Respiratory System

Overview

- **Major function**: gas exchange; supply the body with $O_2$ it needs and dispose of $CO_2$
  - It cannot do this without the help of the cardiovascular (CV) system!!
- **Key structures**: nose, pharynx, larynx, trachea, lungs, diaphragm

Functional Zones

- **Conducting Zone**: warms, humidifies, and filters air as it travels to the respiratory zone
  - Air enters the **nose** through **nostrils** and is warmed/moistened as it passes through the **nasal cavity**
  - Air moves through the **pharynx**, which connects the nasal cavity and mouth to the **larynx (voice box)** and **esophagus**
    - Air travels down the larynx to the **trachea (windpipe)**
      - The **epiglottis** is a piece of cartilage that blocks the larynx when we swallow food.
**Functional Zones**

- **Conducting Zone**: warms, humidifies, and filters air as it travels to the respiratory zone
  - Air travels down the trachea which splits into right and left primary bronchi that enter the lungs
    - Right lung has 3 lobes (superior, middle, and inferior)
    - Left lung has 2 lobes (superior and inferior)
    - Lungs are surrounded by pleurae = serous membranes that line the thoracic wall and diaphragm

- **Respiratory Zone**: where gas exchange occurs in the bronchioles, alveolar ducts, and alveoli
  - Bronchioles empty into the alveolar ducts, which dead end in tiny alveolar sacs that contain alveoli (thin-walled air sacs)
  - This is where the bulk of gas exchange occurs!

**Gas Exchange**

- **Gas exchange**: the diffusion of $O_2$ and $CO_2$ between the alveoli and blood in the lungs and then later the blood and body tissues
  - Arteries and veins feed into each alveolar sac, with capillaries connecting to each alveoli
  - $CO_2$ moves **OUT** of the blood and **INTO** the alveoli
  - $O_2$ moves **INTO** the blood and **OUT** of the alveoli

**Functional Zones**

- **Conducting Zone**: warms, humidifies, and filters air as it travels to the respiratory zone
  - The primary bronchi subdivide into lobar secondary bronchi
    - 1 for each lobe (3 in the right lung and 2 in the left lung)
  - Subdivide further into segmental tertiary bronchi

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    - The smallest passageways (less than 1 mm) = bronchioles

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Breathing

An overview of pulmonary ventilation

- **Diaphragm** = muscle that moves the lungs
  - Separates the thoracic cavity from the abdominal cavity
- **Volume changes in lungs** $\rightarrow$ **pressure changes**, which causes air to move

When we **inhale**, the diaphragm contracts $\rightarrow$ room for lungs to expand

When we **exhale** the diaphragm’s contraction is released and the lungs return to their deflated size

2 Phases:

1. **Inspiration** = when air moves into the lungs
   - Inspiratory muscles contract and the diaphragm lowers $\rightarrow$ increased volume in thoracic cavity
   - Lungs expand $\rightarrow$ air flows in

2. **Expiration** = when air exits out of the lungs
   - Inspiratory muscles relax and the diaphragm rises $\rightarrow$ decreased volume in thoracic cavity
   - Lungs recoil $\rightarrow$ air flows out
Breathing

The details

- The intercostal muscles contract → pulling the ribs up, and the diaphragm contracts and moves down → pulling air into the body through the mouth or nostrils.
- Air passes through the nasopharynx or oral pharynx to the trachea.
- The trachea filters air using tiny hair-like cilia and mucus.
- Air moves down the trachea and into the right and left bronchi.
  - Trachea is very stiff so it stays open and doesn’t collapse every time pressure drops when you exhale!
- Air passes into further branching bronchioles.

Breathing

The details

- Air arrives at alveoli where gas exchange will occur.
  - O₂ that has been pulled into the alveoli diffuse through the really thin alveoli membrane and into the pulmonary capillaries to be circulated through the heart and to the rest of the body for cellular respiration.
- CO₂ that has been created by the body through cellular respiration is brought by the capillaries to the alveoli and diffuses into them.
- The diaphragm relaxes, moving up and causing air (containing CO₂) in the alveoli to be exhaled.

Cellular Respiration

= The set of metabolic reactions that convert chemical energy in food to usable energy (ATP) for the cell, and thus the body

\[ C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{energy (ATP)} \]

- This metabolic process is possible because of diffusion and bulk flow, accomplished by the respiratory and CV systems
  - Diffusion = movement of gases, occurring at short distances
  - Bulk flow = movement of large amounts of gases to different structures that they can then diffuse into
## Unit Topic: Transport

**Essential Question:** How is the body designed to utilize blood as the main transport mechanism of resources to all of the body systems in order to maintain homeostasis?

### Concept 1: Blood

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Describe the different ways our blood plays a critical role in maintaining homeostasis in our bodies.</td>
<td>Blood, Plasma, Leukocytes, Thrombocytes, Erythrocytes, Hemoglobin, Hematopoiesis, Erythropoietin, Hemostasis, Antigens, Antibodies, Agglutinogens, Rh factor</td>
</tr>
<tr>
<td>2. Describe the composition of blood.</td>
<td></td>
</tr>
<tr>
<td>3. Explain how the shape of a red blood cell contributes to its function.</td>
<td></td>
</tr>
<tr>
<td>4. Make connections between the process of hematopoiesis and other body systems it involves.</td>
<td></td>
</tr>
<tr>
<td>5. Describe the steps involved in hemostasis.</td>
<td></td>
</tr>
<tr>
<td>6. Explain how there are 8 different blood types in humans and the factors that contribute to these different types. Include what happens if the wrong blood was donated in a transfusion.</td>
<td></td>
</tr>
<tr>
<td>7. Be able to interpret and answer questions about blood type when given a description of a scenario or diagram to reference.</td>
<td></td>
</tr>
</tbody>
</table>

### Concept 2: The Cardiovascular System

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. List the overall function of the cardiovascular system and summarize how it uses the heart, blood vessels, and blood to accomplish this function.</td>
<td>Blood flow, Blood pressure, Resistance, Blood vessels, Arteries, Arterioles, Capillaries, Capillary beds, Veins, Venules, Veins, Pericardium, Myocardium, Contractile cardiac muscle cells, Pacemaker cells, Heartbeat, Systole, Diastole, Pulse, Electrocardiogram, CPR, AED, Tourniquet</td>
</tr>
<tr>
<td>2. Explain the three factors that can cause resistance to blood flow through the vessels.</td>
<td></td>
</tr>
<tr>
<td>3. Describe the location of the heart in your body, using appropriate anatomical terminology.</td>
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</tr>
<tr>
<td>4. Explain the purpose of the pericardial cavity.</td>
<td></td>
</tr>
<tr>
<td>5. Sketch the interior of the heart and label the atria, ventricles, valves, and major arteries and veins.</td>
<td></td>
</tr>
<tr>
<td>6. Explain the importance of valves in the heart.</td>
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</tr>
<tr>
<td>7. Summarize the pathway that oxygen-poor blood will take in order to become oxygen-rich blood that can then be distributed to the tissues in our body.</td>
<td></td>
</tr>
<tr>
<td>8. Differentiate between the distinct roles and structures utilized in pulmonary, systemic, and coronary circulation.</td>
<td></td>
</tr>
<tr>
<td>9. Describe what makes cardiac muscle tissue unique from other muscle tissues.</td>
<td></td>
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<tr>
<td>10. Summarize how the intrinsic cardiac conduction system works.</td>
<td></td>
</tr>
<tr>
<td>11. Describe the mechanism that causes us to hear a heartbeat through a stethoscope.</td>
<td></td>
</tr>
<tr>
<td>12. Summarize how the heart uses both electrical and mechanical events to circulate blood throughout the body through the cardiac cycle.</td>
<td></td>
</tr>
</tbody>
</table>
13. List some of the extrinsic controls that contribute to regulation of the cardiac cycle.

14. Sketch an EKG and label the key parts. Describe what each shows.

15. Be able to identify the name and function of a structure of the heart when given a description, picture or physical specimen to reference.

16. Be able to interpret diagrams related to circulation.

**Concept 3: The Respiratory System**

**Objectives:**

1. Describe the overall function of the respiratory system and how it works with the cardiovascular system to accomplish this function.

2. Differentiate between the roles of the conducting and respiratory zones, and the structures that compose each.

3. Describe the structure and organization of the lungs and the bronchi inside of them.

4. Sketch or create a flowchart to summarize the pathway air takes to enter the body and make its way to the alveoli.

5. Sketch and label a picture of the alveolar sacs and alveoli.

6. Describe the process of gas exchange in the lungs and in our tissues.

7. Summarize the role of the diaphragm.

8. Explain the relationship between volume, pressure, and air flow.

9. Describe how inspiration and expiration work together to allow us to breathe.

10. Explain why, on a cellular level, we need to be able to breathe to maintain homeostasis.

11. Be able to identify the name and function of a structure of the respiratory system when given a description, picture or physical specimen to reference.

**Vocabulary:**

- Pleurae
- Bronchioles
- Gas exchange
- Cellular respiration
- Diffusion
- Bulk flow
- Lung capacity
- Tidal volume
- Inspiratory reserve volume
- Expiratory reserve volume
- Residual volume
- Vital capacity
Part 1 Matching: *Match the vocabulary terms with the definition. Not all terms will be used.*

1. Prevents blood from flowing back into the atria when the ventricles contract. 
   - A. Aorta

2. When blood leaves this chamber of the heart, it heads out to the body. 
   - B. AV node

3. One of the body’s largest blood vessels that transports blood from the body region below the diaphragm to the heart. 
   - C. Inferior vena cava

4. When this chamber contracts it pushes blood through the tricuspid valve. 
   - D. Left atrium

5. Initiates the action potential that causes the heart to beat. 
   - E. Left ventricle

6. When blood leaves this chamber of the heart, it heads to the lungs. 
   - F. Pulmonary trunk

7. Stops blood from flowing back into the ventricles each time they contract. 
   - G. Pulmonary veins

8. Responsible for distributing electrical impulses throughout the heart. 
   - H. Right atrium

9. This blood vessel splits in two and sends oxygen-poor blood to the lungs. 
   - I. Right ventricle

10. The chamber in the heart that receives oxygenated blood from the lungs. 
    - J. SA node

   - K. Semilunar valves

   - L. Tricuspid and bicuspid valves

Part 2 Fill in the Blank: *Fill in the best word to complete the sentence in the spaces provided.*

11. _________________ are the smallest blood vessels with the _________________ walls in order to maximize diffusion of nutrients in and out of the interstitial fluid.

12. _________________ carry blood towards the heart and _________________ carry blood away from the heart.

13. Blood traveling in the pulmonary circuit goes through the _________________ side of the heart and out to the _________________ . Blood traveling in the systemic circuit goes through the _________________ side of the heart and out to the _________________ .

Part 3 Application:

14. **Label** the four chambers of the heart using the lines on the picture to the right.
Concept 3 Notes: The Respiratory System

Overview

Functional Zones

Conducting zone
Respiratory zone

Gas exchange
Cellular Respiration

Summary Concept 3

*Summarize the pathway that oxygen travels as it enters the body and eventually gets to our tissues and cells. Then summarize how carbon dioxide leaves our cells and exits our bodies.*
Activity: Journey of an Oxygen Molecule

Overview: In this activity, you will pretend you are an oxygen molecule in the atmosphere. You were inhaled by a human and went on a crazy journey through the human body. This has been a crazy ride, and you’ve been through so much (including the two body systems we’ve been learning about!) and now you want to recount your adventures to all of your friends on social media.

Task: Select one of the social media options below to share about your trip to all of your other molecule friends.

- **Instagram**: If you choose Instagram to commemorate your journey, you will be writing #bt posts, reminiscing on where you have been. Instagram is all about the pictures and hashtags, and you can use varying lengths of captions. Just be sure to include a minimum of 5 Instagram posts to reflect on your trip. Every post must include: a picture, caption, and at least 1 hashtag other than #bt.

- **Twitter**: If you choose Twitter to chronicle your journey, you will be “live tweeting” your journey from the atmosphere and through a human. You won’t have to include any pictures, but you do need to include appropriate hashtags and make sure each tweet is 140 characters or less. You must write a minimum of 20 tweets to capture your trip.

- **Snapchat**: If you choose Snapchat to chronicle your journey, it is all about the pictures on your Snapchat story. You will need to create a minimum of 10 Snapchats that would show your followers your journey through the body. Snapchats are all about the pictures, filters, and a very brief caption, so make sure to have excellent pictures if you choose this option.

- **Facebook**: If you really aren’t into pictures at all, but would rather write a lengthy post about your emotional trials that have brought you where you are now. Facebook is the social media option for you. You have the option of including one picture in your post about your journey, but the emphasis on this choice is the writing, not the pictures. You will need to write between 350-500 words about your trip.

**Rubric:**

<table>
<thead>
<tr>
<th></th>
<th>Excellent (10 points)</th>
<th>Satisfactory (9-7 points)</th>
<th>Needs Improvement (6-3 points)</th>
<th>Unacceptable (2-0 points)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method</strong></td>
<td>Student uses their selected social media method accurately and effectively to communicate their molecule’s journey.</td>
<td>Student mostly uses their selected social media method accurately and effectively to communicate their molecule’s journey.</td>
<td>Student somewhat uses their selected social media method accurately and effectively to communicate their molecule’s journey.</td>
<td>Student does not use their selected social media method accurately or effectively to communicate their molecule’s journey.</td>
</tr>
<tr>
<td><strong>Content (x2)</strong></td>
<td>The pathway oxygen takes through the body is clearly understood and communicated.</td>
<td>The pathway oxygen takes through the body is mostly understood and communicated.</td>
<td>The pathway oxygen takes through the body is somewhat understood and communicated.</td>
<td>The pathway oxygen takes through the body is not understood or communicated in a way that shows understanding.</td>
</tr>
<tr>
<td><strong>Connections</strong></td>
<td>There is a clear understanding of the relationship between the structures and functions of the cardiovascular and respiratory systems.</td>
<td>There is a mostly clear understanding of the relationship between the structures and functions of the cardiovascular and respiratory systems.</td>
<td>There is somewhat of an understanding of the relationship between the structures and functions of the cardiovascular and respiratory systems.</td>
<td>There isn’t an understanding of the relationship between the structures and functions of the cardiovascular and respiratory systems.</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td>Overall work is colorful, visually appealing, organized, and accurate. Work stands out from the rest and shows evidence of extra effort.</td>
<td>Overall work is mostly colorful, visually appealing, organized, and accurate. Work shows evidence of good effort.</td>
<td>Overall work is somewhat colorful, visually appealing, organized, and accurate. More effort needed.</td>
<td>Overall work is not colorful, visually appealing, organized, and accurate. Lack of effort is evident.</td>
</tr>
</tbody>
</table>
Overview

- **Function**: Convert the food we eat into the energy and raw materials that build and fuel our bodies
  - Macromolecules in our food get broken down mechanically and chemically into their simplest forms
  - Can then be absorbed into our blood and transported via capillaries (and the rest of our blood vessels) to wherever the nutrients are needed in the body!

Digestion

The “disassembly line” of our food
The digestive process can be divided into 6 overall steps, some of which happen simultaneously in multiple structures at once!

1. **Ingestion**
   - Occurs only in the mouth
2. **Propulsion**
   - Occur in multiple organs along the GI tract that work together cooperatively
3. **Mechanical breakdown**
4. **Chemical digestion**
5. **Absorption**
6. **Defecation**
   - Occurs only in the large intestine

**Main structures**: make up the alimentary canal (Gastrointestinal tract)
- The hollow muscular tube from the mouth to the anus that digests and absorbs our food
  - Includes: mouth, pharynx, esophagus, stomach, small intestine, and large intestine

**Accessory (support) structures**: teeth, tongue, salivary glands, gallbladder, liver, and pancreas

Week 4
Digestion

The “disassembly line” of our food

1. **Ingestion**: eating
   - Teeth begin *mechanical breakdown* with chewing
   - Salivary glands begin *chemical digestion* by releasing enzymes that start digesting starches

2. **Propulsion**: movement of food through the GI tract
   - Starts with voluntary swallowing of the *bolus*
   - Continues with involuntary *peristalsis*
     - the contraction and relaxation of smooth muscles in the esophagus, stomach, and intestines to move food through the canal

Digestion

3. **Mechanical breakdown**: physically breaking down food to increase surface area (which will help with *absorption*) and mix it with enzymes (which will help with *chemical digestion*)

4. **Chemical digestion**: secreted enzymes chemically break down food molecules into their simplest forms (monomers) so that they are able to be absorbed into the blood, transported, and used by our cells

Histology of the GI Tract

- Most structures in the GI tract have **4 main layers**:
  - **Mucosa** = innermost layer
    - Secretes mucus, enzymes and hormones
    - Absorbs nutrients into the blood
    - Protects against infectious diseases
  - **Submucosa** = middle layer of loose areolar connective tissue
    - Provides the tube with elasticity
  - **Muscularis externa** = middle layer of smooth muscle
    - Critical for peristalsis
  - **Serosa** = outermost layer of loose connective tissue
    - Houses the nerves, blood vessels, and lymphatic vessels for each structure

5. **Absorption**: the transport of the end result of our digested food through the walls of the GI tract and into the blood (or lymph) to be transported
   - *These monomers, vitamins, and minerals will then be used for cellular respiration in cells or whatever other process is needed at the time!*

6. **Defecation**: elimination of indigestible substances through the anus as feces
Histology of the GI Tract

- Epithelial tissue also plays an important role in many of the organs, creating a selectively permeable lining
  - Stratified squamous epithelial cells in the mouth, esophagus and anus protect against abrasive foods
  - Simple columnar epithelial cells line our stomach and intestines for absorption and secretion

Digestive Enzymes

<table>
<thead>
<tr>
<th>Digestive enzymes</th>
<th>What they digest</th>
<th>Product that is formed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amylase in the saliva</td>
<td>Starches (complex carbs)</td>
<td>Maltose (a disaccharide)</td>
</tr>
<tr>
<td>Pepsin and HCl in the gastric juice</td>
<td>Proteins</td>
<td>Partially digested proteins</td>
</tr>
<tr>
<td>Proteases, lipases, and amylase in the pancreatic juice</td>
<td>Proteins, fats (that are in bile), and starches</td>
<td>Peptides &amp; amino acids, fatty acids &amp; glycerol, maltose</td>
</tr>
<tr>
<td>Peptidases, sucrase, lactose, and maltase in the intestinal enzymes</td>
<td>Peptides (short chains of amino acids), sucrose, lactose, maltose</td>
<td>Amino acids, glucose, fructose, and galactose</td>
</tr>
<tr>
<td>Bile salts in the liver bile</td>
<td>Fats</td>
<td>Fat droplets</td>
</tr>
</tbody>
</table>

Regulation

- The enteric nervous system = the in-house nerve supply just for the GI tract for regulating activities of the digestive system
  - Part of the autonomic nervous system
  - Receptors respond to external stimuli (like seeing, smelling, tasting or thinking about food) or internal stimuli
    - Internal stimuli can be mechanical (like stretching) or chemical (like changes in pH and the presence of certain end products)

- The enteric nervous system communicates with the CNS via the vagus nerve (the longest cranial nerve in the body!)
  - Has both sensory and motor functions
  - Connects the brain to the GI tract (among other structures)

- Hormones play a significant role as well
  - G cells produce gastrin
  - Enterendocrine cells release hormones like serotonin and histamine
  - These hormones increase/activate the release of HCl and stimulate muscle contractions in the stomach and intestines
Regulation

- Gastric fluid secretion is controlled in 3 phases/places:
  - **Cephalic phase** = ("reflex" phase) in the brain
    - Before food even enters the stomach!
    - External stimuli (like seeing or smelling food) → hypothalamus and medulla oblongata in brain → triggers parasympathetic fibers in vagus nerve → prep stomach for food coming
  - **Gastric phase** = in the stomach
    - Mechanical stimuli activate stretch receptors in stomach → secrete more gastric fluid
    - Chemical stimuli activate chemoreceptors in stomach → G cells release gastrin → increase in HCl secretion
  - **Intestinal phase** = in the intestines
    - Receptors in duodenum receive chyme → intestinal cells secrete more gastrin
# Unit Topic: Absorption and Excretion

**Essential Question:** How does the body effectively and efficiently absorb nutrients and excrete waste from the food we eat in order to acquire necessary substances for maintaining homeostasis?

## Concept 1: The Digestive System

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Describe the overall function of the digestive system and how it works alongside at least three other body systems to accomplish this function.</td>
<td>Alimentary canal</td>
</tr>
<tr>
<td>2. Explain why macromolecules must be broken down by the digestive system and what the end products are used for.</td>
<td>Ingestion</td>
</tr>
<tr>
<td>3. List the steps of the digestive process and the structures in which each step occurs.</td>
<td>Propulsion</td>
</tr>
<tr>
<td>4. Differentiate between mechanical and chemical digestion.</td>
<td>Bolus</td>
</tr>
<tr>
<td>5. Explain the significance of absorption and how the structure of the small intestine (specifically its histology) helps it accomplish this function.</td>
<td>Peristalsis</td>
</tr>
<tr>
<td>6. Describe the significance of the gallbladder, liver, and pancreas to the digestive system.</td>
<td>Salivary glands</td>
</tr>
<tr>
<td>7. Distinguish between the enzymes that accomplish the digestion of each macromolecule, and where the digestive process starts in the GI tract for each.</td>
<td>Epiglottis</td>
</tr>
<tr>
<td>8. Explain the role of the sphincters and valves in the digestive system, including at least two specific examples.</td>
<td>Gastric secretory glands</td>
</tr>
<tr>
<td>9. Summarize the role of the hepatic portal system of the liver and how it interconnects the digestive and cardiovascular systems.</td>
<td>Chyme</td>
</tr>
<tr>
<td>10. Describe the relationship between the gallbladder and the liver.</td>
<td>Bile</td>
</tr>
<tr>
<td>11. Differentiate between the structures and functions of the exocrine and endocrine components of the pancreas.</td>
<td>Bile duct</td>
</tr>
<tr>
<td>12. Sketch and label a picture of the three subdivisions of the small intestine AND the three major sections of the large intestine and briefly describe the unique roles of each.</td>
<td>Segmentation</td>
</tr>
<tr>
<td>13. Summarize the role bacteria in the colon play in the digestive process.</td>
<td>Mesentery</td>
</tr>
<tr>
<td>14. Summarize how the digestive process is regulated, including examples of stimuli and the key structures where regulation occurs.</td>
<td>Enteric nervous system</td>
</tr>
<tr>
<td>15. Describe three examples of health issues/diseases that result from a failure to maintain homeostasis in the digestive system.</td>
<td></td>
</tr>
<tr>
<td>16. <strong>Be able to identify the name and summarize the function of a structure of the digestive system when given a description, picture or physical specimen to reference.</strong></td>
<td></td>
</tr>
</tbody>
</table>

## Concept 2: Nutrition and Metabolism

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Summarize the role of each of the essential nutrients in the body.</td>
<td>Nutrients</td>
</tr>
<tr>
<td>2. Explain where we get carbohydrates, lipids, and proteins from in our diet and how they get digested in the body, including essential enzymes and locations of the breakdown process.</td>
<td>Calories, Vitamins, Minerals, Metabolism</td>
</tr>
</tbody>
</table>
Concept 1 Notes: The Digestive System

Questions/Vocabulary

Overview

Digestion

Ingestion

Propulsion
Mechanical breakdown

Chemical digestion

Absorption

Defecation
Histology of the GI Tract

Day 2

Digestive Enzymes

<table>
<thead>
<tr>
<th>Digestive enzymes</th>
<th>What they digest</th>
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</tbody>
</table>
Describe the critical role the digestive system plays in maintaining homeostasis and how at least 3 other body systems work alongside the digestive system to accomplish this role.
Day 3-5

Project: Digestive System Children’s Book

Overview: We all know that we have to eat in order to stay alive, but what fewer people really understand is how our bodies actually process and use the food that we eat. In this project, you will create a children’s book on the digestive system to creatively demonstrate your understanding of the system and process, while also helping to educate someone else! Your book must be written in a voice that is appropriate for an 8-10 year old to read and understand, so you have to know the content well enough to be able to simplify it, yet still explain it correctly. The goal is to be scientifically accurate in your content and creatively engaging in your storyline and illustrations.

Book Requirements:

☐ Cover page with a title and relevant illustration
☐ Minimum of 10 pages – and each page must include an illustration along with words
☐ Purpose of digestion process (think – why can’t we just use the food we eat, as is?)
☐ Scientific explanation of each step in the digestive system, including:
  o Ingestion
  o Propulsion
  o Mechanical breakdown
  o Chemical digestion
  o Absorption
  o Defecation
☐ Demonstrates a clear understanding of the role each structure plays in digestion, including:
  o Mouth
  o Pharynx
  o Esophagus
  o Stomach
  o Small intestine
  o Large intestine
  o Liver
  o Gallbladder
  o Pancreas
☐ Maintains scientific accuracy but still is written as a story, with an appropriate voice for a children’s book for an 8-10 year old
☐ Creative, neat, colorful, relevant, and appropriate illustrations to support the storyline included on every page
☐ All information must be accurate, informative, and clear
☐ All content was written in the student’s own words and all illustrations were uniquely created by the student
☐ Neatly written or typed using correct spelling and grammar

Evaluation: On the following page, you can find the rubric that will be used to evaluate this project. This will count as a 100-point grade. The main components you will be graded on are:

- Content (40 pts)
- Illustrations (40 pts)
- Overall Project (20 pts)

Due: ____________________________
# Digestive System Children’s Book Project Rubric

<table>
<thead>
<tr>
<th>Day 3-5</th>
<th>Excellent (40 points)</th>
<th>Satisfactory (39-30 points)</th>
<th>Needs Improvement (29-15 points)</th>
<th>Unacceptable (14-0 points)</th>
</tr>
</thead>
</table>
| **Content (40)** | • All content is scientifically accurate and thorough, yet simplified and clear.  
• Content is creatively written with a storyline that would be engaging and appropriate for an 8-10 year old children’s book.  
• Everything on the list of required content is fully covered.  
• Writing shows a clear understanding of the content. | • The majority of the content is scientifically accurate and thorough, yet simplified and clear.  
• Content is creatively written with a storyline that would be engaging and appropriate for an 8-10 year old children’s book.  
• The list of required content is mostly covered.  
• Writing shows an understanding of the content. | • Some of the content is scientifically accurate and thorough, yet simplified and clear.  
• Content may or may not be creatively written with a storyline that would be engaging and appropriate for an 8-10 year old children’s book.  
• The list of required content is somewhat covered.  
• Writing shows somewhat of an understanding of the content. | • Most of the content is NOT scientifically accurate and thorough, and/or simplified and clear.  
• Content is not creatively written with a storyline that would be engaging and/or appropriate for an 8-10 year old children’s book.  
• The list of required content is minimally covered.  
• Writing shows minimal understanding of the content. |
| **Illustrations (40)** | • Illustrations are included on every page.  
• All illustrations are creative, neat, colorful, and relevant.  
• All illustrations support the content and were uniquely created by the student. | • Illustrations are included on most pages.  
• Most illustrations are creative, neat, colorful, and relevant.  
• Most illustrations support the content and were uniquely created by the student. | • Illustrations are included on some of the pages.  
• Some of the illustrations are creative, neat, colorful, and relevant.  
• Some of the illustrations support the content and were uniquely created by the student. | • Illustrations are not included on most of the pages.  
• The majority of the illustrations are NOT creative, neat, colorful, and/or relevant.  
• The majority of the illustrations do NOT support the content and were NOT uniquely created by the student. |
| **Overall (20)** | • Book is neatly assembled, with a minimum of 10 pages and a cover page that has a title and illustration.  
• Overall work is neat, colorful, relevant, and visually appealing.  
• Overall work is accurate, informative, and clear, with no spelling or grammatical errors.  
• Work stands out from the rest and shows evidence of extra effort. | • Book is neatly assembled, with a minimum of 10 pages and may or may not have a cover page that has a title and illustration.  
• Overall work is mostly neat, colorful, relevant, and visually appealing.  
• Overall work is mostly accurate, informative, and clear, with few spelling or grammatical errors.  
• Work shows evidence of good effort. | • Book is not neatly assembled with a minimum of 10 pages and may or may not have a cover page that has a title and illustration.  
• Overall work is somewhat neat, colorful, relevant, and visually appealing.  
• Overall work is somewhat accurate, informative, and/or clear, with a few spelling or grammatical errors.  
• Work shows evidence of minimal effort. | • Book is not neatly assembled with a minimum of 10 pages and may or may not have a cover page that has a title and illustration.  
• Overall work is NOT neat, colorful, relevant, and/or visually appealing.  
• Overall work is NOT accurate, informative, and/or clear, and has spelling and/or grammatical errors.  
• Work demonstrates a lack of effort put into its completion. |

Total Score = ______  

Absorption and Excretion Unit  
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