

# What Is Apoptosis?

## Worksheet

Apoptosis is programmed cell death: a tightly regulated process in which a cell activates enzymes called caspases to dismantle itself in an orderly way, without triggering inflammation.

## Questions

1. Which enzymes execute apoptosis?

- A) Kinases
- B) Caspases
- C) Polymerases
- D) Helicases

2. How does apoptosis differ from necrosis?

- A) Apoptosis causes inflammation, necrosis doesn't
- B) Apoptosis is controlled and non-inflammatory; necrosis is uncontrolled
- C) They are identical processes
- D) Necrosis only happens in plants

3. What happens to a dying cell's remains during apoptosis?

- A) They burst and spill into the tissue
- B) They are packaged into apoptotic bodies and engulfed by phagocytes
- C) They are excreted from the body
- D) Nothing, the cell stays intact

4. Why is apoptosis important during development?

- A) It has no developmental role
- B) It sculpts tissues by removing unneeded cells, like interdigital webbing
- C) It only occurs after birth
- D) It replaces mitosis entirely

5. A tumor biopsy of 1,000 cells shows 25 cells with condensed, fragmented nuclei (apoptotic). Calculate the apoptotic index.

6. During limb development, webbing between fingers is removed by apoptosis. A paddle-shaped hand bud has 4 interdigital regions, each losing about 2,000 cells. How many cells die in total to form separate fingers?

7. A drug inhibits caspase-3, an executioner caspase. Predict the effect on a cell that has received a strong apoptotic signal.

8. Define: What is apoptosis?

9. Define: What enzymes carry out apoptosis?

10. Define: How is apoptosis different from necrosis?

## Answer Key

1. B) Caspases - Caspases are the proteases that carry out the ordered dismantling of the cell.
2. B) Apoptosis is controlled and non-inflammatory; necrosis is uncontrolled - Apoptosis packages cell remains neatly; necrosis spills contents and triggers inflammation.
3. B) They are packaged into apoptotic bodies and engulfed by phagocytes - Apoptotic bodies are cleanly engulfed, avoiding inflammation.
4. B) It sculpts tissues by removing unneeded cells, like interdigital webbing - Apoptosis shapes organs and limbs by precisely removing specific cells.
5. Apoptotic index =  $(\text{apoptotic cells} / \text{total cells}) \times 100 = (25 / 1000) \times 100 = 2.5\%$
6. Total apoptotic cells = regions cells per region =  $4 \times 2,000 = 8,000$  cells This sculpting explains how separate fingers form from a webbed limb bud
7. Caspase-3 normally cleaves structural proteins and DNA-repair enzymes to execute cell death Blocking it stops the execution phase even though initiator signals fired The damaged cell may survive despite being marked for death This is one mechanism by which cancer cells evade apoptosis
8. A regulated form of programmed cell death that removes damaged, infected, or unneeded cells without causing inflammation.
9. Caspases - a family of proteases activated in a cascade (initiator then executioner caspases).
10. Apoptosis is controlled and doesn't trigger inflammation; necrosis is uncontrolled cell death that spills contents and causes inflammation.

### **Bounlu**

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