

Darwinian thought

**Major events in the history of Biology:
Darwinian thought**

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300 years ago as far as we now creation happened, done + lots opf medicine, math and science

Georges-Louis Leclerc, Comte de Buffon - first person to raise the question about did we really arrive here 6000 years ago the way we are today.

(1707-1788)

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Erasmus Darwin darwins grandpa
1731-1802

- Translated Linneaus's work s into English
- Zoonomia (Laws of Organic life)
- The temple of nature

He wrote the fooling poem that really dexribes how life started(oceans as a microbe) and then they evolved and adapted to move about on land

*Organis Wrote the poem about life on land
Was born and nurs'd in ocean's pearly caves;
First forms minute, unseen by spheric glass,
Move on the mud, or pierce the watery mass;
These, as successive generations bloom,
New powers acquire and larger limbs assume;
Whence countless groups of vegetation spring,
And breathing realms of fin and feet and wing.*

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Darwinian thought

The giant bones etc.. =/= dinosaurs, = giant monsterf from somewhere else

He assembled the irish elk, coined the phrase of going extinct since they were same general construction as today.

Georges Cuvier
(1769-1832)



- Comparative biology
- Catastrophic theory
- Extinction

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Now new forays, Lewis & Clarke were supposed to find cuviers extinct over time species, since the world was the same

He proposed a giant catastoiphre that killed these organisms

Cuviers stduent hypothesised that cuviers extinct animals went extinct by not getting on the ark in time

Darwin's five theories – No constancy of species

Extinction


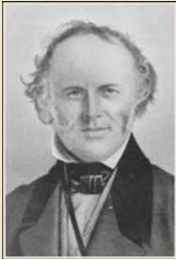


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Charles Lyell
(1797- 1875)



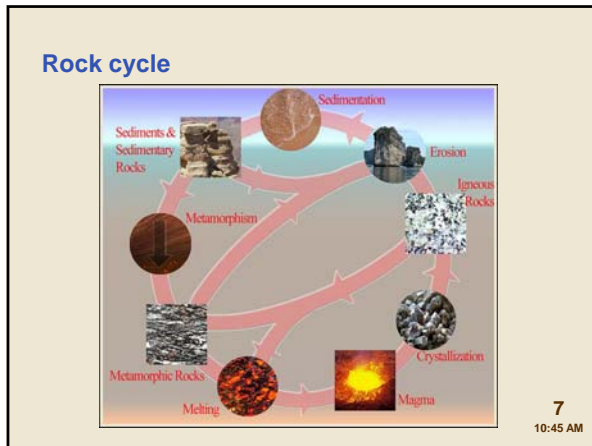
- Uniformitarian theory of geological change
- Stratigraphy and the geological time scale

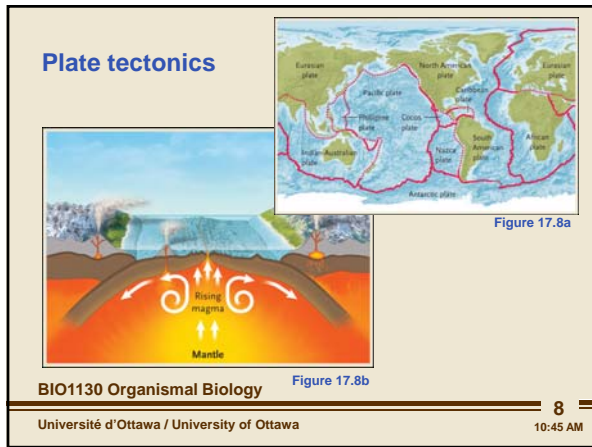
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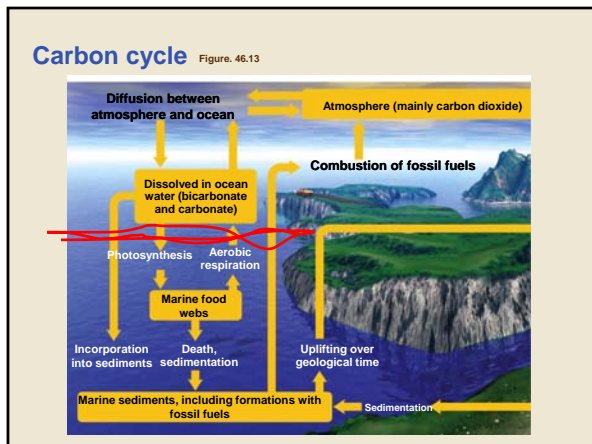
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Darwinian thought





we know thios but they didn't



Imporntat not just for geology, Carbon dioxide is absorbed into the sea

Darwinian thought

Sedimentation of calcium carbonate

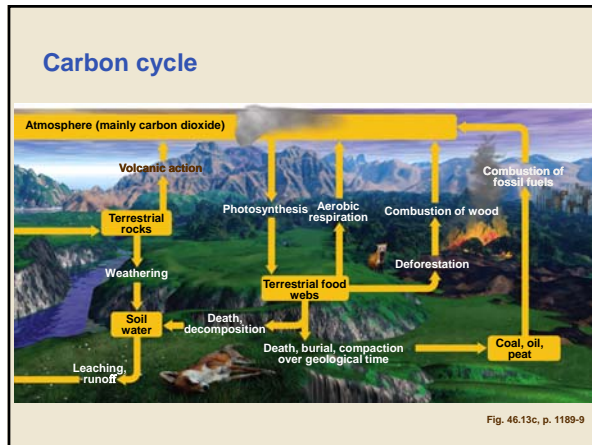
$$\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3$$
 Bicarbonate

$$\text{H}^+ + \text{H}_2\text{CO}_3^- + \text{Ca}^+ \rightarrow \text{CaCO}_3^-$$
 Carbonate

Spontaneous reaction forms carbonic acid, forming bicarbonate that rains down to the bottom of the ocean, which is why I thought the world was old, as this level of sediment could not be made over solely a few thousand years.

Snowball earth with this process the CO₂ is pulled from air-water to minerals constantly to maintain equilibrium to the point where the earth is stripped of its carbon coating and cools down making snowball earth

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Snowball earth with this process the CO₂ is pulled from air-water to minerals constantly to maintain equilibrium to the point where the earth is stripped of its carbon coating and cools down making snowball earth

Continental drift Figure 17.9

Continental drift 1
Continental drift 2

540 Mya (Cambrian) 420 Mya (mid Silurian) 250 Mya (Permian/Triassic)

180 Mya (Jurassic) 65 Mya (end Cretaceous) 10 Mya (mid Miocene)

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Basically these guys were saying that everything was not always the same, but the general knowledge base was that everything was the same.

Darwinian thought

Infusaria- small essence which has a predisposition to prove itself

overtime due to this the complexity of an organism increases over time basically if an athlete bulks up and gets stronger it doesn't mean that your children will be bulkier

Jean-Baptiste Lamarck
(1744-1829)



- **Transmutation of Species**
 - inheritance of acquired traits

gives mechanism for organisms to acquire gtraits/change over time

Lamarckian evolution- organism uses a specific trait more, it becomes larger/more prominent, and si therfore able to be passed to their offspring. Giraffe's neck become longer because stretching their neck is important, essentially the aquisition and ehancement of traits with the enhanced traits being passed on

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He did not know that the somatic cells are put aside from the beginning and are not changed due to the world around them they are frozen and the environment in which they are found does not effect them. he was missing the mechanism of the egg sperm being pristine and unspoiled

Essentialist explanation of change

- **Transmutation** (not Lamarck)
- **Transformation** his mechanims was that life transformed
 - Finalism
 - Environmental (this is Lamarck)


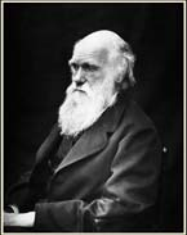
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other believed that every now and again dramatic change happened to life essence

Essentialist also believed that essence were preprogrammed to change over time

Important stages in the history of Biology
19th century: Modern biology



Darwin
(1809-1882)

Wallace - proposed his mehcanism
(1823-1913)

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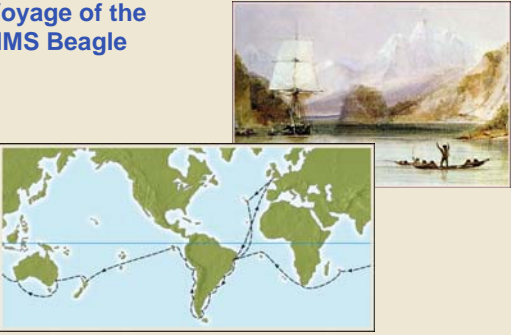
Wallace- in context, wallace is always mentioned in natural selection because Wallace (naturalist who was in indonesia, while darwin was in south america) gave us, natural selection etc.. that happens , essentially same idea its just that he would 'scoop' darwin. darwin has been working for a long time, delaying publication, th royal philosophers society , bnoth presented their papers at the same time. The difference was Darwin had much more weight to his knowledge, more examples etc.. than walace as darwin had been working on it for 20+ years he wrote for 3 hrs a day (also he delayed to avoid angering the truth and his devout christian wight

Darwin gets on the beagle as the steward and companion of the captain, this job given to him by lyle. He has unlimited ability to collect b/c of funds, every time he gets to port he sends hi notes, etc.. in crates to lyle and constantly get new copies of lyle's book on the slow gradual change

darwin has one of the largest natural history collections in europe, where he knows everything about it. B/c of his independent wealt and his wife wedge who is rich he devptes his entire time to this which allpows hime to notice these gradual changes that lyle proposed. unlimited time and works on if or ever

Darwinian thought

Voyage of the HMS Beagle

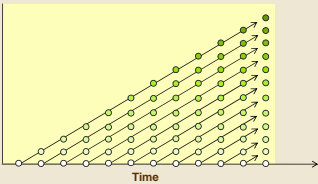


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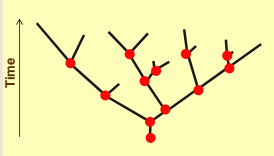
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Lamarck's theory



Darwin's theory



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Darwin's five theories

- No constancy of species
- Common ancestry
- ~~Gradual change~~
- Multiplication of species
- Natural selection

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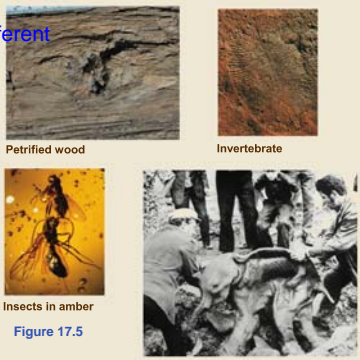
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Darwin's five theories
No constancy of species

- **Fossils**
- **Extinction - Cuvier**
- **Transitional forms**

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Darwin's five theories – No constancy of species
Fossils
come in different forms

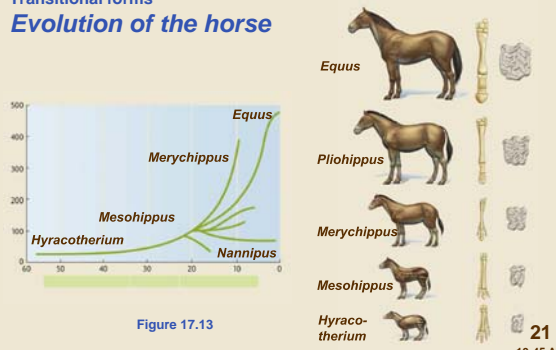


Petrified wood Invertebrate
Insects in amber
Mammoth in permafrost

Figure 17.5 **20**
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- fossil record is considered incomplete (particularly in Darwin's time), because of plate tectonics we can predict where fossils will be better, and we are filling in the fossil record

Darwin's five theories – No constancy of species
Transitional forms
Evolution of the horse



Equus
Merychippus
Pliohippus
Merychippus
Mesohippus
Hyracotherium
Nannipus

Figure 17.13 **21**
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- as forests become grasslands, new advantage of being able to run away from predators, more rigid structure for running faster to escape predators- no toes1 hoof
plants in turn were toughening up, plants become more difficult to chew, therefore molars (resistant to this wear and tear are developed) are developed to be able to eat and digest food better

Darwinian thought

Archaeopteryx- Feathers are attached to a reduced limb, very close to a bird, but the head has teeth, therefore a cross between reptiles and birds, it also has a tail with vertebrae and feathers, these are transition fossils OR MISSING LINKS

Darwin's five theories – No constancy of species
Transitional forms
Archaeopteryx lithographica




Figure 17-21a

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Invertebrates are always thought to be missing because they do not fossilize well, Cambrian deposit of this, therefore they can predict that the second fossil can be found

In Darwin's time transition fossils were very rare, fossils are not random they are more predictable

Darwin's five theories – No constancy of species
Transitional forms
Puijila darwini

Meet the discoverer



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Found transition fossil between humans and chimps

~1960= continental drift

Darwin's five theories
Common ancestry - evidence
Cuvier only gradually

- Comparative anatomy
- Comparative embryology
- Vestigial structures
- Biogeography
- Molecules

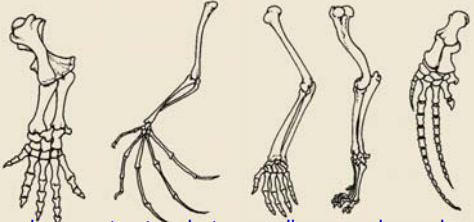
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Darwin's five theories - Common ancestry
Comparative anatomy
Homology – Divergent evolution




Homologous structure between all mammals can be molded into a different shape and structure for a different medium

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Mammal = 1st bone biggest connected to body, then 2 then 5 then 5 digits

Darwin's five theories - Common ancestry
Comparative embryology

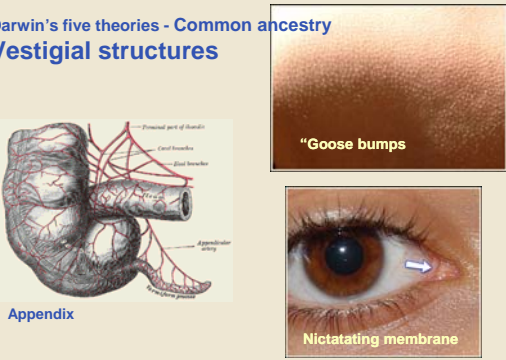


if embryos look similar than the organisms are similar
 2 lineages - 1 were from 4-8 cells, they spiral or do not spiral

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Darwin's five theories - Common ancestry
Vestigial structures



Appendix

"Goose bumps"

Nictitating membrane

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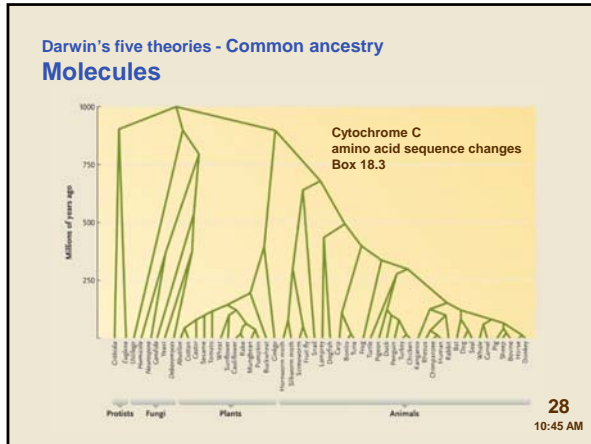
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Vestigial structure : goose bumps= fluff up to look more intimidating, or fur to be warmer

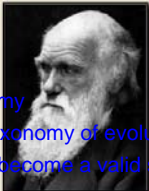
Nictating membrane- membrane over eye to be able to focus under water

Appendix- Function= got bacteria in it, the main bacteria of intestinal flora in addition to being very important in having immune system health

Darwinian thought

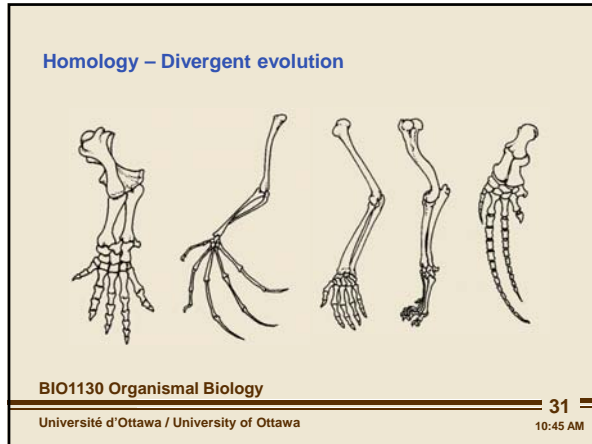


- Darwin's five theories
- **No constancy of species** -lots data
 - **Common ancestry** -lots data
 - **Gradual Changes** - new data
 - **Multiplication of species** -new data
 - **Natural selection**
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- Types of taxonomies
- **Folk** -500 items 2-3 groups
 - **Artificial** -write down lists
 - **Mechanical** -nesting taxonomy
 - **Natural (Evolutionary)** - taxonomy of evolution, like organisms should be classified together
 - **Cladistic (Phylogenetic)** (Phylogenetics become a valid scientific proof)
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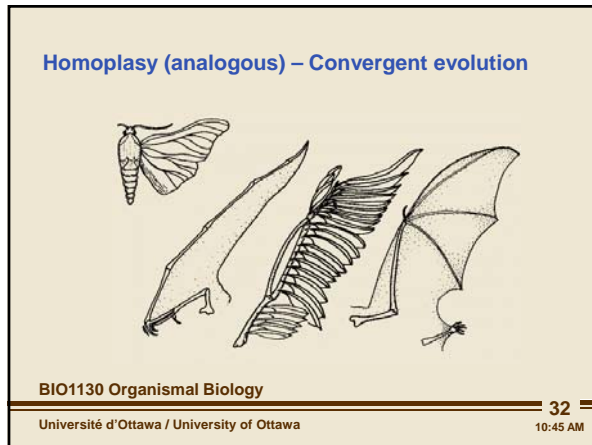
Dr. Houseman, adds 0.7 % at end of semester , to bump up letter grade so there is no point fighting over small points



Most of the time at this point scientists classified things through morphology

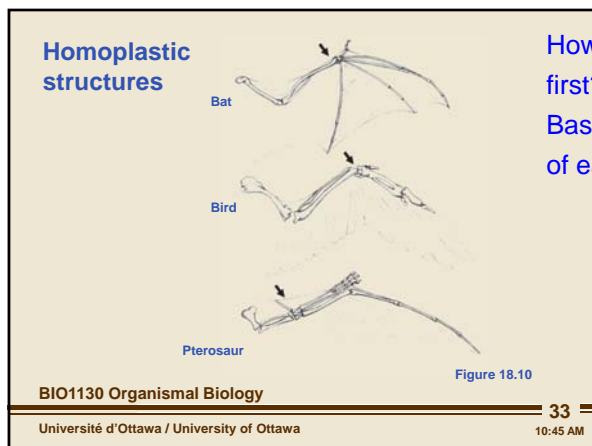
same origin and structure, but different result, in darwins diverging structure you want homology NOT homoplasy

Classify through similarities in the basic bone structure



Classify through everything that flies arose from 1 common ancestor, it all flies, flight evolved once and therefore no matter the difference.

Then insect is very different so it, flight evolved twice in different origin and structure but the same result



How do you evolve Pterosaur into Bat or Bird? we know pterosaur came first?

Basically they all evolved from the same ancestor but they arose independently of each other and therefore have very different methods for gaining flight

Darwinian thought

Homology – Divergent evolution

The diagram shows two cross-sections of skulls. The left skull is an amphibian's, with labels for Skull, Brain, Inner ear, Hyomandibula, and Throat. The right skull is a human's, with labels for Skull, Brain, Ear drum, and Stapes. Red arrows point from the amphibian's inner ear and hyomandibula to the human's ear drum and stapes, illustrating their evolutionary relationship.

Figure 18.9

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amphibians used stapes to hear subsonic/vibrations in ground in addition to sound ion air
Humans still have this but we do not use ours any more

Homoplasy – convergent evolution

The diagram shows a phylogenetic tree with two dolphin-like animals at the top. The left one is a 'Common dolphin' and the right one is an 'Ichthyosaur'. The tree branches from a common ancestor into various groups: Synapsids, Monotremes, Marsupials, Elephants, Primates, Rodents, Whales and dolphins, Pterosaurs, Dinosaurs, Birds, Ichthyosaurs, and Lizards. A 1m scale bar is shown for both animals.

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Homoplasy- Ichthyosaur looks outwardly very similar to a dolphin, however the homology or morphology of the dolphin is very different from ichthyosaur

Pasteur (1822-1895)

- Life from life not spontaneous generation
- Germ theory

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Disproves spontaneous generation, by boiling a nutrient broth, by using a flask with a gooselike bend in the neck the broth did not grow bacteria and turn rancid, therefore life did not appear.
It only turned rancid when germ managed to get in through straight neck

Darwinian thought

Important stages in the history of Biology
19th century: Modern biology

- **Cell theory**
(Schleiden and Schwann – 1860)
 - The basic unit of all organisms is the cell
 - Individual cells have all the characteristics of life and
 - All cells come from the division of other cells



Schleiden
(1804-1881)

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Observed plants and animals tissue through plants and animals
Schwann= animal= schwann cell

Schleiden= plants

Noticed in all cells, = outer limiting membrane, inner granulated dense center- therefore he called this center the nucleus

Both figured out: basic unit in organism= cell= most fundamental unit to life, all organisms are made of cells, cells can become specialised to do different things, but cells do not generate spontaneously but come from other cells.

Mendel
(1822-1884)



- Rediscovered 1900.
- Law of segregation of characters
- Law of Independent Assortment

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Mendel gave use a mathematical formulations to predict what will happen in phenotypical changes

Tall + Short = All tall

Offspring = 75% tall, 25% short

he figured out that 1 packet of information per individual wouldn't work as it didn't have enough, so he figured out to use 2 packets, which ended up being called alleles and Punnett squares, he discovered that this only worked if there is 2 alleles there are two info packets, and each parent only provides one, and that these info packets come in dominant and recessive traits

we do not know how Mendel figured this out

We model how the info packets move through Punnett squares

Mendel = mathematician, he modeled a phenomenon