Anthro. 101:
Human Biological Evolution

Lecture 5: Microevolution

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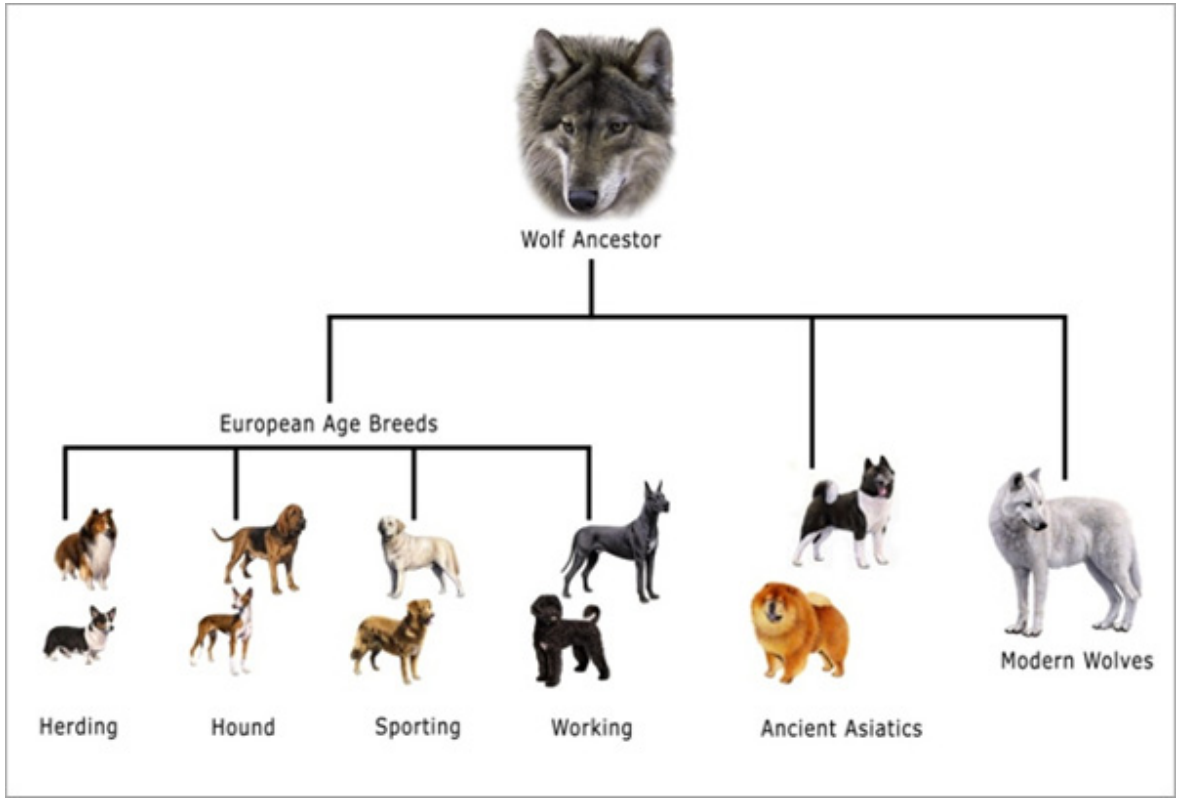
Hidden variation allows species change



New combinations extends the range of variation

= new material for NS to act upon

Lets Check What Causes Evolution: The Five Fingers

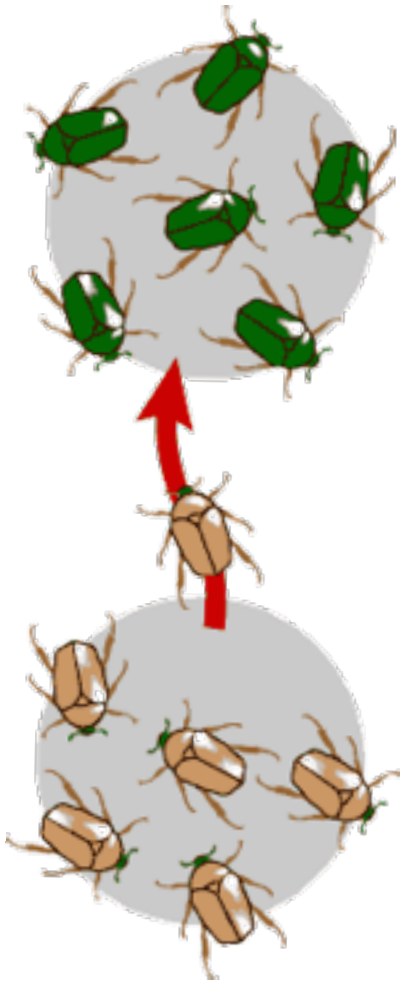
- http://ed.ted.com/lessons/five-fingers-of-evolution#review

Some forces redistribute existing variation

- **Natural selection**
- **Gene flow**
- **Genetic drift**
  - **Founder Effect**
- **Sexual selection**
- **Nonrandom Mating**

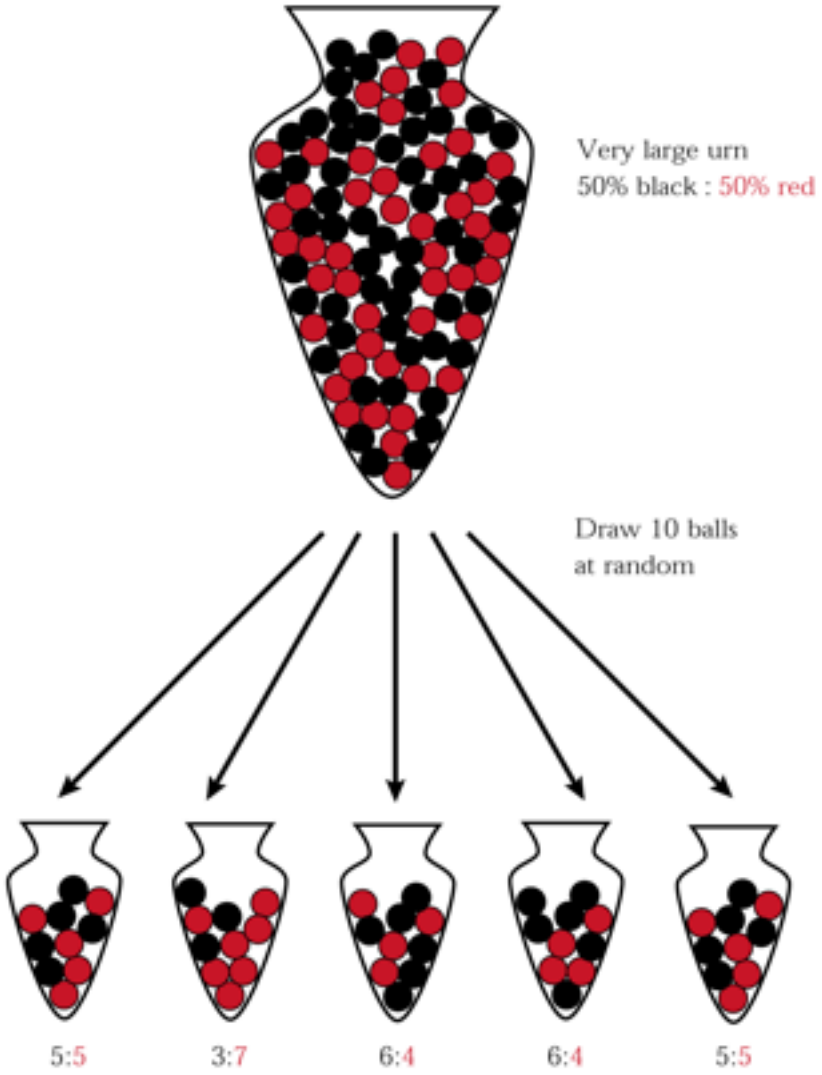
Gene Flow

- Exchange of genes between populations
- Can be one-way or two-way
- Not *exactly* the same as migration
  - Amish: Migration without gene flow
  - Vietnam War: Gene flow without migration
- Maintains variation within populations
- Reduces variation between populations



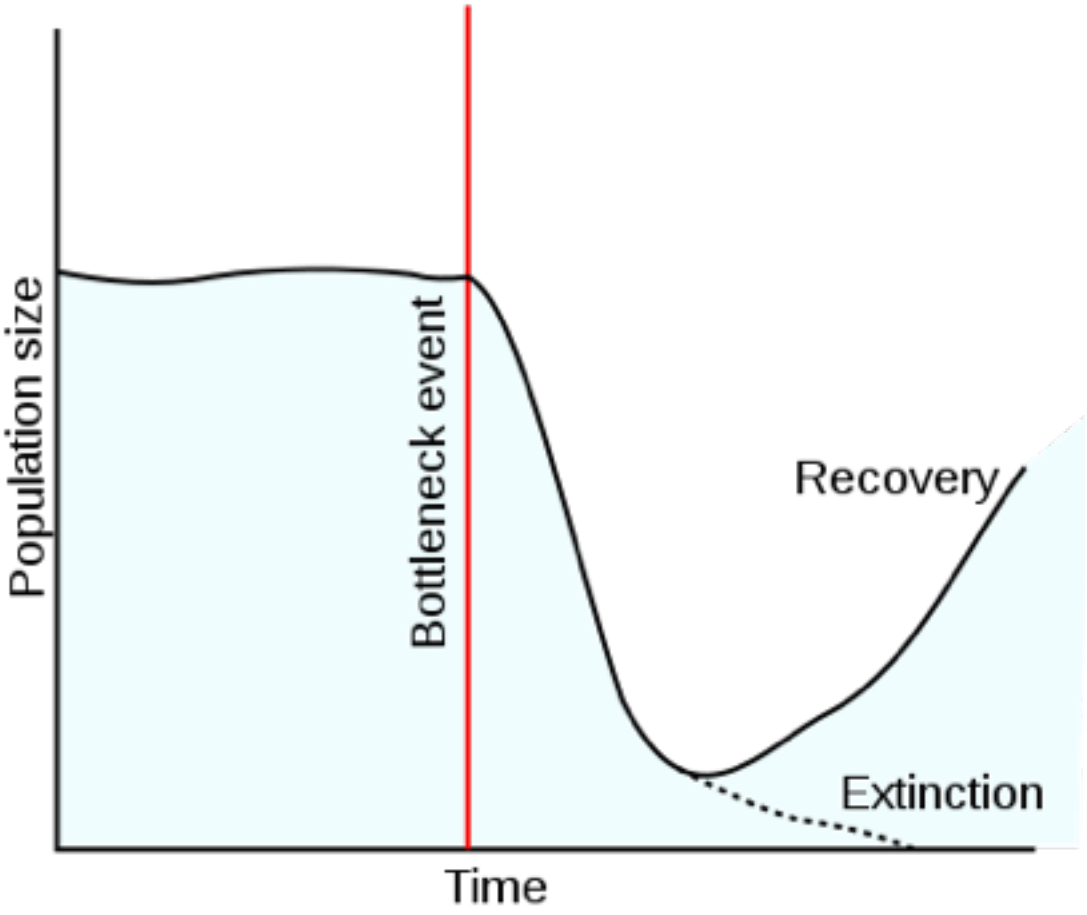
Genetic Drift

- In small populations, random processes affect variation
- Frequencies in small samples show small random differences from large source population
  - 5 red:5 black
  - 6 red:4 black
  - 3 red:7 black
  - 7 red:3 black

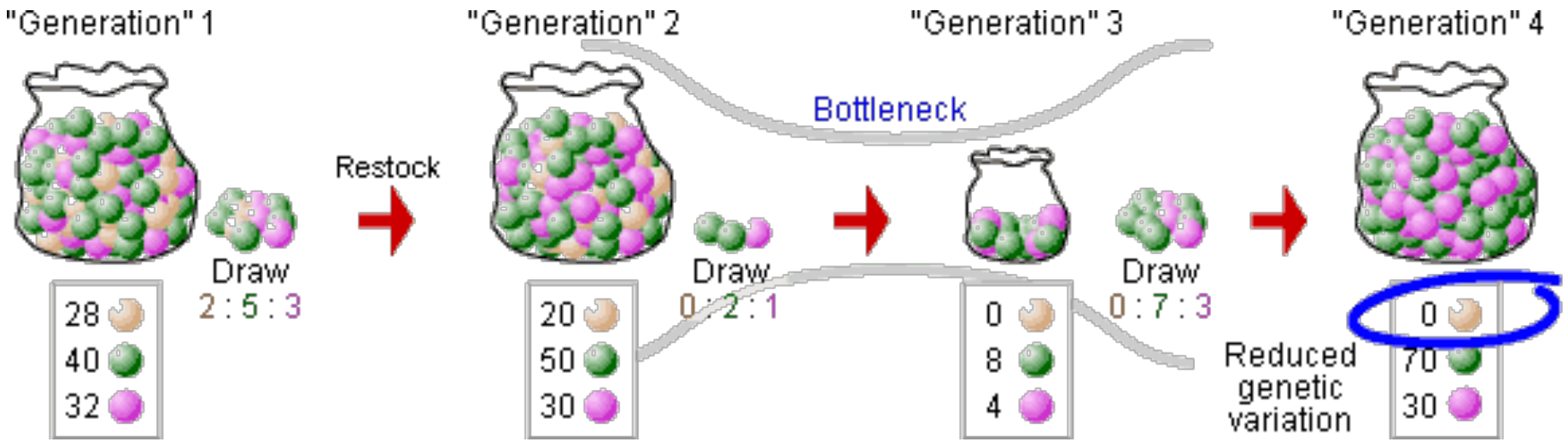


Population Bottlenecking

- Population crash
- Reduces genetic variability



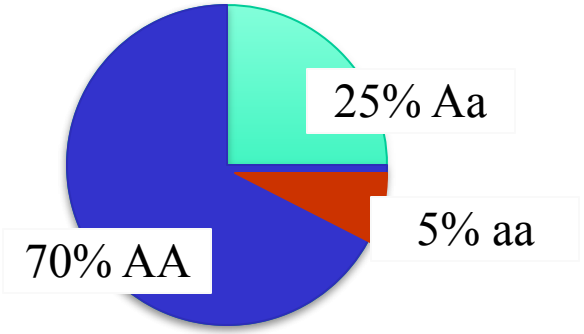
Founder's Effect



- After a Population Bottleneck
- Reduced genetic variability affects the remaining population
  - Color blindness on Pingelap
  - Prophyria in the British Royal Family & South Africans
  - Ellis van-Creveld syndrome among the Amish

Evolution is the change in the genetic composition of a population over time

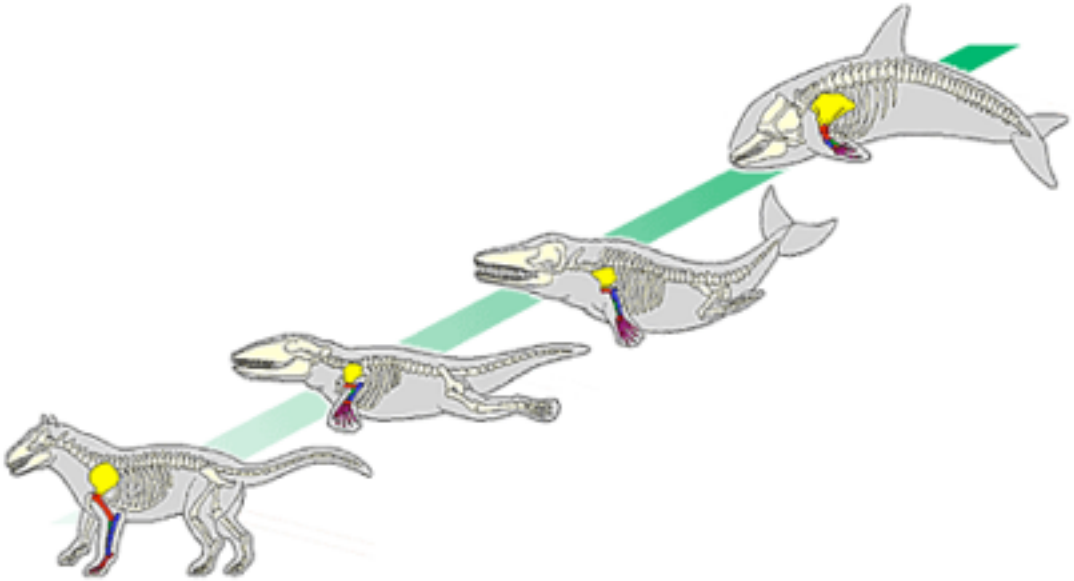
- Natural selection acts on phenotypes (genotypes affected)
- Next generation has different traits (and genes) that are common
- **When allele frequencies change from one generation to the next, evolution is occurring**
- Equilibrium = no change



Population Genetics allows us to track the changes in allele frequencies in a population

- Understand how traits in a population can change over time = Evolution

- Demonstrate how alleles stay hidden in the genome & available for natural selection to act upon



Questions??

- List some of the forces that redistribute variation
- Tell me about a population bottleneck
- How does this influence a founders effect?
- Is population genetics important? Why?

Sickle Cell

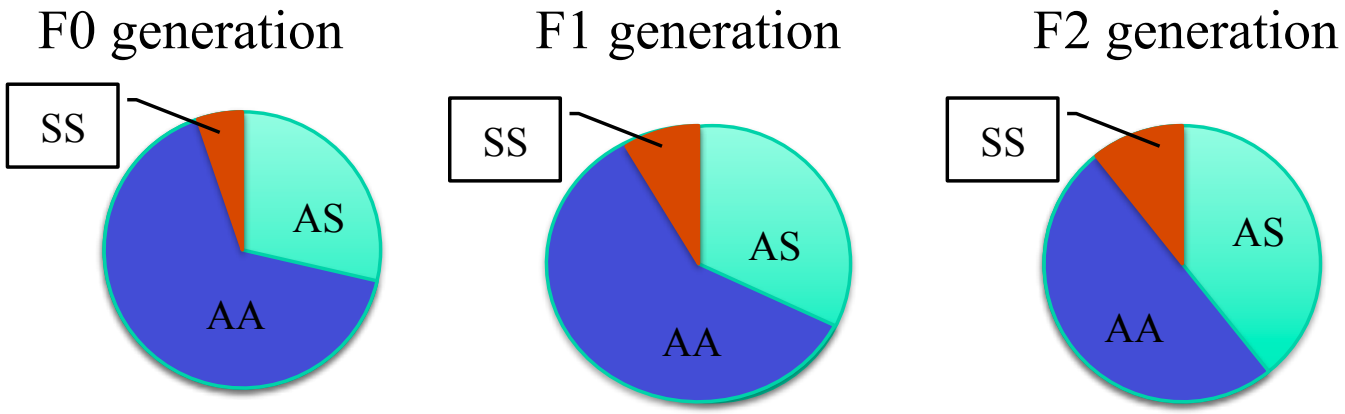
- https://www.youtube.com/watch?v=1fN7rOwDyMQ

Let's follow a Mendelian trait…

- Sickle-cell anemia
- Two alleles
  - A = normal hemoglobin
  - S = sickling hemoglobin
- Three genotypes
  - AA normal blood cells
  - SS sickled blood cells
  - AS defense against malaria

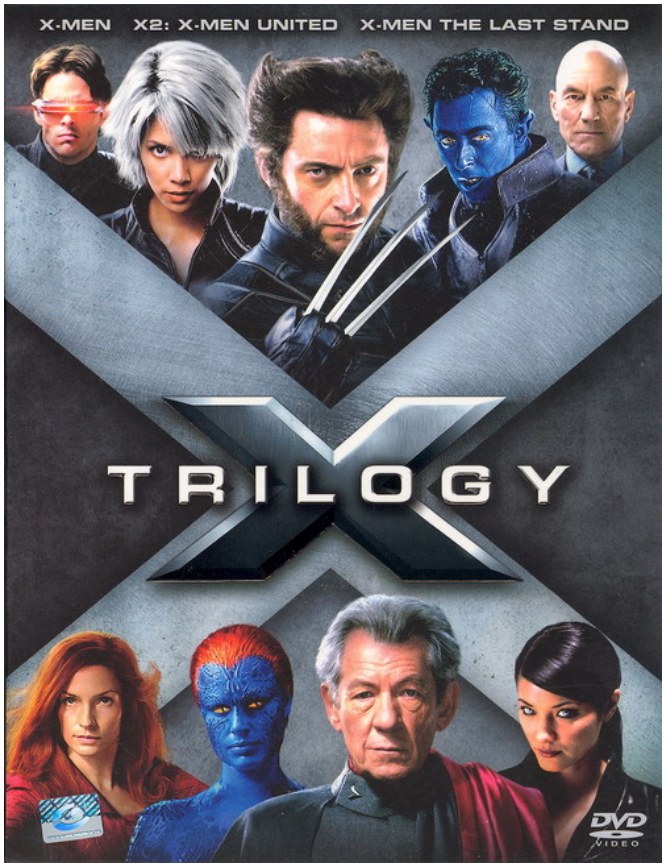
Selection for AS genotype (and S allele)

- AS people have an advantage
- S allele favored as part of the heterozygotes despite SS disease & death (before reproduction)



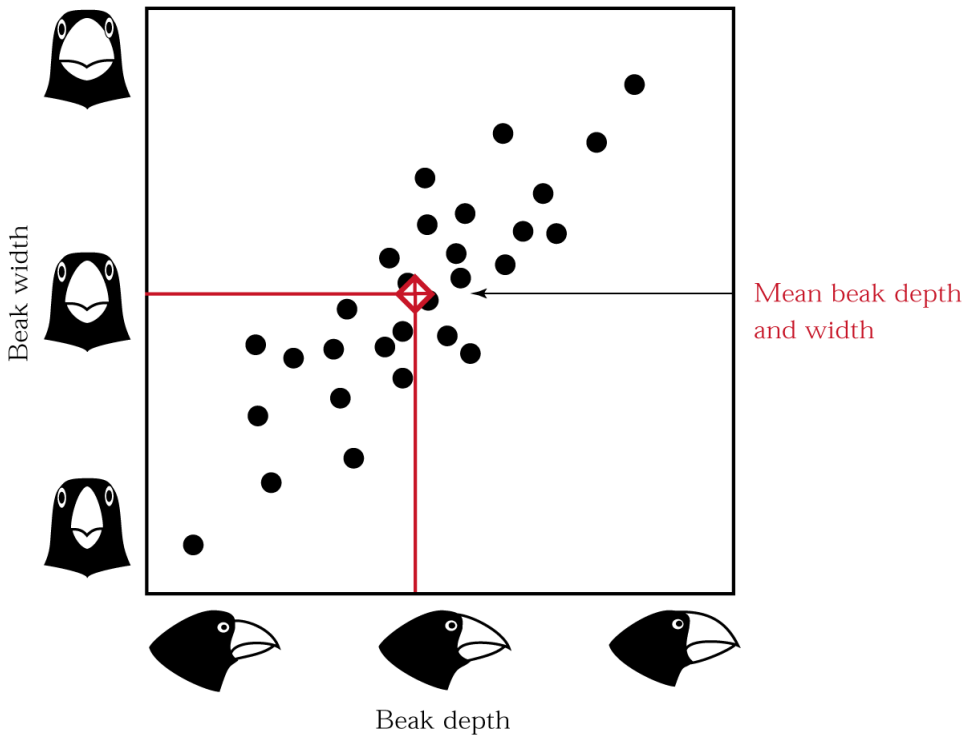
Natural selection is not guaranteed to produce "perfect" adaptations

- NS can only act on existing traits
- Natural selection does not have "foresight"
- Traits arise via mutation, chance



NS limited by Pleiotropy

- In Darwin's finches, beak traits are correlated
  - Deeper & wider
  - Shallow & narrow
- one gene affects multiple traits = correlated traits



NS limited by Disequilibrium

- If environment changes, population is not perfectly suited

In Humans!!

- Some nutrients (fat, salt, sugar) rare in the past
- Selection favored strong preferences
- No longer rare, but still delicious!

NS limited by the Laws of Physics & Chemistry

- Some designs may be physically impossible
- Why can't elephants fly?
- Why can't male mammals lactate?