

CLASS VII
NCERT SCIENCE TEXT BOOK

CHAPTER-12
REPRODUCTION IN PLANTS



K. L. INTERNATIONAL SCHOOL
(Affiliated to Central Board of Secondary Education)

Acknowledgement

In the accomplishment of this Novel, the team has been bestowed with the heart pledged support. We extend our special gratitude to the Principal, Mr. Sudhanshu Shekhar who provided us a platform to execute this idea and encouraged us to do our best.

We extend our heartfelt thanks to Mr. Sandeep Sethi (Director Education, M.S.M.S.II, Museum Trust) for providing us the golden opportunity to do this task. It's because of his prestigious mentorship that an influential novel could be created.

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Preface

Plant reproduction is the production of new individuals or offsprings in plants. In this Graphic Novel we aim to simplify the concept of Sexual and Asexual reproduction in the inquiring minds of students.

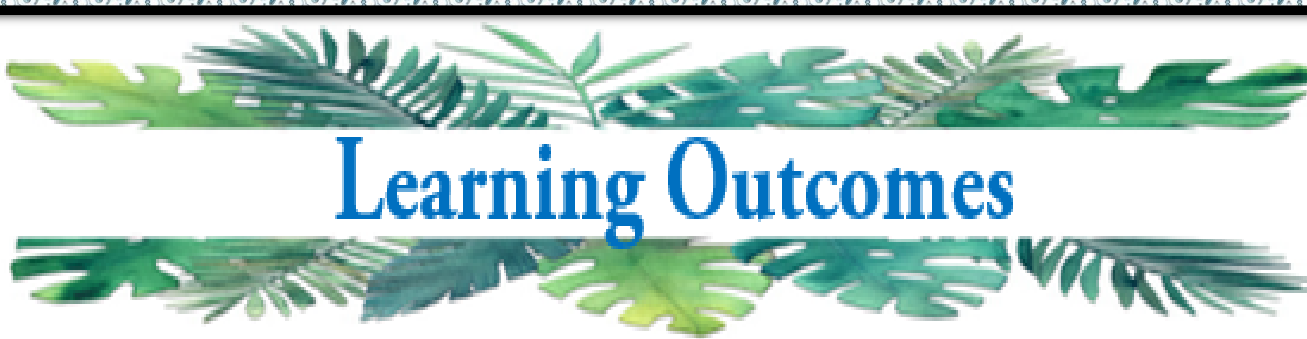
This work will help the students to understand the different methods of Natural and Artificial reproduction in plants. The conversation between our characters will foster their knowledge about the importance of different pollinating agents which lead to fertilization.

This will effectuate clarity about unisexual and bisexual flowers .The process of fruit formation and seed formation will also be grasped by the students easily. They will learn about several modes of seed dispersal techniques.

Furthermore, the scientific explanations in this novel will make the topic smooth and easily comprehensible for students.

Sincere gratitude to all the team members who helped to make this work more informative and interesting for students.

We hope that this Graphic Novel will serve as an indispensable tool for students.



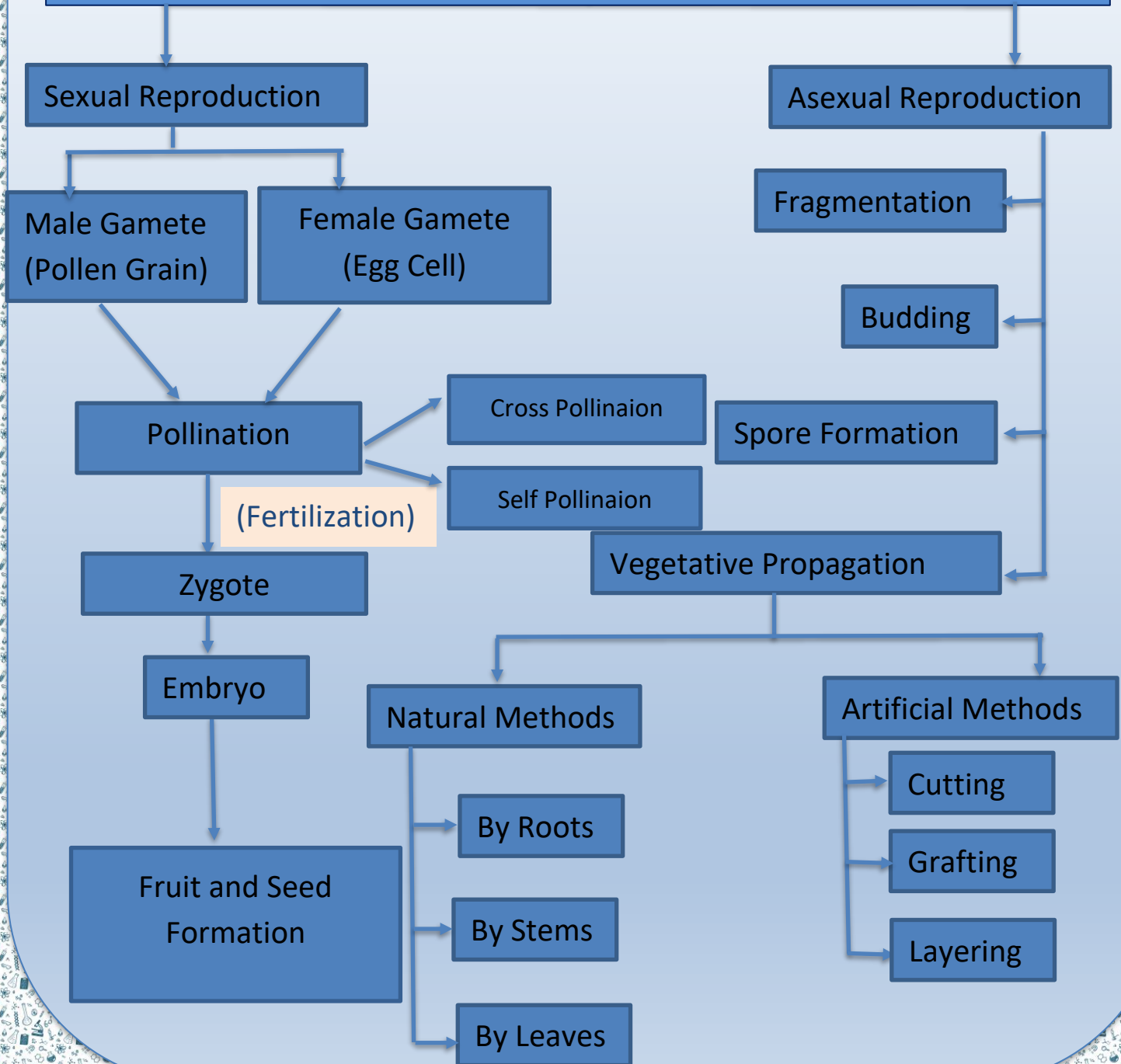
Learning Outcomes

The students will be able to:

- ☐ infer the mode of reproduction from the features of a plant.
- ☐ observe and recall how different types of plants grow new ones in order to differentiate between Asexual and Sexual mode of reproduction.
- ☐ distinguish between any two modes of asexual reproduction, in connection with parts involved.
- ☐ compare the outcomes of sexual reproduction in unisexual plants with those in bisexual plants.
- ☐ define reproduction in order to identify its need.
- ☐ recall details/definitions pertaining to sexual mode of reproduction in plants.
- ☐ critique the idea that any of the categories of seeds might disperse better than another category, in connection with reference to their features.
- ☐ draw a contrast between any two modes of asexual reproduction, in connection with parts involved, etc.

STORY BOARD

Types Of Reproduction



INTRODUCTION OF CHARACTERS

ROHAN



**He is curious and enthusiastic .
He is a keen observer and
a good learner also.**

MOTHER



**She is knowledgeable
and caring.**

ANUJ



**(Rohan's friend)
He is inquisitive and helpful.**

MAALI KAKA



**He is helpful, wise and
well informed about plants.**

TEACHER



**She is understanding,
learned and supportive.**

PRINCIPAL



He is embolden and prudent.

SCENE 1

One Sunday morning, Rohan notices the gardener working in the garden.

Wow! My beautiful garden with lovely flowers. Let me ask maali kaka how these flowers bloom.

Gardener is planting rose cuttings and pieces of potato.

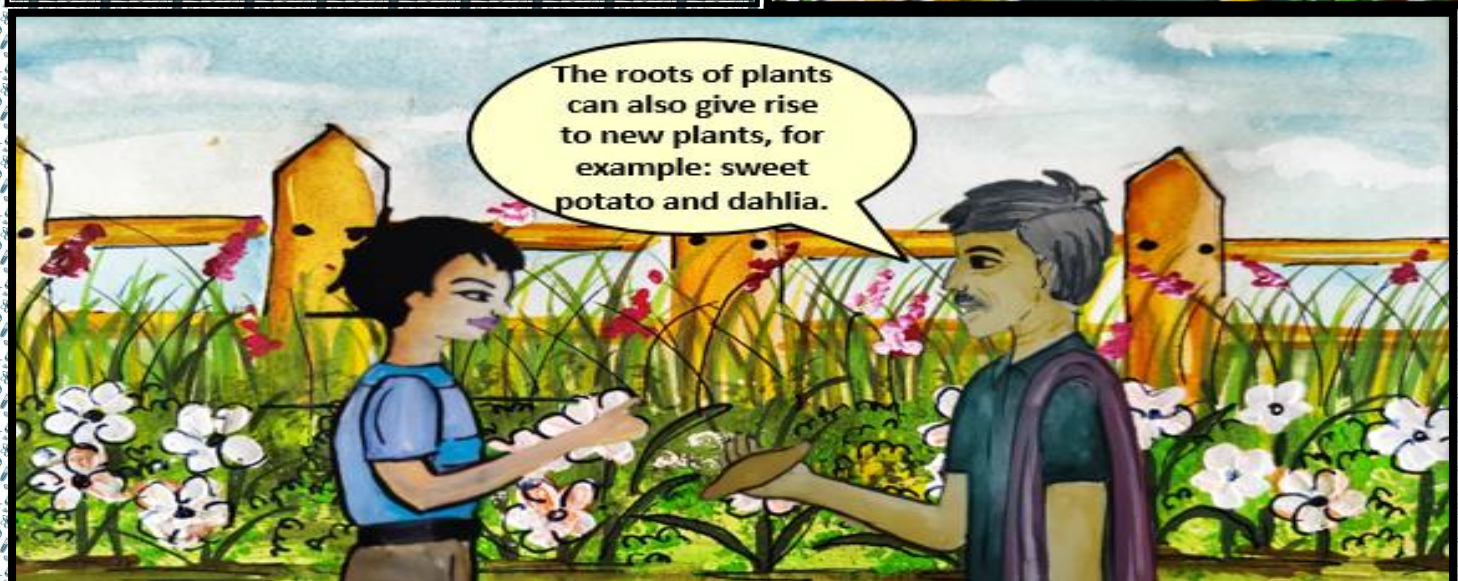
What are you doing with these rose cuttings?

This rose cutting is a vegetative bud and will reproduce easily.

Rohan picks up a potato and examines.

Will this potato piece also form a new potato plant?

This potato piece has scars(eyes) on it. It is a stem tuber and will grow vegetatively when sown in the soil.



Gardener is bending the branch of a plant in the ground.

Why are you bending the branch of this plant in the ground?

Rohan, this method is called layering in which roots develop from the covered part which I have bent towards the ground. Jasmine and Bougainvillea are grown by this method.



Rohan is fascinated by the red roses and wants to pluck some.

Stop! Don't pluck flowers.

But I like these pretty red roses.

I know, but they are colourful to attract insects, not you. Insects suck nectar from flowers and help in completing the reproduction cycle of the plant.

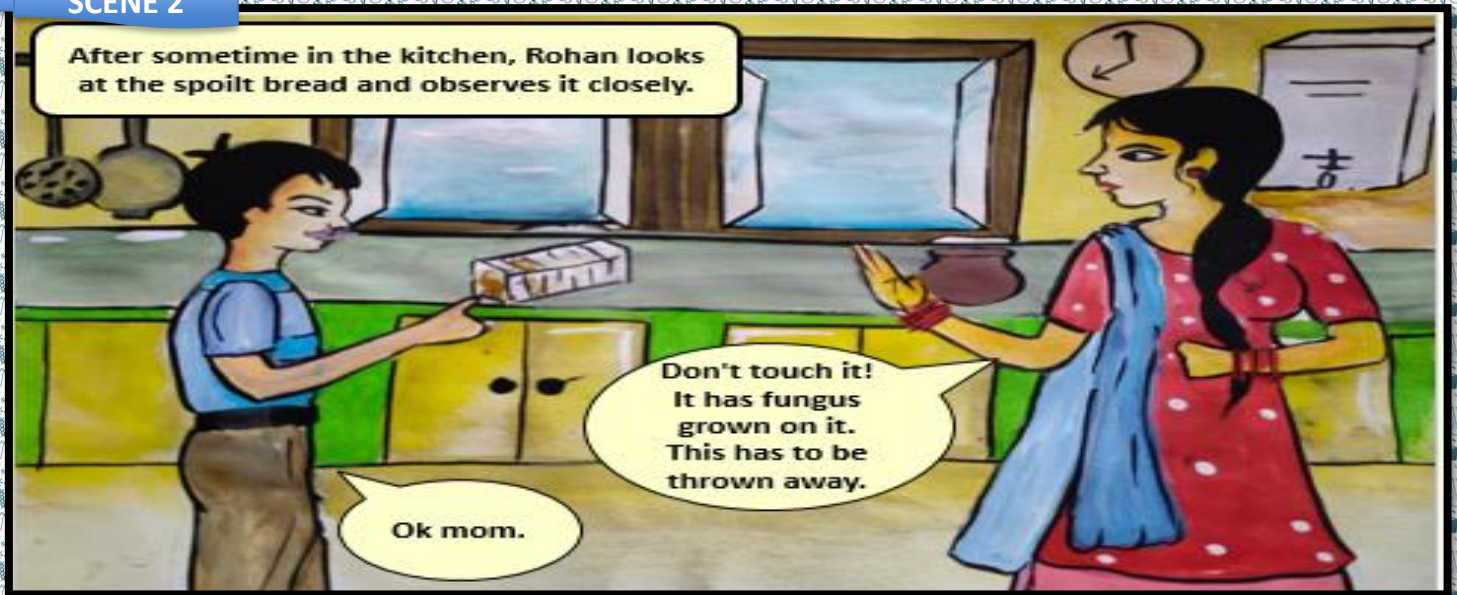


INCREASE YOUR
KNOWLEDGE

Nectar can be defined as a sugar rich liquid, produced by nectaries. These are special glands in a plant, generally located at the base of a perianth. The word nectar has been derived from Greek word "Nektar" that means "overcoming death".

SCENE 2

After sometime in the kitchen, Rohan looks at the spoilt bread and observes it closely.



Don't touch it!
It has fungus
grown on it.
This has to be
thrown away.

Ok mom.

Mother is mixing yeast in
a glass of water.



What are you
doing mom?
What does this
packet contain?

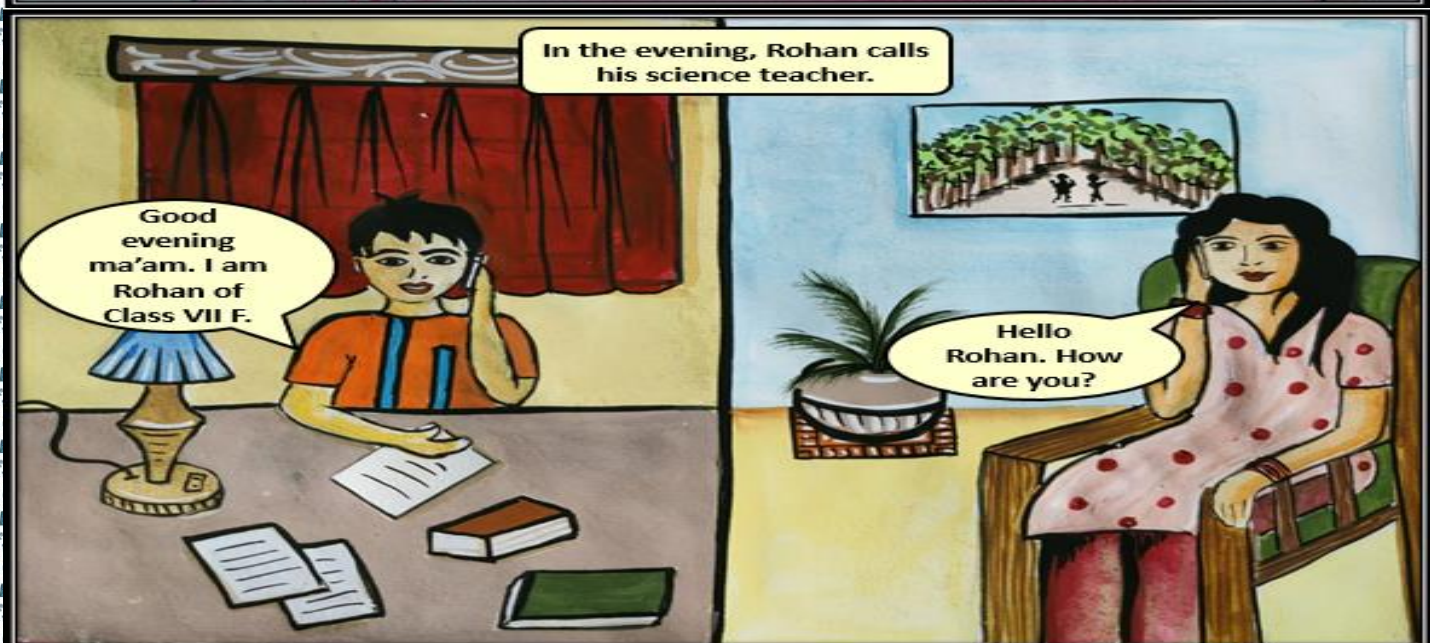
I am mixing
yeast in water
to make idlis.

What is
yeast?



It is a
fungus.





SCENE 3

Monday morning, while going to school Rohan looks at a pond and wonders.

Earlier the pond water seemed greenish but now some green thread like structures have grown in the pond.



Rohan reaches school and after giving attendance goes to the Biology Lab.



Ma'am, can a new potato plant grow from scars present on it?



Yes, potatoes have scars (also known as eyes) on them. Ginger and turmeric also grow in the same way.

Look, this Bryophyllum leaf has buds on its margin which will grow to form new plants. This is an example of vegetative propagation by leaves.



Ma'am, what is fungus? Can we eat it?



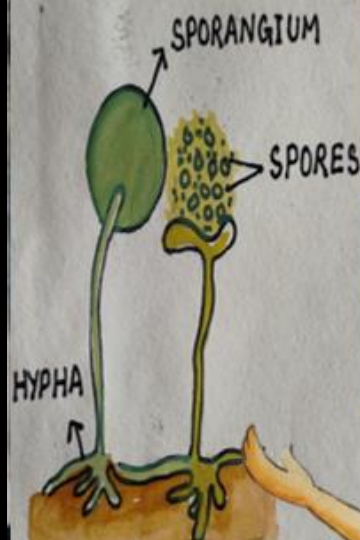
Fungus grows from spores on bread. It is a pathogenic organism, which can't be eaten.



INTERESTING FACTS

- ✓ Some fungi are bioluminescent (they glow in the dark).
- ✓ A scientist that studies fungi is called a Mycologist.

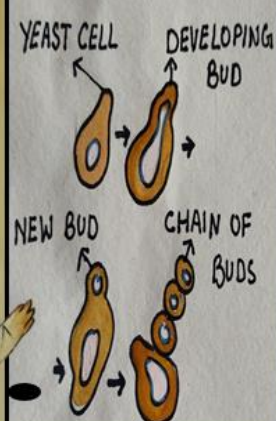
From where
do these
spores come
on bread?



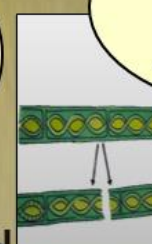
Spores are
asexual
reproductive
bodies,
present in air
and grow in
presence of
moisture and
warmth.



Yeast, an edible
fungus, grows by
budding where a bud
develops, detaches
itself to form new
yeast cell.



Madam on the way
to school, I noticed
the pond with green
thread like structure
grown on water
which is increasing.
How is it possible?



Yes Rohan, that is
spirogyra(an algae). It
divides into fragments and
each fragment forms new
algae by the process of
regeneration. This method
is fragmentation.



Eyes on potato, buds on
yeast and bryophyllum have
meristematic tissues which
have undifferentiated cells
capable of cell division.
These cells can develop into
other tissues and organs of a
plant.





Think & Answer



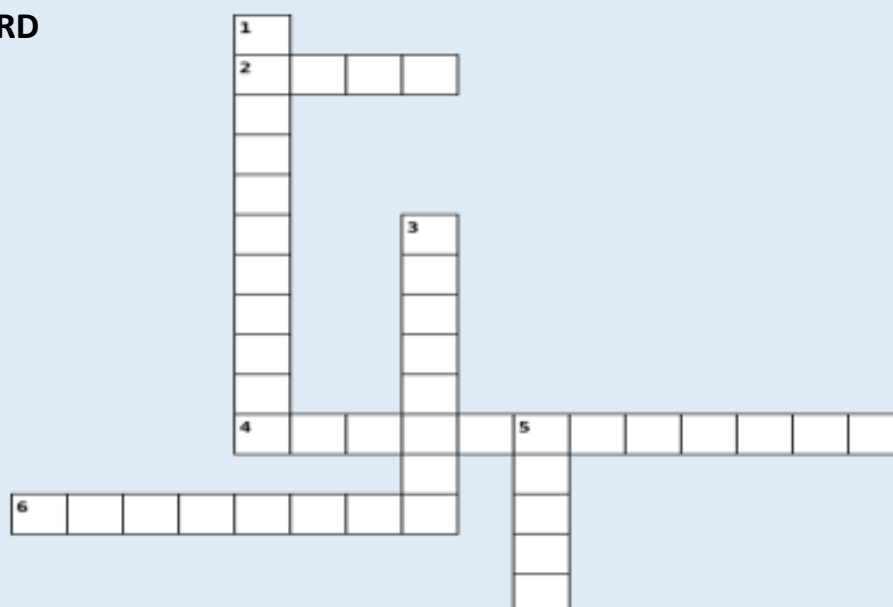
1. Guess who am I?

- a) I multiply rapidly in stagnant water bodies.
- b) I am available at a confectionary shop and just need water and sugar to grow.
- c) I float in the air and have a hard protective coat. I germinate wherever favourable conditions are available.
- d) I have scars (eyes) for vegetative propagation.

2. Match the following:

a) Yeast	Spores
b) Potato	Fragments
c) Algae	Buds
d) Fungus	Eyes

CROSSWORD



Across

- 2. this plant can be artificially propagated by cutting method
- 4. tissues that help in cell division
- 6. a method used to propagate Jasmine

Down

- 1. a plant also known as sprout leaf plant
- 3. this method helps to develop new varieties of fruits
- 5. fleshy part of potato which stores food

SCENE 4

Next day, during Fruit Break.

Anuj, look there are so many seeds in the guava.

But my mango has only one seed.

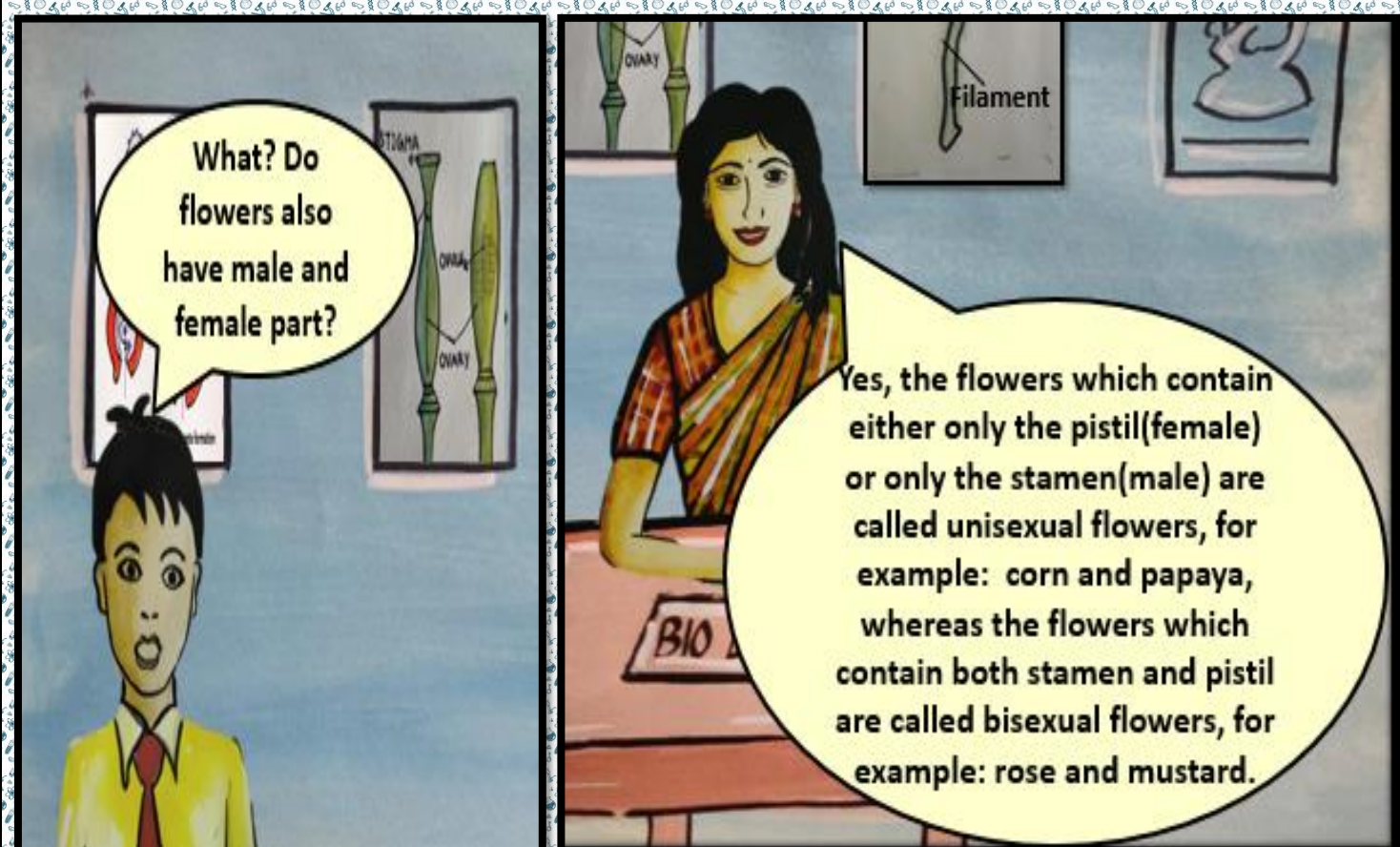
I can't understand this difference. Let's ask the teacher.

INTERESTING FACT

Strawberries are one of the only fruits with its seeds outside.

Ma'am, I have a question. Guava has so many seeds but a mango has only one seed. Why is it so?

This is because guava has many ovules but mango has only one.



What is the role of these male/female parts in a flower?

Male part(stamen) consists of anther and a thin filament. Anther consists of many pollen grains. They help in seed formation inside the female part of a flower.

Female part(pistil) has stigma , style and ovary. Ovary can contain one or many ovules. An egg cell is present inside each ovule.

This means guava has many ovules and mango has only one ovule.Hmm!

Next day, again in the Bio-Lab.

Good Morning ma'am.
If you are free, may I ask some questions?

Yes Rohan, why not?

Do insects suck nectar from the flowers?



Yes, when insects sit on flowers to suck nectar, pollen grains stick to their body parts. They transfer these pollen grains to the female part of another flower.

The process of transferring pollen grains from male part of one flower to female part of another flower is called pollination. If pollen grain lands on the stigma of the same flower, it is called self pollination and if on another flower, then it is cross pollination.

Unisexual Flower

- a) Many pollen grains are released.
- b) There are less chances of fertilization.

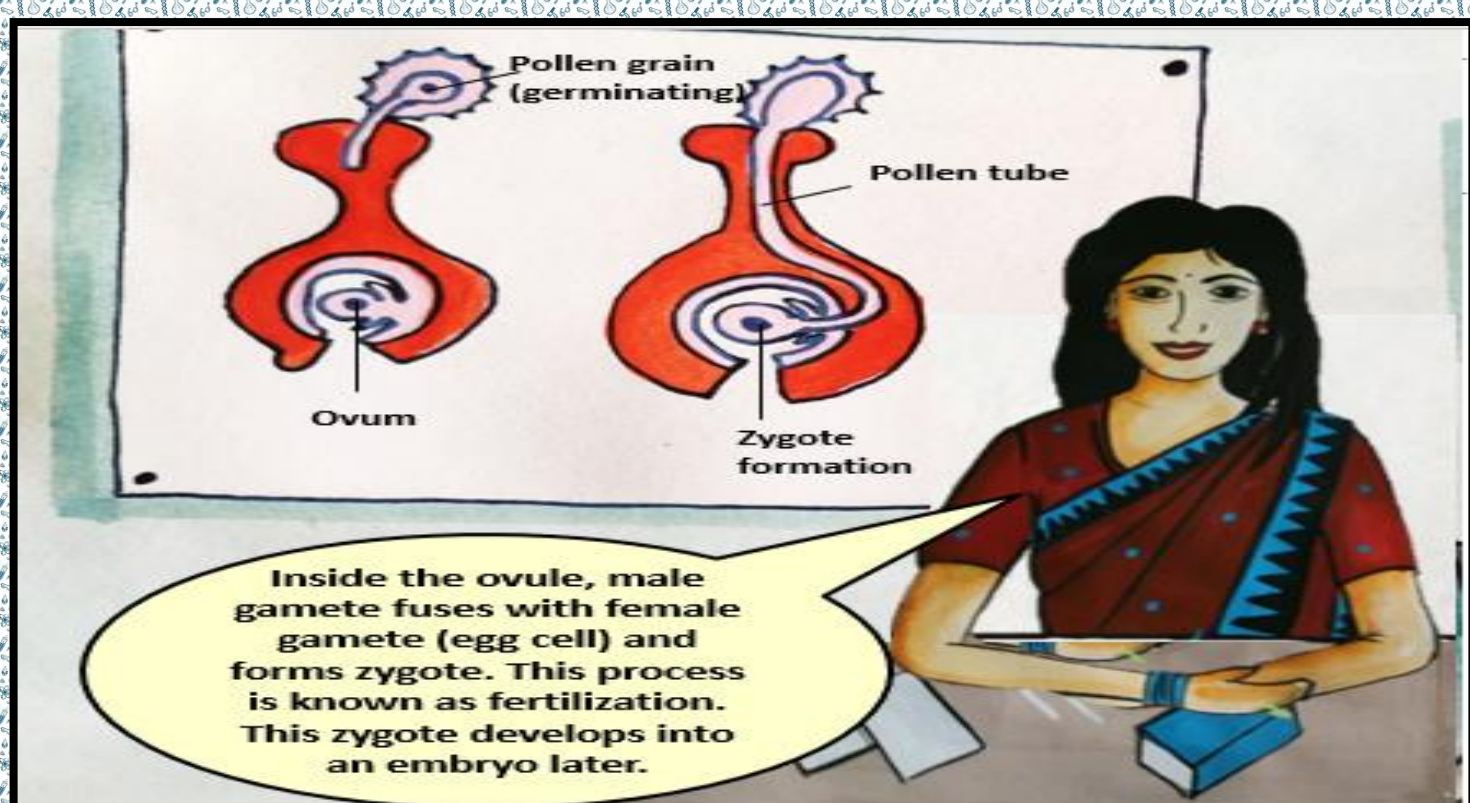
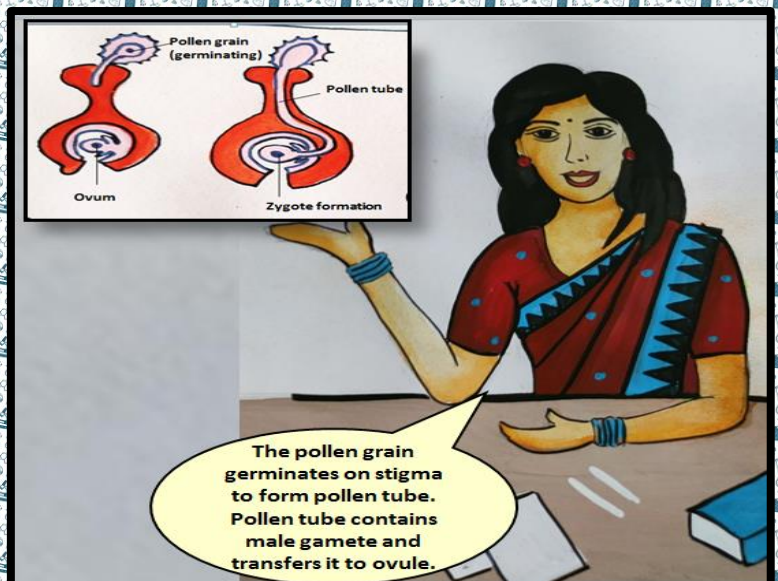
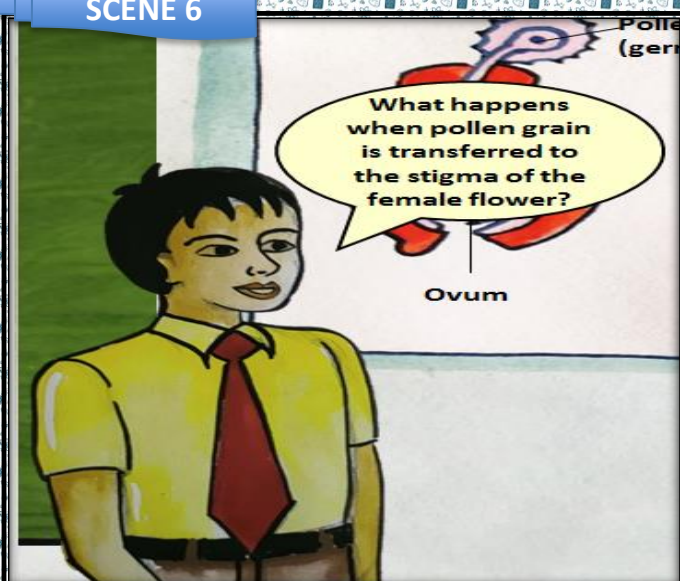
Bisexual Flower

- a) Few pollen grains are released.
- b) There are more chances of fertilization.

INTERESTING FACT

Honeybees eat pollen to get protein and nectar to get carbohydrates.

SCENE 6



Ma'am, what do we call the part outside the mango seed which we eat?



BIOLOGY REPRODUCTION IN PLANTS

It is called ovary. After fertilization, ovary gets converted into fruit which you eat and ovules form seeds. A seed has embryo which grows into a new plant.

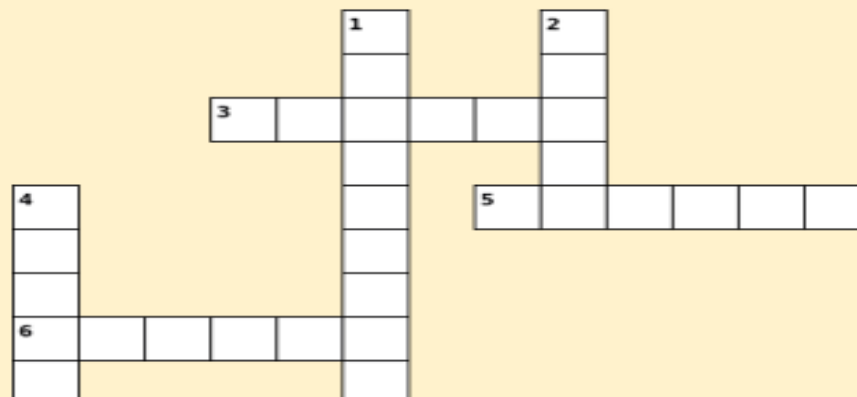
Why are dry fruits called so?

Because dry fruits are dried naturally to remove water content so as to retain them for a longer time as they are not available throughout the year.

Unscramble the jumbled words....

1. tsey a
2. oetzgy
3. yormbe
4. naerfoiizltl
5. xilasnueu
6. itntguc

CROSSWORD



Across

- 3. the dry fruit made from dried grapes
- 5. fine dust like structures present inside the anther
- 6. this part of pistil receives pollen grains

Down

- 1. flowers having less chances of fertilization
- 2. the seasonal fruit with one ovule
- 4. type of pollination where pollen grain lands on the stigma of another flower of same species

SCENE 7

Ma'am, if I sow seeds in my garden, will they grow into new plants?

BIOLOGY REPRODUCTION IN PLANTS

Yes, why not. But sow each seed at a distance otherwise they will not grow properly.



1. A flower contains both male and female reproductive parts. Will it still require insects for pollination?
2. If pollen grains of one species land on stigma of another species, will fertilization take place?
3. Do you think that disappearance of insects from the surface of earth will be harmful for plants?
4. What happens when pollen grains land on stigma?



SCENE 8

Rohan is standing near a window and wondering. He is so mesmerised with the natural world of plants. He is beaming with ideas.

I must ask my science teacher if we can practice these amazing gardening techniques in School. I think it is a good idea if we can have a Gardening Club in the school. Many students can be a part of it. I am sure she is going to support my idea.

A boy with dark hair, wearing a blue t-shirt, stands by a window with red curtains. He is looking out at a lush green garden with various plants and flowers. A small black vase with a red flower sits on the windowsill.

In the evening, Rohan calls his science teacher.

Hello, good evening ma'am. I have a great idea, Can I come to School tomorrow to discuss the idea with you?

Thank you ma'am.

Rohan, it is a holiday for students and we have a meeting with Principal Sir. Umm! Ok. You come at 12 noon, by then I'll be free.

The scene is split into two panels. On the left, Rohan is standing and talking on a mobile phone. On the right, a woman with dark hair, wearing a pink floral dress, is sitting in a wooden chair and talking on a mobile phone. A window with red curtains is visible in the background of both panels.

Next day in school.



Ma'am, I have a great idea. We can have a Gardening Club in the school and students who are interested can be a part of it. We have so much of vacant land behind the building. Ma'am, if you will support the idea, Principal Sir will surely agree to it.

Let me see if Principal Sir is there, we can go and discuss with him.

In Principal's office

Sir, I have an idea of having a Gardening Club in our school where gardening techniques can be practised.

Yes Sir, these children are very innovative. Let's give them a chance to bring out their creativity. Moreover, it is going to be an experiential learning project.



WORD SEARCH



H	E	U	L	Q	M	O	S	S	E	S	P
D	Y	D	D	M	A	W	I	A	A	I	A
J	K	K	S	W	P	S	K	B	C	T	P
M	B	C	P	A	L	A	L	C	B	E	A
G	A	M	E	T	E	X	M	D	D	R	Y
A	X	Q	R	E	H	Z	N	E	Y	Q	A
O	Z	S	M	R	R	B	U	D	E	L	B
F	U	U	N	I	S	E	X	U	A	L	X
P	O	Y	K	F	U	N	G	U	S	F	G

HINTS

Vertical:

- ✚ male gamete
- ✚ winged seed dispersal by wind
- ✚ agent of dispersal
- ✚ an example of incomplete flower

Horizontal:

- ✚ male and female reproductive cells
- ✚ small bulb-like projection coming out of yeast
- ✚ a spore producing organism
- ✚ the flower which contains either pistil or stamen

The school introduces the Gardening Club after a few weeks of planning and preparation. The students start learning and practicing the various methods of vegetative reproduction. They cultivate potato, ginger, onion etc.



The Gardening Club members work with great enthusiasm. The students donate the produce in the nearby old age home. Not only this, the blooming vibrant flowers are utilised by the Home Science students to prepare bouquets for several school events. This is how gardening club with its various utilities proves to be an exemplar of experiential learning.

Check Your Knowledge

Answer In One Word:

1. Which is the male reproductive organ in plant?
2. Which part of the flower changes into seed?
3. What type of reproduction takes place in Yeast?
4. Which form of asexual reproduction occurs in Spirogyra?
5. What is the process of fusion of male cell and egg cell called?
6. My pod splits open and seeds are thrown out with a force. What is likely my dispersal method?

Fill In The Blanks:

1. The method of reproduction that involves only one parent is called ____.
2. Spirogyra reproduces by ____.
3. Tiny rounded structures that contain spores are called ____.
4. ____ leaf has many buds on its margin.
5. ____ of flower develops into fruit.
6. ____ flowers contains only male or female reproductive organs.
7. The fusion product of male cell and egg cell is called as ____.
8. The ovule develops into the ____ after fertilization.
9. Production of new individuals from the vegetative part of parent is called ____.
10. Seed dispersal takes place by means of ____, ____ and ____.

Glossary

1. Reproduction: The process of producing young ones of their own kind is known as reproduction.
2. Gamete: male or female reproductive cell.
3. Vegetative Reproduction: When new plants are produced from the vegetative parts of the mother plant, such as root, stem, or leaves, without the help of any reproductive organs.
4. Zygote: The cell formed by the fusion of male cell and the egg cell.
5. Fertilization: fusion of male cell and egg cell.
6. Pollination: transfer of pollen grains from the anther to the stigma.
7. Spore - A tiny, spherical, unicellular body protected by a thick wall.
8. Scion - The part of the plant, usually a piece of young stem which is inserted into a rooted stock to produce a graft is called Scion.
9. Stock - A plant rooted in soil on which the scion is inserted for grafting is called stock.

EXPERIENTIAL LEARNING

DAY 1



DAY 15



DAY 22



DAY 1



DAY 10



DAY 34



BIBLIOGRAPHY

- NCERT Science Book for Class VII
- Living Science
- Change Color App from Google Play Store
- Facial Expression Changer from Google
- <https://www.leaflimb.com/16-Fascinating-Facts-About-Fungi/>
- <https://www.ducksters.com/science/biology/fungi.php>
- <https://robintidefarms.com/2019/06/07/10-facts-you-didnt-know-about-strawberries/amp/>
- <https://iowaagliteracy.wordpress.com/2015/08/06/9-things-you-didnt-know-about-pollinators/>
- <https://easyscienceforkids.com/all-about-nectar/>
- <https://doubtnut.com/question-answer-biology/define-scion-and-stock-add-a-note-on-advantages-of-grafting-96609271>

DISCLAIMER

All the characters, names, places and incidents in this graphic novel are fictitious. This graphic novel is just an imagination of the team members designed for a better understanding of the topic, Reproduction in Plants for the students. The story line, script and graphics are the creation of the subject experts.

Created and designed by: K. L. International School, Meerut

ANSWER KEY

Think & Answer

1. Guess who am I?

- a) Algae
- b) Yeast
- c) Spores
- d) Potato

2. Match the following

a) Yeast	Buds
b) Potato	Scars
c) Algae	Fragments
d) Fungus	Spores

Crossword (Page 13)

Across

- 2. Rose
- 4. Meristematic
- 6. Layering

Down

- 1. Bryophyllum
- 3. Grafting
- 5. Tuber

Unscramble the jumbled words..

- 1. Yeast
- 2. Zygote
- 3. Embryo
- 4. Fertilization
- 5. Unisexual
- 6. Cutting

Crossword (Page 20)

Across

- 3. Raisin
- 5. Pollen grains
- 6. Stigma

Down

- 1. Unisexual
- 2. Mango
- 4. Cross

Think & Answer

- 1. No, because it already contains stamens which produces pollen grains.
- 2. No, because fertilization occurs between individuals of same species.
- 3. Yes, because they help in pollination.
- 4. It forms a pollen tube which carries male gamete. This male gamete will fuse with female gamete inside ovule to form a zygote.

Word Search

Vertical

-  Sperm
-  Maple
-  Water
-  Papaya

Horizontal

-  Gametes
-  Bud
-  Fungus
-  Unisexual

Answer in one word

- 1. Stamen
- 2. Ovules
- 3. Budding
- 4. Fragmentation
- 5. Fertilization
- 6. Explosion

Fill in the blanks

- 1. Asexual reproduction
- 2. Fragmentation
- 3. Sporangium
- 4. Bryophyllum
- 5. Ovary
- 6. Unisexual
- 7. Zygote
- 8. Seed
- 9. Vegetative reproduction
- 10. Water, Wind, Animals



Summary

Plant reproduction is the process by which the plants generate new individuals or offsprings. Reproduction is either sexual or asexual. In sexual reproduction, a male and female gamete fuse to form a zygote. Asexual reproduction produces new individuals without the fusion of gametes. Reproduction in plants also occurs by the vegetative parts of the plants in potato, ginger, strawberry etc. Several artificial methods have been developed for vegetative reproduction like cutting, grafting, layering etc. Vegetative reproduction is very useful to plant growers as it allows them to produce new varieties of plants and require less attention than plants grown from seeds.

FROM THE PRINCIPAL'S DESK

Dear Readers

*'To embark on a journey towards the goal requires initiation,
To remain on that path requires determination,
To bridge the two requires commitment.'*



Today, schools across the globe are trying to decipher the best case scenario that would provide pertinent knowledge outflow to learners in a consistently changing educational set-up. This calls for deviation from the traditional chalk and talk method towards practical based, experiential learning.

In these changing times the need of the hour is to root students firmly in an enabling constructive work ethic for their meaningful blossoming.

Graphic novel just like traditional forms of literature can be a useful tool for helping students critically examine aspects of Social Science, Science, Mathematics, Languages and Art. Hence fostering of acquisition of critical reading skills is brought about.

In modern era, graphic novels will definitely prove to be a boon not only for publication but also for the young readers. The team has tried to infuse creative work with more meaning, a greater purpose for the readers to set the mood to understand important concepts. It is a great pleasure to announce the accomplishment of this graphic novel based on Reproduction in plants.

It has the potential to appeal to almost any reader. It is a vibrant and compelling tool for teaching.

I extend a heartfelt and sincere thanks to honourable Mr. Manoj Ahuja, Chairman CBSE for providing our school the privilege of being in the league of futuristic schools. My sincere thanks to Mrs. Anita Karwal, Secretary (SE&L) and to Dr Biswajeet Saha, Director Skill Education and Training CBSE and a special vote of thanks to Mr. Sandeep Sethi (Director Education, M.S.M.S II, Museum Trust) for his perseverance through this project.

I congratulate my entire team for putting in the hard work and dedication in the making of this graphic novel. The reflection of the teachers' creativity is the epitome of the novel and will surely stir the minds of the readers and take them to the fantastic world of unalloyed joy and pleasure.

It is anticipated that this graphic novel would find acceptance and appreciation from all.

Happy Reading!

God Bless All

Sudhanshu Shekhar
Principal
K. L. International School
Meerut

“True education must correspond to the surrounding circumstances or it is not a healthy growth.”

- Mahatma Gandhi



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