

# Chapter 1: Cell Injury, Cell Death, and Adaptations

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# Outline

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Necrosis

Apoptosis

Cellular Adaptations

Intracellular Accumulations

Summary

# Introduction

# Introduction

- ▶ Understanding cell injury, death, and adaptations is crucial for diagnosing and treating diseases.
- ▶ This chapter explores the mechanisms and implications of these cellular processes.

# Necrosis

# Necrosis

- ▶ Necrosis is a form of cell death characterized by cell membrane breakdown, organelle swelling, and rupture.
- ▶ It leads to inflammation in surrounding tissue.

## Causes of Necrosis

- ▶ Caused by external factors like toxins, infections, or trauma.

# Types of Necrosis

- ▶ Types include coagulative, liquefactive, caseous, and fat necrosis.



## Example of Necrosis

- ▶ **Example:** Coagulative necrosis often occurs in the heart after a myocardial infarction, where lack of oxygen leads to cell death.

# Apoptosis

# Apoptosis

- ▶ Apoptosis is programmed cell death, crucial for removing damaged or unnecessary cells.
- ▶ Characterized by cell shrinkage, chromatin condensation, and apoptotic bodies formation.

# Characteristics of Apoptosis

- ▶ Does not initiate inflammation.

## Example of Apoptosis

- ▶ **Example:** The elimination of webbing between fetal fingers and toes is a natural occurrence of apoptosis.

# Cellular Adaptations

# Cellular Adaptations

- ▶ Adaptations include changes in size (atrophy, hypertrophy), number (hyperplasia), form (metaplasia), and function.

# Types of Adaptations

- ▶ Atrophy: Decrease in cell size or number, e.g., in unused muscles.
- ▶ Hypertrophy: Increase in cell size, e.g., in heart muscle due to hypertension.



## More on Adaptations

- ▶ Metaplasia: Change of one cell type to another, e.g., in the respiratory tract of smokers.

## Example of Adaptation

- ▶ **Example:** Hyperplasia occurs in the endometrium during the menstrual cycle, preparing for potential pregnancy.

# Intracellular Accumulations

# Intracellular Accumulations

- ▶ Buildup of substances cells can't use or dispose of.
- ▶ Examples include lipids in liver cells, proteins in kidney tubule cells, and pigments like lipofuscin.

## Example of Intracellular Accumulations

- **Example:** Fatty liver disease results from the accumulation of lipids in liver cells, often due to alcohol abuse or obesity.

# Summary

# Summary

- ▶ This chapter covered the fundamental concepts of cell injury, death, and adaptations.
- ▶ Understanding these processes is essential for diagnosing and managing diseases.
- ▶ We explored necrosis, apoptosis, cellular adaptations, and intracellular accumulations.

# Thank You

Thank you for your attention!  
Questions?