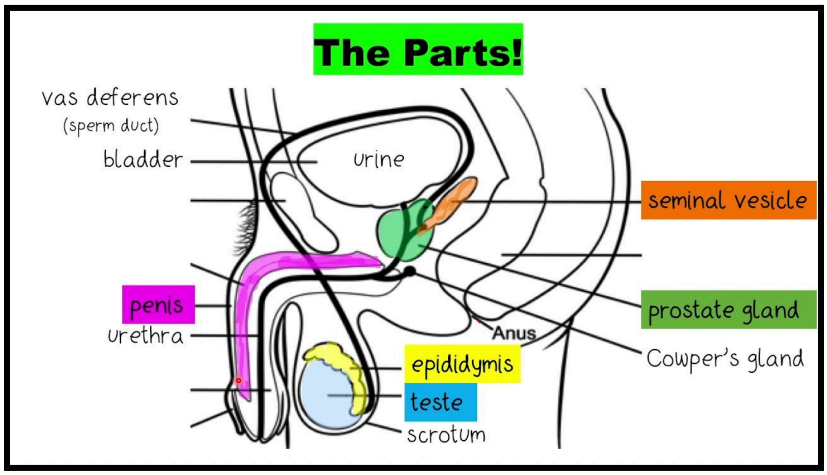
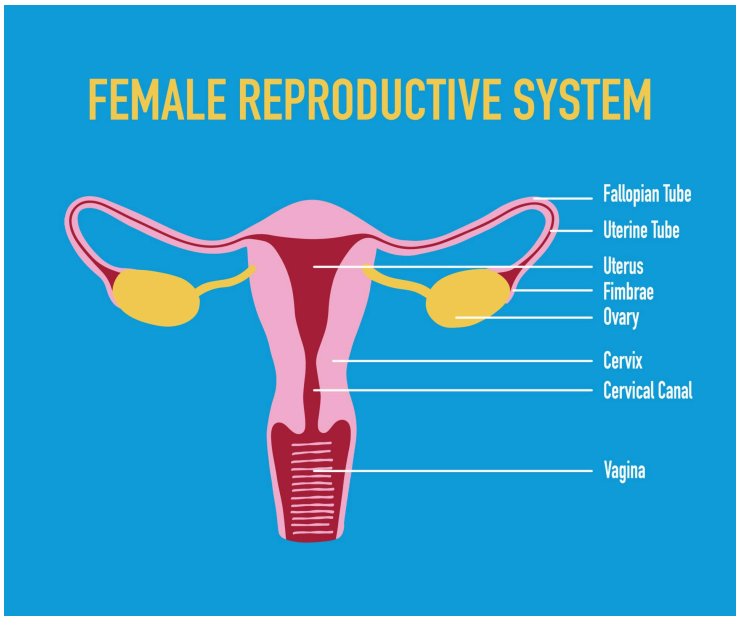
BODY SYSTEMS

LESSON 1: Reproductive system

- Reproduction: is a process controlled by hormones
- Throughout the body, the male and female systems are mostly similar, except for their reproductive systems.

Parts

MALE	FEMALE
	
OUTSIDE PARTS: 1. **Penis** - This is the rod of the body, inside this rod is the urethra. The peenie weenie **allows urine and semen** to exit the body. 2. **Scrotum** - Basically, ito ang gloves ng testes(balls..) this is the pouch that **makes sure that the scrotum is kept at a specific temperature**. WHY? Bicoz sperm is destroyed unless 97 ang temp. **INSIDE PARTS:** 3. **Bladder** - **NOT actually a part** of the reproductive system. Honorary member shea that **holds urine**. 4. **Urethra -** Allows urine and semen to exit. Kung ang penis ang rod, ito ang tunnel sa rod. 5. **Prostate -** Gland that produces fluid na makakasama ng sperm cell. Component ito ng semen. **Sperm** - this is only the cell	**PARTS**: 1. **Vagina**(birth canal) **-** a tube leading from the uterus to the outside of the body. (Where sperm enters. It is acidic.) 2. **Cervix** - the lower portion of the uterus; where vagina and uterus "connect." Looking at the pic above, it looks small. BUT, when the baby comes, it can become big. (This is called: Dilation / Dilate.) 3. **Uterus** - a hollow, fist-sized organ located between the bladder and rectum. (Where the zygote implants and the embryo develops) **PARTS OF UTERUS** - **Endometrium**: lining/pader ng uterus, where the unfertilized egg cell goes back. Tapos yung pader nato, lalabas sa vagina. THIS IS WHAT U CALL PERIOD!!!!

Semen - This is sperm with the fluid na ginagawa ng prostate. (seminal fluid)

6. **Vas Deferens(Sperm duct)** - This is a tube that connects testes to the urethra. So basically, ito yung straw ng testes para makalabas ang semen!

7. **Testes** - two glands na nasa loob ng scrotum. This is what makes the sperm, alongside the male hormone which is **TESTOSTERONE**.

8. **Epididymis** - this is found behind EACH testes. This is basically a parent: it is the home of the sperm cells, and is responsible for the maturation of the cell. (it teaches sperm to swim!) It also delivers the sperm from home, to real life. (BICOZ, it sends the sperm from testes to vas deferens.)

9. **Seminal Vesicles** - also produces and stores seminal fluids.

EXTRA:

1. The penis is made of ***Erectile Tissues*** this is why it can change in size and "hardness," when erect.

- **Fundus**
- **Cervix**

4. **Fallopian Tubes** (oviducts)**-** are two tubes connecting the uterus with the ovaries. Ito yung meetup,sperm cell meets egg cell! (Fertilization tawag)

5. **Ovary -** responsible for the production and release of eggs cells

OVARY FACTS!

- Females are born with all of the eggs they will ever produce.
- Ovaries alternate the release of eggs each month.
- Like testes, the ovaries produce hormones. (Estrogen). This release of the ova is called ovulation.

Menstrual Cycle

This cycle has a total of 28 days/ 1 month - One cycle is counted from the 1st day of a period, to the next.	
Period	a. begins when uterus lining and blood are shed. (kz nga walang fertilization na nangyari.) b. Usually 3-7 days c. Menarche = very 1st period d. Menopause = No more period
Hormones and Ovulation	a. After menstruation, hormones signal the uterus to rebuild its lining b. Around the middle of the cycle, one ovary releases an egg (ovulation). c. The egg travels through the Fallopian tube. d. If the egg is not fertilized, it breaks down and is released during the next period.

Fertilization and Development	a. If fertilization occurs, the egg implants in the uterine lining and begins development. b. Zygote: From fertilization to implantation. c. Embryo: From implantation up to 8 weeks. d. Fetus: After 8 weeks of development. Growth from zygote to fetus happens through mitosis and cell differentiation.
Placenta	a. The placenta allows the exchange of nutrients and gases between mother and child. b. The mother's blood and the developing child's blood do not mix.

TIMELINE

Day 1-7	Menstruation (Least fertile) Follicular Phase
Day 8-9	Possible to conceive Follicular Phase
Day 10-14	Ovulation (Day 14) (Best chance for conception)
Day 15-16	Possible to conceive (Luteal Phase)
Day 17 - 28	Unlikely to conceive (Luteal Phase)

Reproduction

Summary by ChatGPT!

- Intercourse, also known as copulation

1. Purpose of Reproduction

Reproduction is the biological process by which humans produce new individuals, ensuring the continuation of the species.

2. Gametes (Sex Cells)

Humans reproduce sexually, which means two specialized cells are involved:

- Sperm from the male
- Egg (ovum) from the female
  These cells each carry half the usual number of chromosomes.

3. Fertilization
Fertilization happens when a sperm cell fuses with an egg inside the female's reproductive tract (In the fallopian tubes). This fusion creates a single cell called a zygote that has a full set of chromosomes.

4. Beginning of Development
After fertilization, the zygote begins dividing and growing. It becomes an embryo, then later a fetus as development continues inside the uterus over many weeks.

5. Essential Structures
The male and female reproductive systems include organs that produce and transport gametes, and in females, support the fertilized egg as it develops into a baby during pregnancy.

LESSON 2: The Endocrine&Nervous System

- Works hand-in-hand,, for the body's coordination and communication.
- These two systems produce "messengers" which are electrical or chemical by nature.
- MESSENGERS: Carry messages/Instruction to cells

ENDOCRINE	NERVOUS SYSTEM
- Produces Chemical Hormone - **Hormones**: Are slower than neurotransmitter but have long lasting effects	- Produce Neurotransmitters (Chemical and electrical)

TWO TYPE OF GLAND IN THE BODY	
Exocrine	**Endocrine**
- HAVE DUCTS that transport substances to specific areas in the body. - EX: 1. Sweat glands 2. Mucous glands 3. Salivary glands	- NO ducts - Releases hormones into the bloodstream, or into the fluid around tissues of organs.
ENDOCRINE SYSTEM	
- Made of glands that produce chemical hormones that send messages/instructions to cells on what to do. - These hormones functions are to: 1. Allow response to external stimuli	

2. Regulate growth and development
3. Maintain ***homeostasis***
4. Influence behaviour
5. Regulate metabolism
6. Balance water and minerals
7. Influence reproductive processes

HOMEOSTASIS

- Requires coordination of all organs and system, and the communication of cells, tissues, body parts basta lahat nayan.
- Occurs through hormones.

GLANDS IN THE ENDOCRINE SYSTEM	
Thyroid	- Found in the Neck - Controls Metabolism HORMONE/S: **1. (TH) Thyroid Hormone**
Adrenal Gland	- Regulates salt, water balance and blood pressure. - Found on top of each kidney HORMONE/S: 1. **Epinephrine (Adrenaline)** - “fight-or-flight” response causing increased blood pressure and senses
Parathyroid	- Found behind the thyroid in the neck HORMONE/S: 1. **(PTH) Parathyroid Hormone** - Most important regulator of blood/calcium levels.
Pineal	- Found deep within the brain - Regulates slee–wake cycles. HORMONE/S: **1. Melatonin**
Pituitary	- Called the “Master Gland”, “Mustard Gland” - Found in the Brain HORMONE/S: **1. Sex hormone** **2. (GH) Growth hormone** **3. (LH) Luteinizing Hormone** **4. (FSH) Follicle Stimulating Hormone**

	5. **Oxytocin** - stimulates contraction in uterus 6. **Prolactin** - production of milk 7. **(TSH) Thyroid Stimulating Hormone** - “energizes” thyroids to function
Hypothalamus	- Found in the brain below the Thalamus - Also known as “Emotion gland” HORMONE/S: 1. **(GHRH) Growth Hormone-Releasing Hormone** - Stimulates secretion of growth hormone 2. **(TRH) Thyroid releasing hormone** 3. **GnRH - Gonadotropin-Releasing Hormone** - stimulates Pituitary gland to release LH and FSH
Pancreas	HORMONE/S: 1. **Glycogen** - raises blood sugar level 2. **Insulin** - lowers blood sugar level
Thalamus	Found in the brain above the Hypothalamus
THYMUS	- Found in upper part of the chest - Helps mature T-cells which fight viruses - IT decreases with puberty, so usually sa mga bata lang i2
Testes	HORMONE/S: 1. **Testosterone** - Responsible for growth of male features
Ovaries	HORMONE/S: 1. **Estrogen** 2. **Progesterone** - Responsible for growth of female features

NEGATIVE AND POSITIVE FEEDBACK MECHANISMS

Negative Feedback Mechanism

- Governs the production&release of hormones.
- When a variable changes, it causes a counteract response.

- There are three mechanisms in which endocrine glands are stimulated to synthesize and release hormones.

THEY ARE…

1. **Humoral Stimul**i - The release of hormones in response to the **changes in extracellular fluids.**
2. **Hormonal Stimuli** - Release of hormone in reaction to **another hormone**
3. **Neural Stimuli** - Release of hormones due to signal from **nervous system.**

Because of these hormones, the inner balance in humans is maintained.

EX:

1. When the body is warm, the blood vessels dilate, sweat is produced and the body gets cooled down.
2. When blood sugar level is high, insulin is released to blood cells and cells absorb glucose released by the liver.

Positive Feedback Mechanism

- When a variable changes, IT ONLY KEEPS ON GOIN!!! Meaning it intensifies conditions, as it is self perpetuating.
- Less common than negative feedback.
- EX: Childbirth.

NERVOUS SYSTEM

- Function: Sends, receives, and processes information throughout the body, from the environment.
  - FORMALLY SPEAKING, it monitors internal and external stimuli such as touch, smell, sound, BP
- Coordinates and controls all body activities, enabling people to learn, remember, and imagine, thing logically, BASTA LAHAT LECHE

CELLS OF NERVOUS SYSTEMS (MIGHT NOT BE IN EXAM AS IT WASN'T TAUGHT.)

1. **Neurons** - Conducting cells: Transmit, process, and conduct impulses.
2. **Neurologia** - supporting cells

NEURONS	NEUROLOGIA
- Also known as nerve cells	- Also known as helper cells

- Receives stimuli and transmits impulses to other neurons/or muscles.
- Consists of a cell body and two-types of process-dendrites and axons.
- **Dendrites**: processes that receive stimuli from other neurons, and conduct these stimuli toward the neuron cell body. *(afferent processes)*
- Each nerve cell body which contains a single nucleus integrates incoming signals from dendrites and generates outgoing signals to the axon.
- **Axons**: conduct impulses away from the nerve cell body, meaning to say that an axon is an efferent process ; covered by a lipid-rich membrane called the *myelin sheath.*
- Connection between two neurons: **Synapse**
- **Motor nerve:** type of nerve that carries impulse from the brain or spinal cord to target muscles.FUNCTIONAL and anatomic unit of the nervous system.

SO, an impulse in a neuron goes like

Dendrite > cell body > axon

- Protect, feed, and insulate the nerve cells
- This forms 40% of the brains bulk
- 5 TYPES:

1. Astrocyte	Help neurons maintain ability to transmit impulses
2. Epyndrmall cell	Makes cerebrospinal fluid that bathe the brain and spinal chord.
3. Microglia	Helps clean the central nervous system.
4. Oligodendoctryte	Produce protective myelin sheath for insulation of axons.
5. Schwann Cell	Same as Oligodendoctryte

3 NEURONS

1. SENSORY - Receives info

TYPE	LOC.	PURPOSE
Mechanoreceptors	skin	Touch, Hearing (movement pressure)
Thermoreceptors	skin	Touch (heat loss/gain)
Pain receptors	skin	Touch (tissue damage)
Chemoreceptors	Nose, mouth	Taste, smell (responds to chemicals)
Photoreceptor	eyes	Sight (responds to light)

2. INTERNUERON - processes
3. MOTORNEURON - Causes Action

DIVISION OF THE NERVOUS SYSTEM

1. Central Nervous System - brain and spinal cord.
2. Peripheral Nervous System - nerves outside the Central nervous system.

<table>
<tr><th>CNS</th><th>PNS</th></tr>
<tr><td>1. Controls intelligence, sensory, motor activities involving muscle tone, balance and coordination.</td><td>TWO MAIN DIVISIONS OF PERIPHERAL NERVOUS SYSTEM
<table>
<tr><td>Somatic nervous system (voluntary)</td><td>Autonomic nervous system (voluntary)</td></tr>
<tr><td></td><td>Sympathetic nervous system (action and stress)
- Also known as the fight-or-flight</td></tr>
<tr><td></td><td>Parasympathetic nervous system (calm and relaxation)</td></tr>
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LESSON 3: The Code of Life

GREGOR MENDEL (1865)
- Father of genetics
- Discovered mechanism of inheritance, causing scientists to search for the molecule involved in inheritance.

FREDERICK GRIFFITH (1928)
- Tried to create a vaccine for pneumonia, but instead his experiment led to the discovery of **bacterial transformation:** the transfer of virulence from one cell to another. CALLED: **Griffith's Experiment**

AVERY, MACLOUD, AND MCCARTHY (1930-1940)
- Claimed that DNA was the cause of bacterial transformation, NOT protein.

HERSHEY AND CHASE (1950)
- Basically, they supported the claim.

With ALL of this, scientists now believe that genetic information is carried through DNA

- ORIGINAL STRUCTURE OF DNA, was made by **Phoebus Levene(AMERICAN BIOPHYSICIST)**

The basic structure of Nucleotides, which are the monomers of Nucleic Acids, were then known

STRUCTURE CONSISTS OF…
1. Five carbon sugar (pentose)
2. A phosphate group
3. And a nitrogenous base.

TWO TYPES OF NUCLEIC ACIDS FOUND IN ORGANISMS

COMPONENT	DNA	RNA
Nitrogenous-Containing Base	Adenine, Guanine, Cytosine, Thymine	Adenine, Guanine, Cytosine, Uracil
Pentose Sugar	Deoxyribose	Ribose
Overall-Structure	Double-Stranded	Single-Stranded

THENN, Chargaff conducted an experiment, he found something, yay congrats we dont care! BUT, this experiment DID lead to ***"Chargaff's Rule"***

g	=	***c***
a	=	***t***

THENN, people experimented using Chargaff's rule, and then found out that a DNA had the structure of a **DOUBLE HELIX**

DOUBLE HELIX STRUCTURE:
- It was found out that the outside strands were made of sugar and phosphate groups.
- Cytosine and Guanin were found facing each other
- The same goes for Adenine and Thymine.
- THESE ARE HELD TOGETHER WITH HYDROGEN BONDS!

This structure is **Antiparallel**: One strand goes one way, then the other goes the opposite direction, meaning to say…

a. One strand goes 5' to 3'
b. Other goes 3' to 5'

STRUCTURE OF A CHROMOSOME

- Made up of several proteins and nucleic acids packed together.
- It starts with a DNA molecule
- **Histones**: dna strands wrapped around proteins
- Two histones constitute a ***nucleosome***
- SEVERAL nucleosome form a ***Chromatin*** *(*Structure of genetic material found inside the Nucleus)

DURING MITOSIS AND MEOSIS..

- Chromatin coils again and forms: **Chromosome**

AFTER knowing the structure of a chromosome, many scientists put up their mind to connect the relationship of a chromosome and the trait of an organism.

Leading to…

CENTRAL DOGMA OF LIFE.

DNA	>transcription>	**mRNA**	>translation>	**Phenotype**

DNA REPLICATION

DNA replication is the process where the DNA unwinds and replicates the nitrogenous bases in both strands. Being the **Leading** and **Lagging** Strands.

4 Main Types of Enzymes that work on DNA Replication

1. **Helicase** - Unwinds the DNA
2. **Primase** - Places the Primer in the 5 - 3 prime direction to indicate the starting point and direction the DNA polymerase has to build.
3. **DNA polymerase** - Builds the new DNA strands on both the lagging and Leading Strands
4. **Ligase** - Fills up and connects the separated DNA strands in the lagging strands due to Okazaki Fragments.

Okazaki Fragments - Empty spaces in the lagging strand due to it “lagging” or not being filled up by the DNA polymerase.

SSBPs or Single-Stranded Binding Proteins - Stops the DNA from coiling again

Step by Step

1) Helicase Unwinds the DNA

2) Primase places the primer in both lagging and Leading Strand
3) DNA polymerase builds starting from the primers
4) Process repeats until its done
5) Ligase fills up the Okazaki Fragments

TRANSCRIPTION

Transcription is when a strand of messenger RNA (mRNA) is built up in a pattern which replicates the DNA sequence (like a template for a protein to be formed).

Main Types of Enzymes that work on Transcription

1. **Helicase** - Unwinds the DNA
2. **RNA polymerase** - Synthesizes or builds the RNA from the DNA strand

mRNA - Messenger RNA, a type of RNA molecule that carries protein information from the DNA in a cell's nucleus to the cell's cytoplasm

Step by Step

1) **Helicase** unwinds the DNA, exposing the gene to be transcribed.
2) **RNA polymerase** attaches to the DNA template strand.
3) **RNA polymerase** builds an mRNA strand by matching RNA nucleotides to the DNA bases
    a) (A → U, T → A, C → G, G → C).
4) The **mRNA** strand elongates as RNA polymerase moves along the DNA.
5) Once the gene is fully copied, **mRNA** detaches from the DNA.
6) The **DNA** rewinds, and the mRNA exits the nucleus and moves to the cytoplasm.

TRANSLATION

Translation is when the mRNA leaves the nucleus and attaches to the surface of the **ribosomes** in the cytoplasm, which is full of amino acids and has the **tRNA** which a particular version of tRNA bonds to both the corresponding amino acid and the specific mRNA codon. The tRNA molecules line up along the mRNA. The amino acids bond together and the tRNA molecules are released. This continues until the new amino acid sequence is complete.

TL;DR the tRNA matches amino acids to the mRNA strand then leaves after amino acids bond and sequence done, leaving u with an amino acid sequence aka protein boogsh

Step by Step

1. mRNA attaches to a ribosome in the cytoplasm.
2. The ribosome reads the mRNA in groups of three bases called codons.
3. tRNA molecules bind to the codons using complementary anticodons.
4. Each tRNA carries a specific amino acid.

5. Amino acids bond together forming a growing polypeptide chain.
6. tRNA molecules are released after delivering their amino acids.
7. The process continues until a stop codon is reached.
8. The completed amino acid chain folds into a protein.

Codon Chart