Study Guide For Bones And Skeletal Tissue

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BIOL 2111 • Anatomy and Physiology I

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Chapter 6 • Study Guide

Bones and Skeletal Tissues

BIOL 2111 • Human Anatomy and Physiology

Cartilage is surrounded by a membrane called the **perichondrium**. The **perichondrium** contains **blood vessels** that supply cartilage. The **perichondrium** reinforces the **cartilage** and helps it spring back into shape.
Chondroblasts secrete **matrix within cartilage** and at the **perichondrium.**
Hyaline cartilage is the most common type. Hyaline cartilage is found in the **nose, trachea** and **bronchi**, **covering bones** at **moveable joints**, and **costal cartilage** that joins **ribs** to the **sternum.**
Elastic cartilage is the **rarest cartilage**. It is found in the **ear** and in the **epiglottis** - the flap that covers the opening to the larynx when you swallow.
Fibrocartilage has the highest **tensile (stretching out)** and **compression** strength. It is found in **knees** and between **vertebrae.**

Functions of **bones include**
Support, protection and **movement**
Storage of
Calcium
Growth factors
Adipose tissue
Production of blood

Categories of **bones** by **shape**
Long
Bones of limbs **arms, legs,** and fingers are **long bones**
Long bones are **longer than** they are **wide**, but not necessarily large.
Finger bones are **long bones**.

Short
Short bones include small bones of the wrists and ankles
Sesamoid bones are **short bones inserted** into tendons. The knee cap, the **patella,** is a **sesamoid** bone. The function of **sesamoid bones** is to **maintain** the **position** of tendons as they are **stretched** by **movement.**
Two tiny **sesamoid bones** about the size of a corn kernel are at the **base** of the **big toe** and are the first to bear weight when you run or walk.
Sesamoiditis occurs in **ballet dancers, runners**, and from wearing high heels and may be due to **inflammation** of the **tendons** or **injury** to the **bones.**

Flat bones include the **sternum, ribs,** and **most skull bones**

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Study Guide for Bones and Skeletal Tissue

Understanding the bones and skeletal tissue is fundamental for students of anatomy, biology, and health sciences. The skeletal system is not just a framework that supports the body; it plays vital roles in protection, movement, and mineral storage. This study guide will delve into the structure, function, and types of bones, as well as the various components of skeletal tissue, providing a comprehensive overview for learners.

Overview of the Skeletal System

The skeletal system consists of bones, cartilage, ligaments, and joints. It is typically divided into two main parts:

1. **Axial Skeleton**: Comprising the skull, vertebral column, and rib cage, this part of the skeleton supports the central axis of the body.

2. **Appendicular Skeleton**: This includes the bones of the limbs and the girdles (shoulder and pelvic) that attach them to the axial skeleton.

Functions of the Skeletal System

The skeletal system has several key functions that are crucial for the body's overall health and functionality:

- **Support**: The skeleton provides a rigid framework that supports the body and cradles soft organs.
- **Protection**: Bones protect vital organs; for example, the skull encases the brain, and the rib cage shields the heart and lungs.
- **Movement**: Bones act as levers for muscles, enabling movement through joints.
- **Mineral Storage**: Bones store essential minerals, particularly calcium and phosphorus, which can be released into the bloodstream as needed.
- **Blood Cell Production**: The bone marrow, found within the cavities of certain bones, is responsible for producing blood cells through a process called hematopoiesis.

Structure of Bone

Bone tissue, also known as osseous tissue, is a hard and dense connective tissue. Its structure can be broken down into two main types:

Cortical Bone

Also known as compact bone, cortical bone forms the outer layer of bone and is dense and strong. It provides strength for weight-bearing and protection for the inner structures. The features of cortical bone include:

- Osteons (Haversian Systems): The basic structural unit, consisting of concentric layers of mineralized matrix called lamellae surrounding a central canal that contains blood vessels and nerves.
- Perforating Canals: These canals run perpendicular to the central canals and connect them, allowing for the passage of blood vessels and nerves

throughout the bone.

Cancellous Bone

Also referred to as trabecular or spongy bone, cancellous bone is lighter and less dense than cortical bone. It is found primarily in the interior of bones and consists of a network of trabeculae (small rods or plates). Key points include:

- Bone Marrow: The spaces between trabeculae are filled with bone marrow, which can be red (producing blood cells) or yellow (fat storage).
- Stress Distribution: Cancellous bone is structured to withstand stress and redistributes loads effectively during movement.

Types of Bones

Bones can be classified based on their shape and structure into four major categories:

- **Long Bones**: These are longer than they are wide and include bones such as the femur and humerus. They have a diaphysis (shaft) and epiphyses (ends).
- **Short Bones**: These bones are roughly cube-shaped and include the wrist (carpals) and ankle (tarsals) bones.
- **Flat Bones**: Thinner and flatter, these bones provide protection and include the skull, ribs, and sternum.
- **Irregular Bones**: These bones have complex shapes that do not fit into any of the above categories, such as the vertebrae and certain facial bones.

Skeletal Tissue Types

The skeletal system is composed not only of bone but also of various types of skeletal tissues. The principal types include:

Cartilage

Cartilage is a flexible connective tissue found in many areas of the body. It is categorized into three types:

- Hyaline Cartilage: The most common type, providing support and flexibility. It is found in the nose, trachea, and at the ends of long bones (articular cartilage).
- Elastic Cartilage: This type contains more elastic fibers and is found in structures requiring flexibility, such as the ear and epiglottis.
- Fibrocartilage: The strongest type of cartilage, providing tensile strength and the ability to absorb compressive shock. It is found in intervertebral discs and the pubic symphysis.

Ligaments and Tendons

- Ligaments: These are bands of dense connective tissue that connect bones to other bones at joints, providing stability and support.
- Tendons: Tendons connect muscles to bones, facilitating movement when muscles contract.

Bone Development and Growth

Bone development occurs in a process called ossification, which can be classified into two types:

Intramembranous Ossification

This process occurs primarily during fetal development and involves the direct conversion of mesenchymal tissue into bone. It is responsible for the formation of flat bones, such as those in the skull.

Endochondral Ossification

This process involves the transformation of hyaline cartilage into bone and is responsible for the formation of long bones. It occurs in several stages:

1. Development of Cartilage Model: A cartilage model of the bone is formed during fetal development.
2. Growth of the Cartilage Model: The model expands, and the center begins to calcify.
3. Development of Primary Ossification Center: Blood vessels penetrate the cartilage, bringing in osteoblasts that begin to form bone.
4. Formation of Medullary Cavities: As the bone continues to grow, the medullary cavity forms, and secondary ossification centers develop in the

epiphyses.
5. Completion of Bone Growth: Eventually, when growth plates (epiphyseal plates) close after puberty, the bone is fully formed.

Maintaining Bone Health

Bone health is crucial for overall well-being, and several factors can influence it:

- **Nutrition**