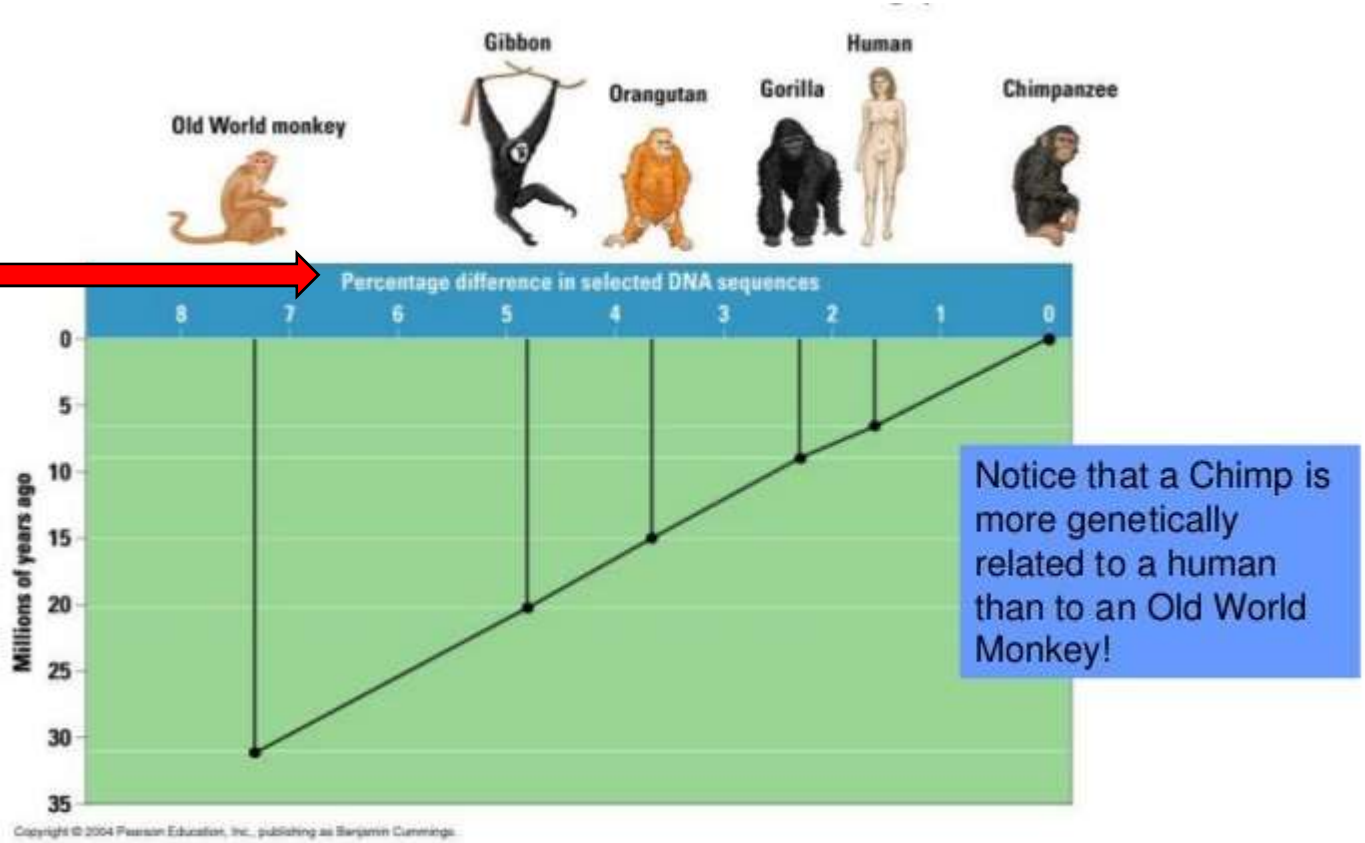
Evidence for Evolution
Part 4: Molecular Evidence

% difference in DNA sequences



Ms. Gill

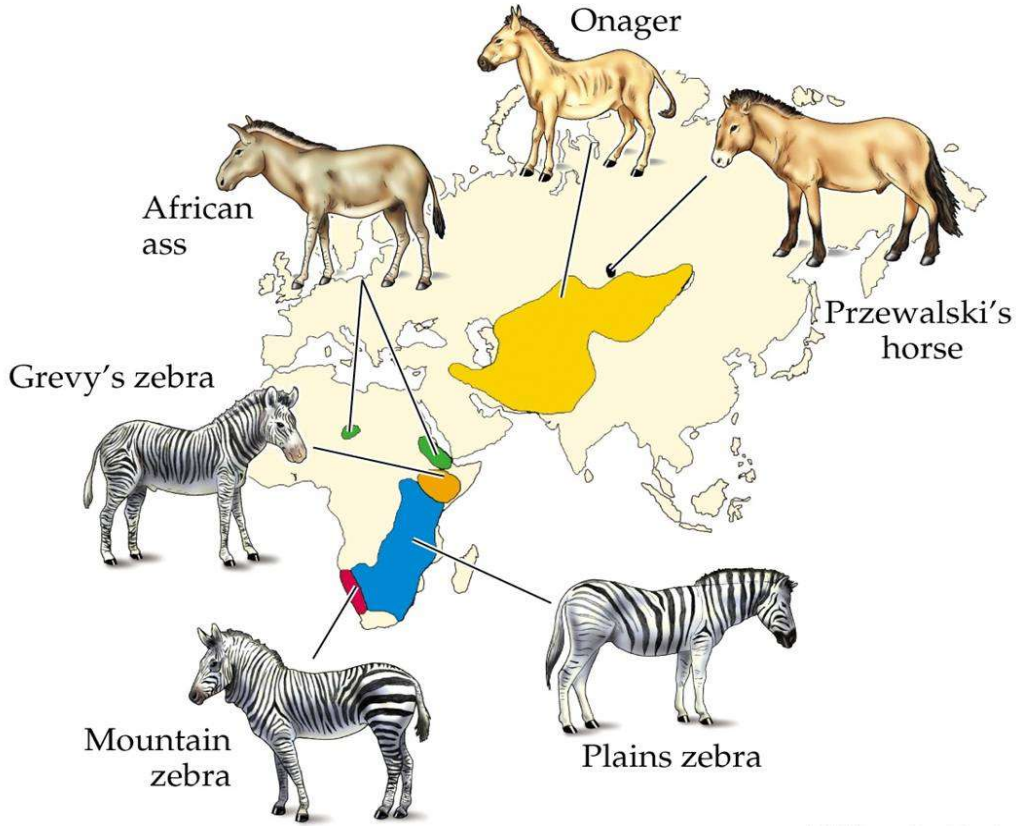
Honors Biology

Agenda

- How are those asses related?
  Biogeography and phylogeny of horses, zebras, and asses
- Notes: molecular evidence
- Cytochrome c protein sequence worksheet
- Finish Canary Island Lizard Lab

- HW: Cytochrome c protein sequence worksheet, FINISH LAB!!!!

How are those asses related? Biogeography and Phylogeny of the Genus *Equus* (horses, zebras, asses)

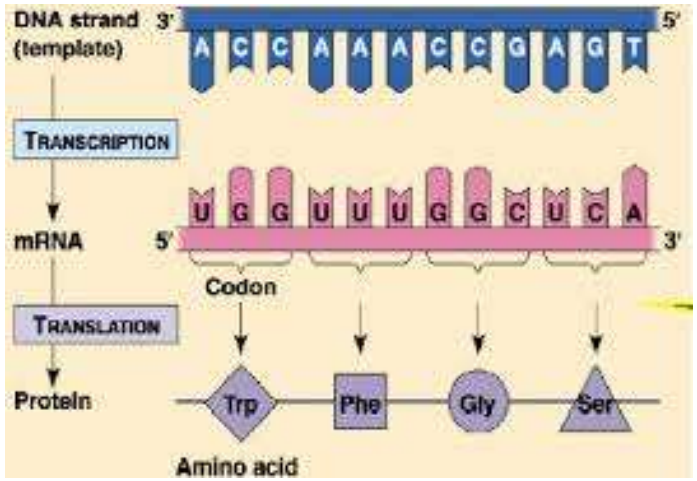


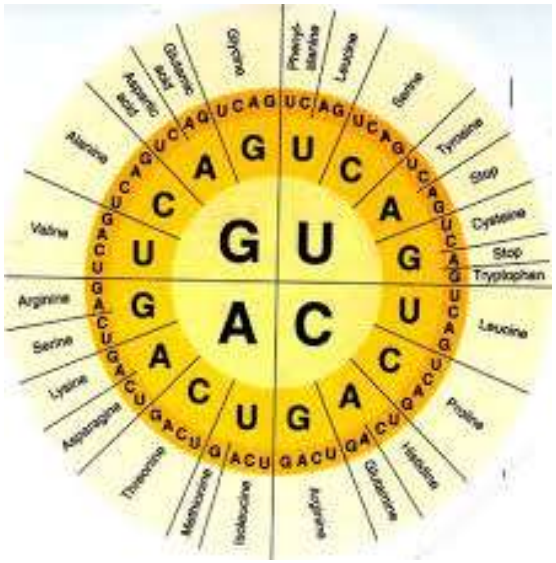
Draw a phylogenetic tree – use the additional info on your handout

Molecular evidence for evolution

- Common genetic code
- Common cell structure and organization
- Sharing of genes for important proteins

Common genetic code



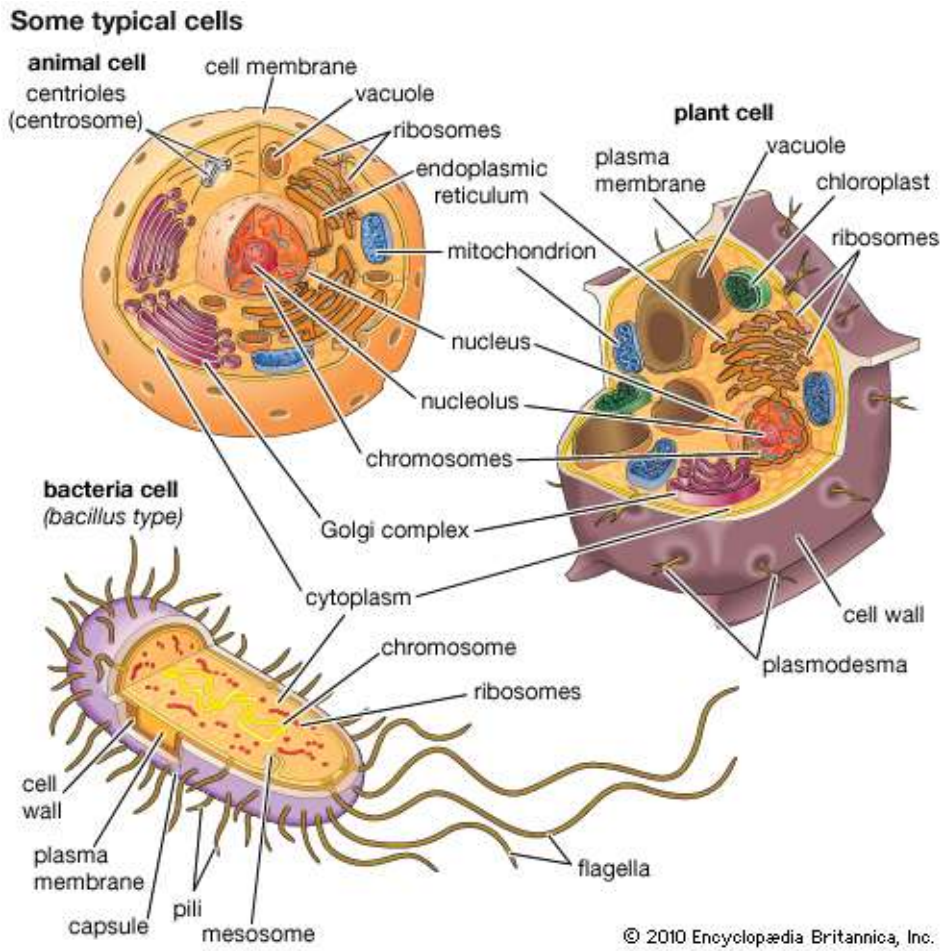


- Everything uses the central dogma
- Basis of life as we know it, incredibly complex, unique, and likely invented only once
- If life originated multiple times, really unlikely DNA-RNA-protein code would emerge each time
- Even if it did, codons would probably code for different amino acids, but they're always the same

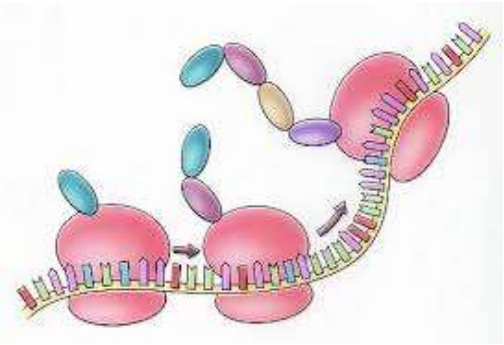
Common cell structure and organization

- All animal cells share the same general structure
- Same with all plant cells
- Same with prokaryotes
- Analogous structures in these cell types

- If life originated multiple times, really unlikely that all lineages would converge on this system

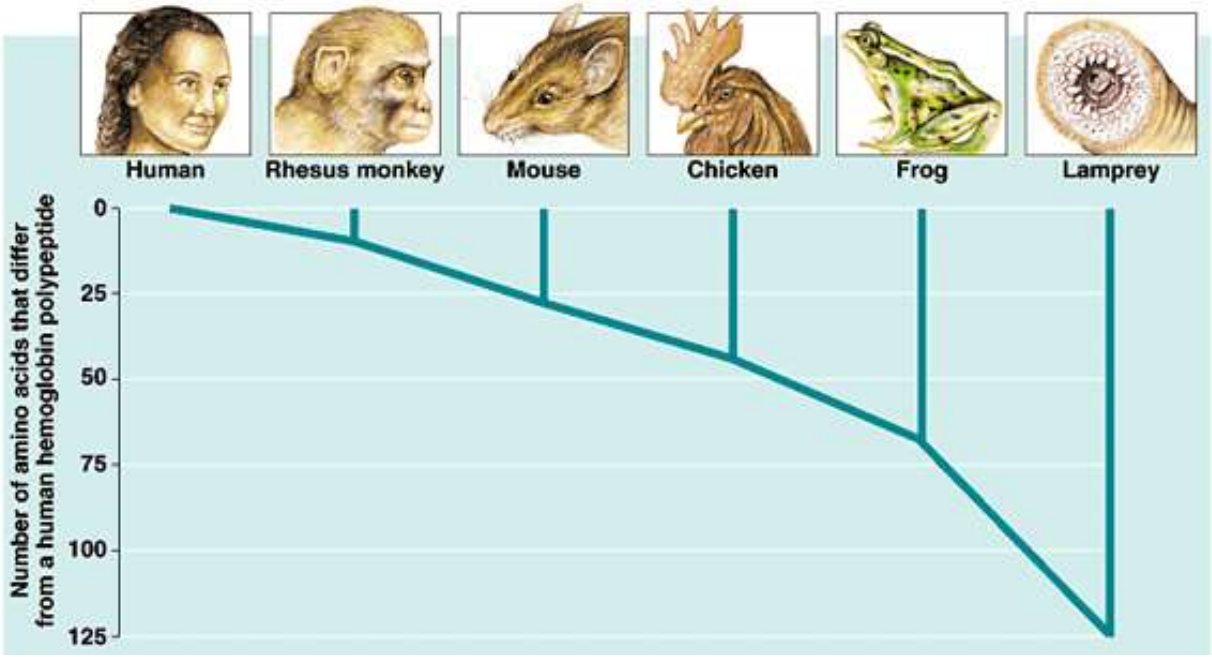


Common genes



- Related species share genes
  - the closer the relation, the more shared genes
- Usually genes that code for proteins/RNA with really key functions
  - Ribosomal RNA – protein synthesis (everything we know)
  - Cytochrome c – mitochondria, energy (eukaryotes)
  - Hemoglobin – oxygen transport in blood (most animals)

Number of DNA/protein sequence differences measures how closely related species are



Cytochrome *c* Evolution

Organism	Number of amino acid differences from humans
Chimpanzee	0
Rhesus monkey	1
Rabbit	9
Cow	10
Pigeon	12
Bullfrog	20
Fruit fly	24
Wheat germ	37
Yeast	42

- Can look at DNA or protein
- Nonessential parts of DNA/protein will gain mutations over time
- The longer species have been separated, the more different mutations they will have
- More sequence differences = more distantly related (less=closer)