

How do Organisms Reproduce?

- **Introduction**



Before we discuss the mechanisms by which organisms reproduce, let us understand *why do organisms reproduce???*

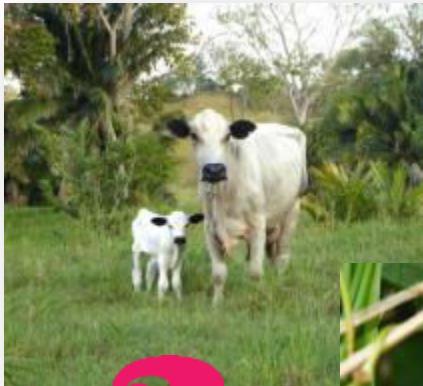


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After all, reproduction is not necessary to maintain the life of an individual organism, unlike the essential life processes such as nutrition, respiration, or excretion.



Also, if an individual organism is going to create more individuals, a lot of its energy will be spent in the process. So why should an individual organism waste energy on a process it does not need to stay alive?



?



?



?

It is obvious that we notice organisms because they reproduce.



If there were to be only one, non-reproducing member of a particular kind, it is doubtful that we would have noticed its existence.



It is the large numbers of organisms belonging to a single species that bring them to our notice.





**How do we know that
two different
individual organisms
belong to the same
species?**

Usually, we say this because they look similar to each other.



Thus, reproducing organisms create new individuals that look very much like themselves.



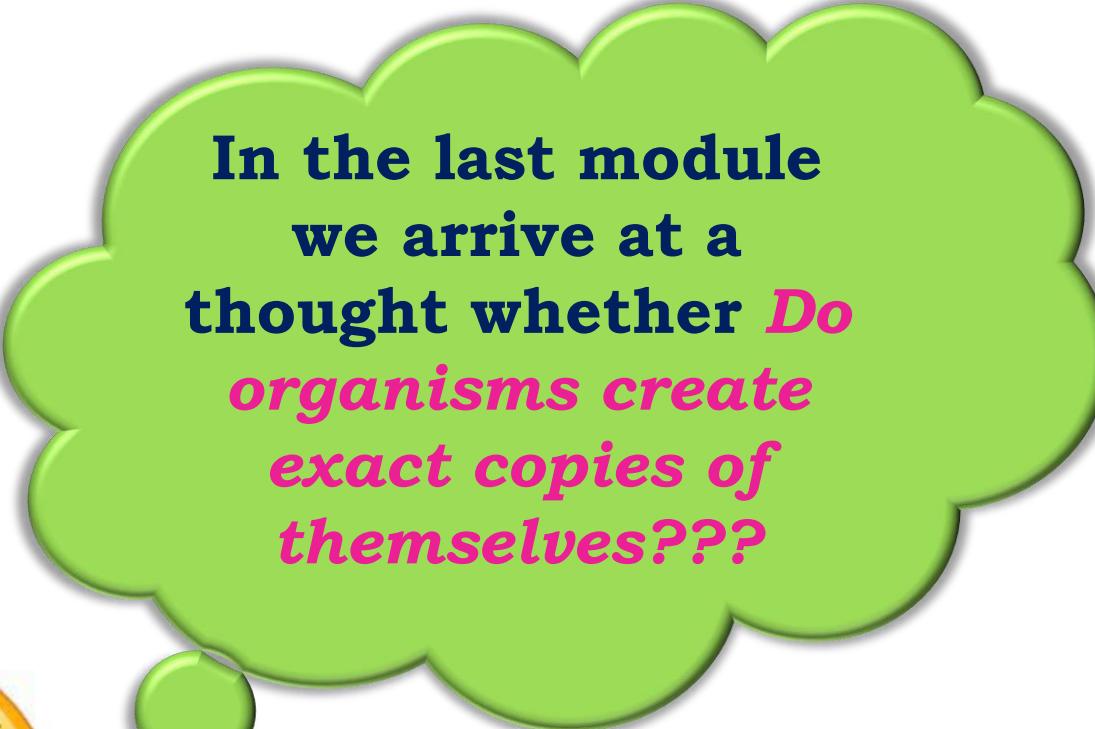


*Do organisms
create exact
copies of
themselves???*

Thank You

How do Organisms Reproduce?

- The process of reproduction (DNA coping)



In the last module
we arrive at a
thought whether *Do*
organisms create
exact copies of
themselves???

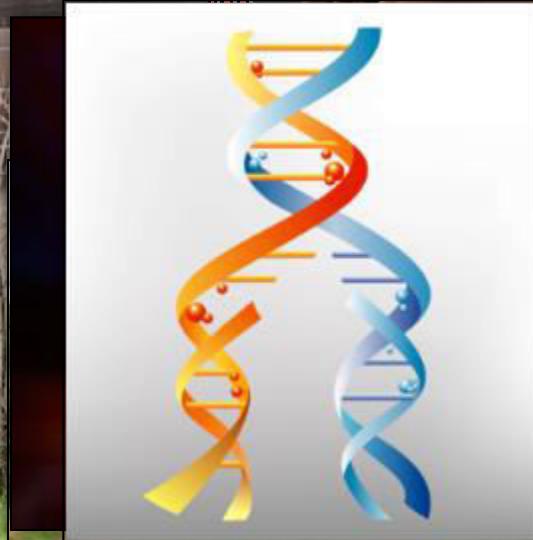


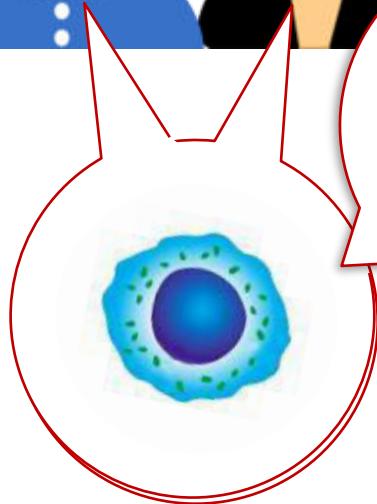
*Let us find
out an answer
to this in this
module*

Reproduction

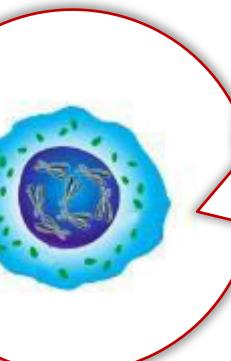
Organisms create new individuals which look very much like themselves.

- Organisms *look similar* – *body designs are similar*.
- *Blue prints* have to be *similar*.
- Reproduction – *making copies of the blue print*.

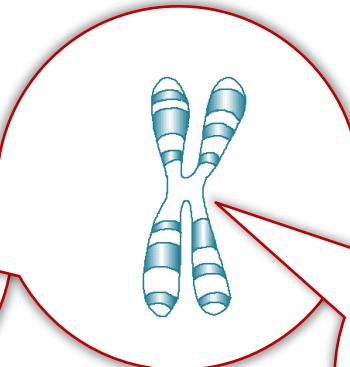




Reproducing cell



Nucleus



Chromosome

**Chemical Reactions
DNA Copies
Variations**



DNA

Identical

Similar

Thank You

How do Organisms Reproduce?

- The importance of variation

The importance of variation



The importance of variation

- Populations of organisms live in well-defined places - *Niches*



The importance of variation

- Populations of organisms live in well define places - **Niches**
- *Their body design allows them to use that particular niche.*



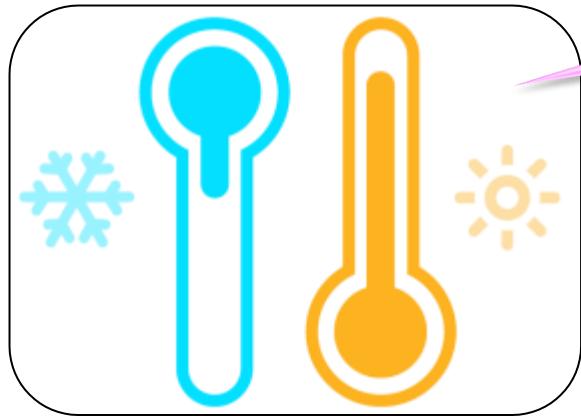
The polar bear is well adapted to its Arctic environment as their white fur helps them blend in with the snow and ice and has a layer of fat under its skin which helps it stay warm

The importance of variation

- However, niches can change *because of reasons beyond the control of organisms.*



The importance of variation



Temperatures can go up and down

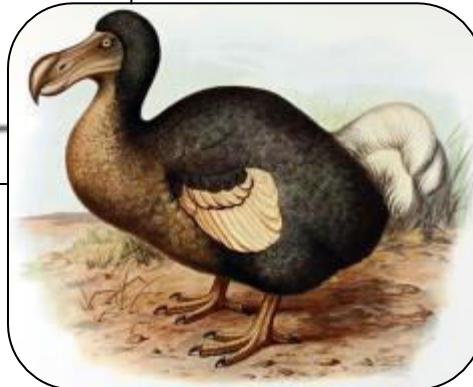
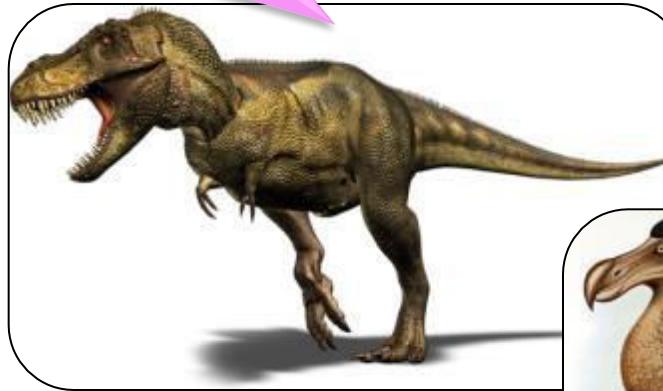
or meteorite
hits.



water levels can
vary

The importance of variation

If this is drastically altered
– population will be wiped
out.



The importance of variation

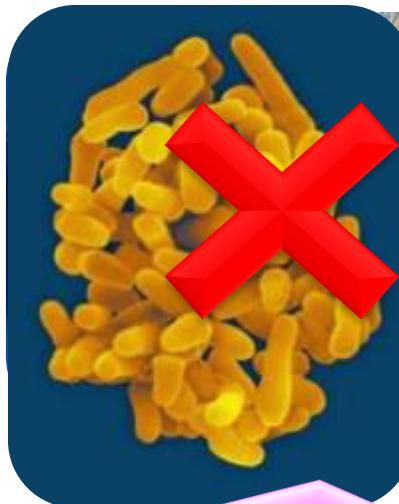


For eg. The Indian Pipe Plant earlier was photosynthetic due to the presence of chlorophyll. During the course of evolution, it lost its chlorophyll and became saprophytic. This variation in the plant mode of nutrition has helped it to survive till date.

However if some variations are present population can survive.

The importance of variation

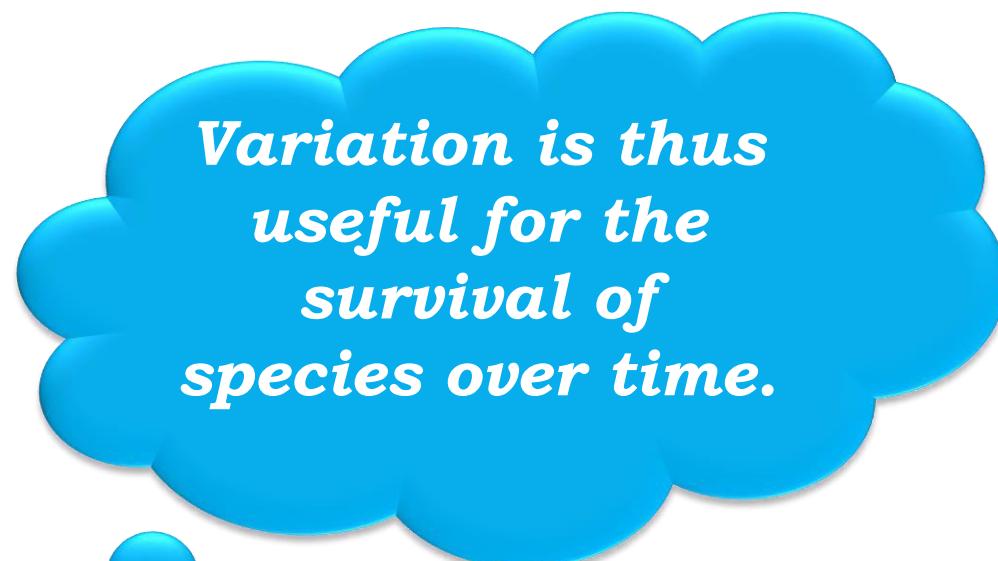
- E.g. if there were a population of bacteria living in temperate water,



and if the water temperature was increased by global warming, most of them would die.



- But few variants resistant to heat would survive and grow further



*Variation is thus
useful for the
survival of
species over time.*

Thank You

How do Organisms Reproduce?

- Modes of reproduction used by single organisms (Binary and Multiple Fission)

MODES OF REPRODUCTION

Asexual

*Only one parent involved
Simple and small organism
like microorganisms*



Sexual

*Two parents involved
Human, Dogs, Elephants, Birds, Plants*



MODES OF REPRODUCTION USED BY SINGLE ORGANISMS (*Asexual Reproduction*)

Fission

Fragmentation

Regeneration

Budding

Vegetative Propagation

Spore formation



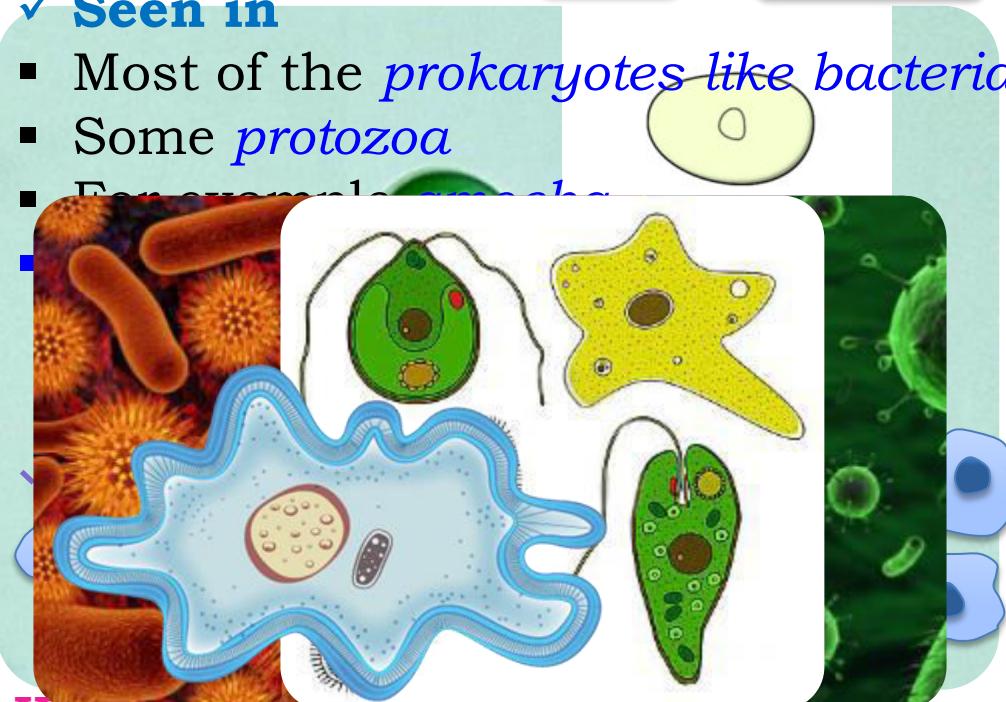
Fission

BINARY FISSION

The living cell divide *Two* tw *Division* or nearly equal parts

✓ Seen in

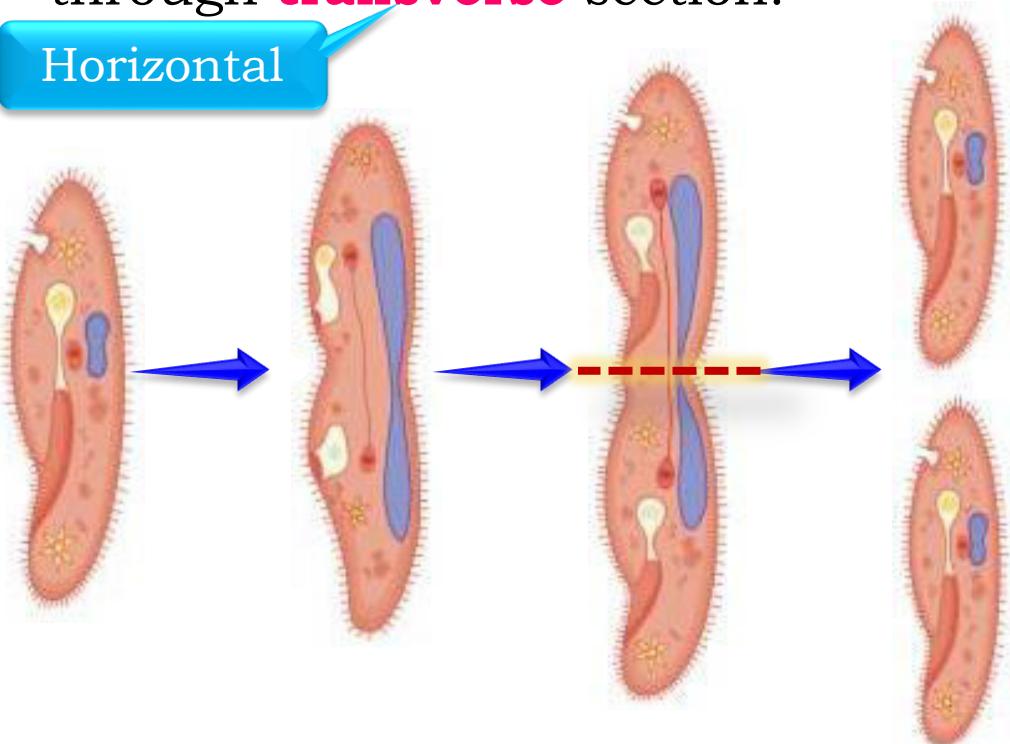
- Most of the *prokaryotes like bacteria*
- Some *protozoa*
- For example *Amoeba*



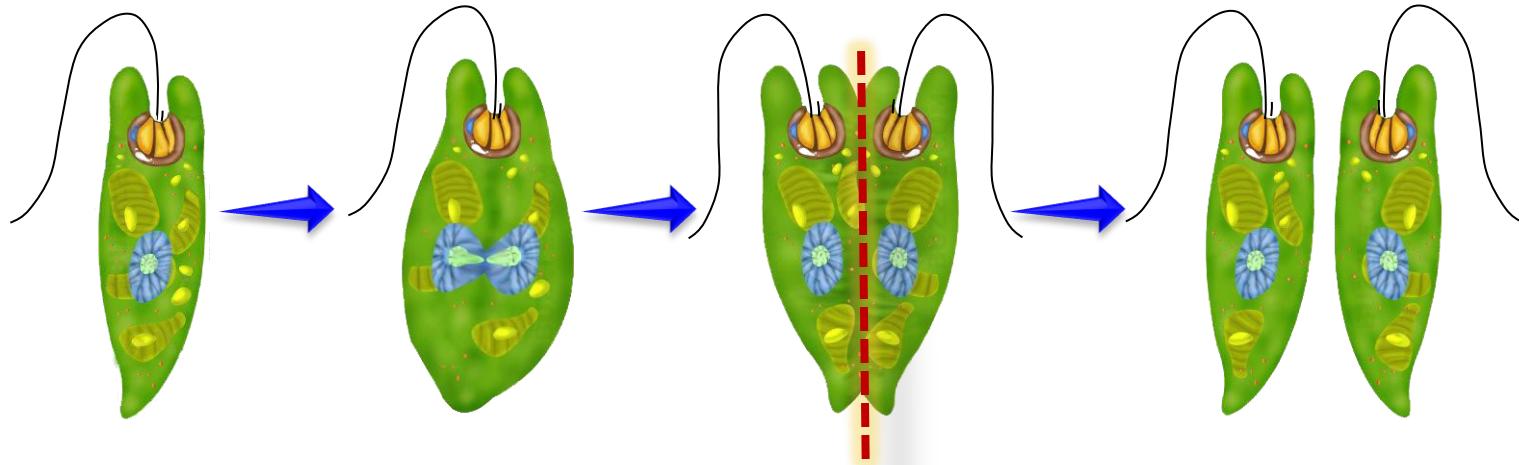
Hence it is called simple binary fission.

- In case of *paramoecium* binary fission occurs through **transverse** section.

Horizontal



Hence it is called **transverse binary fission**.



- In case of *euglena* or *Leishmania* binary fission occurs through **longitudinal** section.

Vertical

Hence it is called **longitudinal binary fission**.

MULTIPLE FISSION

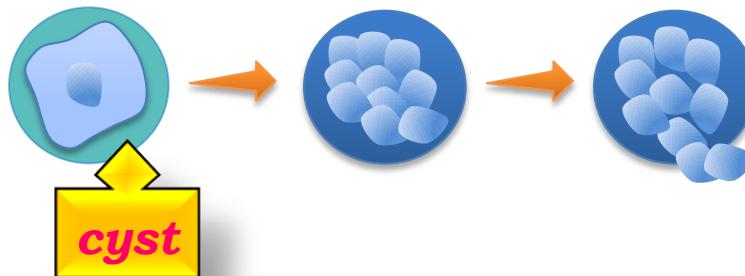
Seen in *plasmodium, amoeba*.

It occurs during *unfavourable conditions*.

Amoeba becomes almost round *Secretes a hard covering called cyst*.
Inside the nucleus divides into many *nuclei* followed by *division of cytoplasm*.

As a result *many daughter cells* are formed.

During favourable conditions the cyst bursts *releasing daughter cells*.

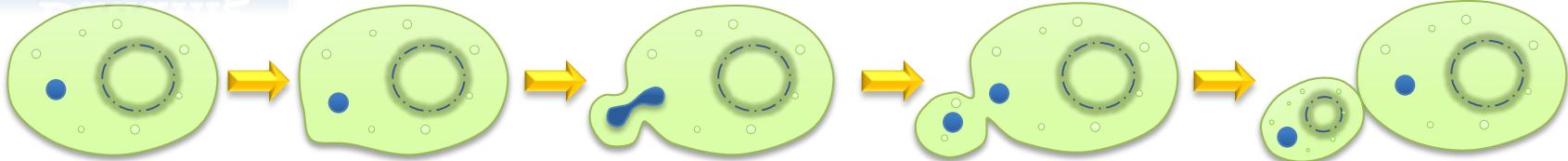


Thank You

How do Organisms Reproduce?

- Modes of reproduction used by single organisms
(Budding, Fragmentation)

Budding



Seen in *Yeast*

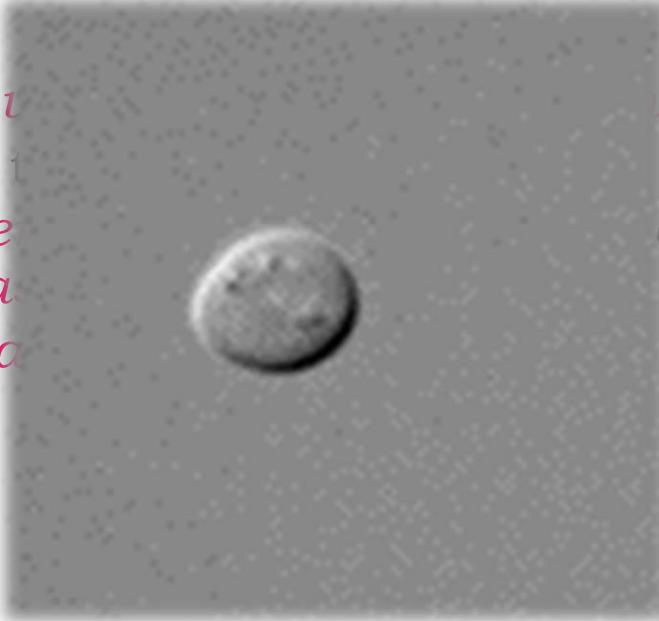
A *small outgrowth*

The *nucleus* of the

& *one daughter*

The *bud increases*

The bud *separates*

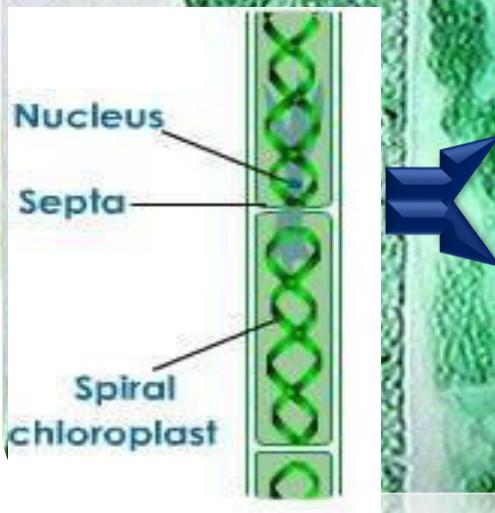


parental cell

the bud

Fragmentation

- Seen in *multi-cellular* body organisation.
- For eg- *Spirogyra*, a green alga.
- On *maturity* the fragment *breaks up* into *smaller pieces*.
- These pieces or *fragments* grow into *new individuals*.



The act or process of breaking into fragments (piece)

body organisation.

new individual



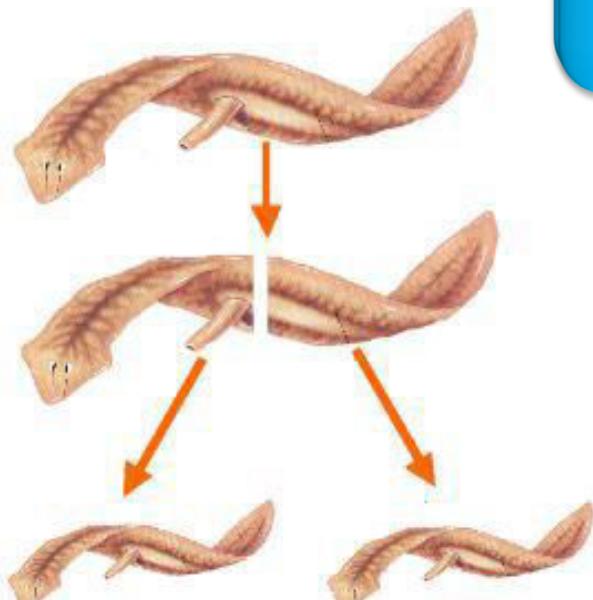
new individual

Thank You

How do Organisms Reproduce?

- Modes of reproduction used by single organisms
(Regeneration)

Regeneration



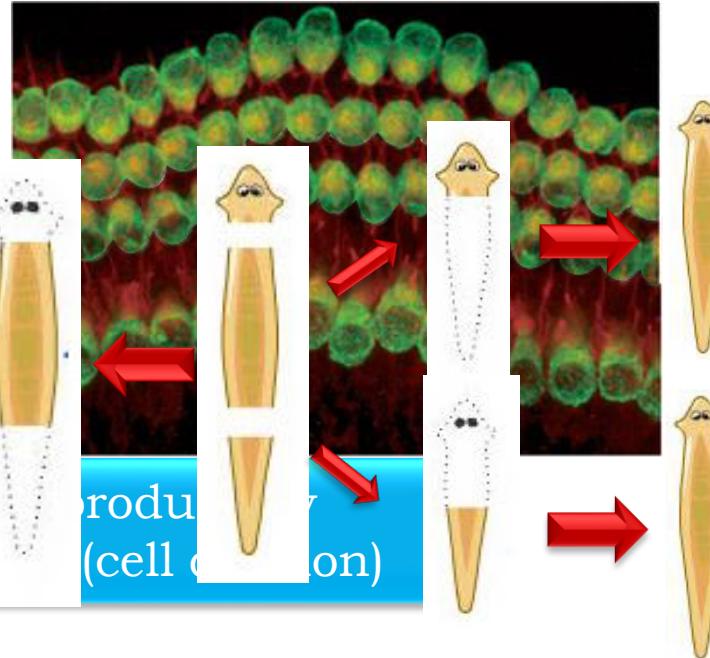
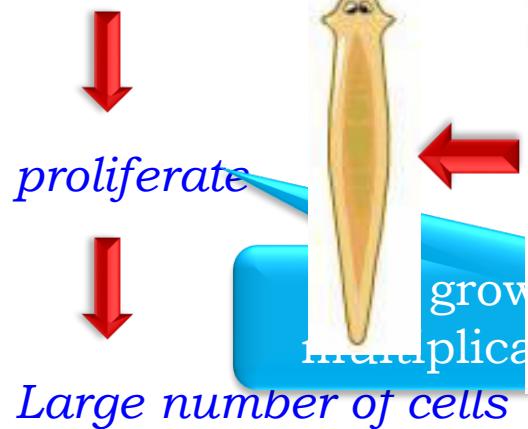
If the individual is cut or broken into many pieces- these pieces grow into separate individuals.



*Let us find
out how does
this
happen???*

Regeneration

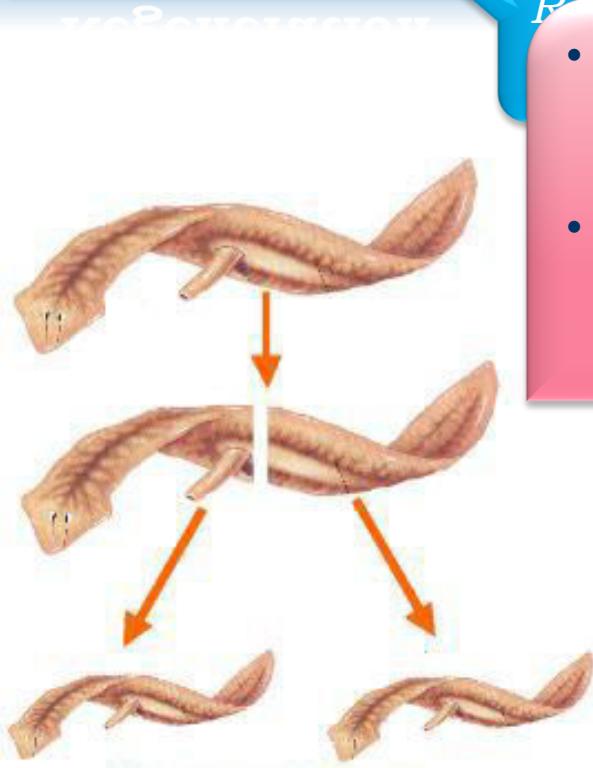
Specialized cells



Cells types and tissues changes

→ *Organised sequence* → *development*

Regeneration



R

- *Regeneration is the reconstruction of entire body from the isolated body cells when the organism body gets cut into pieces.*
- *But animals cannot wait to be cut to reproduce. Therefore, regeneration is not the same as reproduction.*

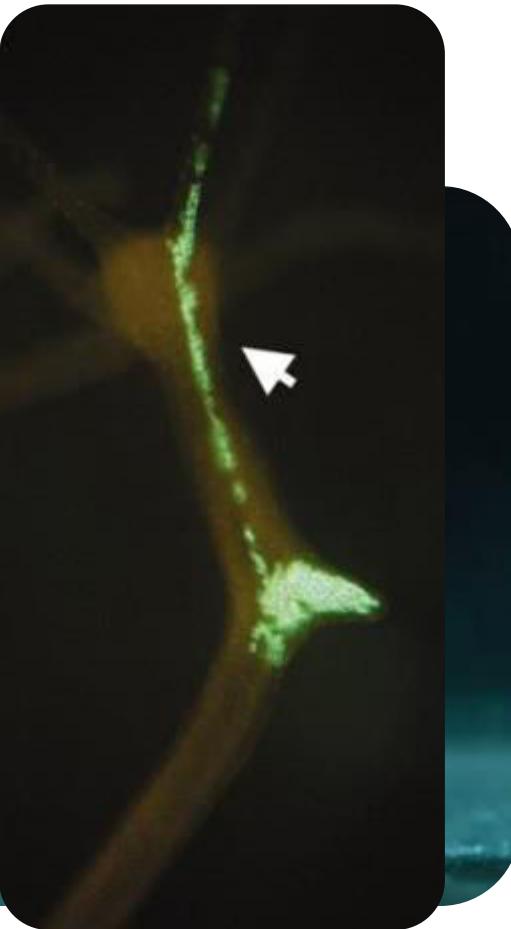
Thank You

How do Organisms Reproduce?

- Modes of reproduction used by single organisms
(Budding, Vegetative propagation)

Budding

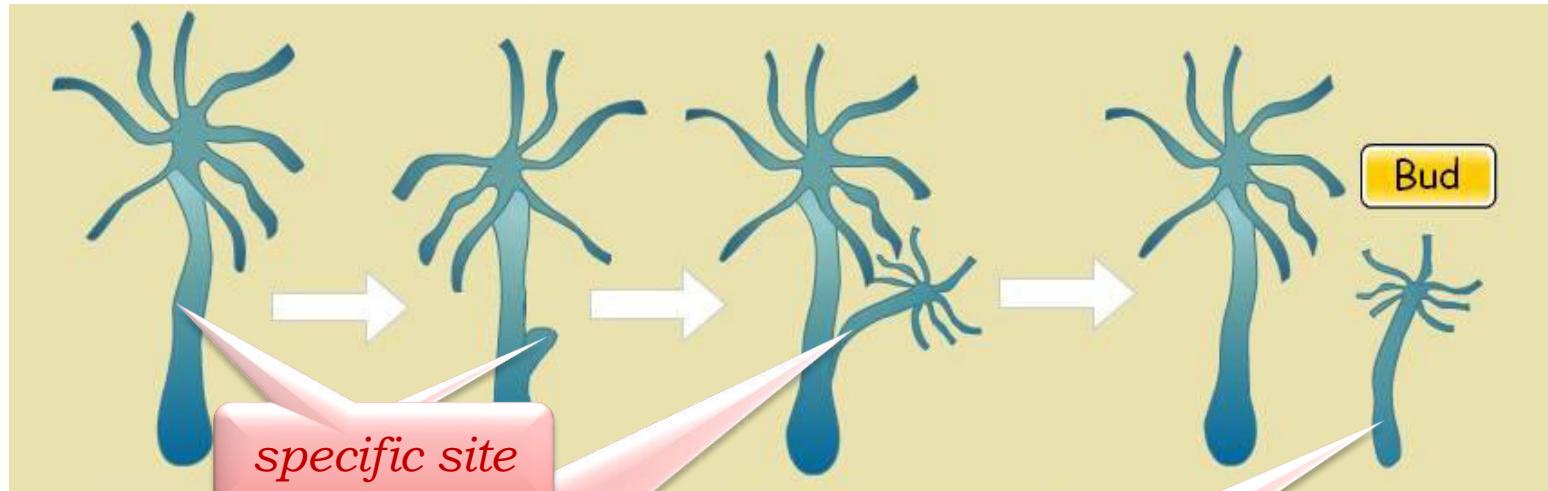
- Seen in *hydra*.
- *Regenerative cells*.



Budding

Regenerative cells

- Due to repeated *cell division* at one *specific site* → *Outgrowth* → *Bud*



specific site

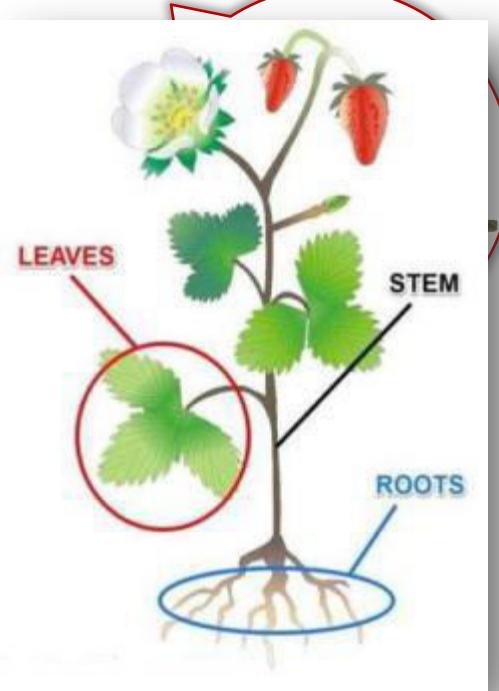
These buds grow into tiny individuals.

When fully matured, they detach from parent body and become new independent individuals.

Vegetative propagation

Plants → Roots, stem, leaves → Develop into new plants

Vegetative organs like



Vegetative propagation

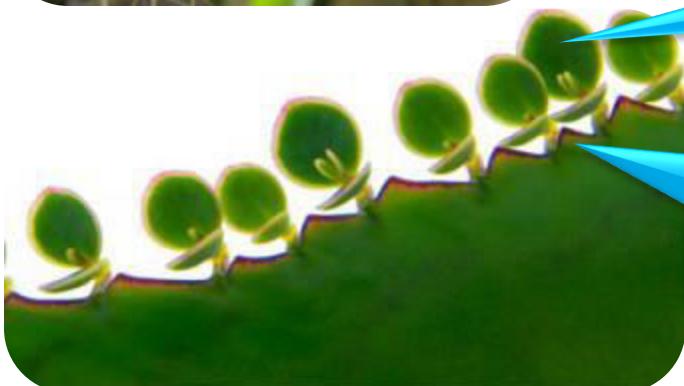
Bryophyllum



Develop into a new plant

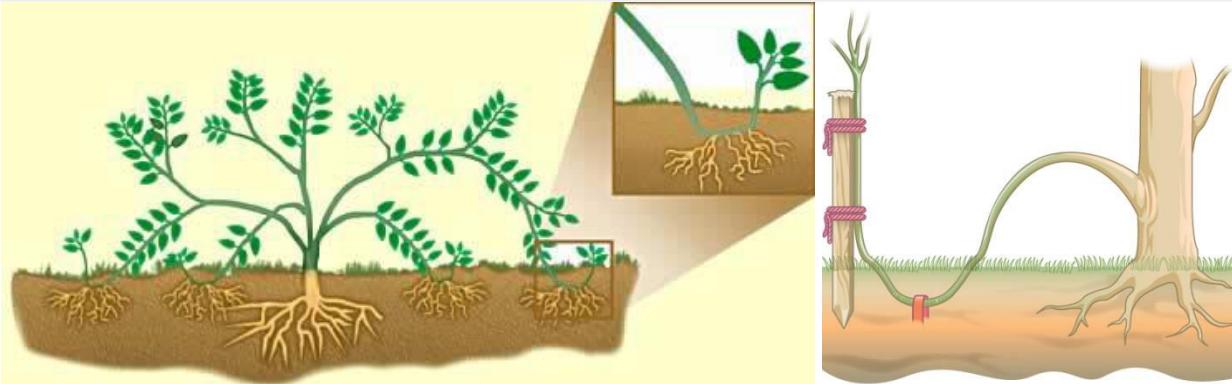
Buds are produced

in the notches
along the leaf
margin



Vegetative propagation

This property of vegetative propagation is used in methods such as *layering or grafting* to grow many plants like *sugarcane*, *roses*, or *grapes for agricultural purposes*.



Vegetative propagation

This property of vegetative propagation is used in methods such as *layering or grafting* to grow many plants like *sugarcane, roses, or grapes for agricultural purposes.*



Vegetative propagation

Advantages

Plants can *bear flowers and fruits earlier* than those produced from seeds.

Also use to propagate *plants that have lost the capacity to produce seeds* – banana, orange, rose, jasmine.

Plants produced are *genetically similar* to the *parent plant* to have all its characteristics.



Thank You

How do Organisms Reproduce?

- Modes of reproduction used by single organisms
(Spore formation, Tissue culture)

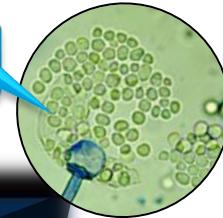
Spore formation

Seen in *bread mould (Rhizopus)*.

Thread-like structures → Hyphae.

On the hyphae → blobs → sporangia → Spores.

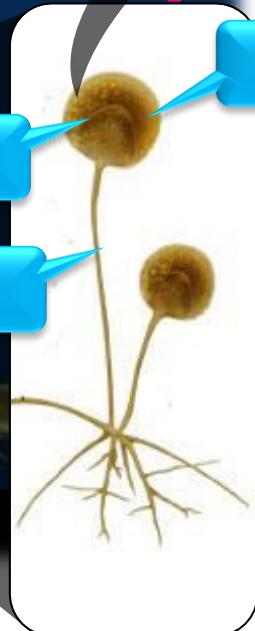
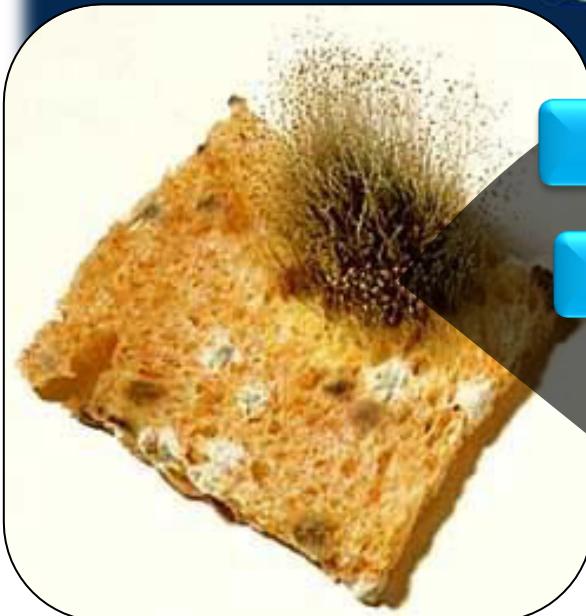
Spores



Sporangia

blobs

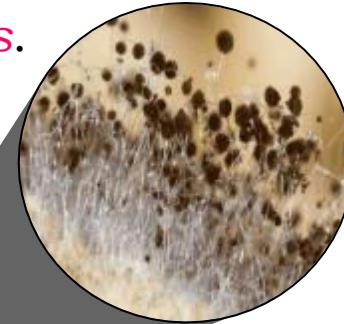
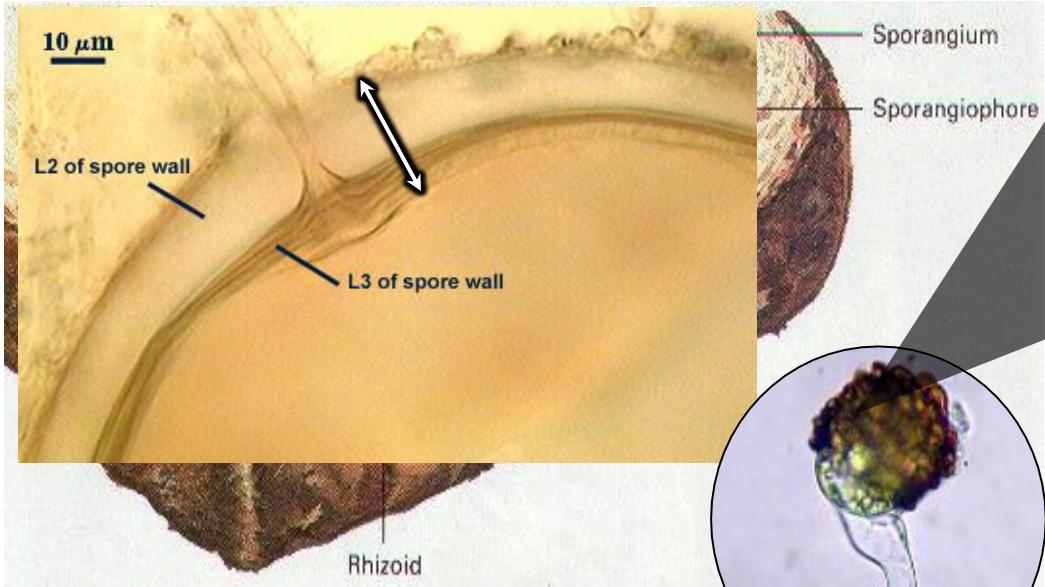
Hyphae



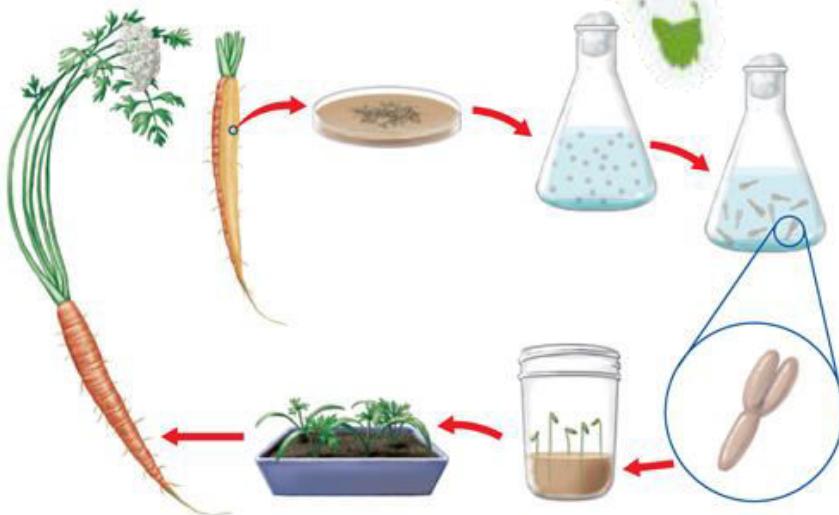
Spore formation

The *spores* are *covered* with *thick walls* that *protect* them.

Spore *eventually develop* into *new individuals*.



Plant Tissue Culture



Tissue culture

New plants grow by *removing tissue* or *separating cells* from the *growing tip* of a plant.



As it contains
meristematic tissue

Tissue culture

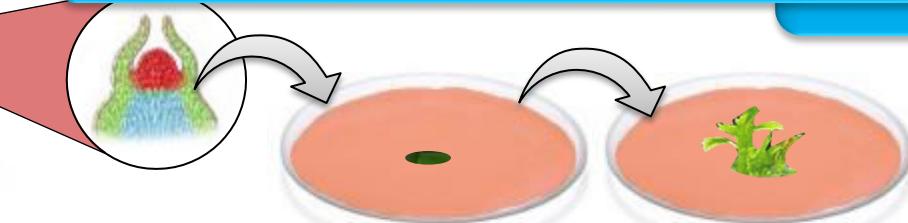
Nutrient agar

Cells are placed in *artificial medium*

divide rapidly - small groups of cells – *callus*.

As it contains meristematic tissue

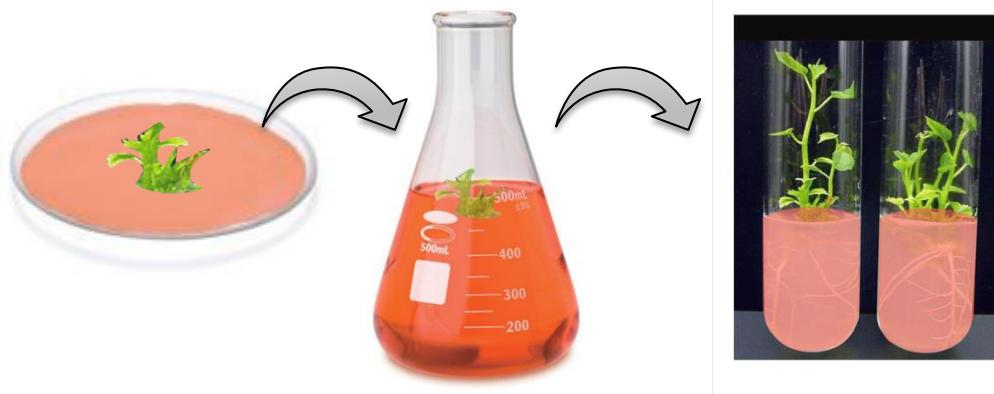
Differentiated tissue



Tissue culture

The *callus* is *transferred* to another medium containing hormones for *growth* and *differentiation*.

Like auxins, gibberellins, etc.



Tissue culture

The plantlets – placed in soil – grow into mature plants.



Tissue culture

Using tissue culture, many plants can be grown *from one parent* in *disease-free conditions*.



Tissue culture

This technique is commonly used for *ornamental plants*.



Tissue culture

This technique is commonly used for *ornamental plants*.



Thank You

How do Organisms Reproduce?

- Introduction to sexual reproduction and its importance

MODES OF REPRODUCTION

Asexual



Sexual

*Two parents involved
Dogs, Human, Plants, Birds*



Sexual reproduction

Two parents are involved



Male gamete



and another *female*



Female gamete

The male and female gamete fuse together to form unicellular zygote

Larger,
contains
stored food

zygote

Importance of sexual reproduction

Since there is fusion of two germ cells from two different individuals, variations are produced.

Variations give rise to variety and diversity.

It enables organisms to adapt and survive in the changing environment.

It helps to prevent the extinction of animal and plant species.



Thank You

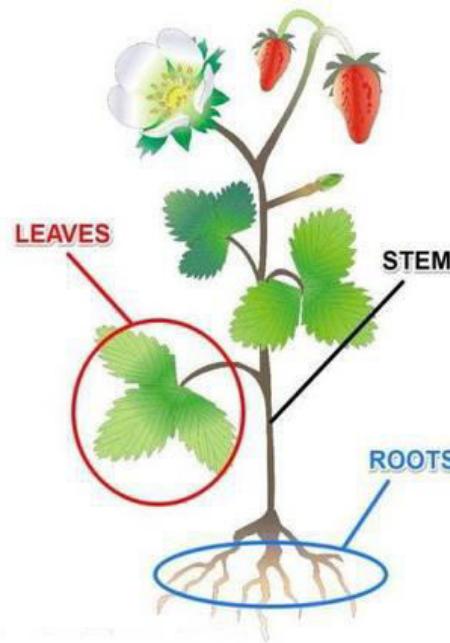
How do Organisms Reproduce?

- Sexual Reproduction in flowering plants (Structure of a flower)

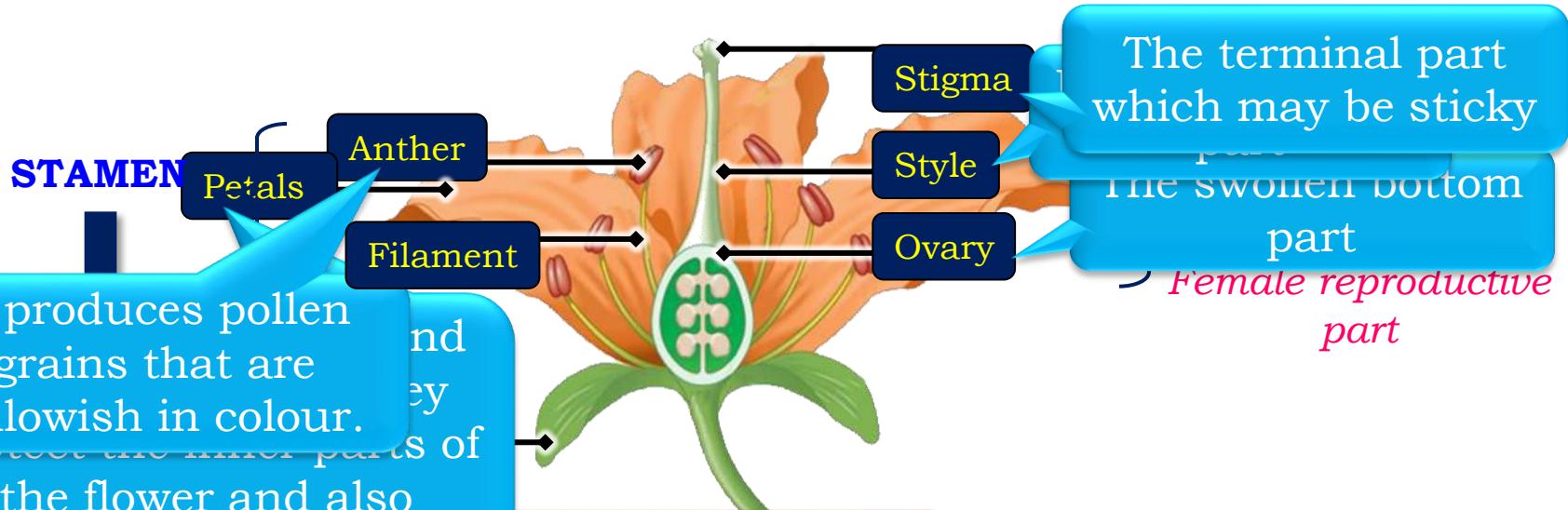
Plants

Vegetative organs

Reproductive organs



Sexual Reproduction in flowering plants



It produces pollen grains that are yellowish in colour.
and they protect the inner parts of the flower and also attract insects.

The centre of a flower and is the female reproductive part. It is made of three parts.

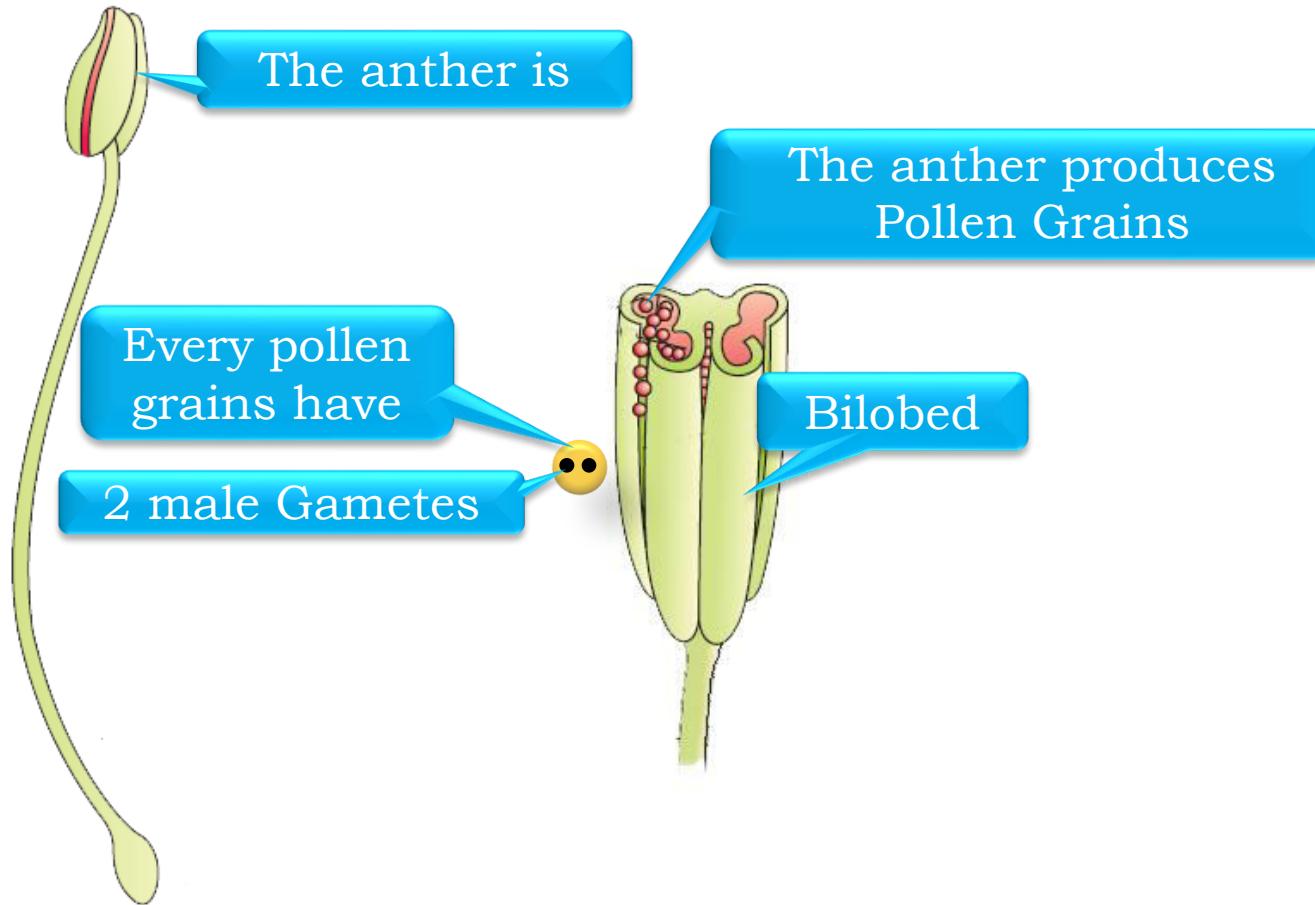
Stamen is the male reproductive part

Thank You

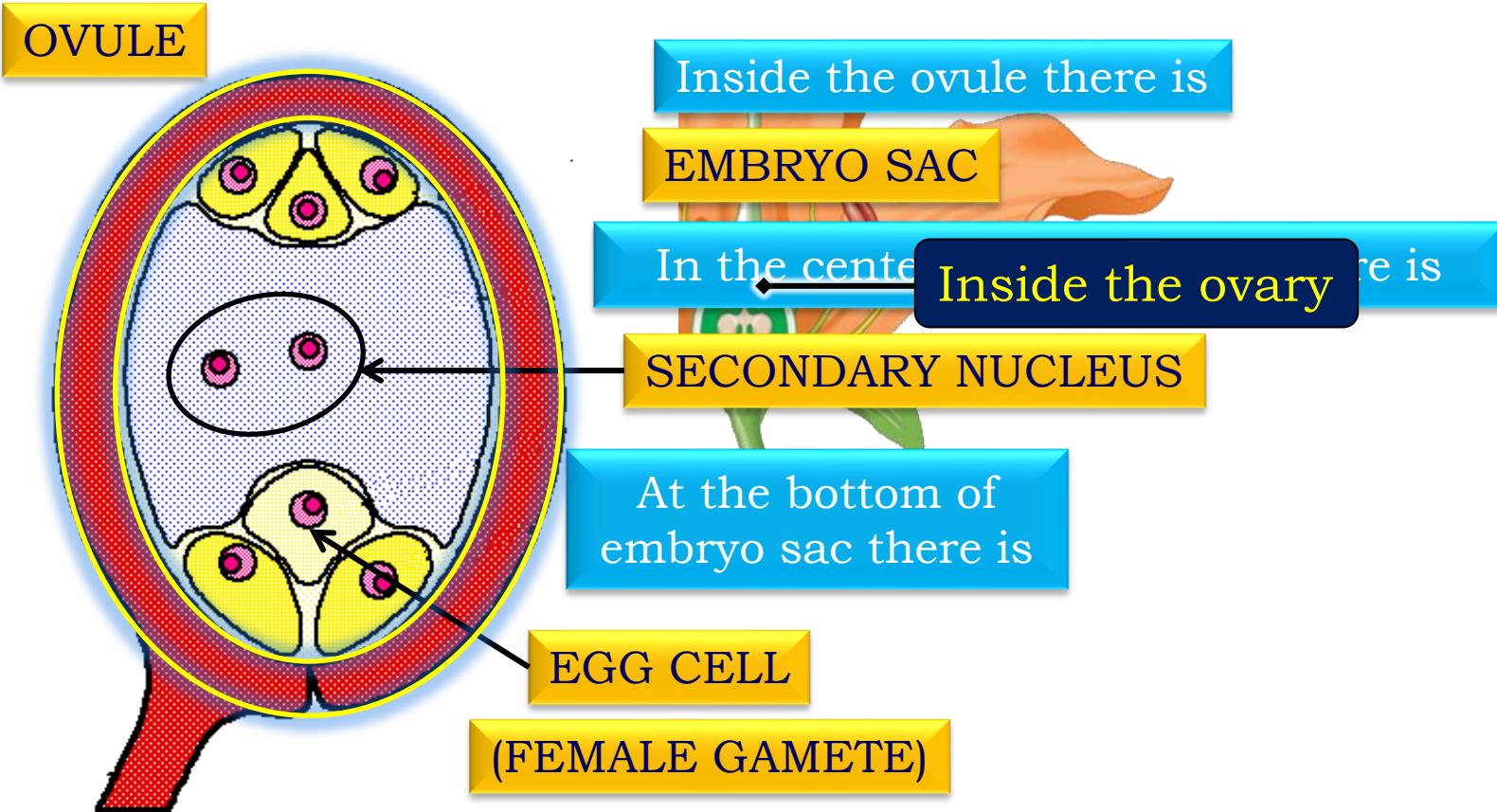
How do Organisms Reproduce?

- Sexual Reproduction in flowering plants (Structure of a stamen, carpel, types of flowers)

Sexual Reproduction in flowering plants



Sexual Reproduction in flowering plants



Sexual Reproduction in flowering plants

Flowers

Unisexual

Bisexual

- *The flower contains either stamens or carpels.*
- Eg- papaya, watermelon
- *The flower contains both stamens and carpels.*
- Eg-Hibiscus, mustard.



Thank You

How do Organisms Reproduce?

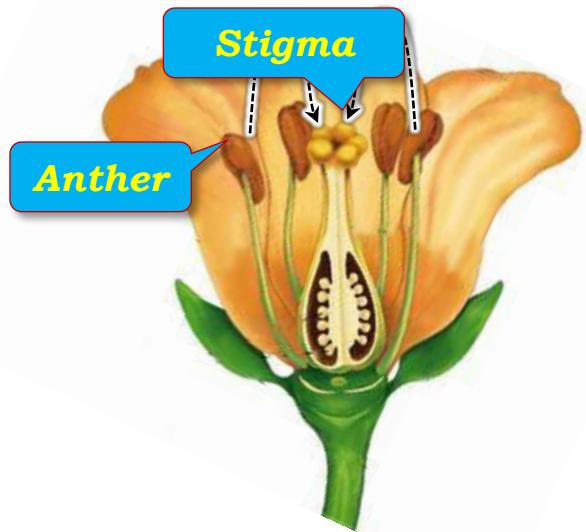
- Sexual Reproduction in flowering plants (Pollination and types of pollination)

Sexual Reproduction in flowering plants

Pollination

The process of transfer of pollen grains from anther to stigma is called **as pollination**.

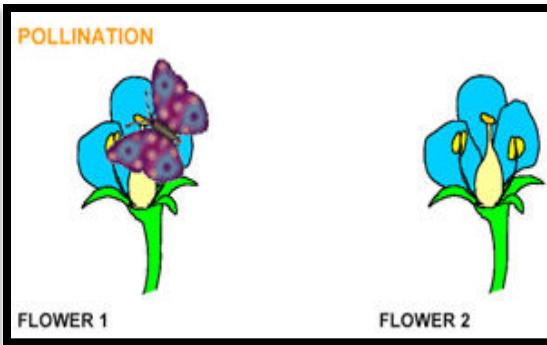
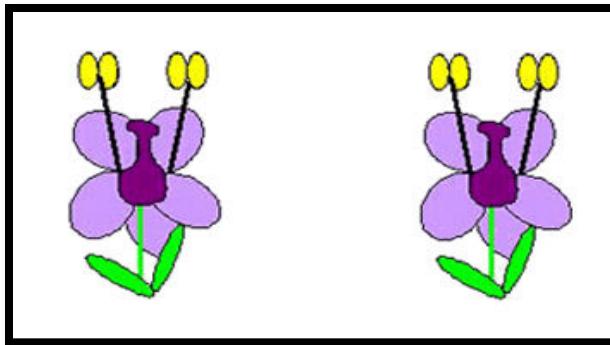
if this transfer occurs in the same flower or another flower of the same plant it is known **as self pollination**



Sexual Reproduction in flowering plants

Pollination

If pollen is transferred from one flower to the flower of another plant of the same species it is known **as cross pollination**.



Sexual Reproduction in flowering plants

Pollination

This transfer of pollen grains can occur through wind, insects, or other agents.



E.g. Maize plant

Sexual Reproduction in flowering plants

Pollination

This transfer of pollen grains can occur through wind, insects, or other agents.

The pollen grains stick to the wings, legs and proboscis of the insects



Sexual Reproduction in flowering plants

Pollination

This transfer of pollen grains can occur through wind, insects, or other agents.



Squirrels, bats, water

Thank You

How do Organisms Reproduce?

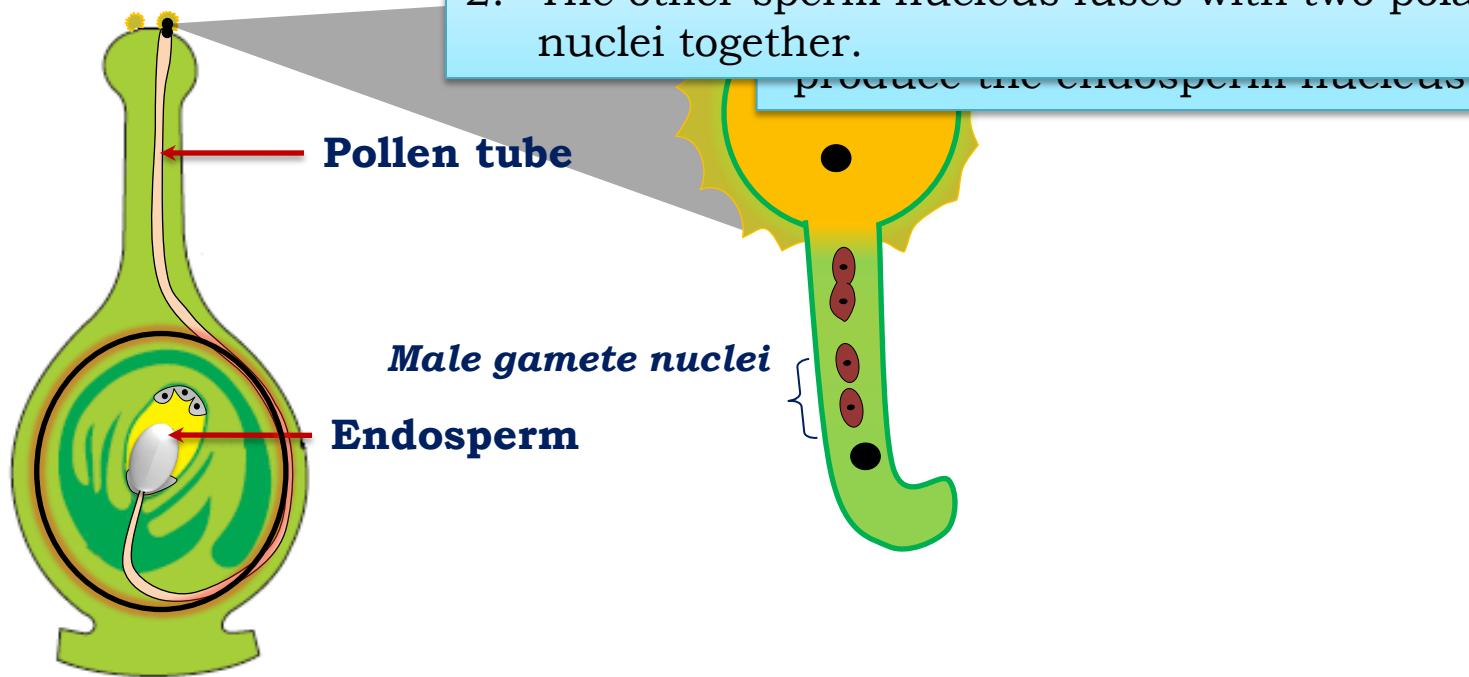
- Sexual Reproduction in flowering plants (Double fertilization, formation of fruit, germination)

Sexual Reproduction in flowering plants

Thus it is called as **DOUBLE FERTILISATION**.

For this, a tube grows out of the pollen grain and travels through the style to reach the ovary. One sperm nucleus fuses with egg cell nucleus. The other sperm nucleus moves towards the two polar nuclei in the central cell and fuses with them.

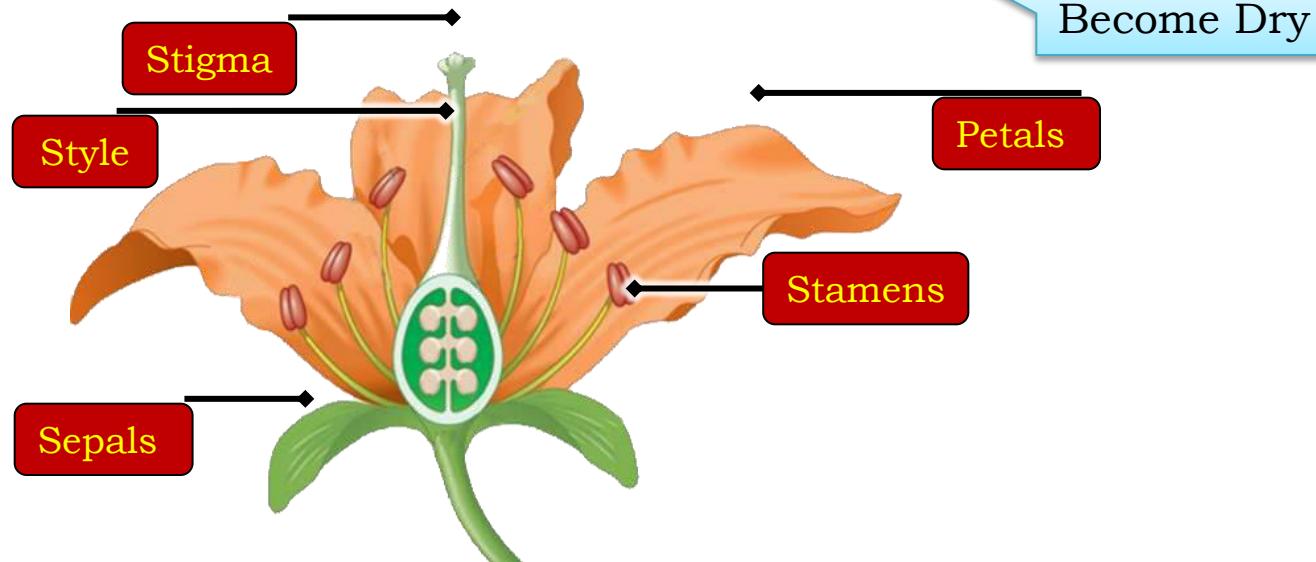
2. The other sperm nucleus fuses with two polar nuclei together.



Sexual Reproduction in flowering plants

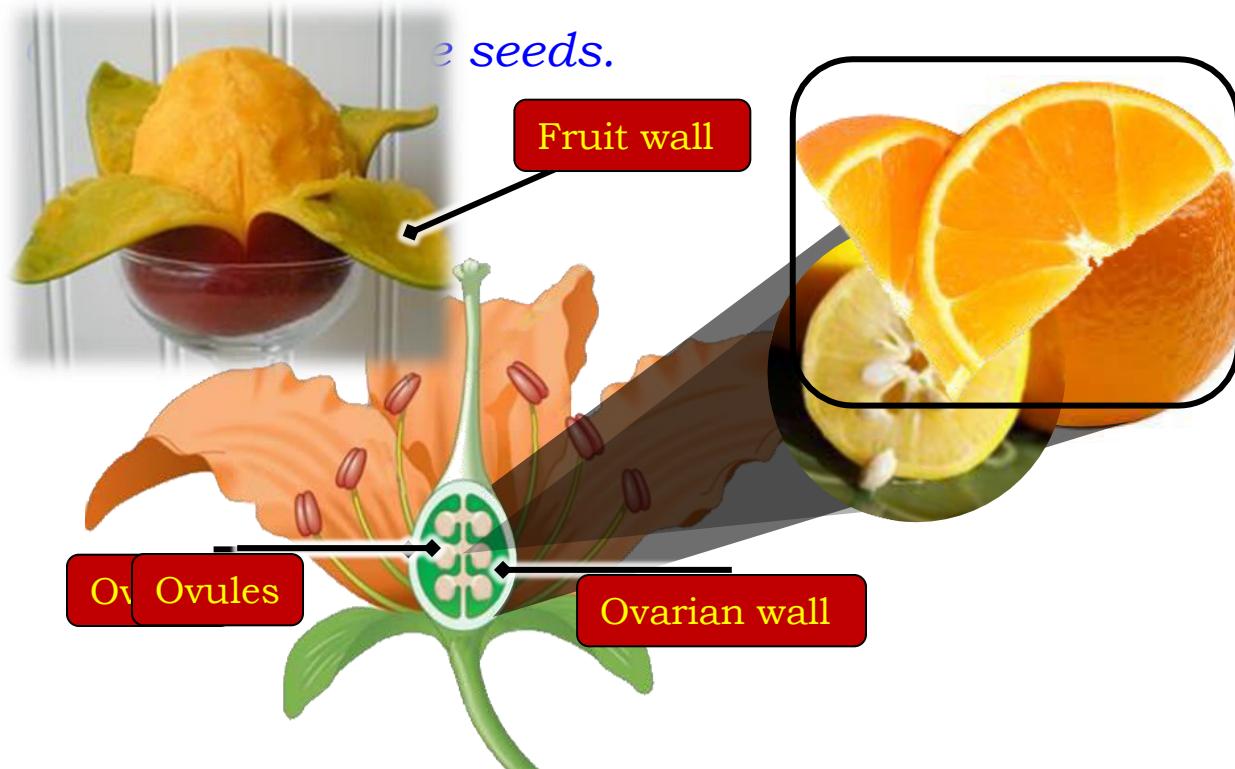
After fertilization, the flower has served its purpose.

The petals, stamens, style and stigma wither and generally fall off.



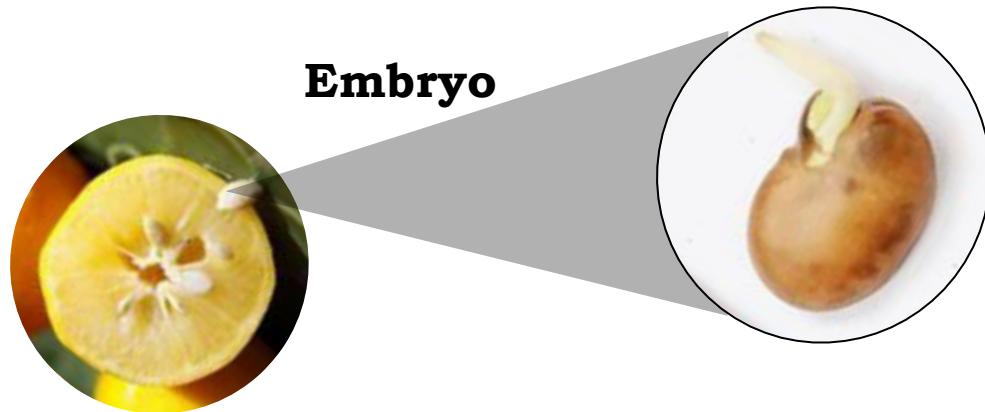
Sexual Reproduction in flowering plants

The ovary enlarges to form fruit, the ovarian wall forming the fruit wall.



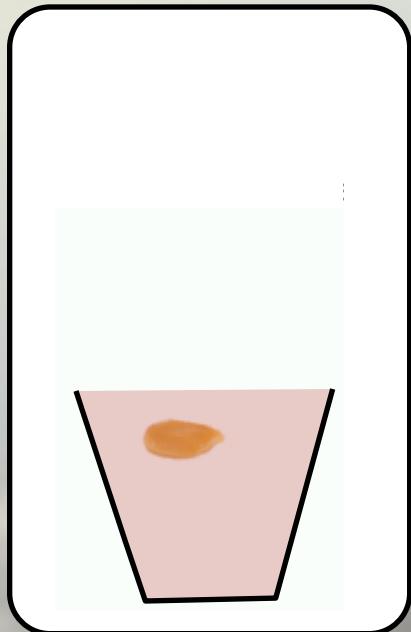
Sexual Reproduction in flowering plants

*The seed contains the **future plant or embryo.***



Sexual Reproduction in flowering plants

*Embryo develops into a seedling under appropriate conditions.
This process is known as **germination**.*



Thank You

How do Organisms Reproduce?

- Reproduction in human beings
(stages of growth)

Reproduction in human beings

Age

From

All of us know that our bodies change as we become older. This change occurs in various phases called as '*growth phases*'...

Let us learn about them first.



*Let us learn about
the first stage of
growth and the
changes that occur
in girls and boys*

Reproduction in human beings

Rate of growth

Higher

Physical growth
(growth of bones ,
muscles, etc.)



Reproduction in human beings

Changes in girls

Increase in height

Increase in weight

Acquire and then lose milk teeth and again acquire new ones.



Reproduction in human beings

Changes in boy

Increase in height



Increase in weight



Acquire and then lose milk teeth and again acquire new ones.



Reproduction in human beings

Stage

Childhood





*Let us learn about
the second stage of
growth and the
changes that occur
in girls and boys*

Reproduction in human beings

Age

11 to age of 18 in girls and 21 in boys (years)



Reproduction in human beings

Rate of growth

Body is growing to its adult size, the *maturation of the reproductive tissue*.



Reproduction in human beings

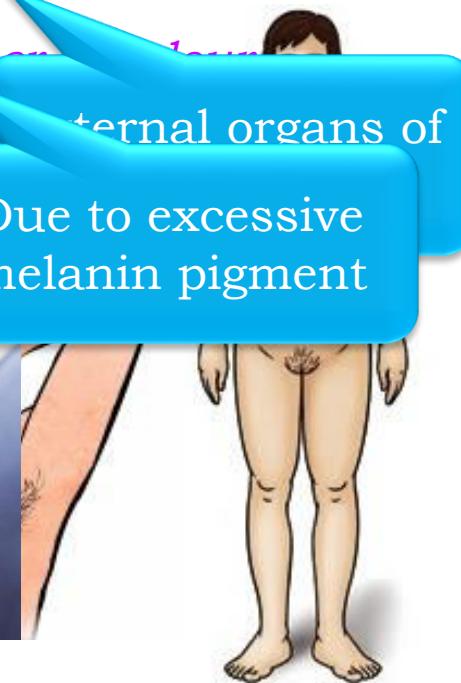
Changes in girls

Hair grows in armpits, genital areas between the thighs, legs and arms.

Genital areas become darker

Skin becomes oily and more sensitive

External organs of
genitalia become larger
Due to excessive
melanin pigment



Reproduction in human beings

Changes in girls

Breast size begins to increase

Darkening of the skin of the breast.

Begin to menstruate

Periodic loss of blood from the body of females starting from puberty

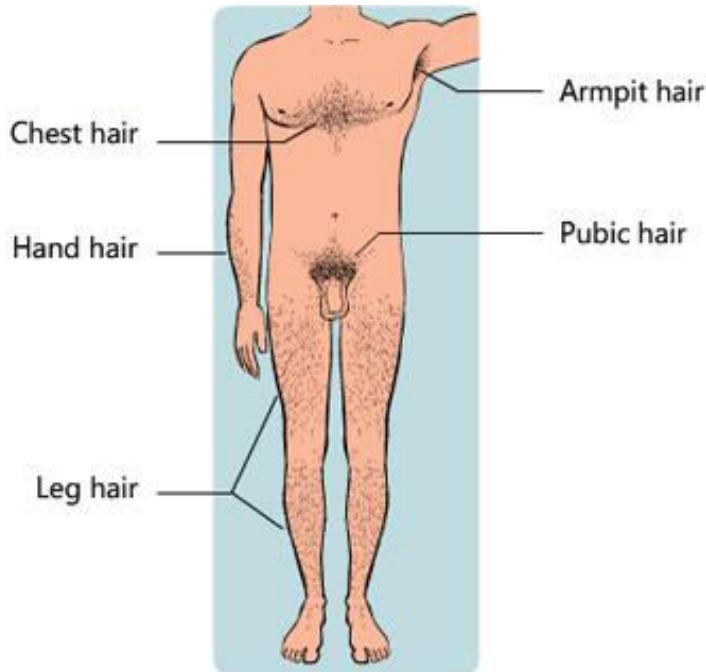


Reproduction in human beings

Change in boys

External organs of reproduction

Hair grows in armpits, genital areas between the thighs, legs and arms.



Reproduction in human beings

Change in boys

Genital areas become **darker** in colour

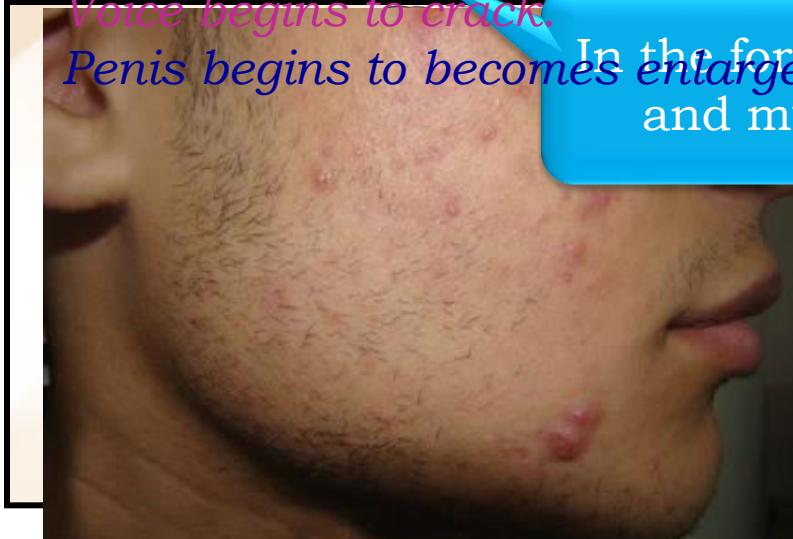
Skin becomes oily and may develop **pimples**

Growth of **thicker** hair on face.

Voice begins to crack.

Penis begins to becomes **enlarged and erect**.
In the form of beard, t and mustache

Due to excess of flow blood in the tissues of the penis in this stage

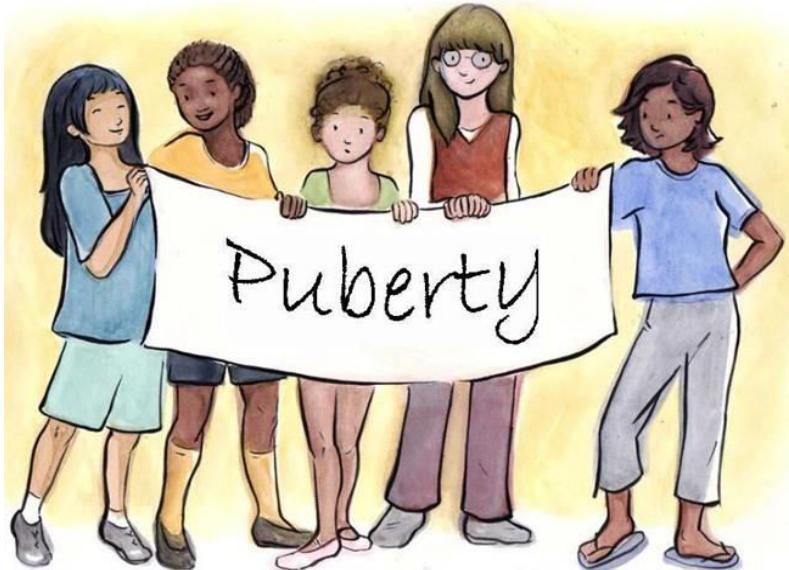


Reproduction in human beings

Stage

Puberty

The stage of attending
sexual maturity



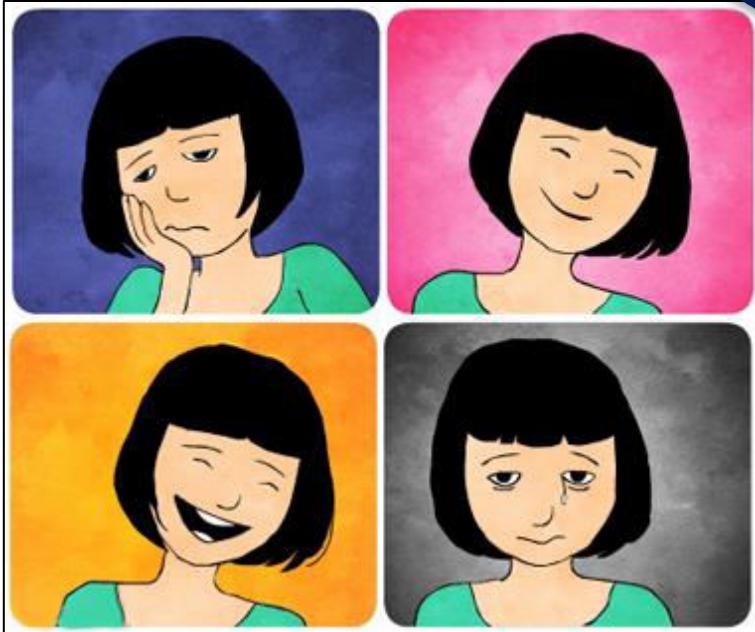
Reproduction in human beings

Phases of Growth

Stage

Puberty is characterized by :

- ✓ *Frequent emotional shifts.*

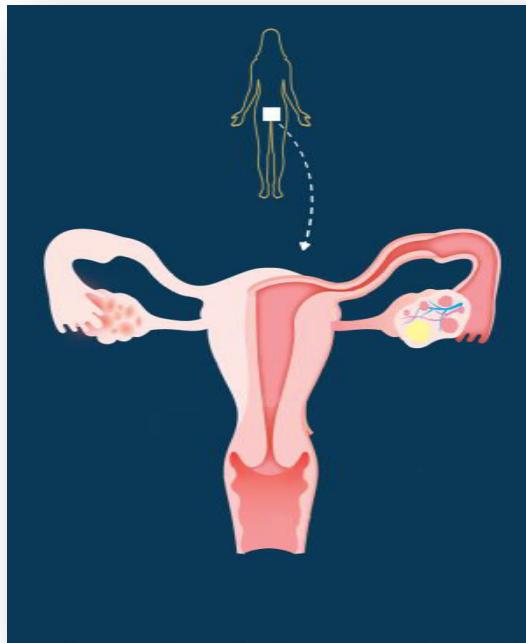
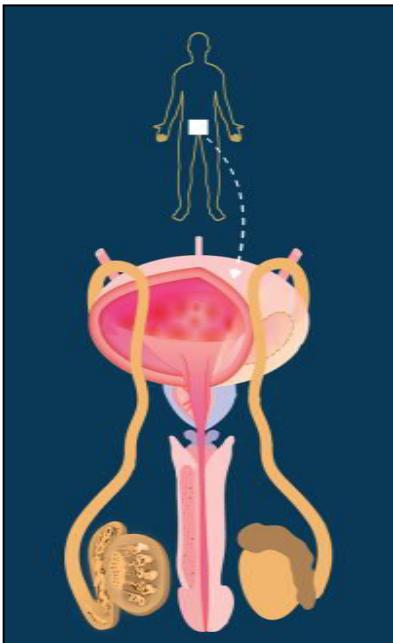


Due to secretion of special hormones as there is maturation of reproductive tissues

Stage

Puberty is characterized by :

- ✓ *Physical maturation of reproductive system.*



Reproduction in human beings

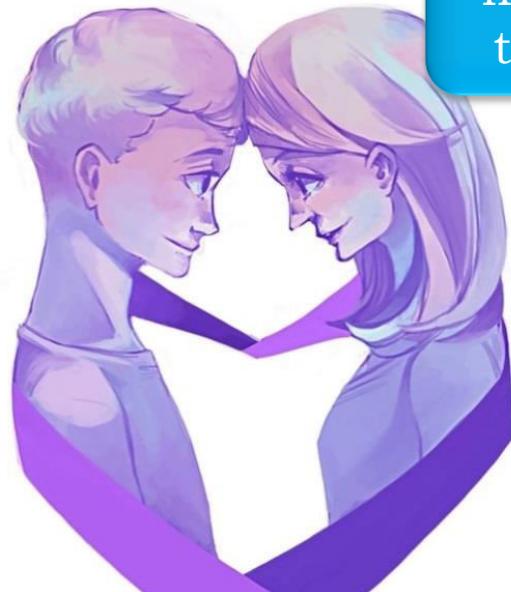
Age

Age 18 onwards in girls and 21 onwards in boys (years)



Reproduction in human beings

*Body is physically ready to reproduce, its happens by two individuals joining their bodies together for **internal transfer** of germ cell for fusion.*



The transfer of sperms
from the body of male
to the body of female

Reproduction in human beings

Stage

Adult



Thank You

How do Organisms Reproduce?

- Male Reproductive System

Male Reproductive System

The male reproductive system consists of portions which ***produce the germ-cells*** and ***other portions that deliver the germ-cells*** to the site of fertilisation.



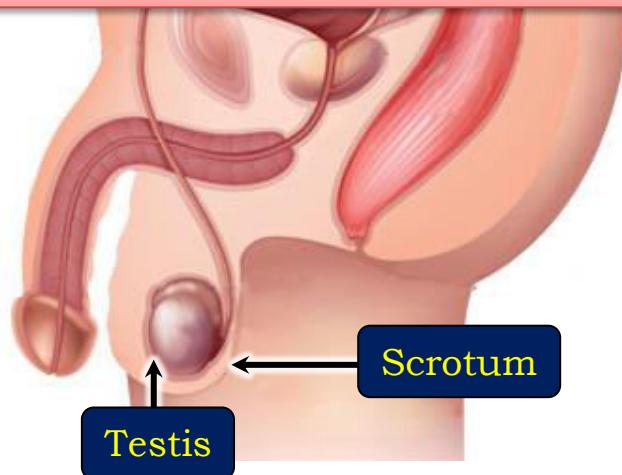
Male Reproductive System

The formation of germ-cells or sperms takes place in the **testes**.

These are located in the cavity in scrotum.

Testes secret a hormone called as **Testosterone**.

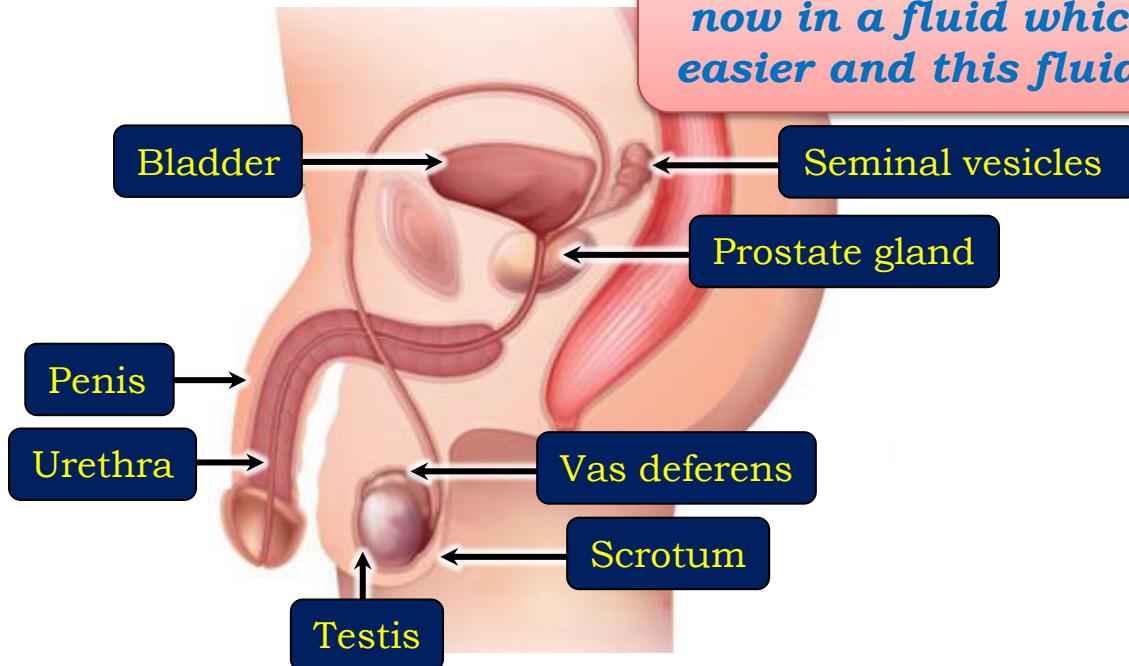
Testosterone regulates the **formation of sperms**, and **brings about changes in appearance seen in boys at the time of puberty**.



Male Reproductive System

Penis is the portion of the reproductive system that **delivers the sperms to the site of fertilization**.

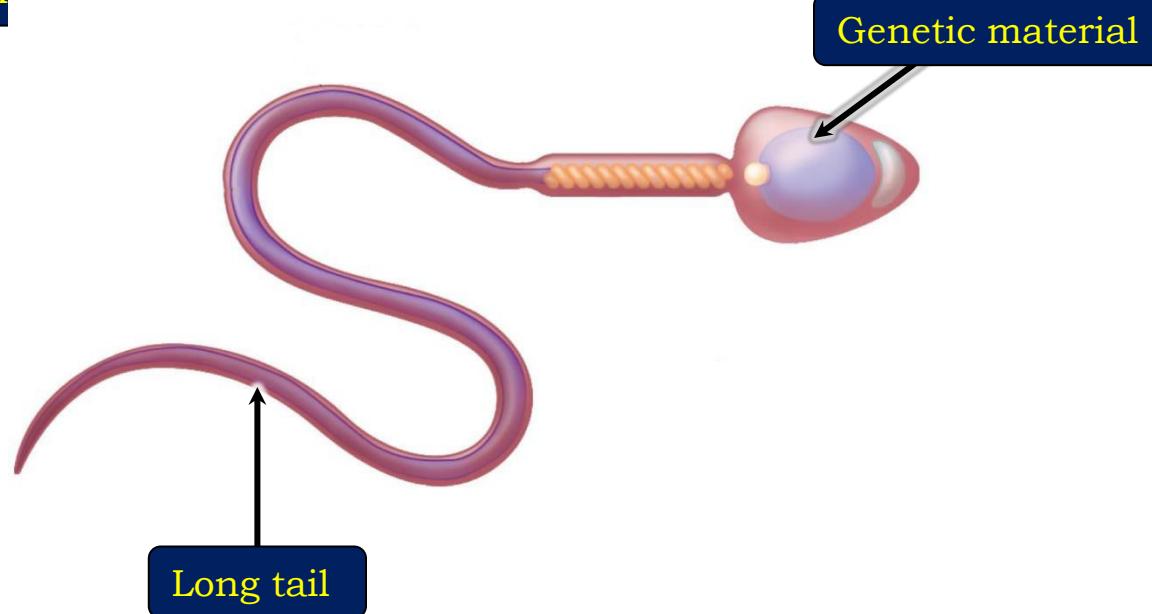
Add their secretions so that the sperms are now in a fluid which makes their transport easier and this fluid also provides nutrition.



Male Reproductive System

The **sperms are tiny bodies** that consist of mainly **genetic material** and a **long tail** that helps them to *move towards the female germ-cell.*

I



Thank You

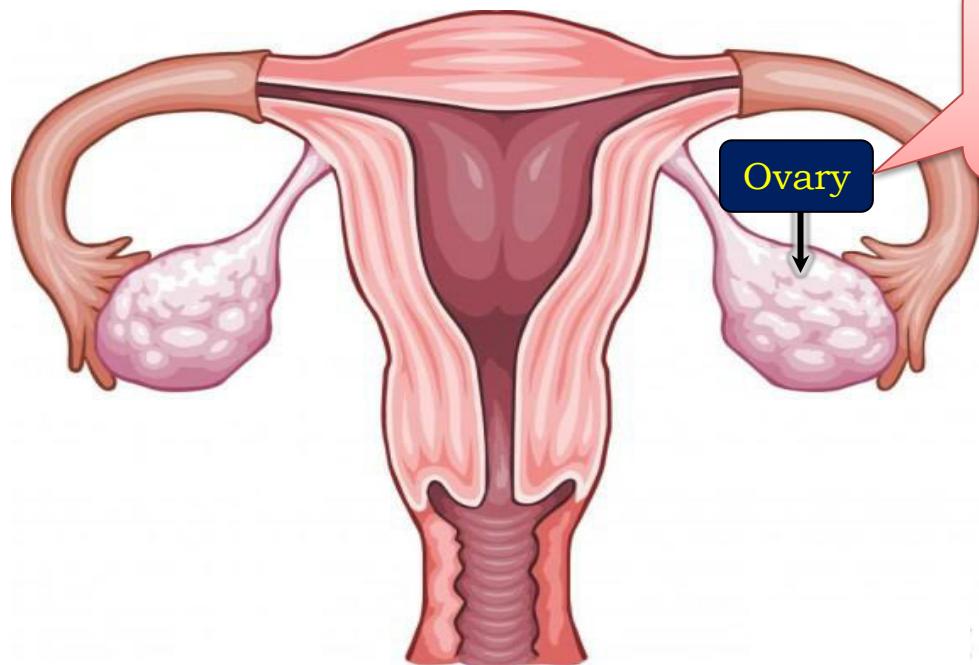
How do Organisms Reproduce?

- Female Reproductive System
- Implantation

Female Reproductive System

The female germ-cells or eggs are made in the **ovaries**.

They are also responsible for the production of some **hormones**.

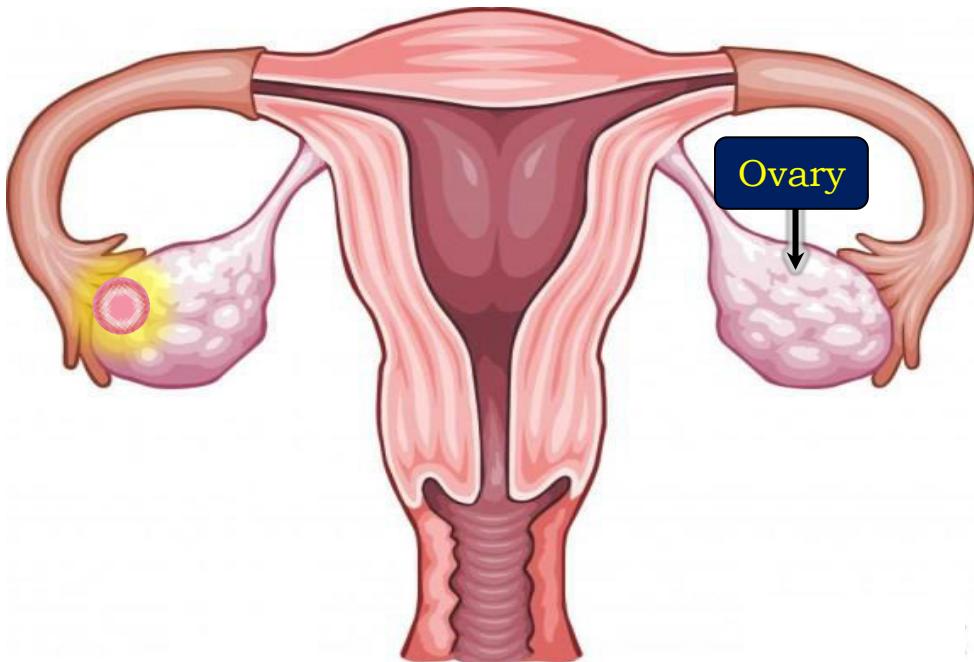


When a girl is born, the ovaries already contain thousands of immature eggs.

Female Reproductive System

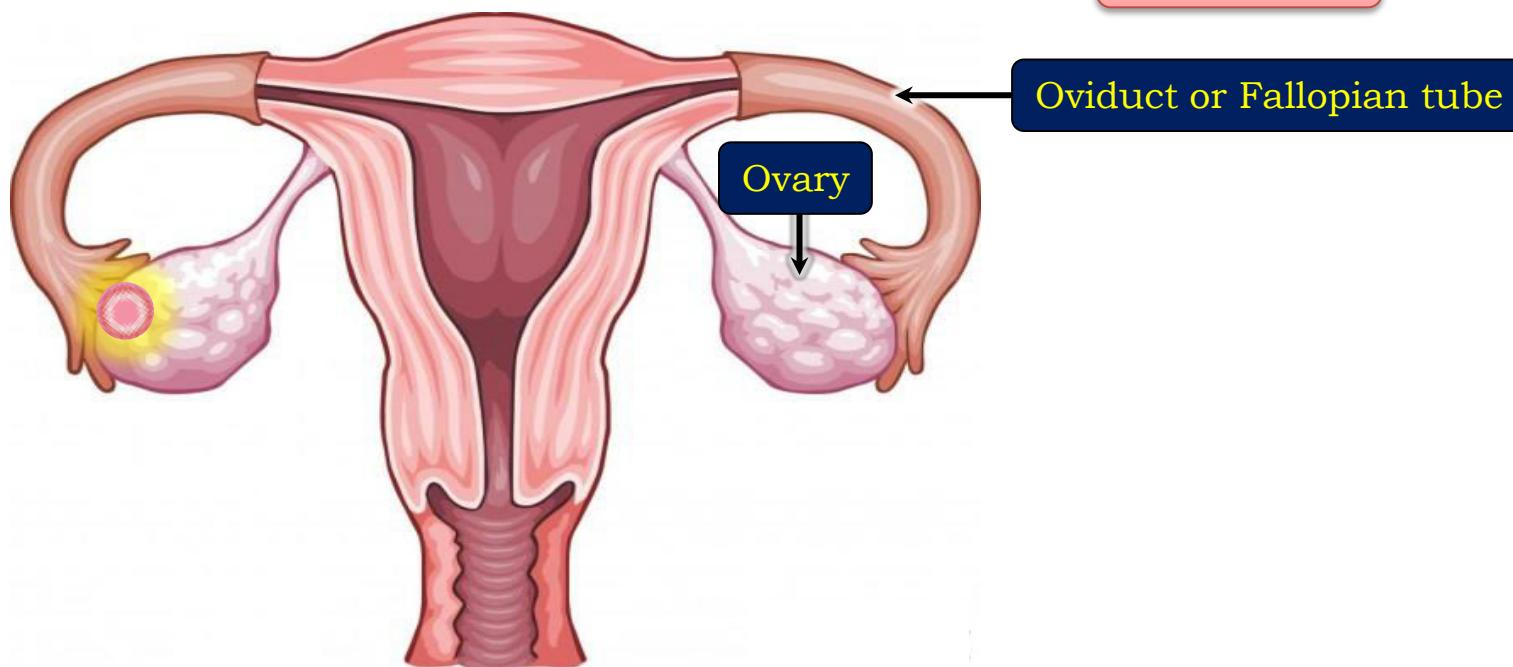
On reaching **puberty**, some of these **start maturing**.

One **egg is produced every month by one of the ovaries**.



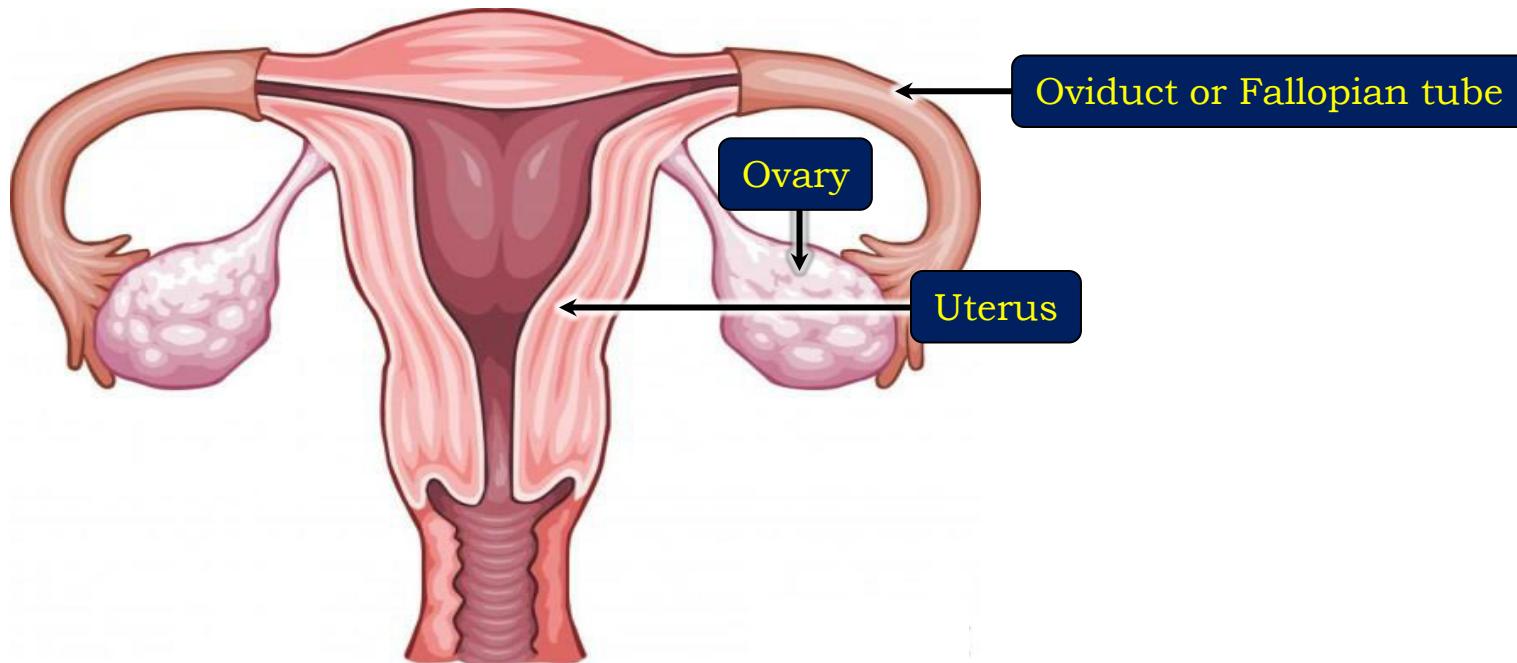
Female Reproductive System

The **egg** is carried from the ovary to the **womb** through a thin oviduct or **fallopian tube**.



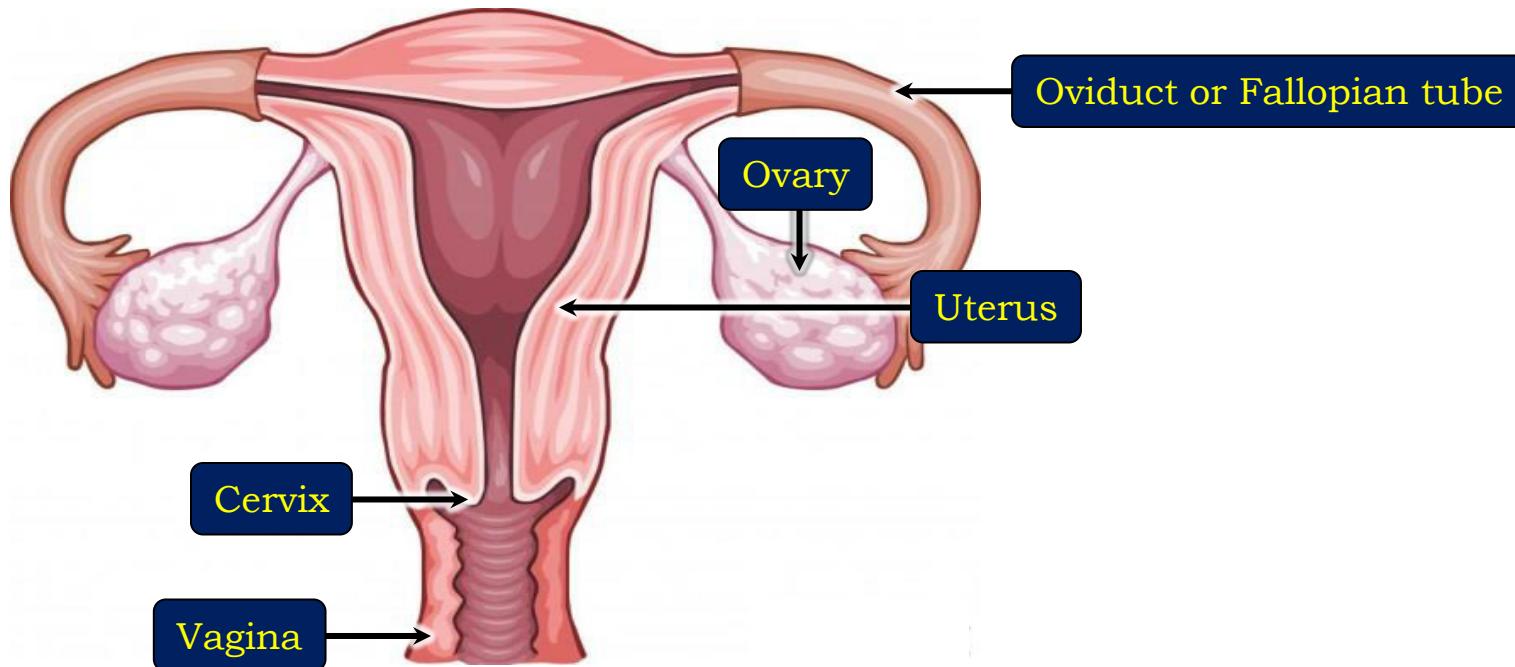
Female Reproductive System

The two oviducts unite into an elastic bag-like structure known as the **uterus**.



Female Reproductive System

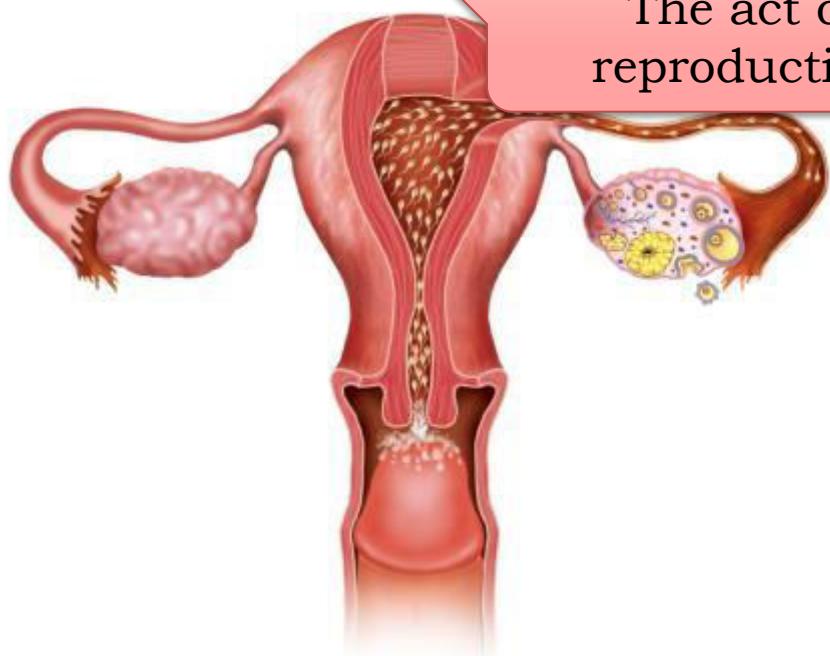
The uterus opens into the *vagina* through the *cervix*.



Female Reproductive System

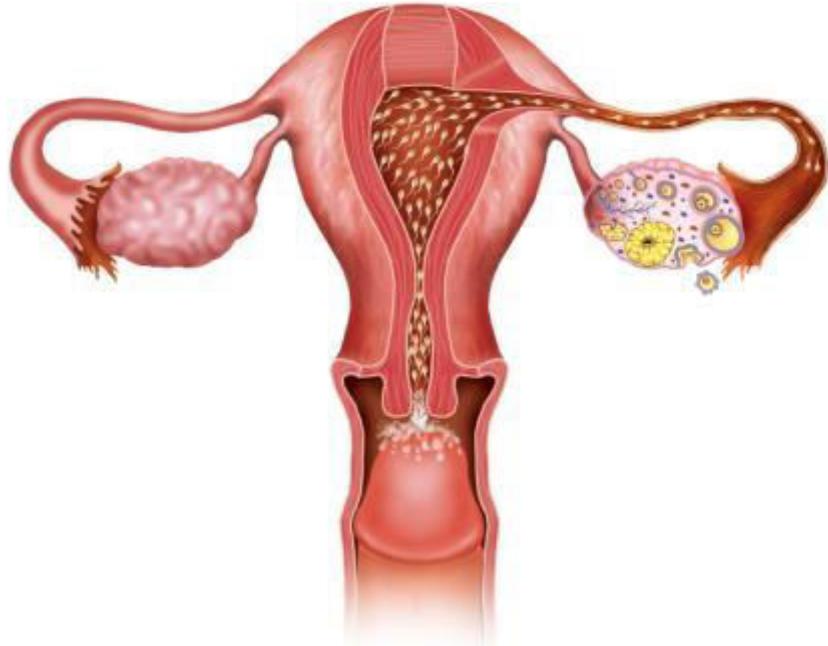
The sperms enter through the vaginal passage during ***sexual intercourse.***

The act of reproduction



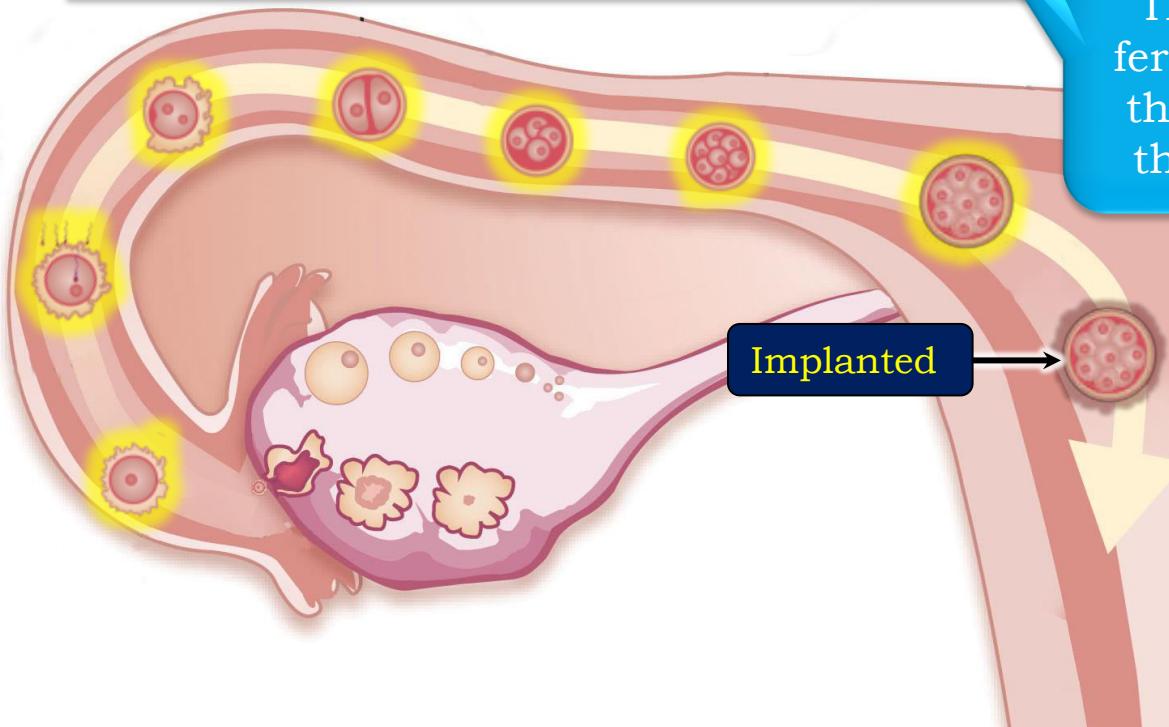
Female Reproductive System

They travel upwards and reach the oviduct where they **may encounter the egg.**



Female Reproductive System

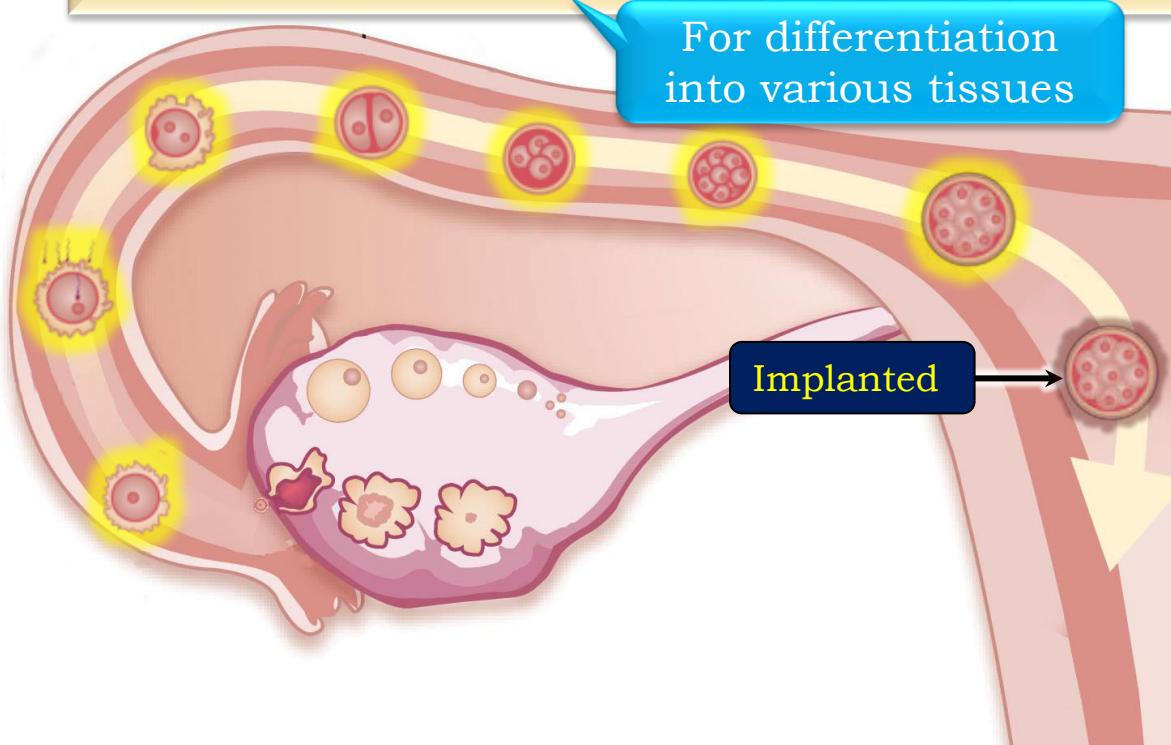
The fertilised egg, the zygote, gets **implanted** in the lining of the uterus, and starts dividing.



The attachment of the fertilized egg or zygote to the wall of the womb at the start of pregnancy.

Female Reproductive System

The fertilised egg, the zygote, gets **implanted** in the lining of the uterus, and starts **dividing**.



Thank You

How do Organisms Reproduce?

- **Development and child birth**

Female Reproductive System

We have already studied that the mother's body is designed to undertake the development of the child.



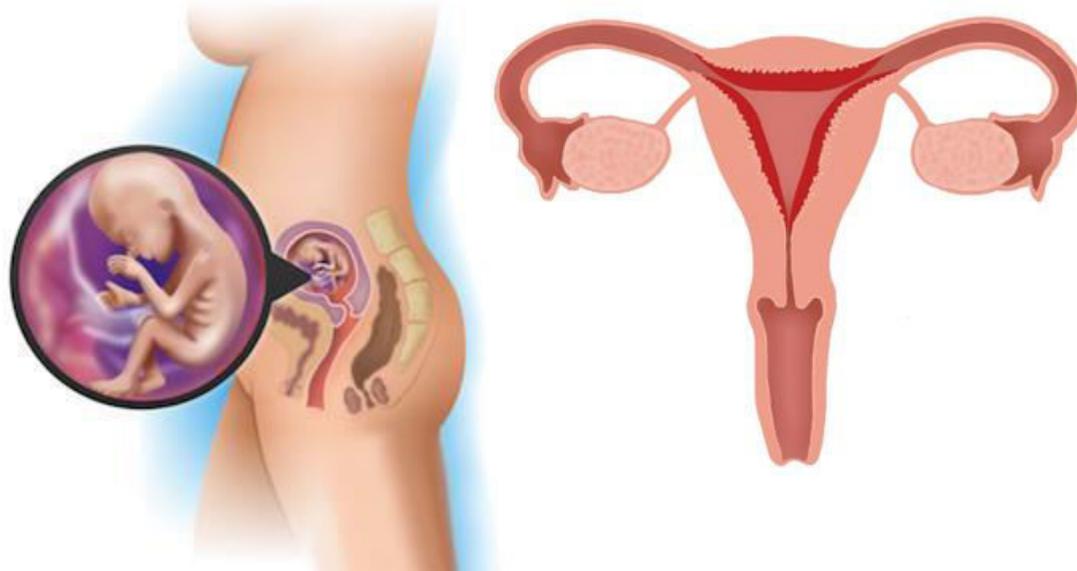
Female Reproductive System

Hence the uterus prepares itself every month to receive and nurture the growing embryo.



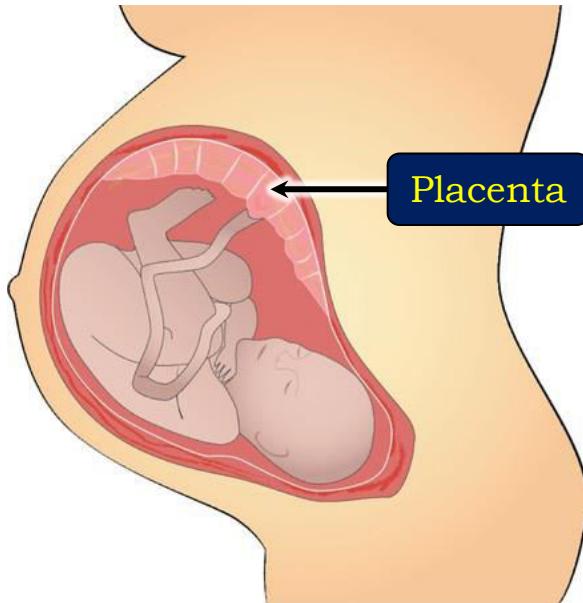
Female Reproductive System

The lining thickens and is richly supplied with blood to nourish the growing embryo.



Female Reproductive System

The embryo gets nutrition from the mother's blood with the help of a special tissue called '*placenta*'.

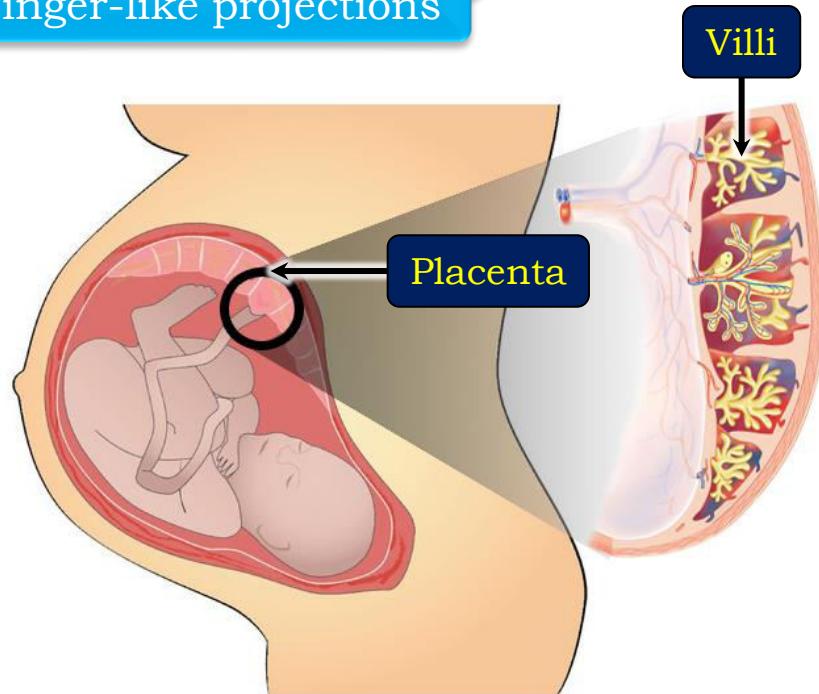


This is a disc which is *embedded* in the *uterine wall*.

Female Reproductive System

Placenta contains **villi** on the **embryo's side** of the tissue.

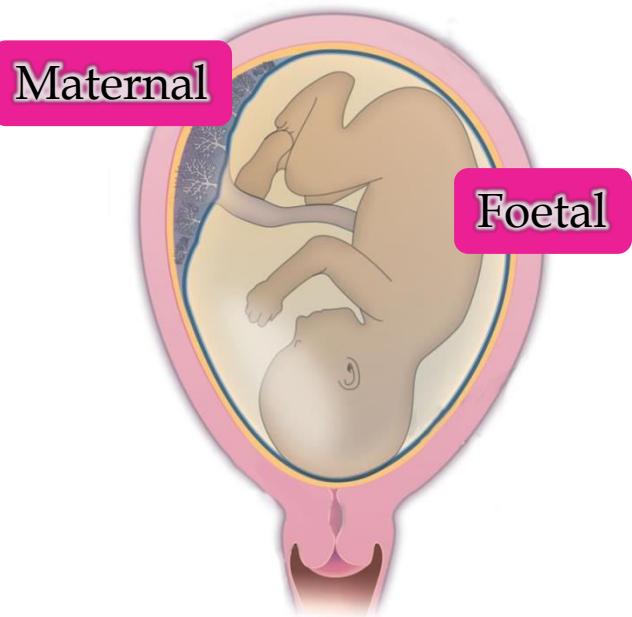
Finger-like projections



Female Reproductive System

On the **mother's side** are **blood spaces**, which surround the villi.

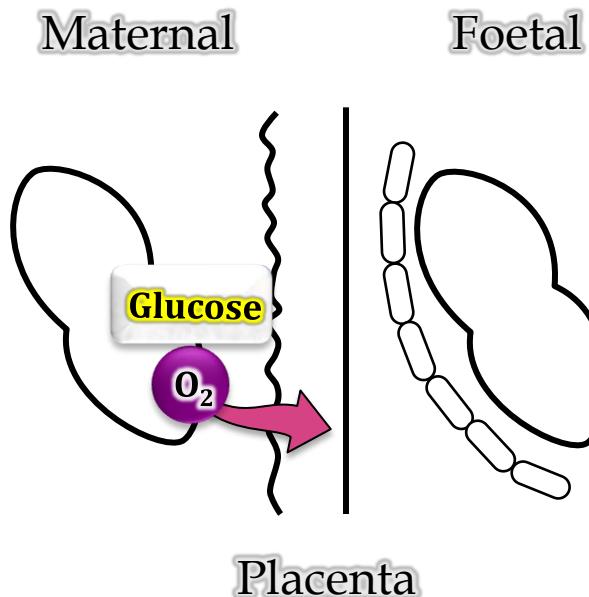
This provides a large surface area for glucose and oxygen to pass from the mother to the embryo.



Female Reproductive System

On the mother's side are blood spaces, which surround the villi.

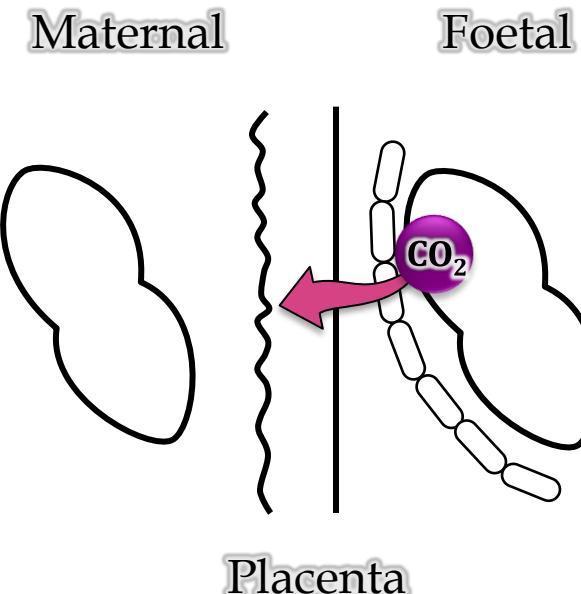
This provides a *large surface area for glucose and oxygen to pass from the mother to the embryo.*



Female Reproductive System

The developing embryo will also generate waste substances which can be removed by transferring them into the maternal blood through the placenta.

Like carbon dioxide (CO_2)



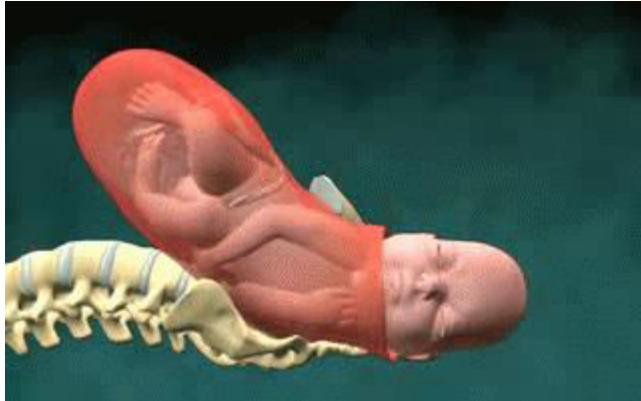
Female Reproductive System

The development of the child inside the mother's body takes approximately nine months.



Female Reproductive System

The child is born as a result of *rhythmic contractions of the muscles in the uterus.*



Thank You

How do Organisms Reproduce?

- Menstruation
- Reproductive health and sexually transmitted diseases

What happens when the Egg is not Fertilized?

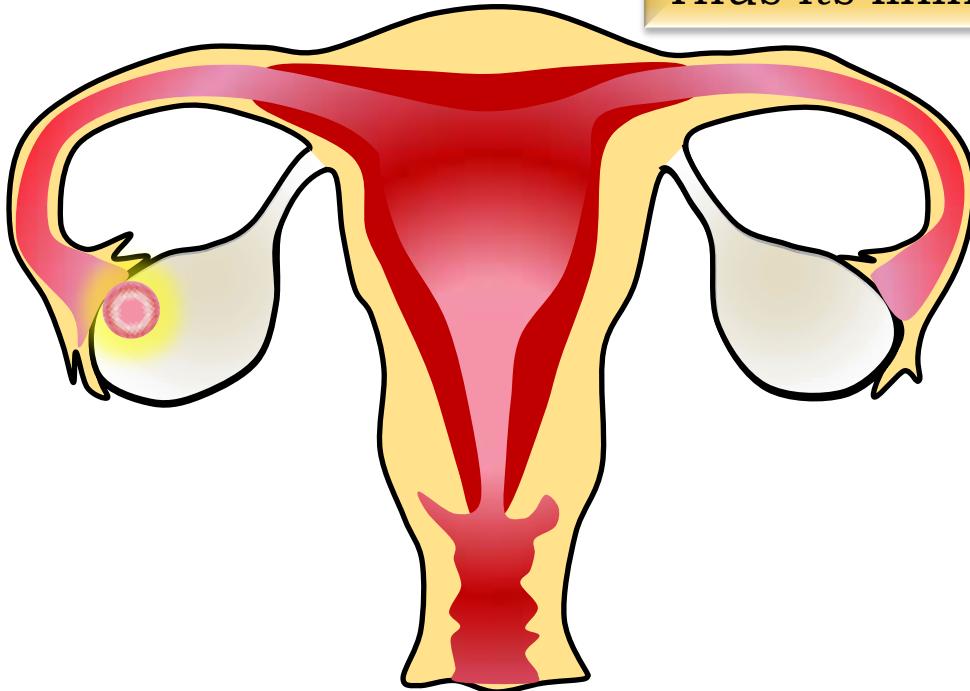
If the egg is not fertilised, *it lives for about one day.*



What happens when the Egg is not Fertilized?

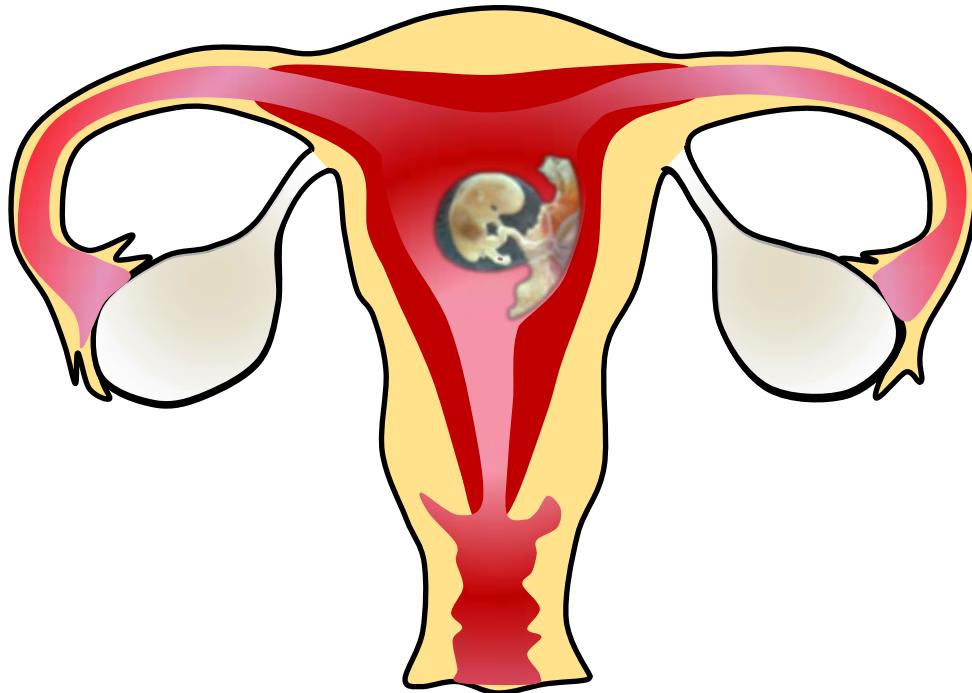
Since the ovary releases one egg every month, *the uterus also prepares itself every month* to receive a fertilised egg.

Thus its lining becomes ***thick and spongy***.



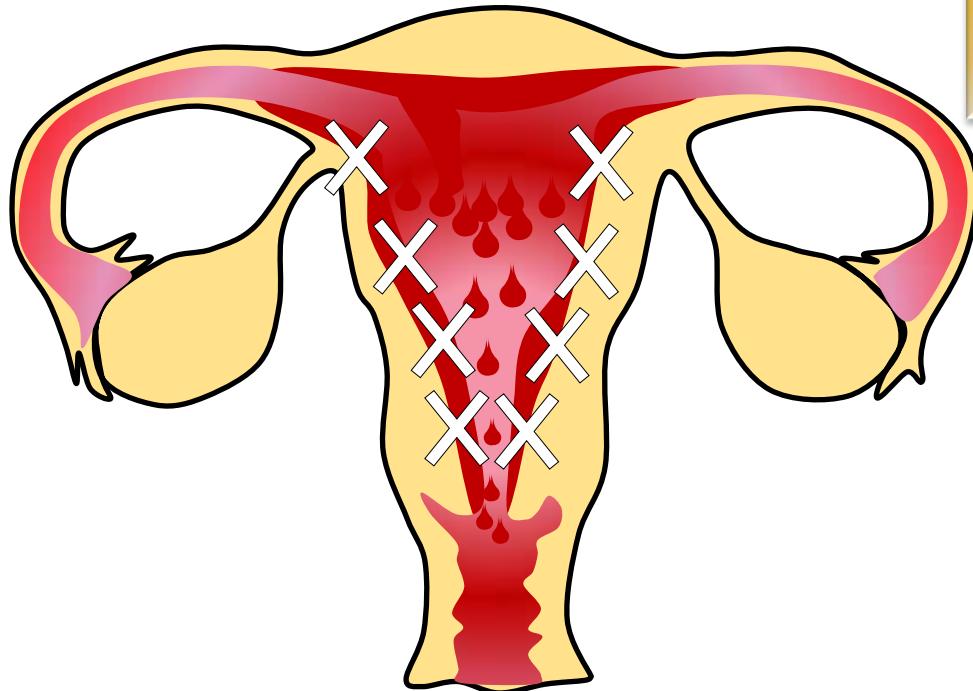
What happens when the Egg is not Fertilized?

This would be required for *nourishing the embryo if fertilisation had taken place.*



What happens when the Egg is not Fertilized?

Now, however, this lining is not needed any longer.

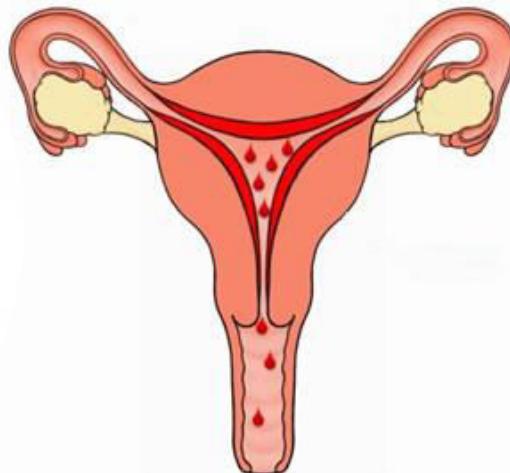
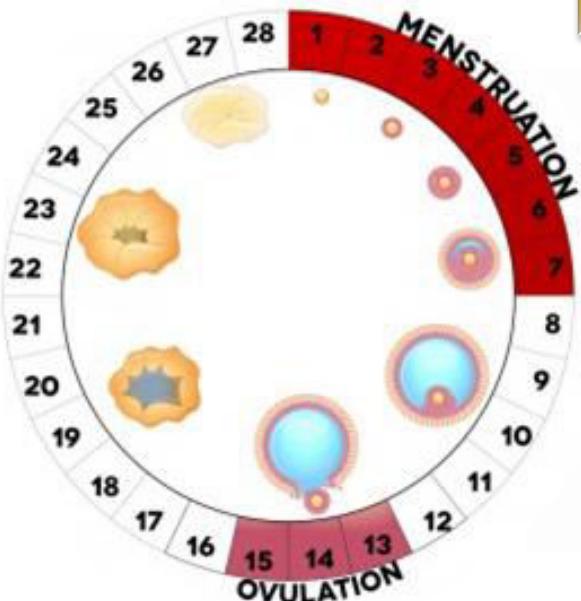


So, the lining *slowly breaks* and *comes out through the vagina as blood and mucous.*

What happens when the Egg is not Fertilized?

This cycle takes place roughly *every month* and is known as *Menstruation*.

It usually lasts for *about two to eight days*.



Reproductive health

Since the sexual act is a very intimate connection of bodies, *it is not surprising that many diseases can be sexually transmitted.*



Sexual Contact



Reproductive health

Diseases which are spread by sexual contact with an infected person

Sexually Transmitted Diseases (STDs)

Gonorrhoea

Syphilis

AIDS

Warts



Bacterial

Viral

Reproductive health

Is it possible to prevent the transmission of such diseases during the sexual act?



Yes

Reproductive health

Using a covering, called a **condom**, for the penis during sex helps to prevent transmission of many of these infections to some extent.



Thank You

How do Organisms Reproduce?

- Need for contraception
- Methods of contraception
- Reproductive health and healthy society

Reproductive health

The sexual act always has the *potential to lead to pregnancy.*



Reproductive health

Pregnancy will make *major demands on the body and the mind of the woman,*



Weakness



Nausea



Stress

and if she is not ready for it, her health will be *adversely affected.*

Reproductive health

Therefore, many ways have been devised to avoid pregnancy.



These methods or ways are called as
'contraceptive methods' or '*methods of birth control*'.

Reproductive health

These ‘contraceptive methods’ have number of categories (based on their approaches).



Reproductive health

One category is the creation of a mechanical barrier so that sperm does not reach the egg.



This method is called as '**barrier method**'.

Reproductive health

Methods of birth control



Barrier

In males

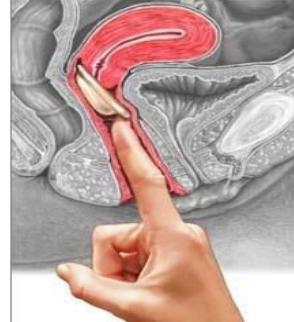
Condom

In females

Diaphragm

Protects from STDs

(Prevent the entry of Sperms)



Reproductive health

Another category of contraceptives acts by changing the hormonal balance of the body so that eggs are not released and fertilisation cannot occur.



This method is called as
'Chemical method'.

Reproductive health

Methods of birth control



Barrier

Chemical

Oral pills



These drugs commonly need to be taken orally (by females) as pills.



However, since they change hormonal balances, they can cause side-effects too.

Reproductive health

*Other
contraceptive
devices such as.....*



Reproductive health

Methods of birth control

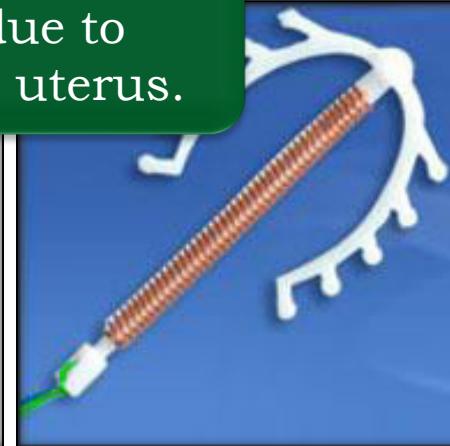


IUCD



T

Again, they can cause side effects due to irritation of the uterus.



Reproductive health

Another approach to contraception is to avoid fertilization by blocking the paths of the male and the female gametes.



Such methods are called as
'Surgical methods'.

Reproductive health

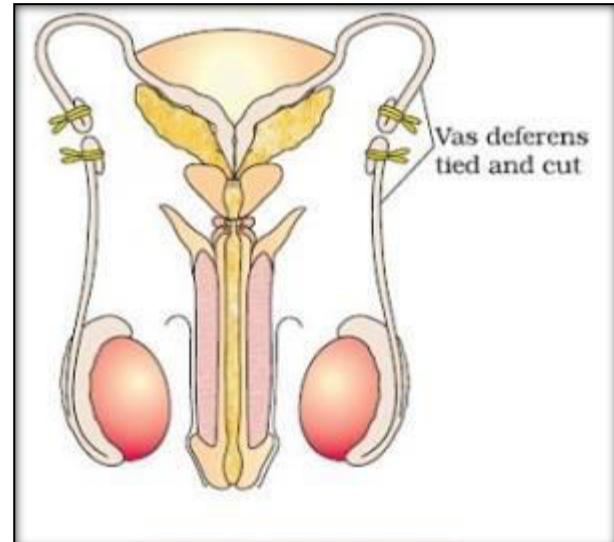
Methods of birth control



Male **Vasectomy**

Removal of small portion of Vas deferens

If the vas deferens in the male is blocked, sperm transfer will be prevented and fertilisation will not take place.



Reproductive health

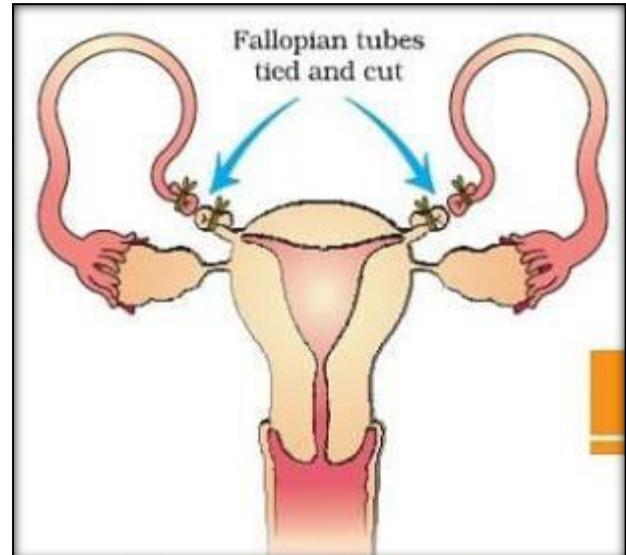
Methods of birth control



Female **Tubectomy**

Removal of small portion of fallopian tube or oviduct

If the fallopian tube in the female is blocked, the egg will not be able to reach the uterus and fertilisation will not take place.



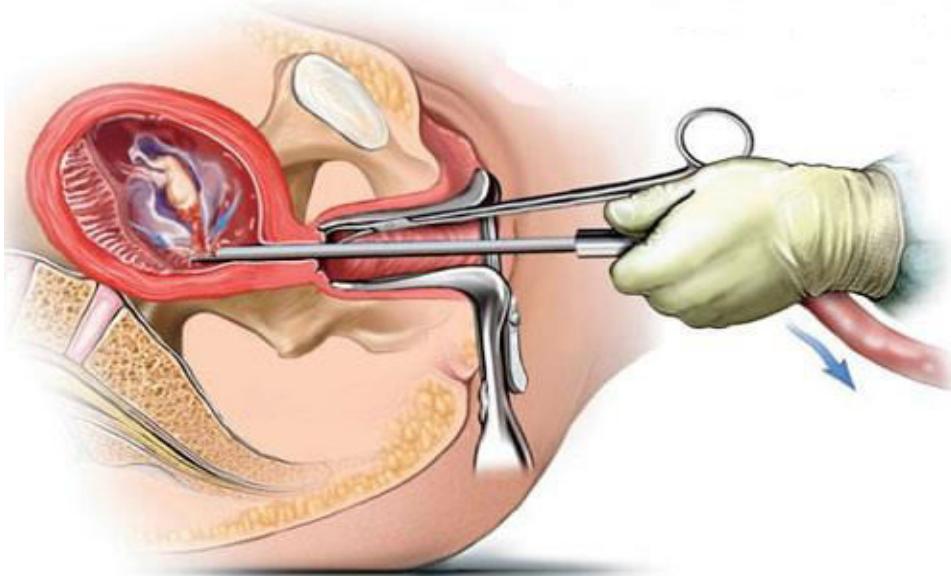
Reproductive health

While surgical methods are safe in the long run, surgery itself can cause infections and other problems if not performed properly.



Reproductive health

Surgery can also be used for ***removal of unwanted pregnancies.***



Reproductive health

Such surgeries may be ***misused by people*** who do not want a particular child,



as happens in illegal sex-selective abortion of female foetuses.

Reproductive health

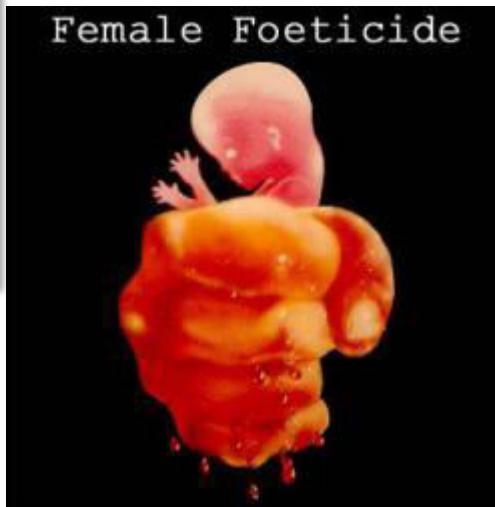
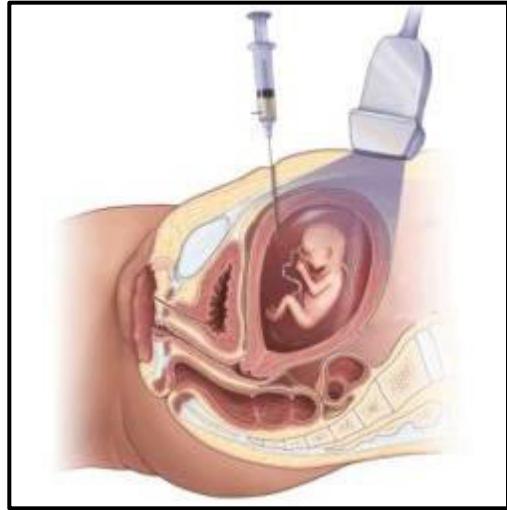
For a healthy society – ***Female-male sex ratio must be maintained.***



Reproductive health

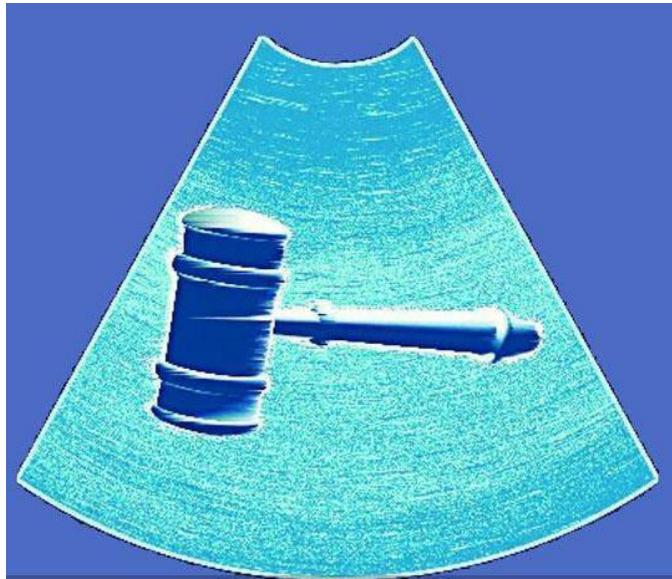
Because of **reckless female foeticides**, **child sex ratio is declining** at an alarming rate.

Illegal the killing of a fetus



Reproductive health

Prenatal sex determination has been ***prohibited by law.***



Reproductive health



Human population has to be controlled.

Thank You