Homeostasis, Endocrine System, and Feedback
Select signaling by: hormones, neurons or both

1. Involves a stimulus
2. Involves a chemical messenger
3. Involves a signal transduction pathway
4. Triggers a response
5. Involves an action potential
6. Signal travels to a specific target location
7. Signal travels everywhere
8. Chemical signal travels through blood stream
Choose: signaling by hormones H, neurons N or both B

1. Involves a stimulus B
2. Involves a chemical messenger B
3. Involves a signal transduction pathway B
4. Triggers a response B
5. Involves an action potential N
6. Signal travels to a specific target location N
7. Signal travels everywhere H
8. Chemical signal travels through blood stream H
Homeostasis

• The maintenance of a relatively constant internal environment

• Humans:
  - temperature 37\(^\circ\)C
  - blood pH 7.4
  - Blood glucose 80-120 mg per 100 mL

• The nervous and endocrine (hormone-producing) systems work together to maintain homeostasis
1. Which hormone acts as a break on [blood glucose]?
2. Which hormone acts as a gas petal on [blood glucose]?
3. Discuss how the opposite actions of two hormones act to maintain blood glucose homeostasis:
Pancreas monitors [blood glucose]

Response: release insulin

Stimulus:
Too high

[blood glucose] ↑

[blood glucose] ↓

Response: release glucagon

Stimulus:
Too low

Negative Feedback: Blood Glucose Homeostasis
Response: release insulin

[blood glucose] ↓

Pancreas monitors [blood glucose]

[blood glucose] ↑

Response: release glucagon

Stimulus: Too high

Stimulus: Too low
Explain why surgical removal of the thyroid gland results in an increase in TSH levels in the blood:
(a) Make a **claim** for whether the model above is an example of positive or negative feedback and **justify** your selection.

(b) Anabolic-androgenic steroids (AAS) are synthetic variants of testosterone that are sometimes abused to enhance athletic performance. Assuming that AAS functions the same as naturally occurring testosterone, predict an outcome of long-term AAS abuse.
Imbalance in Homeostasis: Diabetes Miletus

Type 1 Diabetes: Insufficient Insulin

- Insulin-producing cells
- Insulin-producing cells destroyed

- Diminished insulin

Glucose

Fat/muscle cells

Diminished glucose uptake
<table>
<thead>
<tr>
<th>Type 1 Diabetes</th>
<th>Type 2 Diabetes</th>
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<tbody>
<tr>
<td>Autoimmune disease – immune system kills off the beta cells of the pancreas</td>
<td>Tied to high Body Mass Index (high body fat)</td>
</tr>
<tr>
<td>Insulin is no longer produced</td>
<td>Insulin is produced, but failure is in transduction (the signal does not get passed on)</td>
</tr>
<tr>
<td>[Blood glucose] remains elevated</td>
<td>[Blood glucose] remains elevated</td>
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Make a claim & justify using scientific evidence:
Which patient has Diabetes 1, Diabetes 2, is normal?

Patient A
Patient B
Patient C
Positive Feedback

- Reinforces a stimulus, leading to even greater response
- Does **not** play a major role in animal homeostasis
- Instead, helps to drive a process to completion
- Suckling by infant stimulates sensory neurons in nipple
- Nerve impulse reaches hypothalamus (brain)
- Impulse from hypothalamus triggers release of oxytocin
- Oxytocin stimulates mammary glands to secrete milk
- Triggers more suckling