

The inspiration I'm looking for isn't out there, but inside of me!



Natural Selection



The Peppered Moth

“THE” Classic Evolution Story



The Peppered Moth

Peppered Moths have three colour variations:

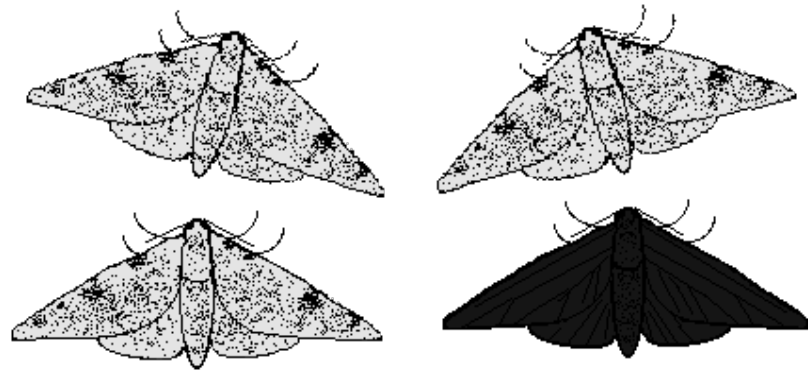
(I) greyish-white with black flecks

(ii) black

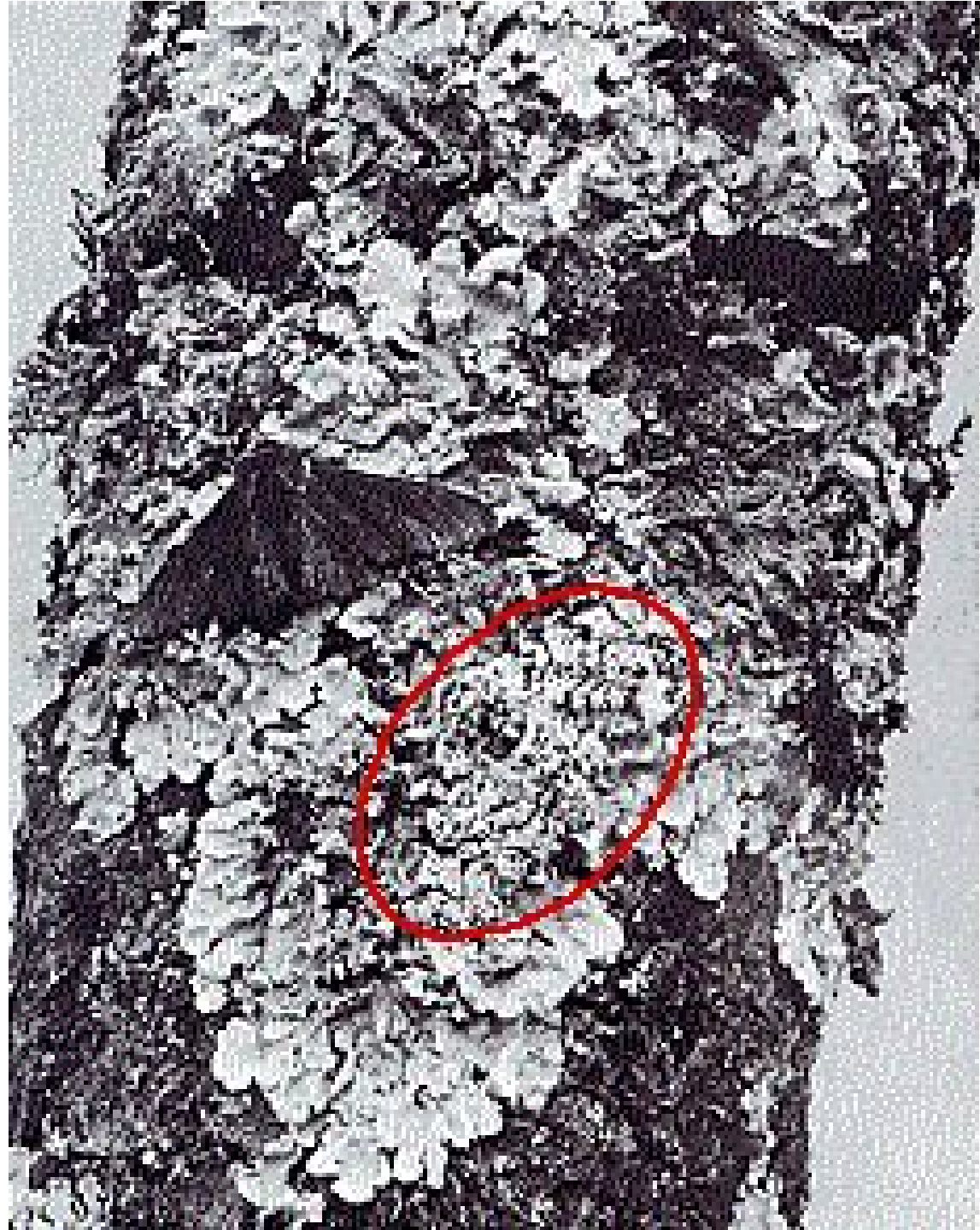
(iii) *intermediate*



- originally black was very rare (approx 2% in 1850)



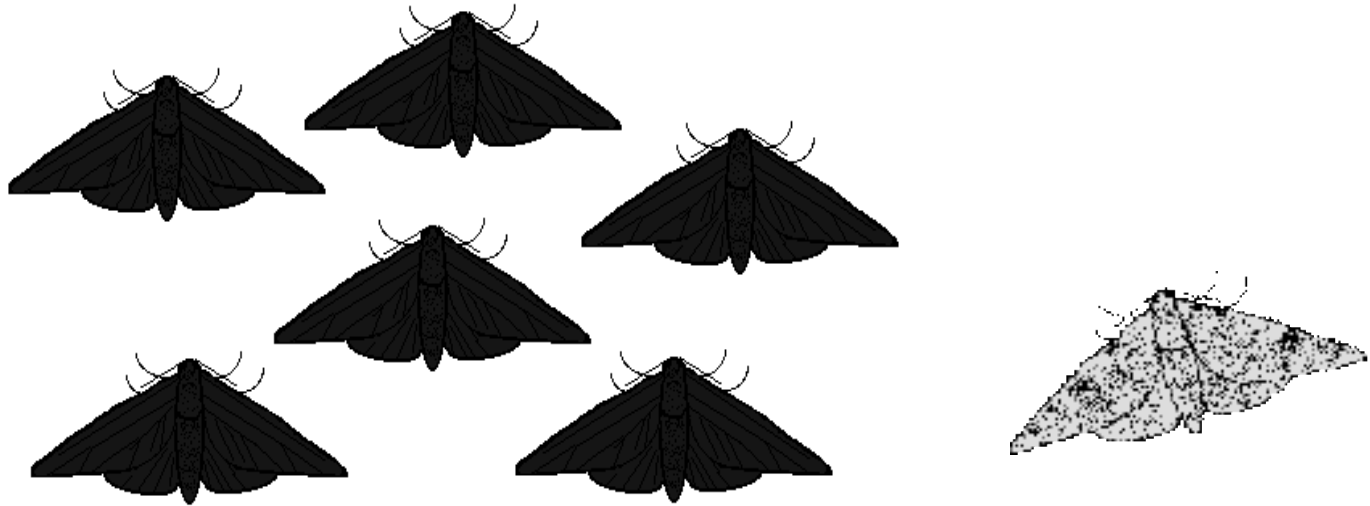
- 1st caught in 1848 in Manchester, England





- 50 years later (early 1900's)

-->95% of moths were black in Manchester

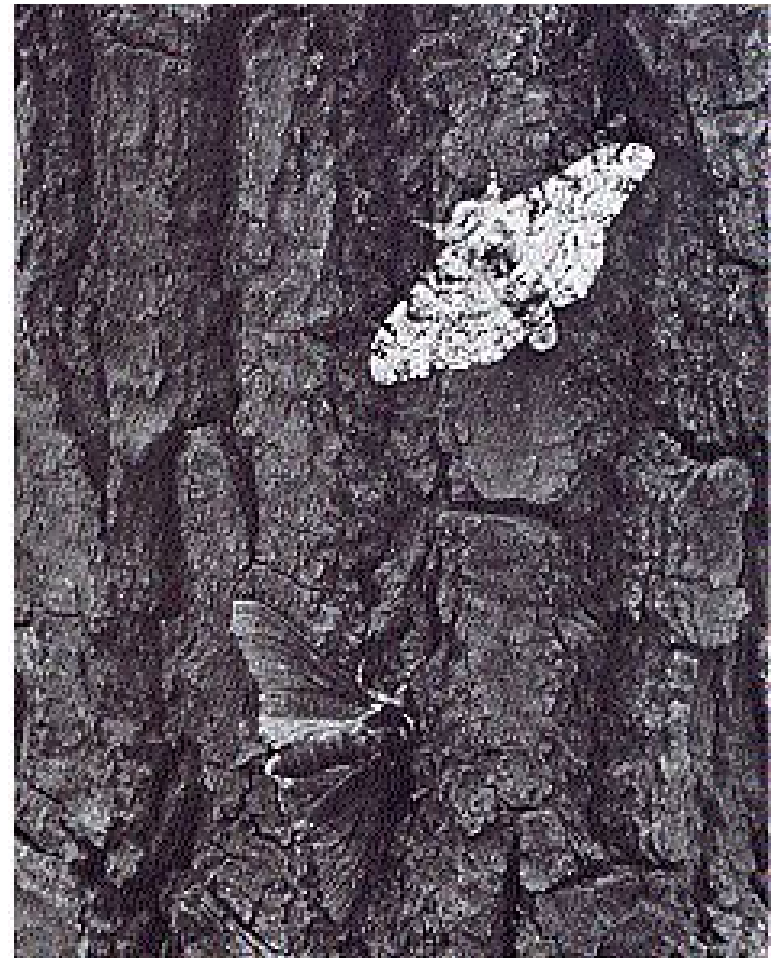


—>however, in rural areas black moths were still rare



Industrial Melanism

- darker varieties of typically light coloured species how Are called melanistic.
- *Biston betularia* or peppered moth is the most famous of these.



Peppered Moth Study by Bernard Kettlewell



Peppered Moth Study by Bernard Kettlewell

1. Release-Recapture experiments

- mark & release moths; recovered more melanic (dark) moths in polluted areas, light in clean areas

2. Direct Observation and filming

- observed birds eating moths off trees

3. Camouflage

- visually ranked effectiveness of moths on different backgrounds

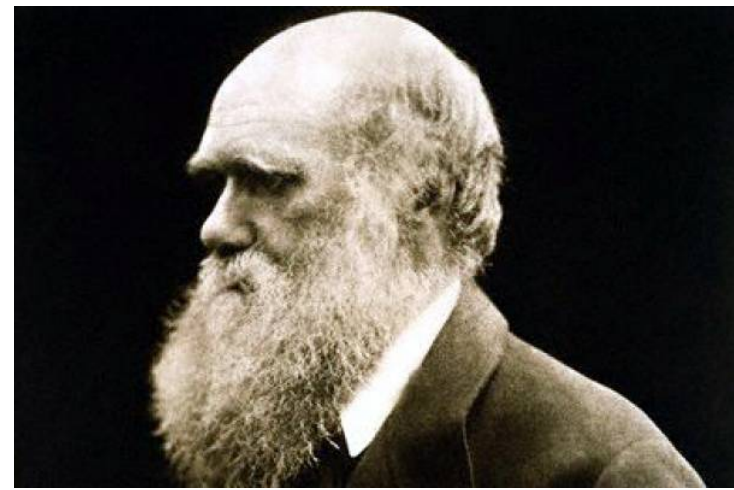
4. Geographic Distribution

- more light coloured moths in clean areas; more melanic in polluted area

Peppered Moth Story

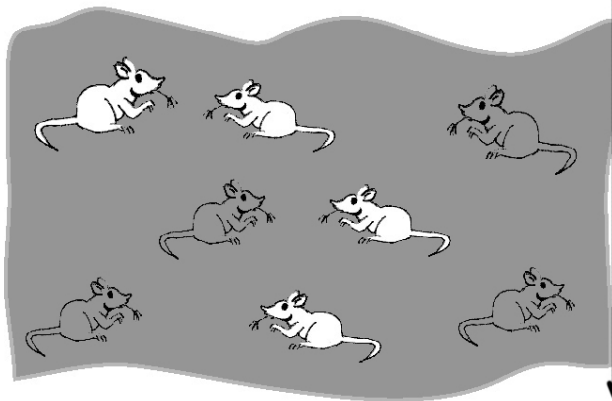
- behaviour & genetic make up of moths & their environment are important
- *during day rest on trees where at risk of predation by birds*
- *fly at night to mate*
- *predators that hunt them do so in the day if they can find them*
- *polluted areas have a greater melanic varieties*
- *peppered individuals were in greater numbers in clean environments with lichened trees*

Darwin's Theory of Evolution by Natural Selection



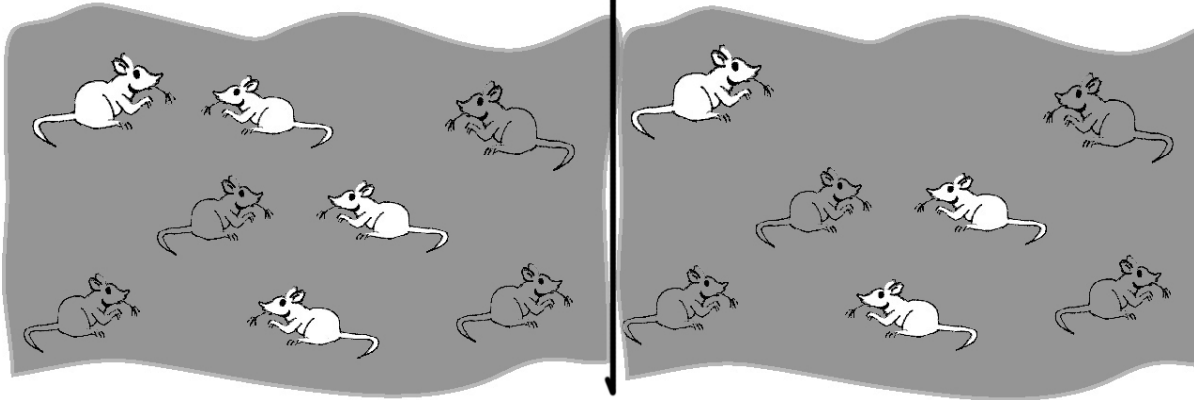
1. Organisms differ; **variation** is inherited
2. Organisms **produce more offspring** than can survive
3. Organisms **compete** for resources that are scarce (struggle for existence)
4. Advantaged organisms have adaptations or successful traits. Many of these are inheritable.
5. Successful individuals **pass on their advantaged traits** to their offspring.
6. Population will have a greater frequency of successful genes
7. Species alive today are descended from those advantaged ancestors

1



1

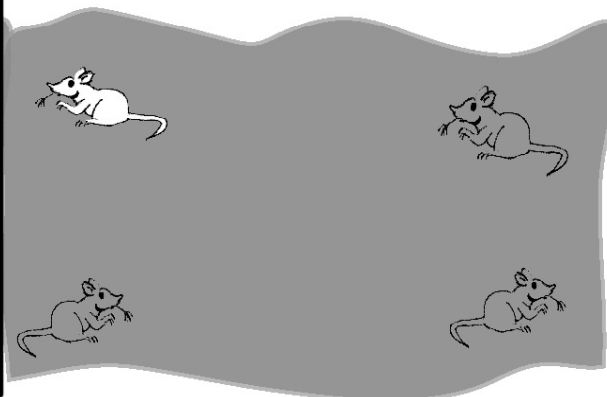
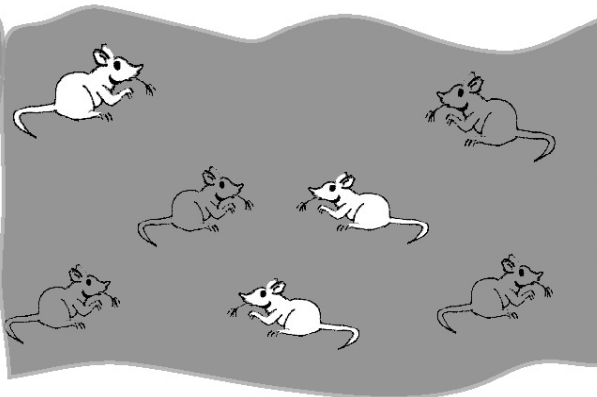
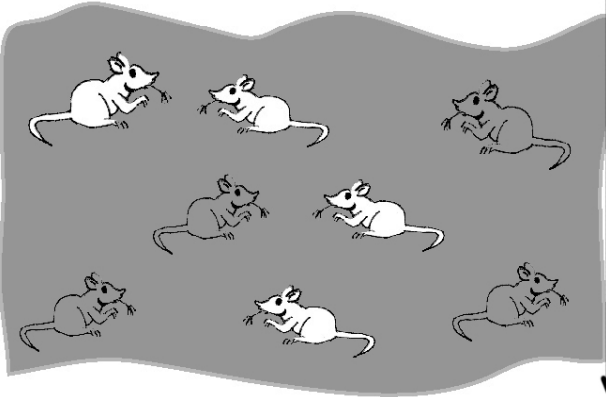
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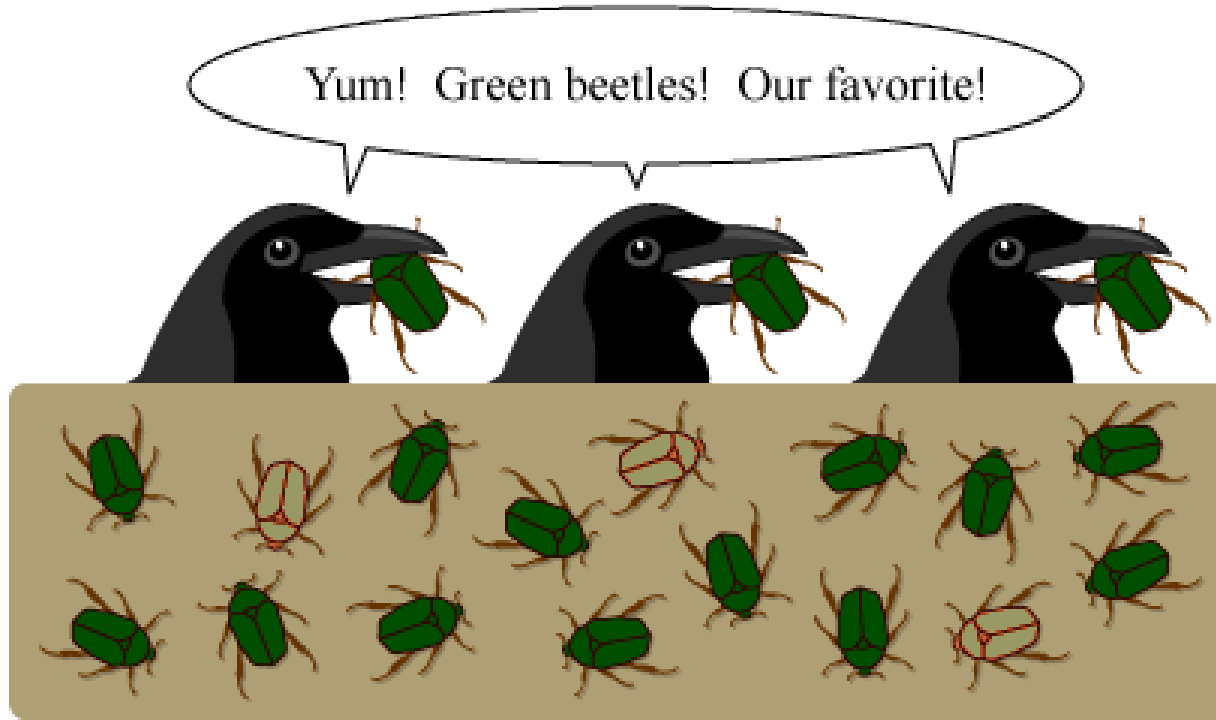
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3



What is Natural Selection?

The process in which **individuals** most successful in their environment tend to survive and transmit their genetic characteristics to future offspring.



Artificial Selection or Selective Breeding

- occurs when **people artificially** select organisms for particular traits that they want to see in future generations (*as opposed to what will make the organism better able to survive the environment*)



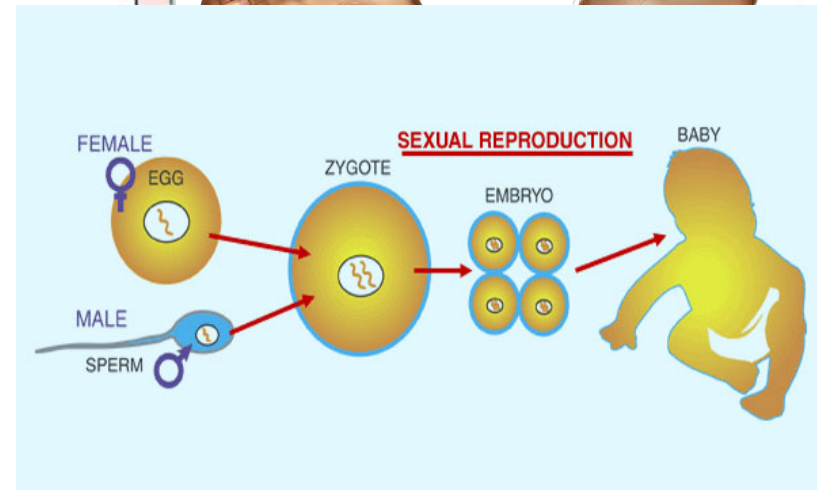
Variation

- Natural selection can only occur if variation exists
- Darwin noticed that all populations varied in size, colour, beak size.
- Without Variation, no favoured individuals would exist



Variation

- Mutations- most are negative, but every so often a positive one prevails
- Meiosis- provides the shuffling and varied combinations of genes (independent assortment and crossing over.
- Sexual reproduction- fusion of male and female of successful traits produces offspring this the ability to have hybrid vigour.



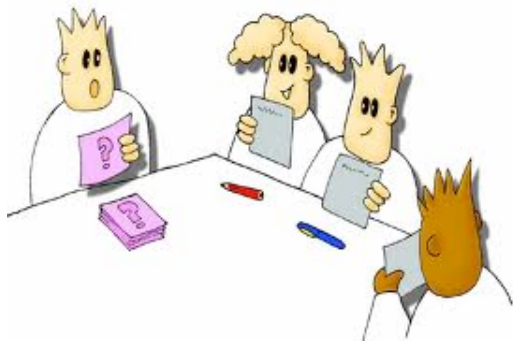
Adaptations

- Are characteristics that make an individual suited to its environment and way of life.



What are these birds adaptations and where would you expect them to be best suited?

- Adaptations may be, behavioural, physical, or physiological
- Adaptations are a product of generation of natural selection



What are the adaptations of the following and how do they help their survivorship?



Viceroy mimics monarchs



Killdeer feigning injury

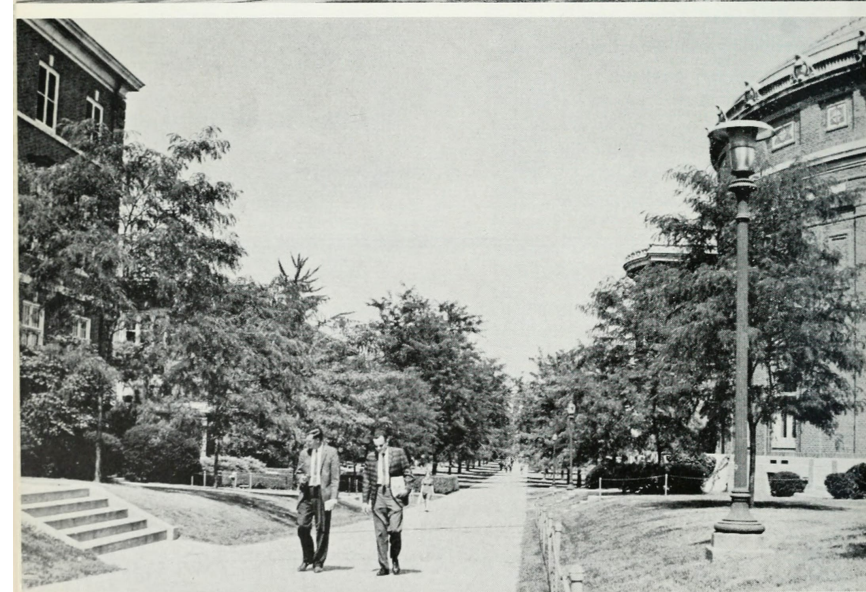


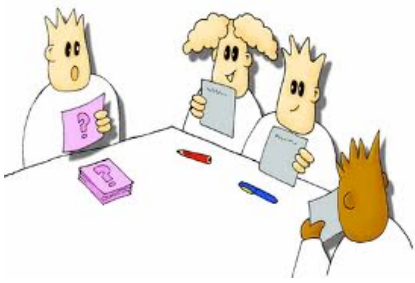
Slow moving sloths

Individuals Produce More Than Can Survive.

- species tend to produce more offspring than the environment can support
- There will be a struggle especially when resources are low, or there are bad years of survivorship

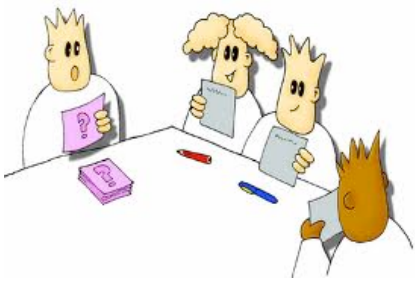






Who is winning the evolutionary race?
Why do you suspect?

Color of fur	Black	Tan	Tan and Black	Cream
Age at death	2 months	8 months	4 months	2 months
# pups produced by each female	0	11	3	0
Running speed	8 cm/sec.	6 cm/sec.	7 cm/sec.	5 cm/sec.



Who is winning the evolutionary race?
Why do you suspect?

Name	George	Dwayne	Spot	Tyrone
Age at death	13 years	16 years	12 years	10 years
# cubs fathered	19	25	20	20
# cubs surviving to adulthood	15	14	14	19
Size	10 feet	8.5 feet	9 feet	9 feet

Surviving Individuals and Sexual Fit Tend to Pass on Genes

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# cubs fathered	19	25	20	20
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Size	10 feet	8.5 feet	9 feet	9 feet

- In a struggle, the fittest individuals will survive and pass on their genes through inheritance to offspring at a greater frequency than less fit individuals
- populations will progressively change since a greater frequency of successful adaptation traits are passed on
- Fewer less desirable traits will also be represented

The lion Tyrone above, although he lives a shorter life, he was sexually fit to pass on a greater number of his genes, Dwayne although, he lived longer had fewer of his gene reach the next generation

Surviving Individuals and Sexual Fit Tend to Pass on Genes



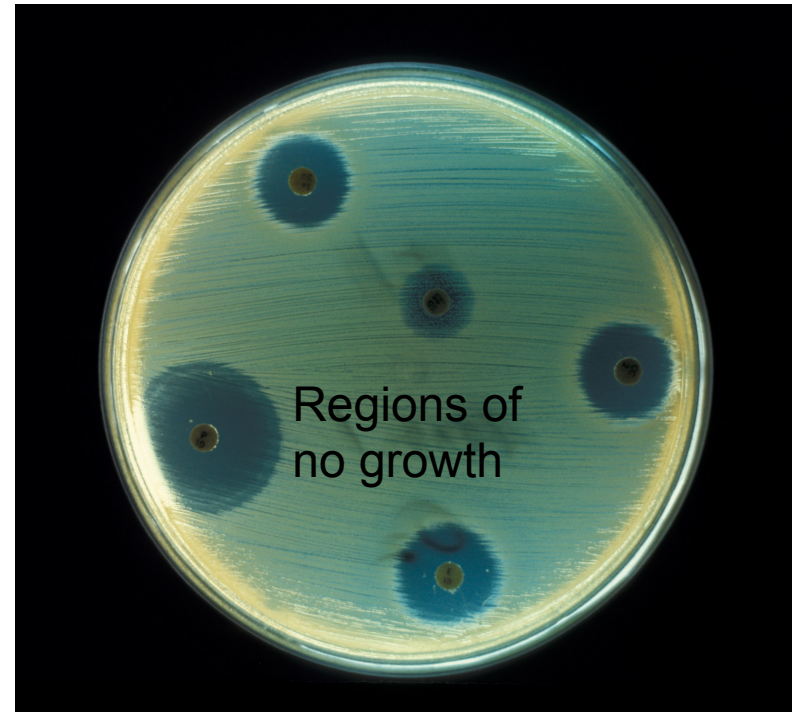
- *This male killdeer in this case, put itself at greater risk of death by predators, but is ensuring that it's genes will be passed on. Therefore a successful adaptation*

Antibiotic Resistance - Natural Selection in Real time



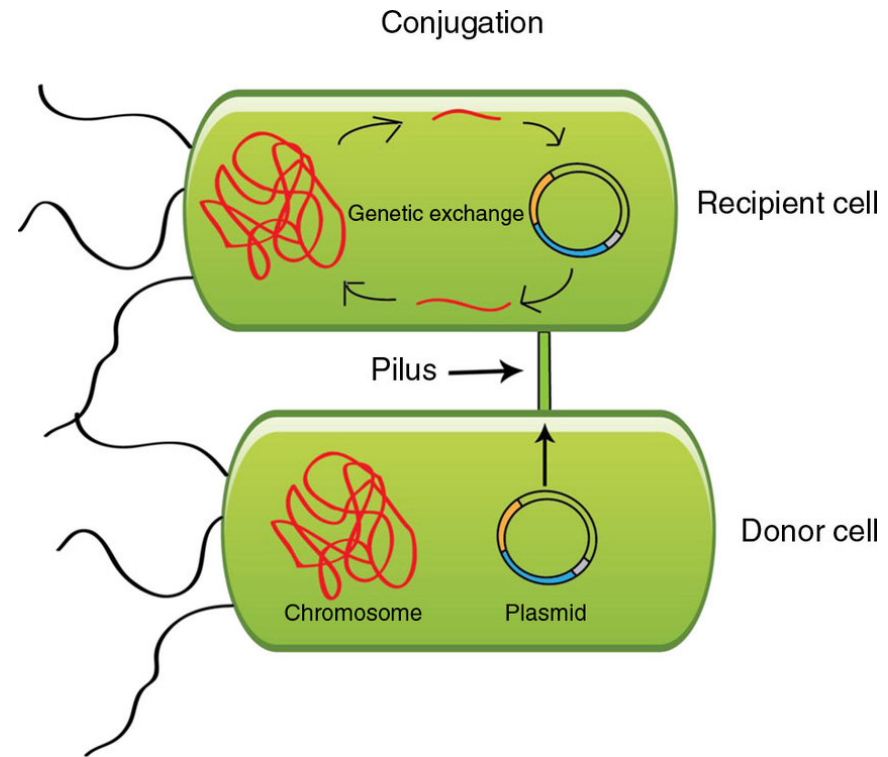
What are antibiotics?

- Drugs that inhibit the growth of or destroys microorganisms.
- Most originate from bacteria or fungi to prevent other microorganism from invading their space
- Organism that make the antibiotic also have genes that give them resistance
- variation exists in bacteria in the ability to resist antibiotics



Remember...

- Bacteria have the ability to share genes through conjugation
- this allows the ability to transfer genes such as plasmids that carry antibiotic resistance



Bacterial Superbugs

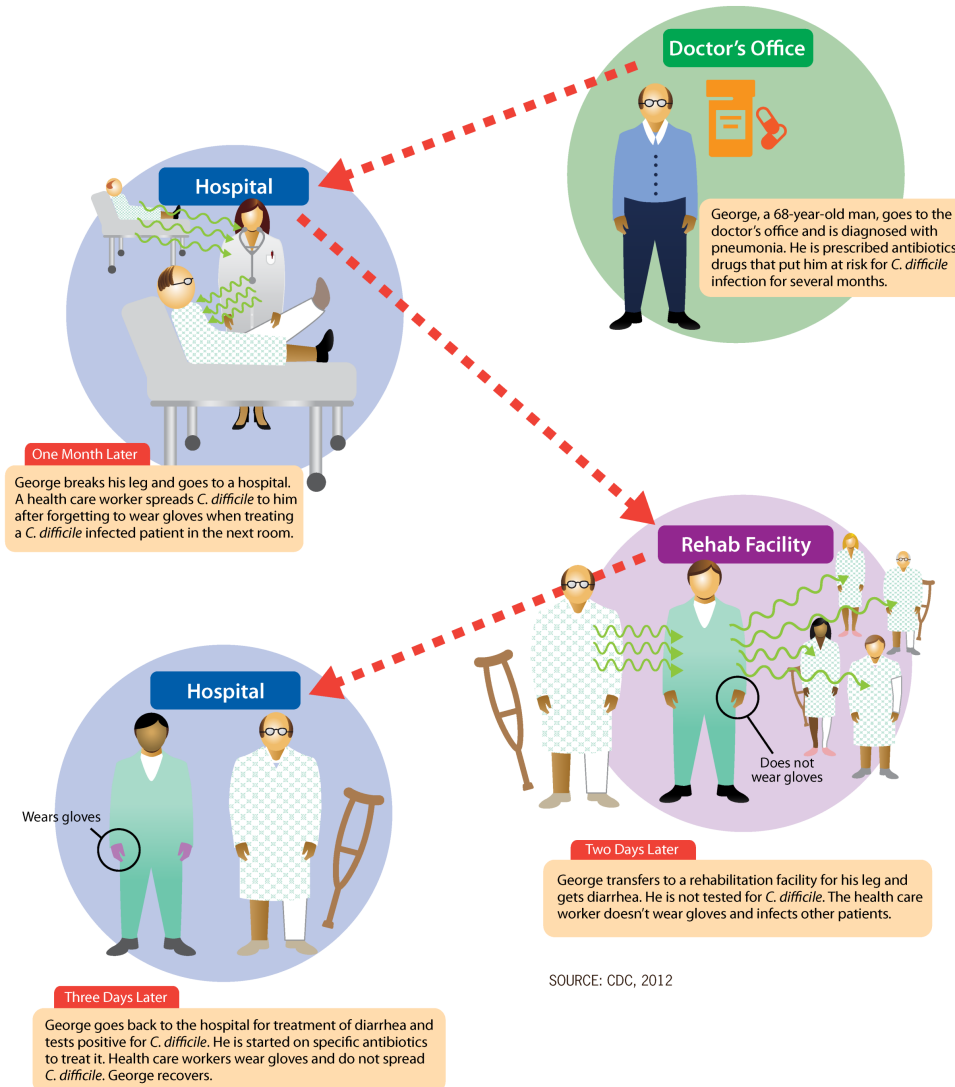
- Bacteria populations evolve when resistance bacteria survive drug treatment while non-resistant are killed
- the surviving population of resistance bacteria can then spread their genes at a faster rate than other strains
- 'superbugs' are produced when strains accumulate the genetics for resistance of all known antibiotics

SUPERBUG

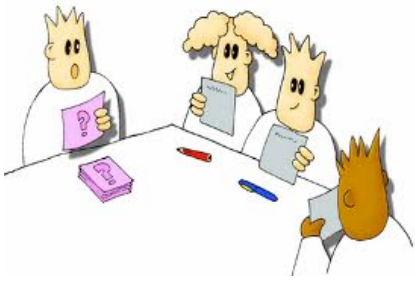


Bacterial Superbugs

How *C. difficile* Spreads.

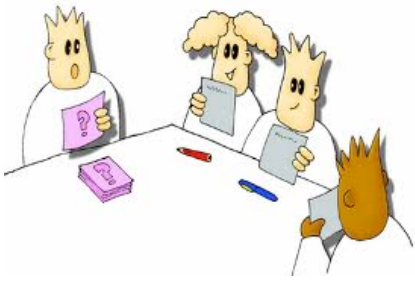


SOURCE: CDC, 2012



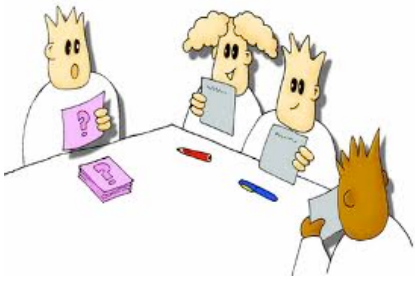
Which statement is incorrect? Effective antibiotics

- a. Show selective toxicity
- b. kill the host cell
- c. kill the pathogens
- d. Are useless against virus



Genes are shared by bacteria through...

- A. Conjugation
- B. Meiosis
- C. sexual reproduction
- D. Homologous chromosome cross overs
- E. Asexual binary fission



Bacterial chromosomes are

- A. single stranded and circular
- B. double stranded and circular
- C. single stranded and linear
- D. double stranded and linear

Homework

- » Evolutionary evidence of Whales
- » Data based questions pg. 249
- » Data based questions pg. 253
- » Summarize how beaks on *Daphne Major*
 - » *What changes and causes evolution*
 - » *What birds were favoured and during droughts? Heavy rain years*