Biol 112

Lecture 3: Evolution and
Population Genetics

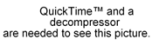
LAB REMINDERS

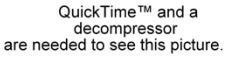
- This week lab will take place at the HMNH
- TURN IN YOUR PIN FROM THE MUSEUM TO YOUR TA with your typed non plagiarized answers to the questions in the lab manual
- If you need a ticket see me after class

LAB SECTIONS

Day	Section	Time	Room	TA
Wed	4	1:00PM-3:59PM	M-1-114	Sarah
Wed	2	5:30PM-8:29PM	M-1-114	Jon
Thurs	3	9:30AM-12:29PM	M-1-114	Jon
Thurs	6	9:30AM-12:29PM	M-1-116	Scott
Thurs	1	2:00PM-5:00PM	M-1-114	Sarah
Thurs	7	2:00PM-5:00PM	M-1-116	Scott

TA's
will be on bench outside Glass flowers





Sarah

Wed &Thurs PM

Jon

Thurs AM/ Sunday AM

Scott

Thurs AM & PM

Great questions from after class

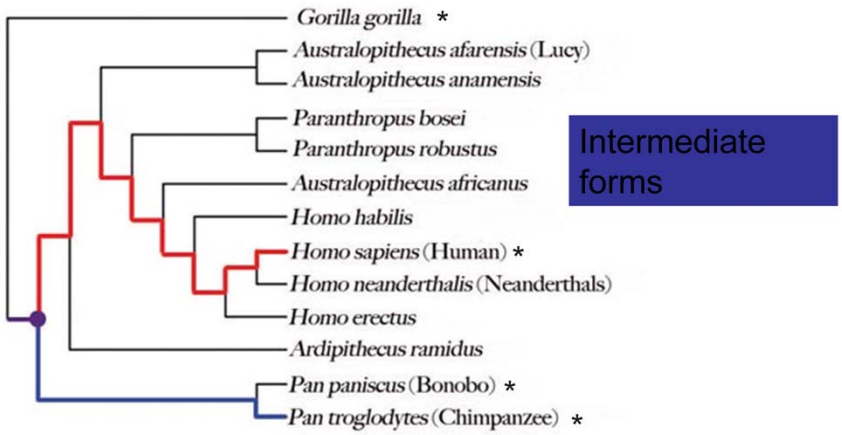
- How do you read phylogenetic trees?
- Were humans once chimps?
- How do vestigial characters evolve? (we will get to this later)

Evolutionary tree of living primates based on DNA data

QuickTime™ and a
decompressor
are needed to see this picture.

4%
difference

Tree based on morphological data (including fossils)



Evolution in populations

- Remember evolution takes place at the population level
- Variation in populations based on inherited traits can result in changes in frequency of traits over time - evolution

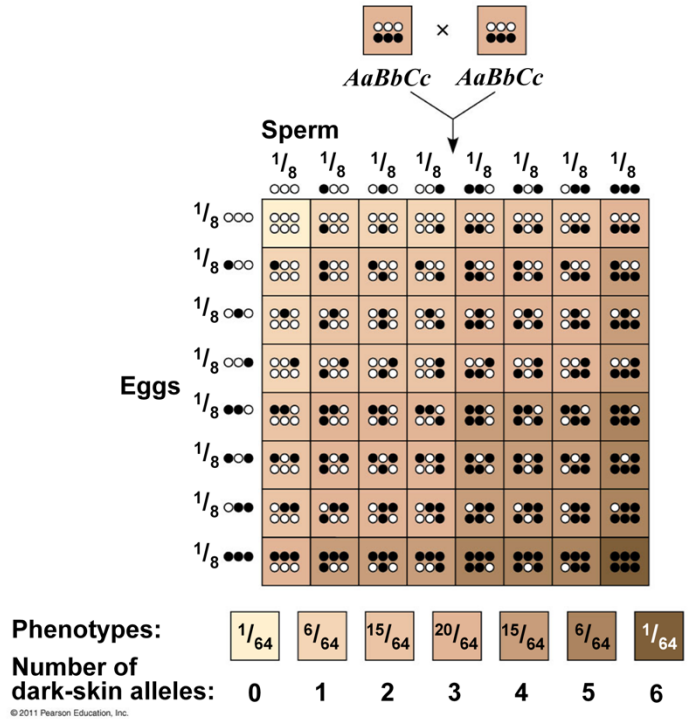
Variation in genetic traits

Discrete traits- based on one gene with more than one allele: examples (remember basic Mendelian genetics)

In humans: Freckles, ABO Blood type

Quantitative traits- phenotype based on multiple genes- in humans: skin color, height, eye color

Figure 14.13



What causes genetic variation ?

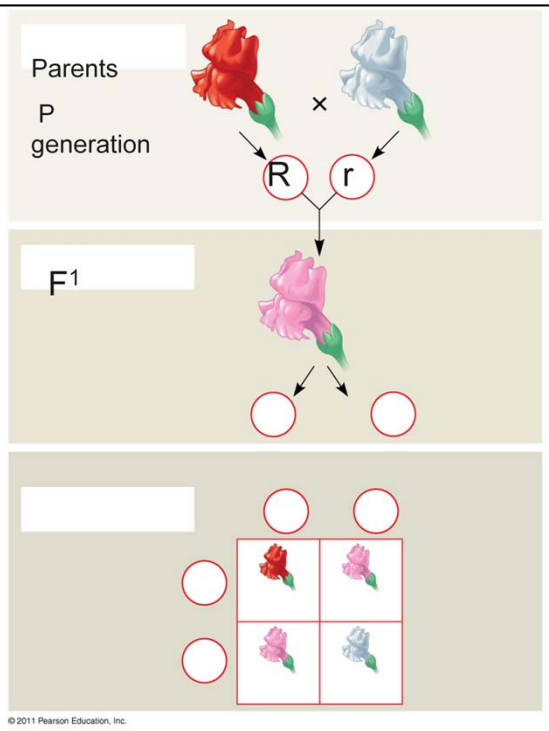
- Mutation- changes in the nucleotide base in a DNA sequence, deletions, or insertions
- Gene duplications and deletions
- Chromosomal rearrangements
- Recombination
- Sexual reproduction (meiosis)

Review of genetics terms

- Gene: controls a character
- Allele: alternative form of a gene (controls trait)
- Genotype: the alleles an individual has for a particular trait (RR, Rr, rr)
- Phenotype: Observable feature of organism

Review of Mendelian genetics

- Have a population of red flowers, white flowers and pink flowers. The gene for flower color is controlled by one gene with 2 alleles. What are the genotypes for these phenotypes?


Parents
P
generation
×
R
r
F1
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Population level

- In 111 you looked at Mendelian inheritance in individual mating pairs now we will look at genetics at the population level
- Population: a group of interacting and interbreeding individuals in one area

Calculating allele frequencies

- See notes

Hardy-Weinburg model

- Using allele frequencies you can predict the genotype frequency and phenotype frequency of the next generation. With the following equation:

$$p^2 + 2pq + q^2 = 1$$

Very simplified model with some assumptions

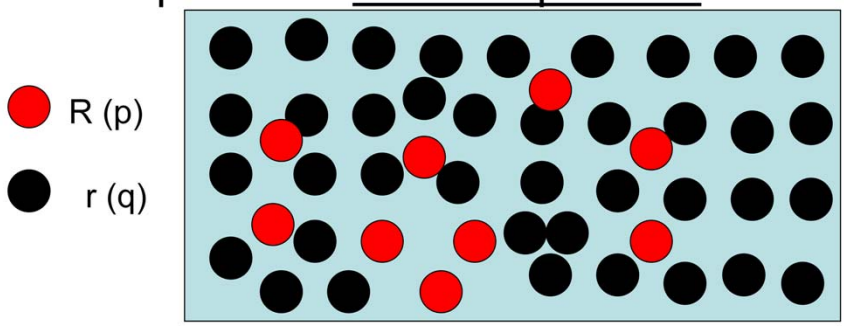
Assumptions of Hardy-Weinberg model

1. Very large population size
2. No migration in or out
3. No mutation
4. Random mating
5. No natural selection (equal fitness)

   Fitness= reproductive sucess

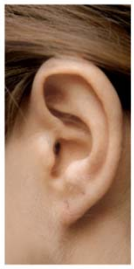
Random mating

- Egg and sperm drawn randomly from population: chance of having R or r depends on allele frequencies



Can use HWE to predict carriers for alleles in humans

- Human genetics: attached vs. free earlobes



Would we expect it to be in HWE

1. Large population size
2. No mutation (low rate)
3. no Migration ?
4. random mating
5. no selection

Ear lobe example cont.

allelle	contribution to phenotype	frequency
E	unattached earlobe (dominant)	p
e	attached earlobe (recessive)	q

Genotype	Phenotype
EE	unattached
Ee	unattached
ee	attached

- Q: How many people in class are carriers for the attached allele?
- Assume that this trait is at HWE.

applying HWE

- Is a population at HWE (not evolving)
- 1. calculate allele frequencies of a trait in a population of a species
- 2. predict genotype frequencies if population were at HWE
- 3. compare predicted and actual
  - see examples from class