

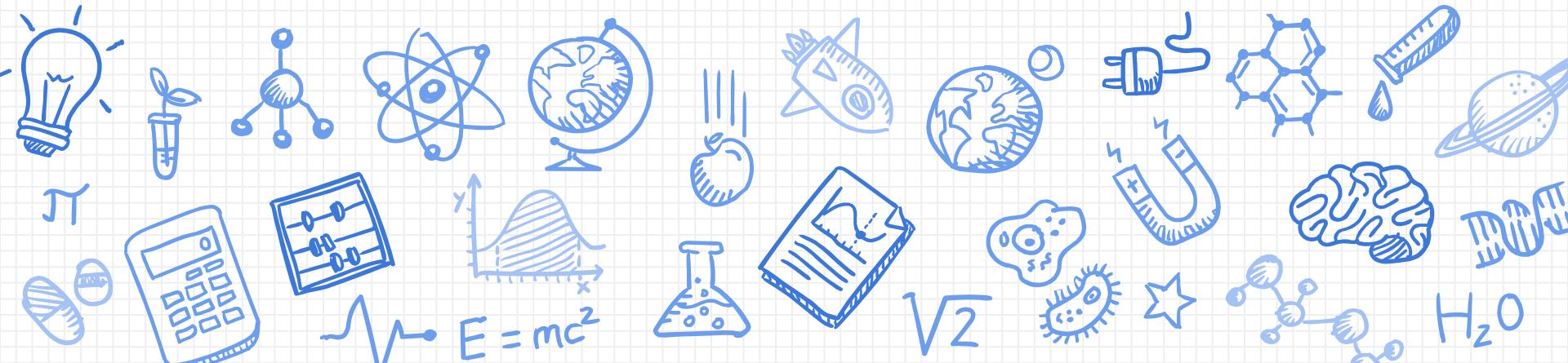
# Let's Take Attendance

<http://sciovirtual.org/attendance>

Attendance code: skull23

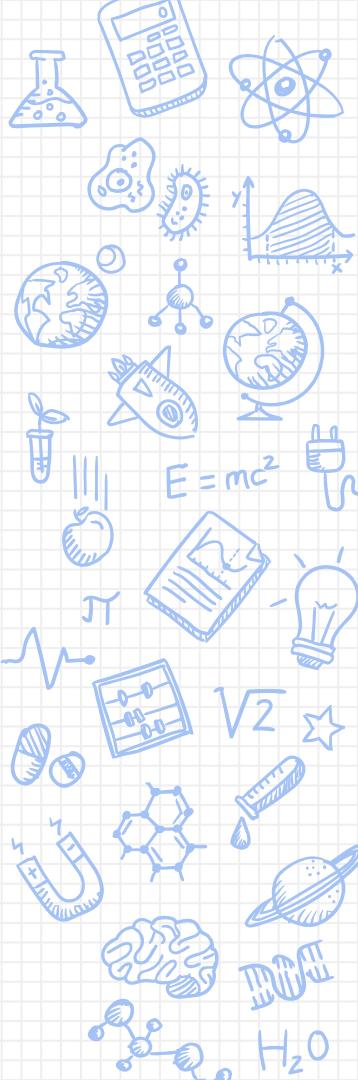
# ScioCamp 2022: Anatomy and Physiology

Google Classroom code: sft5re



# Instructor Introductions

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## Megan Kwok

BioOlympiad UK Gold

IBO HK Team Finalist

Fun Fact: My favourite book is The Great Gatsby!

## Tanush

Former Brain Bee competitor

USABO and Science Fair

Fun Fact: I am quite fond of kiwis and can eat up to 10 a day.

## Cloris

Scioly Anatomy Silver Medalist

Fun Fact: She's a published poet!

## Krutharth

Addicted to Gamepigeon word games

USABO and Scioly

Coming soon (probably Friday)



# Score Points. Win Prizes.



🧠 Course challenges each Friday

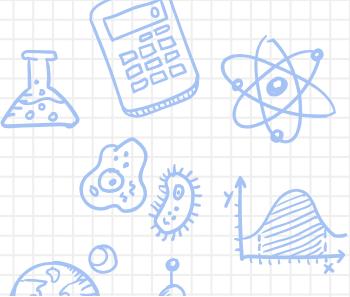
✓ Attendance

👤 Active participation with video on

**Note:** Class scores are added to your team score (if you are in the team competition)

Top 10 Players									
	Player	Team	FC #1	FC #2	FC #3	Attnd.	Bonus	Raw	Div
1		little B	SoS	40	--	--	15	0	55
2		FieryRyan789	Fatal Minds	35	--	--	15	5	55
3		arv	Ishika's Team	35	--	--	10	0	45
4		josie	Bio > All	25	--	--	15	0	40
5		TG	Independent	20	--	--	15	5	40
6		micky	Small Branes	20	--	--	15	5	40
7		vicky	RedFoxes	25	--	--	15	0	40
8		onericboi	The Cats	15	--	--	15	5	35
9		Nitrostrider	Gyarados Guys	10	--	--	15	5	30
10		BL	Independent	10	--	--	15	0	25

More info at [sciovirtual.org/score](http://sciovirtual.org/score)



## Organization of the Body

**Cells** are the smallest living unit of life

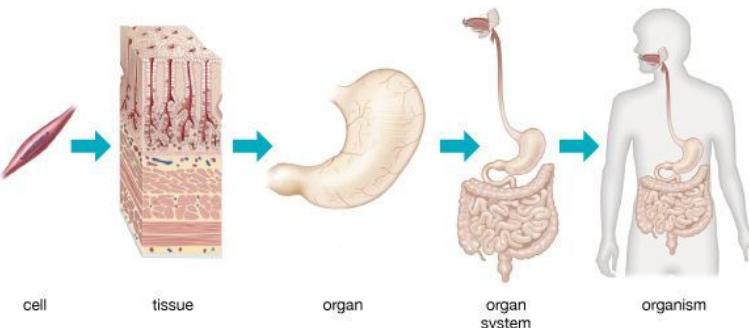
A **tissue** is a group of like cells working together.

An **organ** is a structure composed of several different tissues performing a particular function.

**Organ systems** are groups of organs which together perform an overall function.

The total **organism** is the individual human being.

Levels of organization



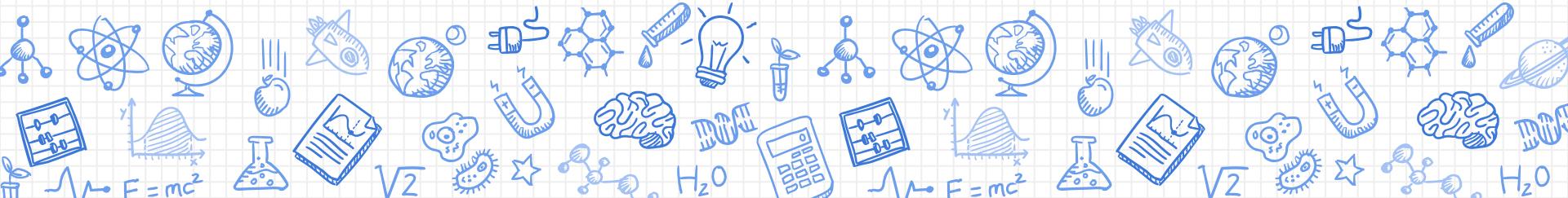
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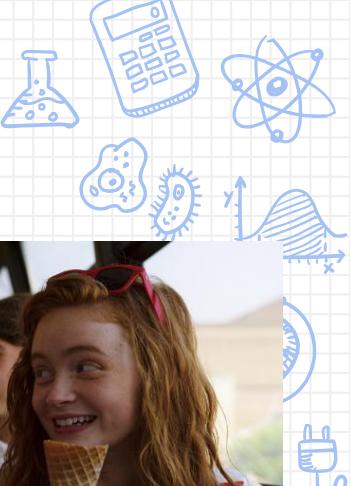


Let's Start with a Quick Quiz so we  
know how far you've all learned  
(about the digestive and respiratory  
systems) in school! Don't worry  
about getting things wrong.

# Digestive System

1. What do you know about nutrition?





## What is Digestion

- Humans need to break down ingested food into small particles to synthesize new particles for specific use for the organisms ingesting the material
  - Amino acids, monosaccharides, nitrogenous bases, sugars, phosphates, glycerol, fatty acids and monoglycerides

What do you think each of these particles make?

E.g. Amino acids make up proteins!



## Types of Essential Nutrients

- Amino acids
- Fatty acids
- Vitamins
- Minerals
- Carbohydrates

Which foods are each of these nutrients found in?



# What happens when you don't take in the right amount of nutrients?

# Scurvy

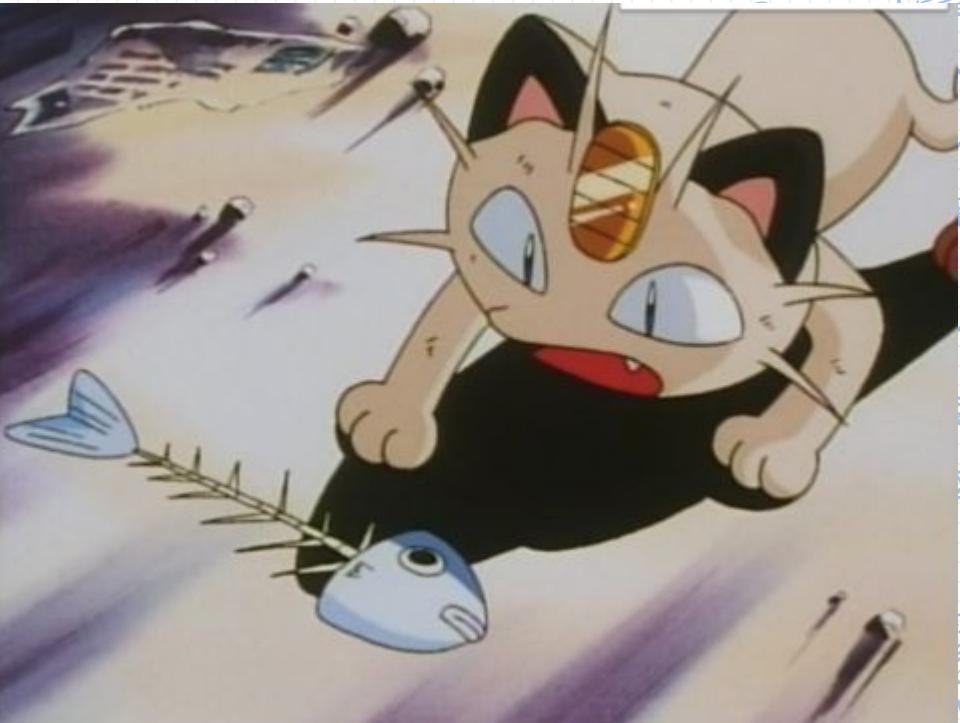
- Vitamin C deficiency
- Pale skin, sunken eyes, loss of teeth
- Easily treated by eating certain fruits and veggies

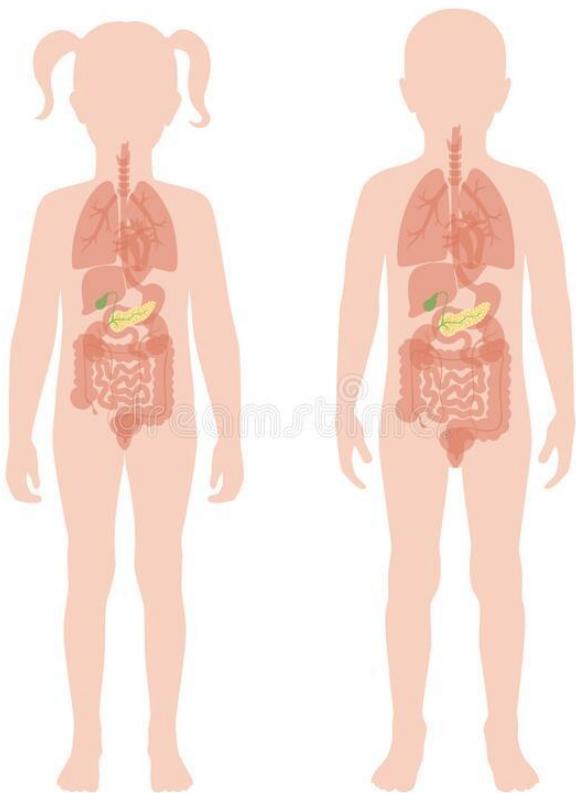
Q: Can you guess why this picture is used? ->



# Rickets

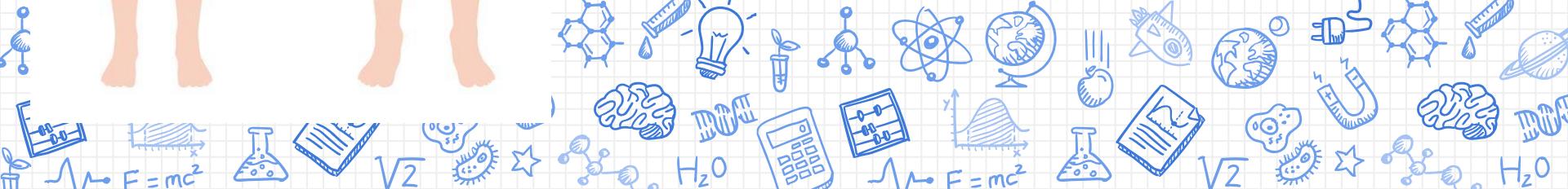
- Vitamin D deficiency
- In children; affects bone development leading to deformities
- Eggs, meat, oily fish

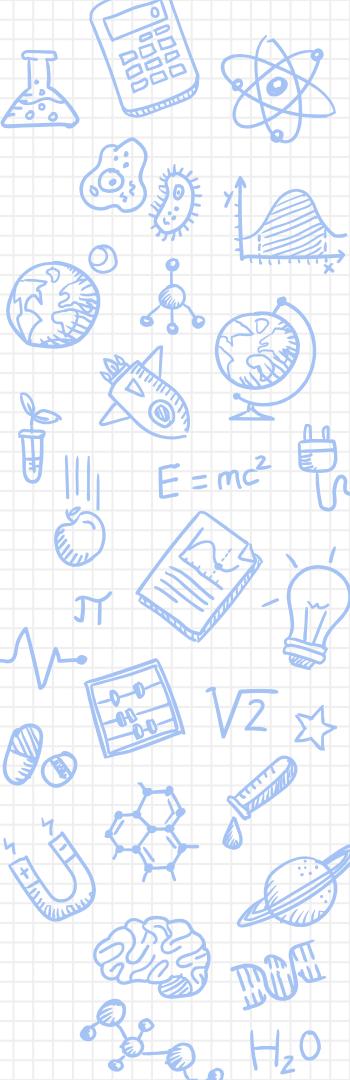




## The Digestive/GI Tract

2. Name one organ in the digestive tract!

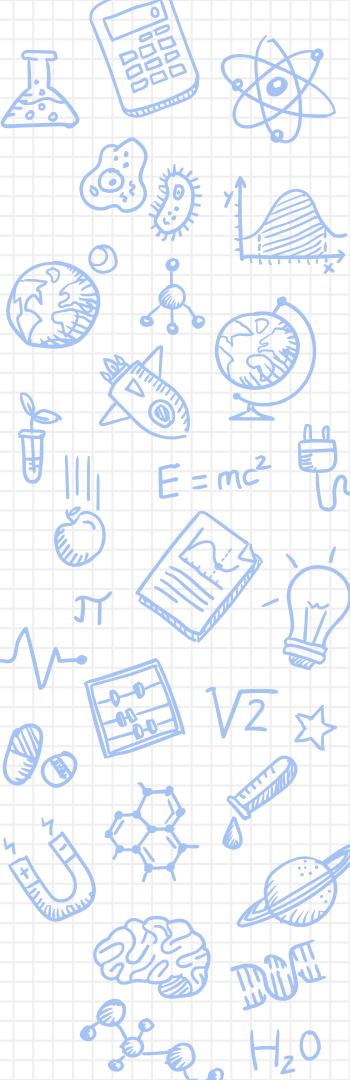




## Mouth

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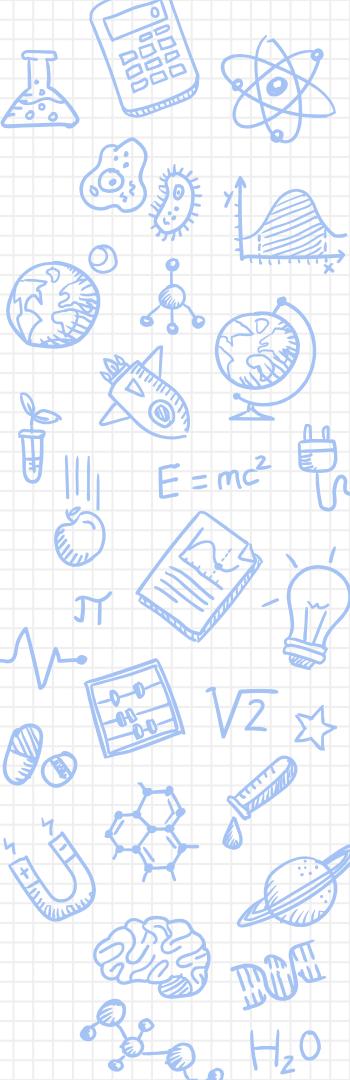
- Here the digestion of food starts
- The teeth chomp, chew, and tear food down into smaller pieces (mechanical digestion); molecular structure of the food
- Salivary glands secrete saliva into the mouth, breaking down starches into dextrin and maltose (chemical digestion). changes the molecular structure of the food.
- Create food boluses.
- Then they go down the **pharynx**, preventing food from going to windpipe/trachea(path to lungs)



## Oesophagus

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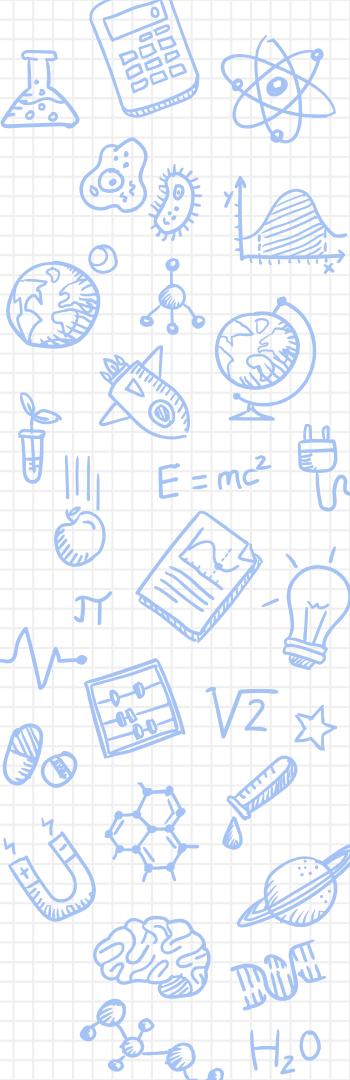
- After the pharynx, food bolus is transported to the stomach via the **esophagus**/oesophagus.
- A muscle-walled tube that goes from the throat to the lower digestive tract.
- Muscular contractions (peristalsis) push food down towards the stomach.
- The reason peristalsis is important is when digestion is working against gravity. For example, when eating upside down, the food bolus is still able to move to the stomach because of peristalsis contractions.



## Stomach

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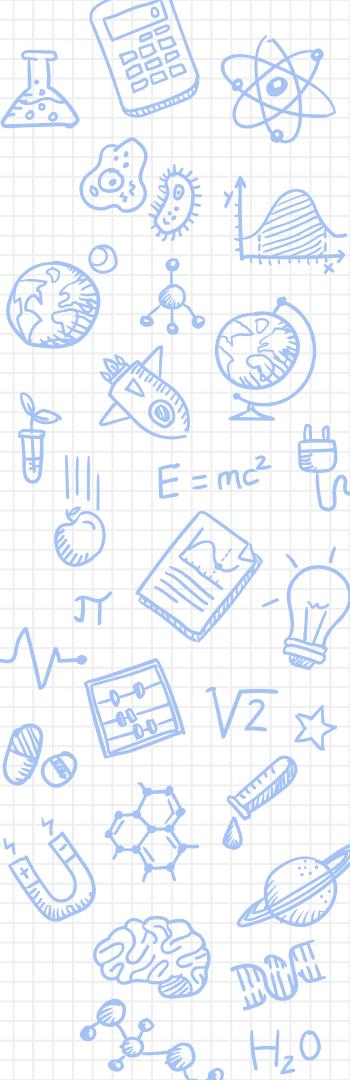
- When we think of digestion, the first thing that comes to mind is the stomach.
- Waiting room for food bolus.
- Stomach breaks the food down into a liquid-like mixture by churning the food (mechanical digestion) and secreting gastric acid (chemical digestion).
- Gastric acid also kills bacteria that may be in the food.



## Duodenum (In the small intestine)

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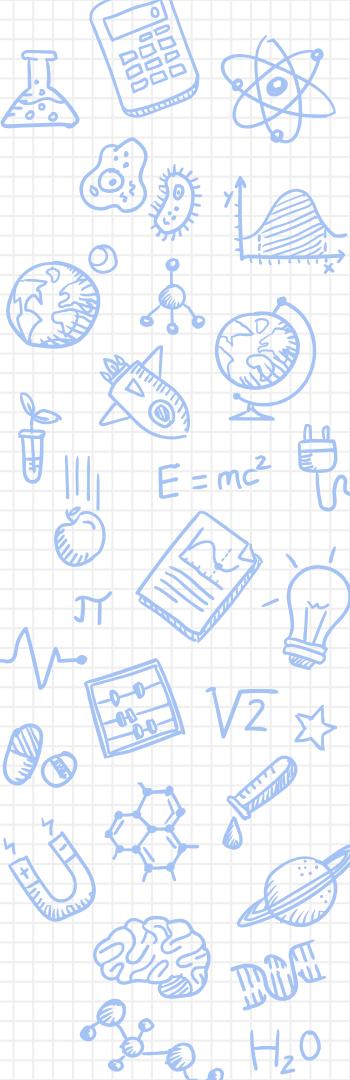
- Transfer to the **duodenum** by contractions of the stomach walls.
- First part of the small intestine; stationary and is fixed behind sheets of connective tissue called peritoneum.
- Glands in the duodenum secrete a thick alkaline fluid that neutralises the acidic chemicals the food bile has absorbed.
- Gallbladder also secretes pancreatic juice and bile into the duodenum.



## Liver

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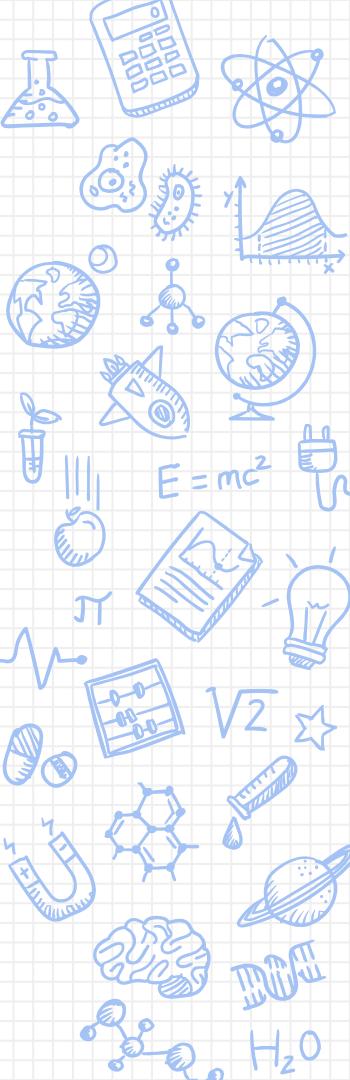
- Very important though food does not directly pass through
- Produces bile (a greenish fluid which aids in the digestion of fats), which is stored in the gallbladder.
- Joins with secretions from the pancreas and goes through the common bile duct into the duodenum.



## Jejunum + Ileum (In the small intestine)

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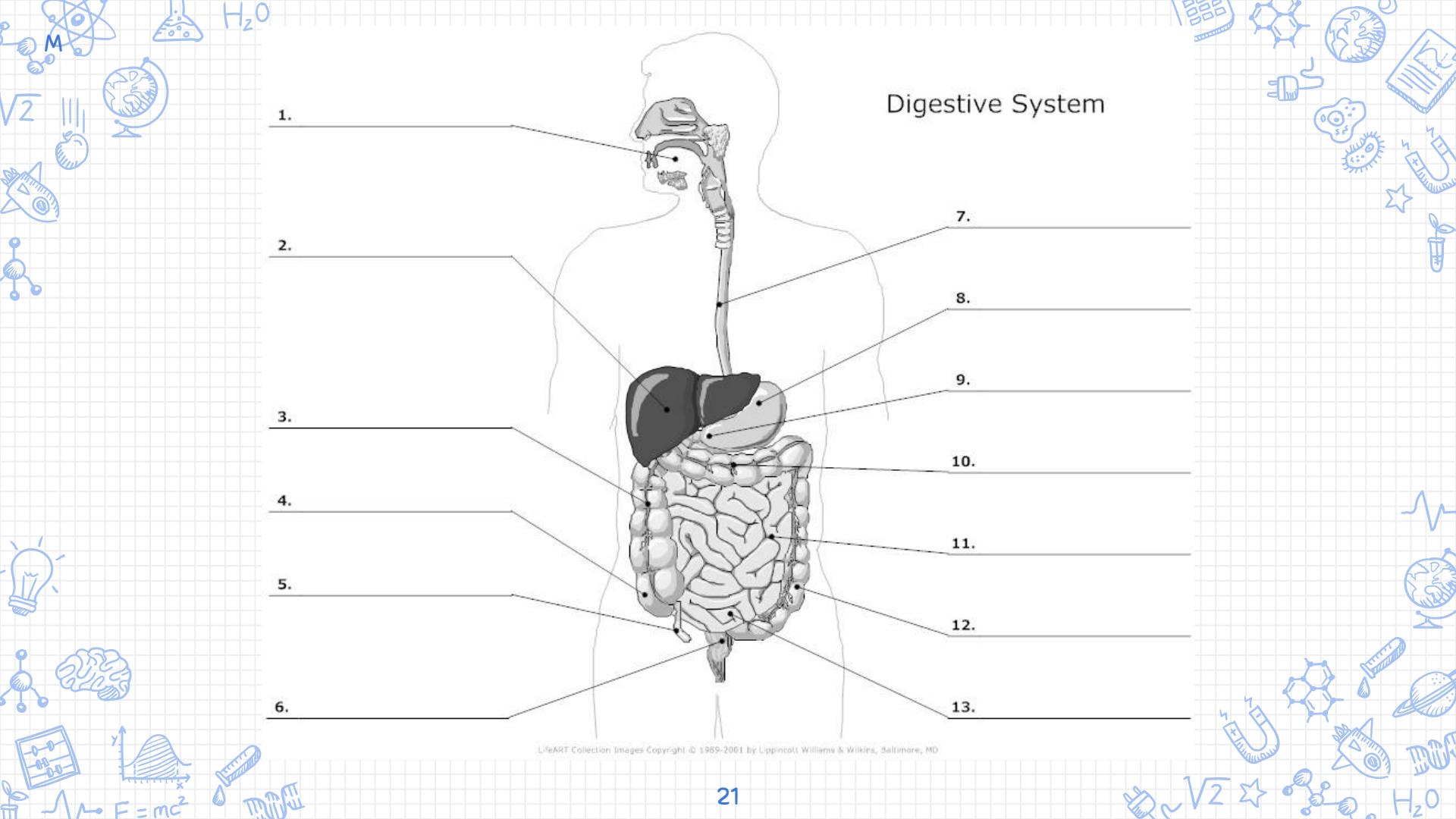
- After the duodenum comes the **jejunum** and the **ileum**.
- Make up the bulk of the small intestine.
- The jejunum comes first.
- Food boluses are digested even further, and some nutrients are absorbed through the walls.
- Ileum is the longest portion of the small intestine.



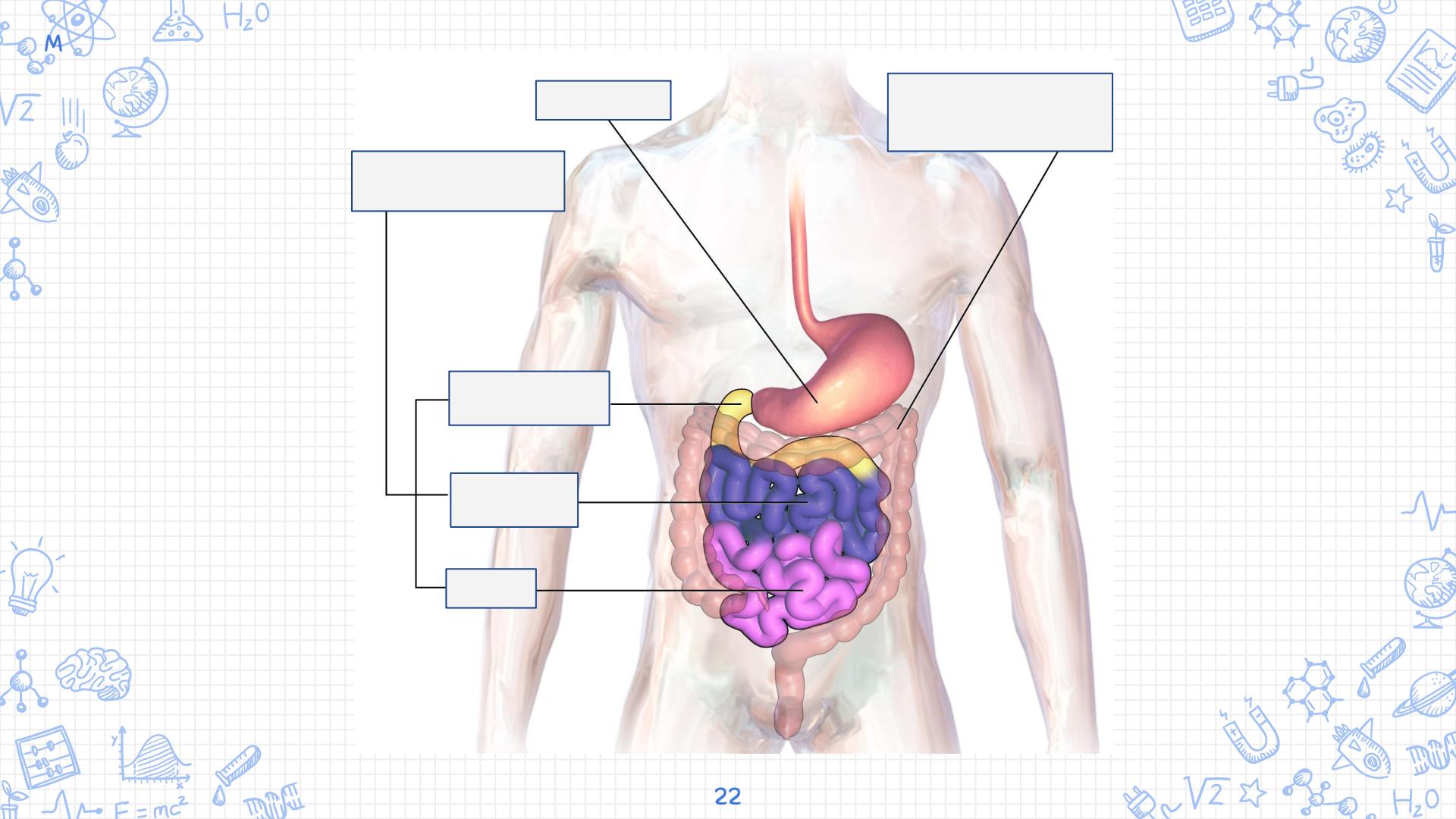
## Large Intestine

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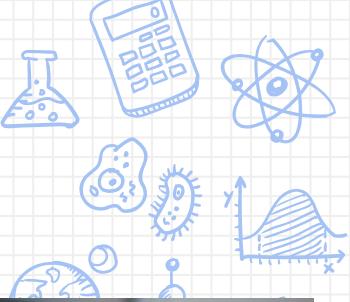
- After passing through the small intestine, food bolus makes its way through the **large intestine**.
- Shorter than the small intestine, but larger in diameter
- Water and electrolytes are removed in the large intestine.
- Microbes such as bacteria aid in further digestion.
- Finally, food bolus comes out of the anus as feces.

$H_2O$ 

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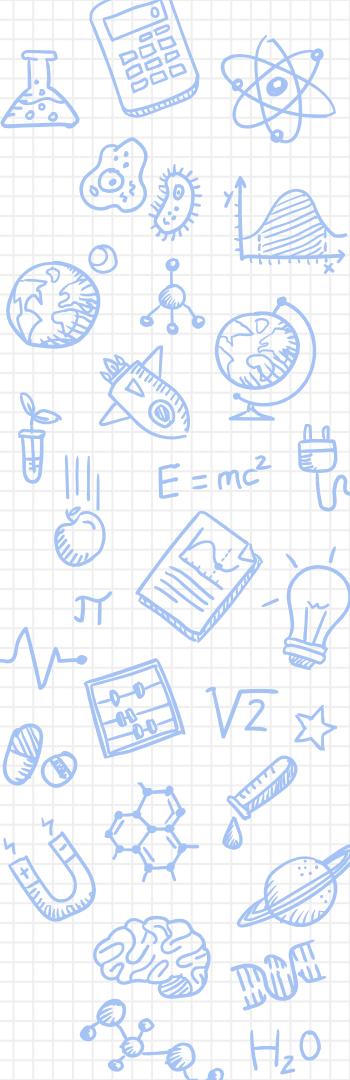
# What About Animals?



## Gizzard

- Many birds, reptiles and fish have gizzards
- Why chickens do not need teeth.
- Muscular part of the stomach
- Chickens use grit (small, hard particles of pebbles or sand) to grind grains and fiber into smaller, more digestible, particles.

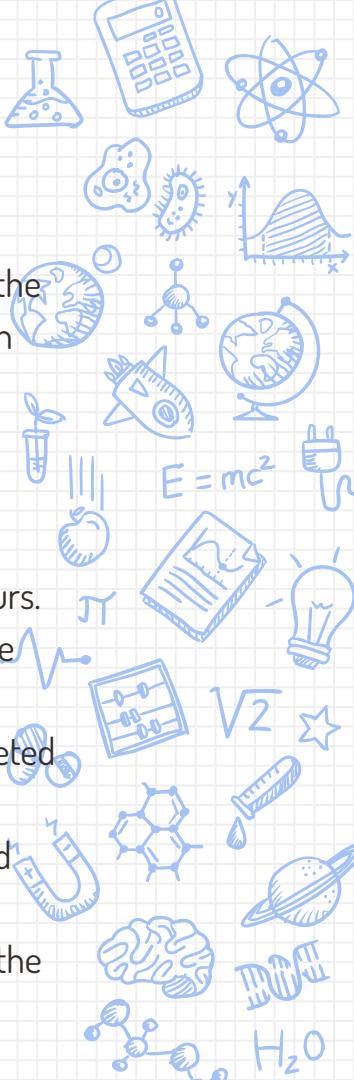




## Crops

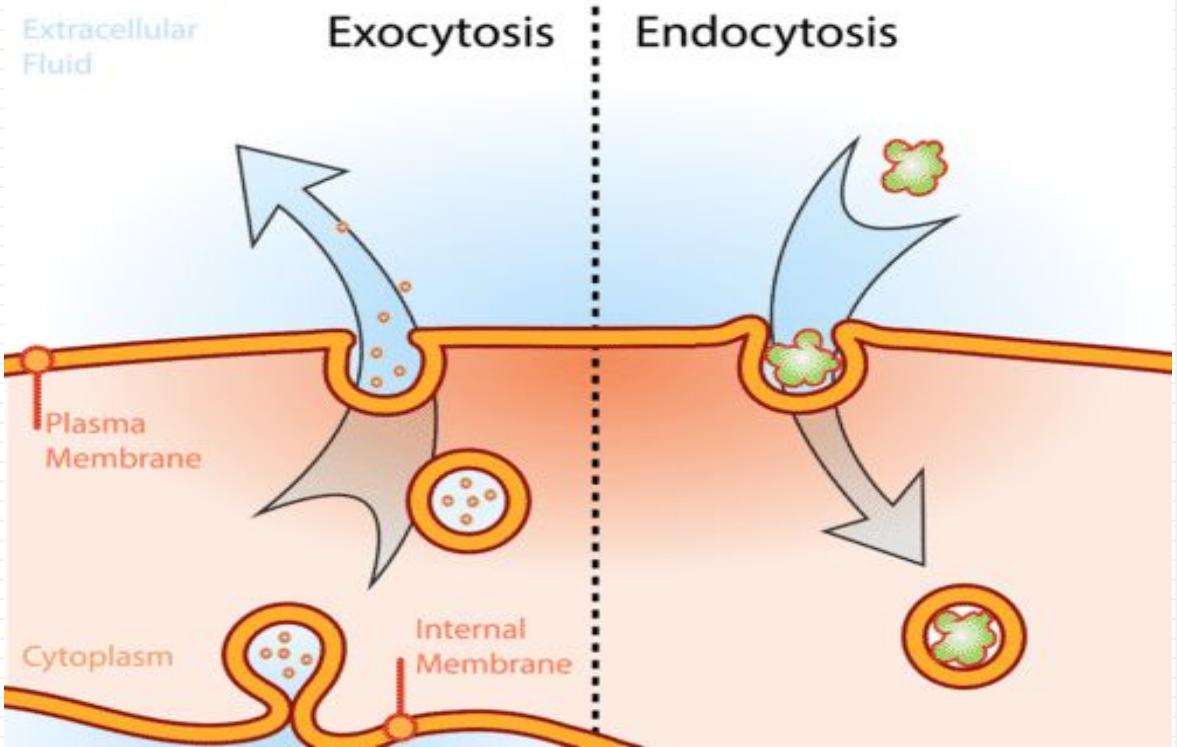
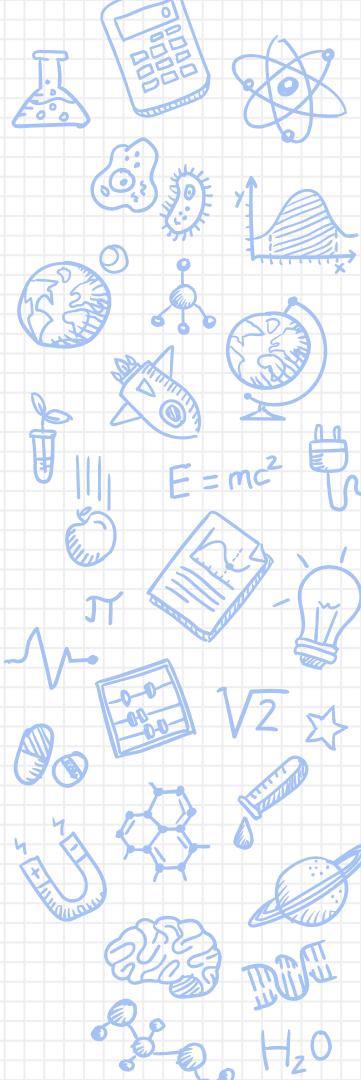
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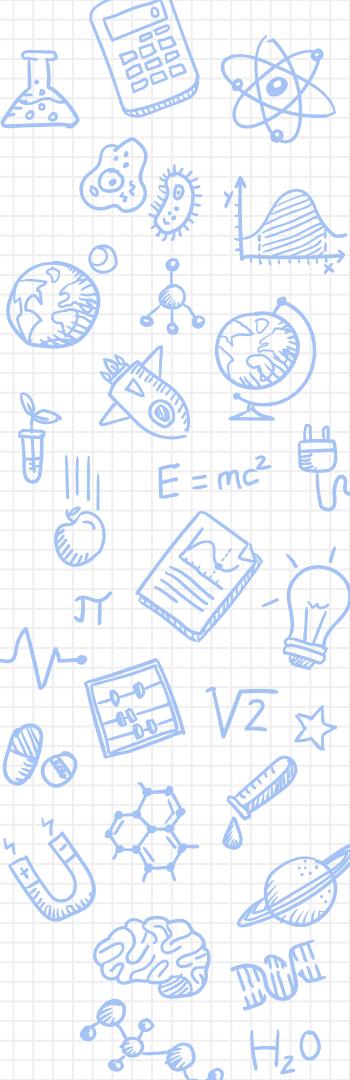
- Many birds, invertebrates, gastropods, earthworms, leeches and insects
- Like a “doggy bag” when the animal eats.
- Many animals eat as much as possible when the opportunity for feeding presents itself.
- Food can't be digested this quick.
- Crop enables the animal to fill up and then the animal can do the digesting later



## Intracellular and extracellular digestion

- Breakdown of food materials occurs inside the food vacuoles.
- Ingestion occurs through the phagocytic vesicles.
- Enzymes involved: lysozyme
- Only chemical digestion
- Nutrients diffuse into the cytoplasm through the membrane of vacuole
- The materials that are not digestible get excreted through the exocytosis.
- Simple mechanism; involves vesicles.
- Mainly occurs in protozoans.
- Breakdown of food materials occurs outside the cell in the lumen of the alimentary canal or on the decaying organic materials.
- Ingestion occurs through the mouth.
- Enzymes secreted from the glands of the alimentary canal.
- Both chemical and mechanical digestion occurs.
- Nutrients absorbed into the blood through the gut epithelia.
- The materials that are not digestible get excreted through the anus.
- Complex mechanism; involves the organs and glands.
- It follows in bacteria, fungi, and animals with the alimentary canal





## Gastrovascular Cavity

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- Primary organ of digestion and circulation in two major animal phyla: Coelenterates and Platyhelminthes
- An open space inside the animal surrounded by endodermal tissue; intracellular digestion.
- Food passes through the opening, or mouth, and enters the cavity.
- Some endodermal cells secrete enzymes
  - Small digested particles taken up by other endodermal cells
- Waste particles expelled from cavity

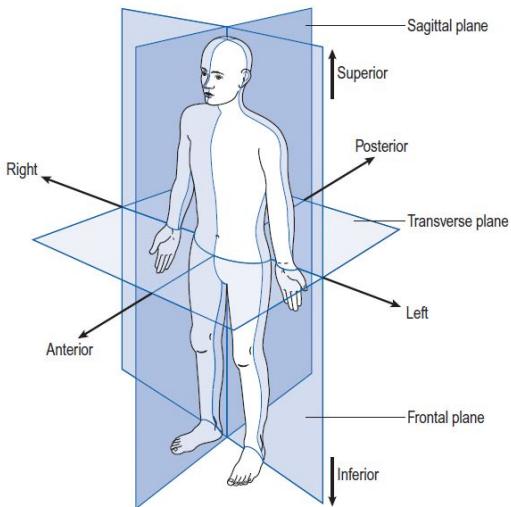
# Any Questions?

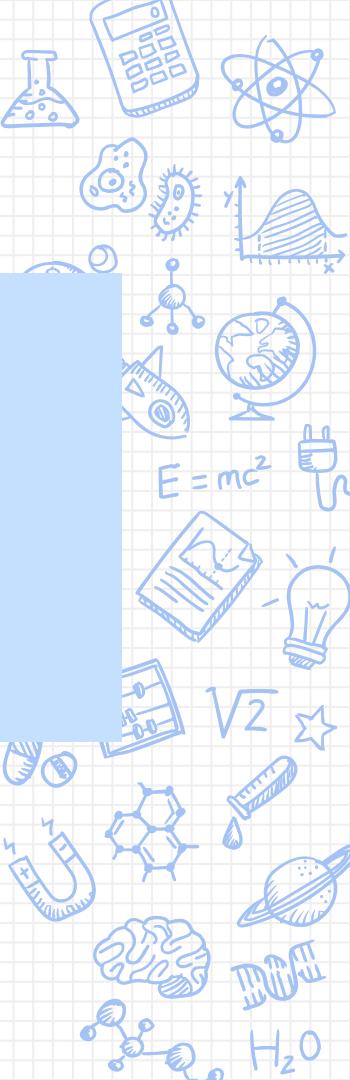
## Anatomical Directions

- Standard anatomical position standing up, palms and feet facing forward

- Standard terms
- Anatomical regions

Ex. bucca (cheek), patellar (kneecap), lumbus (lower back)





## Characteristics of Animals (Humans Included)

- Motility
- Exchange w/ environment
- Advanced Nervous system (with sensory organs)
- Heterotrophs
- Internal digestion

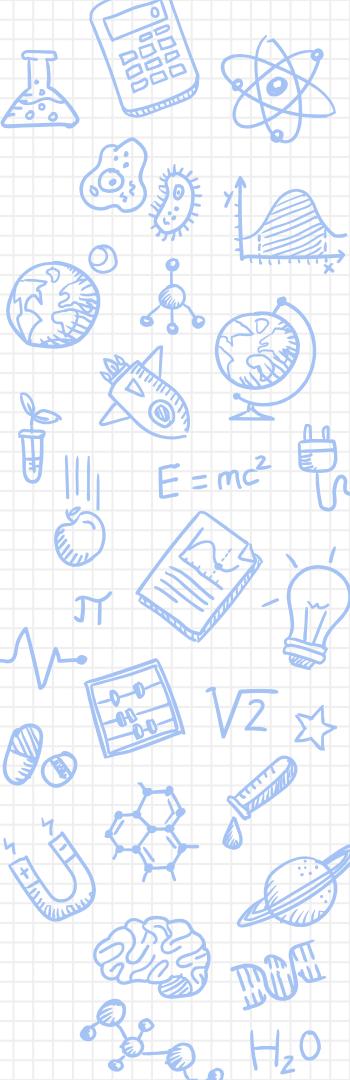
Muscular

Respiratory

Nervous

Digestive

Digestive



## Pharynx

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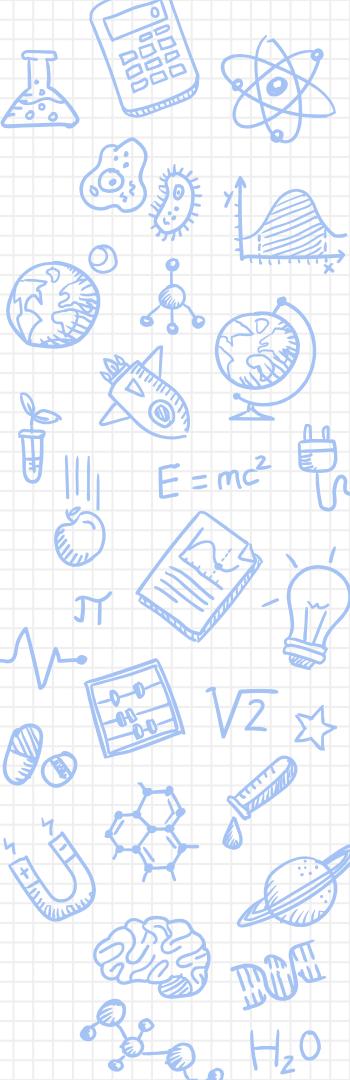
- A shared connection between the nasal cavities, the mouth, the air tract, and the esophagus.
- Structure to prevent the boluses from entering the trachea (passage to the lungs). This is why we have an epiglottis. (a small flap which can open and close the entrance to the trachea).
- When food boluses travel through the pharynx, the epiglottis folds down to protect the airway.
- However, in instances such as talking or eating, the epiglottis can get confused.

# Anaemia

- Vitamin B12/Iron deficiency
- Body lacks iron in red blood cells
- Tiredness, lack of energy, shortness of breath, pale skin

Q: Can you guess which foods can reduce the chances of getting anaemia?

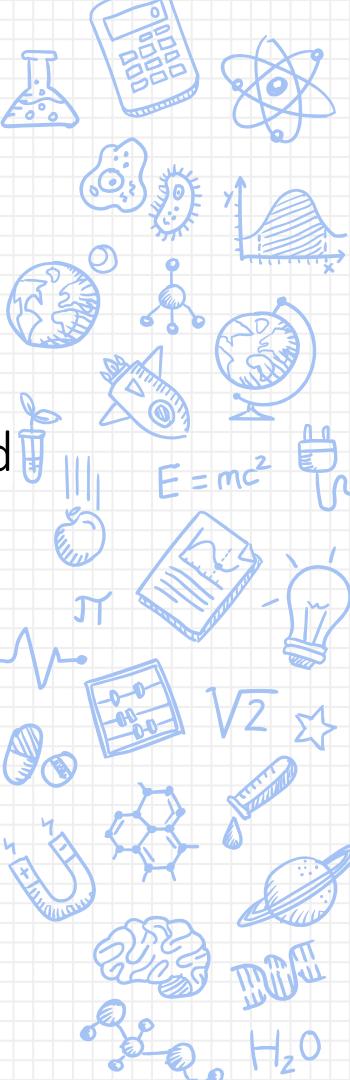




## Chickens' Digestive System

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- CHICKENS DON'T HAVE TEETH
- Food is taken in with the beak; Saliva and enzymes are added as the food moves from the mouth into the esophagus.
- From the esophagus food moves to the crop (storage compartment)
- Food trickles from the crop into the bird's stomach (gizzard) where digestive enzymes are added to the mix and physical grinding of the food occurs.



## Chicken Digestive System (Cont'd)

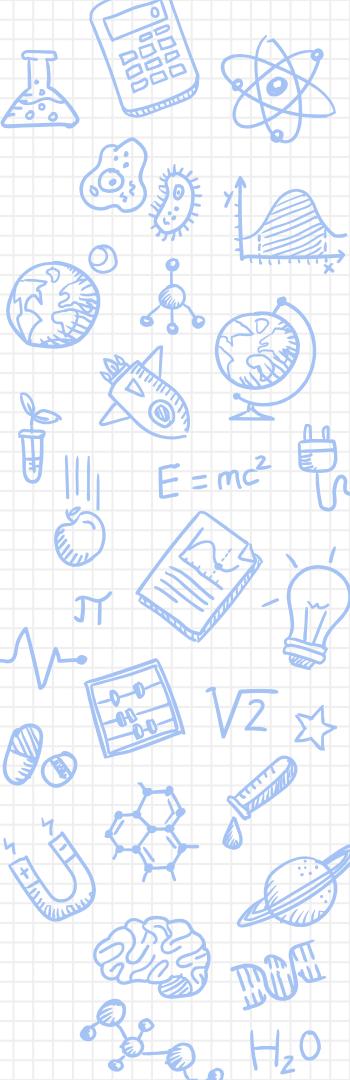
- From the gizzard, food passes into the small intestine.
- Residue then passes through the ceca, a blind sack along the lower intestinal tract, where bacteria help break down undigested food. From the ceca, food moves to the large intestine (same function as humans' large intestine).
- Remaining residue passes through the cloaca where the chicken's urine (the white in chicken droppings) mixes with the waste. Both exit the chicken at the vent, the external opening of the cloaca.



## Bird Digestive System

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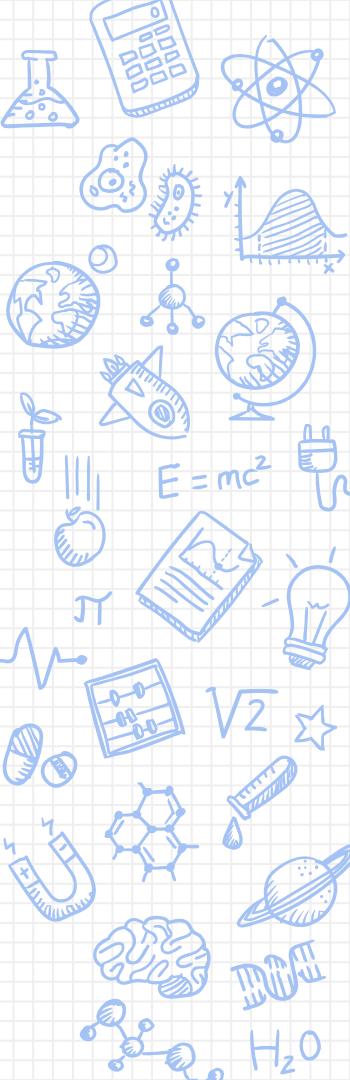
- Bill: scooping, pecking, tearing and generally picking up the bird's food.
- Tongue: direct the food item down the digestive tract and sometimes to help hold onto a wiggling worm or other insect.
- Pharynx is the part between the mouth and esophagus that helps the bird swallow the food item.
- Esophagus



## Birds Digestive System (Cont'd)

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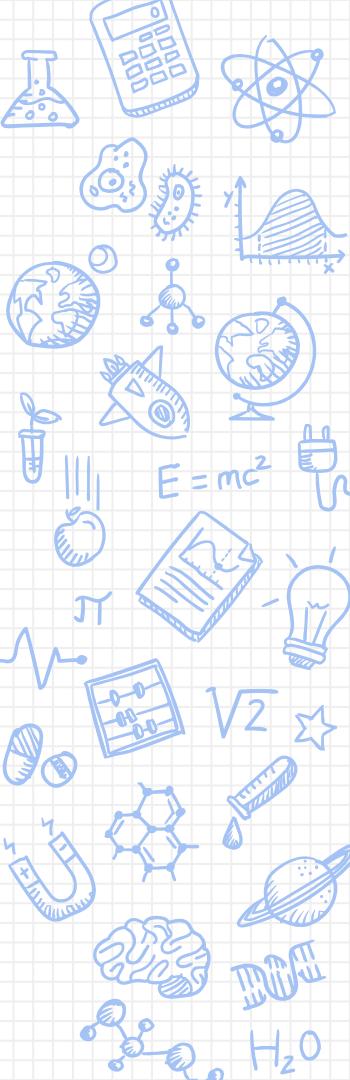
- Proventriculus: first part of the bird's two-chambered stomach; secretes an acid used for breaking down food; best developed in birds that swallow entire fish or other animals containing bones
- Gizzard: second chamber of the stomach; consists of very tough muscles that grind and digest various types of foods.



## Birds Digestive System (Cont'd)

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- Intestines: nutrients absorbed, waste products sent further on through the digestive system.
- Caeca, plural for caecum, because birds usually have two of them.
  - Aid in the absorption of water and proteins, and the microbial decomposition of fiber.
- Rectum: end part of the intestine
- Cloaca: waste from the digestive and urinary tract accumulate before being dumped.

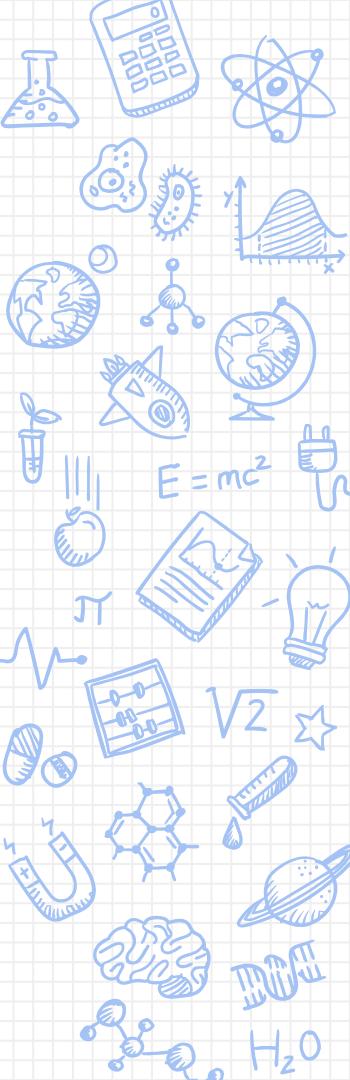


## Cow Digestive System (Ruminant Digestive System)

Stomach has four compartments:

- Rumen
- Reticulum
- Omasum
- Abomasum.

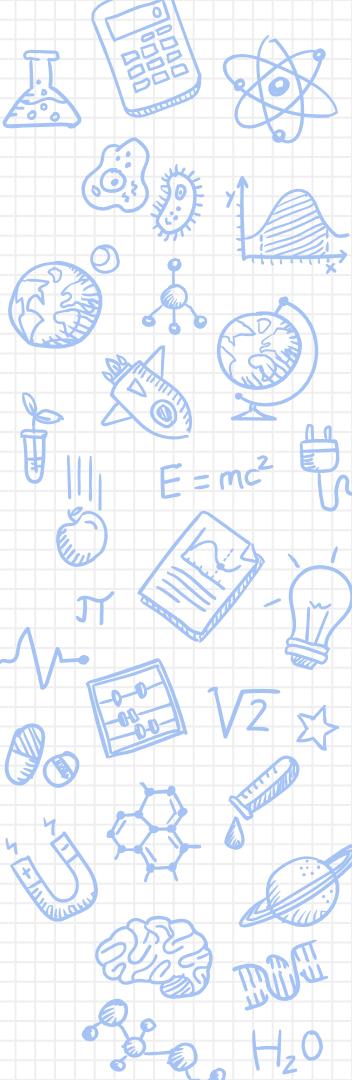
In calves, the esophageal grooves allows milk to bypass the rumen and directly enter the abomasum. Rumen development occurs following a change in diet and microbial growth.



## Rumen

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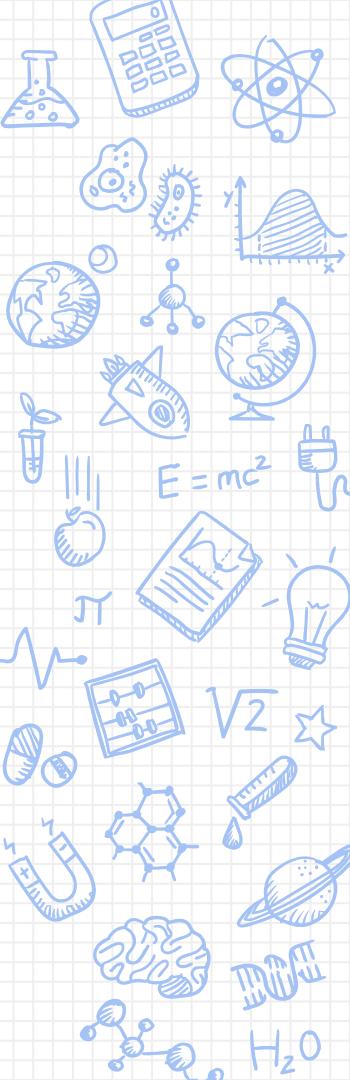
- On the left side of the animal, largest stomach compartment, consists of several sacs
- Storage or holding vat for feed  
Fermentation vat (growth of microbes which digest or ferment feed within the rumen and make volatile fatty acids (VFAs))
- A good blood supply to the rumen walls improves absorption of VFAs and other digestion products. Tiny projections (papillae) line the rumen, which increases the rumen's surface area and the amount it can absorb.



## Reticulum

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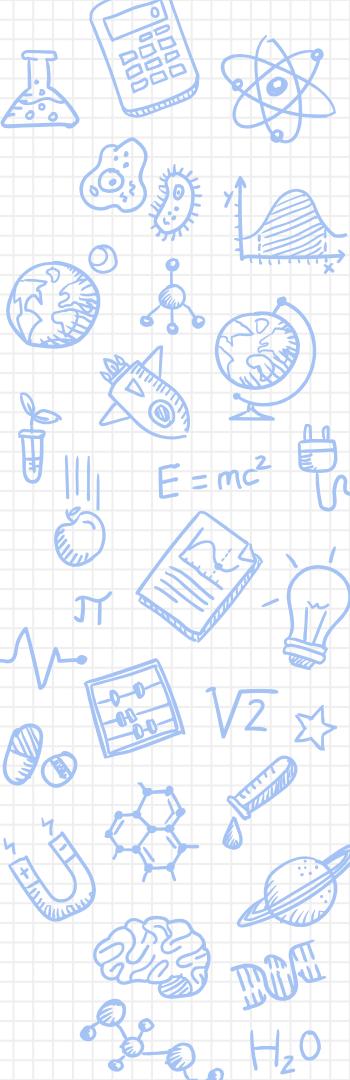
- Pouch-like structure in the forward area of the body, close to the heart. The tissues in the reticulum form a network similar to a honeycomb. A small tissue fold lies between the reticulum and rumen (rumino-reticulum)
- Heavy or dense feed and metal objects eaten by the cow drop into here. Nails and other sharp objects may work into the tissue and cause “hardware disease.” (Magnets to treat)



## Omasum

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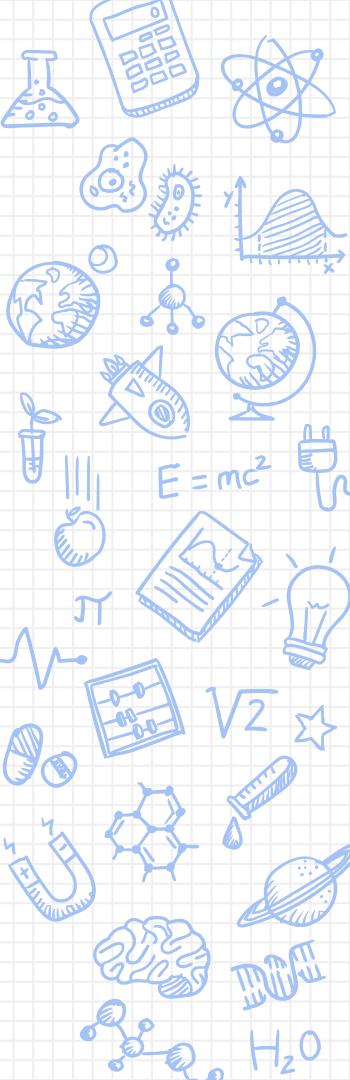
- Globe-shaped structure containing leaves of tissue (like pages in a book).
- Absorbs water and other substances from digestive contents.
- Feed material (ingesta) between the leaves will be drier than ingesta found in the other compartments.



## Abomasum

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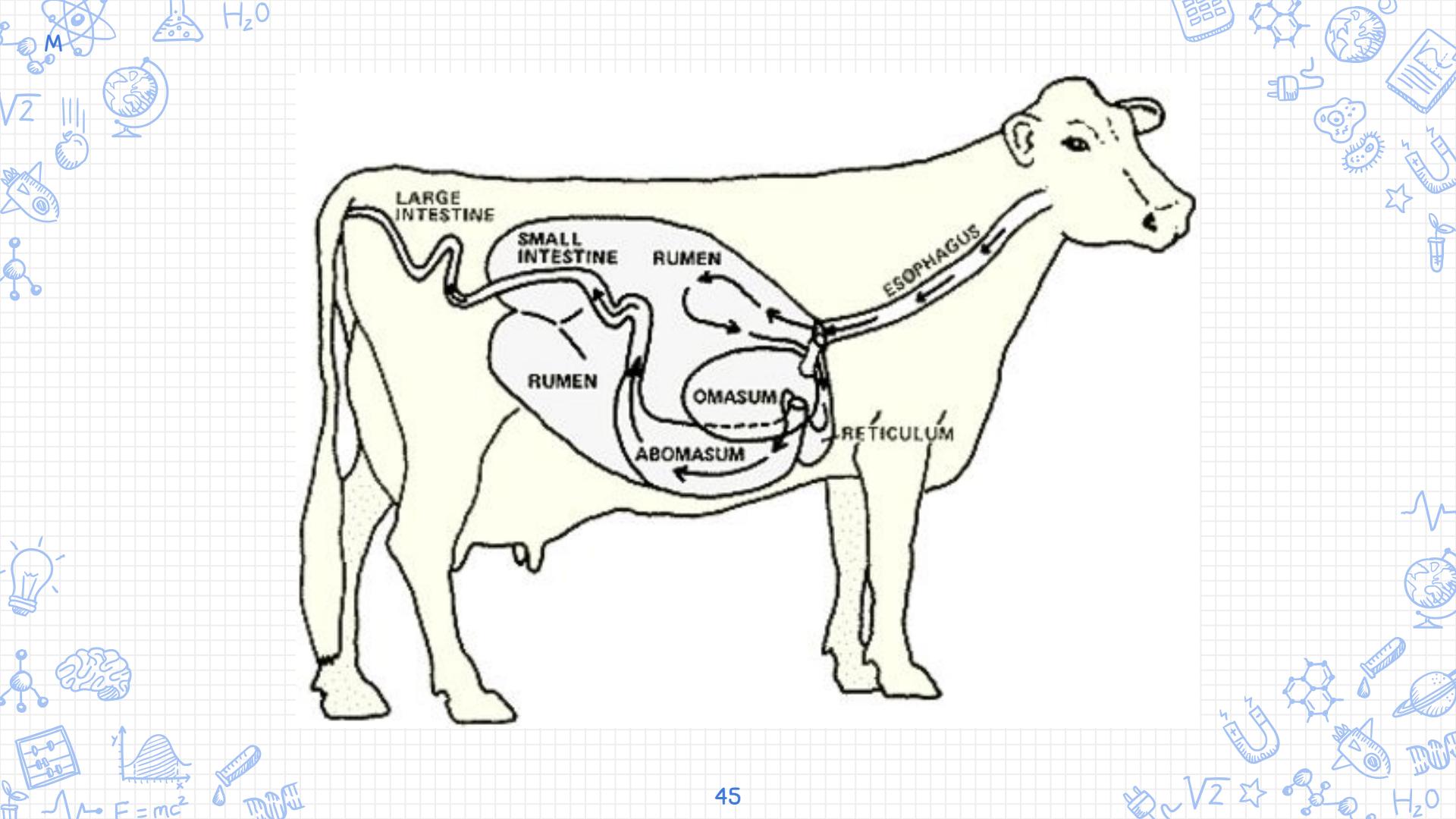
- The only compartment lined with glands.
- Release hydrochloric acid and digestive enzymes, needed to breakdown feeds
- Similar to a non-ruminant stomach.

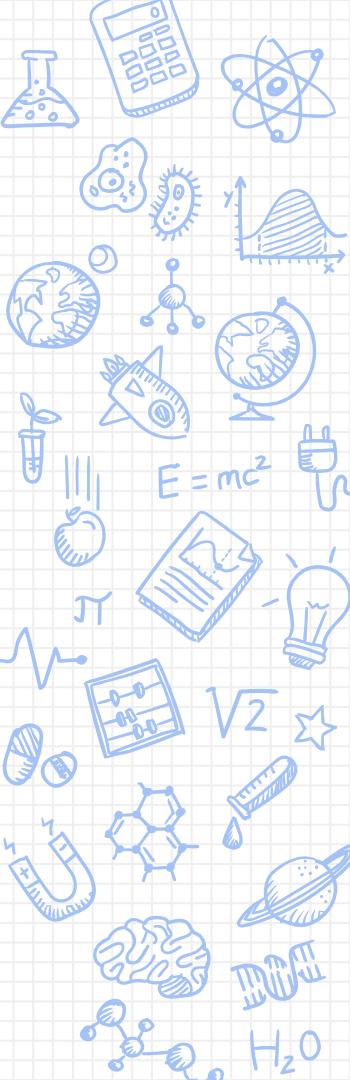


## Global Warming?

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Digestion produces 30 to 50 quarts of gas per hour in the rumen. Carbon dioxide and methane are the main gases present. Cows must release this gas to avoid bloating. Under normal conditions, swelling from gas formation causes the cow to belch and release the gas.





## Feeding Mechanisms

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Substrate feeding: a feeding mechanism in which the organism **lives in/on its food source and eats through it**

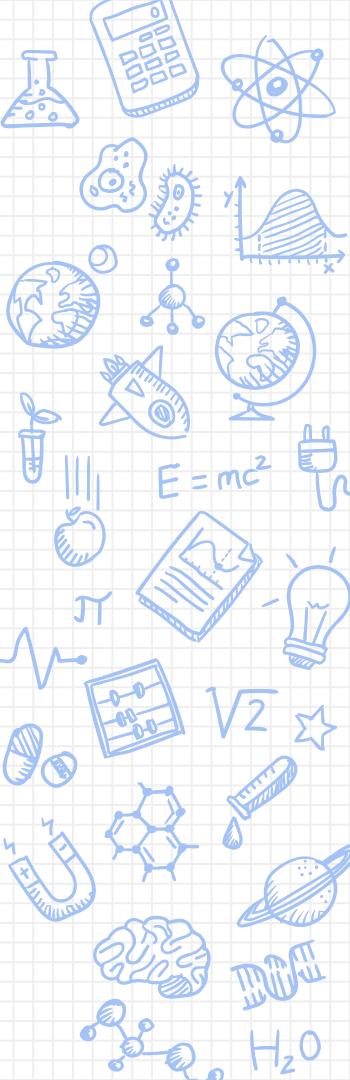
Ex: caterpillar

Filter feeding: organism **filters out nutrients** using currents of water

Ex: whales, clams, some types of fish

Fluid feeding: organism feeds on the **fluids of other organisms**

Ex: mosquitoes, hummingbirds



## Feeding Mechanisms (Continued)

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Bulk feeding: the organism **consumes large pieces if not all of its prey**

Ex: lions, snakes