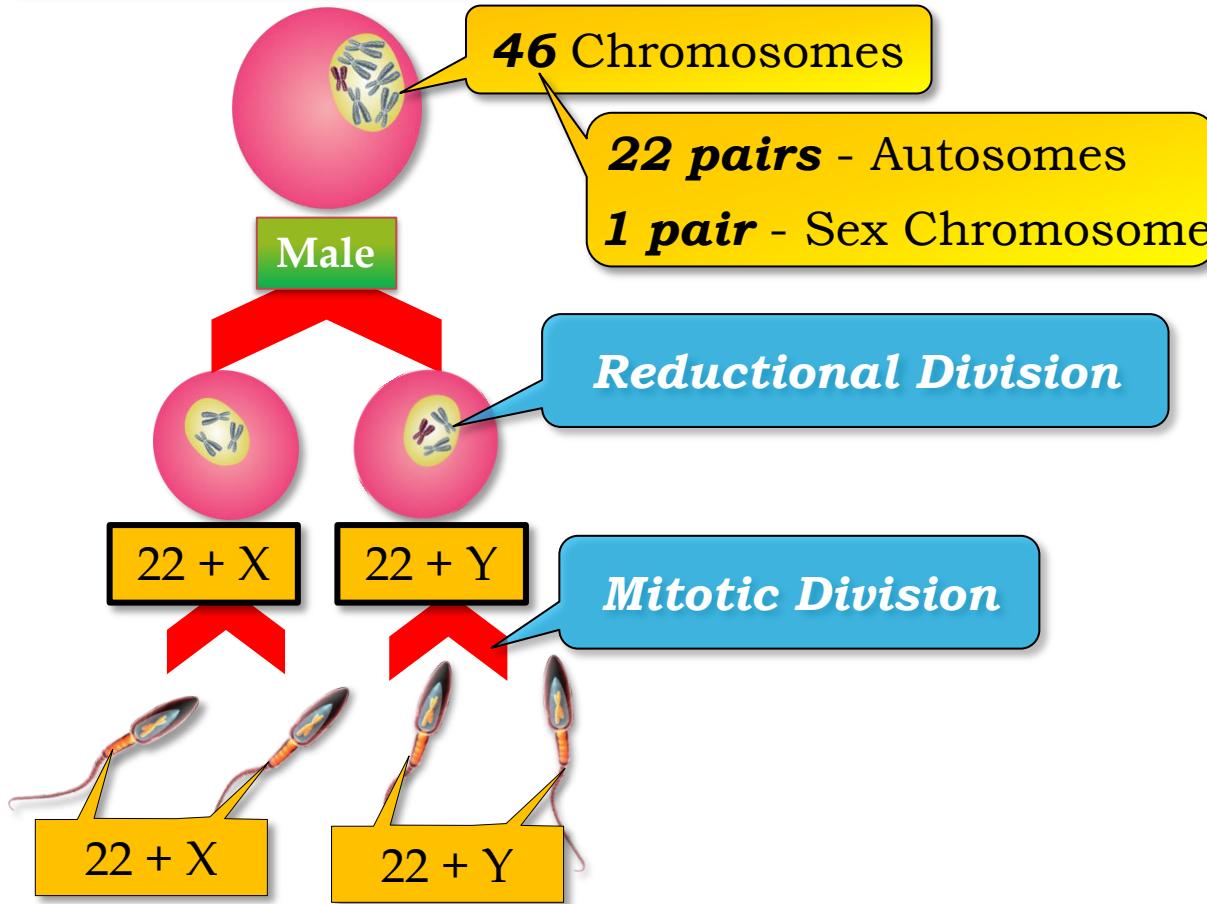


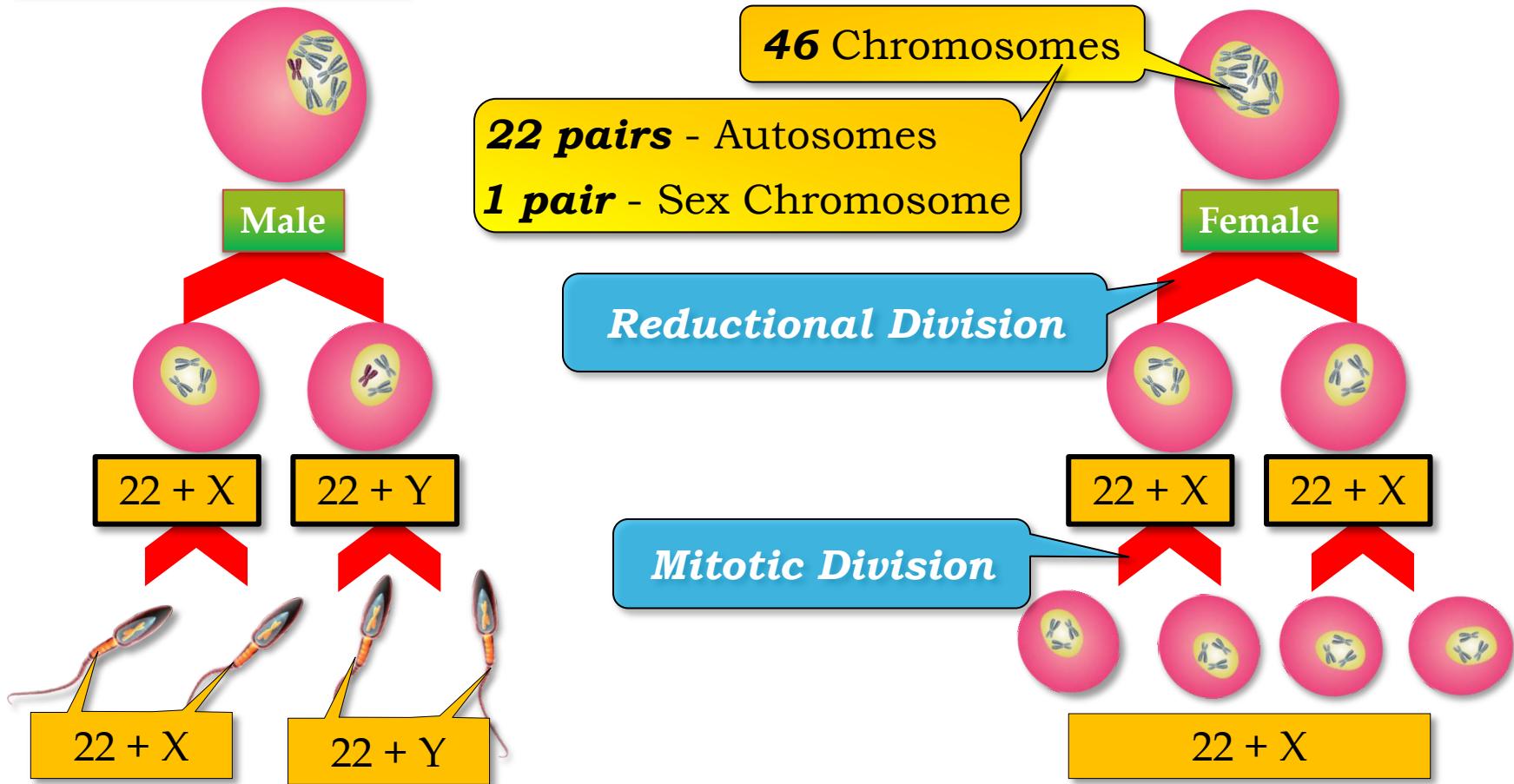
Heredity and Evolution

- **Sex determination**

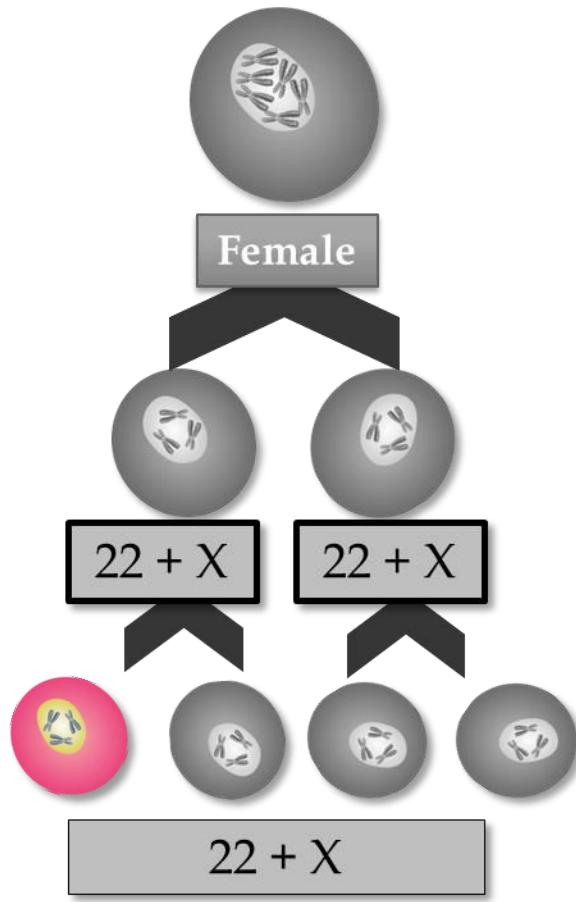
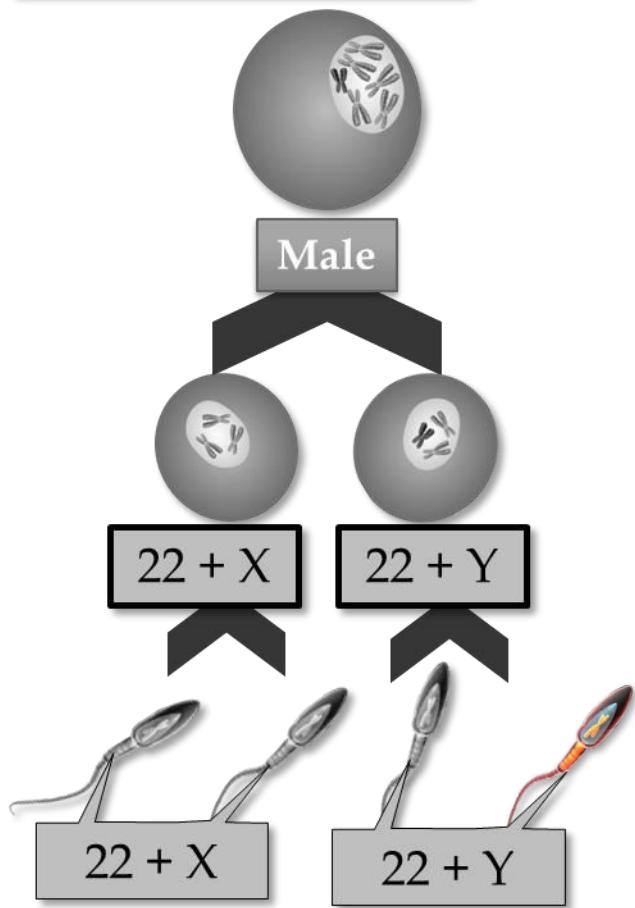
Sex Determination



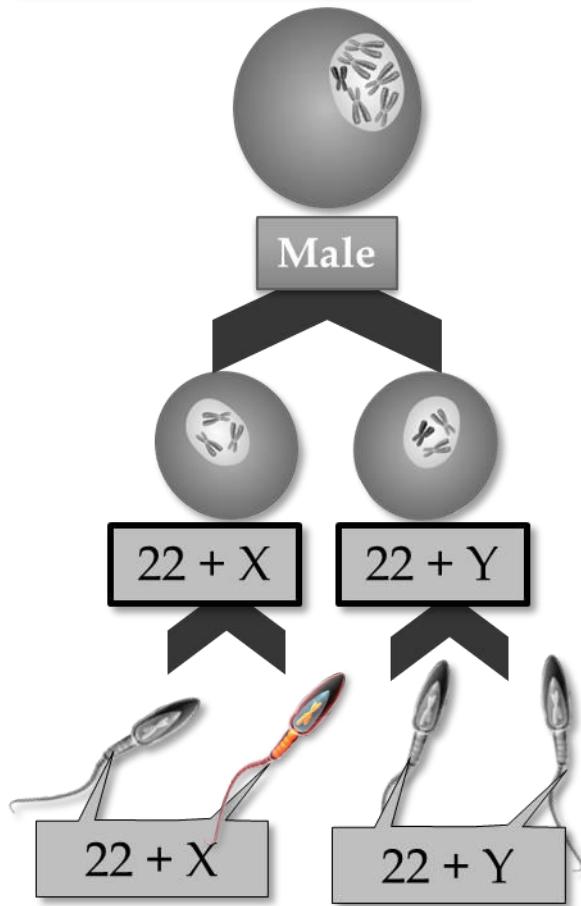
Sex Determination



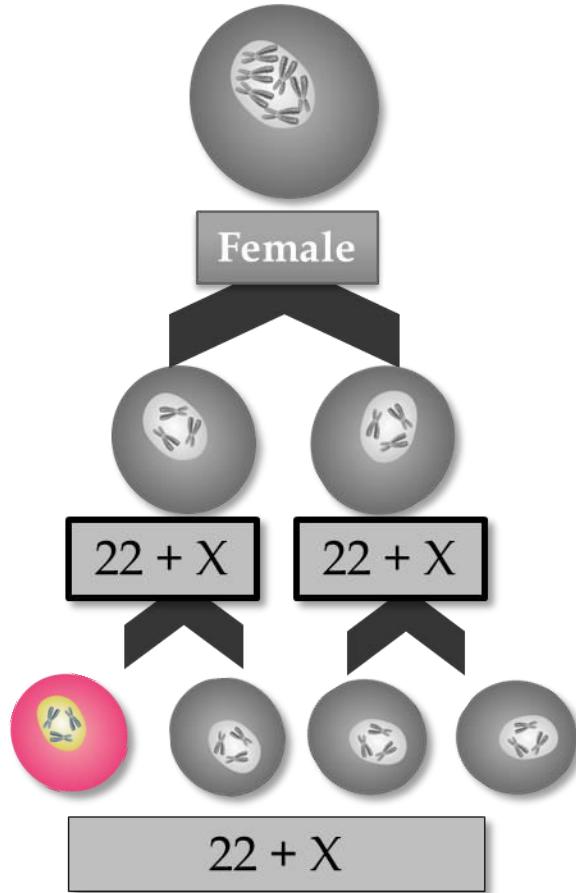
Sex Determination



Sex Determination



Female Child

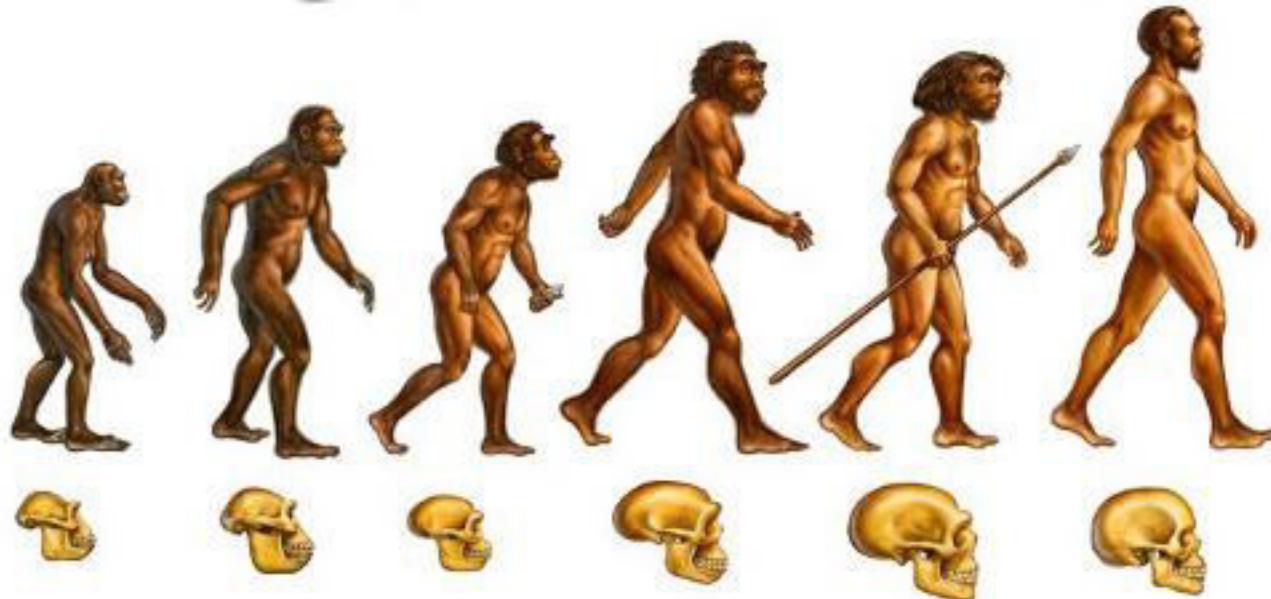


Thank You

Heredity and Evolution

- **An Illustration Of Evolution - Situation 1**

Heredity and Evolution



There is an inbuilt tendency of variation during reproduction, both because of errors in DNA copying, and as a result of sexual reproduction.





These variations
leads to evolution



**Let's understand
evolution with an
illustration**

An illustration of evolution

Let us imagine
the beetles will
Let us assume there is a group of red beetles living in bushes with green leaves

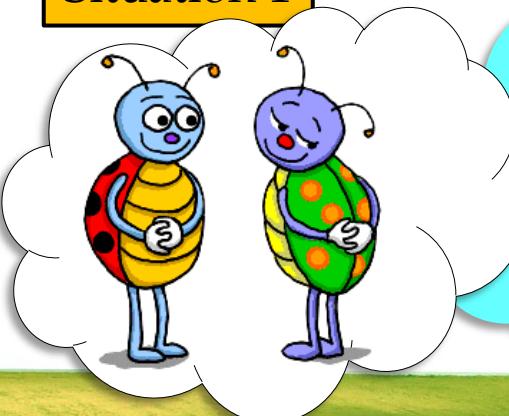
The more beetles there are, the more crows eat them.

Let us think about two different situations that can develop in this beetles population

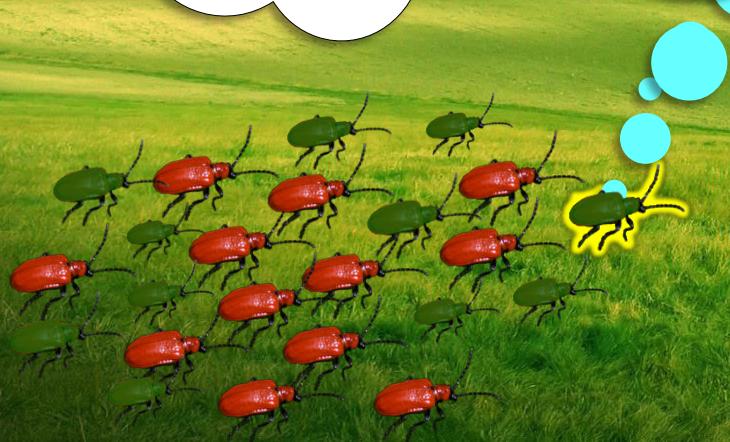


An illustration of evolution

Situation 1



A color change
d, Reproduce and pass
the green colour to its
offspring.



An illustration of evolution

Situation 1

But the red beetles continues to be

From situation 1, we can observe that, what started out as a rare variation came to be a common characteristic in the population.

population.

Now, Let's discuss the second situation



Thank You

Heredity and Evolution

- **An Illustration Of Evolution - Situation 2**

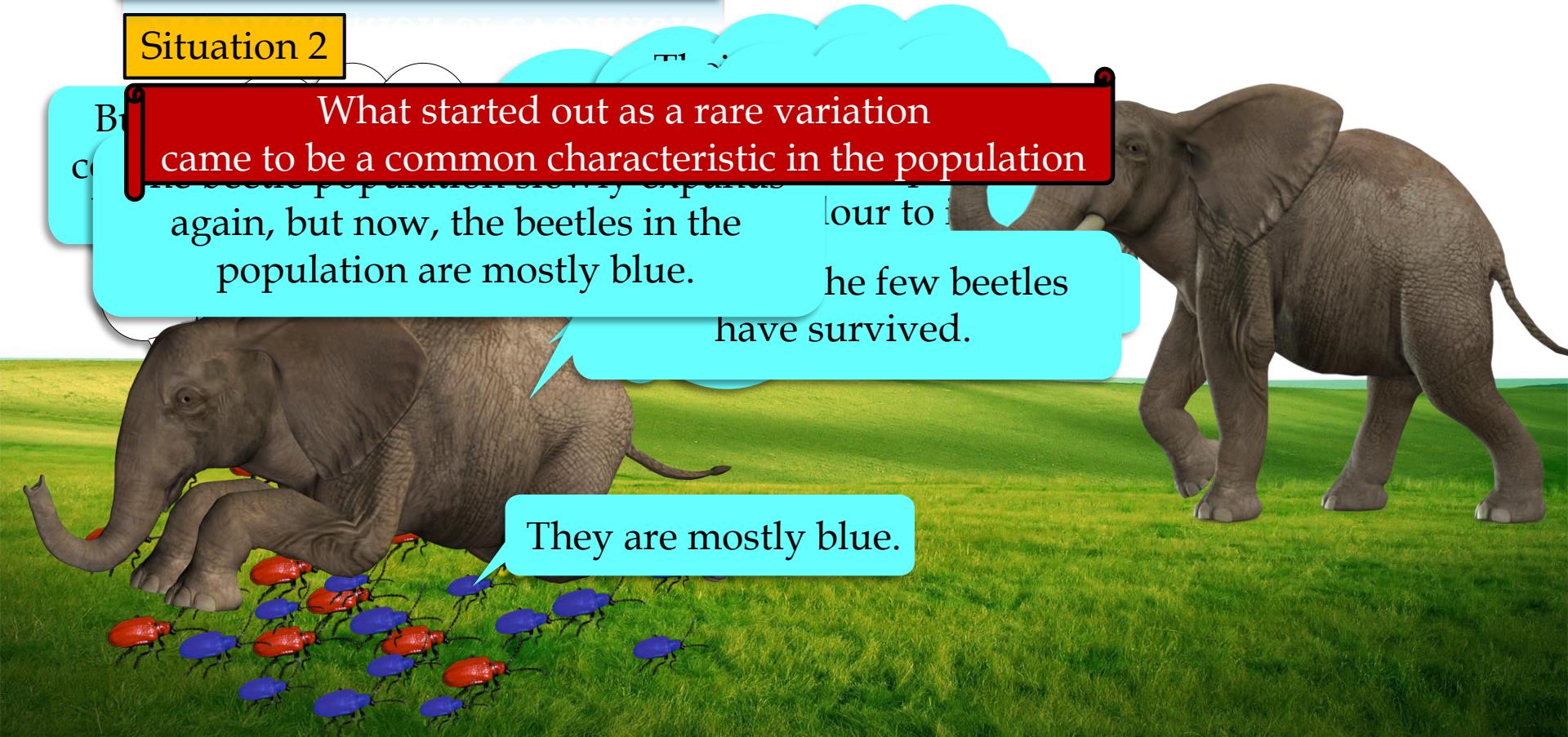
An illustration of evolution

Situation 2

Because of a mutation, some beetles were blue instead of red. This was a rare variation at first. Over time, the environment changed. The grass became more blue. The beetles that were blue had a better chance to survive. They reproduced. Their offspring also had the blue colour. After many generations, most beetles in the population were blue.

The few beetles that were red have survived.

They are mostly blue.



An illustration of evolution

From both the situations, we can state that

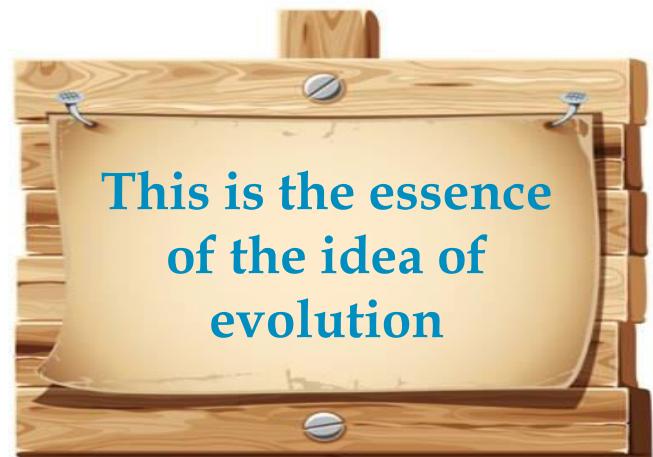
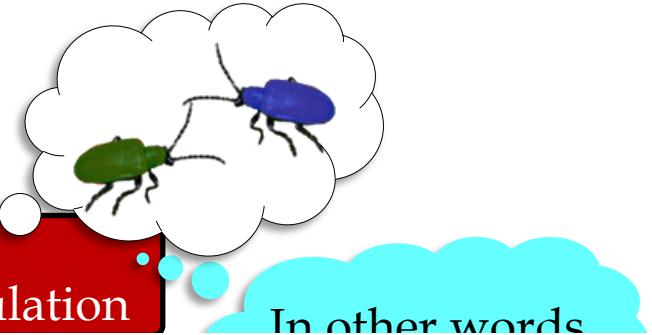
What started out as a rare variation
came to be a common characteristic in the population

Frequency of a trait changed over
generations

Number of Character

Frequency of genes changed over
generations

Character
common
genes



An illustration of evolution

But we can observe interesting differences, in the two situations.

Situations 1

The changes were naturally selected because it gave a survival advantage to the green beetles.

The natural selection is exerted by crows, more crows there are, the more *red beetles* would be eaten, and the more the proportion of *green beetles* in the population would be.



An illustration of evolution

But we can observe interesting differences, in the two situations.

Situations 2

The colour change gave no survival advantage.

It was simply a matter of accidental survival of beetles of one colour that changed the common characteristic of the resultant population.

So, accidents in small populations can change the frequency of some genes in a population, even if they give no survival advantage.



Thank You

Heredity and Evolution

- **Acquired And Inherited Traits**



Lets discuss about
Acquired and Inherited
Traits

Acquired and Inherited Traits

There are two types of cells in any organism

Germ cells

Somatic cells

Germ cells are the cells of reproductive tissue which pass the changes from one generation.

Such traits which can not be passed from one generation to another are called as **Acquired** traits. Such traits which can be passed from one generation to another are called as **Inherited** traits.

Somatic cells are the cells of body tissue which does not pass the changes from one generation to another.

Acquired and Inherited Traits

There are two types of cells in any organism

Inherited Traits

For example

Lets take group
of mice with tail



Acquired Traits

If we breed a group
of mice with tail



All offspring's
will have tail

Acquired and Inherited Traits

There are two types of cells in any organism

Inherited Traits

Germ cells

Somatic cells

Acquired Traits

For example



If tails of mice
are removed by
surgery

If we breed
these tailless
mice



All offsprings
will have tail

All offsprings will have tail as tail don't have
germ cell and removal of tail can't change the
genes of germ cells

Thank You

Heredity and Evolution

- **Origin Of Life On Earth**



So, the ideas of **heredity** and **genetics** are essential for understanding evolution

Transfer of characters from one generation to another

**The first idea of evolution
of species by natural
selection in the nineteenth
century was given by**



Charles Robert Darwin

Charles Robert Darwin (1809–1882)



12 feb 1809



When he was 22
years old.

Charles Robert Darwin was born on 12 feb 1809 in Shrewsbury, England, the son of Robert Waring Darwin and Susannah.



He set out on a
voyage on a ship.

The 5 -year
voyage



Took him to South America and the islands off its coast.

Charles Robert Darwin (1809–1882)



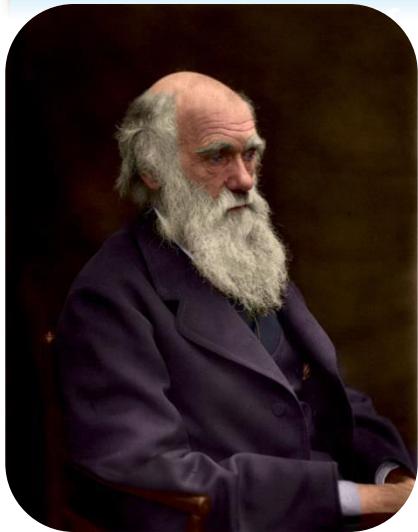
After he got back to England.

He conducted studies during this voyage at the variety of life on earth.



Conducted various experiments that led him to formulate his hypothesis that evolution took place due to natural selection.

Charles Robert Darwin (1809–1882)



But he
mechanical
changes

But these two gentlemen
did not know of each other or their work!

here
ring



Darwin's theory of evolution
and Mendel Experiment give
mechanism for the inheritance
of traits from one generation to
the next.



**But neither tells us
about how life originated
on earth**



Lets discuss how life originated on earth.

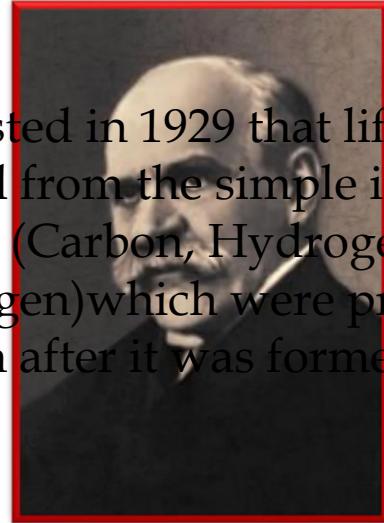
Origin of life on earth

The first theory was given by

J.B.S. Haldane



He suggested in 1929 that life must have developed from the simple inorganic molecules (Carbon, Hydrogen, Oxygen and Nitrogen) which were present on earth soon after it was formed.

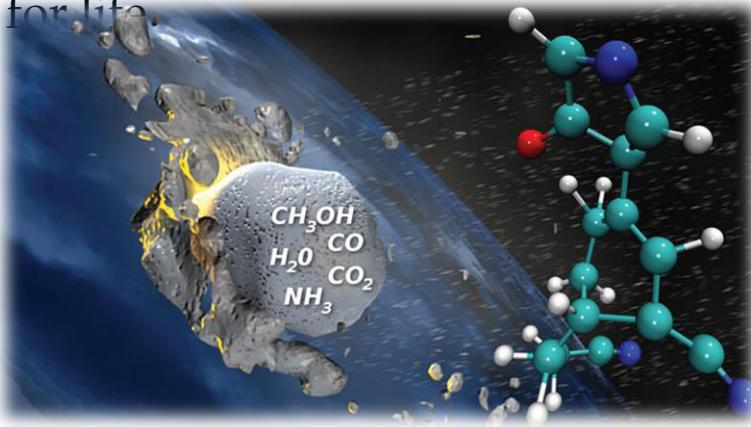


*A British scientist
(who became a citizen
of India later)*

Origin of life on earth

The first theory was given by J.B.S. Haldane

He speculated that these simple inorganic molecules gave rise to more complex organic molecule (Proteins, Carbohydrates, DNA, RNA) that were necessary for life.



i The first primitive organisms would arise from further chemical synthesis.

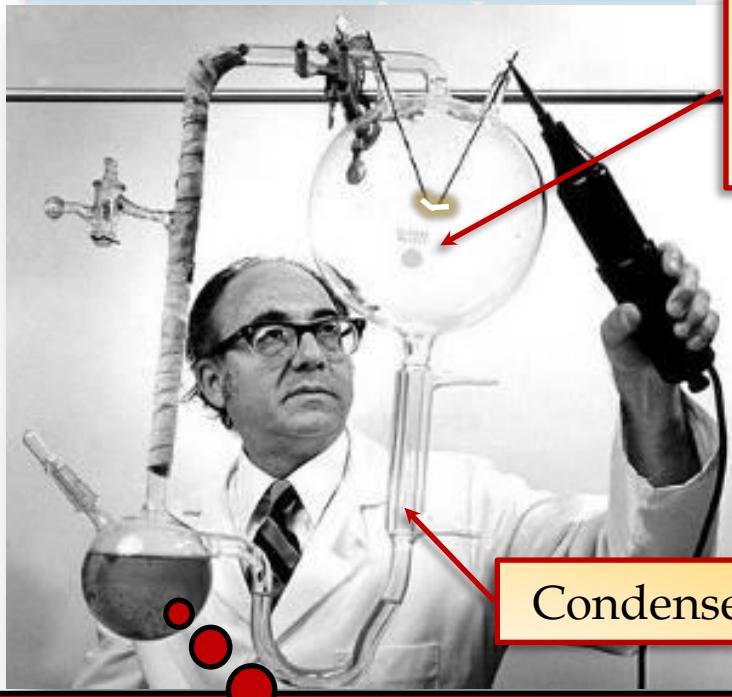


But the question
was how did these
organic molecules
arise???



An answer was suggested by
the experiment
conducted by Stanley L.
Miller and Harold C. Urey in
1953.

Miller and Urey Experiment



Ammonia, methane
and hydrogen
sulphide

methane and
This was made
oxygen).
just below
Sparks were

Condenser

mosphere similar
t on early earth

So, with this
experiment Miller and
Urey suggested the
answer of the origin of
life on earth
in a **condenser.**

At the end of a week, 15% of the carbon (from methane)
had been converted to simple compounds of carbon
including amino acids which make up protein molecules.

Thank You

Heredity and Evolution

- Speciation



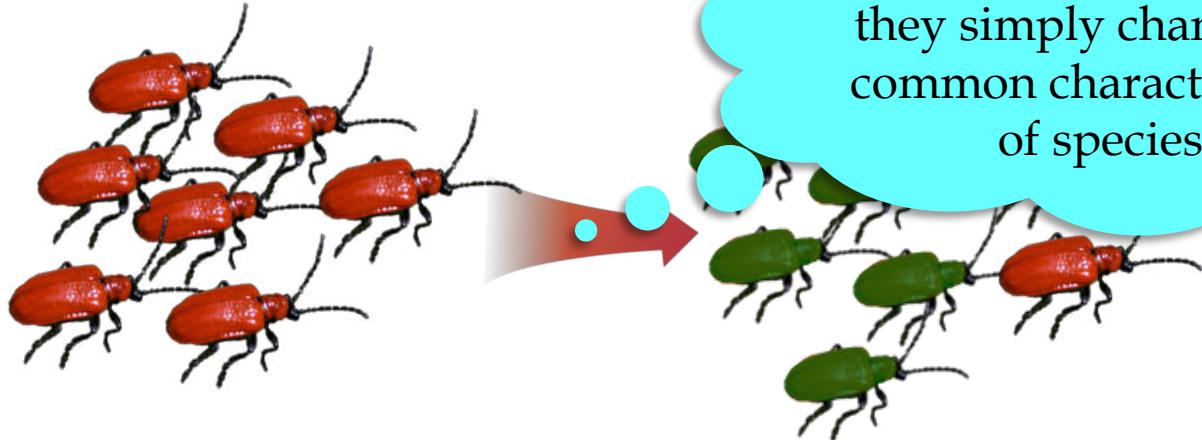
Now, lets
understand the
process of formation
of species on earth

Speciation

What we have seen so far is microevolution.

That means that the changes are

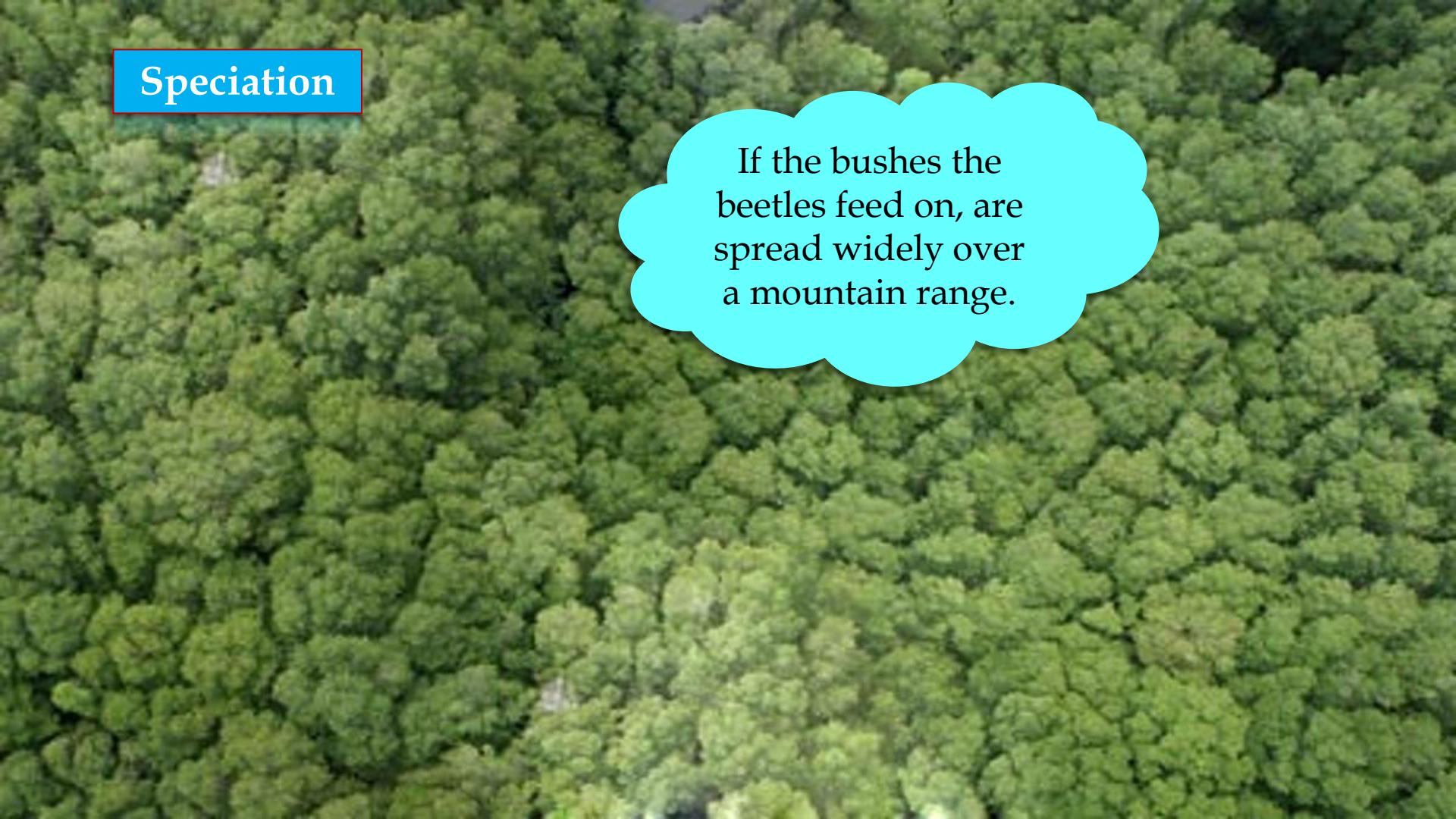
The changes were naturally selected and they simply change the common characteristics of species



But this does not properly explain how new species come into existence.



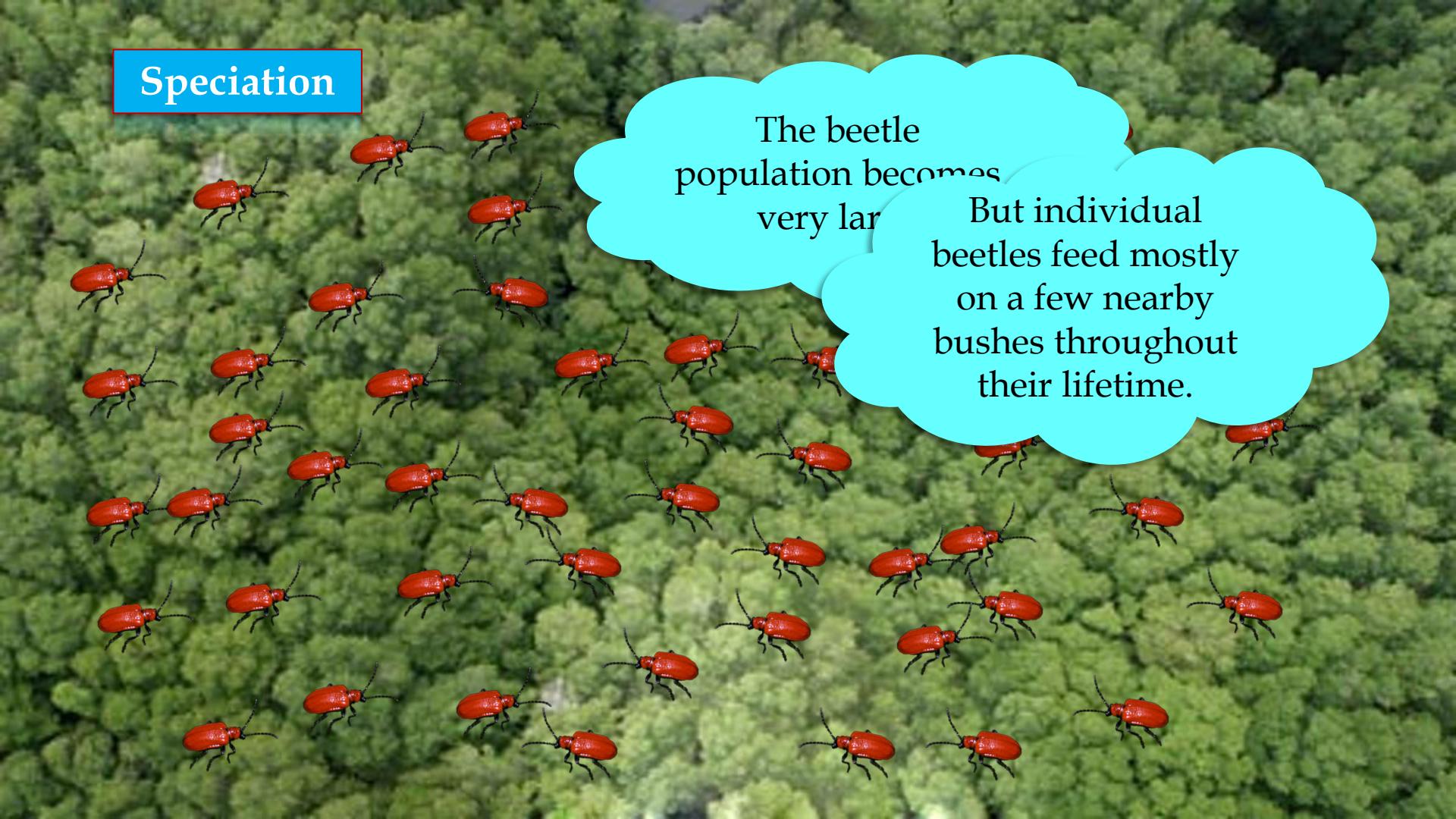
Lets see how new species come into existence

The background of the image shows a steep mountain slope covered in a dense, green forest of bushes. The bushes are tightly packed, creating a textured, layered appearance across the hillside.

Speciation

If the bushes the beetles feed on, are spread widely over a mountain range.

Speciation



The beetle population becomes very lar

But individual beetles feed mostly on a few nearby bushes throughout their lifetime.

Speciation

They do not travel far. So, in this huge population of beetles, there will be sub-populations.

Male and female beetles have to meet for reproduction to happen, most reproduction will be within these sub-populations.



Speciation

But occasional beetle is picked up by a crow from one site and dropped in the other site without being eaten

But populations are partly, but not completely separated. So, separate species can not be formed.

This will result in the

population.



An aerial photograph showing a narrow, winding river flowing through a dense, green forest. The river's path is clearly visible as a lighter-colored, textured band against the surrounding lush vegetation.

Speciation

If a large river comes into existence between the bushes.

Speciation



Hence new species of beetles are generated.

different from each other.



Thank You

Heredity and Evolution

- **Evidences For Darwin's Theory Of Evolution - 1**



Based on these studies,
can we workout the
evolutionary
relationships of the
species around us



Lets understand this by
going backwards in
time and by identifying
the similar
characteristics between
species

What is meant by characteristics???

Characteristics are details of appearance or behavior in other words, a particular form or a particular function.

For example Four limbs is a characteristic.



What is meant by characteristics???

Characteristics are details of appearance or behavior in other words, a particular form or a particular function.

For example

Plants can do photosynthesis is also a characteristic.



What is meant by characteristics???

Some basic characteristics will be shared by most organisms.

The more characteristics two organisms share, the more closely related they are.

All have common four limbs

Organisms will have in common,

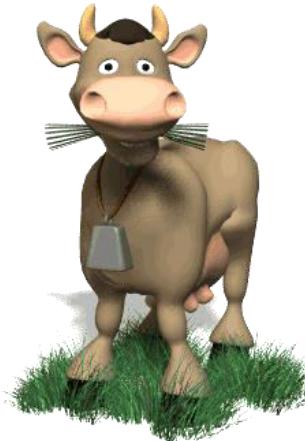
the more recently they are related, the more recently they had a common ancestor.



What is meant by characteristics???

For example

Humans and chimpanzees both have the following characteristics in common:
Skin, paranasal sinuses, pharynx, heart, lungs, stomach, intestines, liver, kidneys, bladder, brain, etc.



What is meant by characteristics???

So, we can build up small groups of species using recent common ancestor.



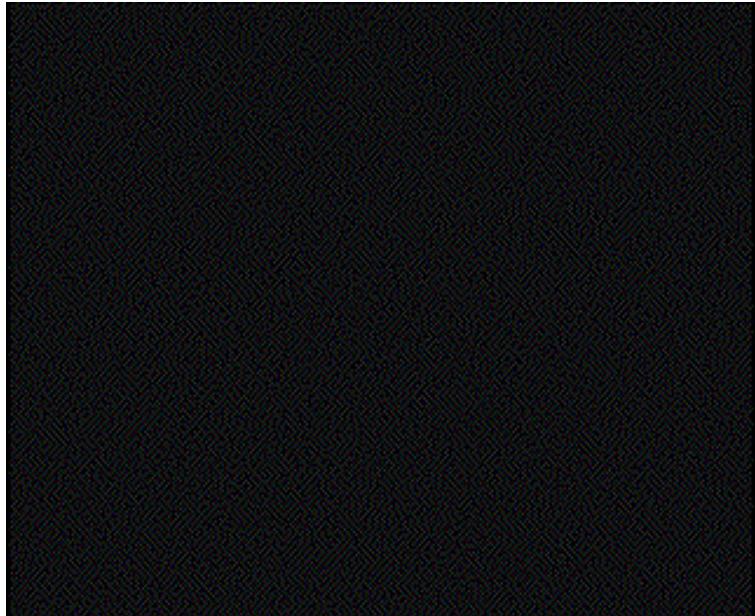
What is meant by characteristics???

Super-groups of these groups with more distant common ancestors.



What is meant by characteristics???

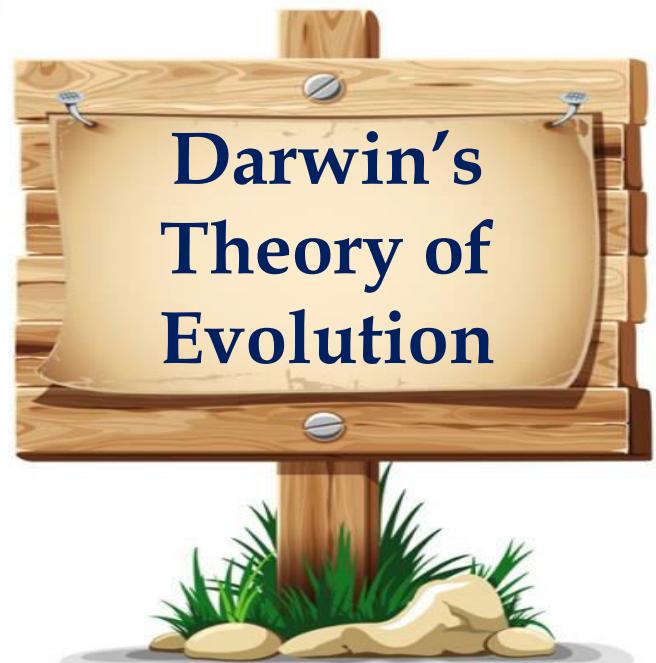
In theory, we can keep going backwards like this until we come to the notion of a single species at the very beginning of evolutionary time.



If that is the case, then at some point in the history of the earth, non-living material must have given rise to life.



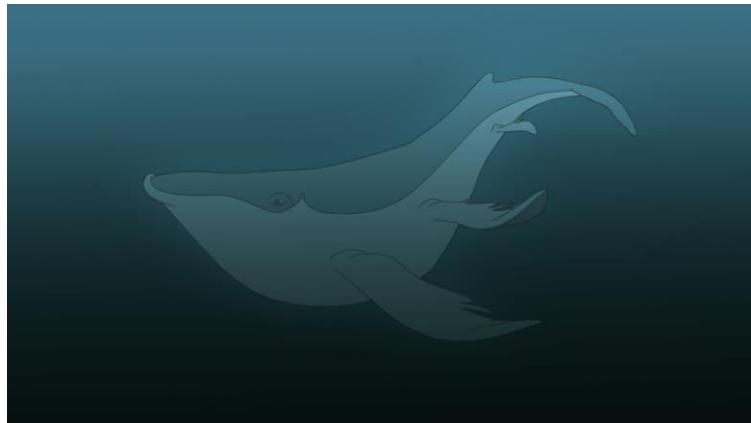
But the most
accepted
theory is.....



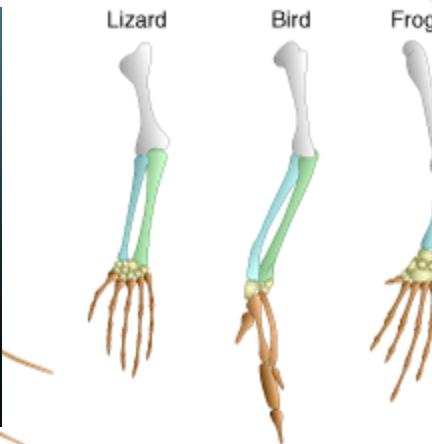
Evidences for Darwin's Theory of Evolution

1. Anatomical Evidences

The basic structure of limbs is similar in mammals, birds, reptiles and amphibians.



Whale use their limbs for swimming



But they all perform different functions

Evidences for Darwin's Theory of Evolution

1. Anatomical Evidences

The basic structure of limbs is similar in mammals, birds, reptiles and amphibians.



**Lizards use their
limbs for Crawling**

**Bats use their
limbs for Flying**

Evidences for Darwin's Theory of Evolution

1. Anatomical Evidences

Such organs which are similar in structure but different in functions are called as homologous organs.

Such homologous characteristics helps to identify an evolutionary relationship between apparently different species.

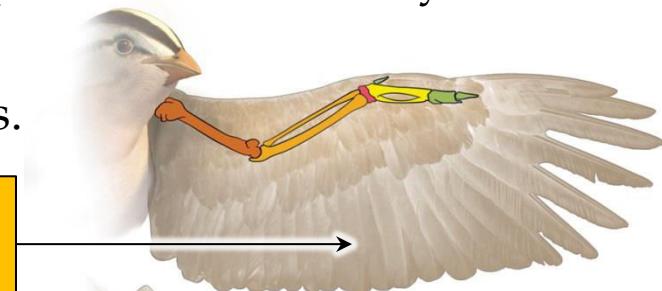
Evidences for Darwin's Theory of Evolution

1. Anatomical Evidences

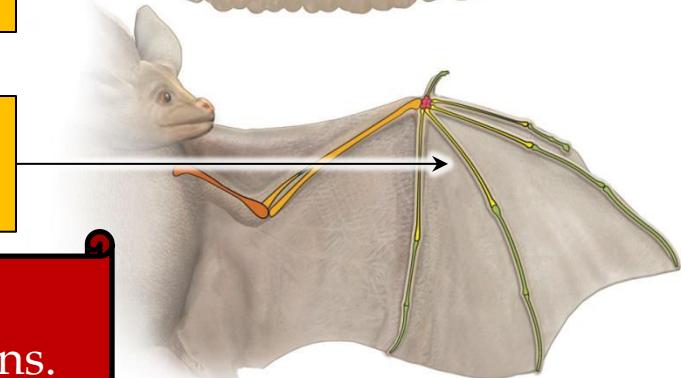
On contrary, all similarities simply in organ shape are not necessarily because of common ancestry.

For example Wings of bird and wings of bats.

Wings of bird are a feathery covering all over the arm.



Wings of bat are skin folds stretched mainly between elongated fingers.



Such organs which are similar in function but different in structure are called as analogous organs.

Thank You

Heredity and Evolution

- **Evidences For Darwin's Theory Of Evolution - 2**

Evidences for Darwin's Theory of Evolution

2. Fossils

Studies of organ structure can be done not only on current species, but also on species that are no longer alive.



How do we know that these extinct species ever existed?

We know this from finding their fossils

Evidences for Darwin's Theory of Evolution

2. Fossils

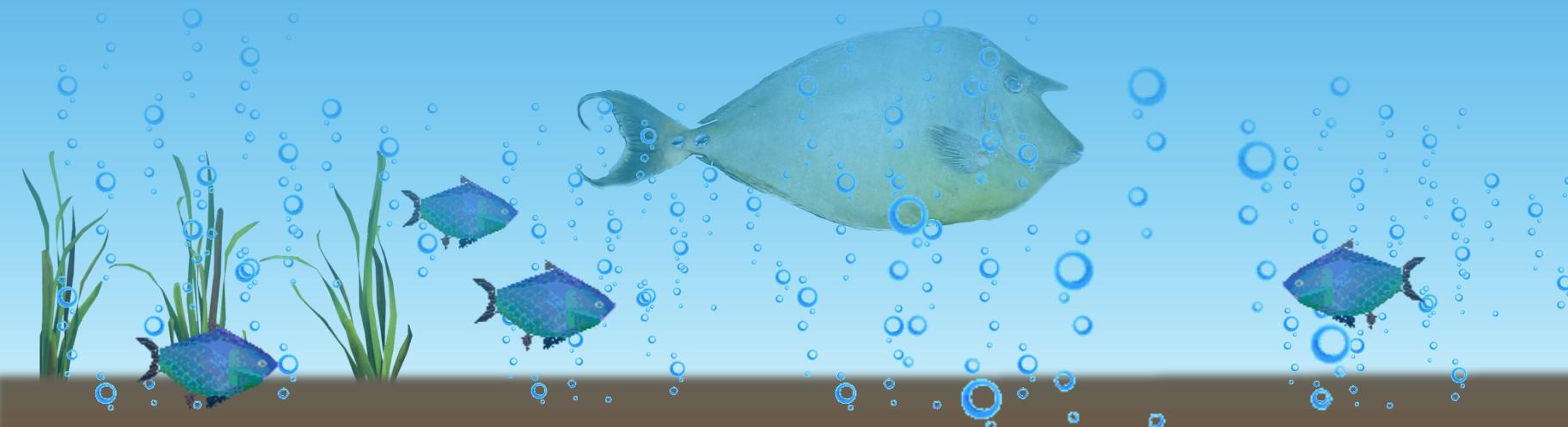
What are fossils?
and how they are
made



Evidences for Darwin's Theory of Evolution

2. Fossils

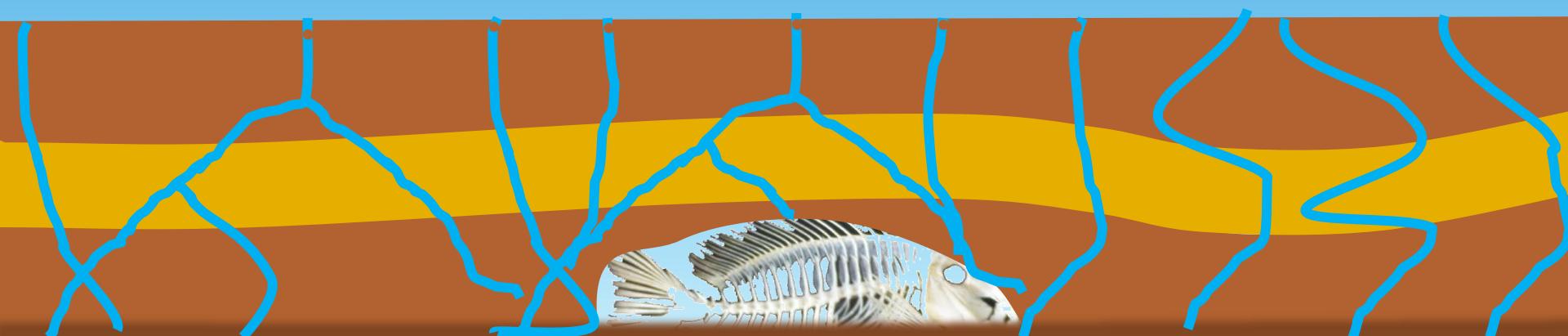
Their bodies will decompose and be lost.



Evidences for Darwin's Theory of Evolution

2. Fossils

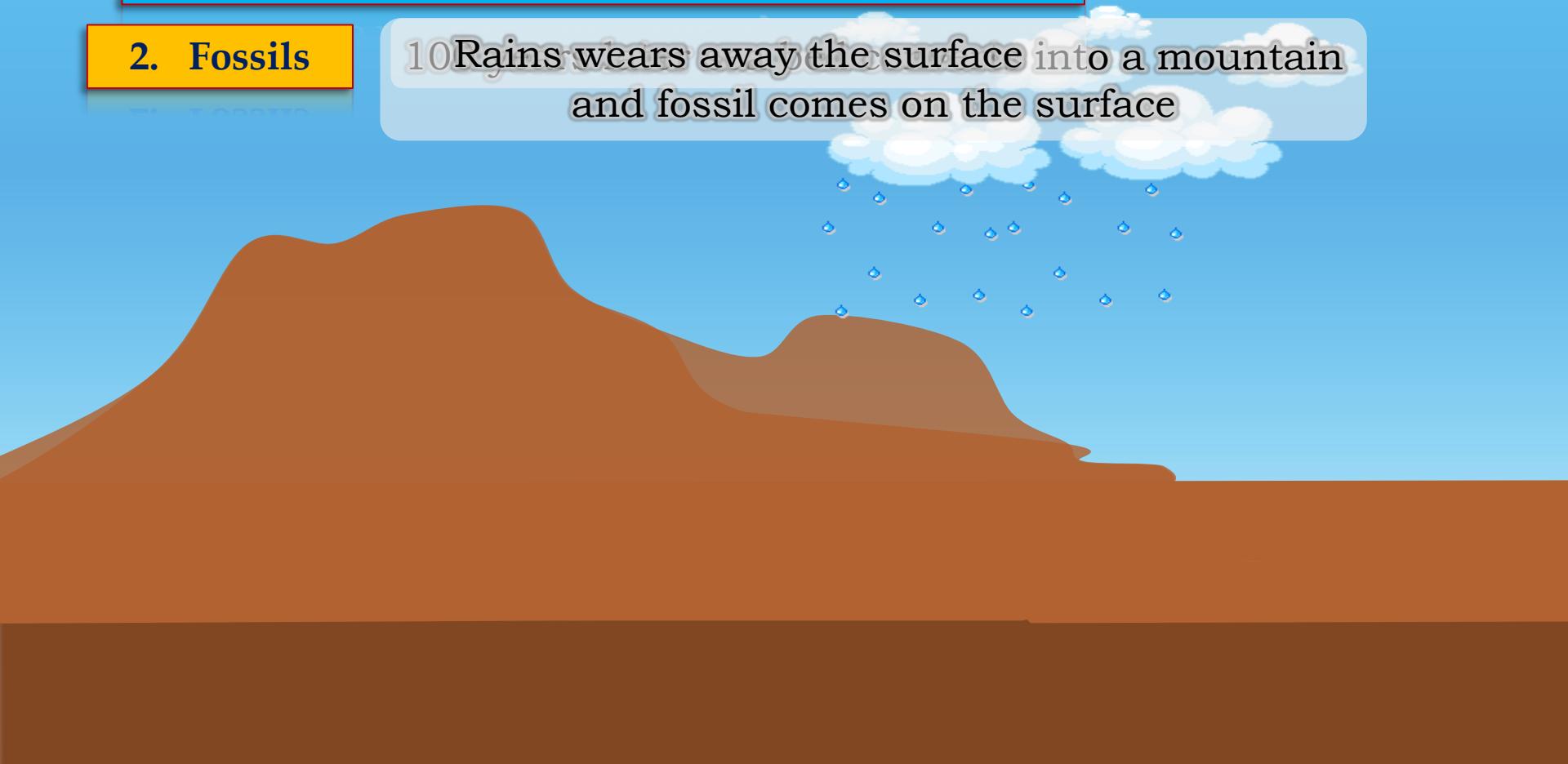
Rock deposit on the fossiliferous minerals of the sea bed.



Evidences for Darwin's Theory of Evolution

2. Fossils

Rains wears away the surface into a mountain
and fossil comes on the surface



Evidences for Darwin's Theory of Evolution

2. Fossils

Archeologist digs the surface and found the fossil.



Evidences for Darwin's Theory of Evolution

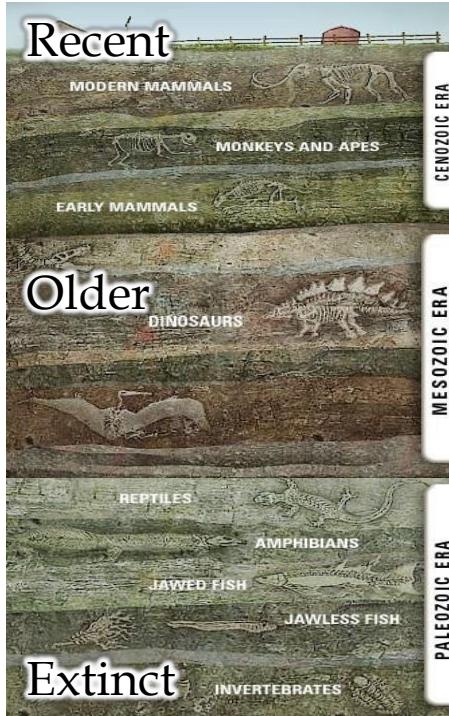
2. Fossils

All such preserved traces of living organisms are called fossils



Evidences for Darwin's Theory of Evolution

2. Fossils



How do we know how old the fossils are?



Relative Method

Isotope Method

If we dig into the earth the fossils we find closer to the surface are more recent than the fossils we find in deeper layer.

Evidences for Darwin's Theory of Evolution

2. Fossils

How do we know how old the fossils are?

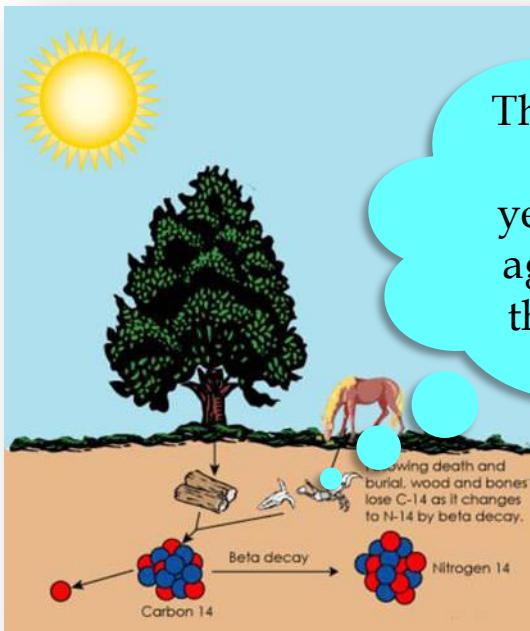


Relative Method

Isotope Method

Detecting the ratios of different isotopes of the same element in fossil material.

The amount of carbon decayed over the years will tell the real age of the fossil from the time of its death.





Complicated organs such as eye can not be generated by a single DNA. But will be created bit by bit over generation



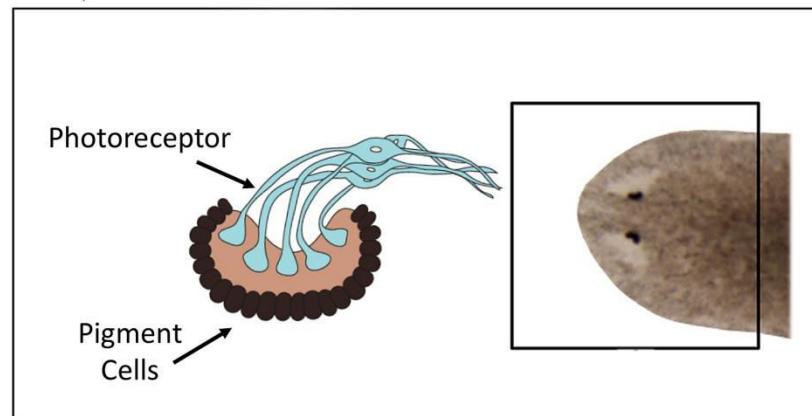
But how can each
intermediate
change be selected
for?



Let's understand
this with a possible
explanation...

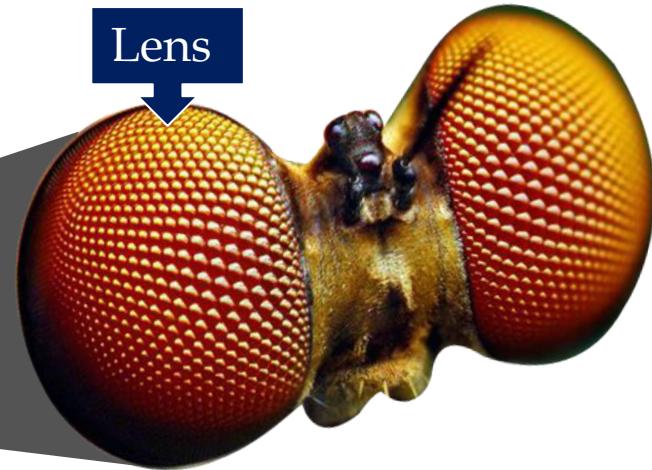
Evolution by stages of eye

The first basic eye was seen in planaria which were just eye spots which can detect light.



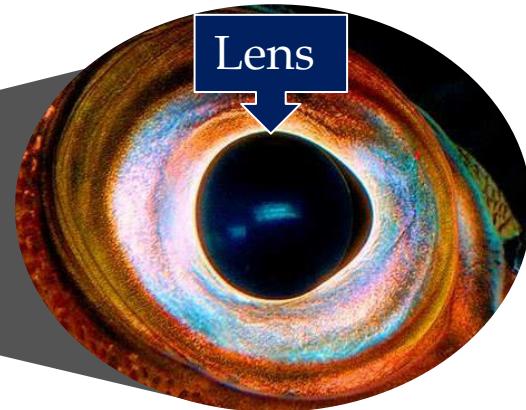
Evolution by stages of eye

The second evolution in eye is seen in insects like cockroach, who has compound eyes. i.e. many lens in one eye.



Evolution by stages of eye

The third evolution in eye is seen in octopus, who has camera type simple eyes with single lens.



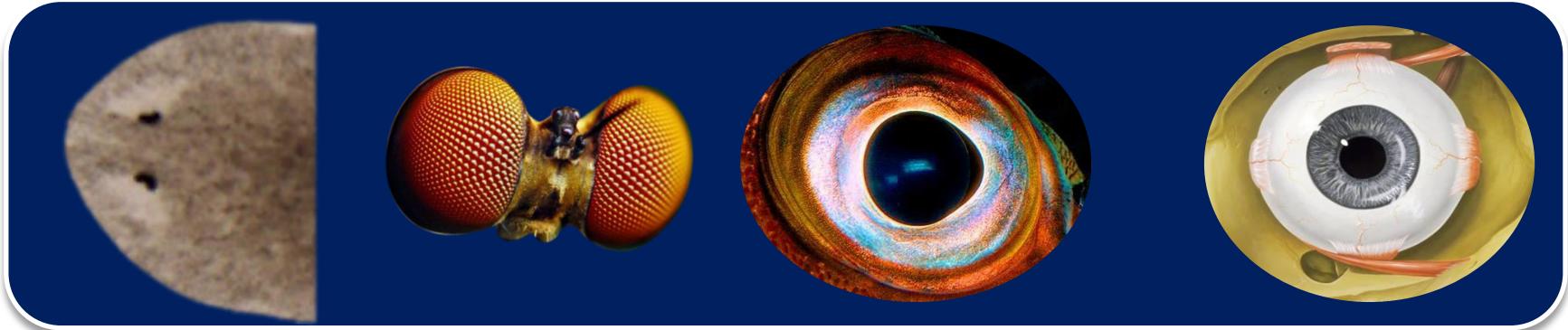
Evolution by stages of eye

The latest evolution in eye is seen in vertebrates, who has an advance eye with single lens.



Evolution by stages of eye

Evolutionary stages of eye



Structure of the eye in each of these organisms is different.

Differences in structures of eye is enough for them to have separate evolutionary origins.

Evolution by stages of feathers

The first feather was seen in dinosaurs although they could not fly using the feathers. These feathers got evolved and become useful for flight in birds.

This, of course, means that birds are very closely related to reptiles, since dinosaurs were reptiles.



Thank You

Heredity and Evolution

- **Evolution By Stages**



It is all very well to say
that very dissimilar-
looking structures
evolve from a common
ancestral design.



But those are guesses
about what
happened in history.



Are there any
current examples of
such a process?



Evolution by stages of Cabbage

Humans, from more than two thousand years, cultivated wild cabbage as a food plant, and generated different vegetables from it by selection.

Some farmers have wanted to select for very short distances between leaves, and have br
t



Cabbage

cabbage we Some have wanted to select for arrested flower development, and have bred **broccoli**.



Kohlrabi

and made the
cauliflower



Cauliflower

The wild cabbage plant is selected and different cabbages were grown for different purposes.

Evolution by stages of Cabbage

So, we can say that all these structures are descended from the same ancestor.



Cabbage



Kale



Broccoli



Wild cabbage



Kohlrabi



Cauliflower

Evolution and its progress



Evolution and its progress



But it is just that **natural selection** and **genetic drift** have together led to the formation of a population that cannot reproduce with the original one.

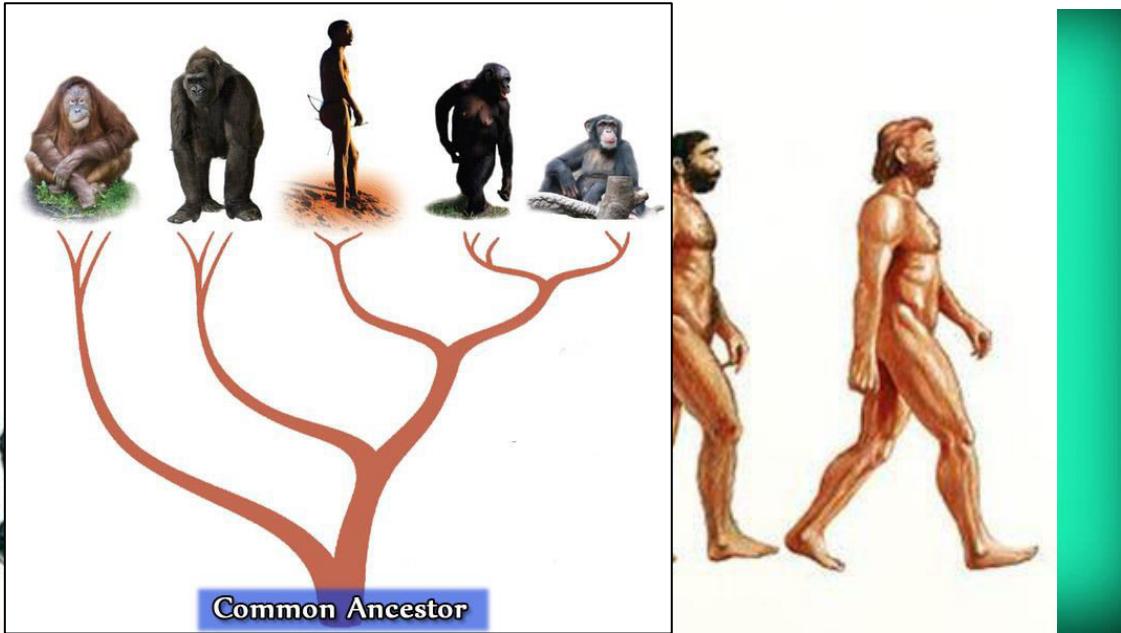
Thank You

Heredity and Evolution

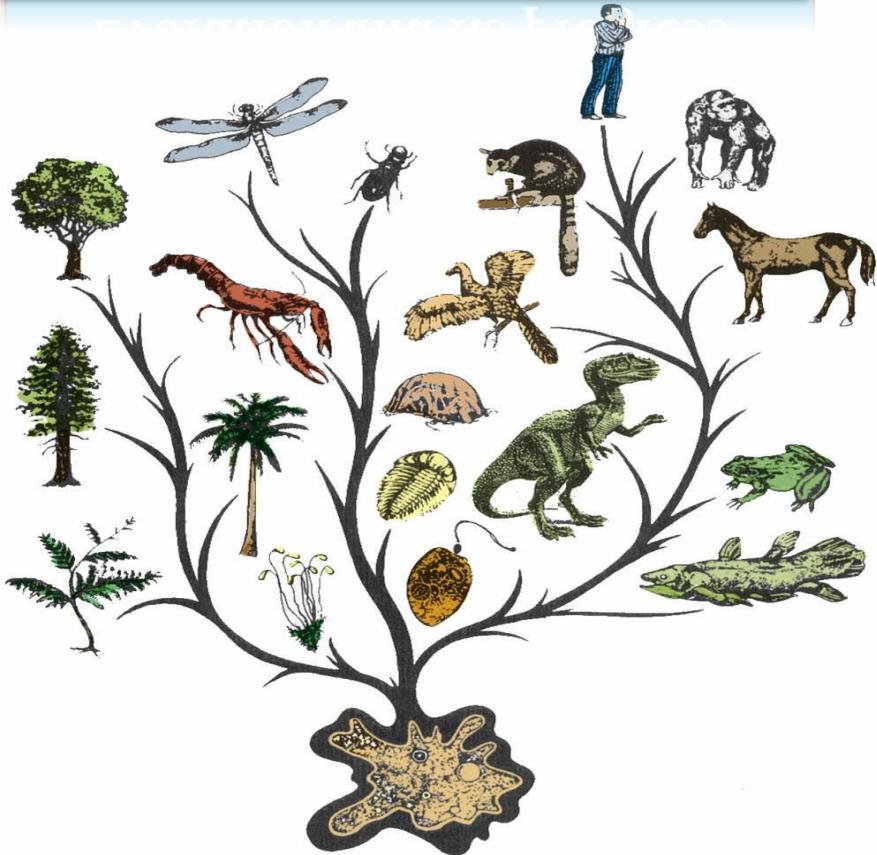
- **Evolution And Its Progress**

Evolution and its progress

Hence we can see there is no real progress in the idea of evolution.



Evolution and its progress



Evolution is simply the generation of diversity and the shaping of the diversity by environmental selection.

Evolution and its progress

The only progressive trend in evolution seems to be that more and more complex body designs have emerged over time.



Evolution and its progress

It is not as if the older designs are inefficient!

Many of the older and simpler designs still survive.

In fact, one of the simplest life forms – bacteria – inhabit the most inhospitable habitats, like



Hot springs



*Deep sea
Thermal vents*



Ice in Antarctica

Evolution and its progress



In other words, human beings are not the pinnacle of evolution, but simply yet another species in the teeming spectrum of evolving life.

Thank You

Heredity and Evolution

- Human Evolution

Human Evolution

The same tools for tracing evolutionary relationships.

1. Excavating
2. Time-dating
3. Studying fossils

As well as determining DNA sequences – have been used for studying human evolution.

There is a great diversity of human forms and features across the planet.



Human Evolution

There is a great diversity of human forms and features across the planet. So much so that, for a long time, people used to talk about human 'races'.



Human Evolution

Skin colour used to be the commonest way of identifying these so- called races. Some were called yellow, some black, white or brown.



Have these different groups evolved differently?

Human Evolution

Have these different groups evolved differently?

Over recent years, the evidence has become very clear.

The answer is that there is no biological basis to the notion of human races.

All humans are a single species



Human Evolution

While the residents spread across **Africa**, the migrants slowly spread across the planet – from **Africa** to **West Asia**, then to **Central Asia, Eurasia, South Asia, East Asia**.

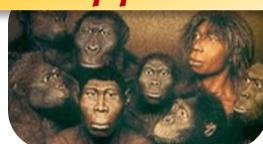
Then they crossed the Bering land bridge to the Americas.

Bering land bridge

They travelled down the islands of **Indonesia** and **Philippines**



America



lived for the past few thousand



Asia

Then they traveled to Australia from Philippines

Philippines

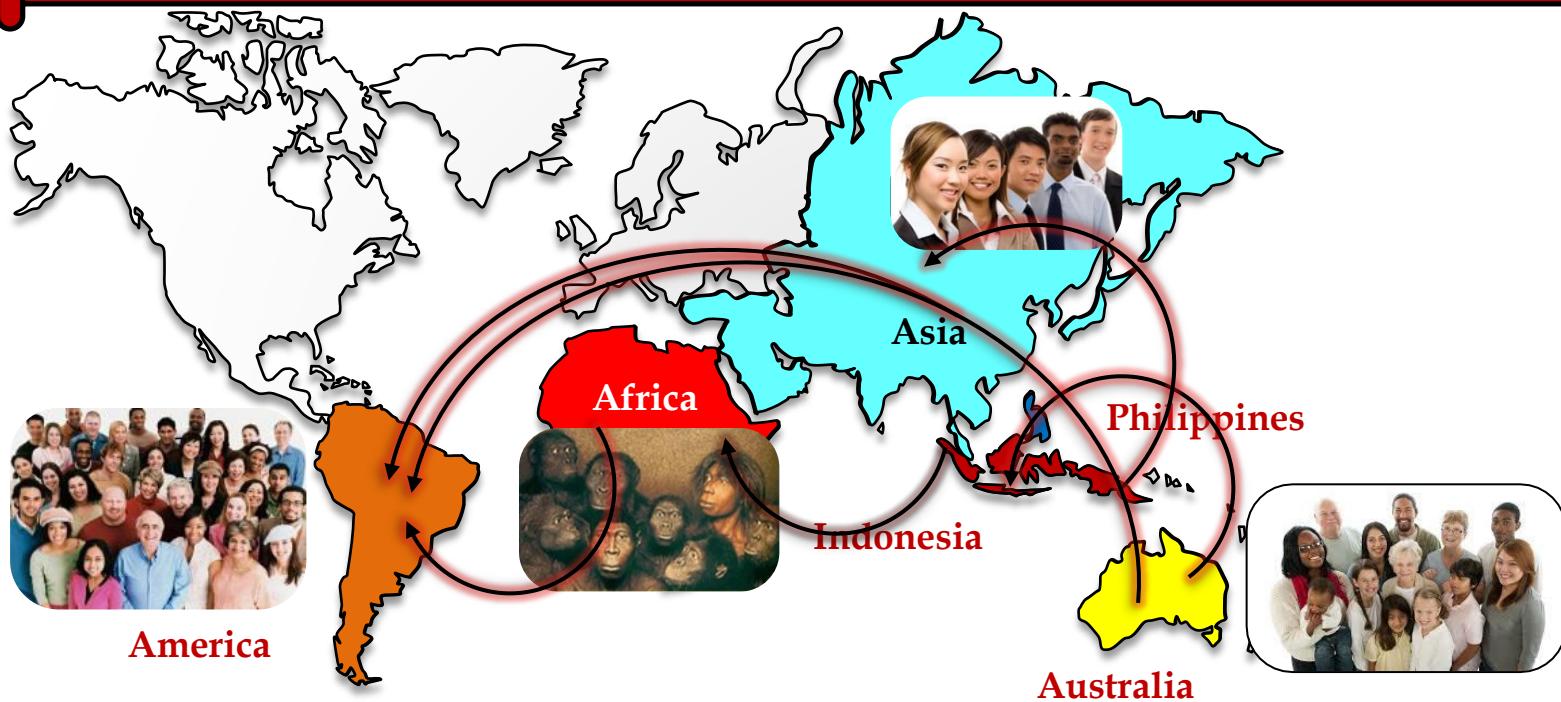
Indonesia



Australia

Human Evolution

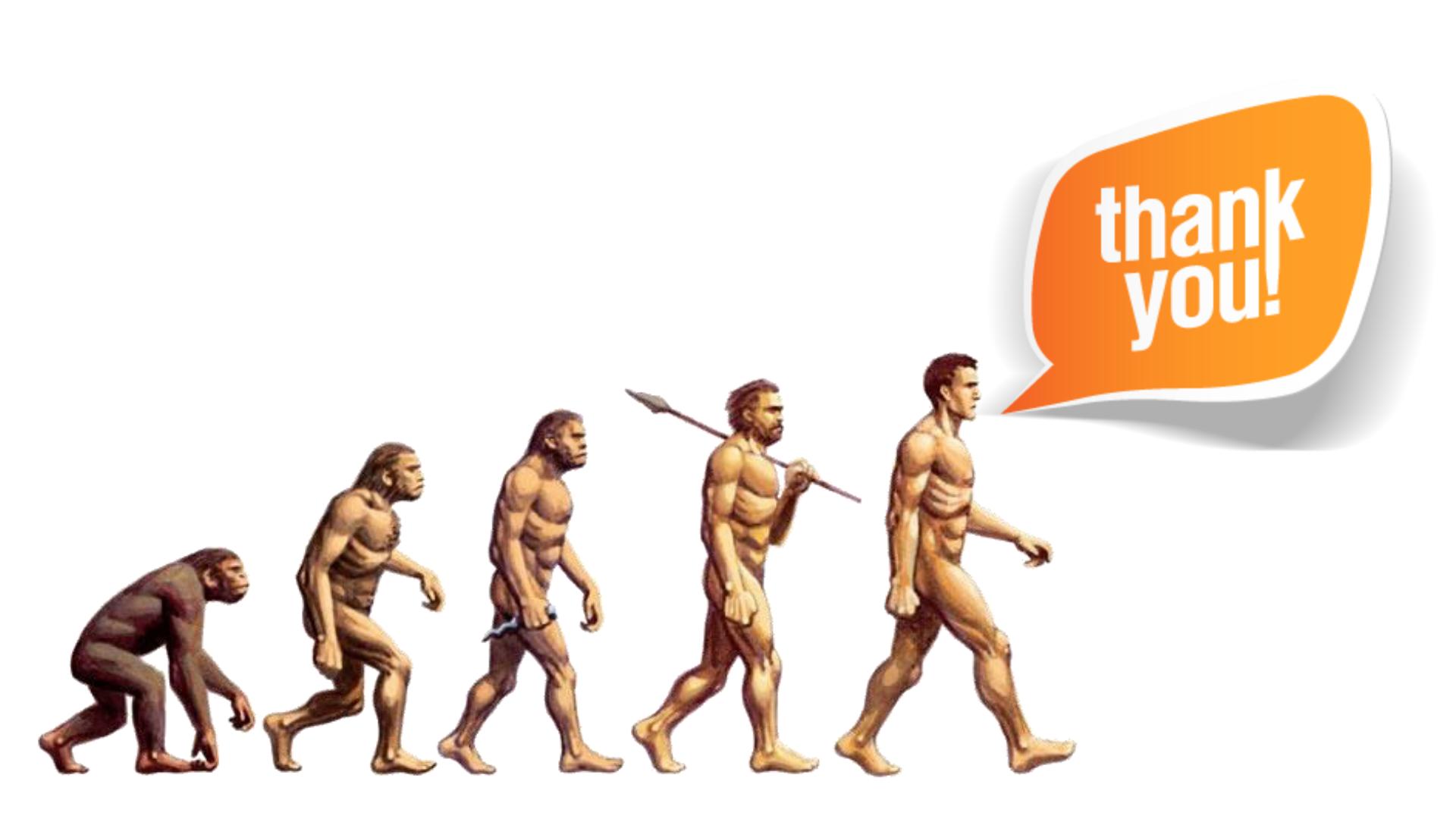
They went forwards and backwards, with groups sometimes separating from each other, sometimes coming back to mix with each other, even moving in and out of Africa.



Human Evolution

Like all other species on the planet, they had come into being as an accident of evolution, and were trying to live their lives the best they could.





thank
you!

Thank You