Chapter 12

Ingestive Behavior

PSY 627

BARDO

Drinking

a. fluid compartments
b. osmometric thirst
c. volumetric thirst

Eating

a. energy sources
b. starting a meal
c. stopping a meal
d. eating disorders

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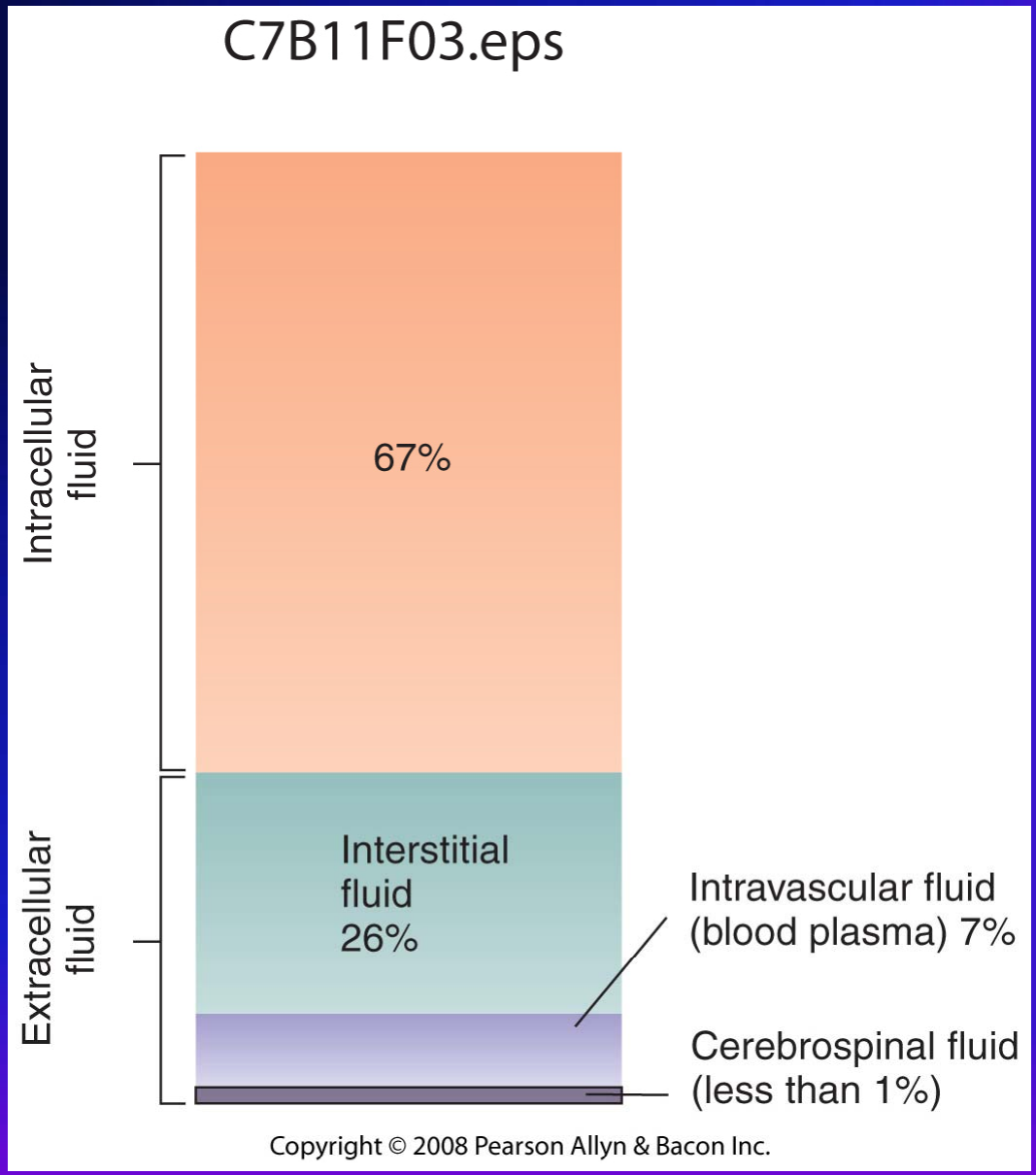
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Intracellular fluid
67%
Extracellular fluid
Interstitial fluid 26%
Intravascular fluid (blood plasma) 7%
Cerebrospinal fluid (less than 1%)
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- Intracellular fluid
  - Fluid contained within cells.
- Extracellular fluid
  - All body fluids outside cells: interstitial fluid, blood plasma, and cerebrospinal fluid.
- Interstitial fluid
  - Fluid that fills the space between cells.
- Isotonic
  - Equal in osmotic pressure to the contents of a cell. A cell placed in isotonic solution neither gains nor loses water.

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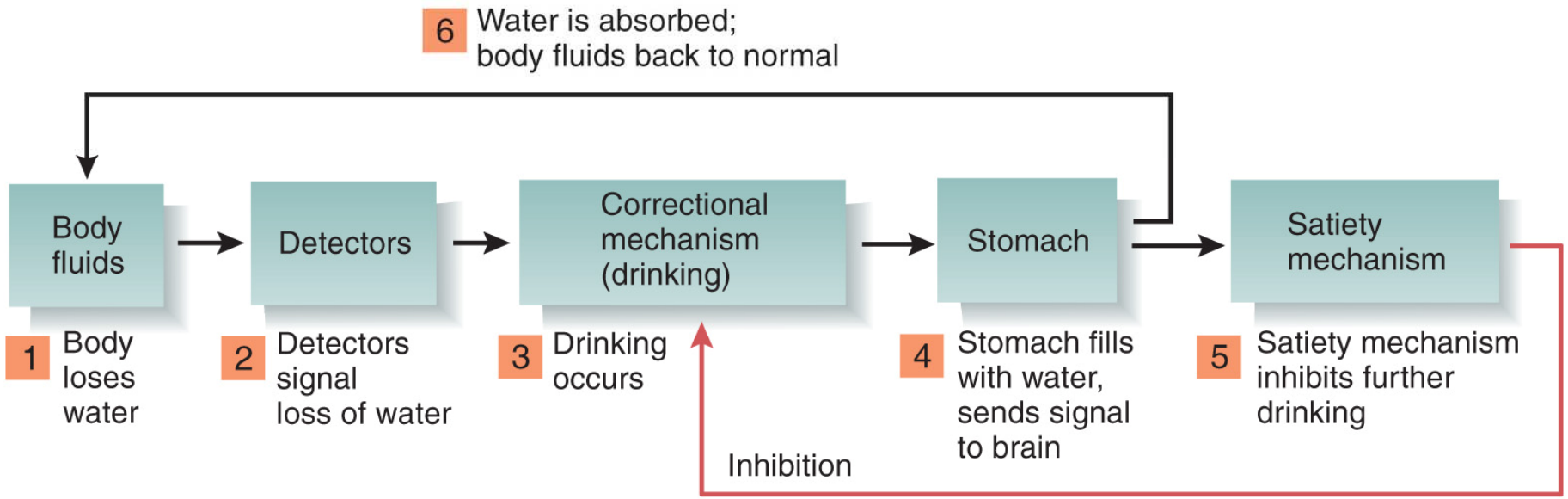

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- Negative feedback
  - Process where the effect produced by an action serves to terminate that action.
- Satiety mechanism
  - Brain mechanism that causes cessation of hunger or thirst, produced by adequate and available supplies of nutrients or water.

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- Osmometric thirst
  - Thirst produced by an increase in the osmotic pressure of the interstitial fluid relative to the intracellular fluid, thus producing cellular dehydration.
- Volumetric Thirst
  - Thirst caused by hypovolemia; occurs when the volume of the blood plasma decreases.

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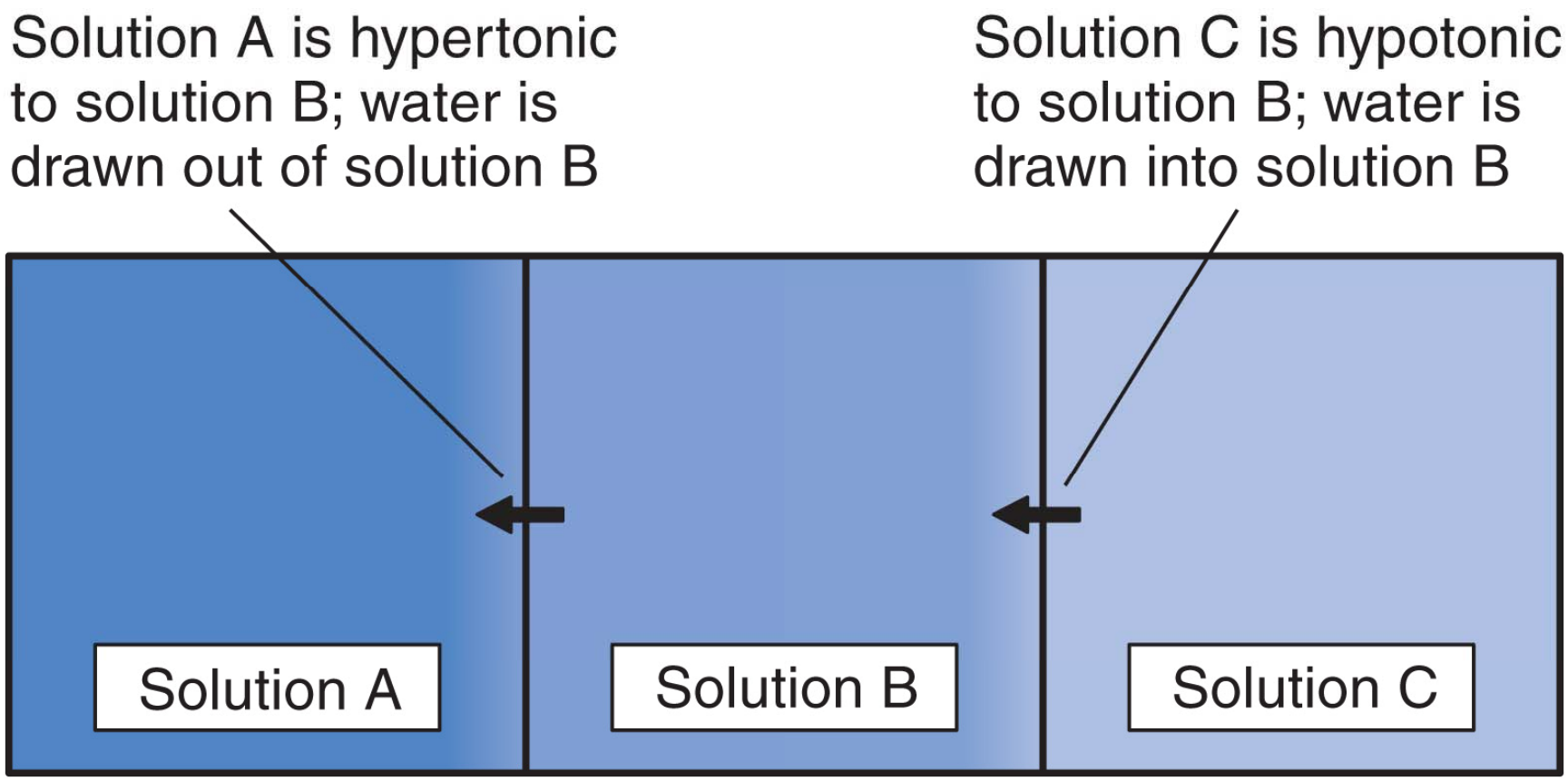

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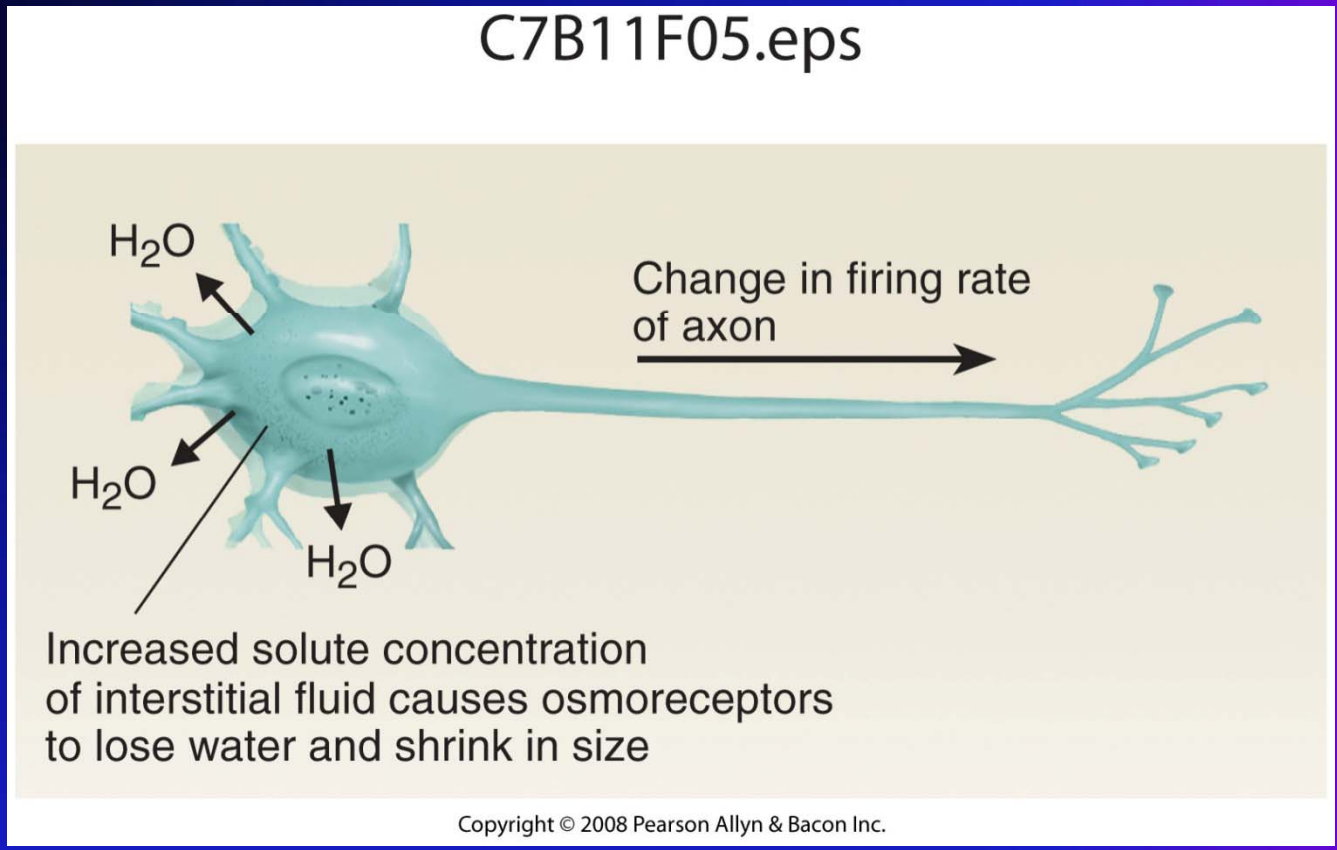

Osmoreceptor

Neuron that detects changes in the solute concentration of the interstitial fluid that surrounds it. Found primarily in hypothalamus, including subfornical organ.

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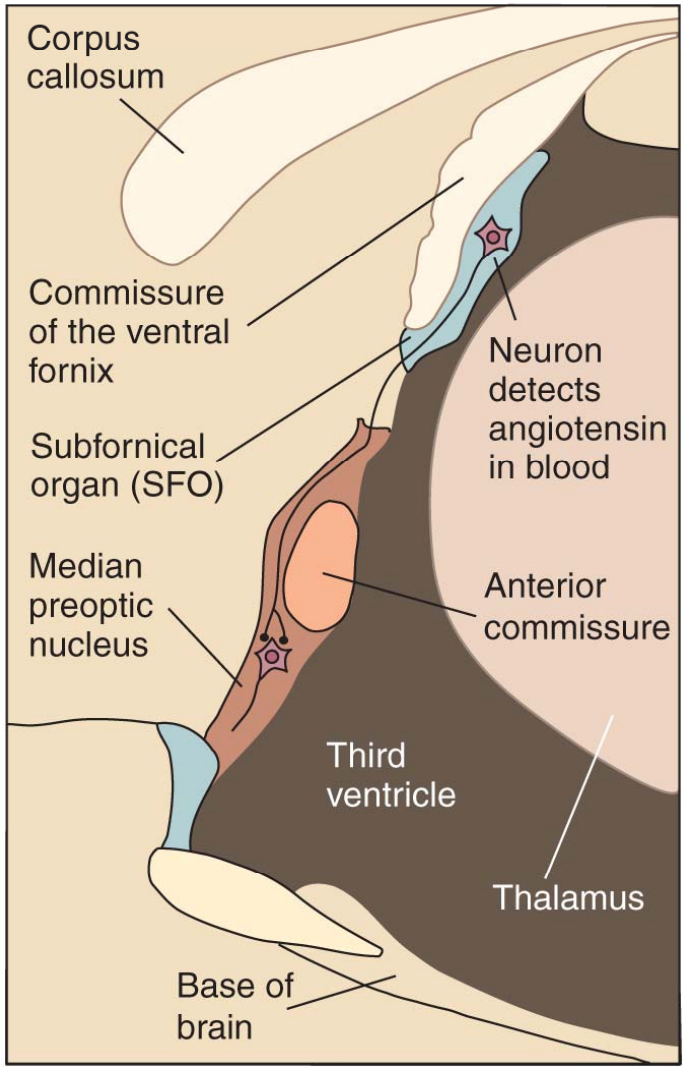

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- Hypovolemia
  - Reduction in the volume of the intravascular fluid.
- Renin
  - Hormone secreted by the kidneys that causes the conversion of angiotensinogen in the blood into angiotensin.

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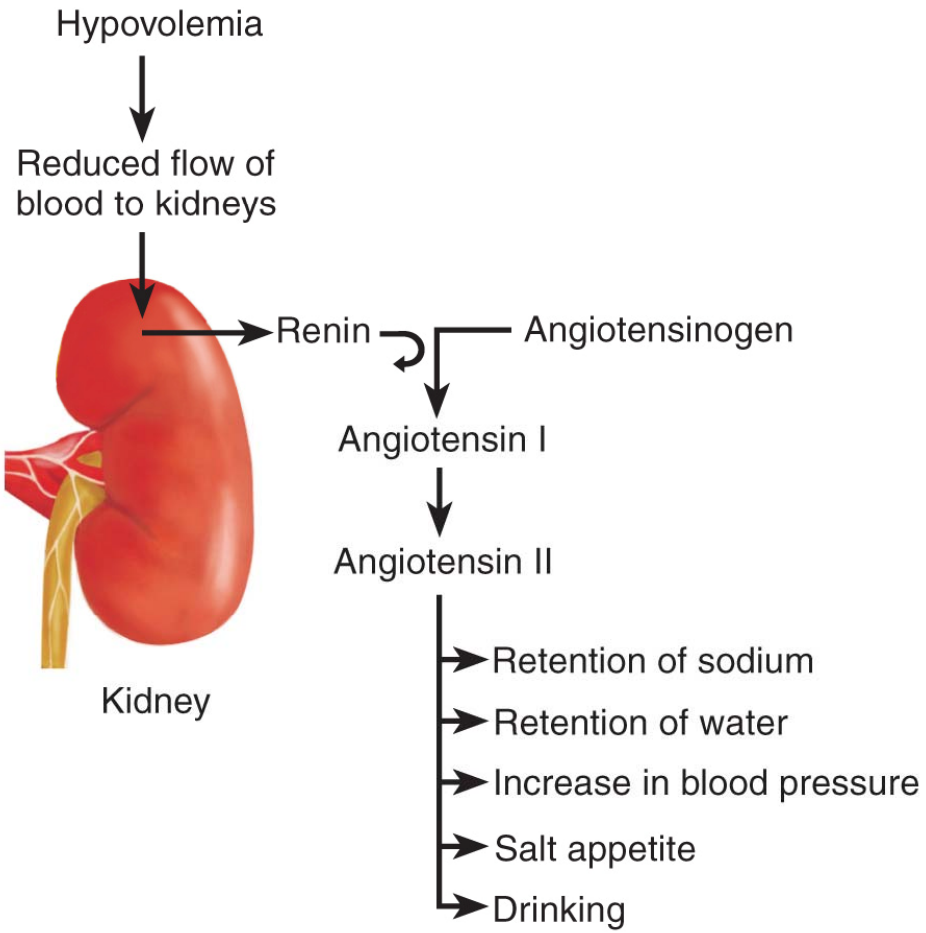

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- Subfornical organ (SFO)
  - Small organ located near lateral ventricles; contains neurons that detect the presence of angiotensin in the blood and excites neural circuits that initiate drinking.
- Median preoptic nucleus
  - A small nucleus near the anterior commissure; plays a role in thirst stimulated by angiotensin.

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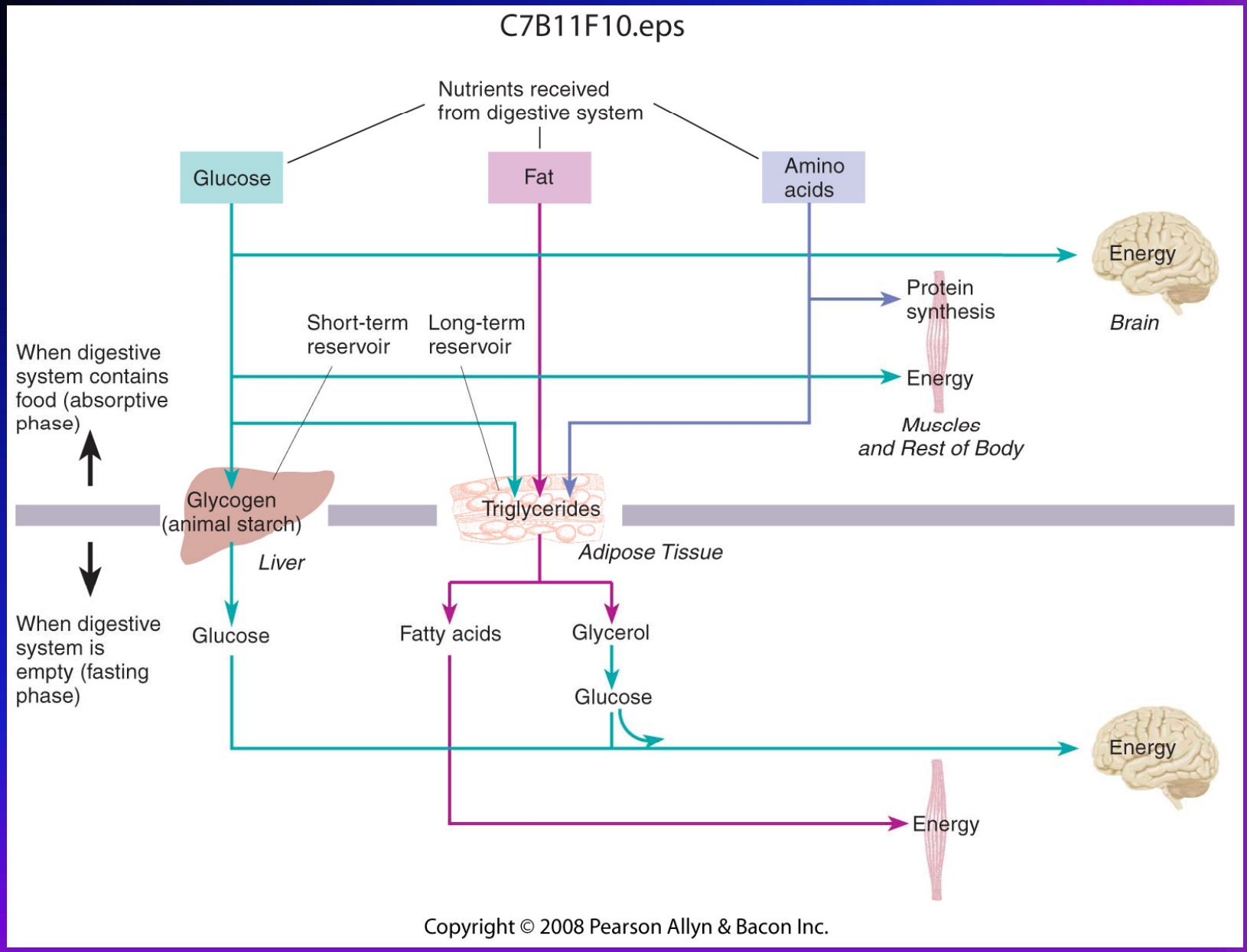
- Fasting phase
  - Phase in which nutrients are not available from the digestive system; glucose, amino acids, and fatty acids are derived from glycogen, protein, and adipose tissue.

- Absorptive phase
  - Phase in which nutrients are absorbed from the digestive system; glucose and amino acids constitute the principal source of energy for cells during this phase, and excess nutrients are stored in adipose tissue in the form of triglycerides.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Nutrients received from digestive system
Glucose
Fat
Amino acids
Energy
Brain
Protein synthesis
Short-term reservoir
Long-term reservoir
When digestive system contains food (absorptive phase)
Energy
Muscles and Rest of Body
Glycogen (animal starch)
Liver
Triglycerides
Adipose Tissue
When digestive system is empty (fasting phase)
Glucose
Fatty acids
Glycerol
Glucose
Energy
Energy
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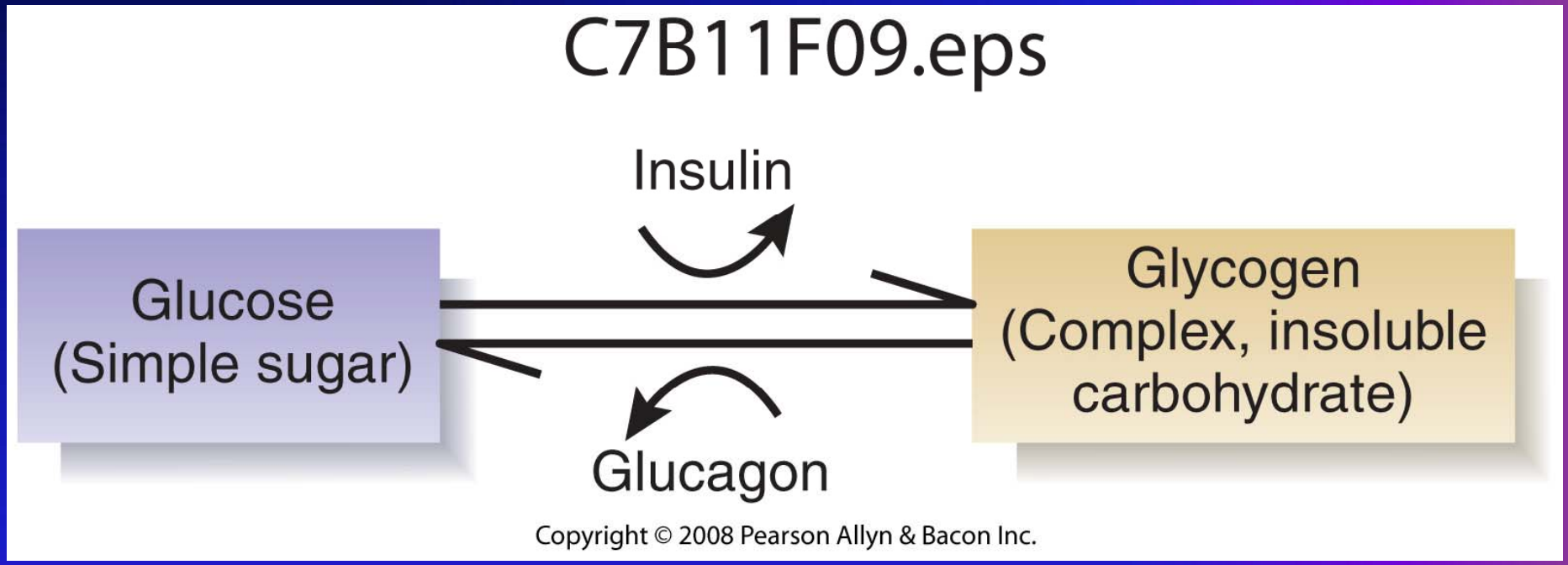
- Triglyceride
  - Form of fat storage in adipose cells.
- Glycerol
  - Substance derived from the breakdown of triglyceride; can be converted by the liver into glucose.
- Fatty acid
  - Substance derived from the breakdown of triglyceride; can be metabolized by most cells of the body except for the brain.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Insulin
Glucose
(Simple sugar)
Glycogen
(Complex, insoluble
carbohydrate)
Glucagon
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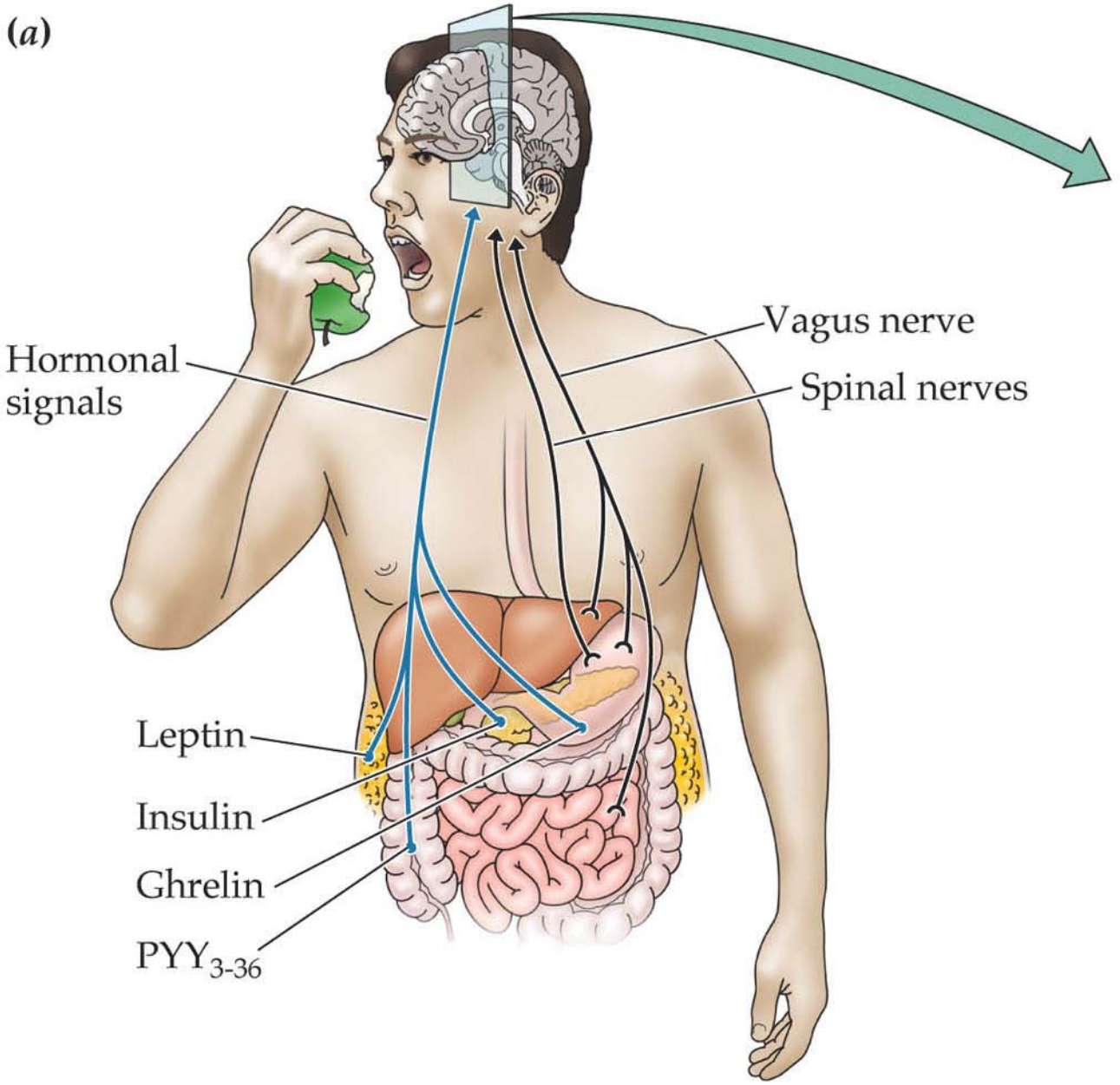
- Glycogen
  - Polysaccharide stored in liver and muscle; constitutes the short-term store of nutrients.
- Insulin
  - Pancreatic hormone that facilitates entry of glucose into cells, conversion of glucose into glycogen, and transport of fats into adipose tissue.
- Glucagon
  - Pancreatic hormone that promotes the conversion of liver glycogen into glucose.



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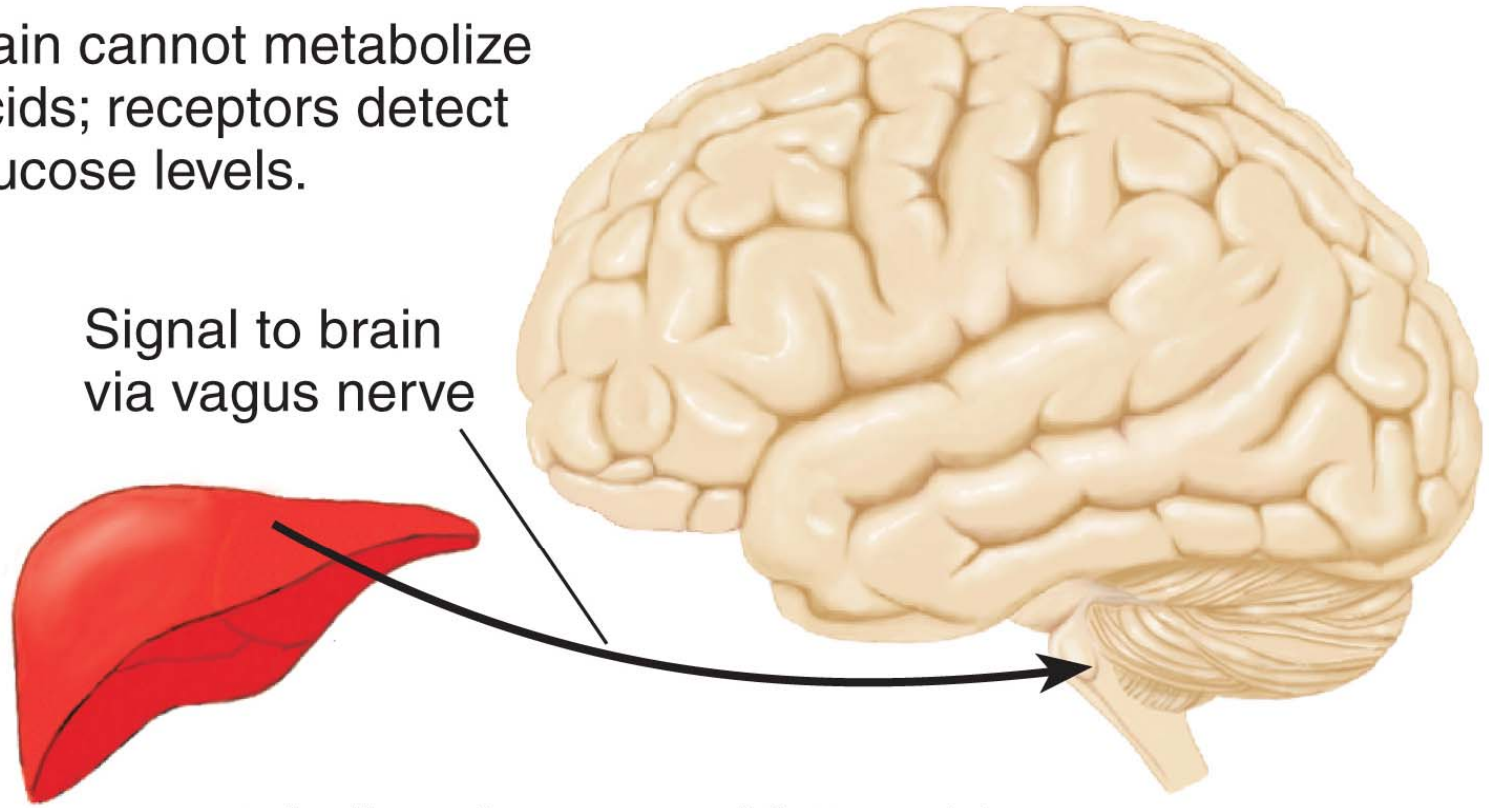
The brain cannot metabolize fatty acids; receptors detect only glucose levels.



The liver can metabolize glucose and fatty acids; receptors detect levels of both nutrients.

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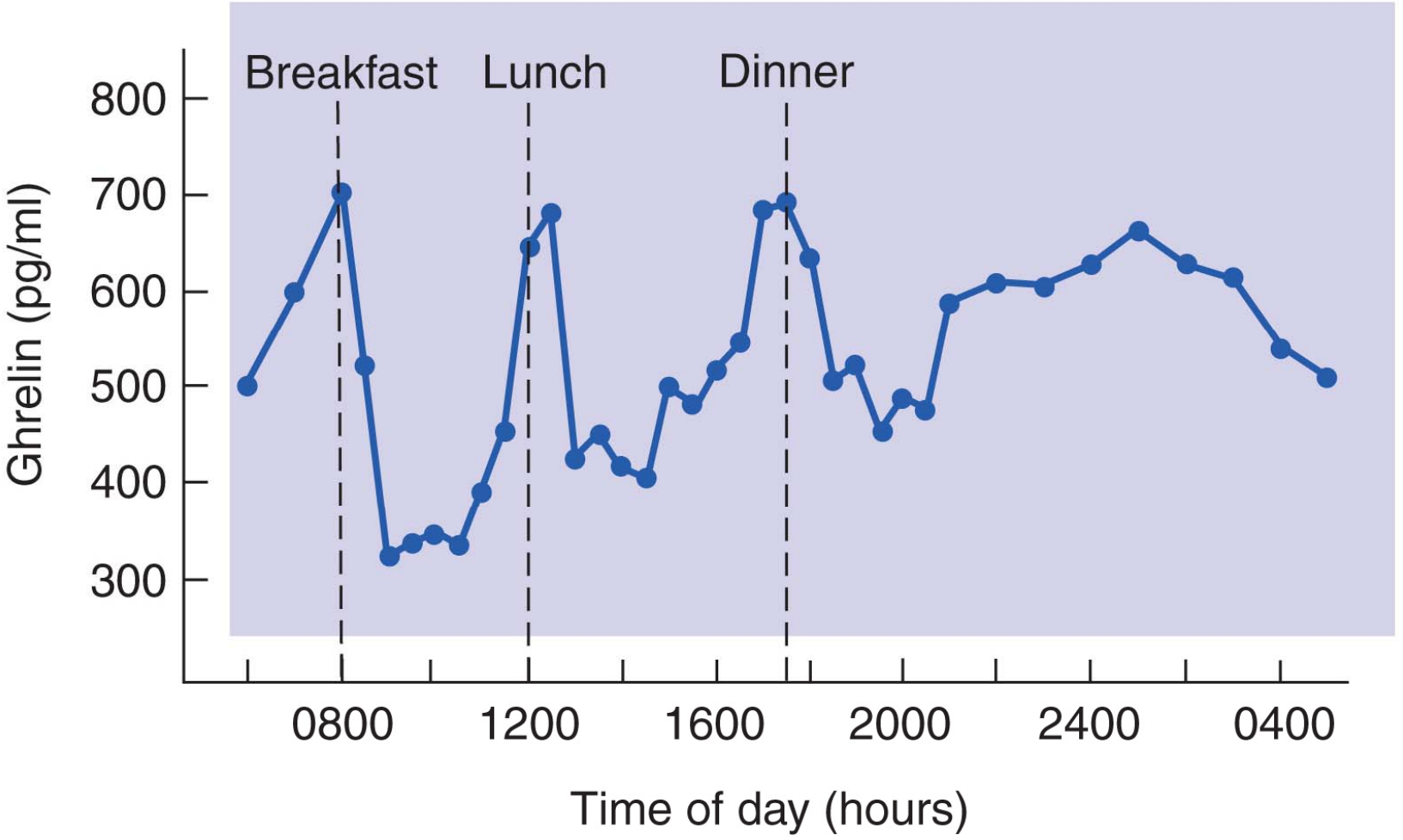

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- What Starts a Meal?
  - Site of food
  - Social and conditioned factors
  - Ghrelin
    - Peptide hormone released by the stomach that increases eating, also produced by neurons in brain.
  - Glucoprivation
    - Fall in level of glucose available to cells.

- Arcuate nucleus
  - Nucleus in hypothalamus that controls secretions of the anterior pituitary gland; contains **neuropeptide Y** secreting neurons involved in feeding and control of metabolism.
- Paraventricular nucleus
  - Nucleus in hypothalamus that contains neurons involved in control of the autonomic nervous system and the posterior pituitary gland.

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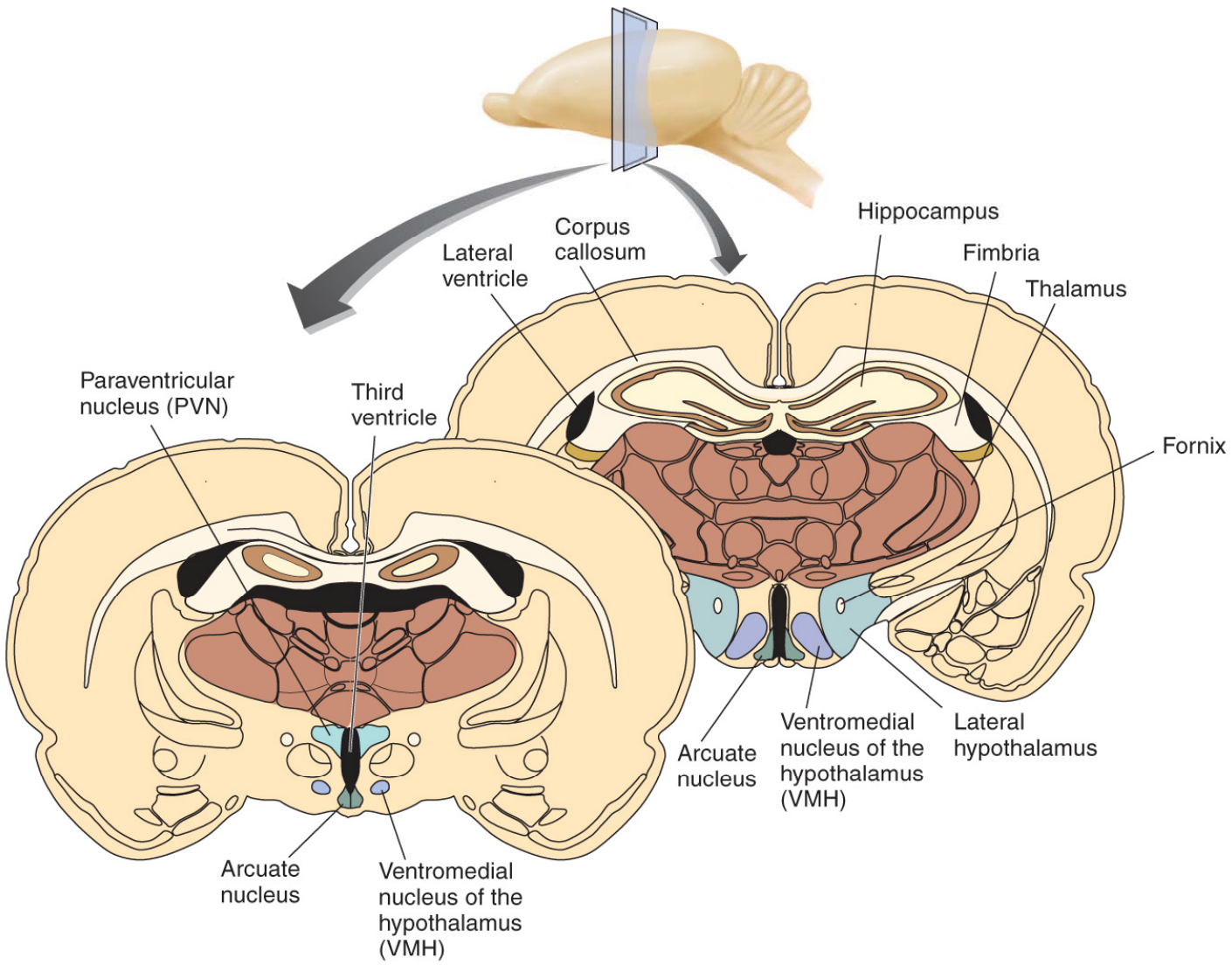

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Neuropeptide Y (NPY)

- Neurotransmitter found in neurons of arcuate nucleus that stimulates feeding and insulin secretion.

- Melanin-concentrating hormone (MCH)
  - Neurotransmitter found in lateral hypothalamic neurons that stimulate appetite and reduce metabolic rate.
- Orexin
  - Neurotransmitter found in lateral hypothalamic neurons that stimulate appetite and reduce metabolic rate.

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- What Stops a Meal?

Cholecystokinin

- Hormone secreted by duodenum that regulates gastric motility and causes the gallbladder to contract; appears to provide a satiety signal transmitted to the brain through the vagus nerve.

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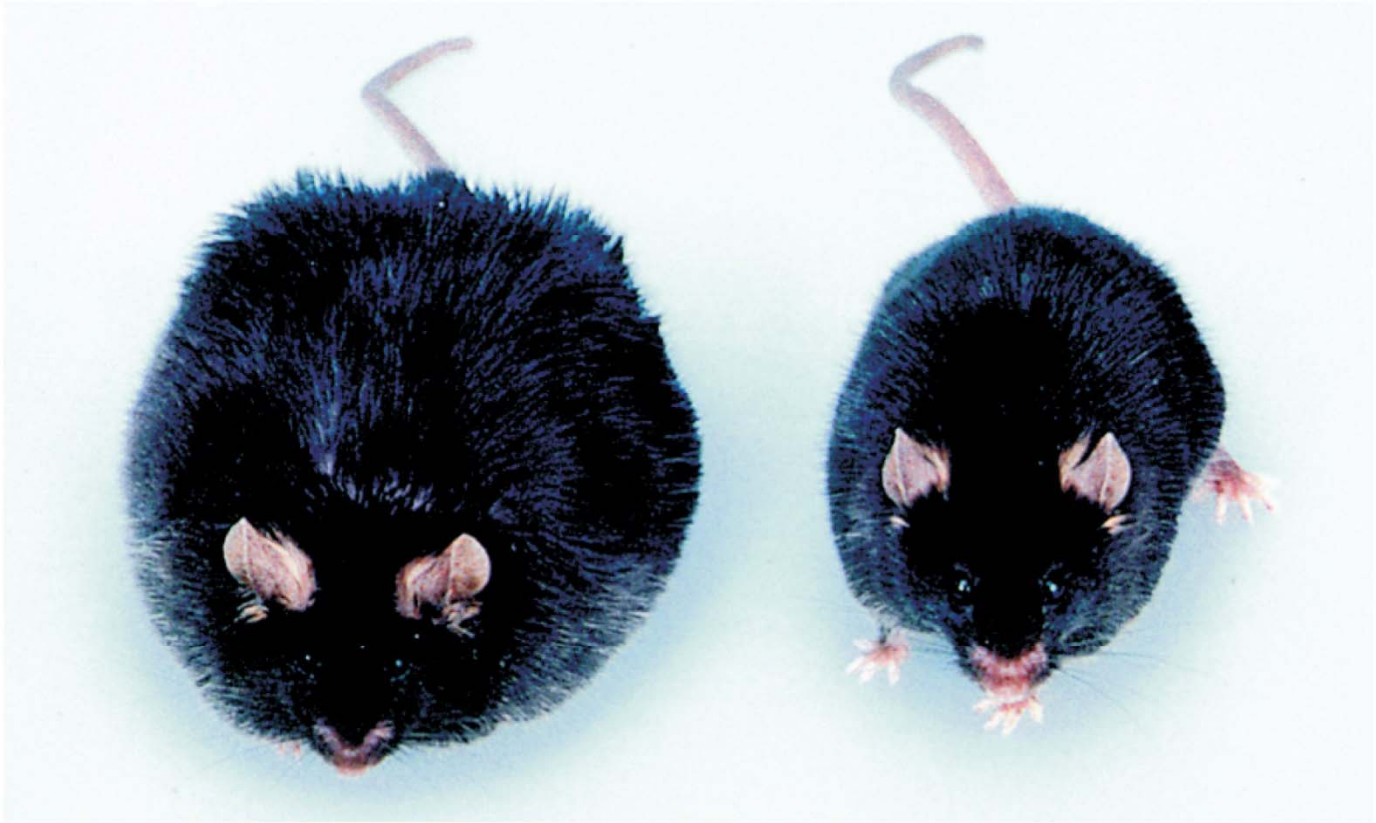

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Ob mouse

A strain of mice whose obesity and low metabolic rate is caused by a mutation that prevents the production of leptin.

Leptin

- Hormone secreted by adipose tissue; decreases food intake and increases metabolic rate, primarily by inhibiting NPY-secreting neurons in the arcuate nucleus.

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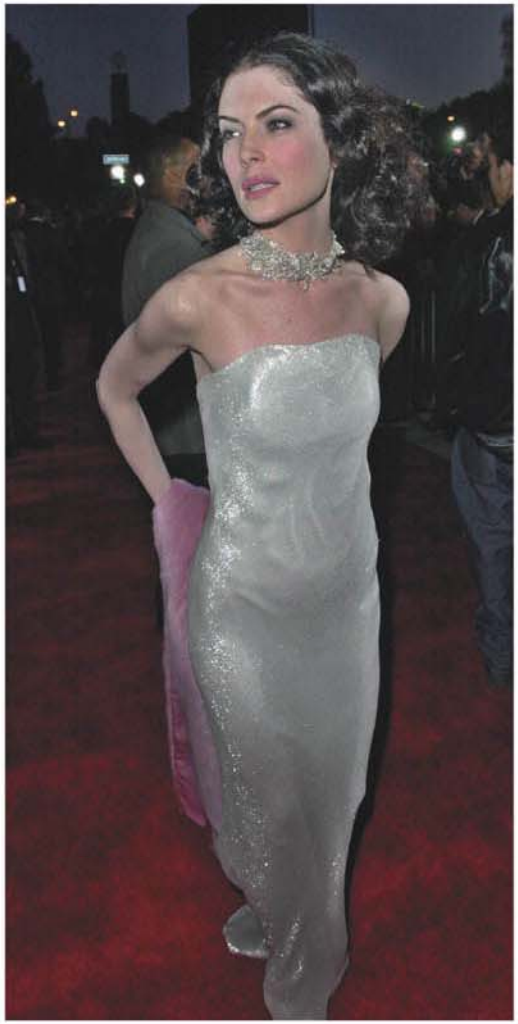
(*a*)



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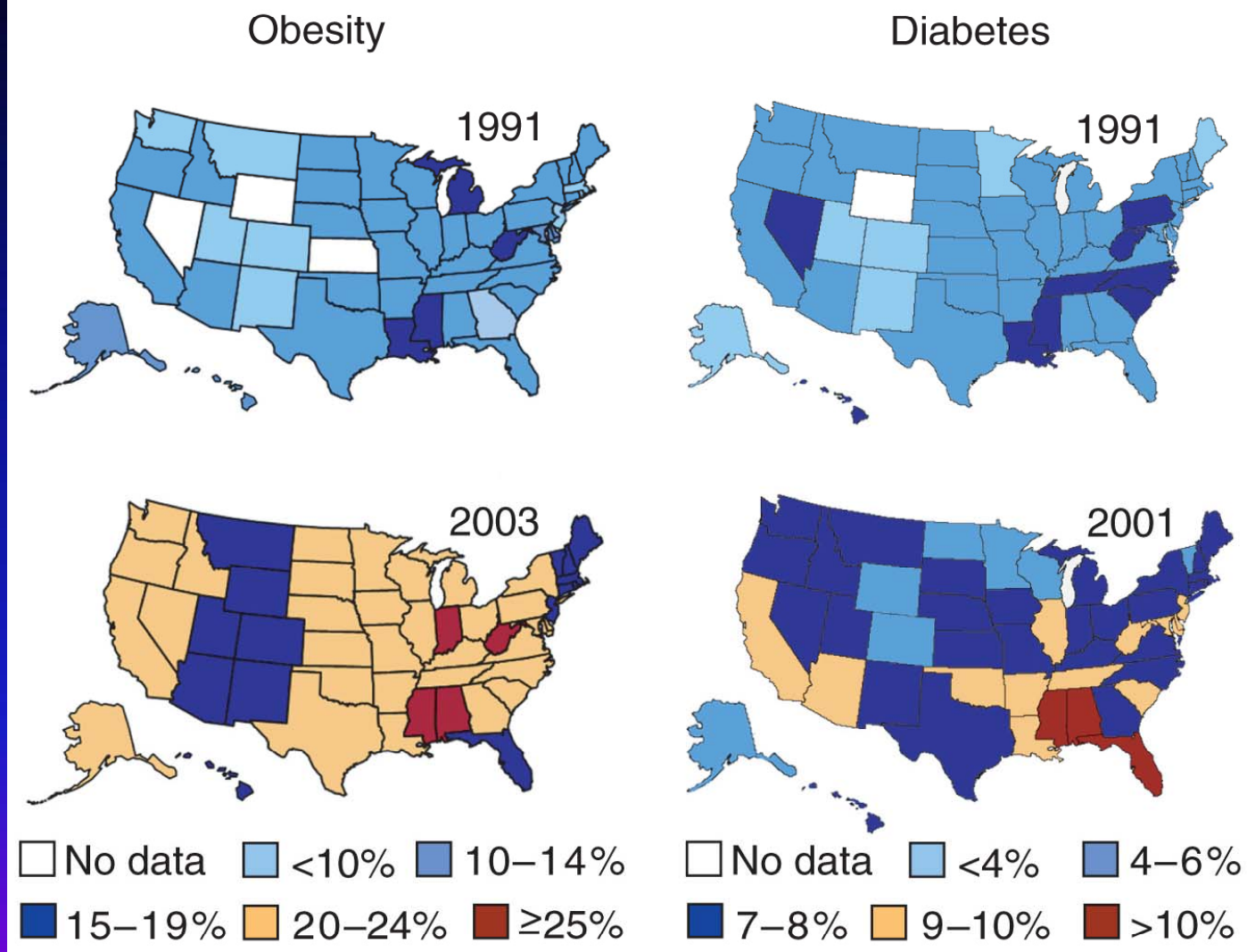

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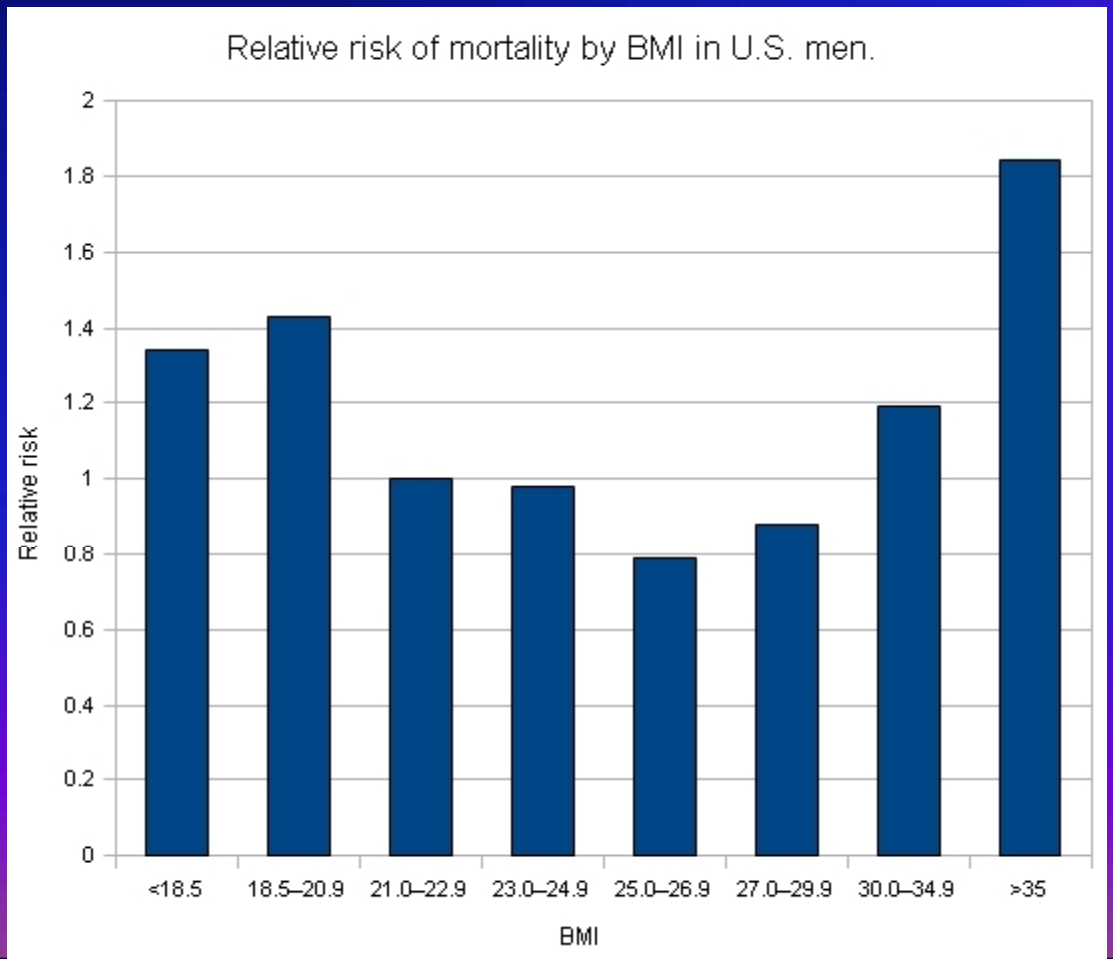
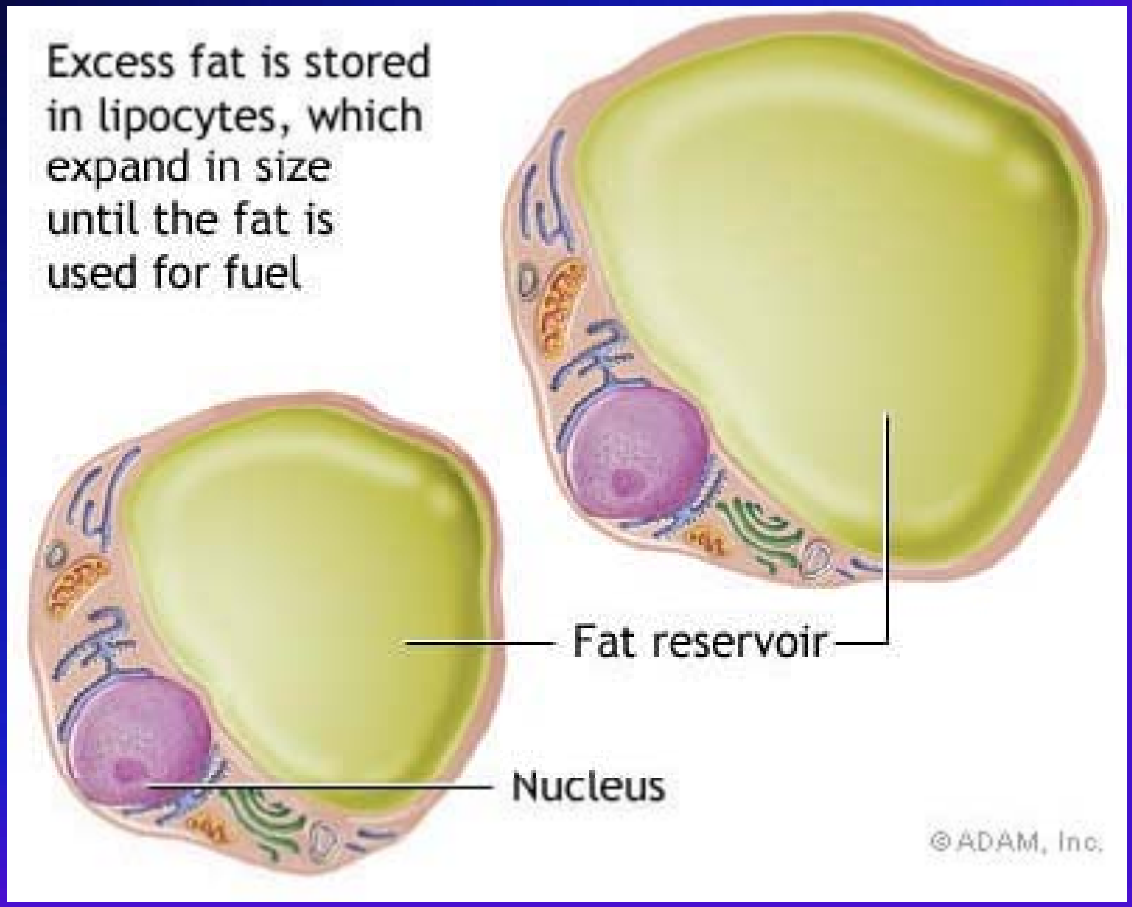
$BMI = mass\ (kg)/[height\ (m)]^2$

BMI	Classification
< 18.5	underweight
18.5–24.9	normal weight
25.0–29.9	overweight
30.0–34.9	class I obesity
35.0–39.9	class II obesity
≥ 40.0	class III obesity

BMI invented in 1850 by Belgian “social physicist” Adolphe Quetelet

BMI of 47 kg/m^2: weight 146 kg (322 lb), height 177 cm (5 ft 10 in)




Excess fat is stored in lipocytes, which expand in size until the fat is used for fuel
Fat reservoir
Nucleus
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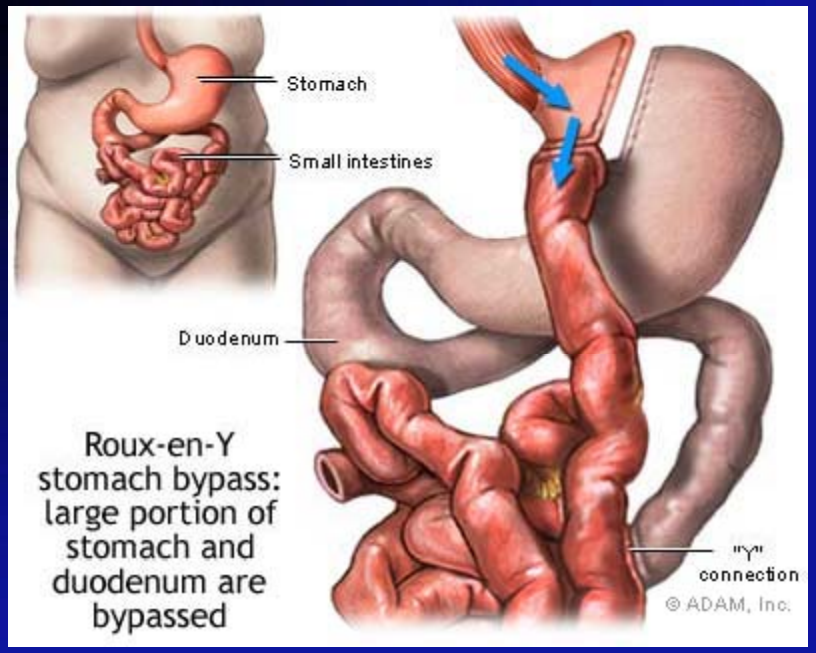
Stomach
Small intestines
Duodenum
"Y" connection
Roux-en-Y stomach bypass: large portion of stomach and duodenum are bypassed
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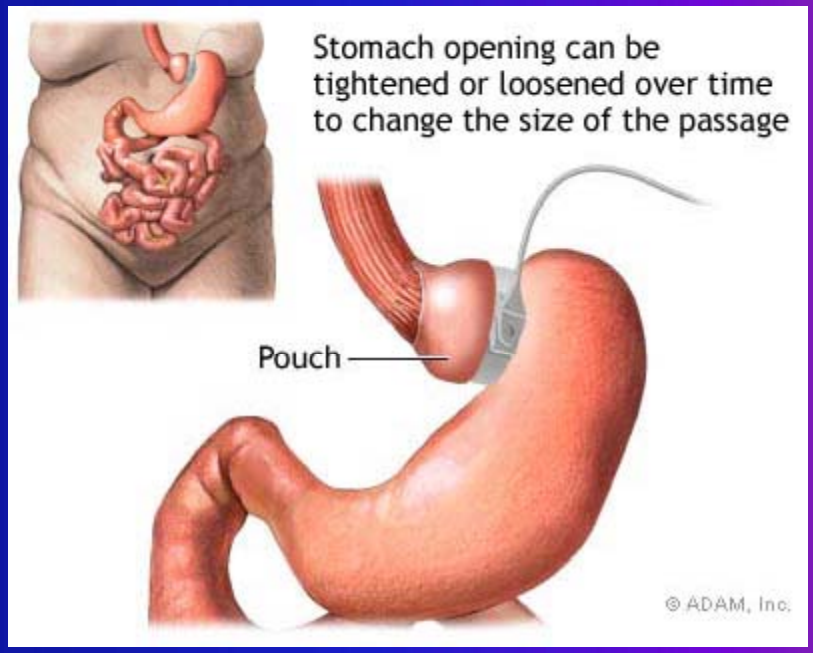
Stomach opening can be tightened or loosened over time to change the size of the passage
Pouch
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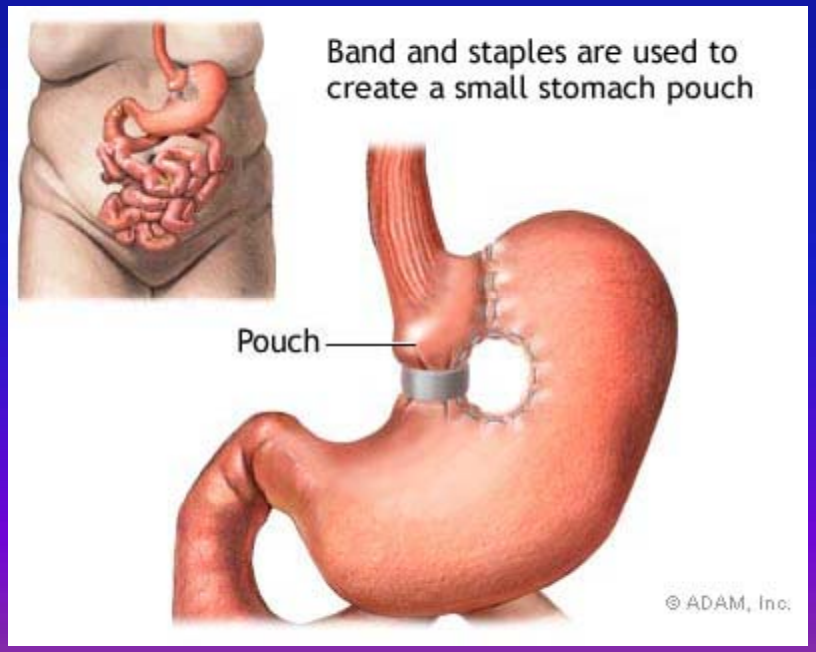
Band and staples are used to create a small stomach pouch
Pouch
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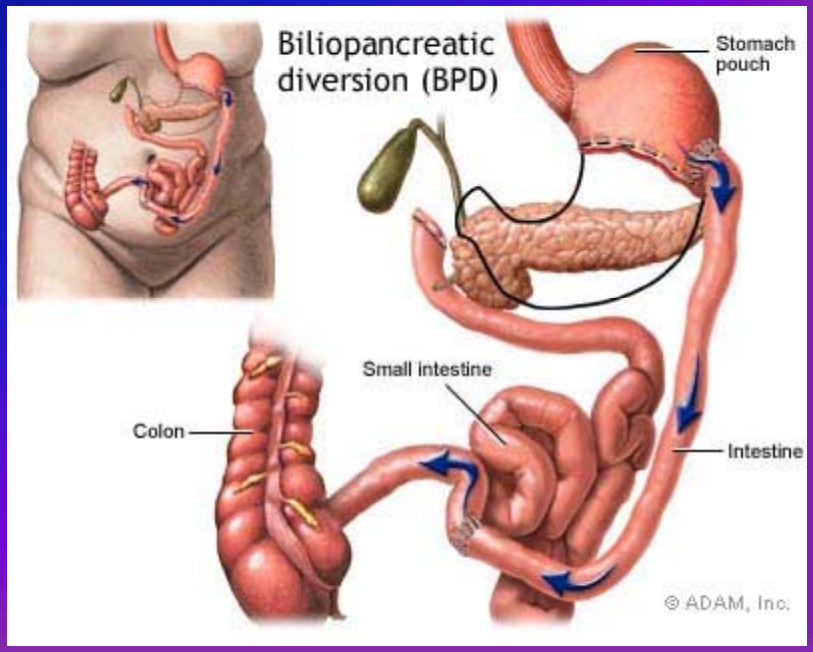
Biliopancreatic diversion (BPD)
Stomach pouch
Small intestine
Colon
Intestine
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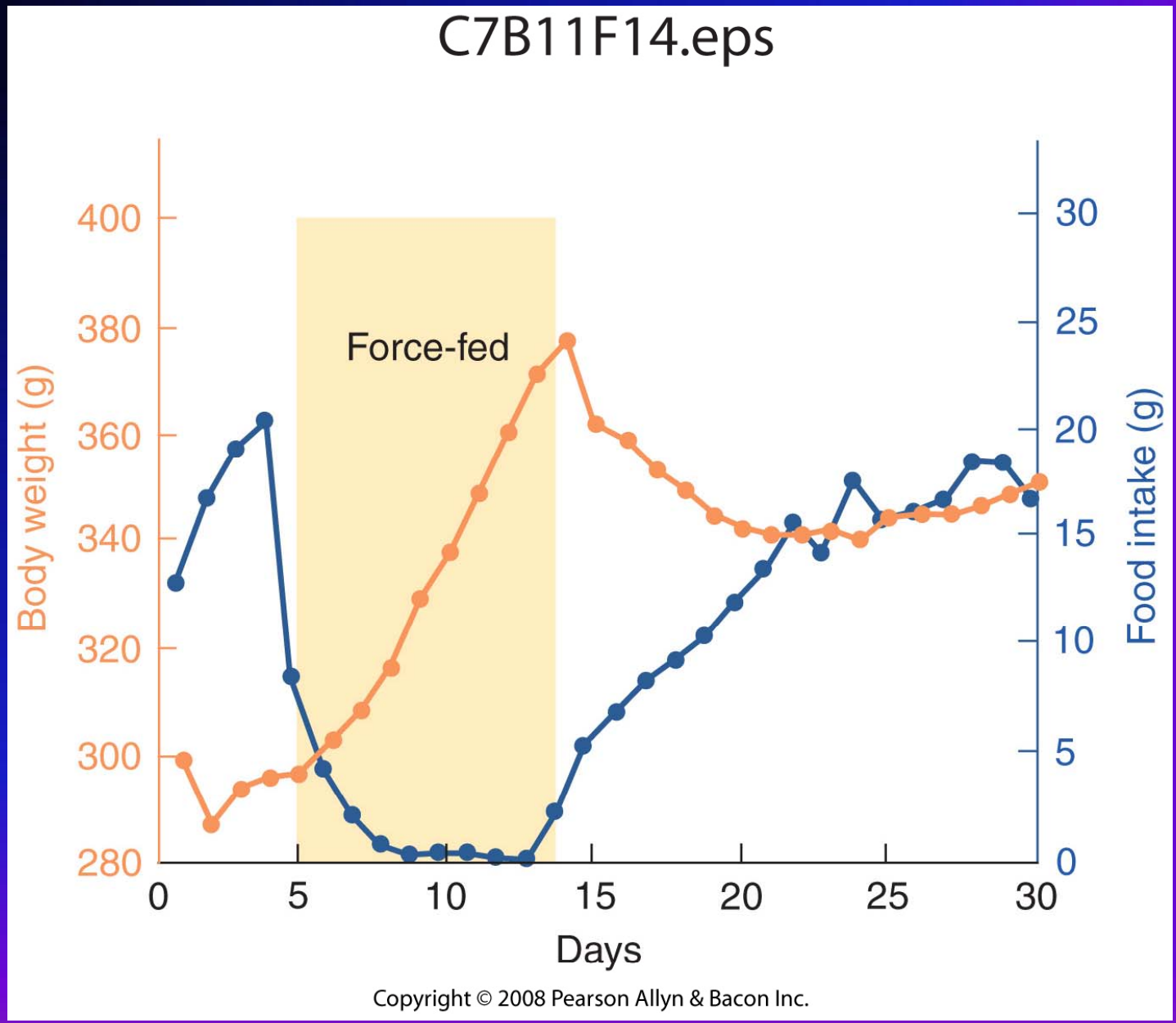
Campaign Against Obesity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Force-fed
Body weight (g)
Food intake (g)
Days
400
380
360
340
320
300
280
30
25
20
15
10
5
0
0
5
10
15
20
25
30
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- Anorexia nervosa
  - Disorder that most frequently afflicts young women; exaggerated concern with being overweight that leads to excessive dieting and often compulsive exercising; can lead to starvation.
- Bulimia nervosa
  - Bouts of excessive hunger and eating; often followed by forced vomiting or purging with laxatives; sometimes seen in people with anorexia nervosa.