Introduction:

Big Ideas:

- ➢ Evolutionary Compromise: when evolving a trait, there needs to be a trade off/disadvantage that is gained. E.x. Humans can speak, but we have a long pharynx → allows for us to be able to choke on food
- ➢ All species share a common ancestor, Darwin: if species look similar, they have a common ancestor
- ➢ All species gain their features from an ancestor
- ➢ Characteristics are mostly general that define larger groups of species, very small percent of each species' characteristics are unique
- ➢ We are unique, we are a result of a unique evolutionary path, which is connected to other species as a result of common ancestors
- ➢ No genetic variability → no adaptation to change
- ➢ Species now represent 1% of all species that lived on the planet

Notes:

- Cheetah has fast bursts of speed and very high cruising speed
    - If the cheetah does not catch prey after burst, it only runs for a few hundred metres before giving up (50%)
- Why is the cheetah so fast?
    - The pelvic girdle (pelvis) is fused to the vertical column (result: propulsion)
        - Hind legs are attached to the hips → vertical column = the motor
    - The pectoral girdle (scapula) is not directly attached to vertical column (sides of the rib cage) → Stride length, propulsion, orientation
        - Allows for further extension of the front legs = allows for longer strides
        - Rib cage is not moving up and down as much, acting as a shock absorber for organs
        - Allows for Cheetah's head to stay straight, as tail is used to counterbalance the cats movement
- What is the disadvantage of being so fast?
    - Their speed is an evolutionary compromise. E.x. once a cheetah catches a prey, they don't protect it in order to avoid getting hurt in a fight and possibly losing its speed → needed for survival.
- How did the cheetah evolve?
    - Follows the notion that all species share a common ancestor
        - The presence of similar DNA
        - E.x. everything from us evolved from fish, except for fingers (tetrapods)
    - Cheetah hind legs evolutionary path:
        - First fish w/ fin (440 myr) → limbs
        - First tetrapod with pelvic fin fused to vertical column (385 myr) → pelvic girdle fused to vertical column

        - Rotation of the knees and elbows under the body, instead of sprawled position (e.x. crocodile) (220 myr) → erect posture: pendulum type limbs, better and more efficient for moving (faster): evolution of mammals
            - Two types of Locomotion:
                - Sprawled position → humorous and femur is parallel to the ground
                    - Disadvantage: constraints maximum size of animal
                - Erect position → knees and elbows under the body
                    - Larger animals are able to support their own weight
                    - Dinosaurs are mixed example of this evolutionary trait, hind legs went under the body (knees rotated), but the front legs stayed in sprawled position
        - Ancestors of each feature:
            - Legs → from fish: limbs evolved once sea creatures moved to land
            - Legs attached to vertical column → reptiles
        - Most carnivores evolved to walk on digitigrades (65 myr) → extends stride
            - Deer walk with unguligrade, allowing deer to extend the leg as a longer limb, fused together. Fused limbs allows for less muscles and tendons/ligaments, causing the limb to be lighter → faster
            - Cheetah cannot evolve like this since it needs claws to catch prey, cannot walk on them (digitigrade)
        - Cats evolved retractable claws, to retract them when at rest and keep them sharp (25 myr)
            - But cheetahs evolved to have semi-retractable claws → allowing them to show a bit and help them grip the ground (traction) when running and turning at such high speeds (5.5 myr)
    - Adaptations of cheetah compared to other felines (“cats”)
        - Fur pigmentation, color with relation to environment
        - Long and thin limbs (especially in distal end) → increasing stride length
        - Lightweight, slender, and muscular → inc. speed
        - Flexibility of the spine → inc. speed by increasing stride length
        - Wide nostrils, heart, and lungs with high functional capacity → increase in oxygen intake = faster
- THUS, what is a cheetah?
    - A mammal characterized by few derived traits that distinguish it from other feline species
        - More than 99% of its characteristics have evolved in species now extinct (only 1% are unique)
        - The cheetah is more the result of the history of its ancestors than of its own history
            - Applies to all species, including humans (big idea)
- Importance of genetic variability

- There used to be a much larger population, now only ~ 10000
    - As a result, cheetahs are almost clones of themselves (lack of genetic variability → you can even skin graph interchangeably from all cheetahs)
    - If a disease comes in, there is very little variation that allows for natural selection to occur and allow for the species to survive.
    - Why are there clones?
        - Population bottleneck: at one point the species must have been decreased to a very little amount of individuals. Which as they repreocreated, allowed for very little variability in the short amount of time
- As predators get faster, prey get faster and faster (as only the ones that can escape can mate)
    - E.x. Pronghorn can run as fast as 95 km/h, puma (fastest predator in north and south america) can only run 60 km/h
        - There used to be a species that hunted the pronghorn (“american cheetah”) that co-evolved with the pronghorn and therefore their speed. “American cheetah” went extinct, leaving pronghorn with its fast speed (allowing it to be able to still run so fast)