BIOLOGY LEARNING STATION STRATEGIES (BLISS)

Students Support Materials in Selected Topics in Biology

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INTRODUCTION

This material is composed of ideas that can help teachers enhance the teaching-learning process concerning the diversity of learners in different aspects.

The assigned activities per station will help the students to learn more in their lessons this material contains activities that can be implemented by teachers who want a unique teaching method.

These activities were based on the objectives from the Mastered Learning Competencies (MELCs) and patterned to the original Biology Learning Station Strategy (BLISS) materials and this will be enhanced by the researchers for further improvements that will lead to more effective teaching materials for Biology Teachers with respect with the selected topics that had been placed according to Mastered Learning Competencies (MELC's).

The activities enhanced by the researchers can lead to a more effective teaching and learning process through online or even offline modes of learning. Students were to explore the activities that have been placed by the researchers for them to further nurture the knowledge that they have in the past few years of studying specifically selected topics in Biology. Each station has specific activities connecter that will help them to easily to comprehend what is the main point of their topic, upon having their own set up of studying and after they have done all the enhanced activities the feedback of their assigned Science teacher is necessary it only shows that this is not just a per-stations setup academics enhanced activities but this also build the relationships between teachers and students.

This material will be done with the help and support of our Professors in the College of Education (COE) at the University of Rizal System (URS) Morong campus.

ACKNOWLEDGMENT

The researchers would like to extend their deepest gratitude and heartfelt appreciation to the persons who help, supported, and guided them in the completion of the study.

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The ORIGINAL BIOLOGY LEARNING STATION STRATEGIES (BLISS) RESEARCH MATERIALS for the inspiration that has been given to us to have contributions to the improvement of the materials for teaching and learning processes in a selected topic in Biology based on Most Essential Learning Competencies (MELC's).

The FACULTY AND STUDENTS OF UNIVERSITY OF RIZAL SYSTEM MORONG CAMPUS, for their help and cooperation during the conduct of the study.

The RESPONDENTS, the BIOLOGY TEACHERS, and the PRINCIPAL for their cooperation and listening.

And lastly, to ALMIGHTY GOD, for His unconditional love and all the blessings, He gave us each day of our life. We thank Him for His comfort during the times that we're about to give up, who showers us their strength, intelligence, and guidance toward the fulfillment of this study.

-The Researchers

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BIOLOGY LEARNING STATION STRATEGIES (BLISS):

COMPETENCY 1

FEEDBACK MECHANISMS INVOLVED IN REGULATING PROCESSES IN THE FEMALE REPRODUCTIVE SYSTEM

Content Standards:

The learners demonstrate an understanding of organisms as having feedback mechanisms, which are coordinated by the nervous and endocrine systems.

Competency:

Describe the feedback mechanisms involved in regulating processes in the female reproductive system (e.g., menstrual cycle) **S10LT- IIIc -35**.

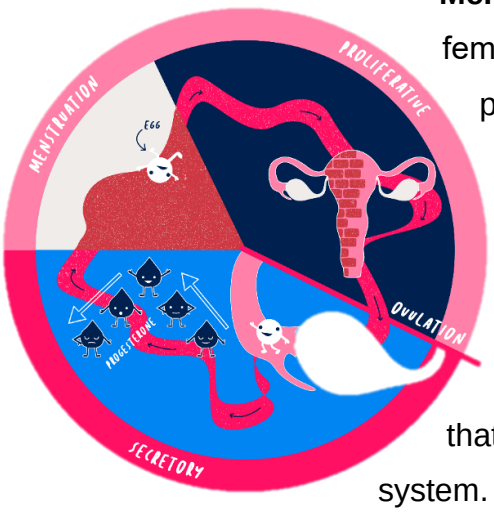
Objectives:

At the end of the material the student will be able to:

1. identify the phases and important events that happen during the menstrual cycle;
2. describe the feedback mechanisms involved in regulating processes in the female reproductive system; and
3. appreciating the importance of learning how the body works together with the hormones to promote self-care.

Introduction

We have learned that, on average, an ovary releases only one egg every 28 days. Now, what controls this timing? Hormones control many of the changes in the reproductive system. Remember that hormones are chemicals that affect certain body organs.

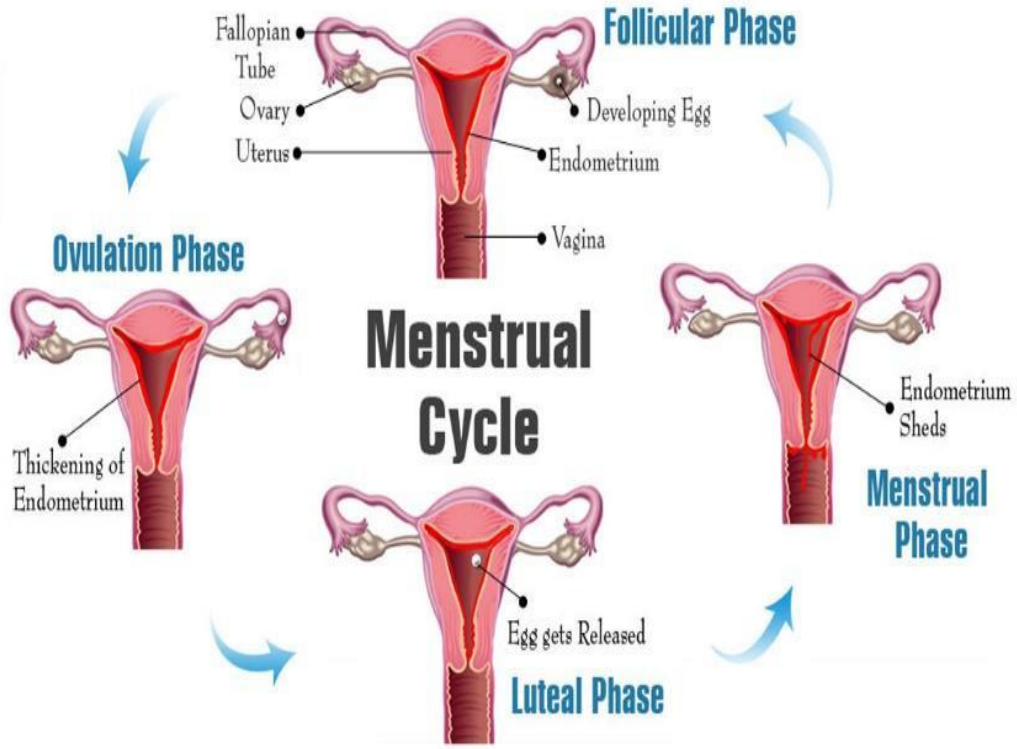


Menstrual Cycle is the monthly hormonal cycle a female's body goes through to prepare for pregnancy. Regular menstrual cycles between puberty (usually 12-14 years old) and menopause (usually 45-55 years old) are usually a sign that your body is working normally.

Menstruation is the monthly change that takes place in the female reproductive system. And when blood and tissue from the uterus come out from the vagina.

Ovulation is when releasing of an egg from your ovary, into your fallopian tube.

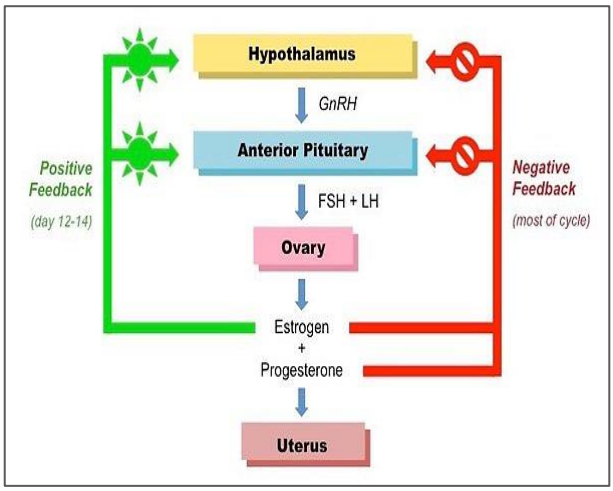
Phases of the Menstrual Cycle



1. **Menstrual Phase**- menstruation occurs
2. **Follicular Phase**- pituitary gland releases (FSH) to create follicles that contain an immature egg. As a follicle matures, the body releases extra estrogen which stimulates the uterine lining to thicken to provide the necessary nutrients to a fertilized egg.
3. **Ovulation Phase**- it starts when rising estrogen levels signal the pituitary to release LH to stimulate the ovulation process. The egg can survive for about 24 hours before it must be fertilized. If it doesn't get fertilized at that point, the egg will dissolve.
4. **Luteal Phase**- if the mature egg is fertilized, the body will produce Human Chorionic Gonadotropin (HCG) which will help to keep the uterine lining thick for the fertilized egg to develop into an embryo. And also, if the egg doesn't get fertilized during ovulation, the corpus luteum will dissolve in the body and disappear.

Hormones Control the Menstrual Cycle with Negative and Positive Feedback

The Negative Feedback Mechanism is the increasing levels of hormone feedback directly to the hypothalamus and pituitary gland to decrease hormone production.



Positive Feedback Mechanism the increasing levels of hormones present feedback for the hormone production to increase.

Feedback Mechanisms in the Menstrual Cycle

1. Follicle-stimulating hormone (FSH) stimulates the ovaries to release estrogen. High levels of estrogen then prevent the further production of FSH.

2. Estrogen also stimulates the release of luteinizing hormone (LH) from the pituitary gland, which in turn controls the production of progesterone. High levels of progesterone then inhibit the further release of LH.

STATION 1

ACTIVITY 1

Mark My Calendar!
(Think, Pair, Share)

Objective:

Describe the feedback mechanisms involved in regulating processes in the female reproductive system.

Materials:

i. 2 Calendar charts
ii. Diagram of the male and female reproductive system
iii. Scissors
iv. Tape or glue

Procedure:

Part A - For no fertilization:

a. Get a calendar, with an approximate size of 8 × 11 inches. It must be marked by the day-to-day changes in the menstrual cycle.
b. Note that certain events are marked on certain days.
c. Make a copy of diagrams of the menstrual cycle like in Figure 12. Some of the diagrams will show events in the ovary, and some will show events in the uterus. They are not in proper order. Cut out each square.
d. Place the diagram in the space to the right of the corresponding description.
e. Tape or glue your diagrams in the right places/ dates where they occur.
f. Make sure that they are correctly placed.

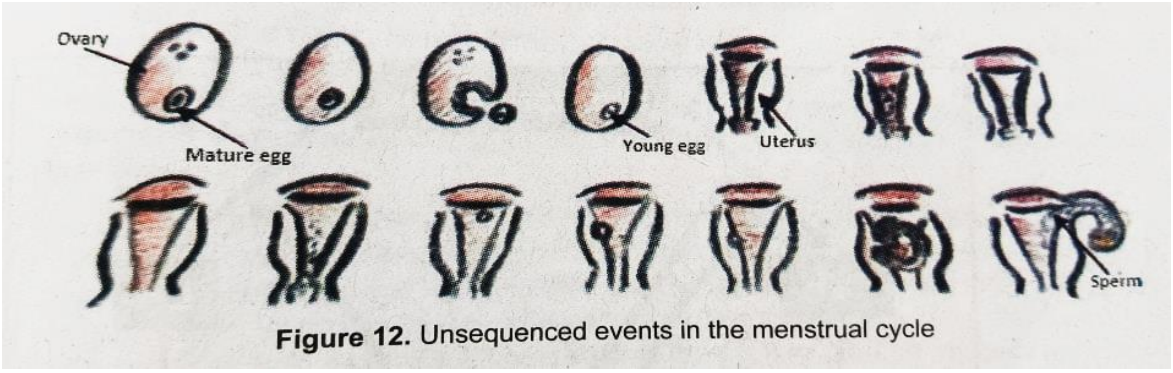


Figure 12. Unsequenced events in the menstrual cycle

Part B - With fertilization of the egg

a. Get another calendar marked by the day-to-day changes in the menstrual cycle.
b. You will be given a set of diagrams to place on the calendar. The diagrams will not be in proper order. You may not need all the diagrams that show the uterus.

Guide Questions:

Q1. How long does a regular menstrual cycle last?

_____
_____
_____

Q2. Describe what happens to an egg during the first 14 days of the cycle in Part A.

_____
_____
_____

Q3. Describe what happens to the egg if fertilization occurs.

_____
_____
_____

Q4. Explain what takes place in the uterus after fertilization.

_____
_____
_____

Q5. Why is it important to study the menstrual cycle?

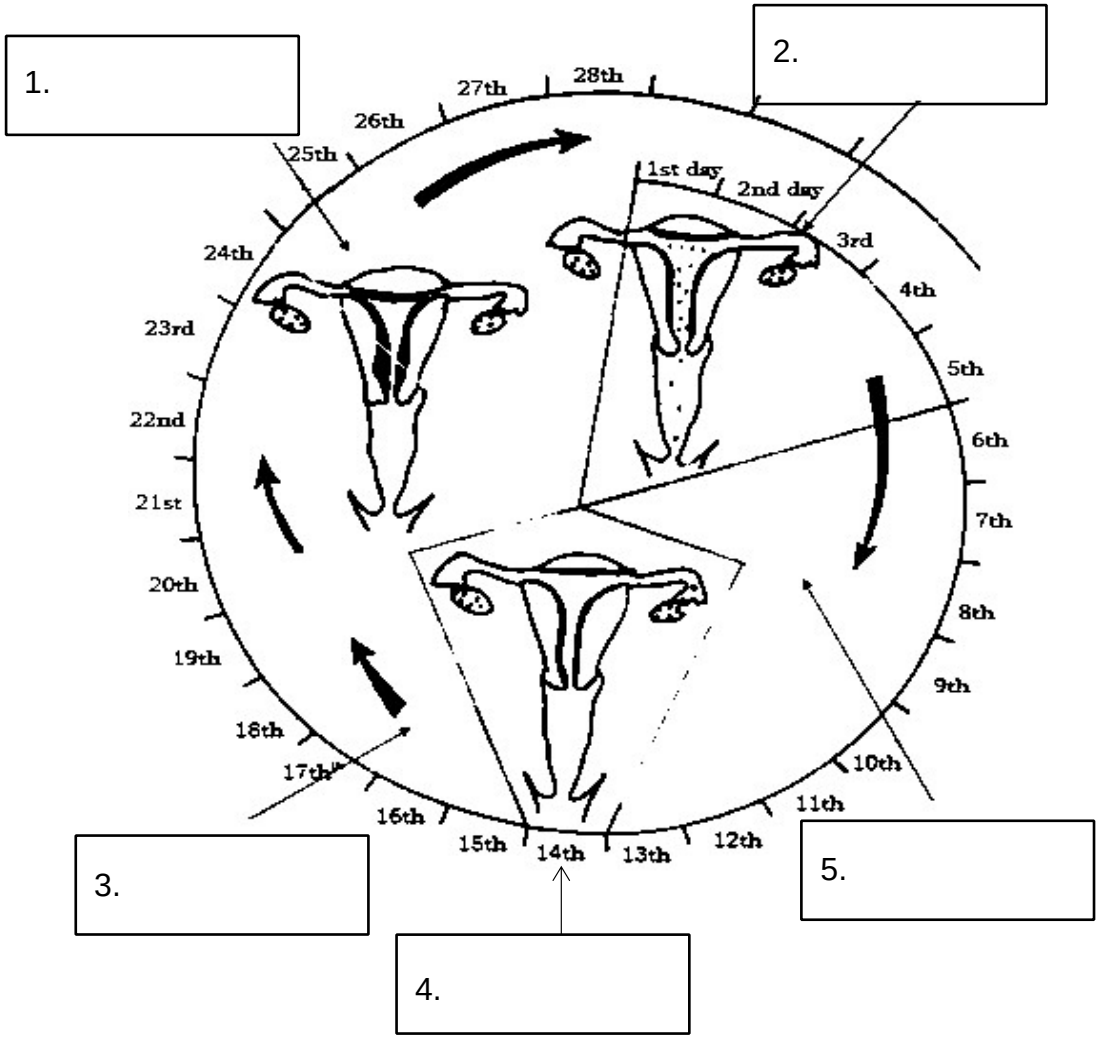
_____
_____
_____

ACTIVITY 2

The Cycle Continues

Direction: Copy these sentences to the correct boxes below.

Egg is release.	Lining starts to thicken.
Menstruation happens.	Egg dies if not fertilized.
If egg is fertilized it settles into thick lining	



ASSESSMENT

Competency 1
Describe the feedback mechanisms involved in regulating processes in the female reproductive system (e.g., menstrual cycle) **S10LT – IIIc -35**

Direction: Choose the letter of the correct answer.

1. Which of the following statements are true about menstruation?
   a. In a normal 28-day menstrual cycle you would expect menstruation to last approximately 3-5 days.
   b. During menstruation, the entire endometrium is shed.
   c. During menstruation, only the functional layer of the endometrium is shed, with the basal layer remaining intact.
   d. The absence of menstruation always indicates an active pregnancy.

2. Which hormone, produced by the ovaries, stimulates the uterus lining to build up after menstruation?
   a. Estrogen
   b. Progesterone
   c. Luteinizing hormone
   d. Follicle-stimulating hormone

3. Which hormone, released by the pituitary gland, stimulates ovulation?
   a. Estrogen
   b. Progesterone
   c. Luteinizing hormone
   d. Follicle-stimulating hormone

4. Which hormones increase after ovulation to keep both FSH and LH levels low?
   a. Estrogen
   b. Progesterone
   c. Luteinizing hormone
   d. Follicle-stimulating hormone

5. In the luteal phase, the uterus is ready to receive a fertilized egg. Assuming that the egg cell is not fertilized by a sperm cell, what would happen to the endometrium?
   a. It would break and shed off.
   b. It will form a new egg cell.
   c. It will continue to thicken.
   d. It will not be affected.

6. Which of the following physical changes is experienced by women during the luteal stage of the menstrual cycle?
   a. Mood swings
   b. Changes in appetite
   c. Depression or sadness

d. Headaches or backaches

7. What will happen inside the uterus if fertilization occurs?
   a. The fertilized egg will get implanted in the uterus.
   b. The uterine wall will continue to thicken for ovulation.
   c. The uterine wall will collapse, releasing blood and tissues.
   d. The egg cell will be fertilized by the sperm cell in the uterus.

8. Why does progesterone inhibit the release of LH after ovulation has occurred?
   a. So only one egg is released from the ovaries
   b. So multiple eggs can be released from the ovaries
   c. So, the uterus lining can be broken down during menstruation
   d. So FSH can be produced and can stimulate the egg to mature

9. The female ovaries are responsible for producing estrogen and progesterone. How is the ovary affected by the hormones released by the pituitary gland?
   a. LH stimulates the release of estrogen, while FSH inhibits the release of progesterone.
   b. LH inhibits the release of estrogen while FSH stimulates the release of progesterone.
   c. FSH causes the follicle to grow in the ovary while LH causes the release of the egg cell.

   d. FSH causes the release of the egg cell in the ovary while LH causes the growth of the follicles.

10. Which of the following are functions of progesterone?
   a. Inhibition of estrogen production.
   b. Does not inhibit LH and FSH production.
   c. Initiation of the other phase of the endometrium.
   d. Increase in basal body temperature.

11. Which of the following symptoms indicate that a woman is about to ovulate?
   a. Decrease in basal body temperature.
   b. Increase in basal body temperature.
   c. Thickening of cervical mucous.
   d. Thinning of cervical mucous.

MUTATION

Content Standards:

The learners demonstrate an understanding of

1. the information stored in DNA is being used to make proteins.
2. how changes in DNA molecule may cause changes in its product.

Competency:

Explain how mutations may cause changes in the structure and function of a protein. **S10LT - IIIe -38**

Objectives:

At the end of the material the student will be able to:

1 illustrate different types of chromosomal mutations;

2 differentiate the kinds of chromosomal mutations; and

3 value the significant understanding of genetic mutation and how it may affect one life.

Introduction

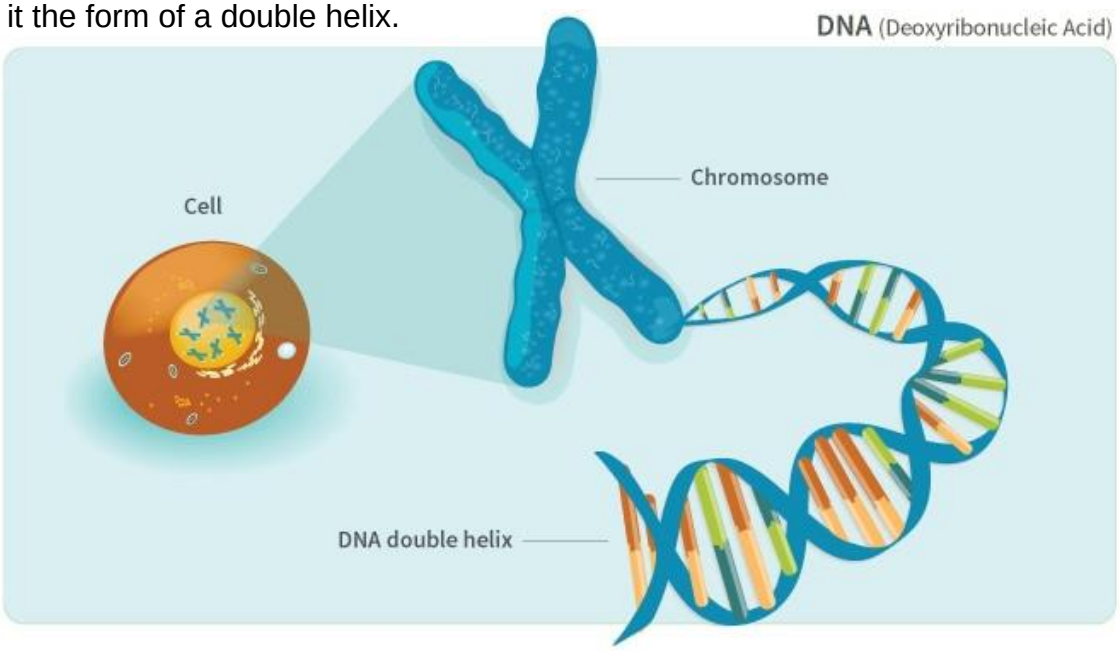
The DNA is required to complete the protein production process. Transcription and translation are the two processes of protein synthesis. Messenger RNA sequences are read and translated into amino acids at the ribosome during protein production. Proteins will be formed from these amino acids.

Codons, which are carried by mRNA, specify these amino acids. The genes will be abnormal if the transcription process is incorrectly replicated. This is referred to as a mutation. A mutation is a change in our DNA sequence that

happens as a consequence of errors during DNA copying or environmental influences such as UV radiation and cigarette smoke. Because DNA replication involves mutation, transcription into mRNA is unusual.

Deoxyribonucleic Acid

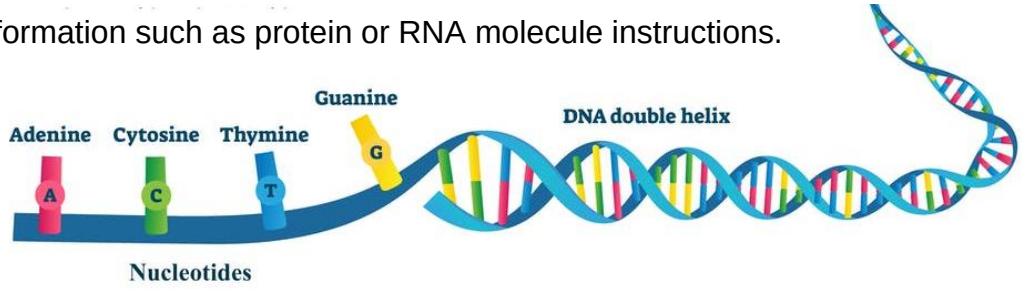
DNA (deoxyribonucleic acid) is the molecule that conveys genetic information for an organism's development and function. DNA is made up of two connected strands that loop around each other like a twisted ladder, giving it the form of a double helix.



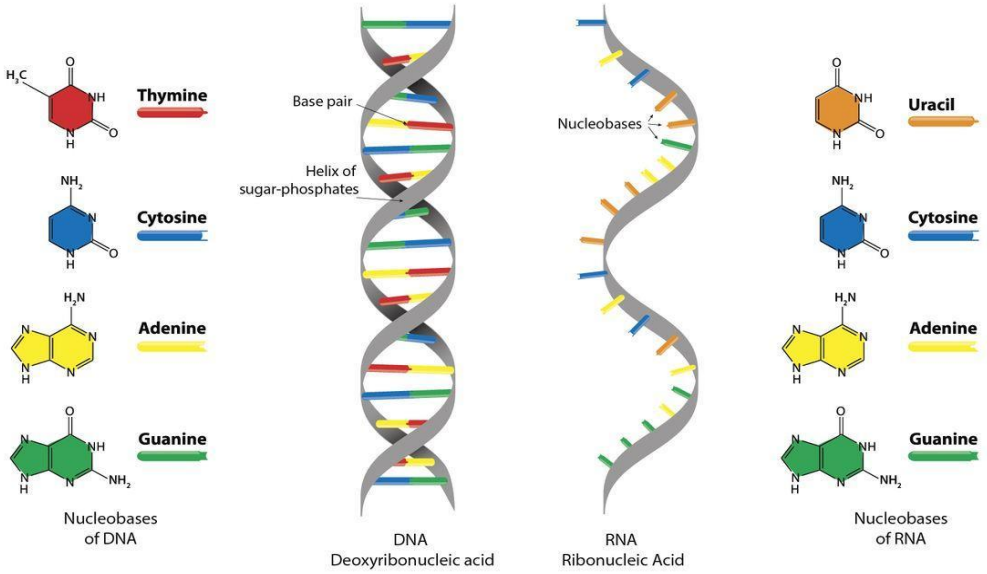
The backbone of each strand is made up of alternating sugar called deoxyribose and phosphate groups. Each sugar has one of four bases attached to it: **adenine (A), cytosine (C), guanine (G), or thymine (T)**. Chemical linkages between the bases connect the two strands.

Adenine (A) binds with thymine (T)
Cytosine (C) binds with guanine (G)

The nucleotide sequence along DNA's backbone encodes biological information such as protein or RNA molecule instructions.



Ribonucleic Acid



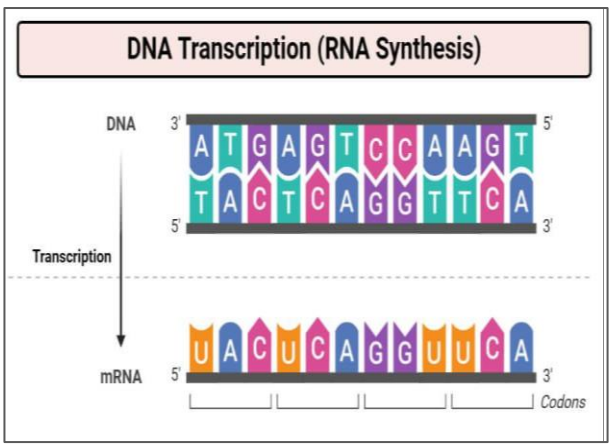
Ribonucleic acid (RNA) is a nucleic acid that has structural similarities to DNA and is found in all living organisms. RNA, unlike DNA, is almost always single-stranded. Instead of the deoxyribose present in DNA, an RNA molecule contains a backbone consisting of alternating phosphate groups and the sugar called ribose. Each sugar has one of four bases attached to it: adenine (A), uracil (U), cytosine (C), or guanine (G). In cells, there are three forms of RNA which are messenger RNA (mRNA), ribosomal RNA (rRNA), and transfer RNA (tRNA).

Gene Expression (Central Dogma)

The Central dogma depicts the flow of genetic information in cells, DNA replication, and transcription, which codes for RNA, which then codes for proteins through translation.

Transcription

DNA transcription is the process by which RNA polymerase rewrites the genetic information contained in DNA into messenger RNA (mRNA). The mRNA then leaves the nucleus and serves as the foundation for DNA translation.



The cell regulates the pace of gene expression by managing the creation of mRNA within the nucleus.

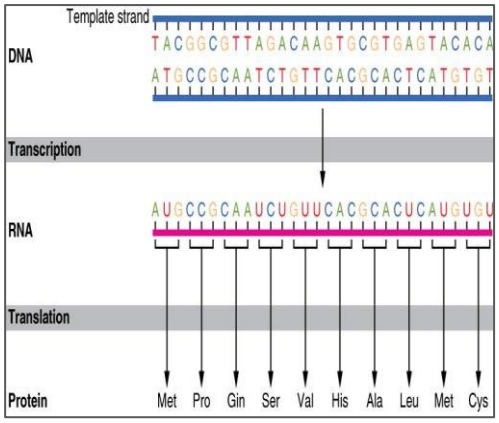
Example:

DNA Replicated sequence – ACGGGTAAGG

Transcribed mRNA – UGCCCAUUCC

This code will be carried by mRNA to the ribosomes, instructing them on how to produce a protein.

Translation



The translation is the process of converting information transmitted from DNA as messenger RNA into a sequence of amino acids linked by peptide bonds. It's a conversion from one code (nucleotide sequence) to another (amino acid sequence). This process takes place on the ribosome, much as mRNA synthesis takes place on the RNA polymerase. The ribosome matches the three complementary bases in the anticodon sections of tRNA molecules to the base sequence on the mRNA in sets of three bases called codons. The base-pairing rule is crucial in this identification once again Adenine (A) binds to Uracil (U) and Cytosine (C) binds to Guanine (G).

The ribosome travels along the mRNA chain, matching three base pairs at a time, and adds amino acids to the polypeptide chain. The ribosome releases both the polypeptide and the mRNA when it reaches one of the "stop" codes. This polypeptide will twist back into its original shape and begin to function as a protein.

Second letter

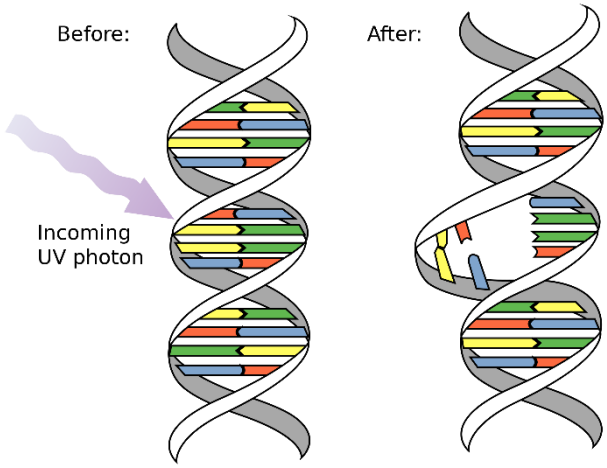
First letter	U	C	A	G	Third letter
U	UUU Phe UUC Phe UUA Leu UUG Leu	UCU Ser UCC Ser UCA Ser UCG Ser	UAU Tyr UAC Tyr **UAA Stop** **UAG Stop**	UGU Cys UGC Cys **UGA Stop** UGG Trp	U C A G
C	CUU Leu CUC Leu CUA Leu CUG Leu	CCU Pro CCC Pro CCA Pro CCG Pro	CAU His CAC His CAA Gln CAG Gln	CGU Arg CGC Arg CGA Arg CGG Arg	U C A G
A	AUU Ile AUC Ile AUA Ile **AUG Met**	ACU Thr ACC Thr ACA Thr ACG Thr	AAU Asn AAC Asn AAA Lys AAG Lys	AGU Ser AGC Ser AGA Arg AGG Arg	U C A G
G	GUU Val GUC Val GUA Val GUG Val	GCU Ala GCC Ala GCA Ala GCG Ala	GAU Asp GAC Asp GAA Glu GAG Glu	GGU Gly GGC Gly GGA Gly GGG Gly	U C A G

Example:

DNA	TAC	CGC	TCC	GCC	GTC	GAC	AAT	ACC	ACT
mRNA	AUG	GCG	AGG	CGG	CAG	CUG	UUA	UGG	UGA
tRNA	UAC	CGC	UCC	GCC	GUC	GAC	AAU	ACC	ACU
AA	Met	Ala	Arg	Arg	Gln	Leu	Leu	Trp	Stop

Mutation

A mutation is a change in the sequence of DNA. In the same way that DNA contains information, Mutations are errors in the genetic coding of amino acids that usually happen in transcription. There are two types of mutation; gene mutation and chromosomal mutation.



Mutagens

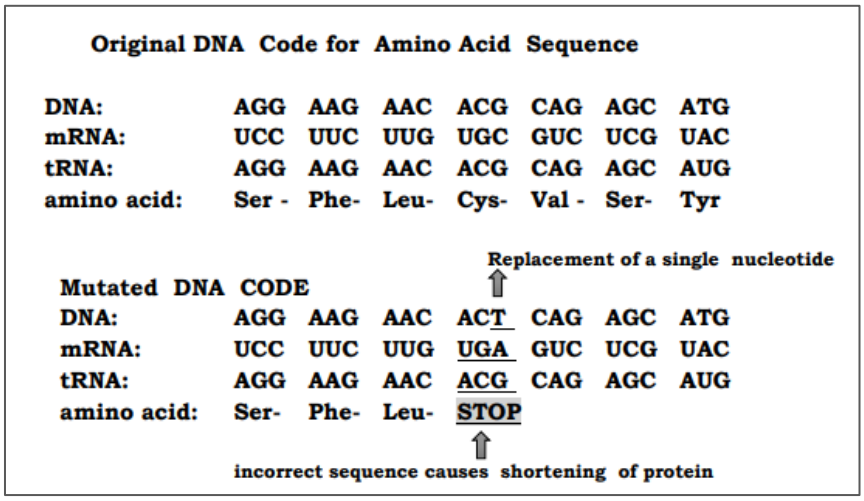
Mutagens are substances that change DNA and can cause cancer. Permanent changes in the DNA sequence are caused by an organism's capacity to repair the damage. Radioactive substances, x-rays, UV light, and some chemicals or medications are examples of mutagens.

Point Mutation

It is a DNA or RNA mutation in which a single nucleotide base is deleted, inserted, or changed. **Substitution mutation** can exist as a result of this. Substitution mutation can have three forms. These are *nonsense, missense,* and *silent mutation.*

1. Nonsense Mutation

Due to the replacement of one nitrogenous nucleotide, nonsense mutation leads to the development of a stop codon. Stop codons are nitrogenous nucleotides that halt the translation step of protein synthesis. In DNA, they are ATC, ATT, or ACT, while in mRNA, they are UAG, UAA, or UGA. They are frequently found near the end of the nucleotide base sequence of messenger RNA. When a substitution mutation leads it to emerge in a different location, the translation process to amino acid is abruptly stopped and the right protein is not produced.



2. Missense Mutation

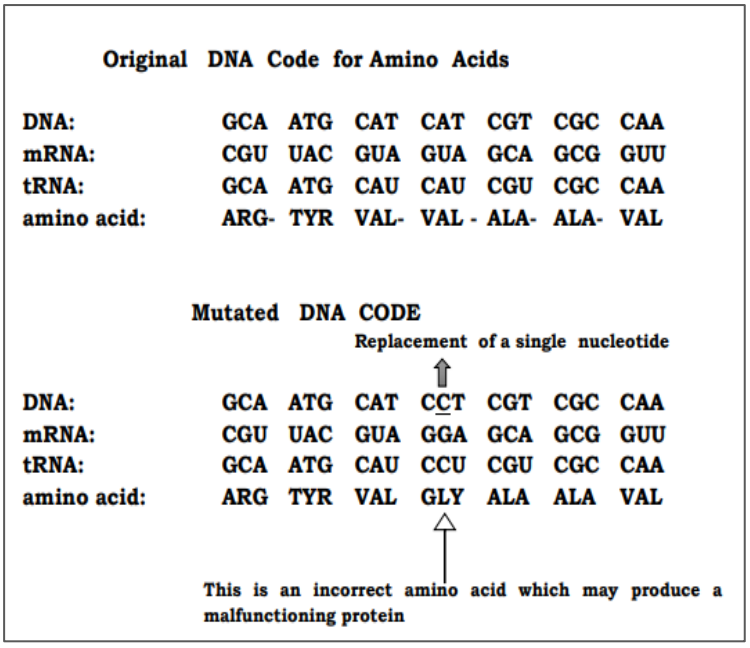
Missense mutation occurs when one nitrogenous base of the DNA is changed, resulting in an altered codon but without forming a stop codon.

This results in the formation of new amino acids during protein synthesis.

Example:

DNA: CAT to **mRNA**: GUA to **tRNA** CAU **(Valine)**

CAT is changed into **CCT** to **mRNA**: GGA to **tRNA**: CCU **(Glycine)**

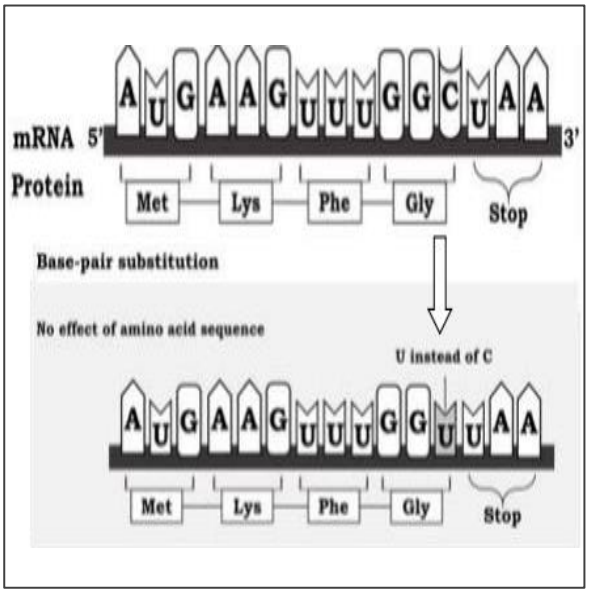


Missense mutations are divided into two types: *conservative* and *non-conservative.*

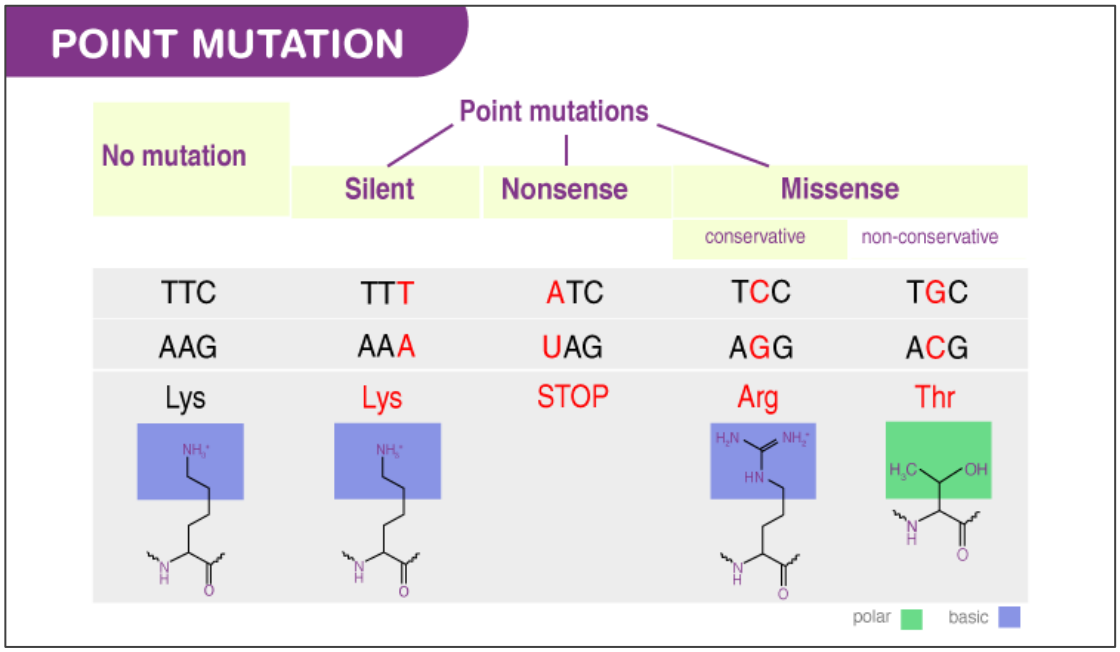
- **Conservative mutation** occurs when the newly created amino acid has the same qualities as the one that was intended to be produced.
- **Non-conservative** occurs when the newly generated amino acid differs from the one that was expected to be created.

3. Silent Mutation

Silent mutation occurs when a nitrogenous base is mutated while producing the same amino acid. Keep in mind that many codons might code for the same amino acid. GGC and GGU, for example, can both code for glycine. If C is changed to U, the same amino acid is generated, and so the amino acid is not modified or altered.



Summary of Point Mutation

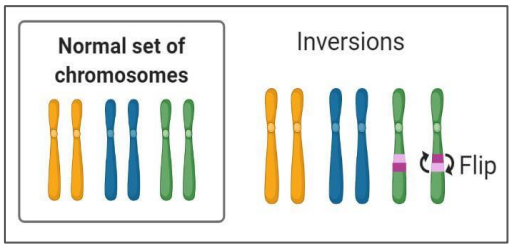


Frameshift Mutation

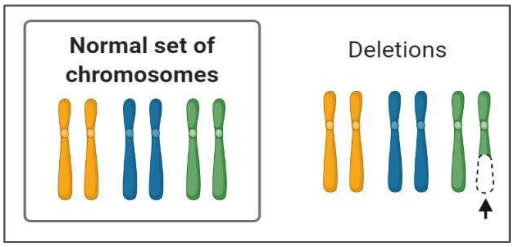
Frameshift mutation occurs when the regular sequence of codons is disrupted by the insertion or deletion of one or more nitrogenous bases, where the number of nitrogenous bases inserted or deleted is not a multiple of three. For example, if only one nucleotide is removed, all codons after the mutation will have an altered reading frame. This can result in the integration of various modifications in amino acids into the protein, which can disrupt the amino acid chain. When three nitrogenous bases are deleted or inserted, there is no change in the codon reading frame, but there is either an additional or missing amino acid in the protein. As a result, frameshift mutations result in an aberrant protein with an incorrect amino acid sequence that might be longer or shorter than the normal protein.

Kinds of Frameshift Mutation

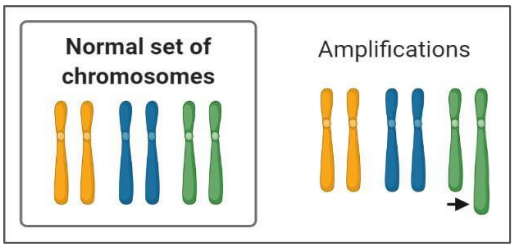
1. **Inversion.** The chromosome is inverted, and its segments are reversed from end to end. A fragment of the chromosome is taken and then reattached, but oppositely as before.



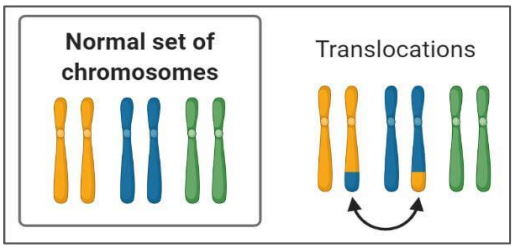
2. **Deletion.** These arise when a chromosomal fragment is unintentionally removed or deleted. There are circumstances when one piece is removed at the end (terminal deletion), two deletions when one is within the chromosome, and one at the end (interstitial deletion).



3. **Duplication/Amplification.** Occurs when the nucleus has an extra copy of a segment or the complete chromosome. These are sometimes referred to as incomplete trisomies. In the case of duplication, an organism that normally has two copies of a chromosome will often have three. This can occur anywhere throughout the chromosome, including the middle and ends.



4. **Translocation.** This occurs when a fragment of a chromosome breaks off and moves to a separate chromosome. As one kind of chromosome fuses with another, fusion chromosomes are formed.

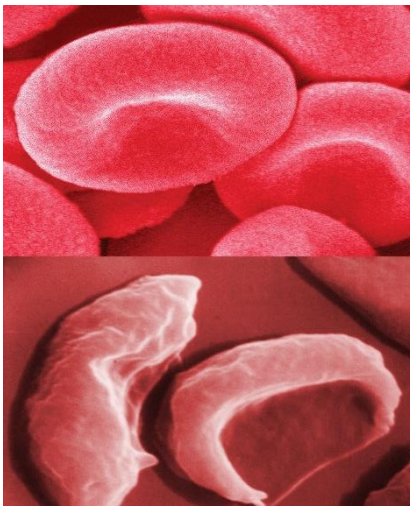


Effects of Mutated Genes

Sickle Cell Anemia

This form of anemia is caused by a recessive condition induced by a single substitution mutation in the gene that produces hemoglobin. Hemoglobin is well-known for transporting oxygen throughout the body. Glutamic acid is generated in the chain of a normal gene.

However, when the amino acid valine replaces glutamic acid, sickle-shaped blood cells are produced. These cells are unable to transport oxygen correctly. Anemia, pain crises, and recurrent infections are signs of sickle cell anemia. Prescription medicines, folic acid, bone marrow transplants, and blood transfusions can all help.

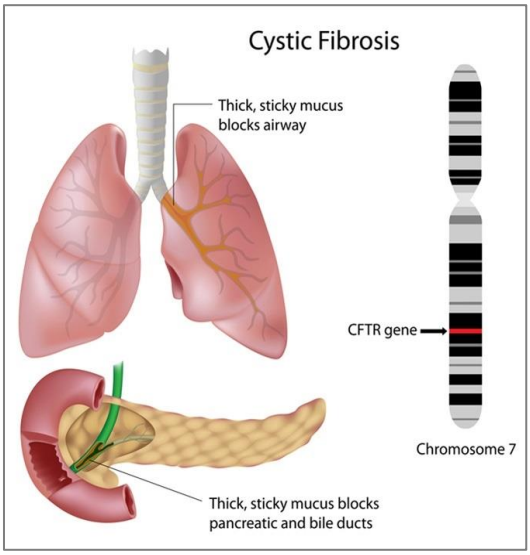


Albinism

It is an autosomal recessive condition caused by a deletion mutation in which melanin synthesis is decreased or nonexistent in skin, hair, and eyes due to tyrosinase inactivity. The loss of the tyrosinase gene causes this.

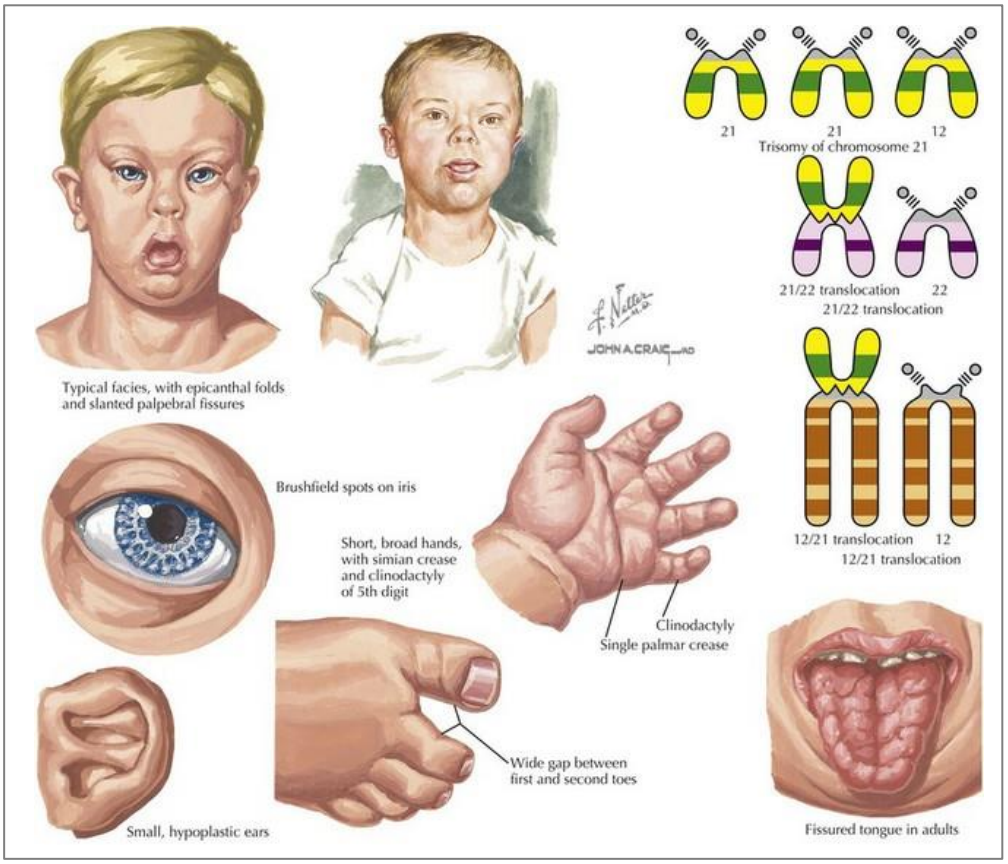
Cystic Fibrosis

Is an inherited recessive condition. Although many distinct variants can cause cystic fibrosis, the deletion mutation is the most prevalent. It affects the cystic fibrosis transmembrane conductance regulator (CFTR) gene, causing the amino acid phenylalanine to be deleted. This results in an erroneous protein.



Down Syndrome

Is associated with mild cognitive impairment. It is also distinguished by physical development, body, and facial characteristics impairment. Down syndrome is caused by a meiotic translocation that transfers the majority of chromosome 21 onto chromosome 14.



STATION 2

ACTIVITY 1

Modeling of Chromosomal Mutations!
(Mastery Modelling)

Materials:

i. Little bit pieces of paper
ii. Pencil
iii. Tape

Procedure:

a. Write numbers 1-8 on pieces of paper (one number for each piece). Tape the pieces together in numerical order to create a model of a chromosome with 8 genes.
b. Use the "chromosome" you created to model four changes in chromosome structure. For example, remove the number 3 and rejoin the remaining chromosome segments to represent a deletion.
c. Reconstruct the original chromosome before modeling inversion, deletion, duplication, and translocation. Use the extra pieces of paper to make the additional numbers you need.
d. You have 10 minutes to construct the model.
e. When time is up, prepare for the presentation of your model.

Guide Questions:

Q1. What do you feel while doing the activity?

_____
_____
_____

Q2. What is mutation?

_____
_____
_____

Q3. Looking at the model you have constructed, how do these four chromosomal mutations differ from each other? How are they similar?

_____
_____
_____

Q4. Do you think the normal genetics of the chromosome is affected? How do you say so?

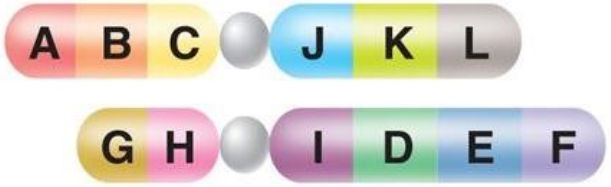
_____
_____
_____

Q5. Can you describe how a cell might be affected by each mutation if the cell were to receive a chromosome with that mutation?

_____
_____
_____

ACTIVITY 2

Chromosomal Mutation
(Individual Activity)

A. 	➢
B. 	➢
C. 	➢
D. 	➢

SUM IT UP!

1. In _____, the chromosome is inverted, and its segments are reversed from end to end.
2. In _____, a chromosomal fragment is unintentionally removed or deleted.
3. In _____, are sometimes referred to as incomplete trisomies.
4. In _____, a fragment of a chromosome breaks off and moves to a separate chromosome.

ASSESSMENT

Competency 2
Explain how mutations may cause changes in the structure and function of a protein. ***S10LT - IIIe –38***

Direction: Choose the letter of the correct answer.

12. What can occur in two different types of cells: the reproductive and body cells?
   a. Mutations
   b. RNA
   c. Gene mutation
   d. Chromosomal mutation

13. What is a permanent change in the DNA sequence that makes up a gene?
   a. Mutations
   b. RNA
   c. Gene mutation
   d. Chromosomal mutation

14. _____ occurs at the chromosome level resulting in gene deletion, duplication, or rearrangement.
   a. Mutations
   b. RNA
   c. Gene mutation
   d. Chromosomal mutation

15. It occurs when a piece of one chromosome breaks off and attaches to another chromosome. What kind of chromosomal mutation is this?
   a. Chromosomal Deletion
   b. Chromosomal Inversion
   c. Chromosomal Translocation
   d. Chromosomal Duplication

16. When a piece or section of chromosomal material is missing, this is referred to as partial monosomy. What kind of chromosomal mutation is this?
   a. Chromosomal Deletion
   b. Chromosomal Inversion
   c. Chromosomal Translocation
   d. Chromosomal Duplication

17. A chromosomal rearrangement in which a chromosome segment is reversed end-to-end. What kind of chromosomal mutation is this?
   a. Chromosomal Deletion
   b. Chromosomal Inversion
   c. Chromosomal Translocation

d. Chromosomal Duplication

18. Involves the production of one or more copies of a gene or chromosomal region. What kind of chromosomal mutation is this?
   a. Chromosomal Deletion
   b. Chromosomal Inversion
   c. Chromosomal Translocation
   d. Chromosomal Duplication

19. The Homologous pair of chromosomes are arranged in what characteristics?
   a. Size
   b. Numbers
   c. Activity
   d. Frequency

20. How do three chromosomal aberrations differ from one another?
   a. They are different by the frequency of smaller genes
   b. They are different by the number of genes within the chromosome.
   c. They are different by the descending sizes of the genes within the chromosome.
   d. They have no distinct difference.

21. This abnormality is caused by an extra chromosome in chromosome 18.
   a. Down Syndrome
   b. Edwards Syndrome
   c. Klinefelter's Syndrome
   d. Turner's syndrome

22. This abnormality causes the female sexual characteristic to be underdeveloped.
   a. Down Syndrome
   b. Edwards Syndrome
   c. Klinefelter's Syndrome
   d. Turner's syndrome

23. Cri du chat which is an abnormality that causes babies to make high-pitched cries is a result of?
   a. Deletion of the short part of chromosome 5
   b. Duplication of the short part of chromosome 6
   c. Deletion of the short part of chromosome 6
   d. Duplication of the short part chromosome 5

24. Why is a specific base pairing essential for transcription and translation?
   a. Because specific base pairing dictates the particular type of amino acids to be created

b. Because specific base pairing powers the translation and transcription processes
c. Because specific base pairing is our defense for specific kinds of mutations
d. The specific base pairing has no influence on the two-process stated.

25. Protein X's eleventh amino acid should be serine, but due to a mutation, it now has alanine at that position. What type of mutation may have resulted in this change?

a. Missense
b. Nonsense
c. Silent
d. Insertion

BIOLOGY LEARNING STATION STRATEGIES (BLISS):

COMPETENCY 3

POPULATION GROWTH

Content Standards:

The learners demonstrate an understanding of:

1. the influence of biodiversity on the stability of ecosystems;
2. an ecosystem as being capable of supporting a limited number of organisms.

Competency:

Explain the relationship between population growth and carrying capacity. **S10LT- IIIi -42**

Objectives:

At the end of the material the student will be able to:

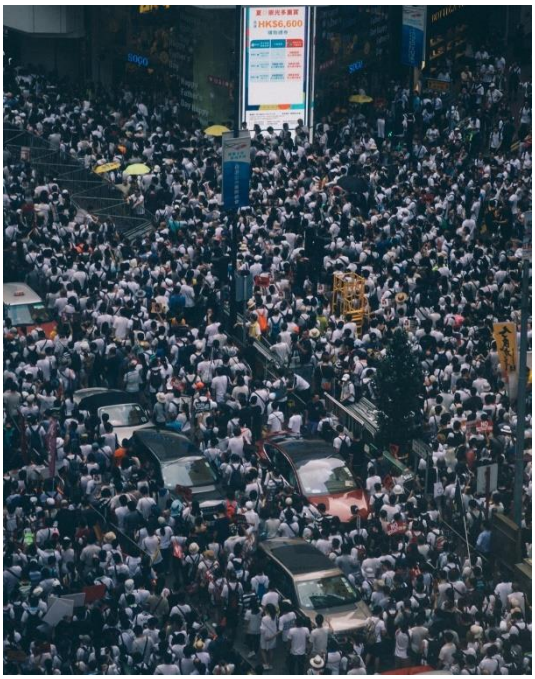
1. define the population growth and carrying capacity;
2. compare and contrast different factors that can affect the size and carrying capacity of a population; and
3. relate the population growth to carrying capacity.

The Ups and Downs of Population Growth

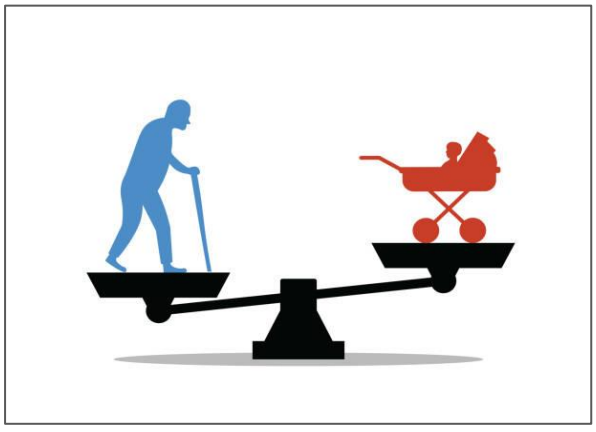
A population is a group of organisms of the same species that live in a certain area. Ecologists regularly monitor the number of organisms in many populations. They also need to know why the number of organisms is decreasing. Populations that are growing or diminishing can be indicators of potential problems in the organisms' environment, and such conditions alarm the ecologists if something is wrong.

Essential Questions:

- But why do they do this?
- Why should we care if the number of organisms in an area is increasing or decreasing?
- But it is not enough to simply know if the number of organisms in an area is increasing or decreasing?
- Why is a population's size increasing or decreasing?



Many factors can cause a population's size to change. But first, we must understand the basic reasons behind why a population increases or decreases. Any population, whether it be that of humans, animals, the mold growing on bread, or the bacteria living in your intestines, will grow if more organisms are being developed as GMO (Genetically Modified Organisms), or born than are dying.



The number of births in a population is called the **birth rate (natality)**. The number of organisms that are dying in a population is called the **death rate (mortality)**. Thus, if the birth rate is greater than the death rate, the population will grow. If the death rate is greater than the birth rate, then the population will decrease. A population of organisms cannot grow forever, at some point, its growth will be limited, or stopped, and the death rate will be greater than the birth rate.

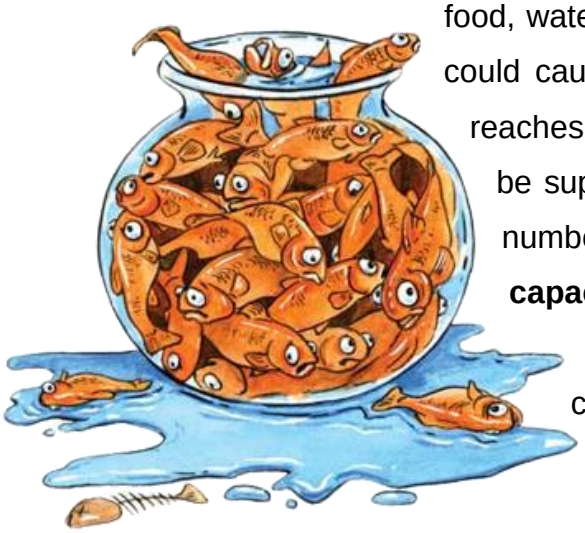
A population's growth is limited by two general factors: density-independent factors and density-dependent factors. **Population density** refers to the number of organisms per unit area. If a population's density is very high, that means there are a lot of organisms crowded into a certain area. If a population's density is low, that means there are very few organisms in an area.

A factor that regulates a population's growth and is influenced by population density is called a **density-dependent limiting factor**. If the population's density does not directly influence changes in population growth, then it is called a **density-independent limiting factor**.

Density-independent limiting factors that can stop a population from growing can be such things as natural disasters, temperature, sunlight, and activities of humans in the environment. Natural disasters such as tropical cyclones, floods, earthquakes, and fires will stop a population from growing no matter how many organisms are living in a certain area.

The same goes for the temperature of an area and the amount of sunlight it receives. If the temperature increases due to global warming, this will cause a decrease in a population's numbers, no matter how large or small the population was, to begin with. Human activities that alter the environment will also decrease the number of organisms in a population, regardless of the size of the population.

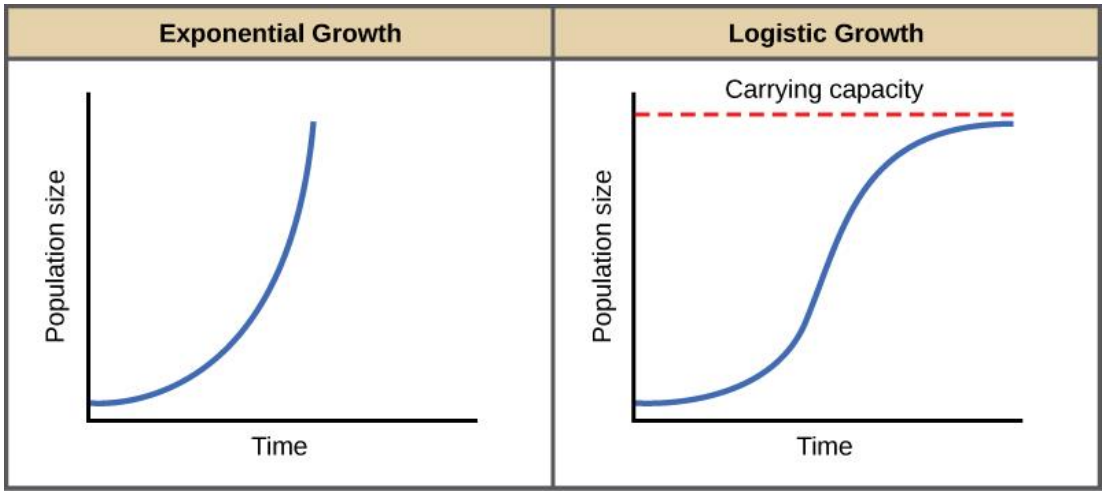
Density-dependent limiting factors come into play when a population reaches a certain number of organisms. For example, when a population reaches a certain size, there won't be enough resources such as



food, water, and shelter for all of the organisms. This could cause the population to stop growing when it reaches the maximum number of organisms that can be supported or carried by the environment. This number is known as the **population's carrying capacity** in a particular environment. Each population of organisms has a different carrying capacity, depending on the number of resources available in the area in which it lives.

Before a population reaches its carrying capacity, it experiences a period of rapid growth. This period of growth is called **exponential population growth**. During this period, there are plenty of resources available for all organisms, so more births are recorded than deaths in organisms.

When resources are unlimited, populations exhibit **exponential growth**, resulting in a J-shaped curve. When resources are limited, populations exhibit logistic growth. In **logistic growth**, population expansion decreases as resources become scarce, and it levels off when the carrying capacity of the environment is reached, resulting in an S-shaped curve.



STATION 3

ACTIVITY 1

"Oh Deer"
(Card Game)

Objective:

Explain the relationship between population growth and carrying capacity.

Materials:

i. Oh Deer Card game set (Please print all the cards: Oh Deer cards, Habitat cards, and Deer Chips)
ii. 2–4 students (per group)
iii. Dealer (optional)

Procedure:

a. Each player gets 1 of each habitat card (food, water, shelter) and 5 Deer Chips to start
b. Mix the "Oh Deer" cards and place them face down in the center of the playing area (this game can be done online)
c. Set the Deer Chips aside in a pile or a bag
d. If there is no dealer, determine the order of play: Players can flip a coin or roll a number cube to determine who goes first, second, third, etc.
e. Play: Before each round, every player will select one of their habitat cards (food, water, or shelter) and place it face down in front of them. The card that they select will be what their deer will be looking for in that round. Once everyone has selected their habitat card, an "Oh Deer" card should be flipped from the stack for everyone to see. If a player's habitat card matches the "Oh Deer" card, they get a new Deer Chip. If their habitat card does not match the flipped card, they lose a deer.

f. Winning: The game continues for 6 rounds. Whoever has the most Deer Chips at the end of the game wins.
g. If there is a dealer, simply have one player or an adult select the “Oh Deer” card for each round.
h. With an adult or educator as the dealer: have the dealer set the deck (without telling the players) so that one of the habitat cards comes up multiple times.

Guide Questions:

Q1. Are you able to collect many Deer Chips at the end of the game? How?

_____
_____
_____

Q2. What have you noticed about the population of deers when it comes to their food, water, and shelter?

_____
_____
_____

Q3. What happens if deer become too numerous?

_____
_____
_____

Q4. What will happen to the population of deers if there are natural disasters?

_____
_____
_____

Q5. Examine the flow of the game, does it show the relationship of the population growth to carrying capacity? Explain briefly.

_____
_____
_____
_____

ACTIVITY 2

Carrying Capacity: How big can a population get?
(Comparative Analysis)

In this activity you will study the effects of environmental stresses (loss of habitation, predation, etc.) on the size of a Tilapia population in Box Lake. You will keep track of this population using pictures and graphs.

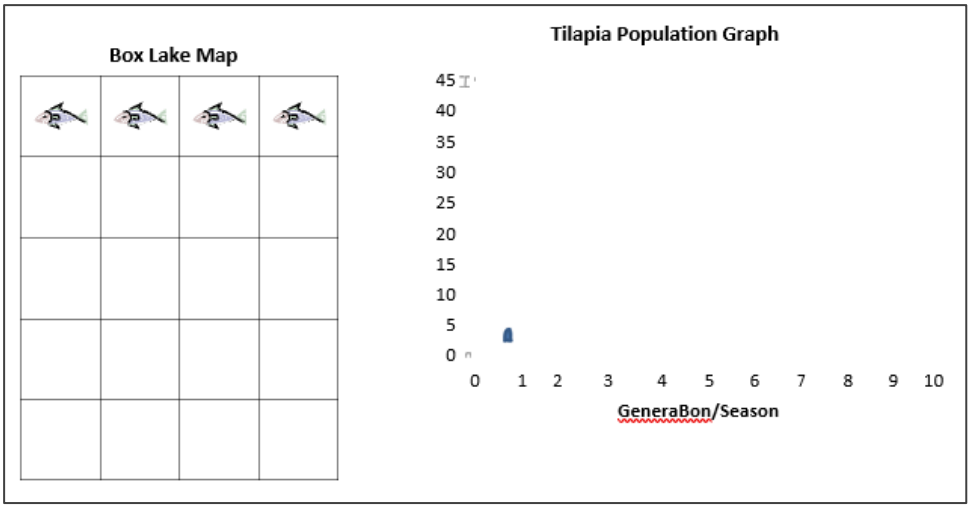
Rules to Box Lake:

1. Tilapia often eat smaller fish for their survival. There is enough food in each Square of Box Lake to keep one Tilapia alive. Therefore, only one Tilapia can occupy a square within Box Lake at a time.
2. For every two Tilapia, one new offspring will survive predators (birds, fisherman, etc.) each generation or season. Add a new Tilapia each generation.
3. If all of the squares are filled in Box Lake with Tilapia during a generation, there will not be enough perch to eat and no additional Tilapia will survive.
4. If all of the squares are filled with Tilapia at the *start* of the generation or season, the small fish population will start to decline. Two Tilapia will starve and need to be removed from Box Lake. No additional offspring will survive.

Scenario 1: Normal Conditions

Generation 1 in this scenario has 4 Tilapia in it. Follow the rules to Box Lake above. For each generation, draw additional Tilapia on the Box Lake Map.

For example, since there are 4 Tilapia, 2 offspring would be added. The total number of Musky will now equal 6. On the Tilapia Population Graph, record 5 Tilapia for Generation 2. Continue for 10 generations.



1. Does the Tilapia population continue to increase over time? Why?

2. The maximum number of organisms that an environment can support without ruining the environment is called the "Carrying Capacity."

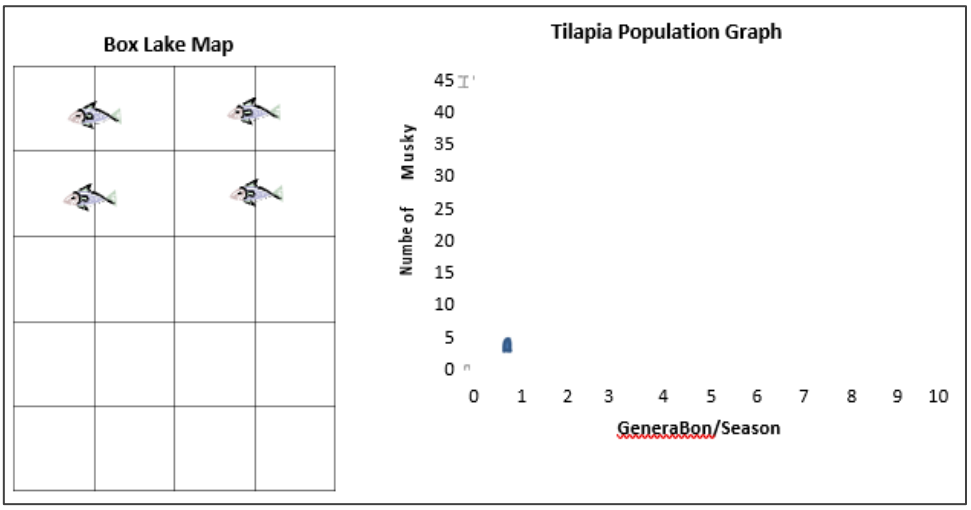
    a. The carrying capacity for Musky in Box Lake is about 19 Tilapia. Draw a line across your graph at 19 Tilapia and label it "Carrying Capacity."

    b. Describe how you can determine the carrying capacity of an organism by just looking at a Population vs. Time graph.

3. Populations tend to fluctuate naturally around the carrying capacity. Why do you think populations fluctuate?

Scenario 2: Invasive Species

Thai Catfish species have been introduced into Box Lake. Thai Catfish and trout compete to eat enough zooplankton to survive. This competition over resources leads to a decrease in zooplankton and trout populations. Follow the rules to Box Lake to complete the Map and the Graph only this time there can only be one Tilapia for every 2 squares due to the decrease in trout. Complete 10 generations.



4. What is the new carrying capacity for Tilapia after Thai Catfish have been introduced? Support your answer using evidence from your population graph.

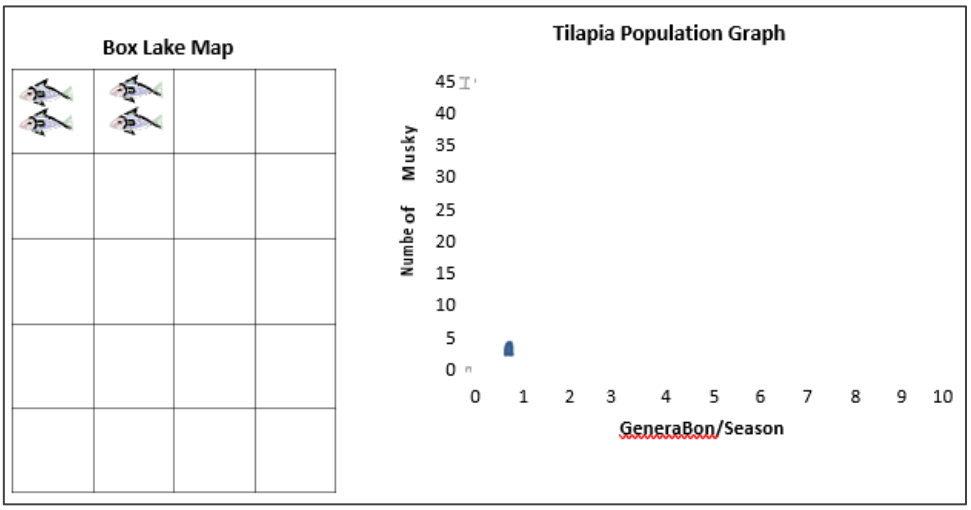
5. Why did the carrying capacity of Tilapia lower in this scenario than in scenario 1?

6. Brainstorm two other scenarios or changes to the Box Lake environment that would also lower the carrying capacity of Tilapia.

Scenario 3: Fishing Regulation Change

The minimum length needed to keep a trout caught through fishing has increased to 13" at Box Lake. This means more trout survive from generation to generation, providing more food for Tilapia.

Follow the Rules to Box Lake to complete the Map and Graph only this time two Tilapia can fit in a square due to the increase in trout population.



7. What is the new carrying capacity after the fishing regulation change? Support your answer using evidence from your population graph.

8. Why was the carrying capacity of Tilapia higher in this scenario than in scenario 1?

9. Brainstorm two other scenarios or changes to the Box Lake environment that would also increase the carrying capacity of Tilapia

10. Viral Hemorrhagic Septicemia (VHS) is a deadly fish virus that infects many fish species including Tilapia and trout. While most of the infected fish die, some survive and produce antibodies to help protect them from future exposure to the virus. Sketch a Tilapia Population graph for this scenario. Make sure it is obvious if the carrying capacity is lower, higher, or the same as the normal carrying capacity at Box Lake. Explain your reasoning behind your graph.

ASSESSMENT

Competency 3
Explain the relationship between population growth and carrying capacity. S10LT- IIIi -42

Direction: Choose the letter of the correct answer.

26. Which of the following describes a group of organisms of the same species that live in a certain area?
a. Population
b. Community
c. Biodiversity
d. Society

27. What refers to the number of organisms per unit area?
a. Exponential population growth
b. Logistic population growth
c. Population density
d. Community growth

28. Who is responsible for regular monitoring of the number of organisms in many populations?
a. Census
b. Anthropologists
c. Environmentalists
d. Ecologists

29. An increase in the number of organisms in the population depends on the following:
I. Emigrate
II. Immigrate
III. Natality
IV. Mortality

a. I and III
b. II and III
c. I and IV
d. II and IV

30. What does it indicate if the birth rate is greater than the death rate?
a. The population is growing
b. The population is decreasing
c. The population is constant
d. None of the above

31. What factor regulates a population's growth and is influenced by population density?
a. Density-dependent limiting factor

b. Density-independent limiting factor
c. Exponential population growth
d. Logistic population growth

32. Which of the following factors described in population density does not directly influence changes in population growth like natural disasters, human activities, etc.?
a. Exponential population growth
b. Logistic population growth
c. Density-dependent limiting factor
d. Density-independent limiting factor

33. Which of the following refers to the maximum number of organisms that can be supported or carried by the environment?
a. Logistic population growth
b. Density-independent limiting factor
c. Population's Carrying capacity
d. Density-dependent limiting factor

34. What does it imply if the population's density is very high?
a. There are a lot of organisms crowded into a certain area
b. There are few organisms living in a certain area
c. There is a little to no organisms present in a particular area
d. None of the above

35. In which period explains that plenty of resources are available for all organisms and what happens before a population reaches its maximum number of organisms?
a. Carrying capacity
b. Exponential population growth
c. Population density
d. Logistic population growth

36. Which period of growth implies that population expansion decreases and results in an S-shaped curve?
a. Logistic growth
b. Exponential growth
c. Population growth
d. Population density

37. Why should we care if the number of organisms in an area is increasing or decreasing?
a. Populations that are growing or diminishing can be indicators of potential problems in the organisms' environment.
b. To monitor the population density and report to the authority.
c. It conveys an alarming condition and resolves what is going wrong in the population growth.
d. The act of knowing the status of a population in an area depicts indirect help to the authority.

38. Which is NOT a factor in population size increasing or decreasing?
   a. More organisms are being developed
   b. Birth rate or natality
   c. Mortality rate or mortality
   d. Family planning

39. What do you think will happen if the human population reaches its carrying capacity?
   a. In a certain way, when a population reaches its maximum number of organisms, there will be a scarcity of resources; thus, leading to population growth to stop.
   b. Population density decreases due to the emigration of people to look for pretentious life.
   c. Nothing will happen. People tend to decrease their number and they can provide enough resources from the environment they live in.
   d. A better resolution for this is to report it to the authority and complain about resources.

40. Which of the following BEST describes the relationship between population growth and carrying capacity?
   a. A population of monkeys has enough food as their number increases
   b. Nick and his mother fill up their storage room that will be sustainable for a month
   c. A group of tigers and lions consumed two prey that is good for one 1-week
   d. Charlie's family of 3 has insupportable sources

GENERALIZATION

This Biology Learning Station Strategy (BLISS) Students Support Materials in selected topics in Biology is intended to help and contribute to teachers who are to teach Grade 10 students in Biology. The topics in each station, such as the activities, and test items are aligned in the Most Essential Learning Competency (MELCS). Those chosen activities are opportunities for both teacher and learner to get engaged in interactive, integrative, collaborative, and reflective teaching-learning for academic performance. They may also serve as activity tasks which having a different teaching strategy to determine the extent to which the intended learning outcomes have been attained.

Also, this is an opportunity for the researchers to enhance this material that not just focuses on the learning but more importantly focuses on having a good relationship between students and teachers.

The selected three (3) competencies topics, Describe the feedback mechanisms involved in regulating processes in the female reproductive system (e.g., menstrual cycle) S10LT- IIIc -35, and Explain how mutations may cause changes in the structure and function of a protein. S10LT - IIIe -38, then the Explain the relationship between population growth and carrying capacity. S10LT- IIIi -42, are all important topics that students might encounter for this student support material. All the information that can support each activity has also been placed in each station. Feedback mechanisms are the process through which the level of one substance influences the level of another substance. A mutation is a change in the base sequence of DNA. Mutations may affect only one gene, or they may affect whole chromosomes. And also, Population growth gives us an idea of how fast a population change over time and can be affected by density-dependent or density-independent limiting factors.

This material will also help the researchers on how the be exactly students' support materials during this time of the pandemic. Learning is a continuous process of helping students become more competitive enough in dealing with different stations in academics to be specific in Biology Science. For teachers to have great ideas and ways how to make the learning more engaging than too tedious for students to do. Learning these ways with these Enhancement materials just made it clear and easy to understand.

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DNA
embryo
Cell
ATP
HDL
Benedict's sol-n test
LDL
CH
Cell
CH
CH
2n=46
I2 sol-n test
Cell
(Ea)
endocrine system
Ca2+

BSE-3