Animals Changing Color

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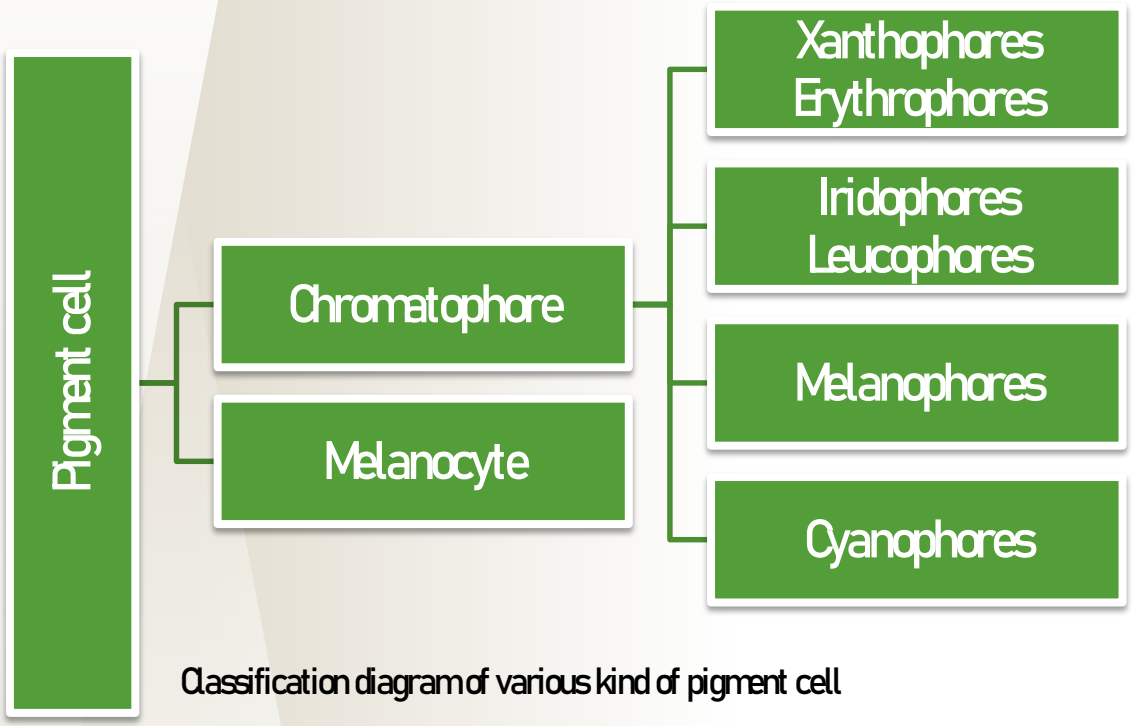
Many Animals Change Their Color

Classification of Pigment Cell

- Chromatophore is for amphibians, fish, reptiles, crustaceans and cephalopods.
- Melanocyte is for mammals and birds.

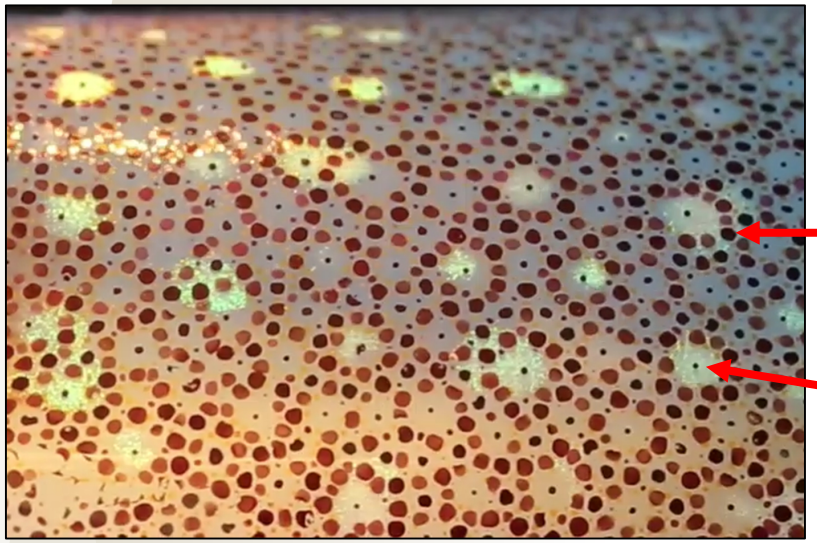
- Xanthophores and erythrophores has yellow and red pigment inside.
- Iridophores and leucophores make colors by reflecting light.
- Melanophores absorbs light.
- Cyanophores makes blue color by similar mechanism with iridophores.



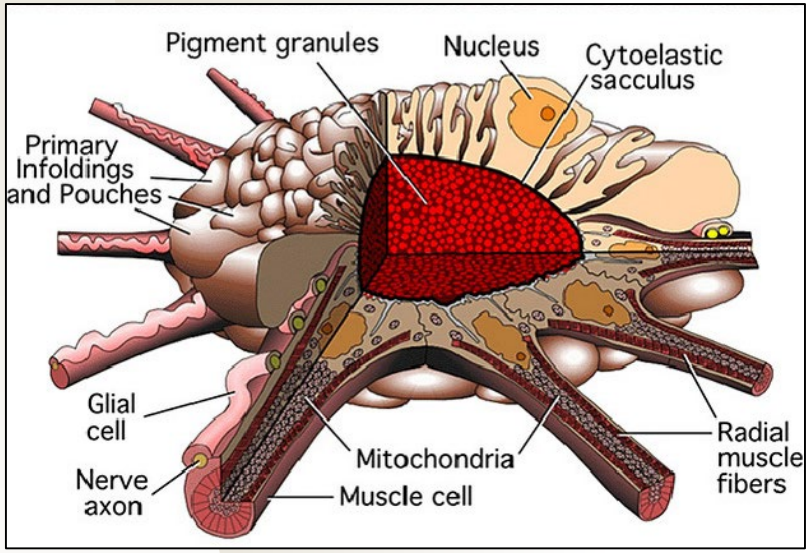
Classification diagram of various kind of pigment cell

Case of Animals: Squid

- Squid has chromatophore on their skin.
- By contracting muscles, squid can expand or shrink the size of chromatophore.
- It is practically gradient between two colors.



Skin of squid with many chromatophore



Squid can change the size of chromatophore

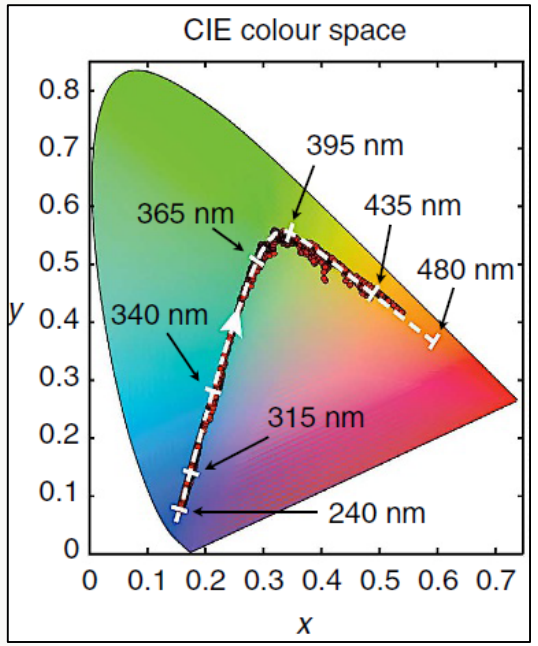
Case of Animals: Panther Chameleon

Furcifer Pardalis

- Have green stripe and blue line on center.
- They change their color by temperature or mood

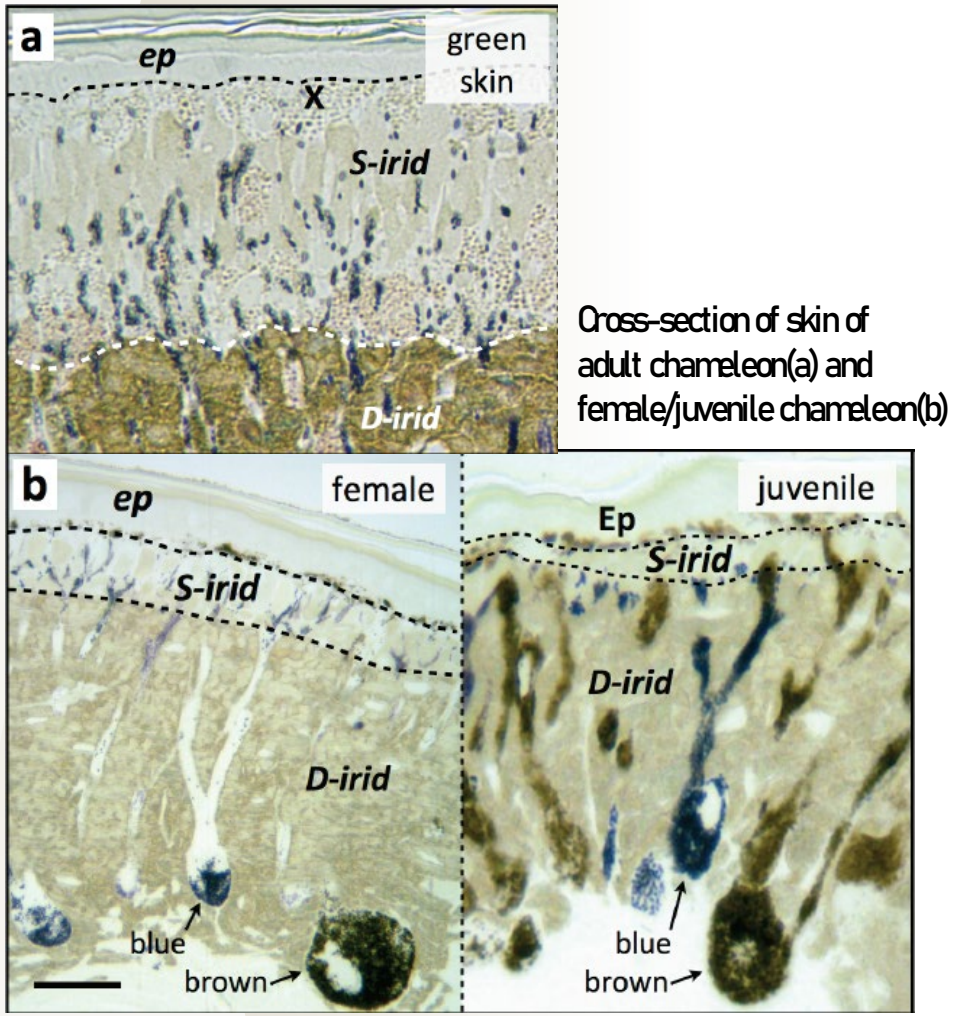
  → Color spectrum is limited.
- Color change is significant in adult male

Color change in chameleon skin



Case of Animals: Panther Chameleon

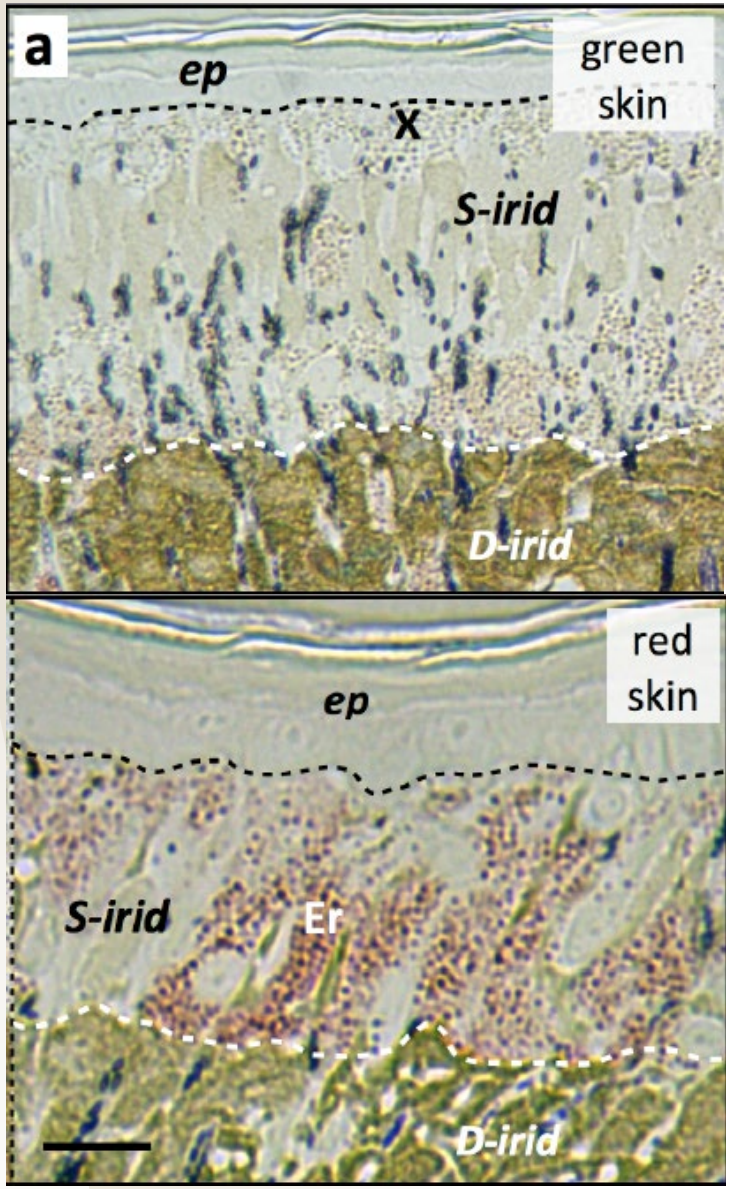
- Skin is consisted of epidermis(ep), superficial-iridophore (s-irid), deep-iridophore(d-irid)
- Color change occurs in s-irid and d-irid protects chameleon from sunlight.
- S-irid is highly developed in adult male.
- Both iridophore has nanocrystals made of guanine.



Cross-section of skin of adult chameleon(a) and female/juvenile chameleon(b)

Case of Animals: Panther Chameleon

- Also chameleon has pigment cell such as xanthophores and erythrophores
- Pigments decide original skin color of chameleon.



Cross-section of chameleon's skin by its original colors

Case of Animals: Panther Chameleon

Structure of S-Iridophore

- Iridophore is consisted of well-shaped guanine crystal.
- It has face centered cubic(FCC) structure.
- Distance between crystal makes frequency of reflecting light to change.
- Chameleon can control this distance by their mood.

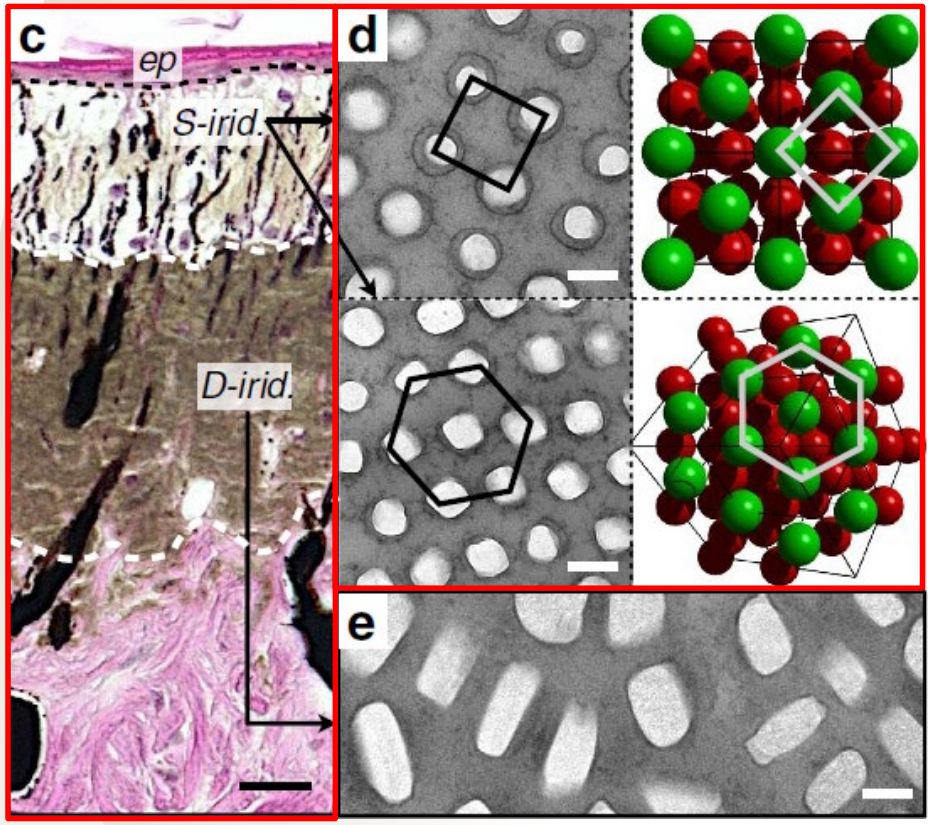


Figure (c) and (d) shows the structure of s-iridophore

Case of Animals: Panther Chameleon

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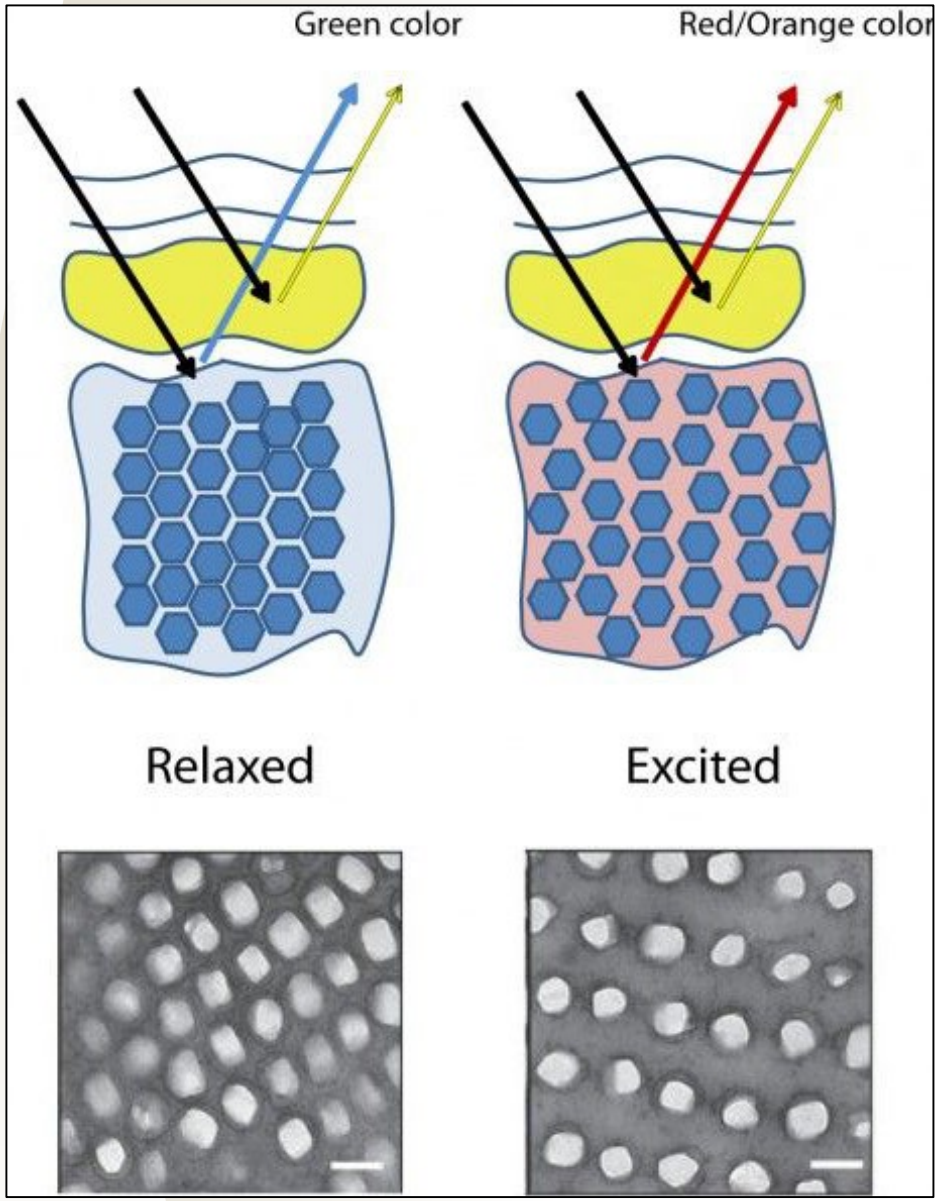


Mechanism of s-iridophore reflecting different color

Case of Animals: Panther Chameleon

Structure of D-Iridophore

- Iridophore is consisted of disorganized guanine crystal.
- D-iridophore does not affect color change.
- Crystal in this area reflects light in near-infrared region, reflects about 45% of sunlight.

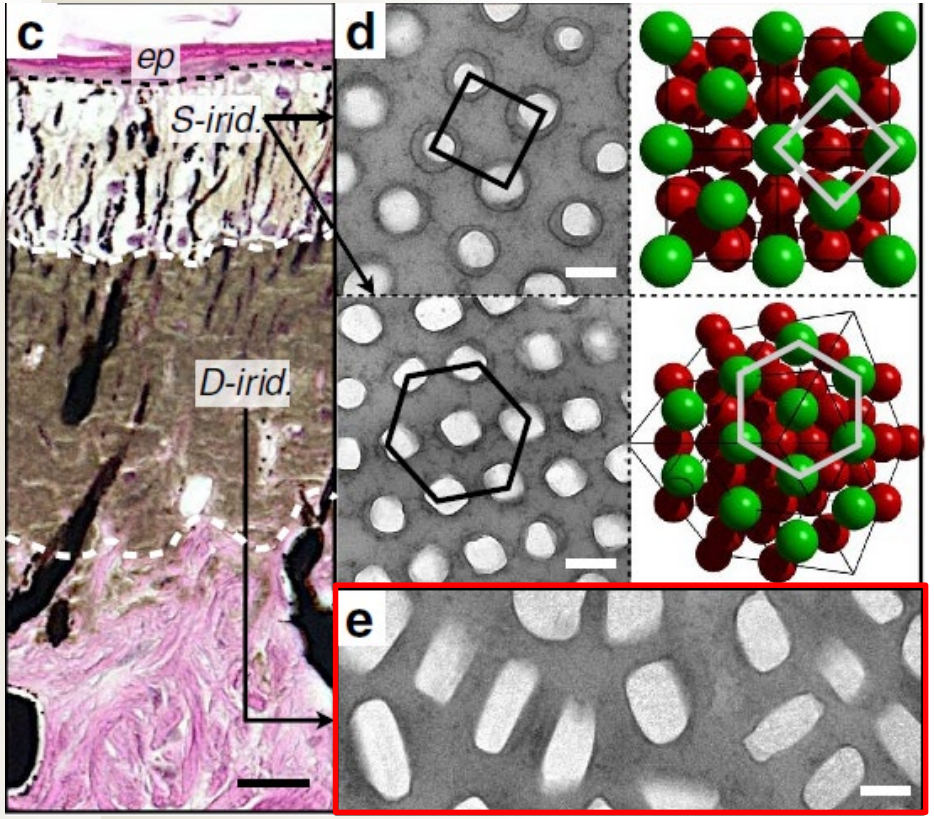
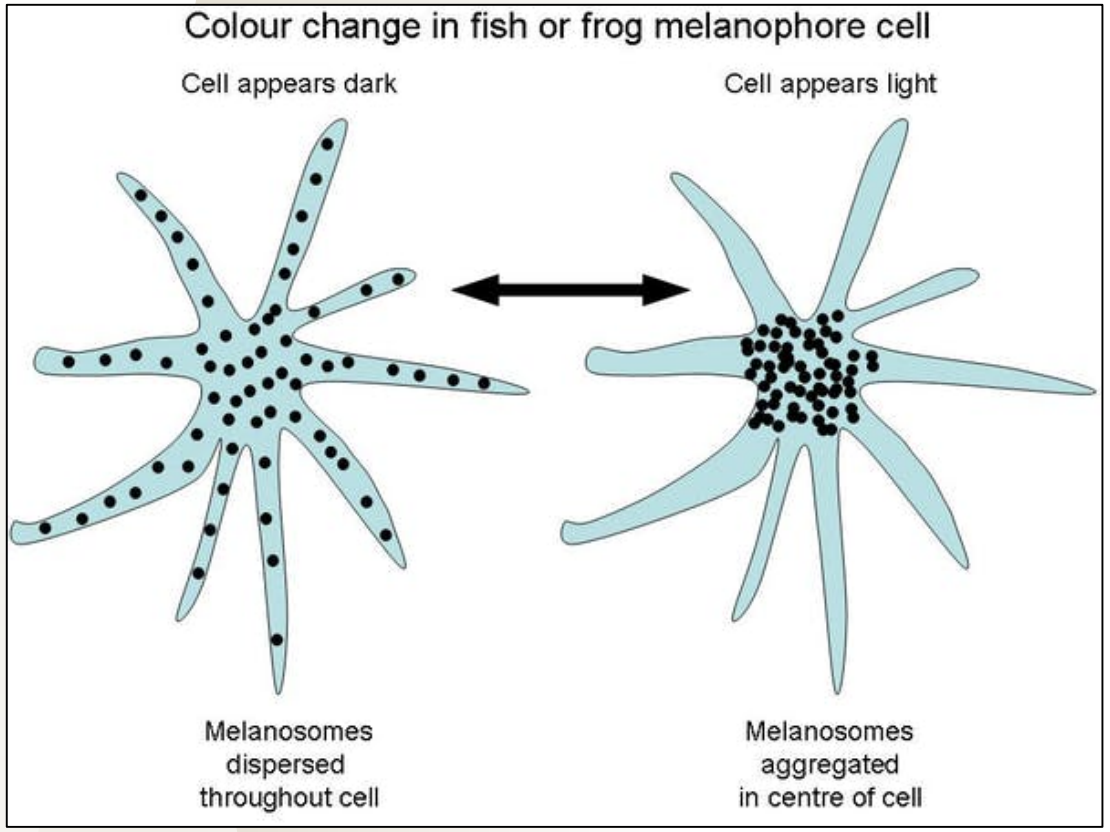


Figure (e) shows the structure of d-iridophore

Case of Animals: Fish, Frog, Reptiles

- Color change is controlled by MELANOPHORES
- Melanophores = star-like cells with long dendrites.
- Melanophores are located in the deeper layer of the skin, however the dendrites extend toward the upper layer of the skin.
- Packets of melanin pigment (called melanosomes) can move.
- The transportation of melanosomes in the cell are coordinated by microtubules and actin filaments, which are organelles responsible for intracellular transport



- Normally the melanin pigment is gathered within the center of the cell.
- Certain stimuli makes the pigment scattered throughout the dendrites.

Case of Animals: Green Anole

Anolis carolinensis

- The outer layer of the skin contains xantophores (yellow pigment)
- The middle layer contains reflective iridophores.
- The bottom layer contains melanophores (black pigment)

Case of Animals: Pacific Tree Frog

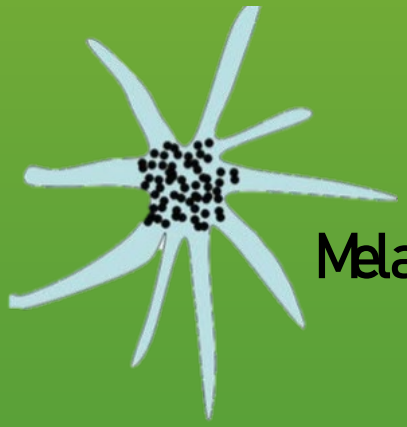
Pseudacris regilla

- Changes color from bright green to dark brown to match their environment's brightness and hide from predators
- Bright at high temperatures and dark at low temperatures.

Color Changing Mechanism Under the Skin

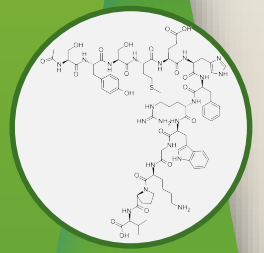
Xantophores

Iridophores



Melanophores

When melanin pigment is concentrated in one location in melanophores, the animal look green.



Melanocyte Stimulating Hormone

+

Norepinephrine

Xantophores

Iridophores

*The dendrites extend toward the upper layer (above the xantophores)

Melanophores

When the pituitary gland releases melanocyte-stimulating hormone, dispersal of melanin in the cells is triggered, making the skin turn brown.

Case of Animals: Golden Tortoise Beetle

- There are pockets of fluid in the layer of its exoskeleton
- The fluid makes a smooth surface in the exoskeleton that reflect light perfectly -> metallic gold appearance
- Subjected to external stresses (touched by a human, disturbed by a predator)
  -> the beetle dries up the fluid
  When the fluid is dried up, light cannot reflect evenly on the exoskeleton and it becomes transparent
  -> exposes red pigment underneath
- Changes color in just under two minutes
- Dark red makes the beetle look poisonous to predators

Looks gold when undisturbed; There is fluid in its exoskeleton

Looks dark red after the fluid has dried up

Case of Animals: Goldenrod Crab Spider

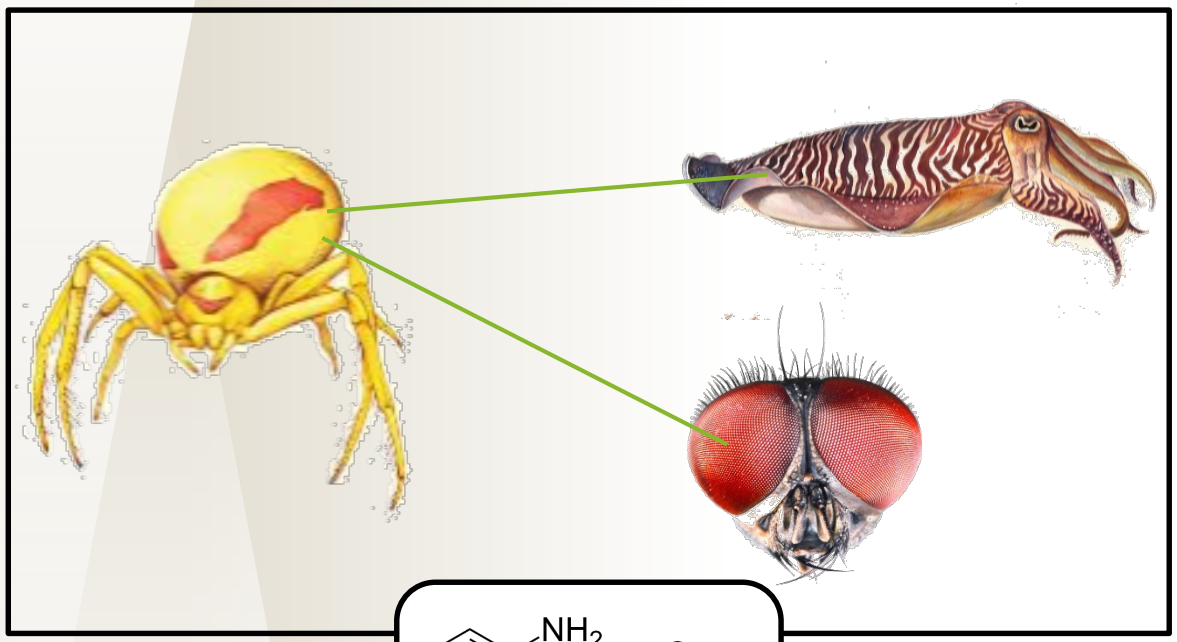
Misumena vatia

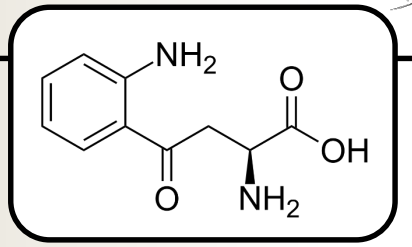
- Female of the species can change color between yellow and white when it hangs around a yellow flower or a white flower

Case of Animals: Goldenrod Crab Spider

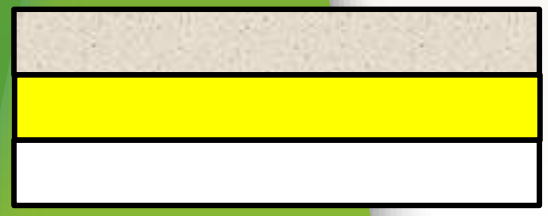
- Hangs around a yellow flower
- Secretes a liquid yellow pigment into the hypodermis to change color to yellow.
- It takes 10-25 days to change its color from white to yellow because the spider has to produce yellow pigment

Female crab spider with yellow coloring





Kynurenine, an ommochrome (visual pigment) found in cephalopods and insects



Cuticle

Hypodermis

Guanine layer

Case of Animals: Goldenrod Crab Spider

- Hangs around a white flower
- In order to change back to white, yellow pigment in the hypodermis is transported back to lower layers so the layer below the hypodermis which contains massive amounts of white guanine become visible.
- The spider becomes white in color
- This takes around 6 days
- Scientist believe that color changing help the crab spider to hide from predators and stalk their prey easier

Female crab spider with white coloring

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Thank You For Listening!