

# Comparative Anatomy of Vertebrates

## *Unit-1* (Integumentary System)

**B.Sc. 4<sup>th</sup> Semester**

**Presented By:**

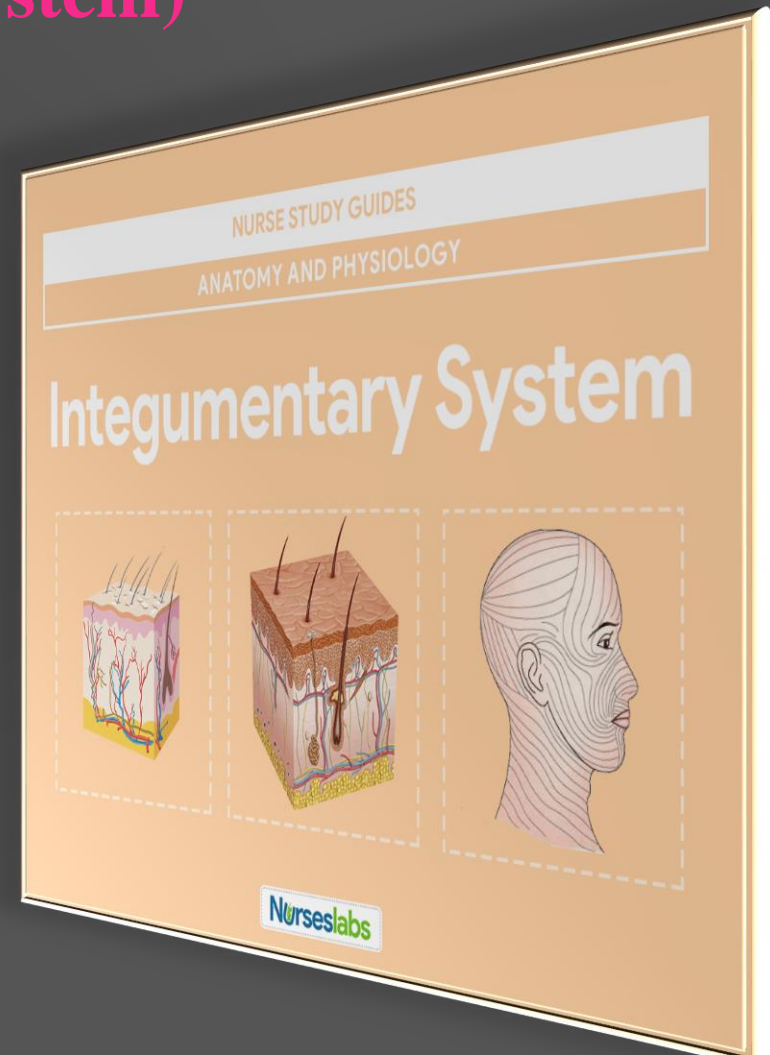
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# Introduction

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- Comparative anatomy is the study of the anatomical structures of different organisms, with the aim of identifying similarities and differences between them.
- The purpose of this study is to better understand the evolutionary relationships between different species, as well as the adaptations that have allowed them to survive and thrive in their environments.
- One of the key concepts in comparative anatomy is homology, which refers to the similarity of structures that are derived from a common ancestor.
- The forelimbs of mammals, birds, reptiles, and amphibians are all homologous structures, despite their different functions, because they are all derived from the same ancestral structure.
- Another important concept is convergence, which refers to the development of similar structures in different organisms as a result of similar selective pressures.
- For example, the wings of birds and bats are an example of convergence, as they have similar functions but are structurally different.
- Comparative anatomy can provide insights into the evolutionary history of organisms, as well as their adaptations and relationships to one another.
- It can also be used to identify new species or classify existing ones based on their anatomical characteristics.

# Introduction

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Comparative anatomy is the study of similarities and differences in the anatomy of different species. In vertebrates, there are several anatomical features that are shared among different groups, as well as some unique features that distinguish them from one another. Here are some examples:

- ❖ **Skeletal System:** Vertebrates have an internal skeleton made up of bones, which provide support and protection for their bodies. However, the structure of the skeleton can vary significantly between different groups. For example, mammals have a skull with a single lower jaw bone and a set of specialized teeth, while reptiles have a skull with multiple bones in the lower jaw and teeth that are not as specialized.
- ❖ **Respiratory System:** All vertebrates have a respiratory system that allows them to exchange gases with the environment. However, the structures involved in this process can vary greatly. Fish have gills, which extract oxygen from water, while mammals have lungs that extract oxygen from air.
- ❖ **Circulatory System:** Vertebrates have a closed circulatory system, which means that blood is pumped around the body in vessels. However, the structure of the heart and the number of chambers it has can vary among different groups. For example, fish have a two-chambered heart, while mammals have a four-chambered heart.
- ❖ **Nervous System:** Vertebrates have a highly developed nervous system that allows them to sense and respond to their environment. However, the organization of the brain and the number of sensory structures can vary among different groups. For example, birds have a well-developed cerebellum, which is important for coordinating movement during flight.
- ❖ **Reproductive System:** Vertebrates have a variety of reproductive strategies, which can involve internal or external fertilization, and different types of eggs or live birth. For example, birds lay eggs with hard shells, while mammals give birth to live young.

# *Integumentary System in Vertebrate:*

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The integumentary system is the organ system that consists of the skin, hair, nails, and glands.

**Skin:** The skin is the largest and heaviest organ in the body. It weighs about six pounds (or more) and is approximately 2 millimeters thick — thinner on sensitive areas like eyelids, and thicker on surfaces that take more stress, like the soles of the feet. One inch of the skin contains nearly 19 million cells.

The skin is composed of three layers, with nerves that recognize different sensations in each layer:

**Epidermis:** The top layer of the skin. This is the part of the skin that you can see and touch. It's made up of three types of cells: melanocytes, keratinocytes and Langerhans. It gives the skin its color and provides a waterproof barrier.

**Dermis:** The middle layer of the skin. This layer is the thickest. It contains sweat and oil glands and hair follicles.

**Hypodermis:** The bottom layer of the skin. It's the fatty layer of the skin that helps insulate the body.

# *Integumentary System in Vertebrate:*

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- ❑ **Hair:** Hair is a thread-like outgrowth of the epidermis that covers the body and provides insulation, protection, and sensory feedback. Hair growth and structure vary among species and can also be influenced by hormones and environmental factors. The hair is made of a protein called keratin. Hair consists of three parts-
- ❑ **Hair shaft:** The part of your hair you can see, touch and style.
- ❑ **Hair follicle:** The tube-like structure that keeps your hair in your skin.
- ❑ **Hair bulb:** Located under your skin and responsible for hair growth.
- ❑ Goosebumps are caused by your integumentary system. We all have hair erector muscles connected to our hair follicles and skin. When it contracts, it makes your hair stand up. The “goosebumps” are what we see when these tiny muscles contract.
- ❑ **Sebaceous Glands:** These glands produce sebum (oil) and give your face its oil.
- ❑ **Ceruminous Glands:** These are the glands in your ear that secrete ear wax.
- ❑ **Mammary Glands:** These are the glands on a person’s chest. In people assigned female at birth (AFAB), mammary glands produce milk after giving birth.

# Structure Integumentary System

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The structure of integumentary system is the organ system that covers and protects the body from external damage and harm. It consists of the skin, hair, nails, sweat glands, and oil glands. The skin is the largest organ in the integumentary system and is composed of three main layers:

- ▶ **Epidermis:** The outermost layer of the skin, composed of stratified squamous epithelium. This layer is responsible for producing the pigment melanin, which helps protect the skin from harmful UV radiation.
- ▶ **Dermis:** The middle layer of the skin, composed of dense irregular connective tissue. This layer contains blood vessels, nerves, hair follicles, and sweat glands.
- ▶ **Subcutaneous tissue (also called hypodermis):** The deepest layer of the skin, composed of adipose tissue and loose connective tissue. This layer contains larger blood vessels and nerves and serves as an insulating layer for the body.

# *Derivatives of Integument in Vertebrates:*

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Depending upon the layer of skin from which they are derived. They are epidermal derivatives and dermal derivatives:

**Epidermal Derivatives:** The epidermal derivatives include-

1. **Epidermal gland:**
2. **Epidermal scales and scutes:**

**1. Epidermal glands:** It is formed by the Malpighian layer of epidermis but often invade the dermis they may be unicellular or multicellular.

**2. Epidermal scales and scutes:** They are developed by the accumulation of a protein, known as KERATIN. All the stratum corneum cells are cornified and form horny hard exoskeleton like scales, hairs, beaks, horns, claws, nails etc. in different vertebrates.



# *Function of integumentary system:*

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## **Function of integumentary system:**

The integumentary system serves several important functions in the body, including:

**Protection:** The skin acts as a barrier between the body and the external environment, protecting the body from physical, chemical, and biological damage.

**Thermoregulation:** The skin helps to regulate body temperature by controlling the amount of heat loss through sweating and blood flow to the skin.

**Sensory Reception:** The skin contains sensory receptors that respond to touch, pressure, temperature, and pain, allowing us to sense and respond to our environment.

**Vitamin D Synthesis:** The skin is capable of producing vitamin D when exposed to sunlight, which is important for bone health.

**Immune Defence:** The skin contains specialized immune cells that help to defend against pathogens and prevent infections.

**Excretion:** Sweat glands in the skin excrete waste products, including urea and salt.

**Social Interaction:** The appearance of the skin, hair, and nails can be used for social communication, such as signalling attractiveness or social status.

A close-up photograph of a red ballpoint pen with a silver tip, positioned diagonally from the top right. The pen is in the process of writing the words "Thank you" in a black, cursive script on a plain white surface. The pen's tip is just finishing the letter 'u' in "you".

Thank you