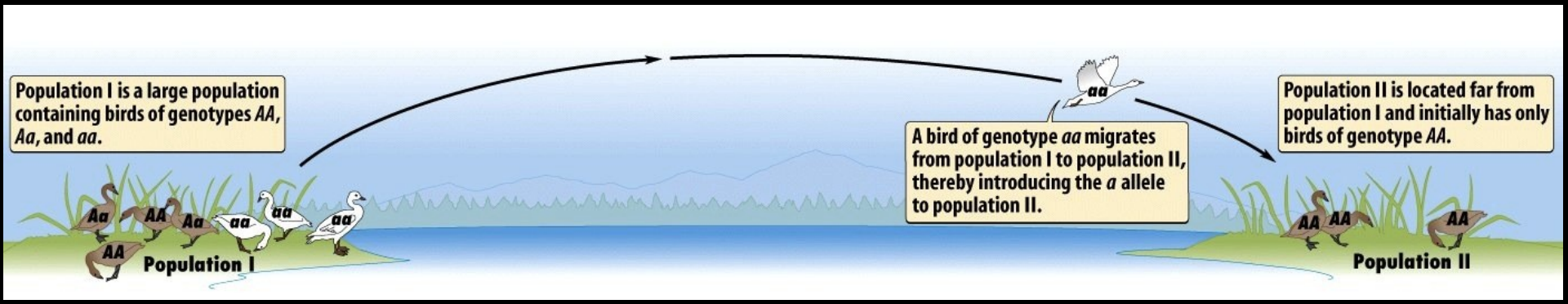
- Midterm on Friday at 2 pm

Gene flow

- Consists of “flow” of alleles between populations due to movement of fertile individuals (or gametes, e.g. in pollen)
- Causes populations to have more similar gene pools (can benefit pop. , but also sometimes be maladaptive)



Genetic Drift

- Random changes in allele frequencies within populations which result from **chance** variation in individual survival and reproduction
- Most important in small populations
- Changes can be neutral, maladaptive, or adaptive

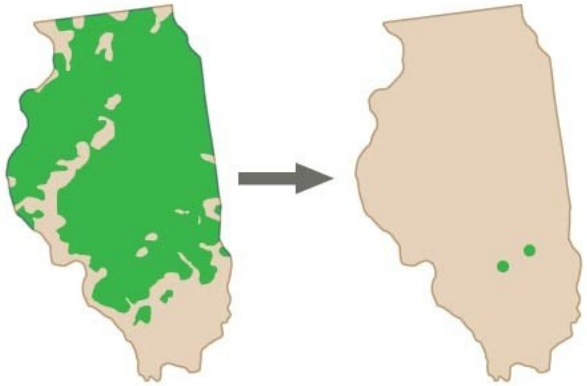
Genetic drift:
Bottleneck effect (happens at near-extinction events)

- Dramatic decrease of population size leaves only part of the genetic variation
- Example: Northern elephant seals

Greater prairie chicken

Pre-bottleneck (Illinois, 1820)

Post-bottleneck (Illinois, 1993)



Range of greater prairie chicken

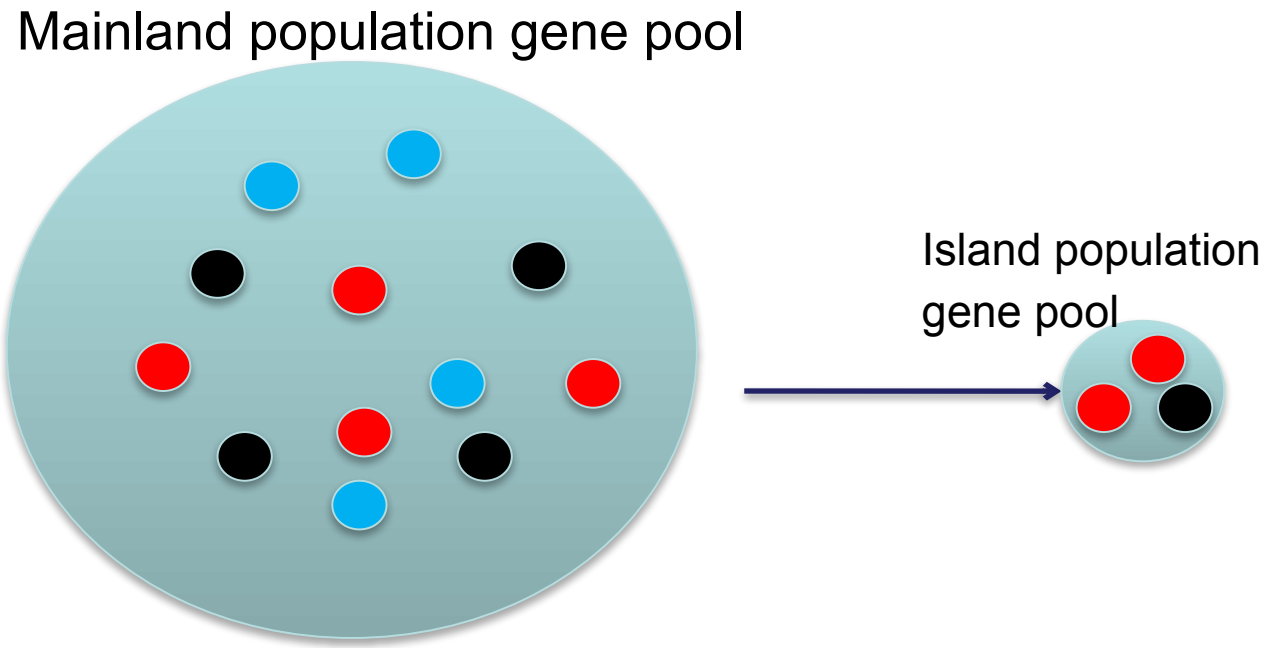
(a)

Location	Population size	Number of alleles per locus	Percentage of eggs hatched
Illinois 1930–1960s 1993	 1,000–25,000 <50	 5.2 3.7	 93 <50
Kansas, 1998 (no bottleneck)	750,000	5.8	99
Nebraska, 1998 (no bottleneck)	75,000–200,000	5.8	96

(b)

Genetic drift :
Founder effect (happens at dispersion events)

- Dispersion to small founder population can lead to random differences in allele frequencies



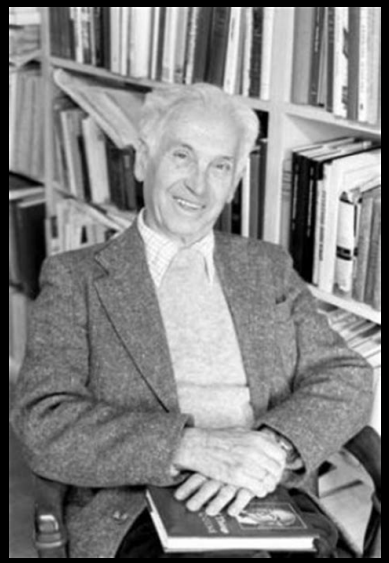
Genetic drift: Founder effect examples

- Amish – small founder population – EVC syndrome (Ellis Van Creveld); polydactyl, short-limb dwarfism
- Descendants of British colonizers of Tristan da Cunha – retinitis pigmentosa; blindness

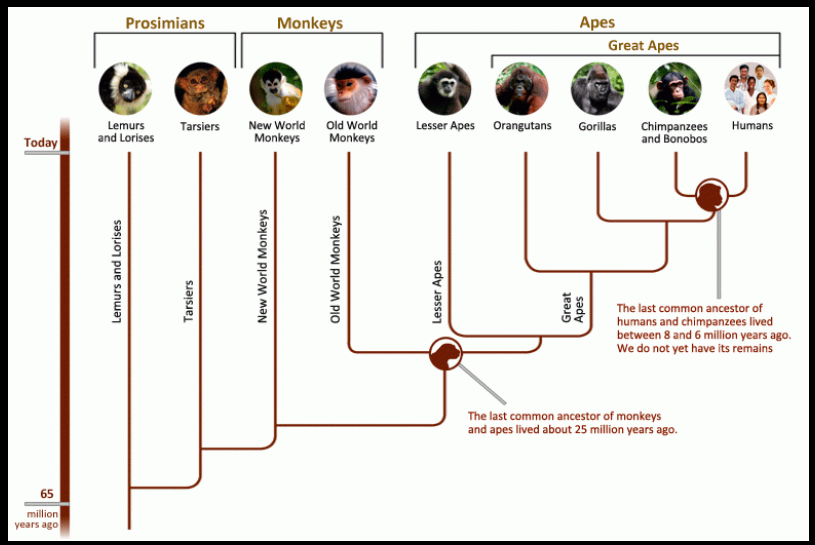
The Modern Synthesis

- First half of the 20th century e.g. Ernst Mayr and Theodosius Dobzhansky
- Natural selection combined with genetics, particularly Mendel's inheritance laws (also DNA transcription, plus paleontology , speciation, and phylogenetics)

Dobzhansky 1900-1975

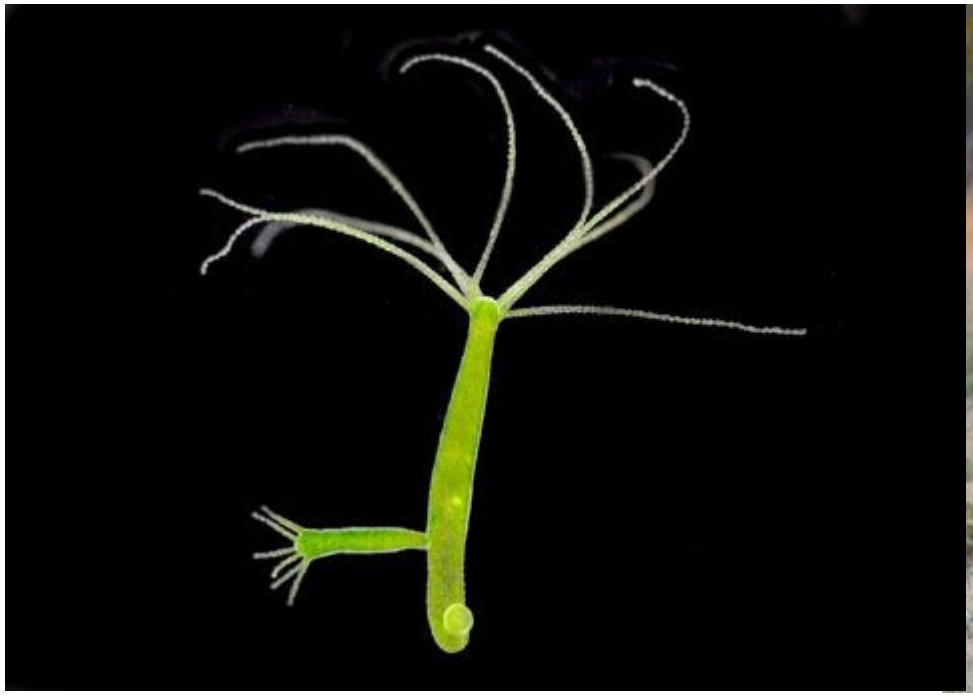


Mayr 1904-2005



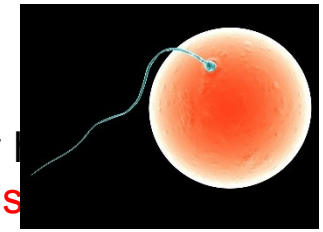
Sexual reproduction and sexual selection

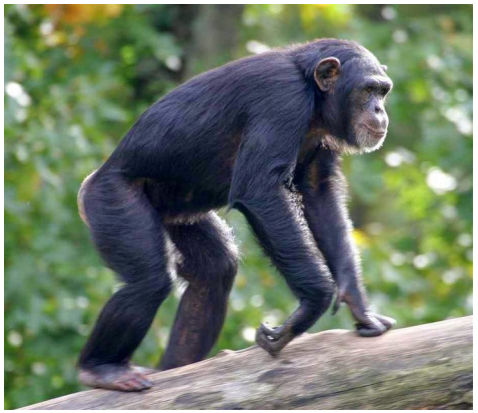
- Microorganisms typically reproduce through simple mitosis, some asexual reproduction (multicellular) happens by budding – offspring are clones
- Sexual reproduction is more common in complex organisms (most vertebrates, all mammals), many plants can reproduce both asexually and sexually.



Defining Biological Sex?

Defining Biological Sex?



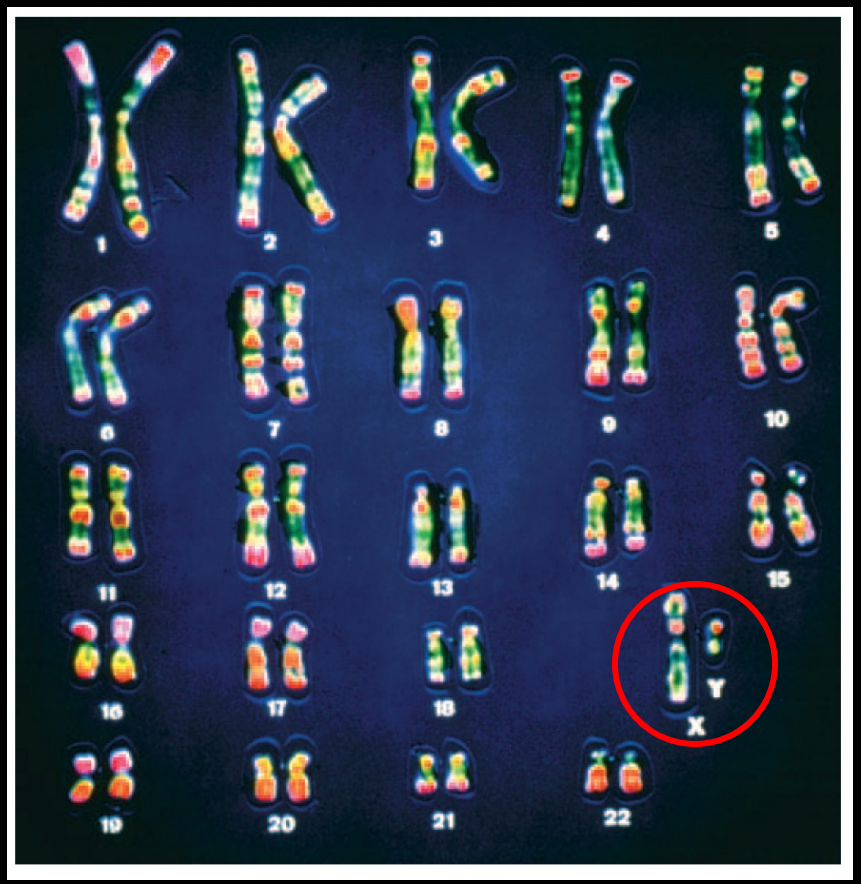


- In biology, defined by [illegible] that can produce eggs or sperm (testis, male)

  - In <u>mammals</u> males always have XY chromosomes, while females have XX
  - There is an enormous amount of variation in other animals and plants (e.g. birds: females XY; crocodiles: temperature, not chromosomes)

Inheritance of sex-linked genes

- Sex is determined by X and Y chromosomes in all mammals (XY=male, XX=female)
- The mammalian sex chromosomes have genes for many characters unrelated to sex (e.g. color blindness vs normal color vision)
- A gene located on either sex chromosome is called a sex-linked gene (Sex-linked genes follow specific patterns of inheritance)



Expense of Sexual Reproduction

- Find mate, sometimes facing competition
- Assess mate potential
  -Both sexes have to show signs of sexual maturity and fertility

- So why do it?

Expense of Sexual Reproduction

- Find mate, sometimes facing competition
- Assess mate potential
  -Both sexes have to show signs of sexual maturity and fertility

Increase genetic variation among offspring

Sexual selection (non-random mating)

- Discussed by Darwin, who identified two components
  -competition within one sex for access to the other - intrasexual selection
  -mate choice - intersexual selection

Often leading to strong sexual dimorphism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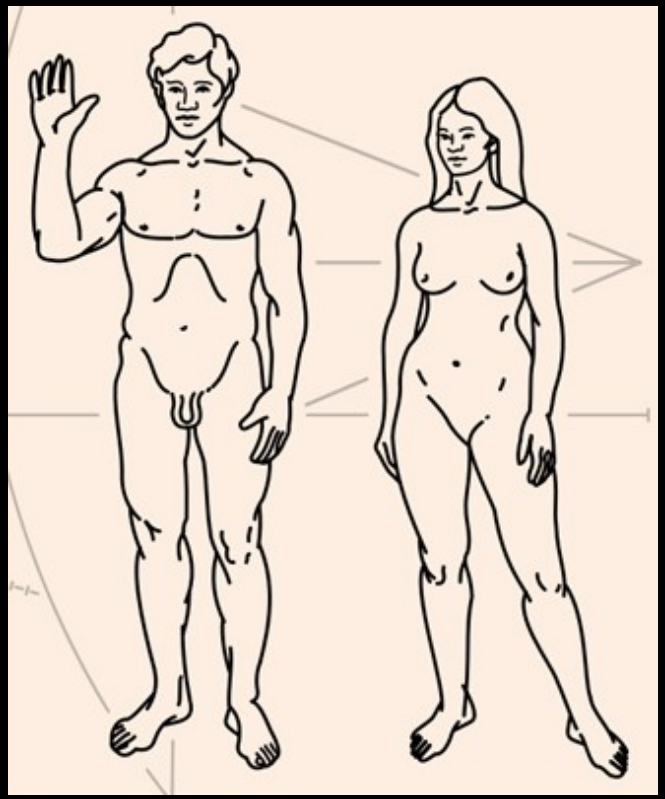


Sexual dimorphism in humans

- **Why are men larger than women?**

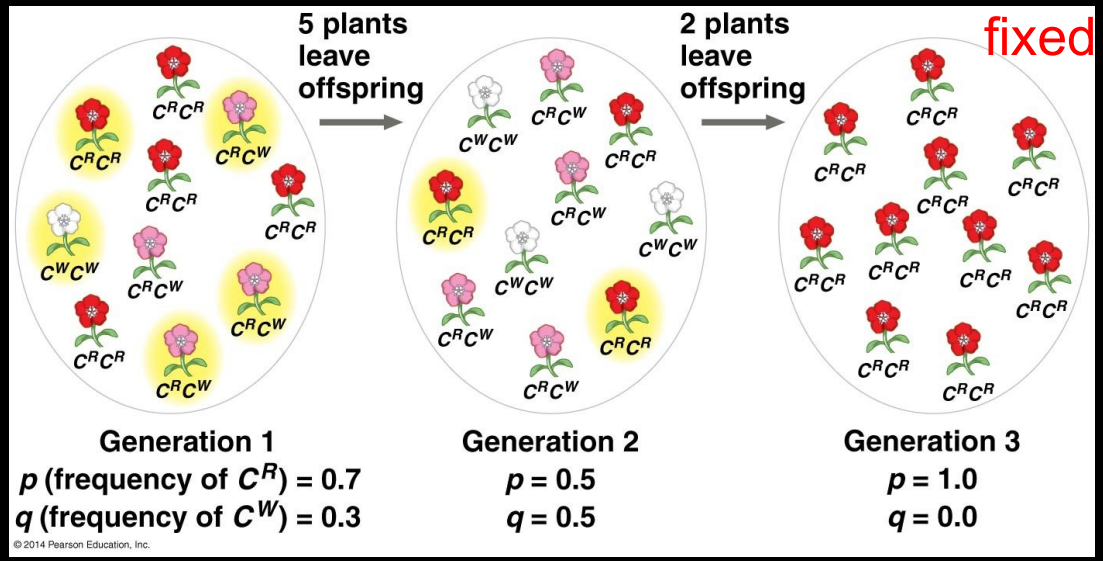
Hadza, hunter-gatherers Tanzania
-Most common reason for murder: men fighting over women
-Women also tend to prefer men who are larger than themselves

Intro to population genetics

- How do alleles and genotypes behave in whole populations?

Gene pool

- A concept denoting the entire genetic makeup of a population i.e. all the alleles present in an interbreeding population
- If only one allele is present, this is allele said to be fixed (this can happen by natural selection, or genetic drift)



Intro to population genetics

- Genotype frequency: the frequency of individuals with a specific genotype (e.g. homozygous for white C^wC^w)
- Allele frequency: the number of copies of one specific allele divided by number of copies of all alleles in that population (for that gene, remember two copies for each individual)
- Allele frequencies in a population; typically denoted by lowercase letters (e.g. alleles C^R, C^w could have allele frequencies p, q)
- If there are only two alleles present, then p+q = 1 (100%)
- If there is only one allele for a given locus, then it is said to be fixed (e.g. if all individuals are white C^wC^w)

Intro to population genetics

- E.g. a population of 100 plants has two alleles for flower color, C^w and C^R. 10 individuals are homozygous for white, 20 are heterozygous C^wC^R (if pink, what kind of dominance?), and 70 are homozygous red.

- Number of white alleles: (10x2) + (1x20) = 40. Allele frequency: q= 40 / 2x100 = 0.2

- Red allele frequency: p= 1- 0.2 = 0.8

Intro to the Hardy Weinberg principle

- Population = a localized group of interbreeding individuals of the same species
- Hardy and Weinberg studied the allele frequencies in stable populations

Hardy Weinberg principle

- Given a series of assumptions, allele frequencies and genotype frequencies in a population will not change between generations, and genotype frequencies follow a set pattern

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