009) in Spanish



Genespoir & ALBA (2012) in French



Normal Biosynthesis of Melanin



Biosynthesis of Melanin



Albinism: pigmentation versus vision



Charles and Calvin



María (ocular albinism)



Luis Carlos

Visual deficiency is commonly found in all types of albinism

Melanin functions

- **Protect the skin from UV radiation** (sun)
- Prevents DNA damage (mutagenesis) in cells
- In the absence of melanin the risk for skin cancer increases (BCC, SCC, melanoma)
- Antioxidant and radical scavenger (prevents cells from these damages/insults too)



In the absence of melanin skin lesions appear



In the absence of melanin skin lesions appear



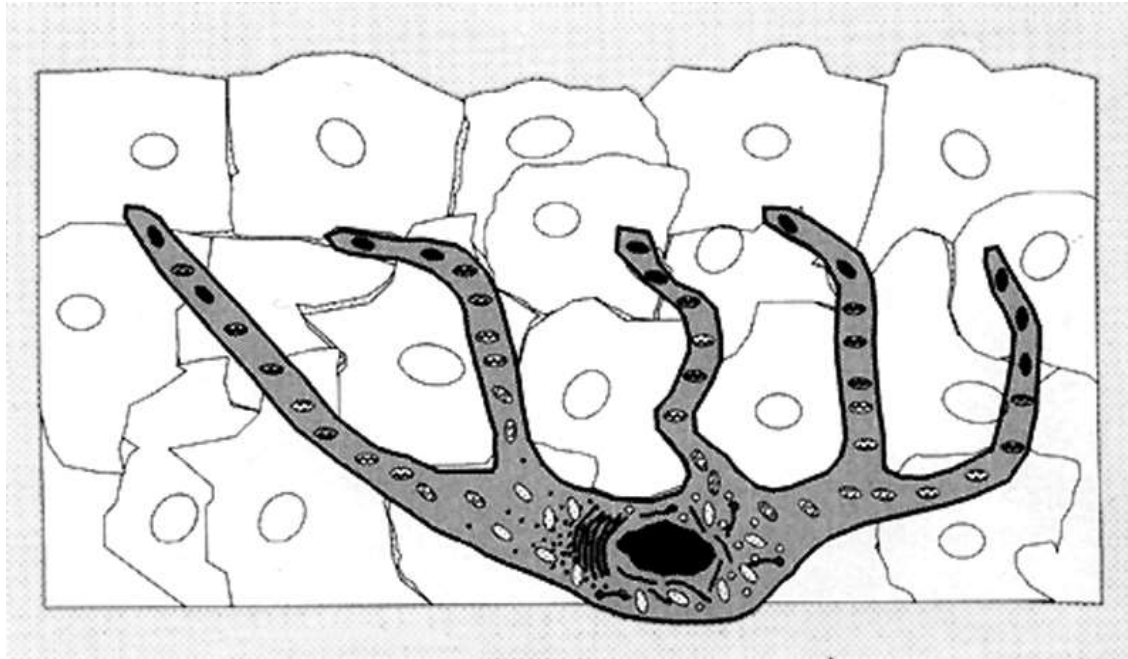
Without melanin skin lesions can develop into skin cancer

**Melanin is made inside
pigment cells**

Melanocytes

Retinal Pigment Epithelium

Melanocytes

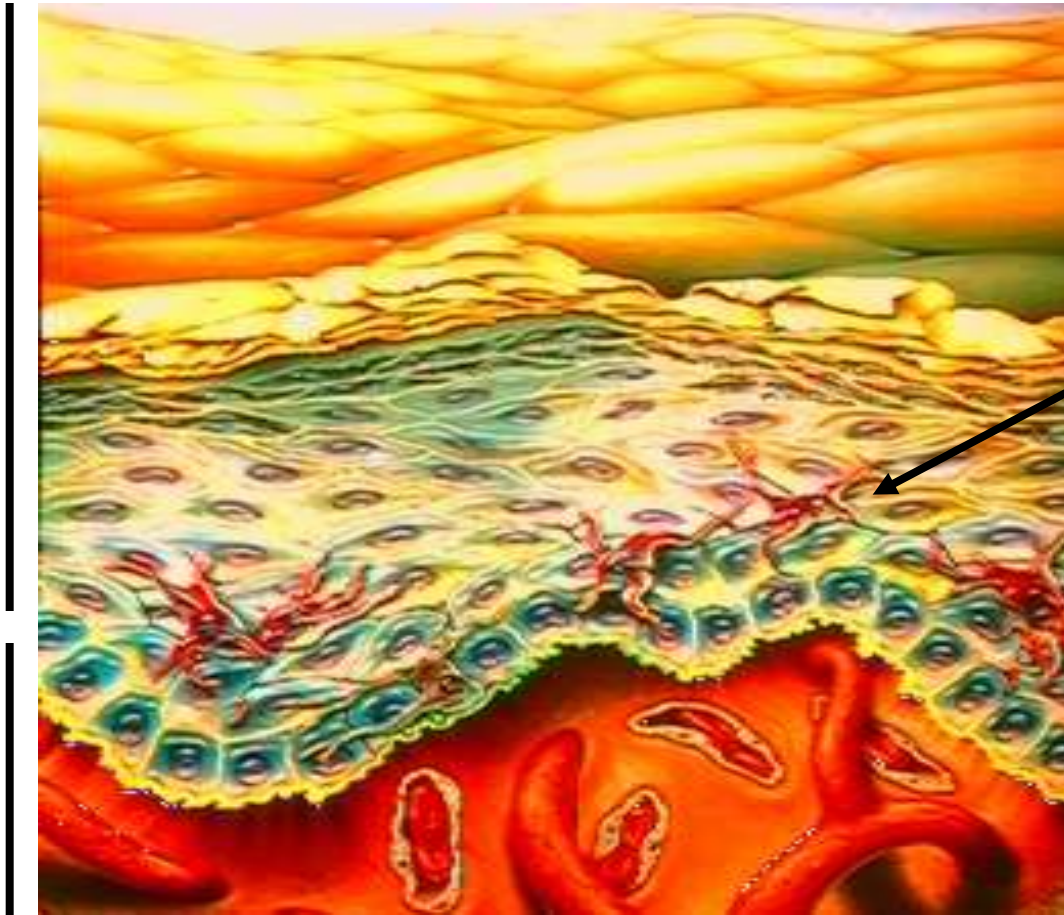


melanocytes

Where are the melanocytes?

epidermis

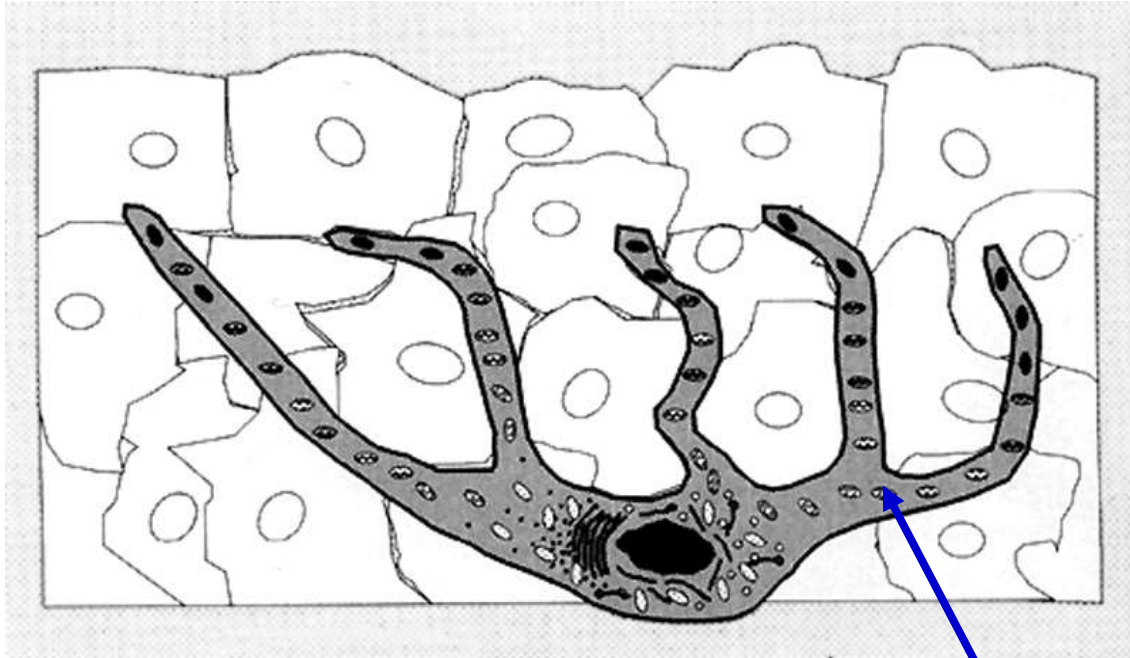
dermis



melanocytes

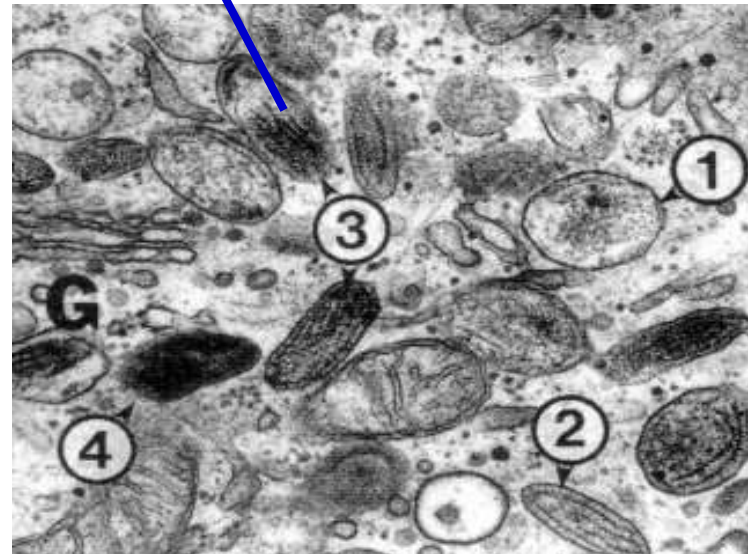
SKIN

Where the pigment is made inside pigment cells?

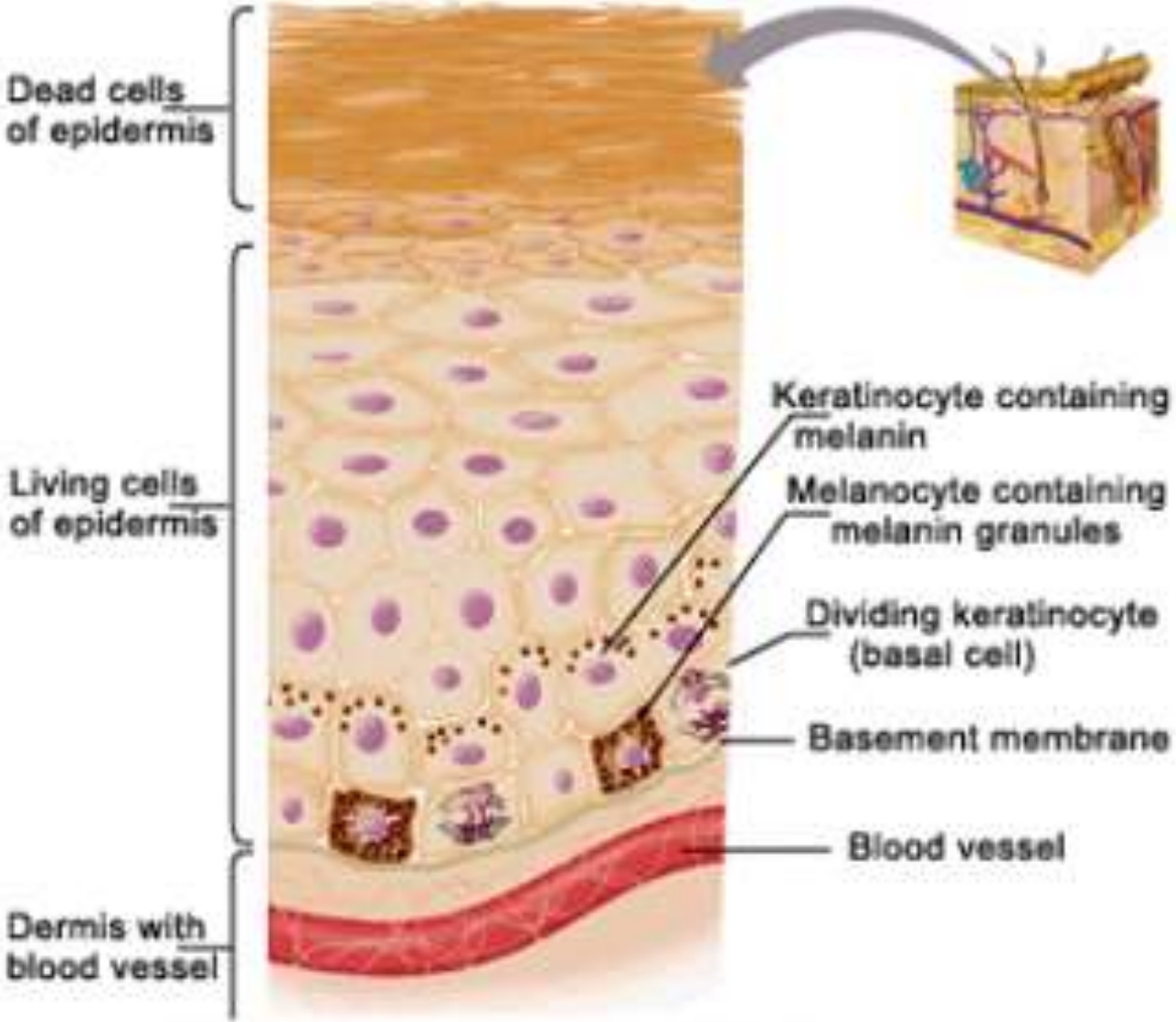


Melanocyte

Melanosomes

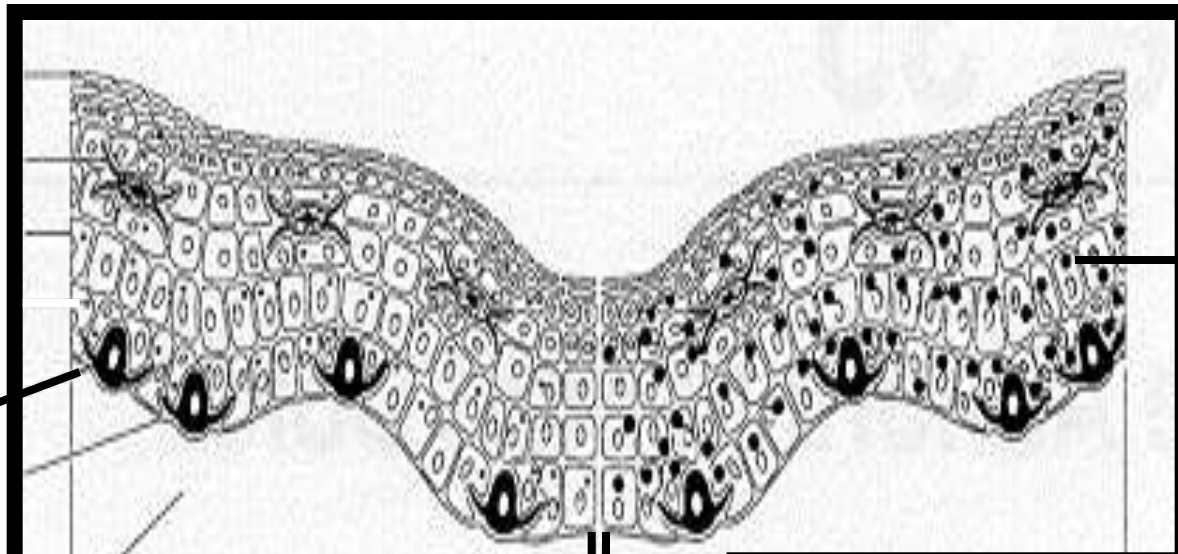


Melanocytes transfer melanosomes to keratinocytes



**Black and White People have similar numbers of melanocytes
BUT
the transfer of melanosomes from melanocytes to keratinocytes
is more efficient in black people**

EPIDERMIS



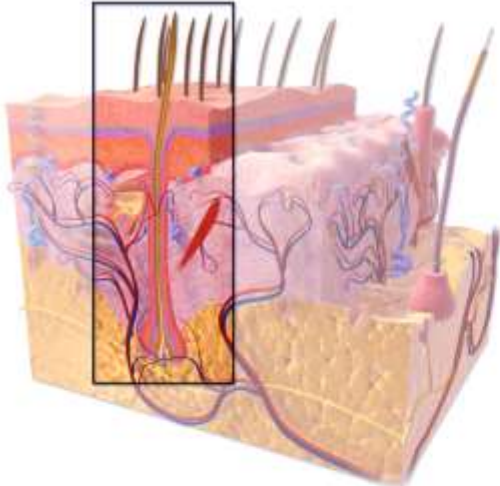
white

black

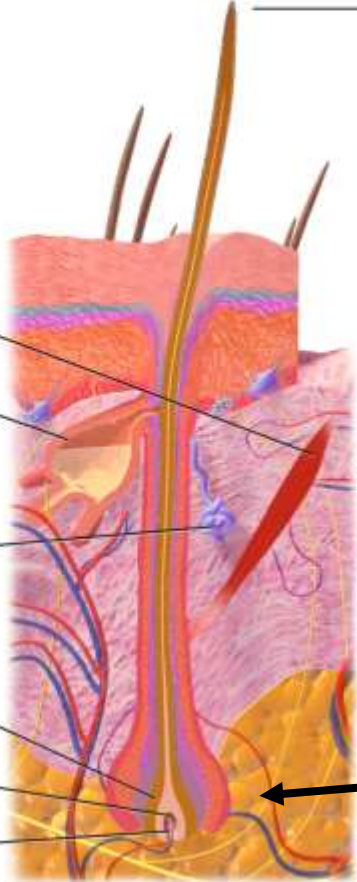
Where else do we have melanocytes?

Hair Follicles and Hair

HAIR



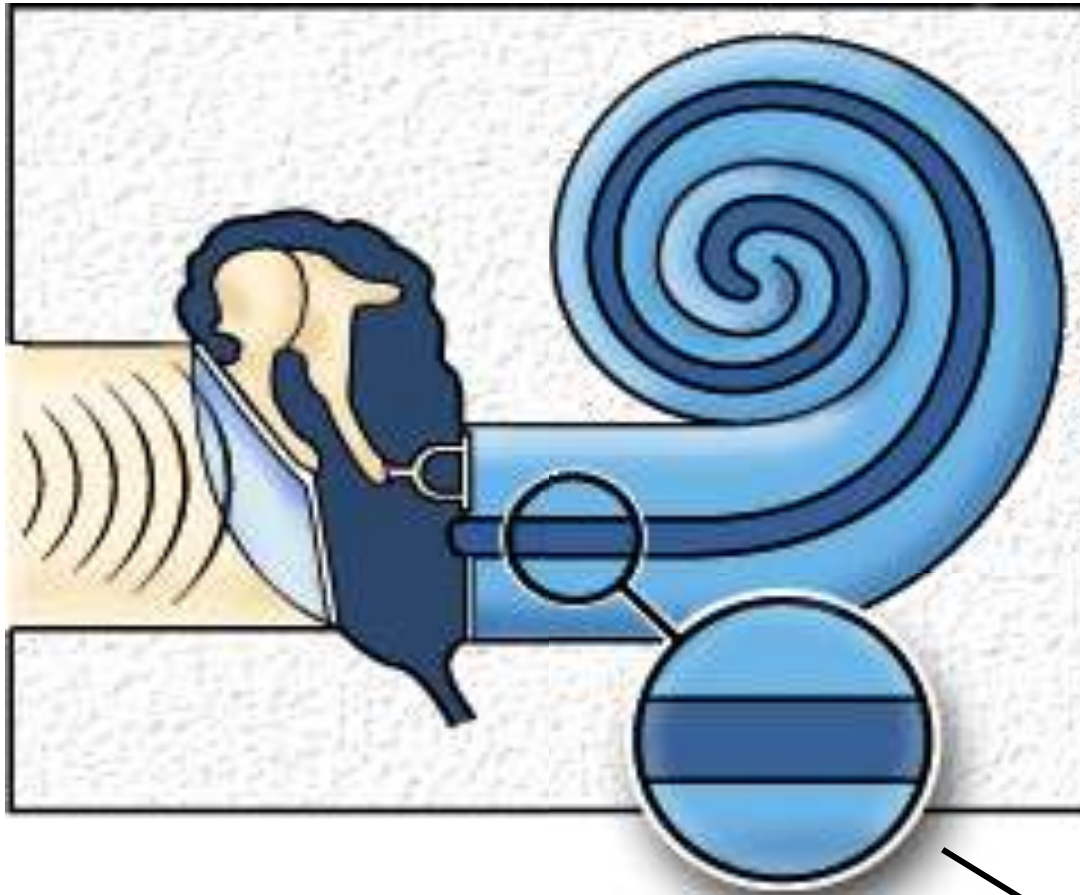
- Arrector pili muscle
- Sebaceous gland
- Apocrine sweat gland
- Hair bulb
- Hair matrix
- Hair papilla



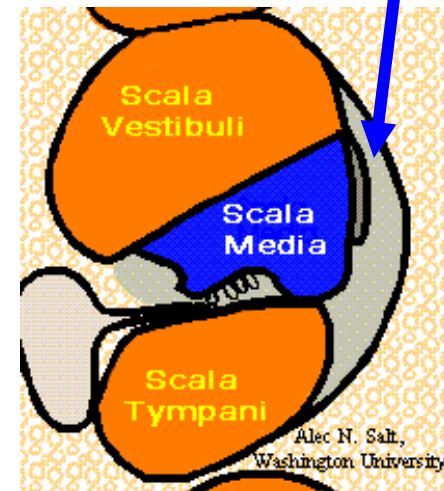
- Hair shaft
- Hair root

melanocytes



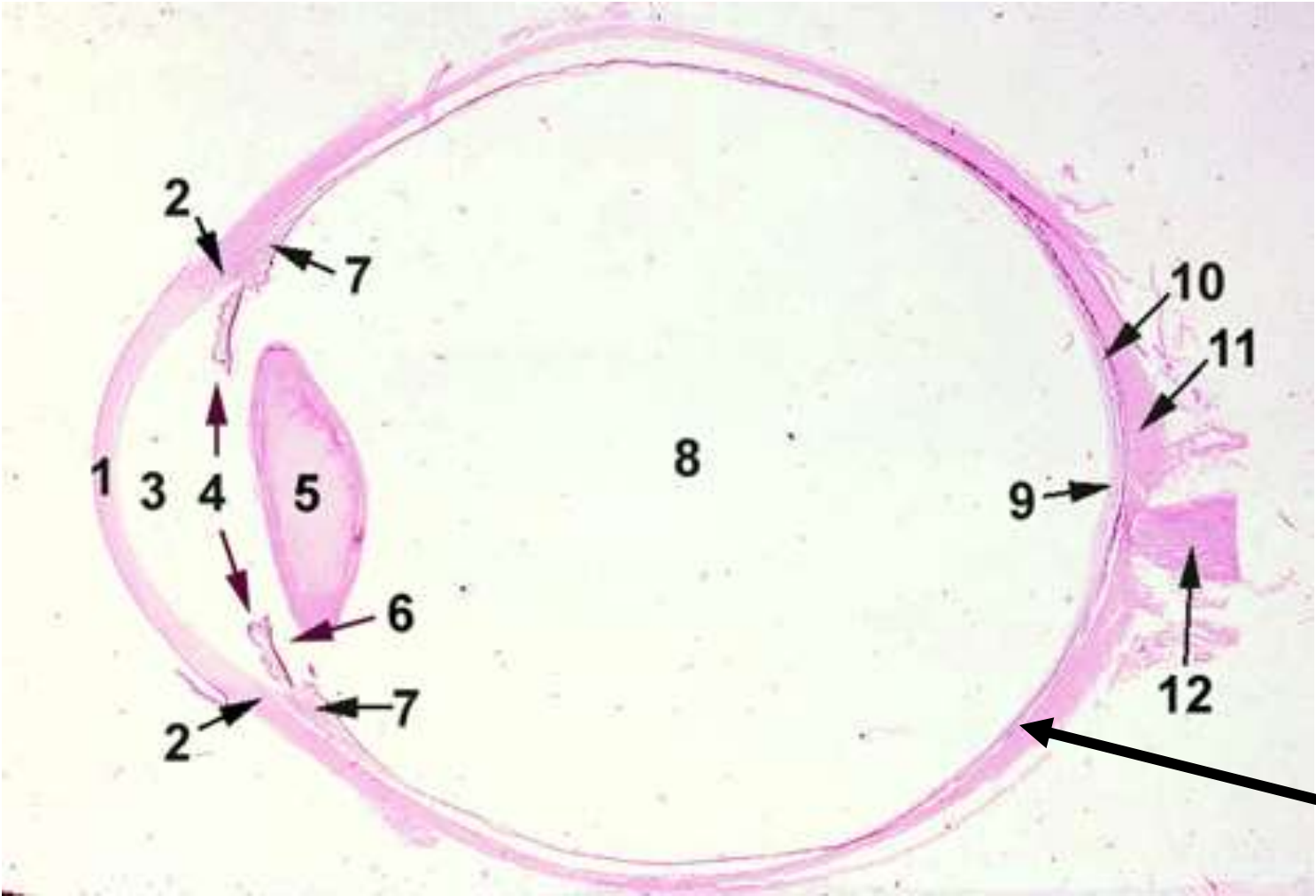


**Also in the
inner ear
(cochlea)**



Alec N. Salt,
Washington University

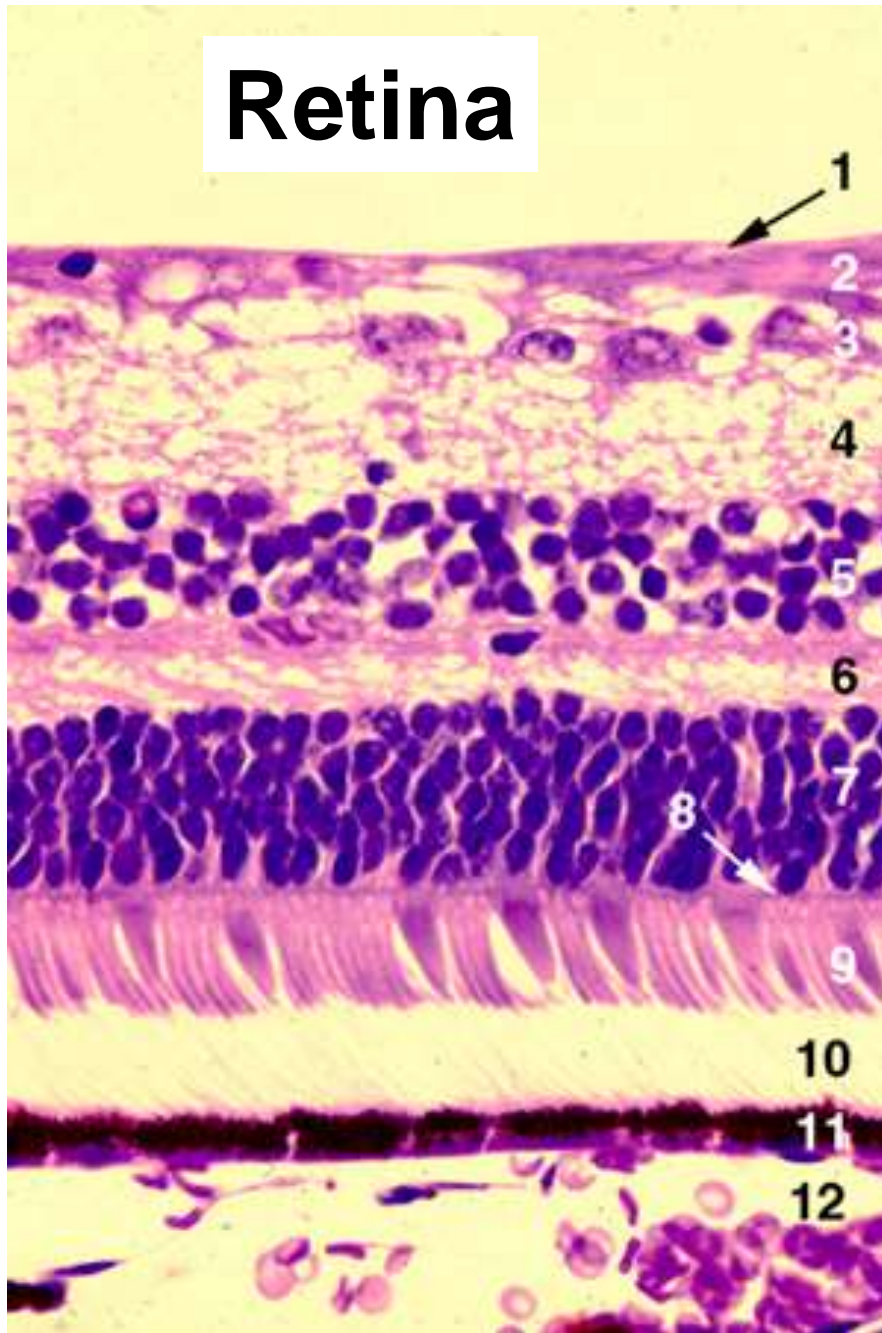
Pigment cells (RPE) exist also in the retina



Retina

The Human Eye

Retina

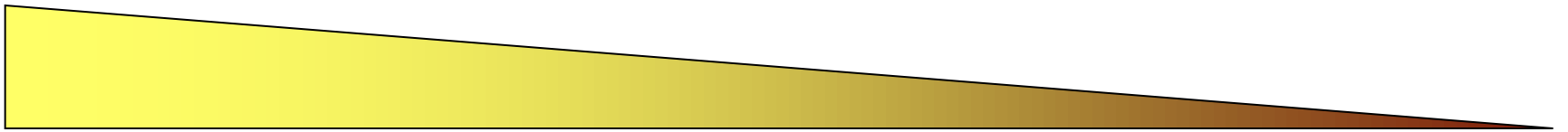


Photoreceptors

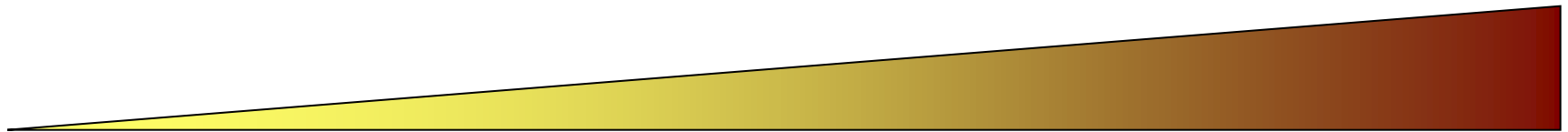
RPE cells



PHEOMELANIN



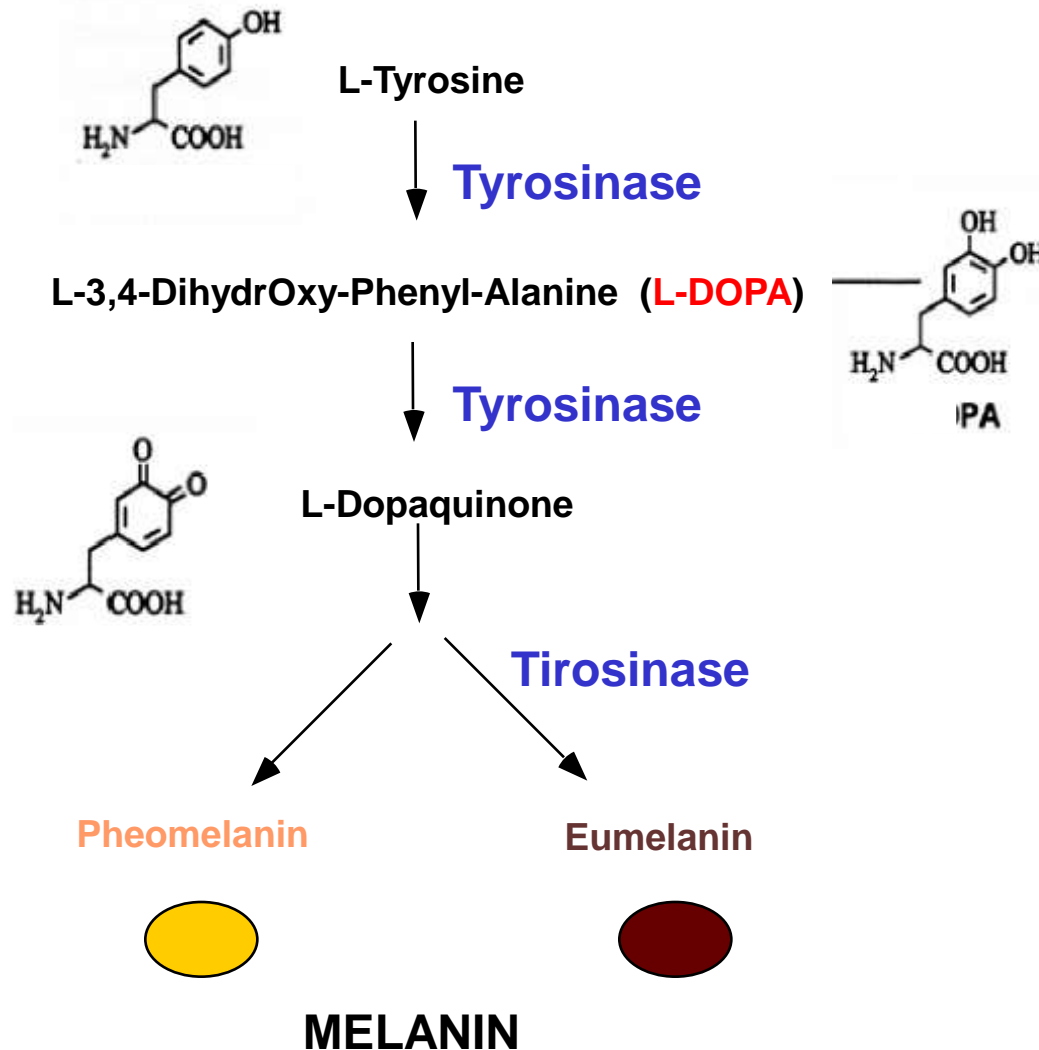
EUMELANIN

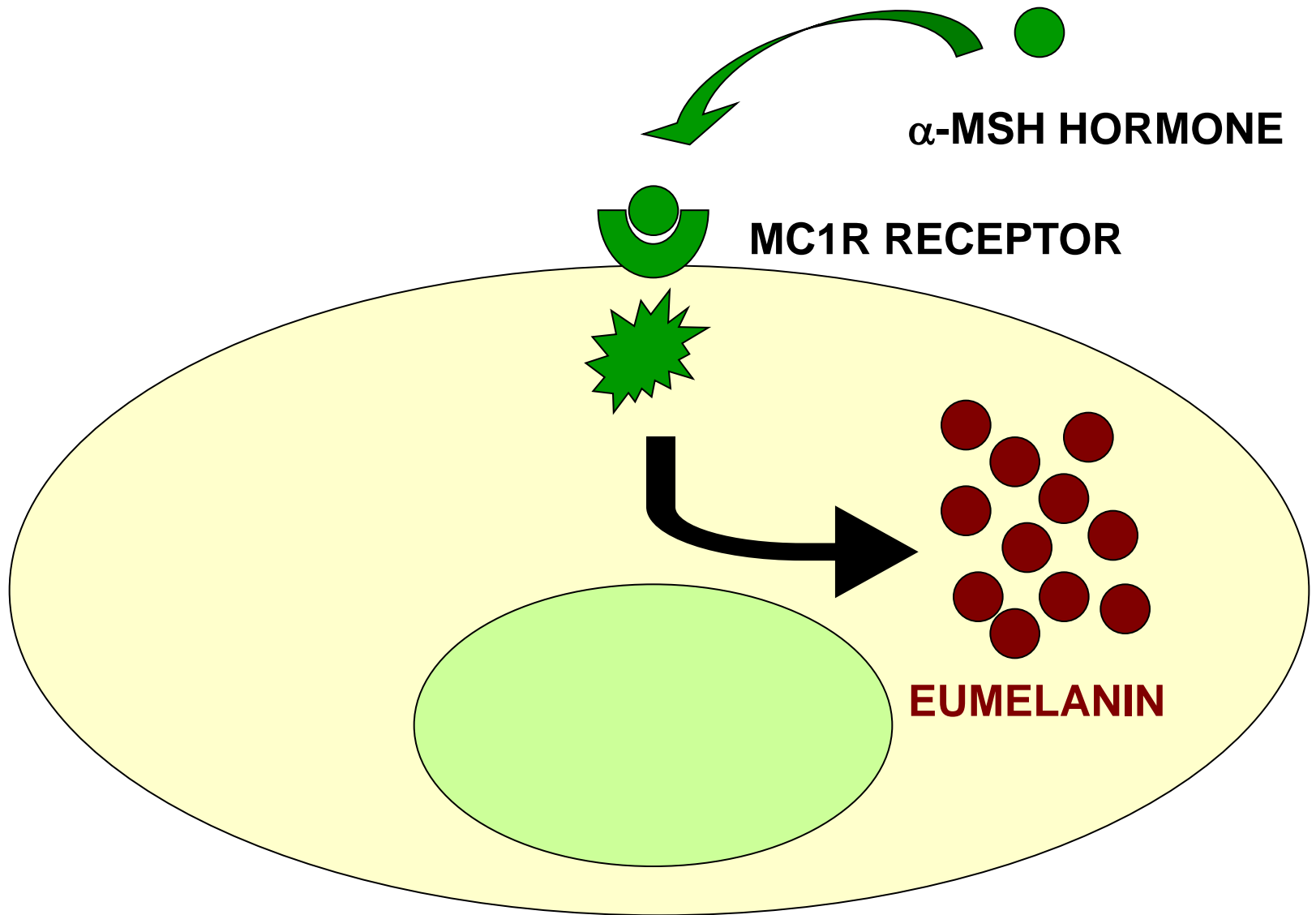


There are two types of melanin

How melanin is synthesized?

Biosynthesis of melanin



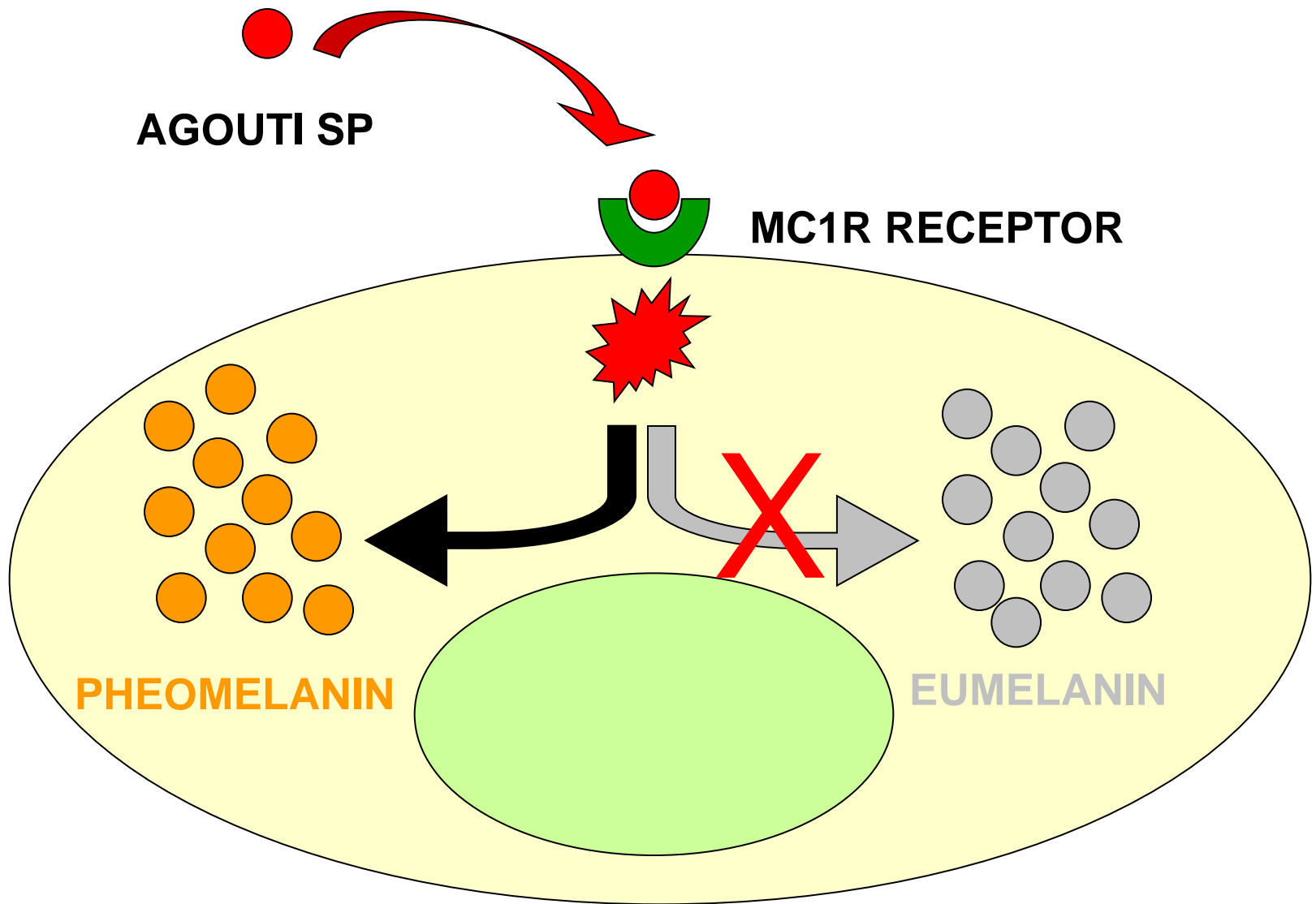


α -MSH HORMONE

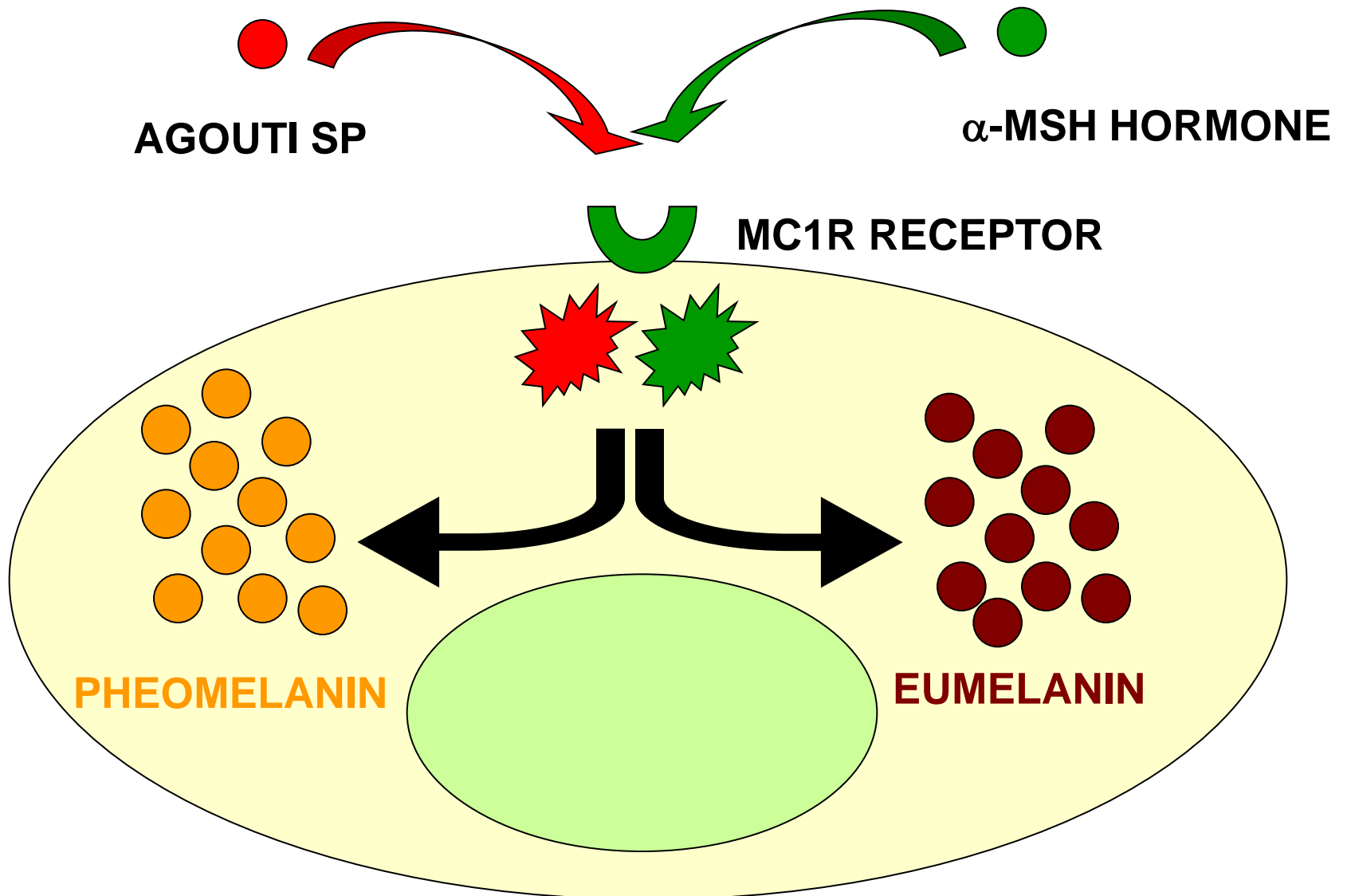
MC1R RECEPTOR

EUMELANIN

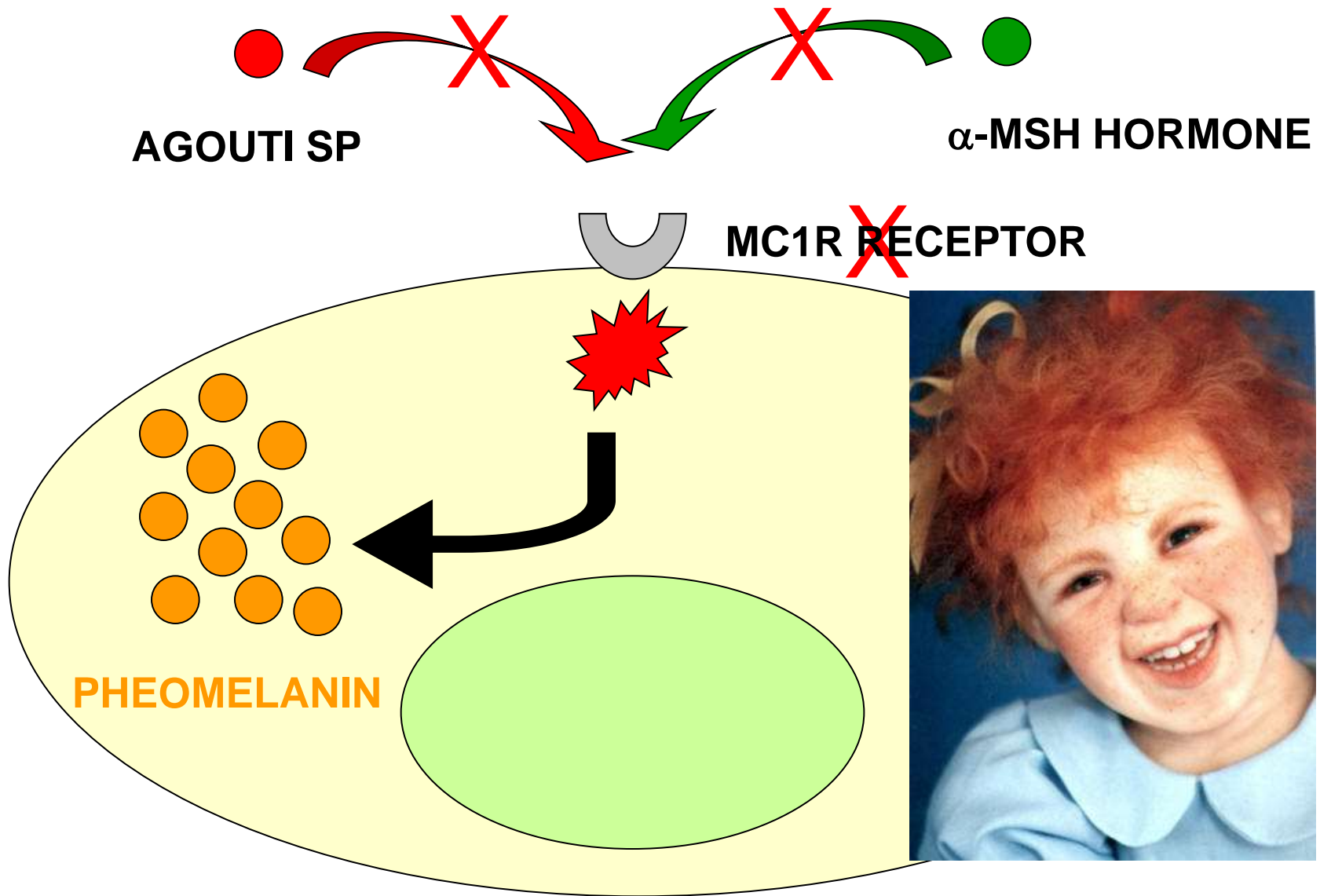
IN A PIGMENT CELL
(melanocyte)



IN A PIGMENT CELL
(melanocyte)

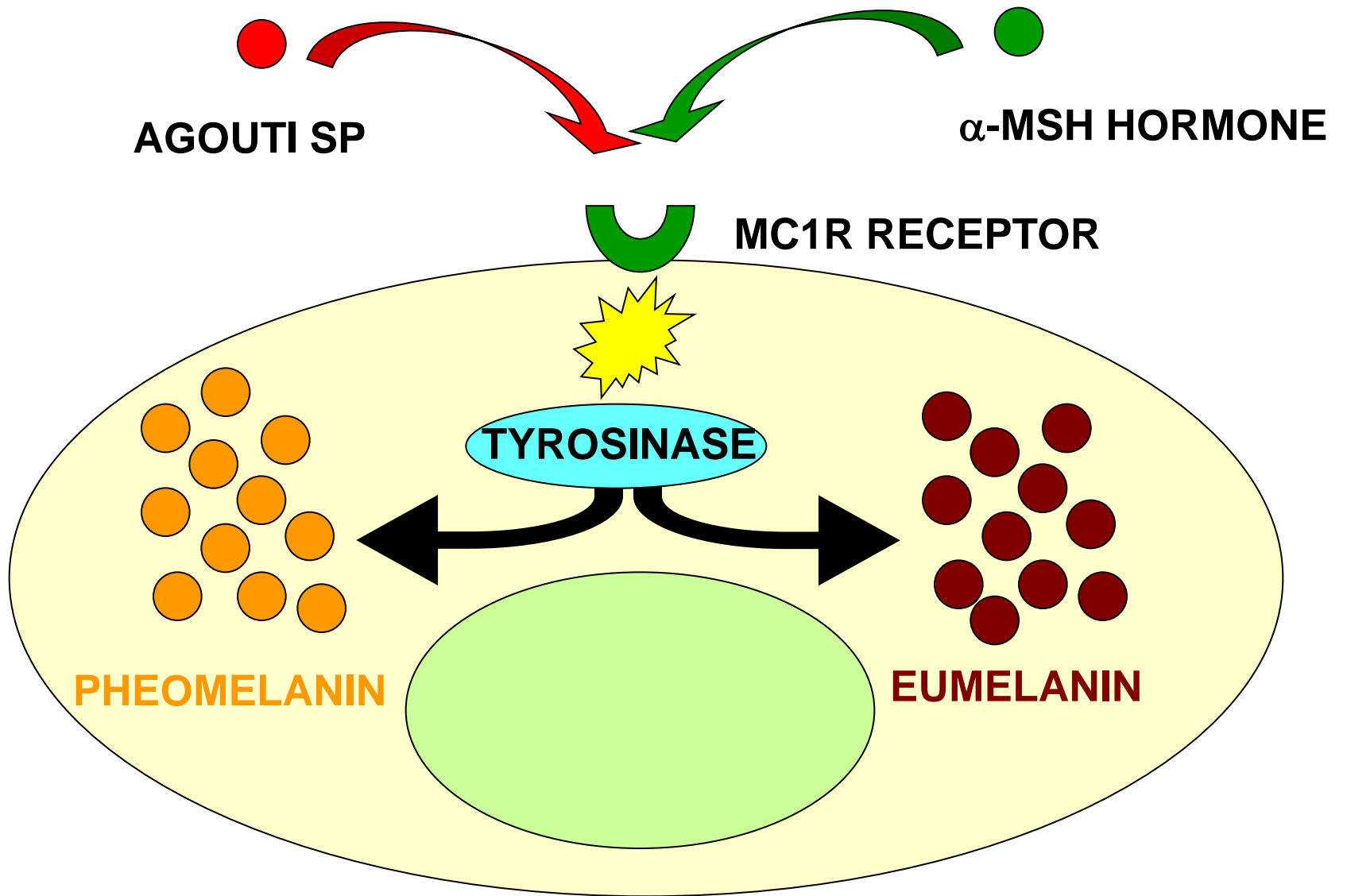


IN A PIGMENT CELL
(melanocyte)

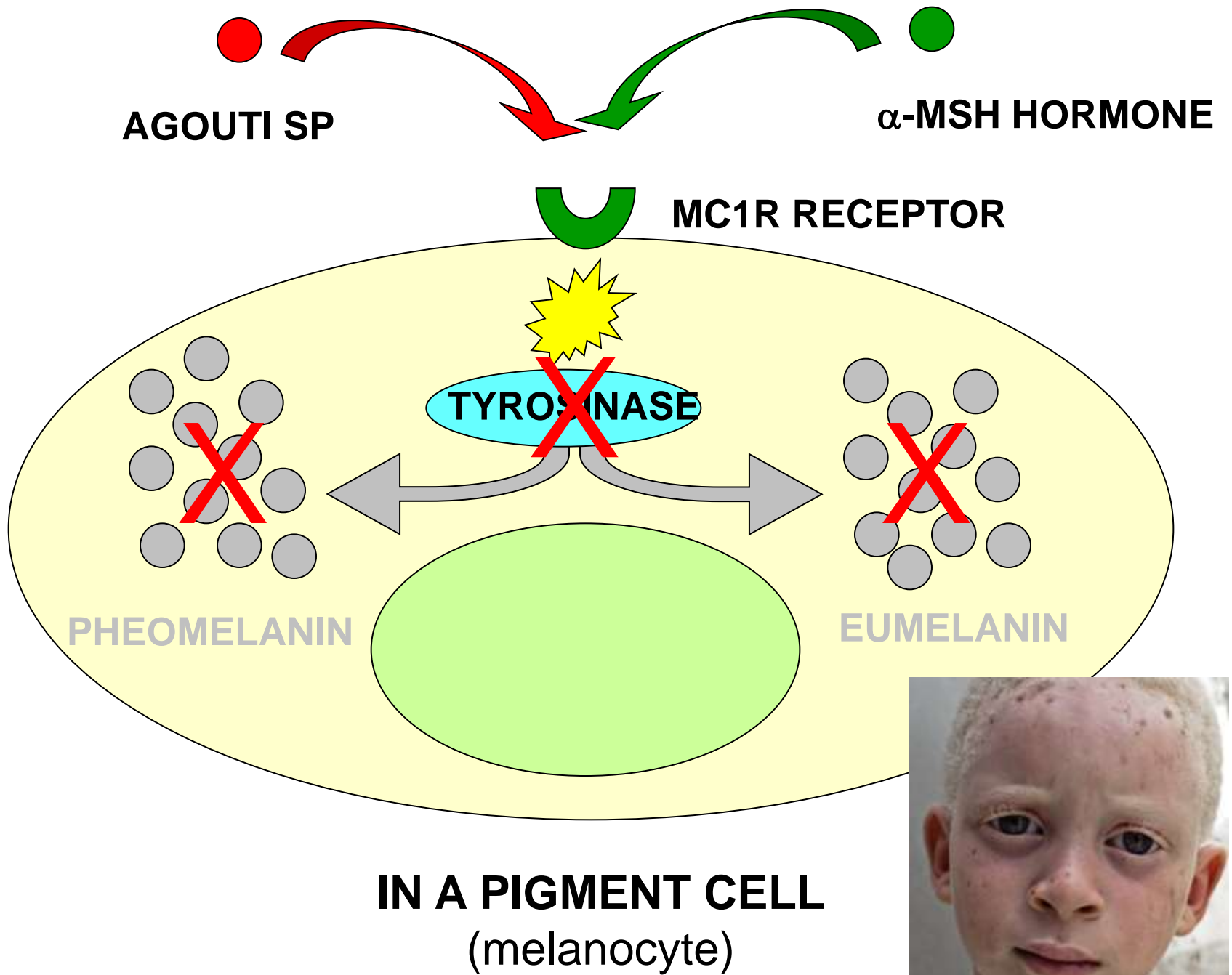


IN A PIGMENT CELL
(melanocyte)

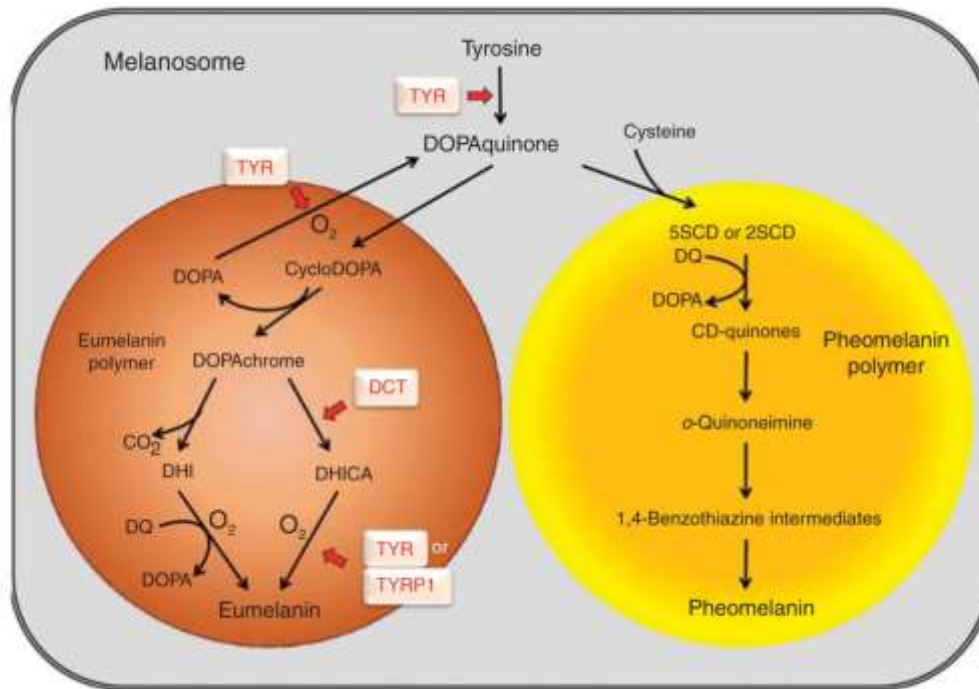
REDHAIR



IN A PIGMENT CELL
(melanocyte)



How many genes do we need to make melanin? (we have ~ 25.000 genes)



**~ 400 genes
needed to make
pigment
(< 2%)**



are all these ~400 genes associated to albinism?

NO, to date only 18 genes have been confirmed to be associated with albinism



1ST EUROPEAN
DAYS

OF ALBINISM

October 27th & 28th 2012

Paris, FRANCE





2nd European Days of Albinism

Valencia, Spain, 5-6 April 2014



ALBA



Asociación
de ayuda a
personas con
albinismo

3rd European Days of Albinism

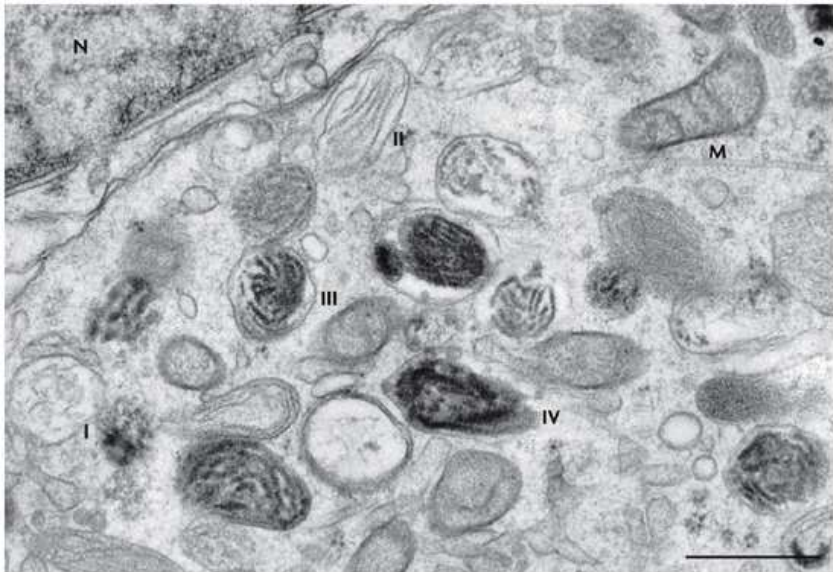
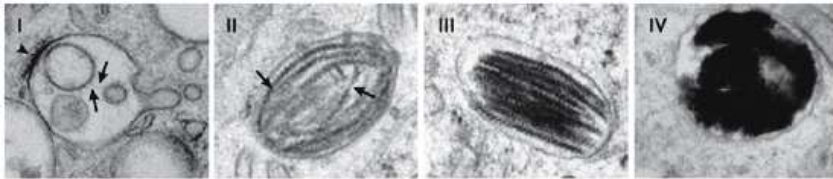
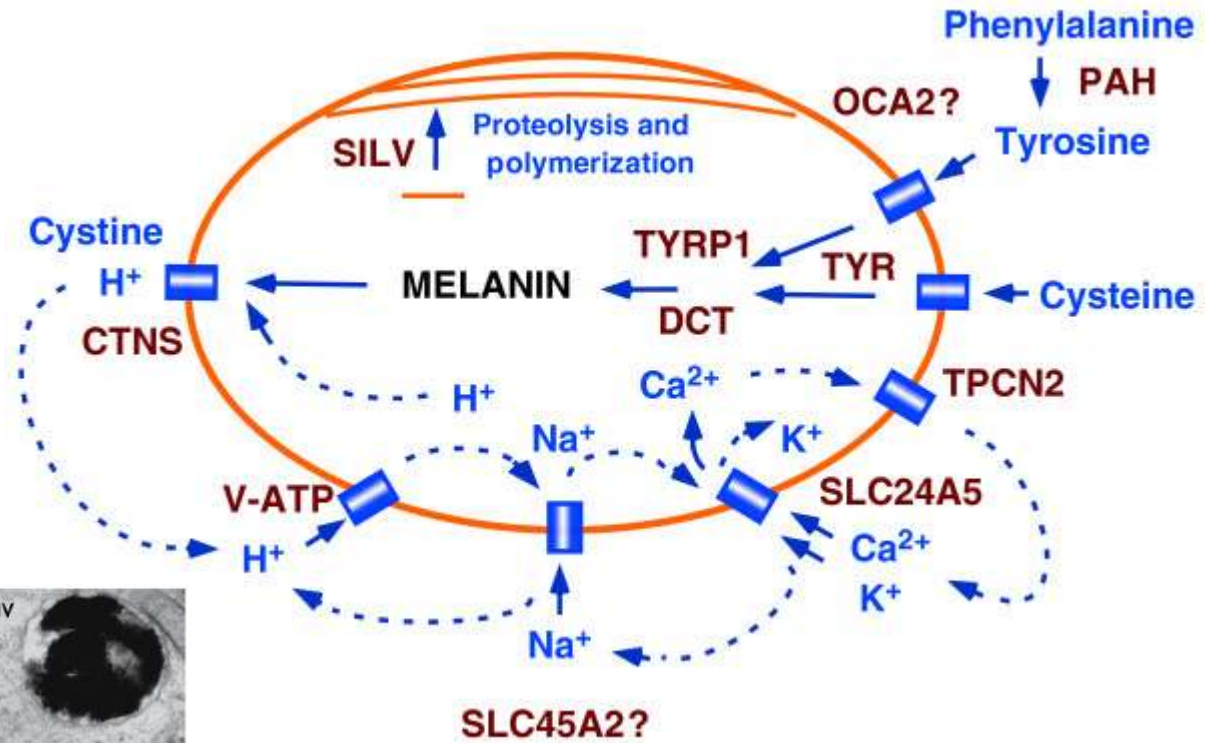
Milano, Italy, April 2016

18 genes associated to albinism

Mouse	Human	Albinism	Mutations (HGMD)
<i>Tyr</i>	<i>TYR</i>	OCA1	303
<i>Oca2</i>	<i>OCA2</i>	OCA2	154
<i>Tyrp1</i>	<i>TYRP1</i>	OCA3	16
<i>Slc45a2</i>	<i>SLC45A2</i>	OCA4	78
??	4q24	OCA5	1
<i>slc24A5</i>	<i>SLC24A5</i>	OCA6	2
<i>c10orf11</i>	<i>C10orf11</i>	OCA7	6
<i>Gpr143</i>	<i>GPR143</i>	OA1	114
<i>Lyst</i>	<i>LYST</i>	CHS1	53
<i>Hps1</i>	<i>HPS1</i>	HPS1	31
<i>Ap3b1</i>	<i>AP3B1</i>	HPS2	20
<i>Hps3</i>	<i>HPS3</i>	HPS3	7
<i>Hps4</i>	<i>HPS4</i>	HPS4	13
<i>Hps5</i>	<i>HPS5</i>	HPS5	11
<i>Hps6</i>	<i>HPS6</i>	HPS6	9
<i>Dtnbp1</i>	<i>DTNBP1</i>	HPS7	2
<i>Bloc1s3</i>	<i>BLOC1S3</i>	HPS8	2
<i>Bloc1s6</i>	<i>BLOC1S6</i>	HPS9	2

Melanogenesis / Melanocytes

Melanosomes



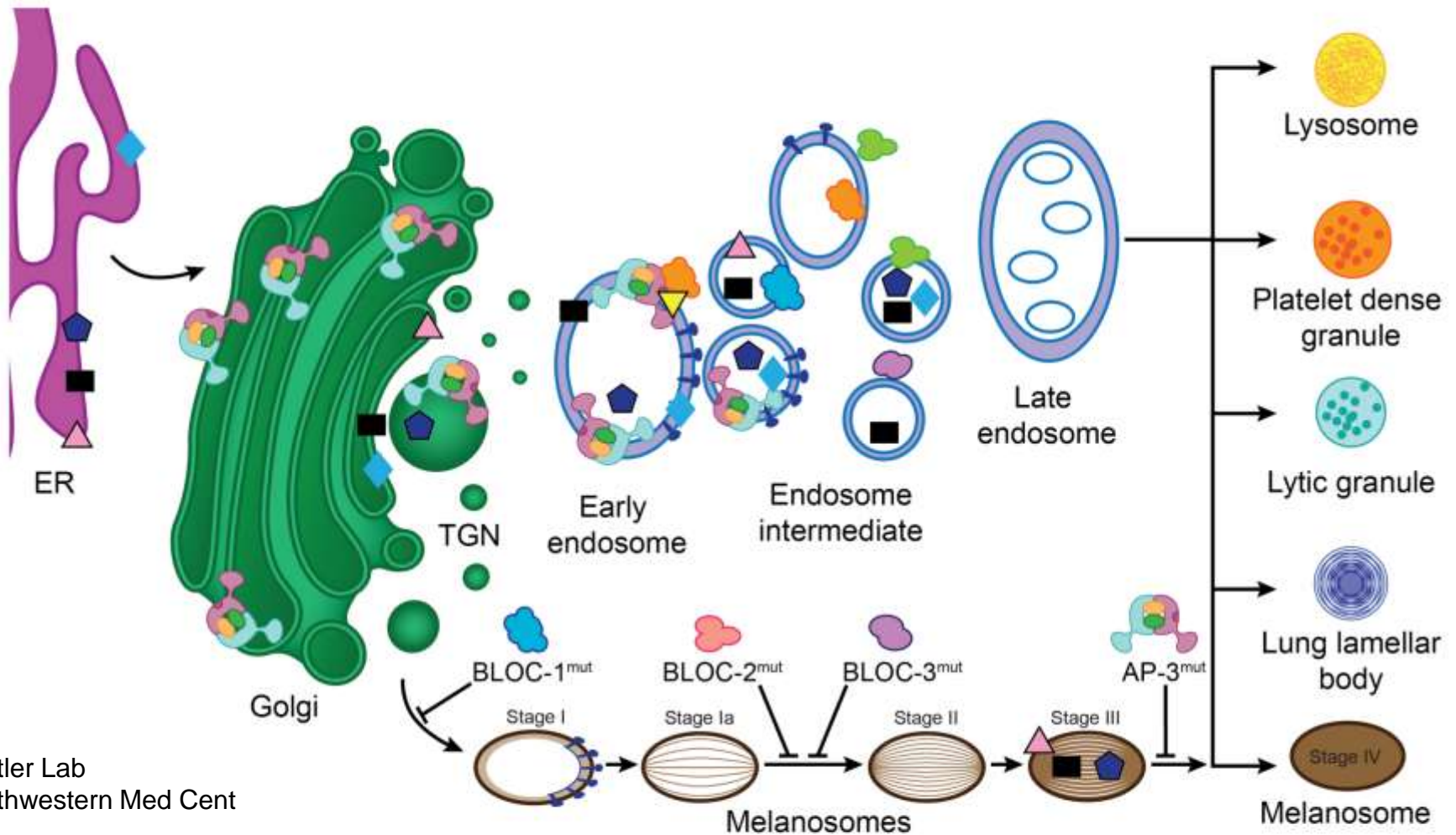
Melanogenesis

18 genes associated to albinism

Mouse	Human	Albinism	Mutations (HGMD)
<i>Tyr</i>	<i>TYR</i>	OCA1	303
<i>Oca2</i>	<i>OCA2</i>	OCA2	154
<i>Tyrp1</i>	<i>TYRP1</i>	OCA3	16
<i>Slc45a2</i>	<i>SLC45A2</i>	OCA4	78
??	<i>4q24</i>	OCA5	1
<i>slc24A5</i>	<i>SLC24A5</i>	OCA6	2
<i>c10orf11</i>	<i>C10orf11</i>	OCA7	6
<i>Gpr143</i>	<i>GPR143</i>	OA1	114
<i>Lyst</i>	<i>LYST</i>	CHS1	53
<i>Hps1</i>	<i>HPS1</i>	HPS1	31
<i>Ap3b1</i>	<i>AP3B1</i>	HPS2	20
<i>Hps3</i>	<i>HPS3</i>	HPS3	7
<i>Hps4</i>	<i>HPS4</i>	HPS4	13
<i>Hps5</i>	<i>HPS5</i>	HPS5	11
<i>Hps6</i>	<i>HPS6</i>	HPS6	9
<i>Dtnbp1</i>	<i>DTNBP1</i>	HPS7	2
<i>Bloc1s3</i>	<i>BLOC1S3</i>	HPS8	2
<i>Bloc1s6</i>	<i>BLOC1S6</i>	HPS9	2

Melanosomes / lysosomes

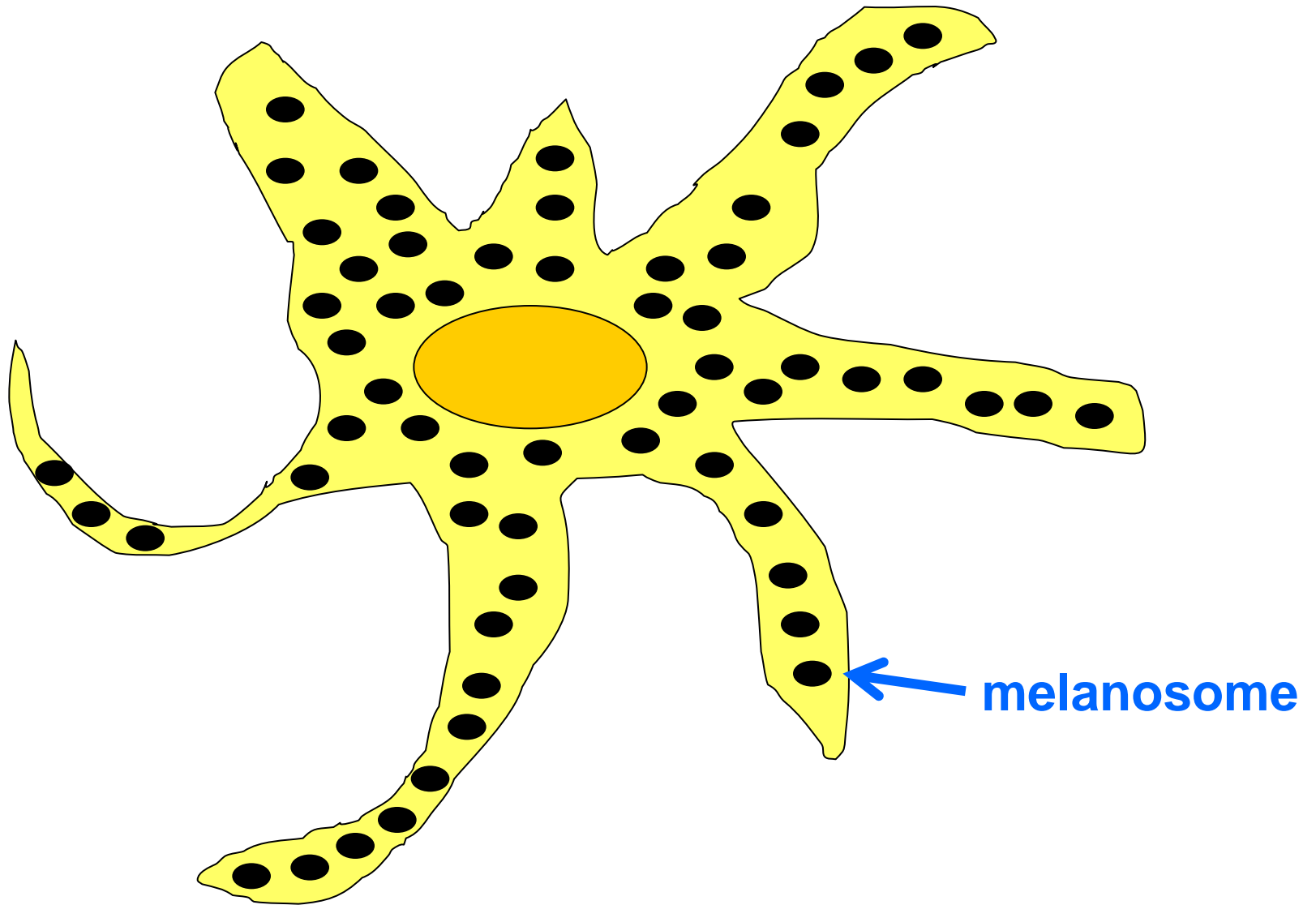
HPS/CHS proteins: mediators in the formation of lysosomal-related organelles (as the melanosomes)



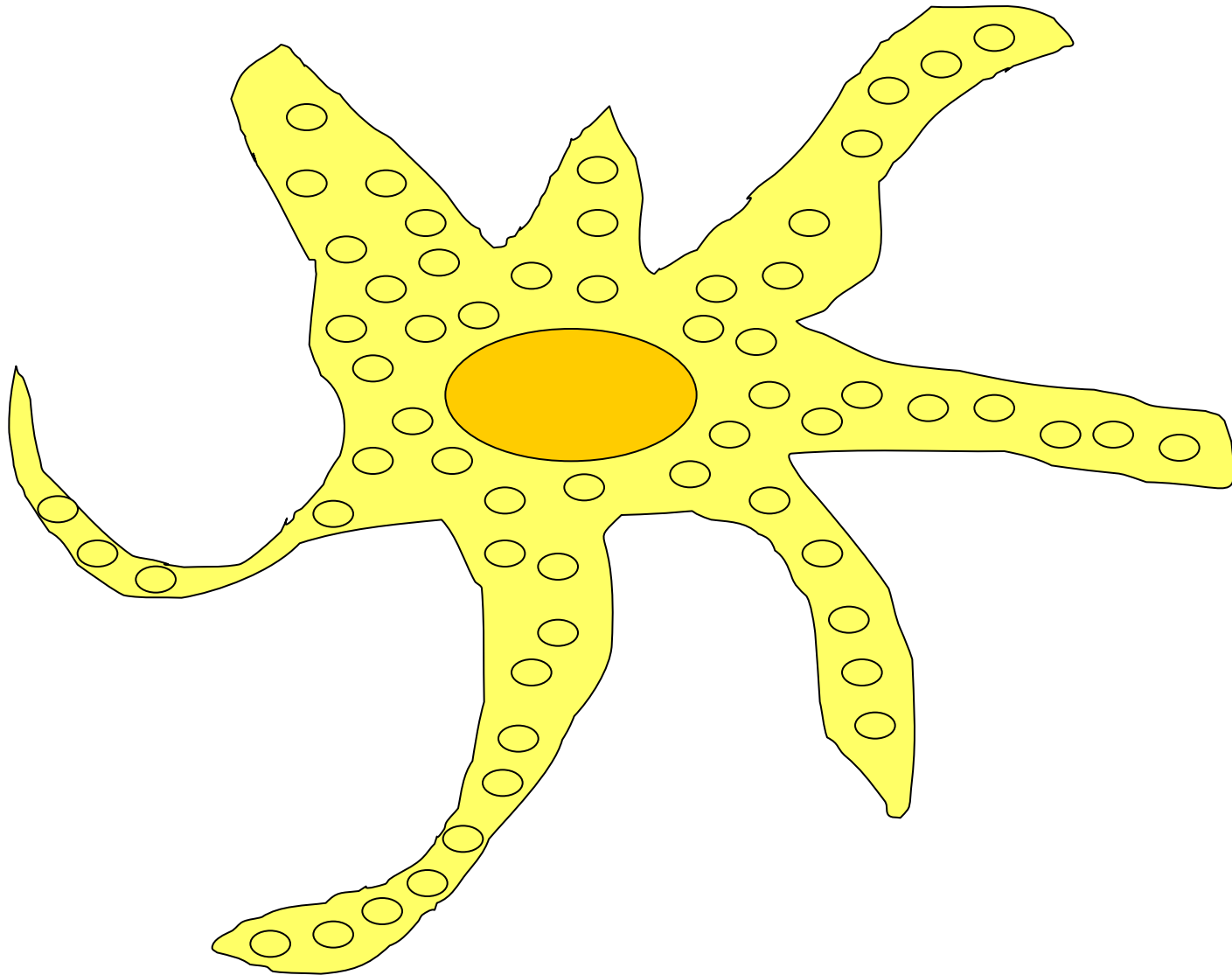
Beutler Lab
Southwestern Med Cent



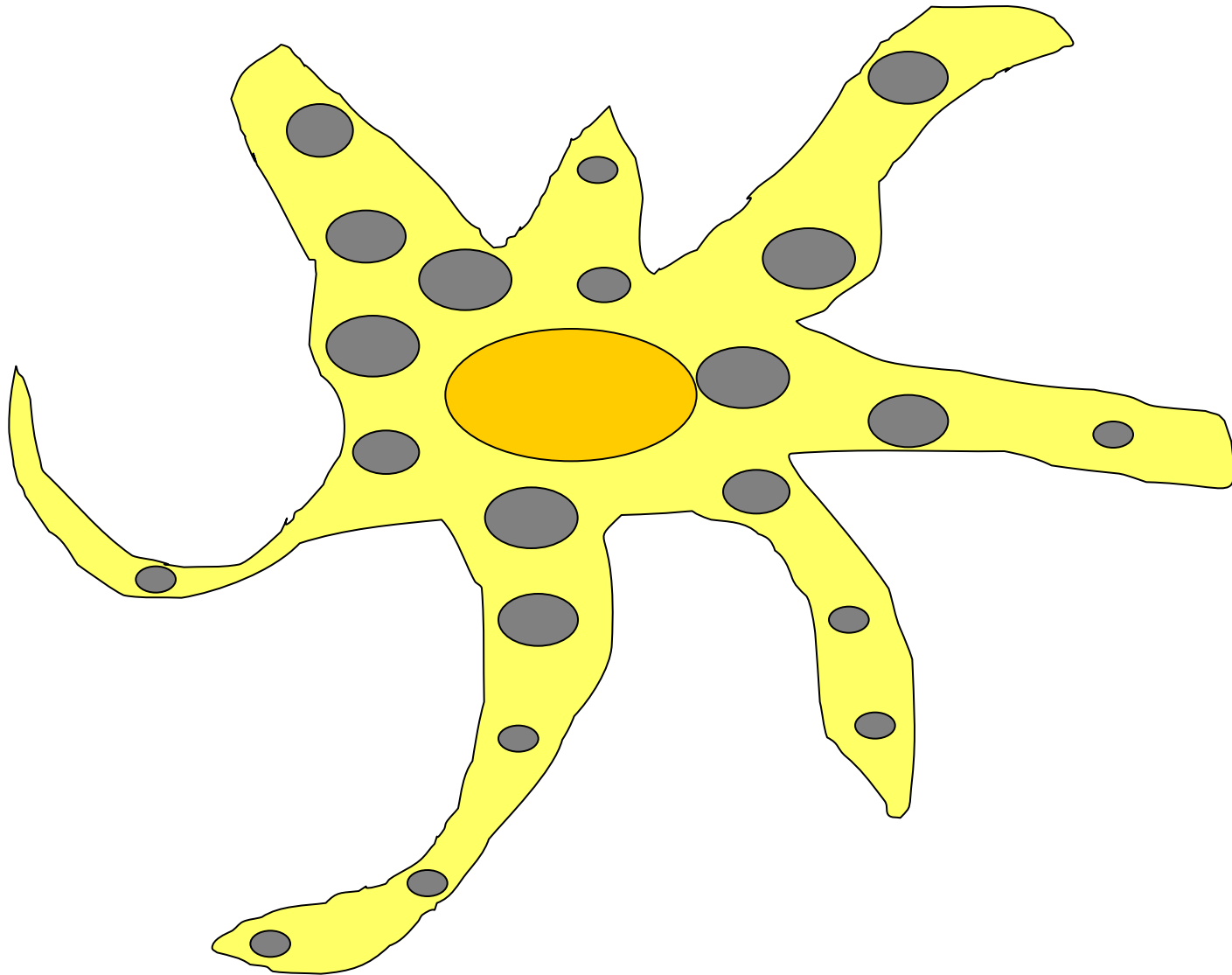
A pigmented melanocyte



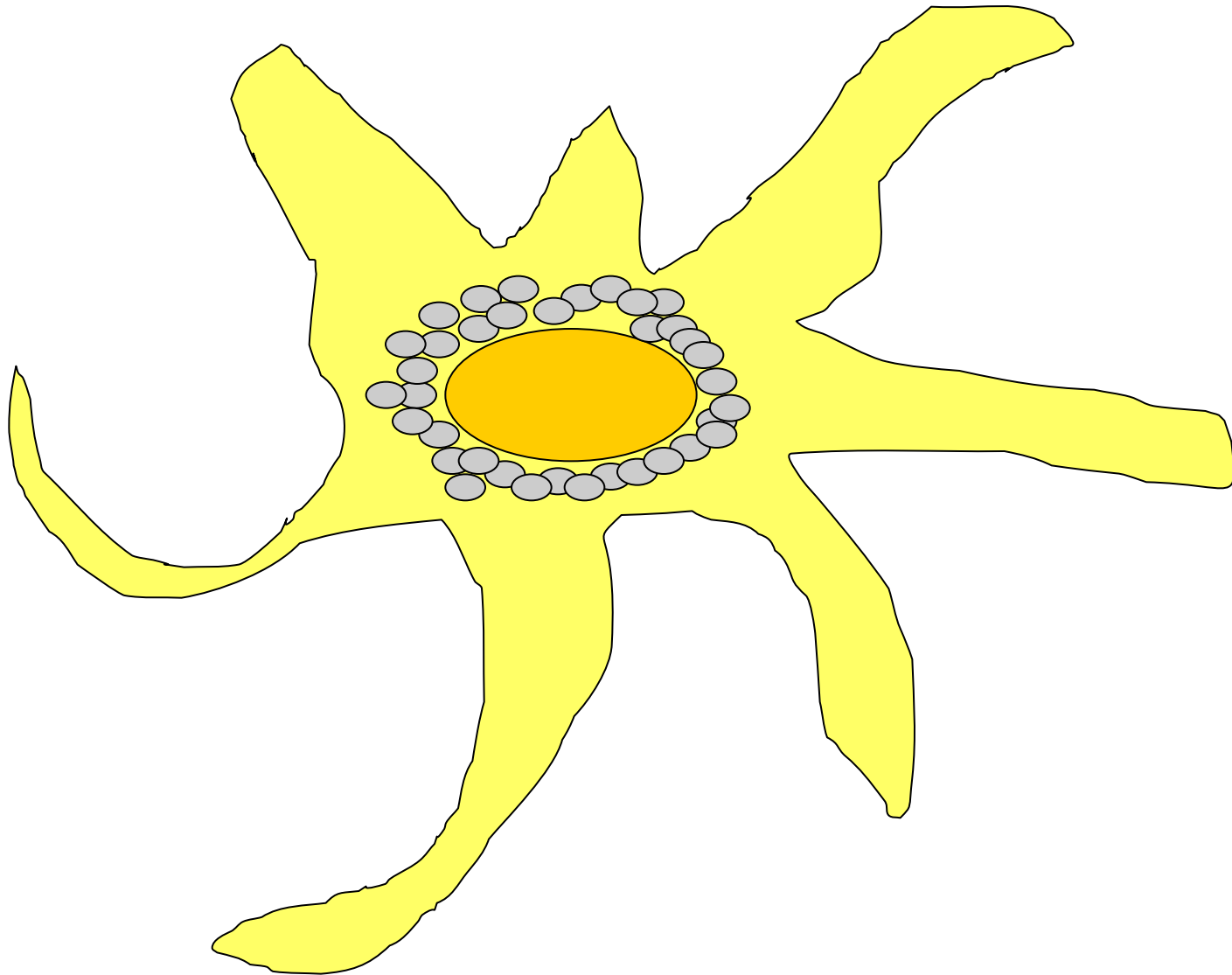
A melanocyte from OCA1



An OA1 melanocyte



HPS/CHS melanocytes



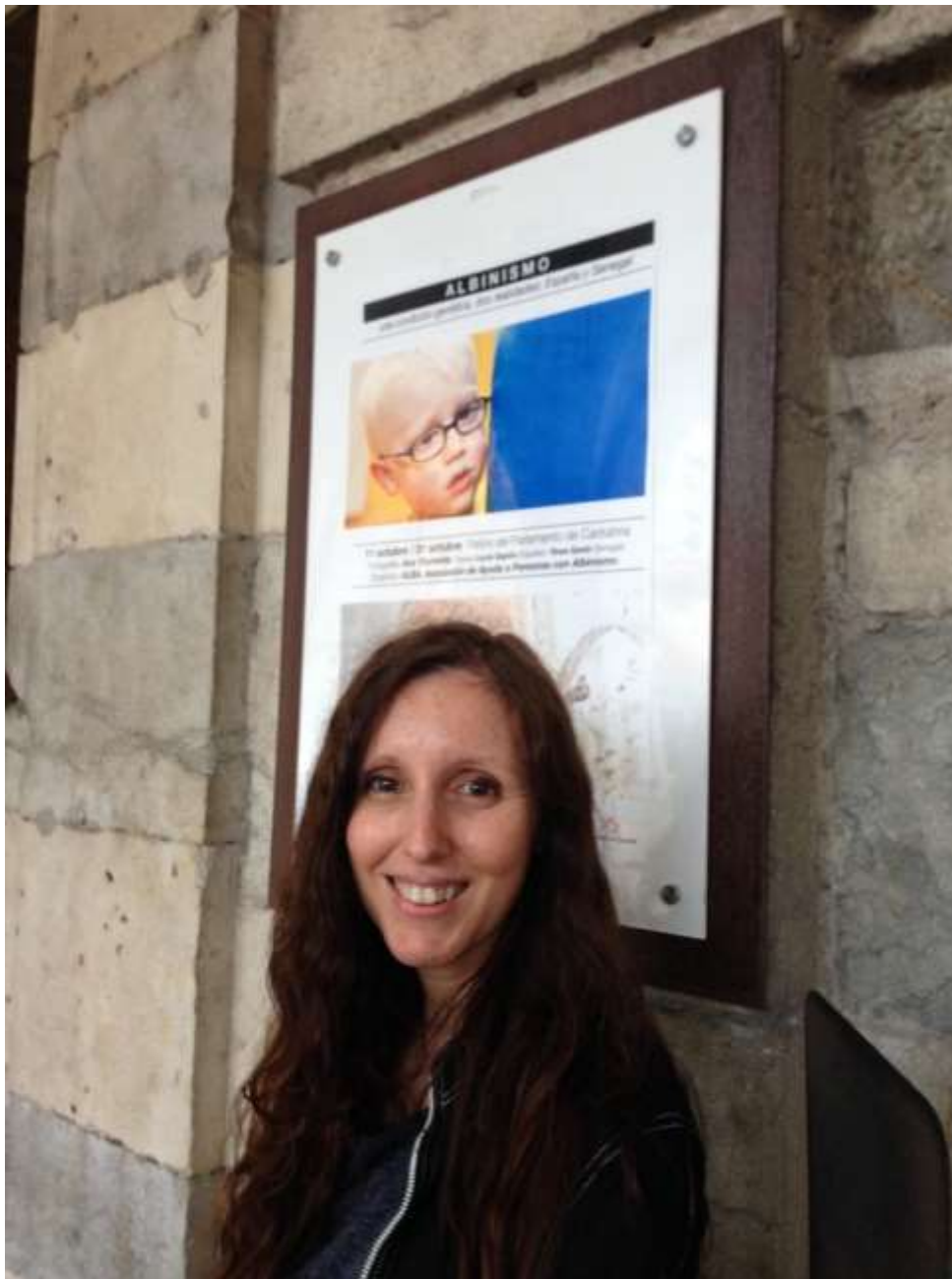
Summary

- **Melanin's** most important function is to **protect skin cells from UV radiation**
- **Melanin is made inside pigment cells** (melanocytes and retinal pigment epithelium cells)
- Melanin is produced in the **melanosomes**
- There are **two types of melanin** (eumelanin, pheomelanin)
- **400 genes** are required to produce **melanin**
- **Only 18 genes**, to date, are associated to **albinism**

Albinism

- Albinism is not a disease but a **genetic condition**
- Lack or reduced amount of pigment is a **consequence** rather than the cause of albinism
- Not all types of albinism are associated with **hypopigmentation** features
- All types of albinism are associated with **visual deficits**, this is the common feature





Ana Yturralde
Freelance photographer



www.albinismo.es