Genetics 453 J. Felsenstein
Evolutionary Genetics Winter, 2002

Outline of lectures 1-3

History of genetics in evolution

1. History's persistent influence in biology. Monster movies are a major example of the survival of Victorian ideas about evolution. (e.g. *The Lost World* by Conan Doyle).

2. Aristotle. "genus" and "species". This was typological thinking

3. The Great Chain of Being. Linear order of animal species. Influential to this day when people think of "higher" and "lower" species. Not per se evolutionary as the linear order can be static.

4. (Mentioned John Greene's *The Death of Adam*). From the 1500's on, developments in astronomy, anthropology, geology, linguistics that led to people being more ready to consider evolutionary ideas.

5. Karl Linné (Carolus Linnaeus). Hierarchical classification (also type specimen system, binomial nomenclature). Was presented as disclosing the true (static) order of nature as laid down at creation. It became widely used, succeeding in summarizing biological diversity better than many other systems present at the time, based on geometric or numerological schemes.

6. If the groups we made in a classification system were entirely genealogical (so that each group was a branch of the tree and all its descendants – a *monophyletic* group), then we would expect a hierarchical classification system that was predicted by the phylogeny (evolutionary tree). Many textbook writers unthinkingly assume that this is the kind of classification system we have had.

7. However, the Linnean classification of organisms that has been in use most of the time since Linneaus has many groups that are not monophyletic. Within the vertebrates, groups like Osteichthyes (bony fishes), and Reptilia (reptiles) are not monophyletic. There has been a trend away from this, toward a purley monophyletic classification system, called "phylogenetic systematics", since the 1960's.

8. George-Louis Leclerc, Comte de Buffon (d. 1788). *Historie Naturelle*. Described animal species as graded into each other along a continuum. Also said that organisms changed and environment affected this. He primarily envisaged changme by degeneration. (Also said earth was much older than 6000 years). Did not give much of a mechanism for this evolutionary change.

9. Jean Baptiste Pierre Antoine de Monet (Chevalier de Lamarck). The first true evolutionary biologist. Worked on invertebrates at the Natural History Museum in Paris. He was a great pioneer of invertebrate systematics, rearranging and clarifying it greatly. In his *Philosophie Zoologique* (1809) Held that organisms had evolved, and that the mechanism was the effects of use and disuse, passed on by inheritance of acquired characters. He did not invent the latter, which was "common knowledge" at the time. "Lamarckian inheritance" was not invented by Lamarck or even promoted by him, as it was widely believed in.

10. Controversies between Lamarckians and others in the early 1800's partly owing to political implications of Lamarckian views in medicine. Etienne Geoffroy Saint-Hilaire. Major supporter of Lamarck who tried to use anatomy to connect vertebrates, invertebrates.

11. Georges Cuvier. Geoffroy's great oponent, and the great founder of comparative anatomy. A central figure in purging French academia, in the period after the defeat of Napoleon, of supporters of republican views. Debunked Geoffroy's assertions of homology rather effectively (for example Geoffroy's "homologies" between crustaceans and fish). Lamarckian views inspried many reformers and radicals of the early 1800's (especially in medicine). Adrian Desmond's book *The Politics of Evolution* goes over this in detail, explains how Cuvier and others played a major role in defending the establishment, and how Darwin probably delayed publishing his work because of these controversies.

12. *Naturphilosophen*. Group of romantic philosophers who asserted a unity of all life and that different life forms were explained by different amounts of development (but not evolution) along one common course. Johann Wolfgang von Goethe, the central figure in German literature, was allied with them and was also the first person to connect the flower parts with leaves (by a developmental argument). Flowers arose by the same developmental pathway that leads to leaves, but gave flowers if continued further (in Goethe's view).

13. Charles Darwin. Journey on the *Beagle*. Natural selection. Alfred Russell Wallace, co-discoverer of natural selection. Darwin's theory of heredity was called Pangenesis (the units were gemmules).

14. Fleeming Jenkin (1867) criticism of Darwin. Buddy of William Thompson (Lord Kelvin). Kelvin thought he had a fatal physical objection to Darwin's work based on the length of time the sun could remain hot, which he calculated meant that it could not be very old. It turns out that nuclear fusion within the sun creates heat and that invalidates his calculation. Jenkin had a different criticism than his friend Kelvin. It was based on blending inheritance. It would cause progress to stall (half the variance of the population goes away every generation). Kelvin encouraged him to publish this. Darwin increased his emphasis on inheritance of acquired characters to cope with the criticism.

15. Gregor Mendel. Under Mendelian inheritance there is no "blending" of different alleles. The variability does not disappear as it does with blending inheritance.

16. Mendel's laws rediscovered by Karl Correns, Hugo de Vries, and Erich von Tschermak-Seysenegg in 1900. Maybe only Correns really discovered them independently, the others from finding Mendel's paper first (though that is not what they claimed).

17. Controversy between the "Biometricians" (Francis Galton and Karl Pearson) and the Mendelians over evolution. The Mendelians put forward mutation (discovered by De Vries) against natural selection. The Biometricians put forward a statistical prediction and developed many regression and correlation methods, having a great effect on the development of statistics.

18. R. A. Fisher, Sewall Wright, and J. B. S. Haldane reconciled natural selection with Mendelian genetics, founding theoretical population genetics, in the period 1918-1930, kicking off the Neodarwinian Synthesis which matured and came to the attention of most biologists through the books of George Gaylord Simpson, Ernst Mayr, Theodosius Dobzhansky, G. Ledyard Stebbins, and Julian Huxley (all but the last one published by Columbia University Press!).