Chapter 19

Introduction

Three key observations in life:
-organisms are adapted for life in their enviornments
-the unity of life
-the rich diversity of life

-evolution: descent with modification
  - species accumulate differences from their ancestors as they adapt to different enviornments
  - change in genetic composition of a population from each generation
  - evolution is a pattern and a process
  - pattern revealed by data from biology, geology, physics, chemistry
  - process consists of mechanisms that cause the pattern of change

Section 1: Darwinian revolution challenged traditional views of Earth inhabited by unchanging ans

-ppl used to believe animals didn't change
-Carolus Linnaeus: binomial format for naming species
  - grouped animals in increasingly general groups
-Darwin says classification should be based on evolutionary relationships
-fossils: the remains or traces of organisms from the past
-strata: layers of rock that compress fossils
-paleontology: the study of fossils, created by Georges Cuvier
  - older fossils = wierder animals
-change happens over a long time
-James Hutton: Earth's features could be explained by gradual mechanisms
-Charles Lyell: geological processes happening at the same rate
-Lamarack: how does life change over time?
  - compared livings w/ fossils
  - found several lines of descent
  - lined up fossils: older → younger → living
  - use/disuse: parts of body no longer needed deteriorate
  - inheritance of acquired characteristics: organisms pass down modifications
  - organisms have a drive to become more complex

Section 2: descent w/ modifcation explains adaptions

- Charles Darwin: goes on a voyage (Beagle)
  - physical evidence doesn't support the view that the earth is young
-adaptations: inherited characteristics of organisms that enhance their survival/reproduction
-adaption to enviornment relates to the origin of new species
-natural selection: individuals that have certain inherited traits survive and reproduce at higher rates bc of those traits
-organisms share many characteristics = unity of life
  - organisms share an ancestor, as they moved to different habitats they changed
  - discent + modification
-natural selection = patterns in evolution
-artificial selection: human modification of species by selecting and breeding

DARWINS OBSERVATIONS + INFERENCES

-observation 1: members of a population vary in their inherited traits
-observation 2: all species can produce more offspring than their eviornment can support, those offspring die
-inference 1: individuals fit for survival leave more offspring

-inference 2: there is an accumulation of favorable traits in future populations
-connection btwn natural selection and overproduction
-all species can overproduce
-organisms' heritable traits increase their preformance and their offsprings' ability to cope with enviornmental challenges

MAIN IDEAS OF NATURAL SELECTION:
- individuals w/ certain heritable traits survive + produce at higher rates
- ns increases the frequency of favorable adaptions
- if enviornment changes / animal moves, ns creates adaption, sometimes new species

*individuals don't evolve, population does

Section 3: Evolution supported by scientific evidence

-research by direct observation, homology, fossil records, biogeography

DIRECT OBSERVATION:
-example: herbivores having adaptions that help them feed
- soapberry bugs + needlike beak help them feed

-example: drug-resistant bacteria
- some strains of different viruses/bacteria have drug resistant pathogens
  ↳ MRSA - some resistant to multiple antibiotics

-these two examples highlight three key examples of ns
- natural sel. is editing, not creating
- evolution by ns can occur rapidly
- ns depends on time/place

HOMOLOGY: analyzing similarities btwn different organisms
-organisms that have evolved share similar features with their ancestors
-homology: similarity resulting from common ancestry
-closely related = similar characteristics
-homologous structures: represent variations on a structural theme that was there in a common ancestor
-vestigial structures: remnants of features that served a previous functions
-convergent evolution: independent evolution of similar features in different lineages
-analogous: species share characteristics because of convergent evolution

THE FOSSIL RECORD
-fossil document patterns in evolution
- show evolutionary changes
- shed light on origins of new groups
- fossils show movement from land to sea

BIOGEOGRAPHY: Scientific study of the geographic distribution of species

*continental drift
-figure out how animals got to where they are today
-endemic: species only found in one place

-Darwin's theory shows pattern/process of evolution
-natural selection causes pattern