

Synapsida



**Mammalia
(Synapsids)**

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typically called mammals



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only animals that have returned to every environment on the planet
arctic, marine, tropic, freshwater, etc



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insect were unable to do this - they are restricted to freshwater and terrestrial environments

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Reptiles – Therapsids

- Warm-blooded
- Noturnal
- Glandular skin
- Specialized teeth and chewed their food

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ancestor of the group is a set of dinosaurs - therapsids

had a number a characteristics that gave them an advantage during their time

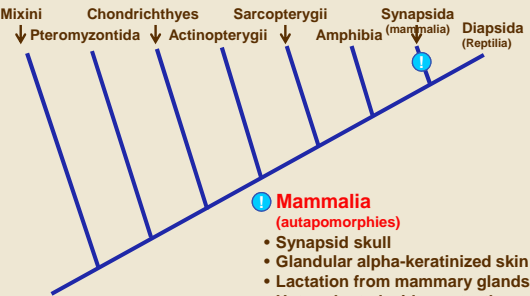
tend to be smaller (selection for warm blooded vs cold blooded animals) - mostly nocturnal to avoid reptiles, lives in burrows

-therapsids were homeoothermic -generate heat by metabolism and had hair that covered the body as insulation

-chemically communicated by smells and use hair for communication (whiskers)

-forces skin to have glands that would protect the hair

Vertebrate phylogeny



Mixini
↓ Pteromyzontida

Chondrichthyes
↓ Actinopterygii

Sarcopterygii
↓ Amphibia

Synapsida (mammalia)
↓ Mammalia

Diapsida (Reptilia)

Mammalia (autapomorphies)

- Synapsid skull
- Glandular alpha-keratinized skin
- Lactation from mammary glands
- Heterodont, deciduous teeth
- Alveolate lungs
- Nephric loop-of-Henle

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synapsid skull - only one opening to the skull

alpha-keratinized skin

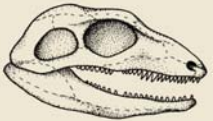


skin is glandular - associated with the hair follicle

some gland become concentrated to secrete nutrients to feed the young

get alveolate lung

adaptation to the kidney attached to water conservation in terrestrial environment- loop of henle

Reptile like synapsids

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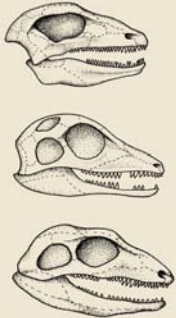
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Temporal fenestra

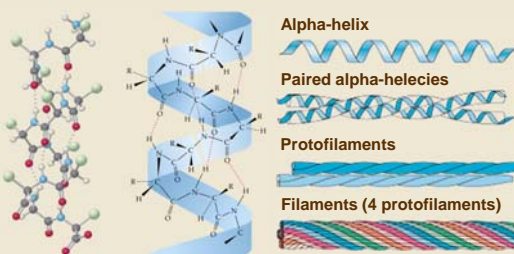
- ~~Anapsids~~
- **Diapsids (Anapsids)**
 - Dinosaurs, pterosaurs, birds, snakes and lizards
 - Turtles
- **Synapsids**
 - Modern mammals



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Keratinized skin



Alpha-helix

Paired alpha-helices

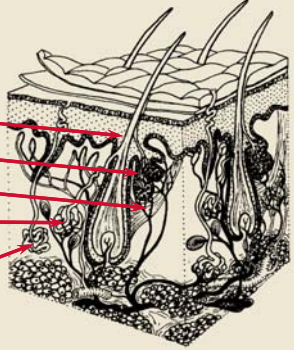
Protofilaments

Filaments (4 protofilaments)

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Integument



Hair follicle

Sebaceous gland

Arrector pili

Apocrine sweat gland

Eccrine sweat gland

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unique to the group is the glandular skin

-hair is produced by the skin (dermis) - have in-pocket of the dermis where keratin production occurs - gets molded into a hair

grows in similar way but flat for scales and circle of feathers

hair can become brittle and wont be able to carry out its function

contain heat

defensive posture - make the hair stand up for defense

-arrector pillai = pull on the hair from the base to make it look bigger

with the hair follicle:

the sebaceous gland that produces sebum -fatty oily substance that wicks the surface of the hair so that it doesn't get split/break

apocrine sweat gland that produce water/pheromones/scent - main function to wick substance up the hair to the outside

-mating and territorial by leaving its scent

there is an eccrine sweat gland that open to the surface (not from the hair follicle)

-primates used them for evaporation

-can also be used for chemical signal and communication within other groups

--mammary gland : secretions from the apocrine mixed with the sebaceous- make nourishing fluid for young to feed on

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Types of hair

- **Vibrissae**
- **Quills**
- **Underfur**
- **Guard hairs**

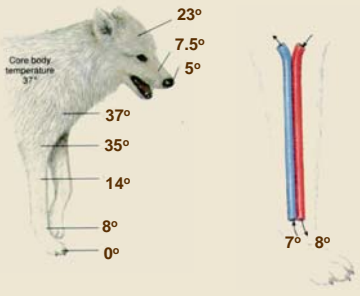




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vibrissae- whiskers
 quills hairs used for defense in porcupine
 rhino horn - compacted hair
 underfur for insulation
 guard hairs - thicker hair to protect the underfur

Countercurrent heat exchange




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counter current heat exchange in animal in cold terrestrial environments
 as blood moves out to the distance part of the limb it warm the blood that goes back into the body -
 mostly tendon at the feet - prevents thermal shock to the core of the body

Mammalian dentition

- **Deciduous and diphodont**
- **Types of teeth**
 - Incisors
 - Canines
 - Premolars
 - Molars




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teeth are unique
 first group that have different types of teeth in different parts of the jaw
 incisors for cutting
 canines for piercing
 molars for grinding
 make food small enough by grinding before being swallowed for digestion
 called heterodont because there are different types of teeth
 -the jaw continues to grow from the back meaning that there is more space for the teeth- shed there
 teeth - grow second set of teeth (baby to adult teeth)
 -another set of molars in adult

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Shrews

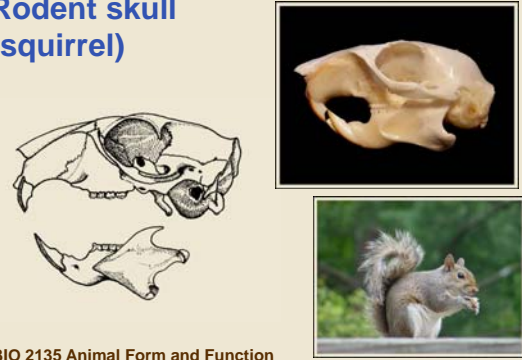


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teeth are mostly identical in shrews

Rodent skull (squirrel)



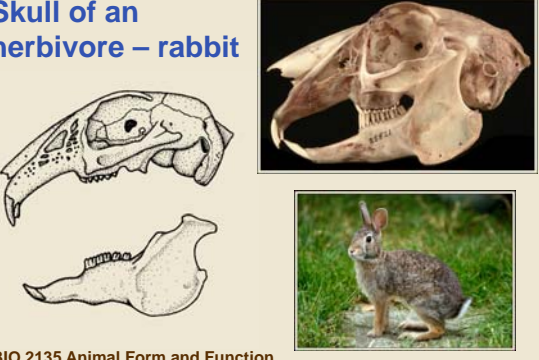
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rodents and squirrels specialize at chomping on nuts

have incisors that chip away at nuts - constantly grow and have holes on the side for pieces to fall out and don't go into the mouth

Skull of an herbivore – rabbit



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have herbivores that use incisors to eat plant material


need to break the cellulose wall to get to the food
cellulose has no nutritional value

have internal bacteria to work on the cellulose

rabbits eat the first round of poop to fully process their food
deer will regurgitate their food and chew it again

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Skull of an herbivore – deer

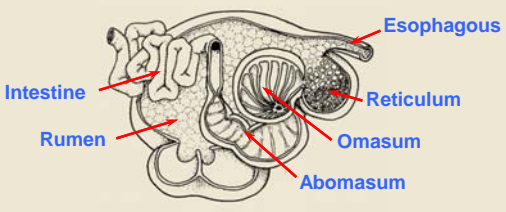


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have big grinding jaw

Ruminant stomach

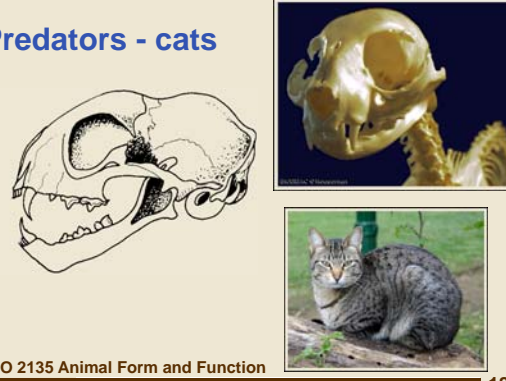


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have ruminant stomach that has four chambers
two are associated with the rumen and reticulum - mixes the food with the bacteria
liquid material will move out and undissolved material goes back up and chewed and goes back down
liquid moves to other compartments to absorb the water
last compartment acts as a normal stomach with acid digestion

Predators - cats



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canines-break a major blood vessel - puncture a lung to prevent prey from escaping

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**Omnivores –
Raccoon**



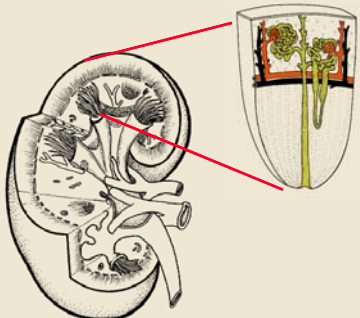
The image shows a raccoon skull from two perspectives: a lateral view on the left and a photograph of the skull on the right. The lateral view highlights the presence of both incisors and molars, characteristic of omnivores. The photograph shows the skull in a natural setting.

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omnivores

Kidney

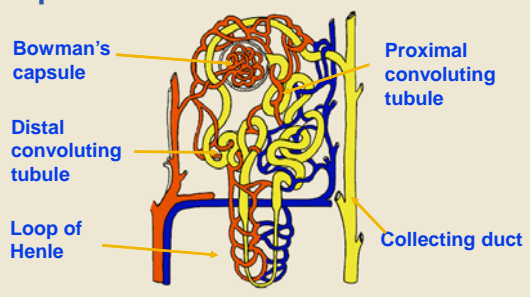


The diagram illustrates the internal structure of a kidney, including the renal cortex, medulla, and renal pelvis. A smaller inset diagram shows the kidney's position within the abdominal cavity, connected to the renal pelvis and ureter.

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Nephron

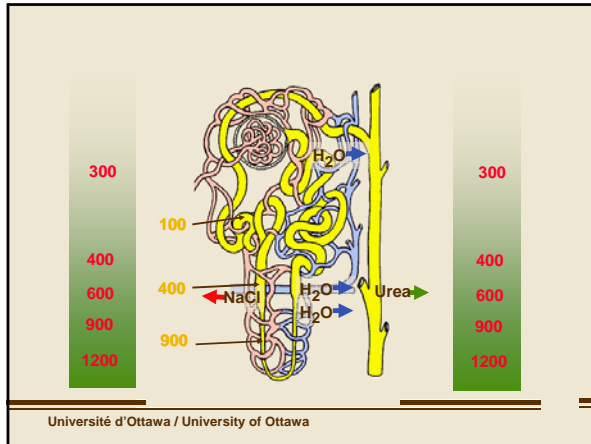


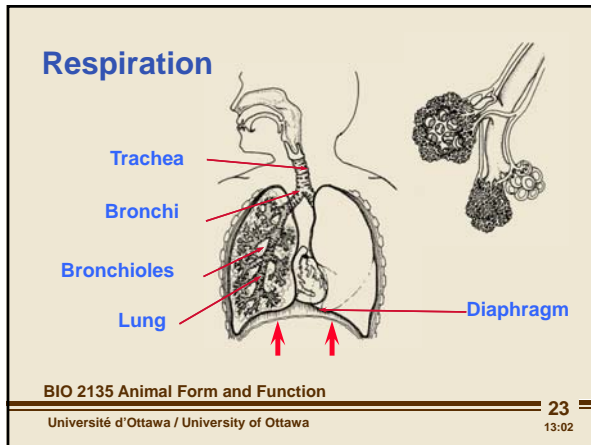
The diagram shows a nephron with the following labeled parts: Bowman's capsule, Distal convoluted tubule, Loop of Henle, Proximal convoluted tubule, and Collecting duct.

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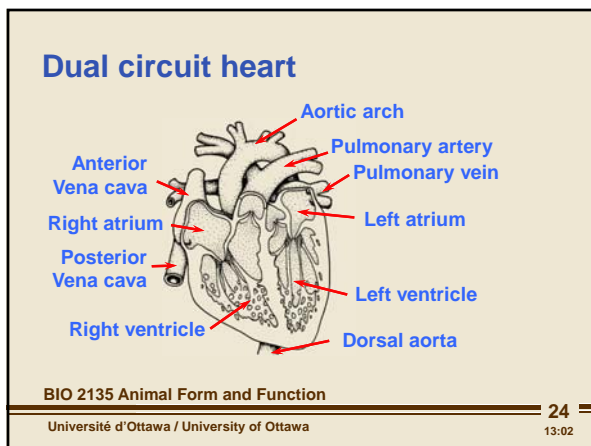
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have diaphragm that goes up and down



combined with a four chambered heart that pumps the blood out to a more efficient system with a left aortic arch instead of a right one

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Circulatory system

1. Carotids
2. Innominate
3. Pulmonary artery
4. Lung
5. Pulmonary vein
6. Systemic arch
Dorsal aorta

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Arterial circulation

Systemic
4. Innominate
6. Carotid
Subclavian
Pulmonary
Anterior mesenteric
Dorsal aorta
Posterior mesenteric
Renal
Gonadal
Iliac
Caudal

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Venous circulation

Subclavian
External jugular
Internal jugular
Anterior vena cava
Azygous
Hepatic
Posterior vena cava
Hepatic portal
Renal
Gonadal
Iliolumbar
Iliac
Caudal

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everything goes back to the sinus venosus to be pumped back through the body once again

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Reproduction

- **Oviparous**
 - Monotremes
- **Viviparous**
 - Marsupial
 - Placental Mammals

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have egg producing forms - known as the monotremes



Monotremes (Prototheria)

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platypus mom takes her babies and puts them on the chest where nutrients can be take out from the glands that are made from where the hairs are located

Marsupials (Metatheria)



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marsupials - the young is born and fertilized inside - viviparous

embryo quickly leaves the uterus and goes into the pouch to continue nourishment via the mammary gland to be nourished inside

embryo is seen as a foreign body by the mom's body so it can only survive internally for a short period of time

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Placental mammals (Eutheria)



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solution comes with placental mammals - placenta gets a barrier between the mom and the developing embryo so that it is not seen as a foreign body

- young can develop internal for longer periods of time

have unique reproductive system and end up getting rid of the shell
