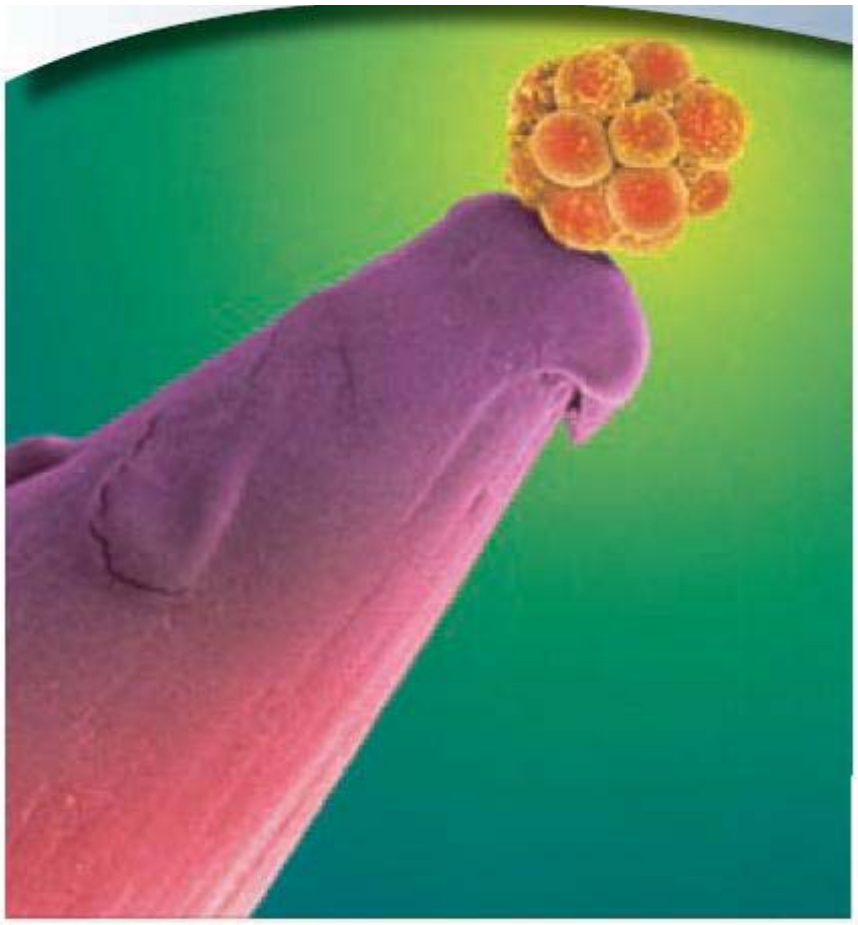
Evolution & Natural Selection



Human Origins & Adaptations

- **Charles Darwin**
  - *Darwin did not discover evolution*
  - *Darwin explain how "natural selection" decided which genes would be selected and passed on to the next generation*
  - *On the Origin of Species by Means of Natural Selection* (1859) – 'book that shook the world'
  - *The Descent of Man* (1871) – about human evolution

Human Origins & Adaptations

- **Theory of natural selection**
  - how species originate and change through time
  - changed view of “our origin, our nature and our place in the universe”
  - Increased our understanding of human form and function // our inter-connection to other species

Evolution, Selection, and Adaptation

- **What is evolution?**
  - change in genetic composition of a population for an organisms over time
  - Mutlicellular organisms change slowly over time
  - Bacterial have very short generation times // Able to demonstrate evolution in real time with bacteria (examples)
    - We see evolution occur as bacteria develop resistance to antibiotics
    - Virus also evolve // appearance of new strains of AIDS virus

Evolution, Selection, and Adaptation

- **Natural Selection**
  - some individuals within a species have hereditary advantage over their competitors
    - better camouflage // e.g. brown bears vs polar bears
    - disease resistance
    - ability to attract mates
  - produce more offspring
  - Force to pass on genes to next generation
  - Selection Pressures – natural forces that promote the reproductive success of some individuals more than others

Evolution, Selection, and Adaptation

- **Adaptations**
  - features of an organism's anatomy, physiology, or behavior that have evolved in response to these selection pressures and enable the organism to cope with the challenges of its environment.

Our Animal Relations

- **Closest relative - chimpanzee**
  - difference of only 1.6% in DNA structure
  - chimpanzees and gorillas differ by 2.3%
  - Bonobos, chimpanzees, and humans share 98.7% of their genes
- **Study of evolutionary relationships**
  - help us chose animals for biomedical research (the animal model)
  - rats and mice used extensively due to issues involved with using chimpanzees

Vestiges of Human Evolution

- **Vestigial Organs –** remnants of organs that apparently were better developed and more functional in the ancestors of a species, and now serve little or no purpose

  - E.g. piloerector muscle
  - E.g. auricularis muscles

Life in the Trees

- Primates – order of mammals to which humans, monkeys, and apes belong

- Earliest Primates

  - squirrel-sized, arboreal, insect-eating African mammals
  - moved to trees due to safety, food supply and lack of competition

- Adaptations for arboreal (treetop) life style

  - mobile shoulders
  - opposable thumbs made hands prehensile to grasp branches and encircle them with the thumb and finger
  - forward-facing eyes (stereoscopic vision) // depth perception for leaping and catching prey
  - color vision // distinguish ripe fruit and young, less toxic foliage
  - larger brains and good memory // remember food sources and improved social organization

Walking Upright

- African forest became grassland 4-5 million years ago // producing more predators and less protection

- Bipedalism - standing and walking on 2 legs // helps spot predators, carry food or infants

- Adaptations for bipedalism

  - skeletal and muscular modifications
  - increased brain volume
  - family life and social changes

Walking Upright

- ***Australopithecus* –** oldest bipedal primate // “Lucy” walked the earth 4 million years ago

- ***Homo genus*** (appeared 2.5 million years ago) // taller, larger brain volume, probable speech, tool-making

- ***Homo erectus*** *(*appeared 1.8 million years ago) // migrated from Africa to parts Asia

- **Other Homo species** discovered recently still matter of considerable debate

- ***Homo sapiens*** originated in Africa 200,000 years ago // humans are Homo sapiens // sole surviving hominid species // We are hominids!

- **Evolutionary (Darwinian) medicine** traces some of our diseases and imperfections to our past