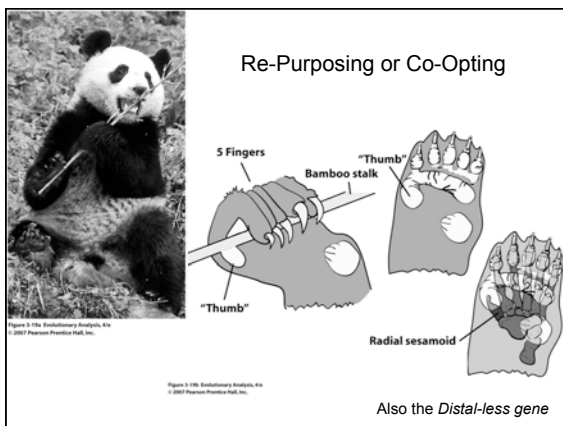
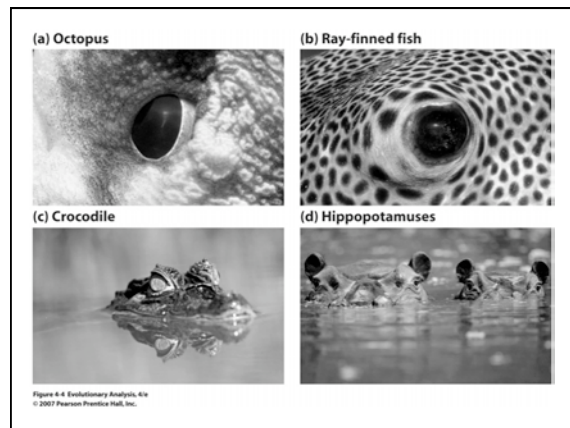
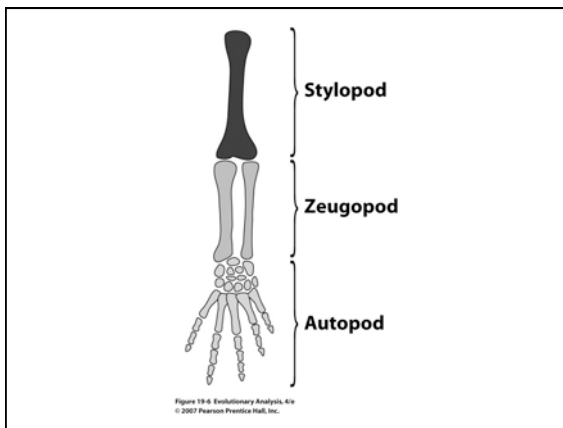
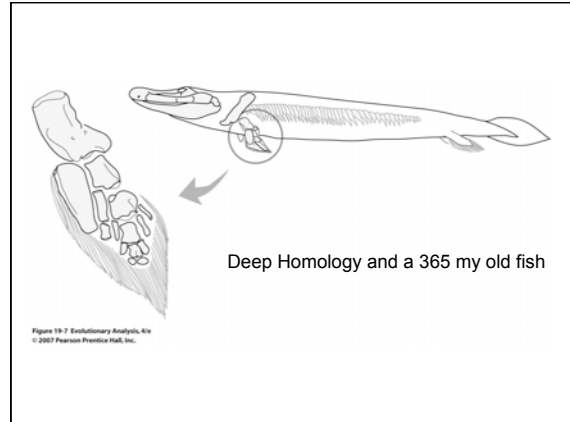


## Evolution and Development

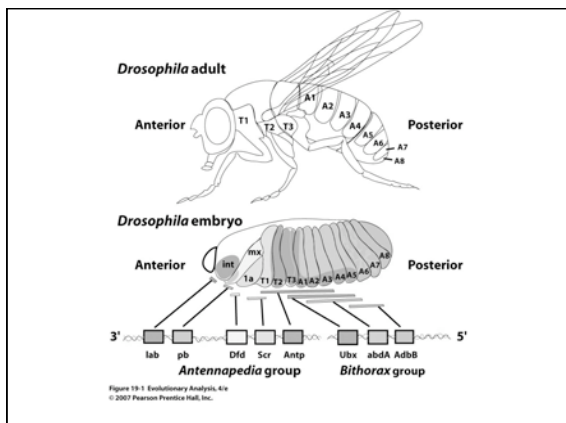
- Embryo starts out as a mass of identical cells, each with identical DNA
- Depending where in the embryo they are, they get a specific combination of signaling molecules which activate proteins called transcription factors which turn genes on and off
- Some code for other transcription factors that turn other genes on and off
- New genes are expressed or shut down as cells divide and so cells in different parts of the embryo begin expressing distinct subsets of the genome



## Hox Genes

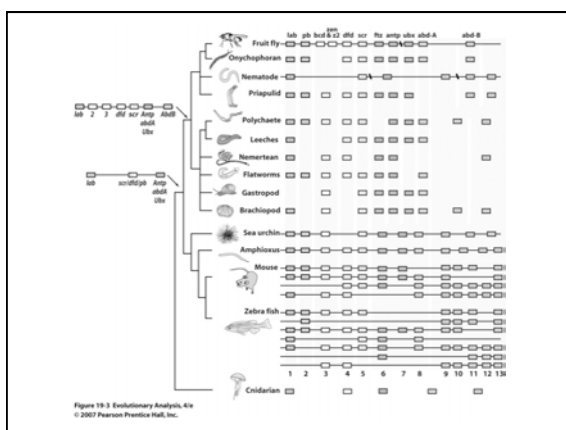
These have been found in all major animal phyla and share 3 key traits:

- ◆ They occur in groups
- ◆ There is correlation between the order of genes on the chromosome and the anterior to posterior location of gene products in the embryo
- ◆ Each Hox gene contains a 180bp sequence which produces transcription factors that bind to DNA and control



### Hox Genes and Diversification

- Hox homologs have been found in non-segmented animals like jellyfish and sponges and plants and fungi---so they predate the evolution of most animals
- Within animals, number of genes within each Hox cluster varies
- So have Hox gene duplication events driven evolutionary diversification patterns?
- More Hox genes = More complexity/



### Hox Genes and Evolution

- The entire Hox complex was duplicated several times during vertebrate evolution
- Echinoderms (closest relative to the Chordates) have one Hox cluster
- Most verts have 4 but ray-finned fish have 8
- Theoretically, if a larger suite of genes can specify body locations, larger and more elaborate bodies can be produced

- Molluscs, with over 100,000 species, have just 3-6 Hox genes.
- Tubeworms have 10
- Mice have 39
- Zebrafish have 52

### Reconstructing Ancestry: ancestor of bilaterally symmetric animals

- Serial repetition of some body parts, but not complex differentiation of segments
- A simple appendage, but not a complex limb
- Clusters of photoreceptors, but not an eye
- A contractile blood vessel, but not a heart
- Condensations of nerve cell bodies into nerve cords, but not a brain