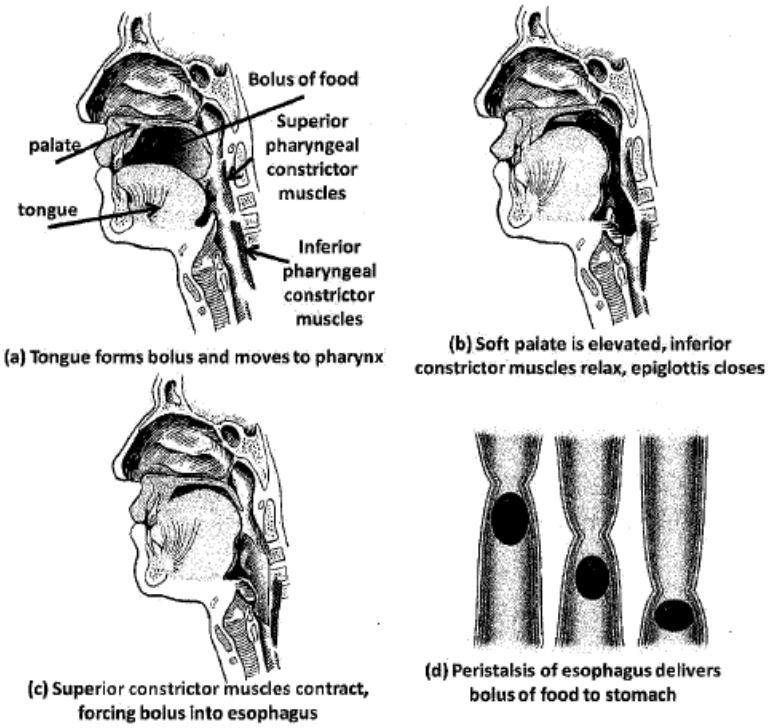
Modeling the Digestive System

Name: _____

Model 1: The Swallowing Reflex



Critical Thinking Questions

1. Part (a) of the model shows **Phase 1** of the swallowing reflex. What muscular organ is responsible for forming the **bolus** or ball of food and moving it into the pharynx?

   a. Is this organ made of cardiac, smooth, or skeletal muscle?

   b. Is this muscle type voluntary or involuntary?

   c. Is Phase 1 of the swallowing reflex voluntary or involuntary?

2. Parts (b) and (c) comprise **Phase 2** of the swallowing reflex. What structure in the pharynx closes off the trachea and prevents choking?

   a. In the first Part of Phase 2, do the inferior pharyngeal constrictor muscle contract or relax?

   b. What will this do to the esophagus?

   c. After the food moves into the upper esophagus, what do the superior constrictor muscles do?

   d. What will this cause the bolus of food to do?

3. Part (d) of the model shows **Phase 3** of the swallowing reflex. What type of specialized muscle contraction moves food through the esophagus and to the stomach?

   a. Can you stop swallowing once you've started? [try it if you need to]

   b. Based on this, are Phases 2 and 3 voluntary or involuntary?

Application

4. You are examining the histology of the esophagus and pharynx. You notice a great deal of skeletal muscle in your slide. Explain which end of the GI tract your are examining and how you know this based solely on the presence of skeletal muscle.

Model 2: Components of Gastric Juice [memorize this!]

Component	Source	Function
Pepsinogen	Chief cells of gastric glands	Precursor to pepsin
Pepsin	Made from pepsinogen in the presence of HCl	Protein-splitting enzyme that breaks down nearly all dietary protein
Hydrochloric acid	Parietal cells of gastric glands	Denatures proteins and causes pepsinogen to be converted to pepsin
Mucus	Goblet cells, mucous neck cells (glands)	Forms a thick alkaline protective layer over the gastric mucosa (stomach wall)
Intrinsic factor	Parietal cells of gastric glands	Essential for the absorption of vitamin B_{12}
Gastrin (hormone)	G-cells of gastric glands	Stimulates gastric glands to release more gastric juice, makes stomach churn

Critical Thinking Questions

5. Fill in the following concept map:

_____ →secrete _____ → is converted to _____
(cells) (precursor) (active enzyme)

6. What two substances are secreted by the parietal cells of the gastric glands?

   a. Write the functions of the substances next to their name.

7. What provides the protective barrier that keeps you from digesting your own stomach?

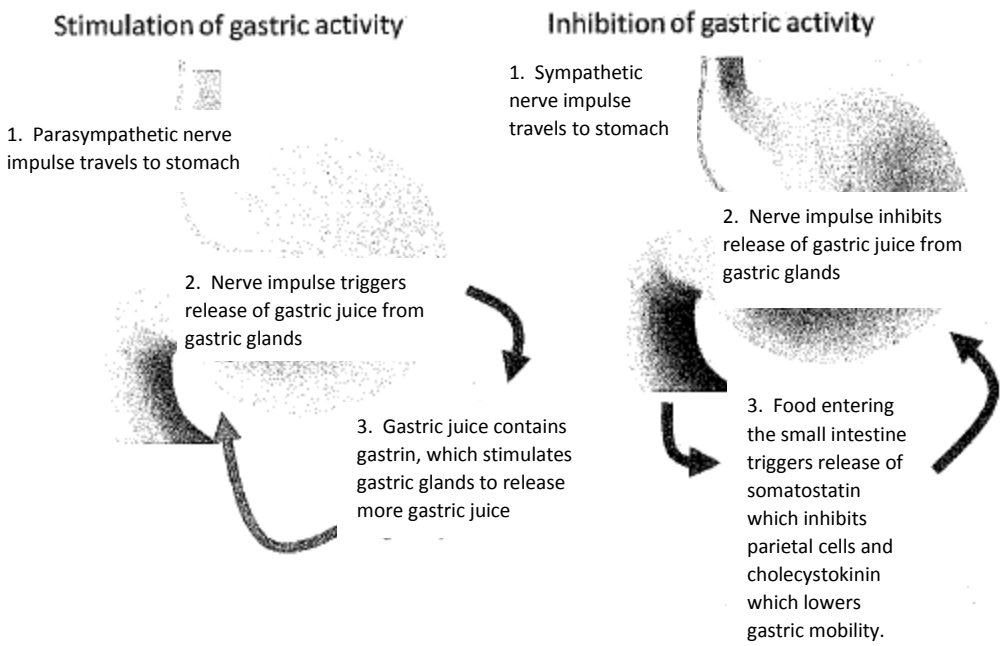
a. Where is it produced?

Application

8. A deficiency of one of the components listed above can result in a gastric ulcer, or erosion. Which substance is it?

9. A deficiency of another gastric juice component can result in anemia, which one?

Model 3: Regulation of Gastric Secretion

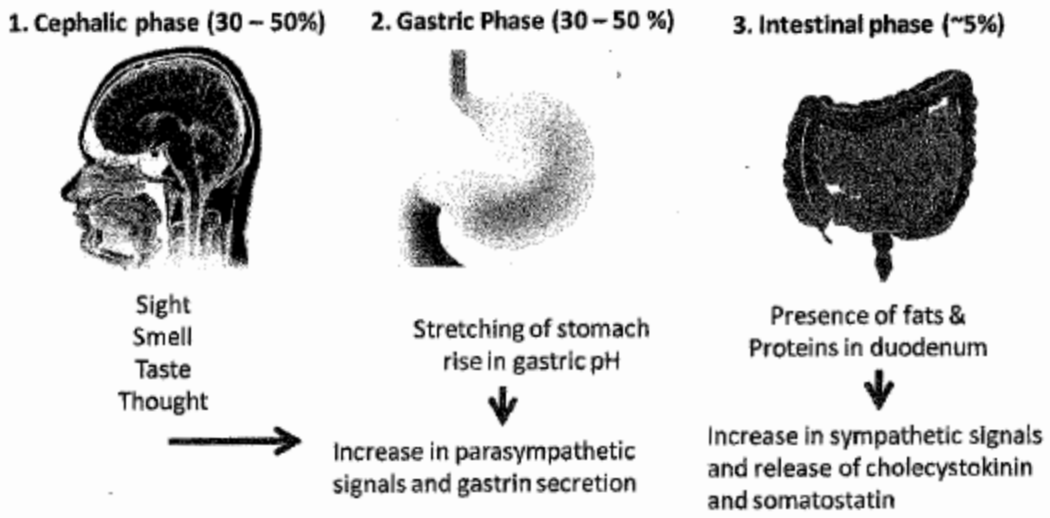


10. Which branch of the autonomic nervous system will stimulate gastric secretion and mobility?

a. Which branch will inhibit gastric secretion and mobility?

11. According to the model, there is one hormone that stimulates gastric activity and two hormones that inhibit gastric activity. In the space below list those hormones and their effects on the stomach.

Model 4: The Three Phases of Gastric Secretion



Critical Thinking Questions

12. When your tummy rumbles and your mouth waters because you are thinking about your favorite food, which Phase of gastric secretion is being activated?

    a. What percentage of total gastric secretion can be accounted for by this Phase?

13. What are the two triggers that initiate the gastric Phase of gastric secretion?

    a. What does your group think will cause the gastric pH to rise?

    b. What percentage of total gastric secretion can be accounted for by this Phase?

14. Does the intestinal Phase stimulate gastric secretion or inhibit it? Hint: think about what sympathetic signaling and those two hormones do]

Application

15. Based on what you know about how food enters the stomach and how gastric secretion is regulated, answer the following as a group: Why is it easier to overeat if you eat really fast?