Lab manual website : biolab1.uottawa.ca
Science building third floor
Get a combination lock
No need for goggles
These species are newly discovered
Tapanuli
- Lives in small territory
- Threatening environment

Snailfish
- Lives deep in the ocean
- Considered top predator in his habitat

Flower
- No green- it doesn't do photosynthesis
- Feeds on organic material - feeds on fungus

Shrimp

BIO 1130
INTRODUCTION TO THE BIOLOGY OF ORGANISMS
Prof. François Chapleau

- Lab of BIO1130
- Coordinator : Dr. Fabien Avaron

Science and skepticism

http://blogs.discovermagazine.com/crux/2019/08/06/meet-homo-naledi-the-mysterious-human-cousin/#.XVrcy-NKiUk

Homo naledi discovered in 2013 (study published in 2015): Height: 150 cm; weight: 45 kg; cranial volume: 465 cm^3 to 550 cm^3 (one third of *Homo sapiens'* volume)

Fossils: 1680+ bones belonging to 18 individuals.
Found in two caves in South Africa

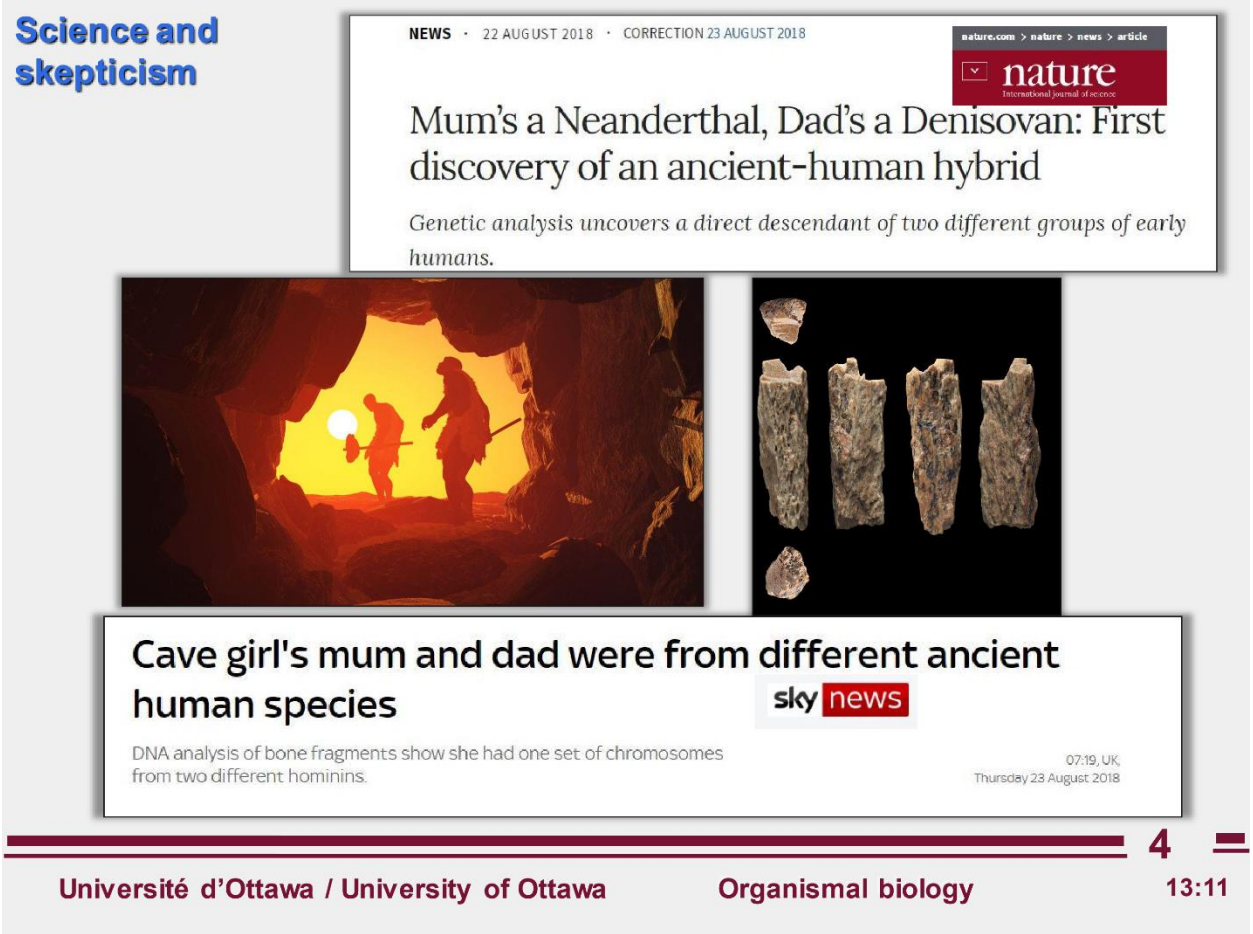
Homo naledi: In 2015, labeled as possible first species of genus *Homo* (nearly up to 2,400,000 years old).
In 2017, viewed as a recent *Homo* species (probably less than 300,000 years).

Uncertainty is associated with science.
Always find new ways to express the answers
There is no truth in science
Open for test and justification
It is seen as a defect. The weak point is science gets close to the truth but never certain
Skepticism is important - why science progresses
2015 - new species of homo - was the oldest of the genes
    For many it was the beginning of the research

Homo naledi
    Issues-
    The caves are difficult to access -
    First human species
    They took care of their dead - all of them found in the same place - funeral rights started 6000 years ago the bones were 2 million years old

Bones were 300 thousand years old not 2 million
Q: Why were the bones there?

Point: Science doesn't stop with a discovery



Last year, discovered female hominin result of crossbreed - male Denisovan - group of Asian specie. They were two different species - found that species crossbreed
Fossil of a girl 90 thousand years old
Instead of a line of evolution it's a tree- large diagram of species
Question - are we dealing with one species or many species of humans?

BIO 1130
INTRODUCTION TO THE BIOLOGY OF ORGANISMS
Prof. François Chapleau

Lectures:

Schedule (in Marion Hall)

BIO1130A Monday 8:30 am to 10:00 am; Thursday 10:00 am to 11:30 am
BIO1130B Wednesday 1:00 pm to 14:30 pm; Friday 11:30 am to 1:00 pm
BIO1130C Monday 5:30 pm to 7:00 pm; Wednesday 5:30 pm to 7:00 pm

Book

Reece et al. (2017). Campbell Biology. (2nd Canadian edition). Pearson. Price: variable.

Web site

Virtual Campus (Brightspace)

textbook

He doesn't use the code but get the book

BIO 1130
INTRODUCTION TO THE BIOLOGY OF ORGANISMS
Prof. François Chapleau

Contact information:

- **Office hours: (Gendron 376):** Monday: 10:00 am - 12 pm
  Wednesday: 10:00 am - 11:15 am

- **Other times of availability:**
  - By email appointment (chapleau@uottawa.ca)
  - Open door : you are always welcome.

- **Questions by email: Usually fast reply + short answer.**
  - Always put BIO1130A, B or C in the title of your email and always put your name and student number as a signature to your question.

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Evaluation

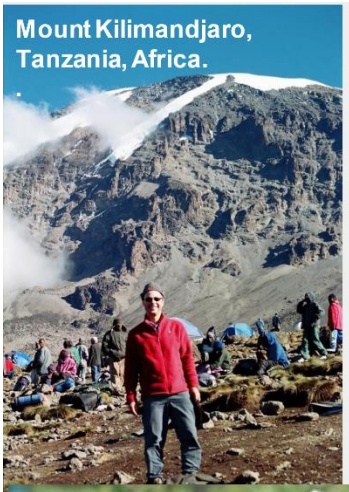
Midterm exam 1: Saturday am, September 28: 15 or 20%*

Midterm exam 2: Saturday am, November 2: 20 or 25%*

Final exam: December 2019 (date to be determined): 40%

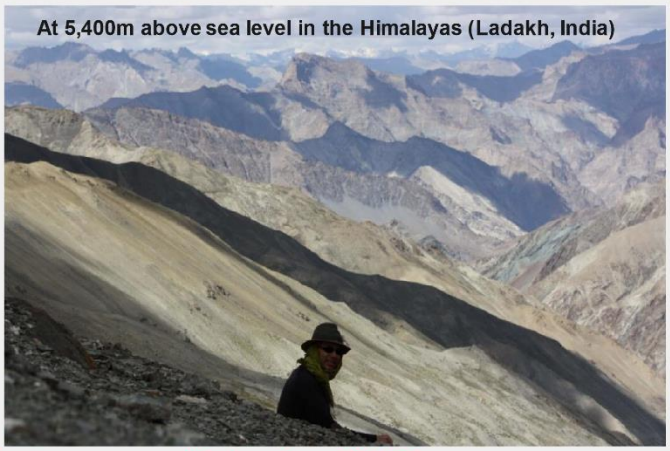
Laboratories : 20%

***The combination of midterms giving the highest score on 40 will be selected.**



Academic profile

- **Specializing** in the evolution and ecology of fish.
  - Phylogeny and taxonomy of flatfish.
  - Ecology of freshwater fish in the Ottawa area (Canada)

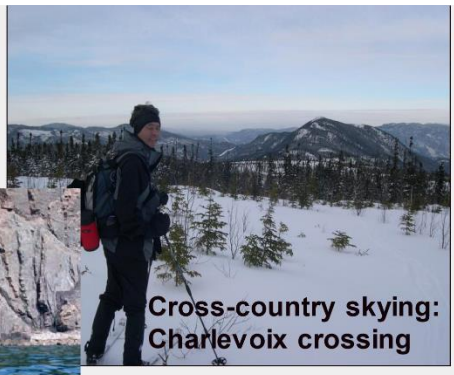


More photos : https://www.instagram.com/frchapleau/?hl=En

My other interests

My first marathon
Montreal 2007

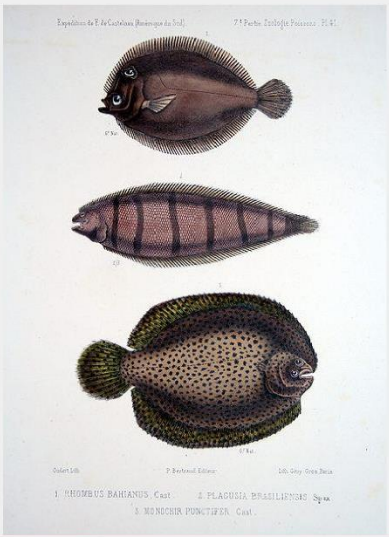
Sea Kayak in
Greenland



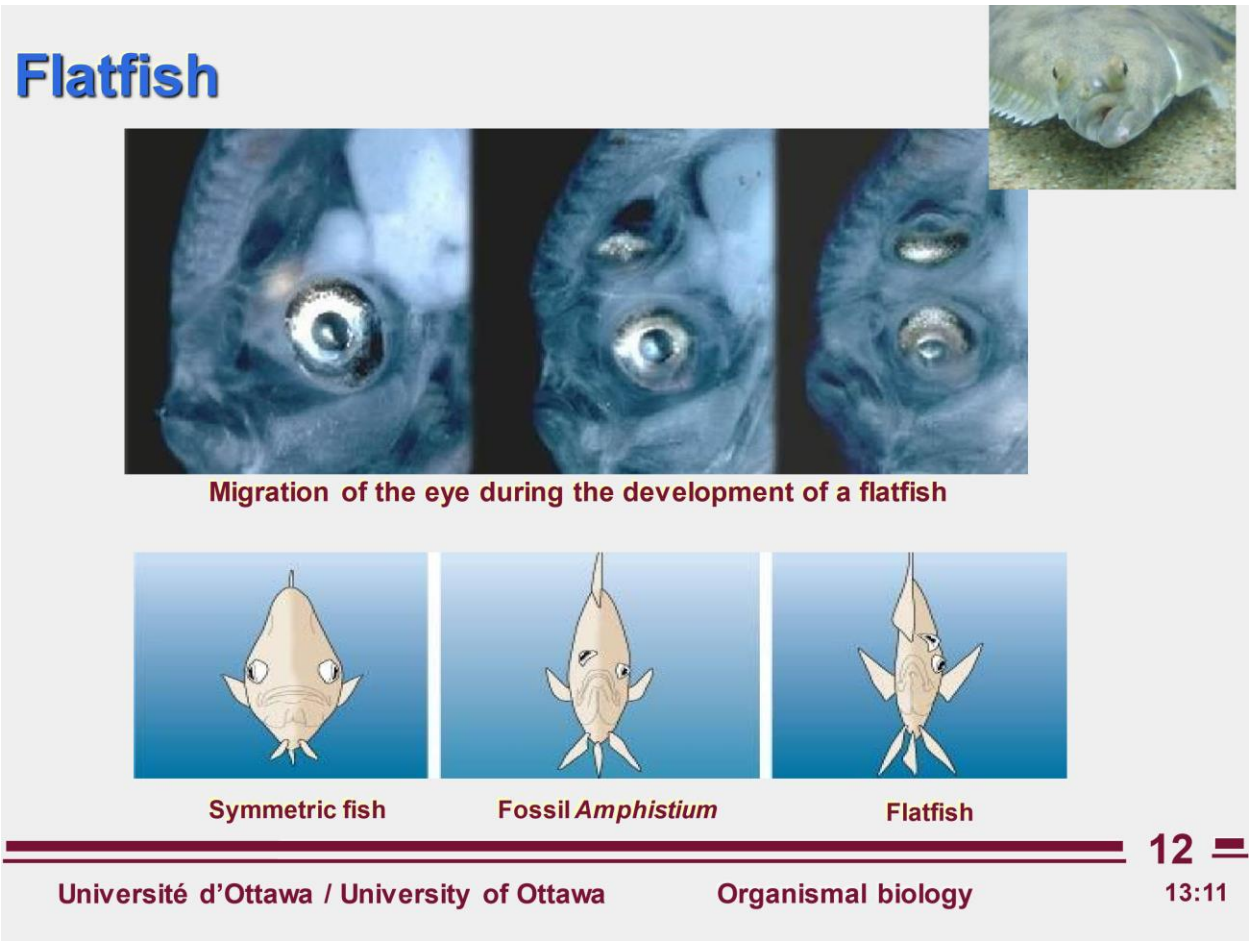
Cross-country skying:
Charlevoix crossing

Research profile

- Phylogenetics and systematics of flatfishes (sole, turbot, halibut, plaice)



Mayor of New York City (M. Laguardia) posing in front of a 150 kilos halibut. Photo taken in 1939.

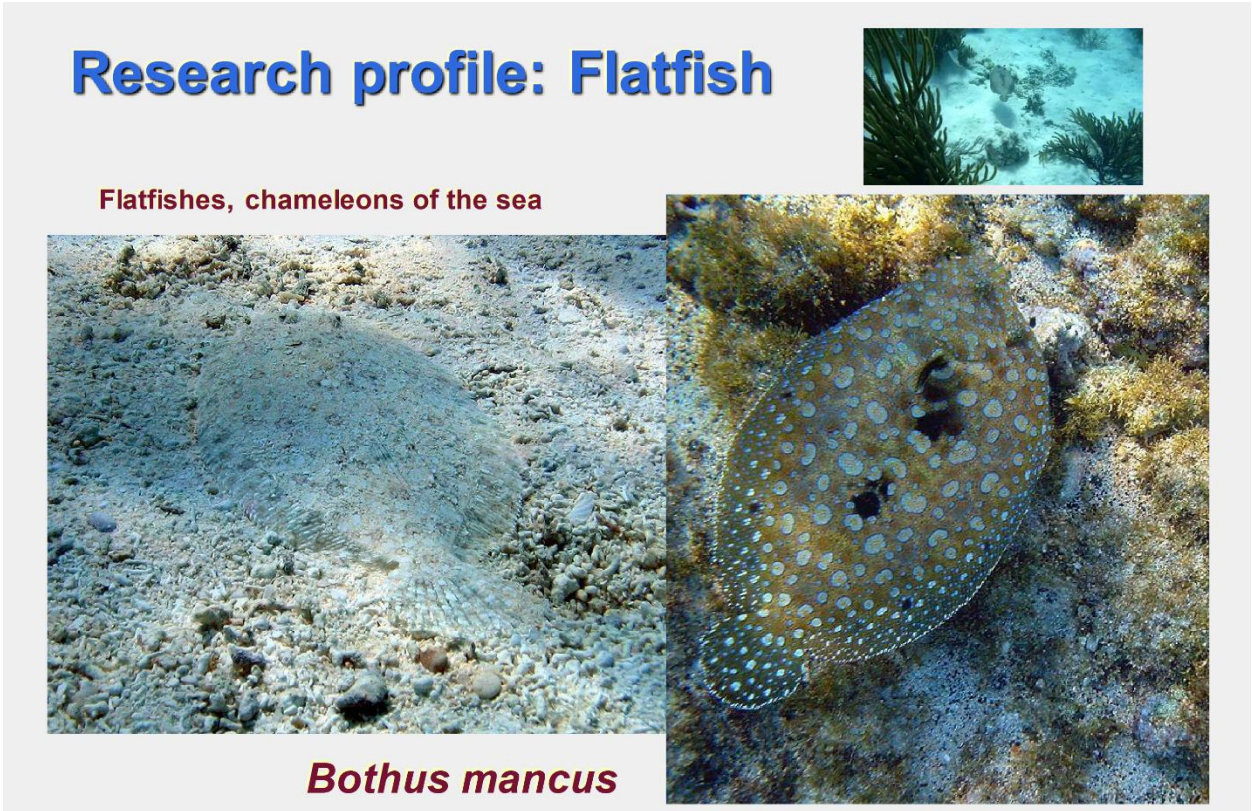


They have a blind side and eyes on one side
Larva has eyes on both side and the eye migrate to the other side
They lie on their blind side

My Q: As in every other evolution, what is the benefit of having both eyes on one side? How did this evolution occur?

Q: What is the advantage of eye migration?
Darwin struggled to answer this evolution
Key is to find an intermediate bw symmetric fish and flatfish

Fossil Amphistium is the intermediate between the two evolution



Some of them can adapt-change colours- to the environment

Q: What's happening in the cell to change pigments?

Research profile: Flatfish

Eyed side

Blind side

New flatfish species of Colombia (*Trinectes hubbsbollinger*)
Published : Duplain, Chapleau et Munroe (2012) in Copeia

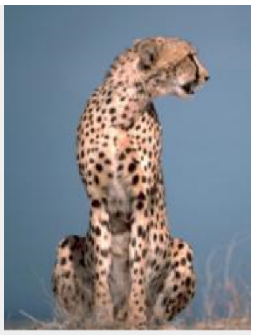
Research profile: Flatfish

Eyed side

Blind side

New flatfish species of Colombia (*Trinectes hubbsbollinger*)
Published : Duplain, Chapleau et Munroe (2012) in Copeia

My chapters



- Chapter 1. Science: definition, methodology and perception
- Chapter 2. Evolutionary thoughts before Darwin.
- Chapter 3. Charles Darwin and the theory of evolution
- Chapter 4. Genetics, Neo-Darwinism and Modern Synthesis
- Chapter 5. The evolution of populations
- Chapter 6. Adaptation
- Chapter 7. Geographic variation and speciation
- Chapter 8. Phylogenetics
- Chapter 9. Biosphere and ecology
- Chapter 10. Ecology of populations
- Chapter 11. Conservation Biology
- Chapter 12. The origin of life
- Chapter 13. Bacteria and Archaea
- Chapter 14. Protists
- Chapter 15. The Cambrian explosion
- Chapter 16. Invading terrestrial habitats: evolution of plants
- Chapter 17. Evolution of animals: general concepts
- Chapter 18. Evolution of animals: from echinoderms to chordates

1

2

3

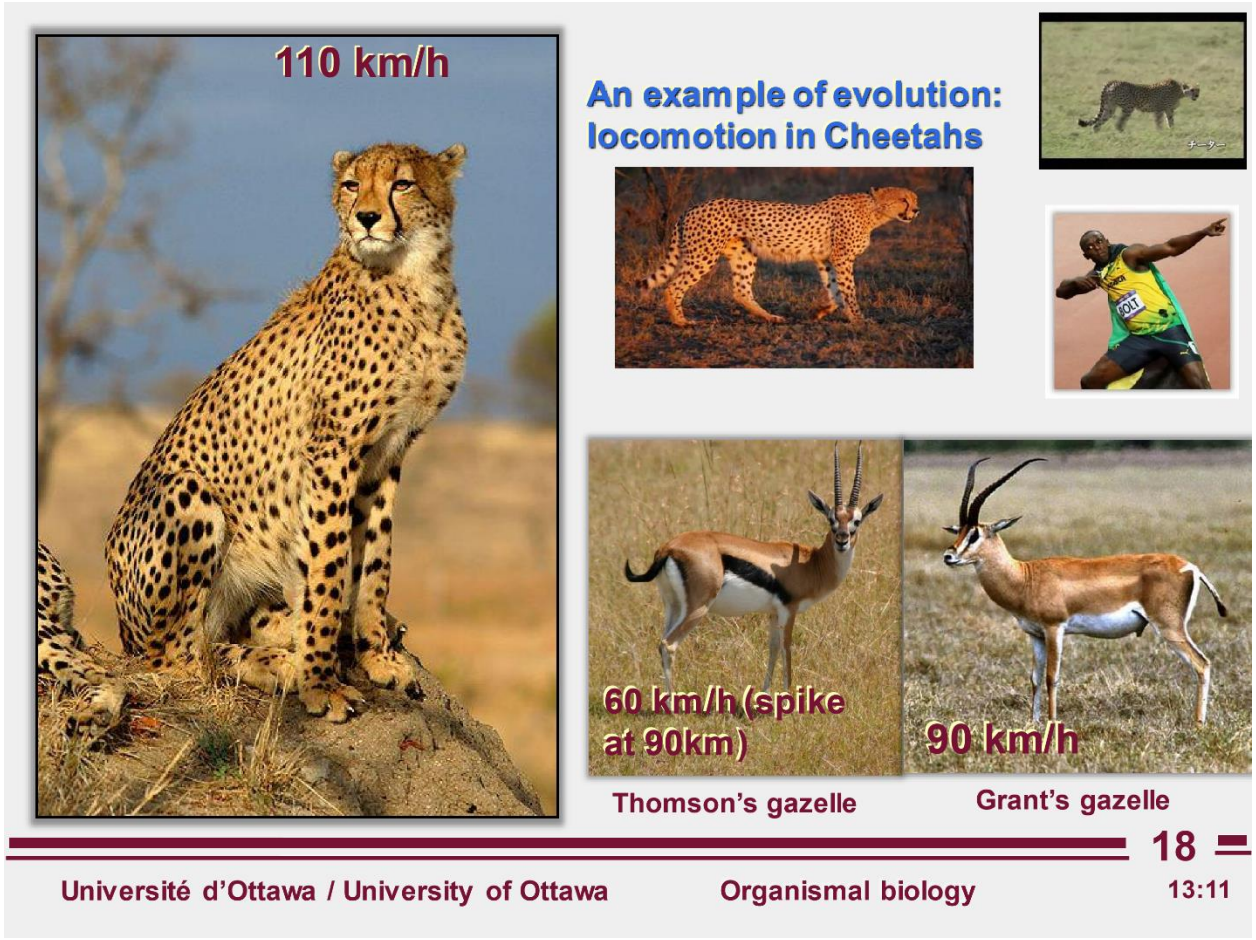
16

1. Evolution
2. Mechanics of Evolution
3. History of Life

How to succeed in BIO1130

- Attend lectures (really important)
- Download PPT (or PDF) presentations from Brightspace before lecture
- Fill empty spaces in PPT (or PDF) presentations during classes.
- Take supplementary notes on Powerpoint (or PDF) slides.
- After the lecture (same day or day after) : review your notes and ensure that you understand all concepts and examples
  - Study tools:
    - Textbook (Mastering Biology); Podcast (audio only)
    - Discussion groups (topics + Q&A)
    - Prof (email or office visit)
- Weekends : take a couple of hours to revise and ensure that you understand the course content from the beginning of lectures.

Focus on concepts not details



Fastest mammal
Preys are also fast -
Running preys increased their speed by survival evolution
Cheetahs can do 0-70 in 2 seconds (element of surprise) - hunt takes less time than other hunts

Focus on Morphology

Scapula attached to the muscle but not to the vertebral column

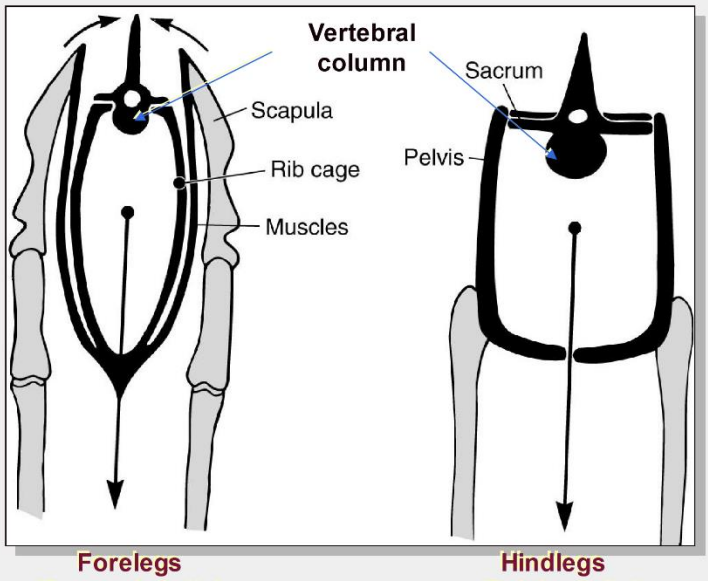
Q: Why don't they have the flexibility we have if scapula is not directly attached to the vertebral column? Wouldn't this make them more flexible?

Q: Compare human scapula anatomy vs. Cheetah

Q: What's the advantage of having scapula in line with the legs?

An example of evolution: the cheetah

Mammals



- Pelvic girdle (pelvis) _____ to the vertebral column (propulsion)
- Pectoral girdle (scapula) _____ to the vertebral column (slides on the rib cage) (propulsion, orientation, stride length)

words: fused – not directly attached

Hindlegs (Back)

Pelvis (hip) fused to vertebral column - this is what gives them speed

Unique to most of the mammals

Motor of the cheetah -pushing the animal forward

Forelegs(Front)

Bone seems to slighting on the ribcage

They don't have the flexibility we have

Limbs attached to Scapula(human have it back of the rip cage)

Muscle allows the rib cage to stay stable - Head is allowed to stay stable so the animal can concentrate on the prey

Scapula is in line with the leg (limbs)

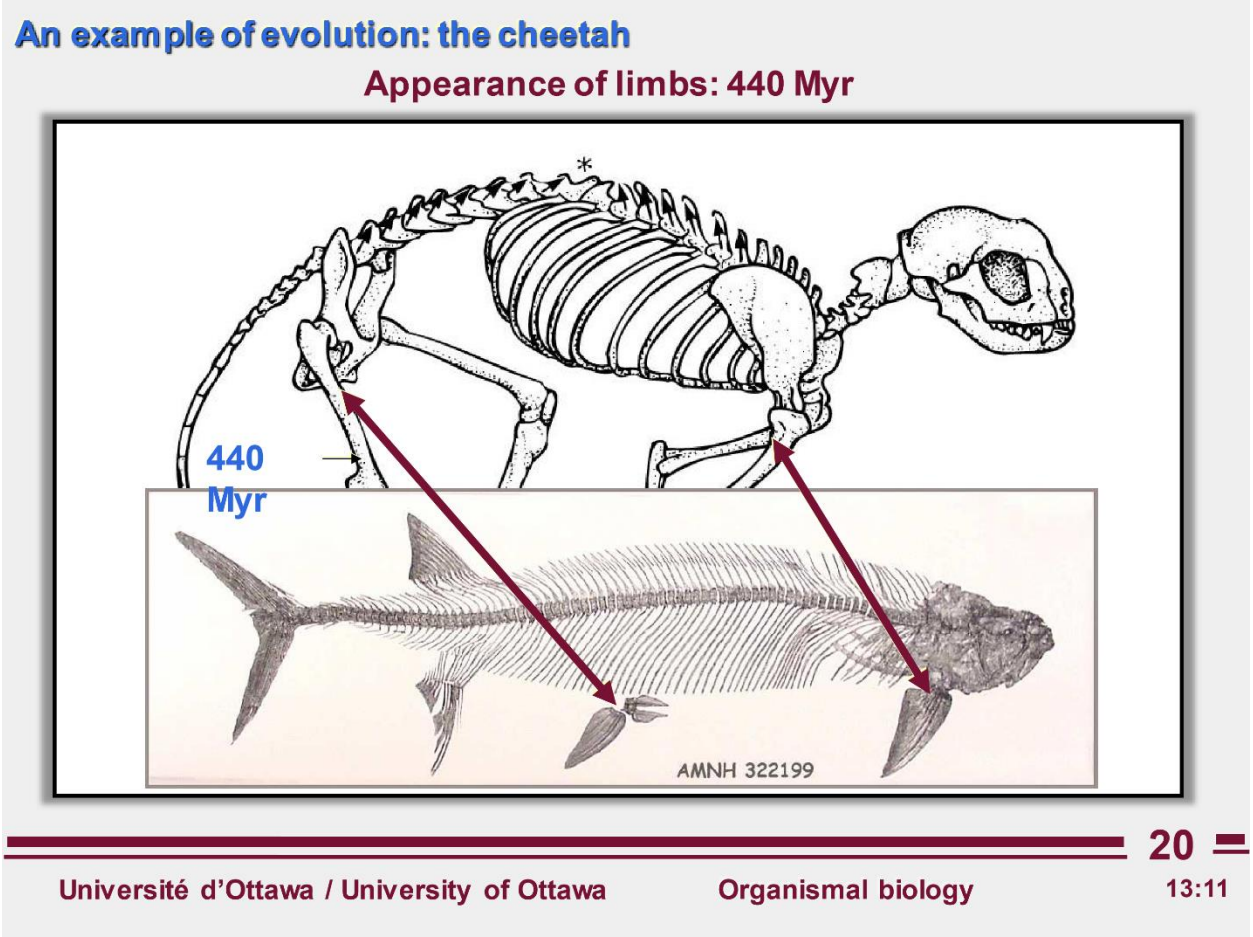
Rib cage is sitting and its stretching when the animal runs and keeps the head stable

If everything would be fused the head would go up and down

Legs are longer- longer strike

To prevent too much movement internal organs
Cheetahs can run for a short amount of time
Behavioural evolutionary - will never defend their prey - never fights for the prey - they wont want to get injured - important for reproductivity - eats their prey really fast - group eating their prey one of them watches for danger (another adaptation)

Due to high success rate they leave the prey when needed

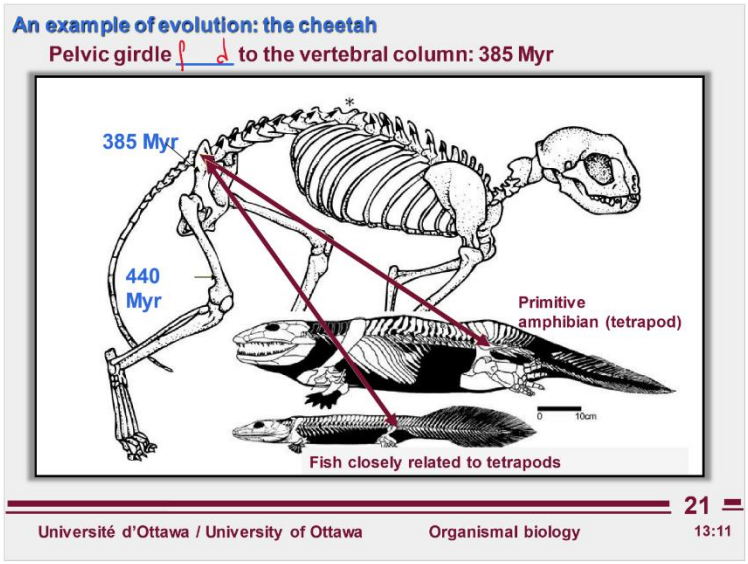


Q: where does this evolution come from?
Answer lies in Evolution of ancestor
Q: Where do legs come from?

Hindlimbs of mammals or any vertebrate comes from the fin of the fishes (for orientation)

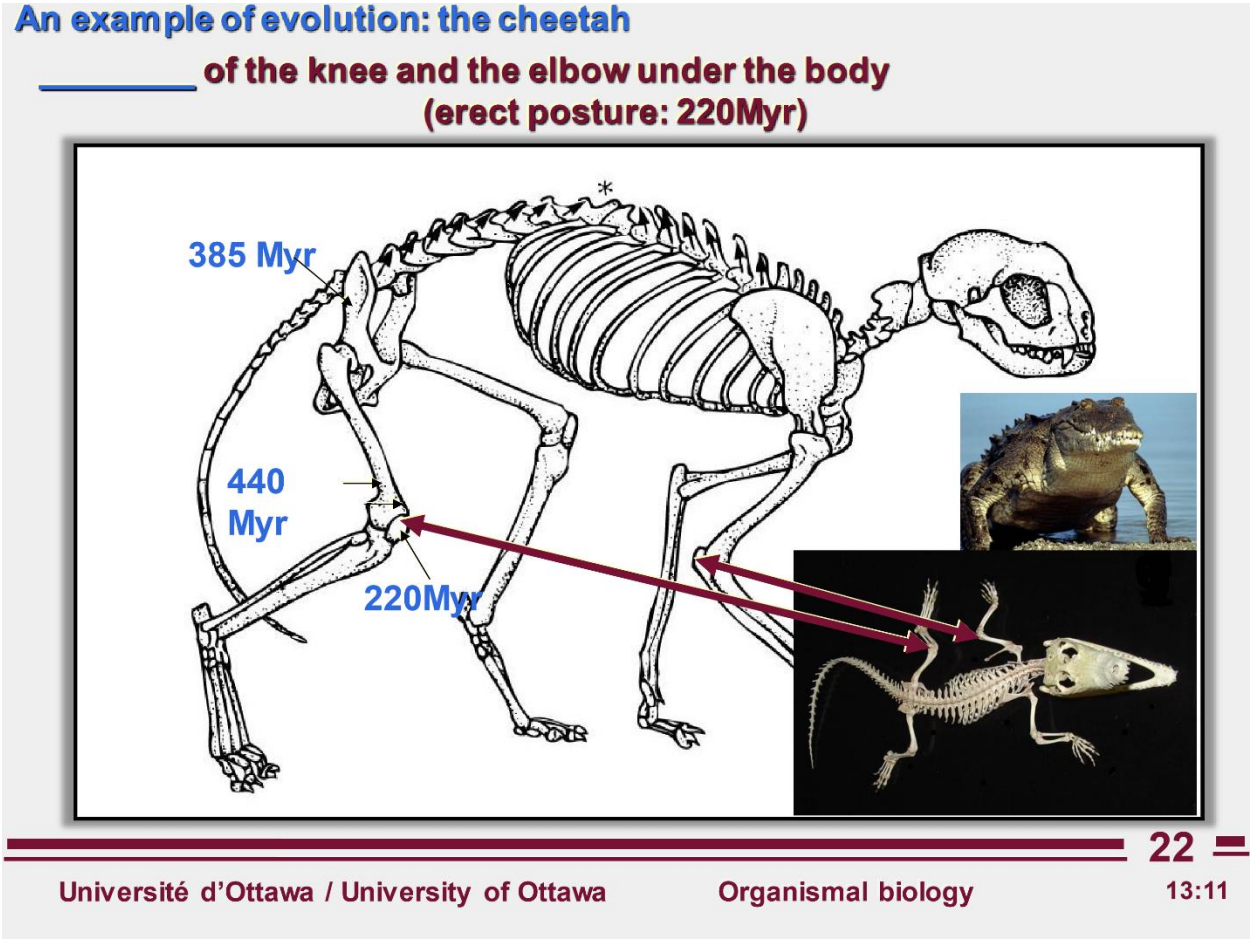
Their hips attached to vertebral column - fish do not have a support structure once they invaded land they needed to support their body

Morphology is similar to ghazel
First step of the process of evolution
Fish don't need body support cause environment supports it
Fins became support structure
Oldest fossil is 440 myr for the limbs

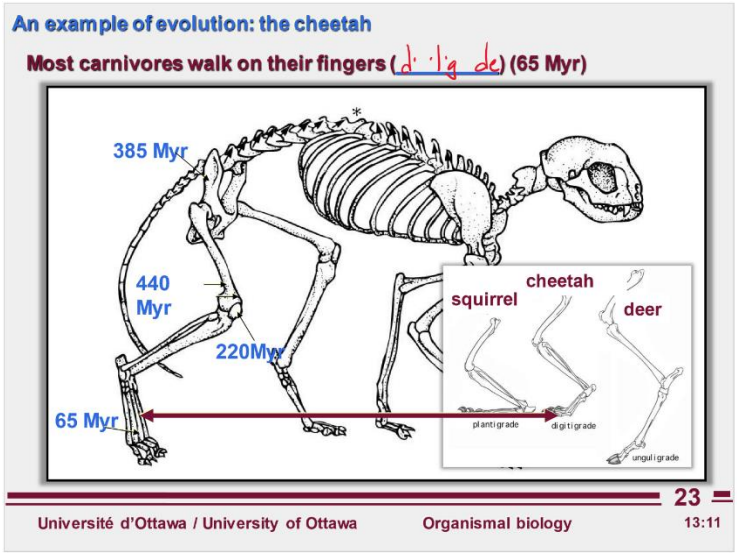


Hips attached to vertebral column feature evolved in tetrapods- one of the first thing evolved with land invasion
Provides support prevents squishing of internal organs allows vertebral column to be above the ground
Oldest fossil is 385 yrs old

Word: fused

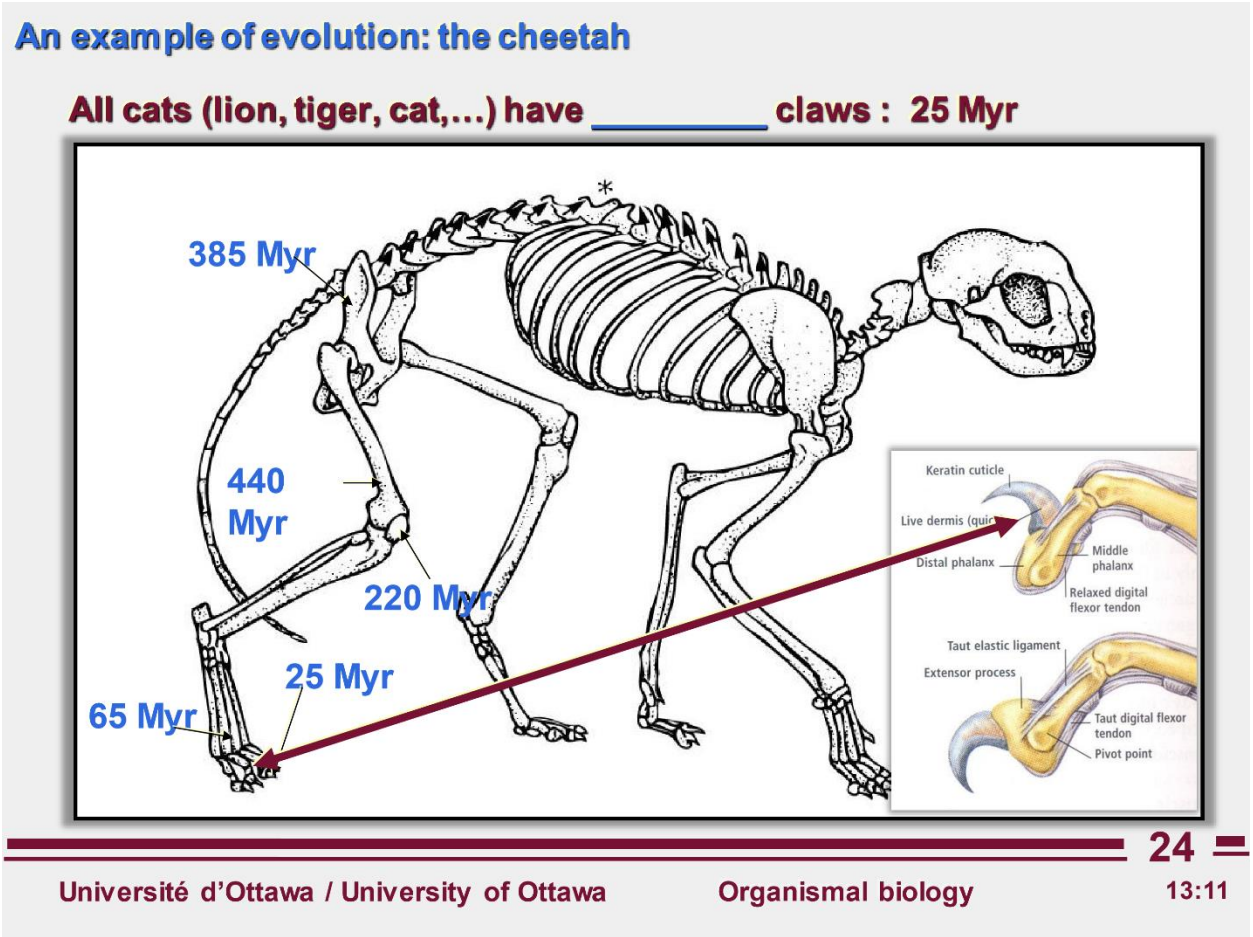


Supral posture - elbow away from the body, make torsions of the torso in order to move forward
Erect posture - elbow under the body, knees under the body - this shows Some part of evolution there was a rotation of the elbow and the knee
Oldest fossil that shows this 220 myr
Dinosaurs never had the rotation up the body elbows but had it under the body knees - they got large mainly because the rotation of the knee - they have kinda supral posture
Birds are modified dinosaurs - interior limbs became wings



Carnivores walking tip of their digits
Advantage - sole of the foot becomes part of the land of the limb - means longer strike - more speed
Carnivores - claws is the important feature to catch their preys
Ghazel - increase in length of the limb - walk on their toes to increase speed (unguligrade) - no need to catch prey -- it makes it light
A lot of fusion of bones in the wrist - fused bones no muscles or ligaments There is a lot of bone fusion in their toes and the limb that makes it faster - more movement not attached to the muscle - makes it light tip of the limb

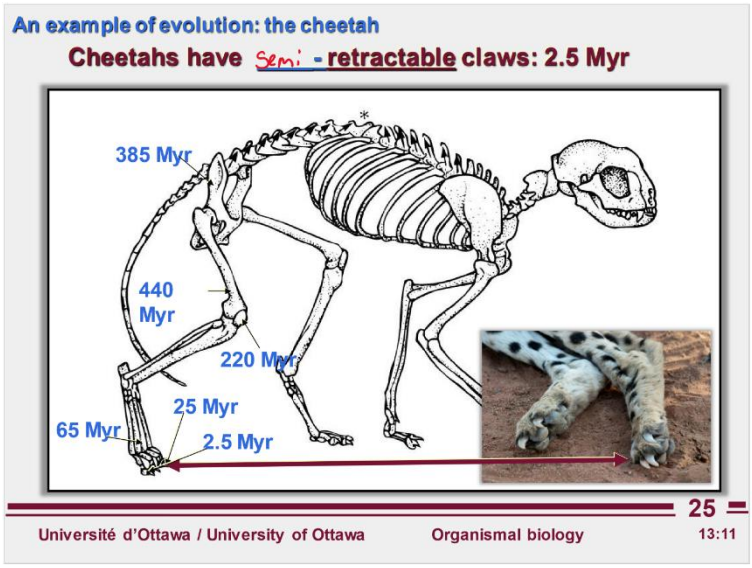
Word: digitigrade



Word: retractable

All cats have that

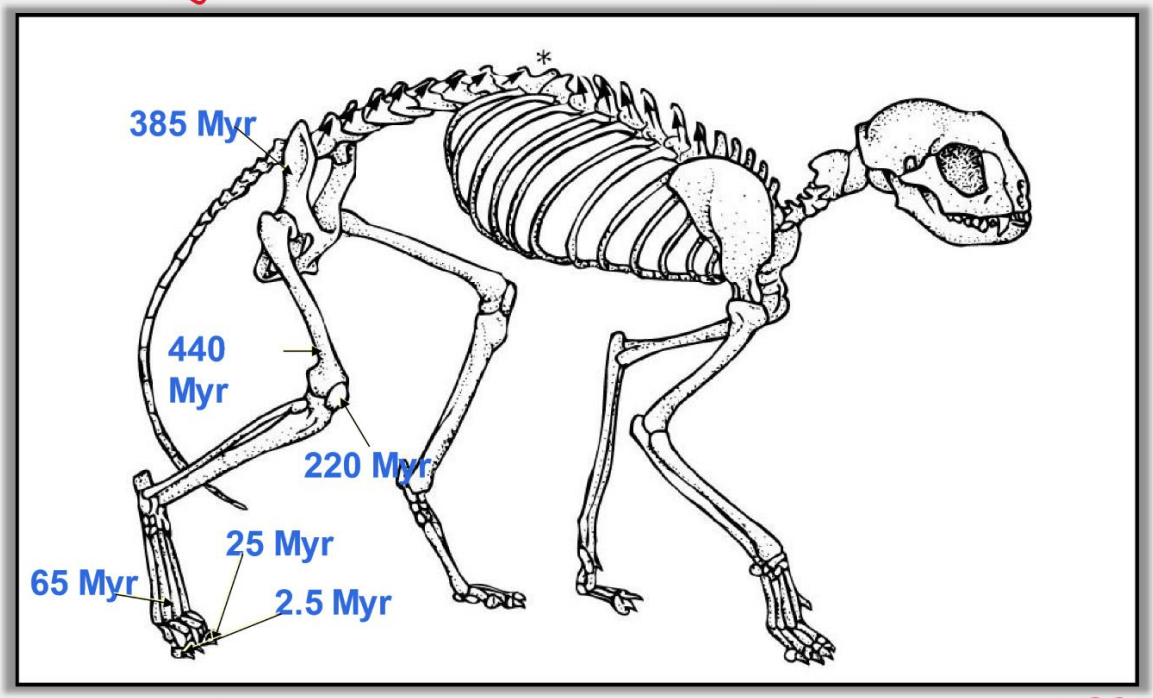
Advantage - keeping the claws inside protects the claw
Oldest fossil 25 myr



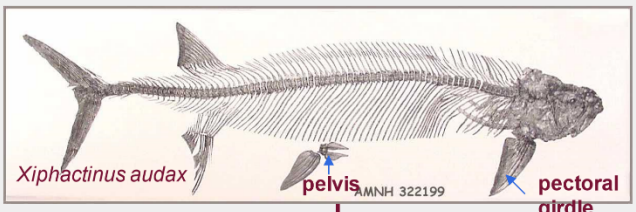
Unique to cheetah
Advantage - might be associated with speed
Others don't because they have different types of hunting style - ex lion

An example of evolution: the cheetah

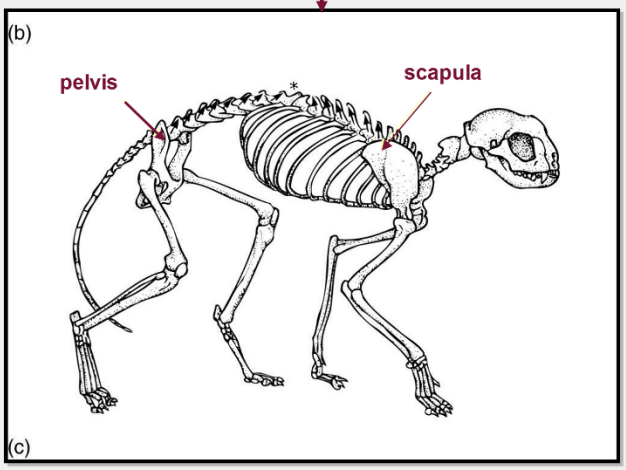
The hindlegs of a cheetah is the result of 440 Myr years of evolution.



An example of evolution: the cheetah



- Adaptations of Vertebrates in cheetahs
  - locomotion organs (fins or limbs)
- Adaptations of terrestrial _____ in cheetahs
  - Pectoral girdle (scapula) detached from the skull
  - Pelvic girdle (pelvis) fused to the vertebral column.
- Adaptations of _____ in cheetahs
  - Rotation of the knees and elbows under the body (support and/or speed)
- Adaptations of the order _____ in the Cheetahs.
  - Walk on fingertips (digitigrade)



Words: tetrapods, mammals, carnivores

Presence of limbs good characteristics of vertebrates
Tetrapods - 4 legged animal
Front limb attached to cranium - one thing evolution - detached from the cranium - allowed the evolution of the neck - unique to tetrapods

An example of evolution: the cheetah

Adaptations of the _____ compared to other felines

- Fur pigmentation
- Long and thin limbs especially in the distal end (_____)
- lightweight, slender and muscular body (_____)
- Flexibility of the spine (speed, stride length)
- Wide nostrils, heart and lungs with high functional capacity

Words: cheetah, stride length, speed

Spotted fur allows it (in savannah) to get close to the prey - surprise effect

Among the most flexible spines of all the cats - 1 jump - 7meter - due to the extension of vertebral column

These are unique to cheetah

Thus, what is a cheetah?

- A cheetah is a mammal characterized by few derived traits (evolutionary innovations) that distinguishes it from other feline species.
  - The species is the result of 3,500 Myr of evolution. Why?
  - More than 99% of its characteristics have evolved in species that are now extinct.
  - Less than 1 % of its features are unique.
- So the cheetah is more the result of the _____ _____ than of its own history.
- This applies to all living species, including _____.

Words: history of its ancestors, humans

Because its presence is linked with its ancestor - commona ncestor linked with first living being has in common? DNA

DNA is the characteristic that unites all the species

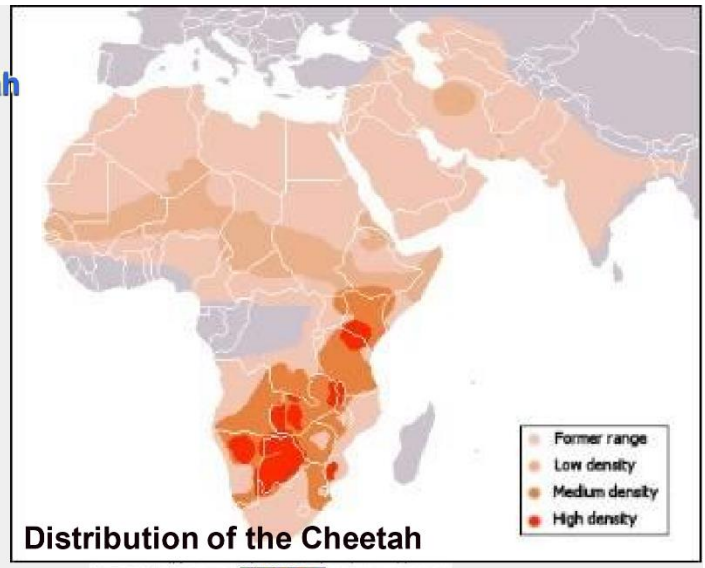
Notion of articular speech - associated with only humans

Point - only few features differentiate humans others are the same

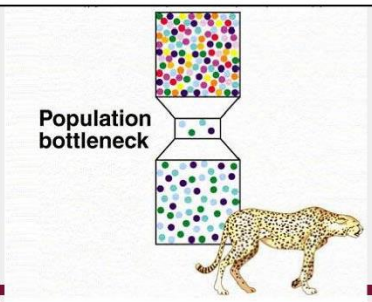
An example of evolution: the cheetah

- Importance of genetic variability

Royal cheetah
(species or _____?)



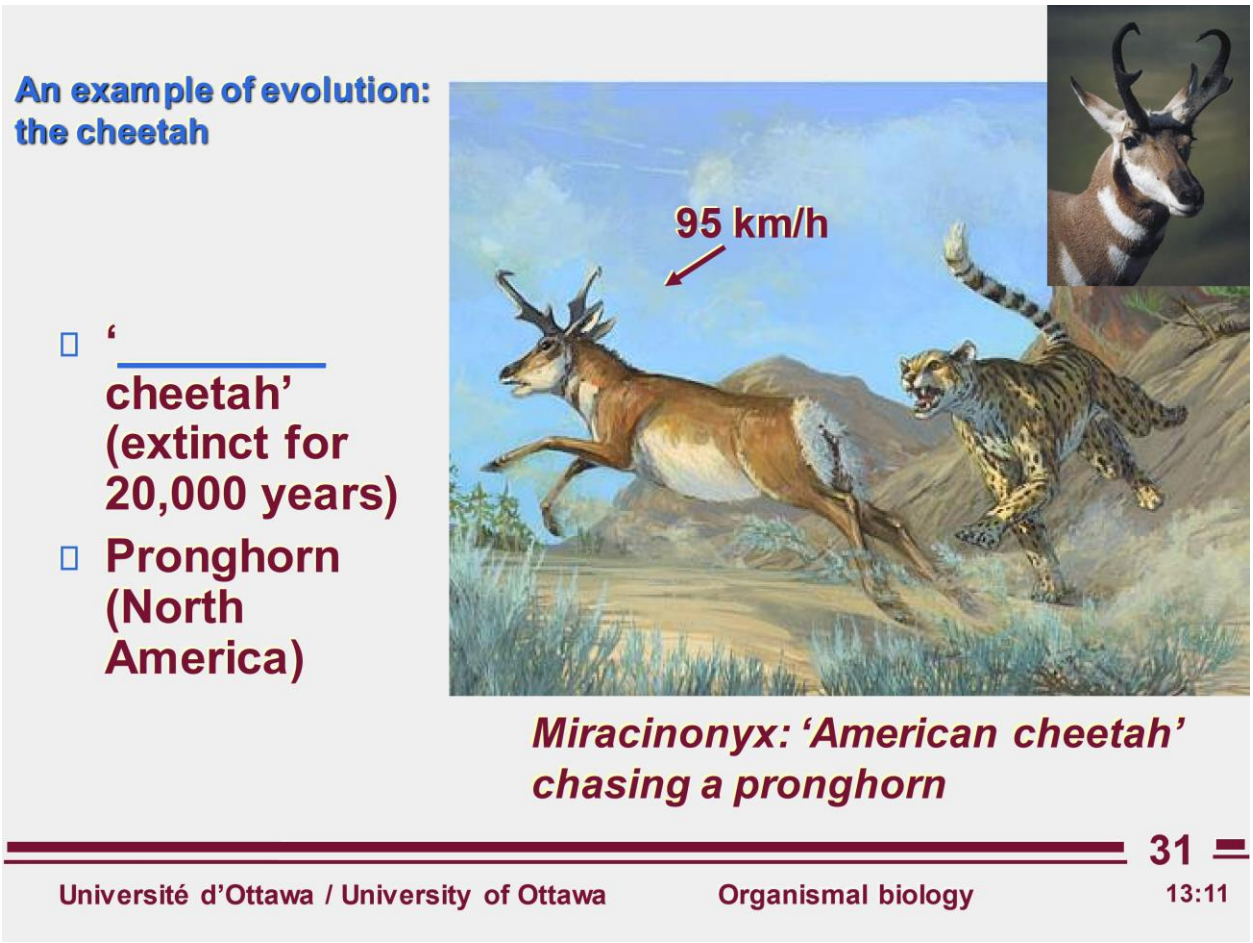
Distribution of the Cheetah



Word: mutation
Diversity of cheetah - different pigmentation on their fur
Answer came in a zoo when one of the kittens were royal cheetah
Royal cheetah is not a specie it's mutated
Changes the development of pigmentation

Cheetah DNA - almost clones of one another
You can take a skin and make a skin graph and the skin will take
Why ? What's the impact?
Population might go though population bottleneck probably the di
cheetahs that we have now survived
Genetic variability is low (important for conversation biology later on in t

Problem with this - Very little resiliency - disease that kills 1 will ill them a similarity



Word: American
99% of the species are now extinct - massive extinction of human impact r

Coevolution - as prey gets faster predator gets faster.
Pronghorns are have high speed but their predator can run only up to 60 k
Extinction of the American cheetah is unknown (fossil are important in orc
what's going in the current phana (fanah))

North American cheetah is more similar to a puma than African cheetah (r
of convergent evolution- species has evolved similar speed independently
come from different species

Science and religion

(Discussion group will be activated during the first week of class)

- To the following question from a Globe and Mail reporter (March 17 2009) « Do you believe in evolution? », the Canadian Minister of science and technology at that time answered : " I'm not going to answer that question. I am a Christian, and I don't think anybody asking a question about my religion is appropriate,".
  - As a student in a science course, what do you think of the minister's answer?
  - Can faith (religion) be part of a methodological process to answer scientific questions? If no, why? If yes, how?
  - Can faith (religion) provide us with objective knowledge about the origin of life? Or about the origin of our species? If no, why? If yes, how?

Give your answer or your opinion (anonymously or not) in the *discussion group* dealing with this issue on Virtual Campus (Brightspace). Remember that you will be anonymous to your colleagues but not to the instructors of the course. Please be constructive and courteous in your comments or they will be deleted.