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Fully Revised

Shikha Gupta
Shikha Nautiyal

SCIENCE OLYMPIAD

National Science Olympiad

5

Strictly according to the latest syllabus of Science Olympiad

Human Body

Force and Work

Matter

Ecosystem

Natural Resources

Analogy

Embedded Figures

Puzzle Test

The Gen X Series

A SUCCESS PACKAGE FOR ASPIRANTS OF SCIENCE OLYMPIAD

NATIONAL SCIENCE OLYMPIAD

Exploring the World of Science

Class 5

Author

Shikha Gupta

Shikha Nautiyal



V&S PUBLISHERS

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Publisher's Note

V&S Publishers, after the grand success of a number of Academic and General books, is pleased to bring out a series of *Science Olympiad books* under *The Gen X series – generating Xcellence in generation X* – which has been designed to focus the problems faced by students. In all books the concepts have been explained clearly through various examples, illustrations and diagrams wherever required. Each book has been developed to meet specific needs of students who aspire to get distinctions in the field of science and want to become Olympiad champs at national level.

To go through the exams successfully, the students need to do thorough study of topics covered in the *Olympiad syllabus and the topics covered in the school syllabus as well*. The Olympiads not only tests subjective knowledge but Reasoning skills of the students also. So students are required to comprehend the depth of concepts. The Olympiads check efficiency of candidates in problem solving. These exams are conducted in different stages at regional, national, and international levels. At each stage of the exam, the candidate should be fully prepared to go through the exam. Therefore, this test requires careful attention towards comprehension of concepts, thorough practice, and application of rules.

While other books in market focus selectively on questions or theory; V&S Science Olympiad books are rather comprehensive. Each book has been divided into five sections namely *Science, Logical Reasoning, Achievers section, Subjective section, and Model Papers*. The theory has been explained through solved examples. To enhance problem solving skills of candidates, *Multiple Choice Questions (MCQs)* with detailed solutions are given at the end of each chapter. Two *Mock Test Papers* have been included to understand the pattern of exam. A CD containing Study Chart for systematic preparation, Tips & Tricks to crack Science Olympiad, Pattern of exam, and links of Previous Years Papers is accompanied with this book. The books are also useful for various other competitive exams such as NTSE, NSTSE, and SLSTSE as well.

We wish you all success in the Olympiad and a very bright future in the field of science.
All the best

Contents

Section 1: Science

1. Animals	9
2. Human Body	21
3. Food and Health	37
4. Plant Life	50
5. Natural Resources and Calamities	64
6. Earth and Universe.....	84
7. Matter	100
8. Water	114
9. Force, Work and Energy	127
10. Ecosystem	145
11. General Science.....	157

Section 2: Logical Reasoning

1. Patterns	167
2. Analogy	179
3. Classification	189
4. Coding and Decoding	195
5. Direction Sense Test	205
6. Ranking Test	215
7. Alphabet Test and Logical Sequence	222
8. Puzzle Test	233
9. Mirror Images	242
10. Water Images	249
11. Embedded Figures	255
12. Geometrical Shapes	261

Section 3: Achievers Section

High Order Thinking Skills (HOTS)	269
---	-----

Section 4: Subjective Section

Short Answer Questions	279
------------------------------	-----

Section 5: Model Papers

Model Test Paper – 1	291
Model Test Paper – 2	302

Section 1: Science



Animals

Learning milestones:

- Classification of animals
- Habitat and ecosystem
- Adaptation in animals
- Migration in animals

Animals are living organisms that can move independently and can recognize and react to the environment around them.

Classification of Animals

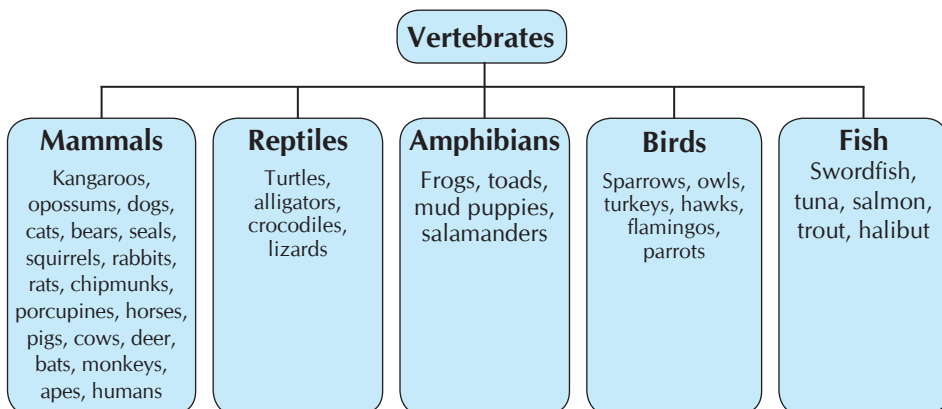
Animals can broadly be grouped into the following two categories:

- (i) Vertebrates
- (ii) Invertebrates

Vertebrates

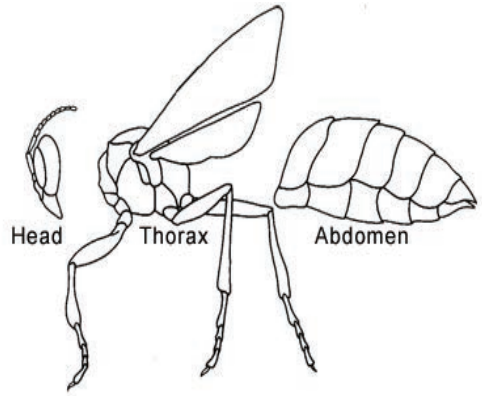
Animals that have a backbone are called vertebrates. Vertebrates can further be divided into five major categories:

- (i) **Mammals:** Warm-blooded vertebrates that have hair or fur.
- (ii) **Reptiles:** Cold-blooded vertebrates that have dry scaly skin.
- (iii) **Fish:** Cold-blooded vertebrates that have fins and gills and live under water.
- (iv) **Amphibians:** Cold-blooded vertebrates that can breathe both on land, and in water.
- (v) **Birds:** Warm-blooded vertebrates that have a beak, wings, feathers, and are usually able to fly.



Invertebrates

Animals that do not have a backbone are called invertebrates. All **insects** fall under this category of invertebrates. Instead of having bones to hold their bodies up, these cold-blooded invertebrates have exoskeletons. Exoskeletons are like miniature suits of armour. Insect bodies are divided into three parts, and each part has further smaller segments. The three body parts of an insect are: **the head** (which includes the mouth, eyes, and antennae), **thorax** (where the legs and wings connect), and the **abdomen** (which contains the digestive organs, reproductive organs, breathing holes called spiracles, and, if there is one, a stinger).



Habitat and Ecosystem

Habitat

The place where an animal lives, eats, grows and reproduces is called its **habitat**. The habitat fulfills all the requirements that an animal needs to survive. Animals need food, water, shelter or cover, and space for survival. An animal's habitat includes an appropriate arrangement of all of these items.

Ecosystem

Ecosystems include physical and chemical components, such as soil, water, and nutrients that support the life of the organisms living within them. These organisms may range from large animals and plants to microscopic bacteria. The ecosystem also includes the interaction of all these organisms in a given habitat.

Adaptation in Animals

The special characteristics an animal develops over time to help it survive in its own habitat is called **adaptation**.

Animals have special skills to help them survive. They are able to get food, water, breathe air and protect themselves from the heat, cold and even predators. This is why some animals have excellent eyesight, others can fly and some others can even burrow themselves underground. The following are some of the important types of adaptations seen in animals:

Adaptation for feeding

Animals eat plants, other animals, or both plants and animals. Feeding organs like the beaks, teeth, and mouth are modified according to the kind of food they eat. Based on the type of food they eat, animals can be classified as:

Herbivores



Animals that eat only plants are called herbivores.




Carnivores

Animals that eat only other animals are called carnivores. Carnivores have sharp canines (teeth) for tearing flesh. They have strong sharp claws for catching and holding onto their prey. They also have a strong sense of smell.

Omnivores

Animals that eat both plants and animals are called omnivores. Insects like butterfly have a tube-like mouthpart called **proboscis** which helps them in sucking nectar, tree sap, pollen, etc.

Type of Animal	Adaptive Feature	Examples
Herbivores (animals that eat only plants)	They have sharp, broad teeth for chewing grass	 

<p>Birds (herbivores, carnivores, and omnivores)</p>	<p>Seed-eating birds have short and pointed beaks. Fruit-eating birds like parrots have beaks shaped like a hook. This helps them dig into the fruit. Birds that hunt preys have sharp beaks. Their beaks are also shaped like a hook, which helps these birds bite into the flesh of their prey.</p>	 
<p>Carnivores (animals that eat flesh of other animals)</p>	<p>They have strong teeth on the sides of their mouth. These are called canines. They are sharp enough to bite into flesh.</p>	

Adaptation for movement

Animals move from one place to another. This is called locomotion. Different animals have different types of adaptation for moving around.

Adaptation in land animals

Land animals have long legs and a flexible backbone which increases the length of their stride. This helps them in running fast. Reptiles crawl with the help of their short legs, whereas snakes crawl with the help of their plates and scales.



Adaptation in aquatic animals

The animals that live in water have a streamlined body which helps them swim in water. Most fishes have fins for movement. They have both, paired and unpaired fins. The two pairs of paired fins help them move forward while the unpaired fins help them in maintaining balance. The tail fin is used for changing direction. Some aquatic animals do not have limbs. They move around by either changing the shape of their body, using appendages, or even by floating in water. These include various worms, snails, cnidarians, and protozoans, among others.



Adaptation in aerial animals

Birds have adapted themselves to moving in the air. Their front limbs have turned into wings and their strong pectoral muscles move these feathered wings.

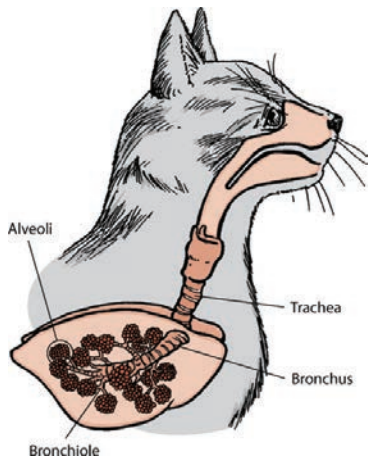
Bird bones are hollow inside and so their bodies are very light. This makes it easier for them to fly.



All flies, mosquitoes, and houseflies have one pair of wings. Their hind wings have reduced over the years. The wings have become halteres that help keep their flight balanced.



Adaptation in Breathing



Animals need oxygen to survive. They take in oxygen from their surroundings and give out carbon dioxide.

Large animals have special respiratory organs (trachea and lungs) to obtain sufficient oxygen. All amphibians, lizards, birds, and mammals breathe through their lungs.

In water, many animals like **fish** breathe through their gills. A **gill** consists of a stack of thin flaps connected to the animal's blood supply.



The breathing organs in **insects** such as cockroaches and grasshoppers are called **spiracles**. Spiracles are small air holes.

Very small animals, such as amoeba and paramecium, do not need any special adaptation for obtaining oxygen. Oxygen enters their body through the surface of their bodies.

Migration in Animals

Animal migration is the relatively long-distance movement of individuals, usually on a seasonal basis. It is found in all major animal groups, including birds, mammals, fish, reptiles, amphibians, and insects. Some animals migrate to escape harsh weather or shortage of food, but it is most common in birds such as white storks, spotted sand pipers, Siberian cranes, etc.

Test Your Skills

1. Observe the video link given in the box below and think about the type of adaptations involved.

<http://www.youtube.com/watch?v=sLVWsaIlsQ>

2. Fill in the blanks using the five types of vertebrates:

Fish; Bird; Mammal; Reptile; Amphibian.

- ◆ A _____ is an animal whose body is covered in hair or fur.
- ◆ A _____ is an animal whose body is covered in feathers.
- ◆ A _____ is an animal that breathes under water and has no legs.
- ◆ _____ are animals that lives both on land and in water.
- ◆ A _____ is an animal whose body is covered in scales.

HOTS: What happens if a sparrow's beak is replaced with an eagle's beak?

Multiple Choice Questions

1. A habitat is:

- A. An animal's immediate natural surroundings which contains an arrangement of food, water, shelter or cover, and space that meets the animal's needs
- B. A place containing an arrangement of food, water, shelter or cover, and space
- C. An animal's immediate natural surroundings or environment
- D. The surroundings in which a plant or an animal grows and lives

2. Ecosystem can be defined as:

- A. An interacting system of living organisms and non-living parts of the environment
- B. The place where these interactions (stated in point A) take place
- C. An interactive system of living organisms and non-living parts of the environment where these interactions take place
- D. A network of interconnected food chains

3. Which category of animals makes up 90 per cent of the animal world?

- A. Mammals
- B. Vertebrates
- C. Soft-bodied animals
- D. Invertebrates

4. Which group of animals have been on earth the longest?

- A. Birds
- B. Mammals
- C. Whales
- D. Fish

5. Like water beetles, which other animal breathes oxygen from the air, renewing its supply of air on the surface?

- A. Backswimmer
- B. Water striders
- C. Water flea
- D. Water strider

6. Which of the following have hearing organs on their front legs?

- A. Squirrel
- B. Viper
- C. Rabbit
- D. Bush cricket

7. Who am I?

I swim in swamps, I bloat my cheeks,

I dive in dams and croak in creeks.

- A. Emu
- B. Water Holding Frog
- C. Green and Golden Bell Frog
- D. Penguins

8. Which of the following is a correct match with the given headings?

Can fly **Cannot fly**

- | | |
|------------|---------|
| A. Emu | Crow |
| B. Sparrow | Pigeon |
| C. Kiwi | Ostrich |
| D. Parrot | Penguin |

9. Which of these animals camouflage with its surrounding?



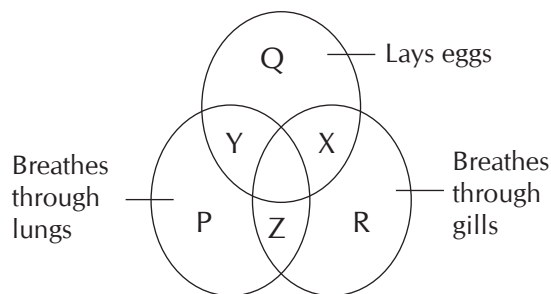
D. All of these

10. Choose the correct option to answer the sentence below:

Animals return water to the environment by.....

- (i) Perspiring (ii) Drinking
(iii) Urinating (iv) Breathing
- A. (i), (iii) and (iv)
B. (i) and (ii)
C. (i) and (iii)
D. (iii) and (iv)

11. Study the given Venn diagram carefully. Which alphabet represents fish?



- A. Y B. X
C. Z D. P

12. In the following list, one organism does not correlate because it eats different types of food than the other organisms in the list. Cross off the organism that does not correlate.

Carnivore	Producer
------------------	-----------------

- | | |
|---------------|---------------|
| A. Green crab | Phytoplankton |
| B. Minnow | Seaweed |
| C. Sea bass | Marsh grass |
| D. Algae | Ribbed mussel |

13. Which invertebrate is the most advanced?

- | | |
|--------------|--------------|
| A. Octopus | B. Spider |
| C. Jellyfish | D. Barnacles |

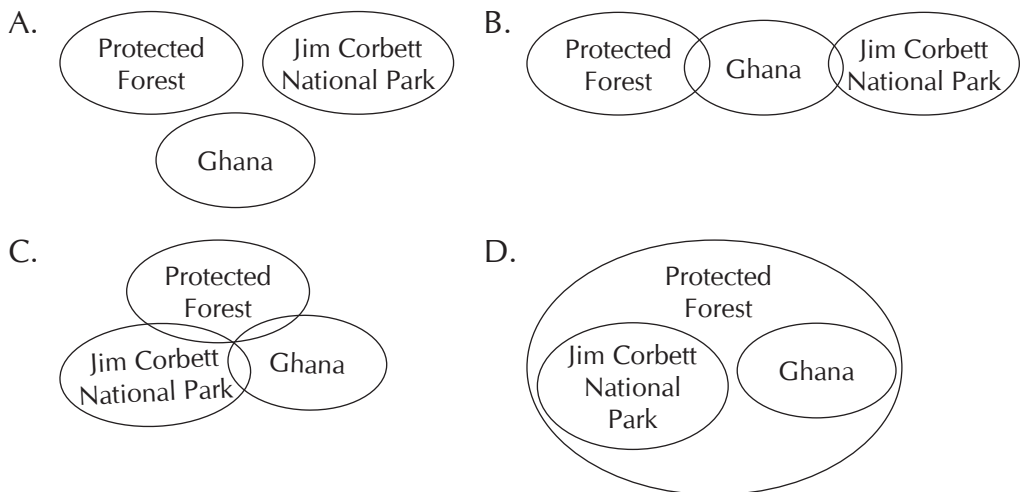
14. Which of the following statements about fishes is not true?

- | | |
|----------------------------------|------------------------------|
| A. All fish have gills | B. All fish live in water |
| C. All fish use fins for balance | D. All fish are warm blooded |

15. What does a jellyfish use to catch food?

- | | |
|-------------------|------------|
| A. Sponges | B. Limbs |
| C. Stinging cells | D. Muscles |

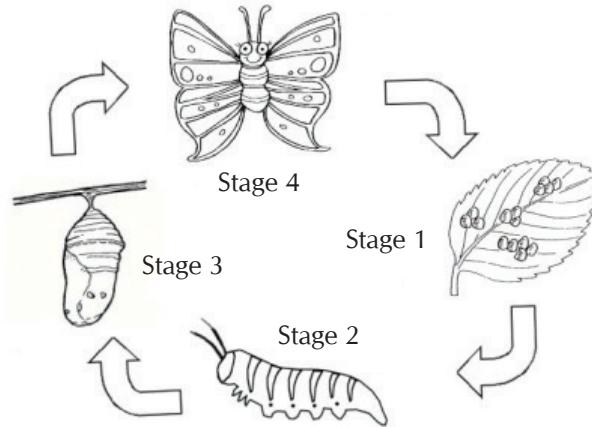
16. Look at the Venn diagram and choose the correct option from the following:



17. Cranes and herons have long legs with spread-out toes. They can be categorized as:

- | | |
|-----------------|-------------------|
| A. Flying birds | B. Water birds |
| C. Wading birds | D. Perching birds |

18. In the given figure of the lifecycle of a butterfly, what does stage 3 represent?



- A. Caterpillar
- B. Pupa
- C. Nymph
- D. Adult

19. Complete the sentence. Animals migrate:

- A. To reach their breeding groups
- B. To escape harsh weather
- C. To search for food
- D. All of the above

20. Which of the following statements is true?

- A. The mass movement of animals from one place to another is known as hibernation
- B. Gills are special organs with which all mammals breathe
- C. Emu is a flightless bird
- D. Mammals like ants and cockroaches crawl on their legs

21. Drop some jaggery on the ground and observe it for a while. Now look at the following statements and mark the ones that are true.

- A. In the beginning, only one ant comes near the jaggery
- B. In the beginning, a group of ants come near the jaggery
- C. In the beginning, only one ant comes near the jaggery and as the ants move, they leave a smell on the ground
- D. As the ants move, they produce light

22. I can spot my prey from miles away:

- A. Ant
- B. Eagle
- C. Rat
- D. Leopard

23. Mosquitoes can find you by the:

- A. Sound of your body
- B. Smell of your body
- C. Shadow of your body
- D. All of the above

24. The animal shown in the picture below warns other animals of dangers such as the arrival of a tiger or leopard, by:



- A. Producing some chemicals
- B. Making a special warning call
- C. Dancing
- D. None of the above

25. It looks like a bear but is not. It spends almost 17 hours a day sleeping while hanging upside down on a tree branch. It lives for about 40 years and in that time moves around only eight trees. Guess which animal am I.

The animal referred to in the above paragraph is a:

- A. Monkey
- B. Sloth
- C. Bat
- D. Gibbon

Answer Key

1. A 2. C 3. D 4. D 5. A 6. D 7. C 8. D 9. D
10. C 11. B 12. D 13. A 14. D 15. C 16. D 17. C 18. B
19. D 20. C 21. C, 22. B 23. B 24. B 25. B



Learning milestones:

- Skeleton
- Muscles
- Nervous system
- Sensory organs

Skeleton

Bones are the strongest part of our body. All the bones in our body form a framework to give a shape to our body. This framework is called the skeleton. We have 206 bones in our body; they constitute the skeletal system. The main features of a skeletal system are:

1. To provide a definite structure to the body.
2. To help in body movement.
3. To provide safety and protection to the soft and delicate internal organs of the body.

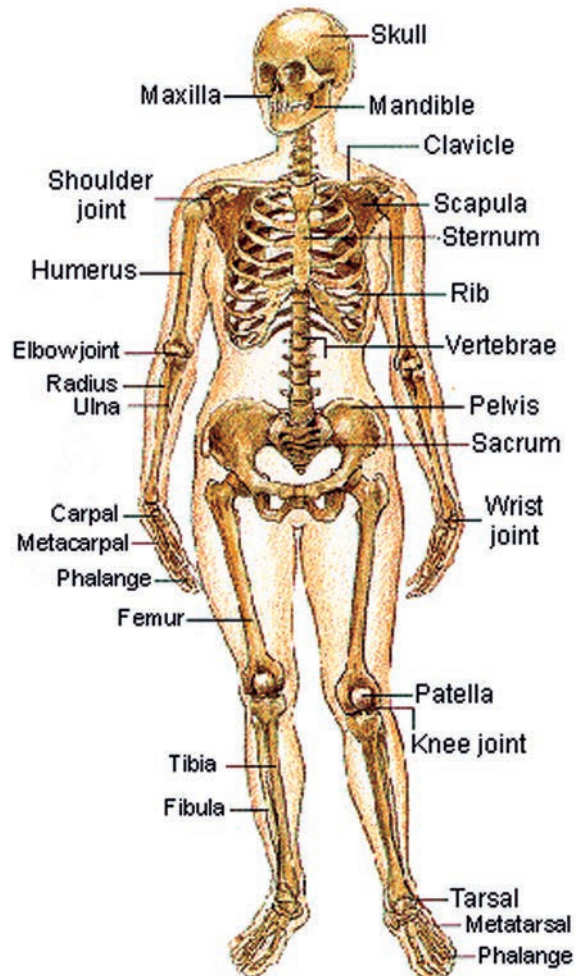
Bones in a human body undergo change throughout the lifetime. They undergo growth from birth to adulthood. When a human being attains adulthood, bones start the mineralization (formation of minerals) and demineralization (loss of minerals) process.

Parts of the skeleton

The skeleton is made up of many parts:

Skull

The skull is made up of eight bones. It protects the brain. The face is made up of 14 bones. All the bones are fixed except the lower jaw, which is movable and enables us to talk and eat.

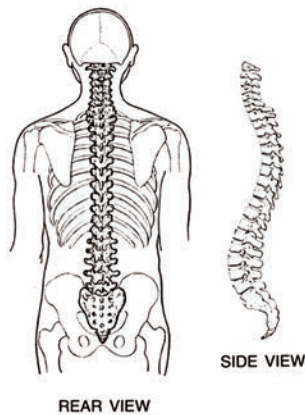


Skeletal System

Backbone:

The backbone is made up of 33 small bones called vertebrae. They run from the base of the neck till the hip region.

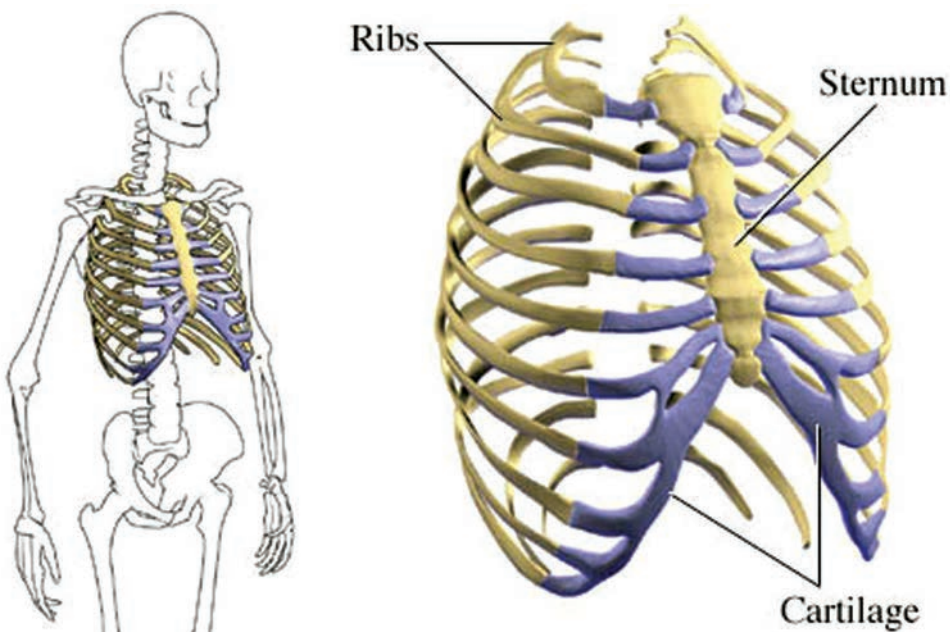
A soft elastic tissue called cartilage is present between the vertebrae to cushion the bones. The backbone or vertebral column protects the spinal cord that passes through it.



Ribs

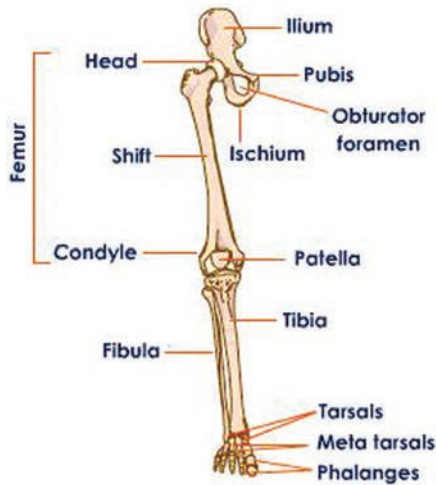
There are 12 pairs of ribs that form the rib cage, attached to the backbone at the back. The first 10 pairs of ribs are connected to the breast bone or sternum in the front. The last two pairs of ribs that are not joined to the sternum are called floating ribs.

The rib cage protects the heart and lungs.



Limbs

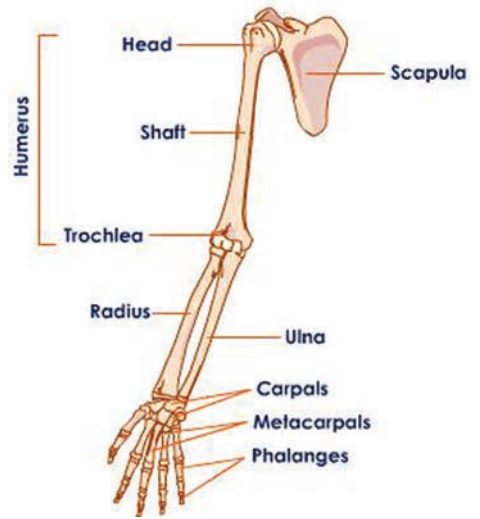
The arms are called **forelimbs**. The upper arm is made up of a single bone called humerus. The lower arm is made up of two bones called radius and ulna. Many small bones form the wrist and hands.



Hind limbs

The legs are called **hind limbs**. The upper legs or thigh is made up of one long bone, which is the longest bone in the body and is called femur.

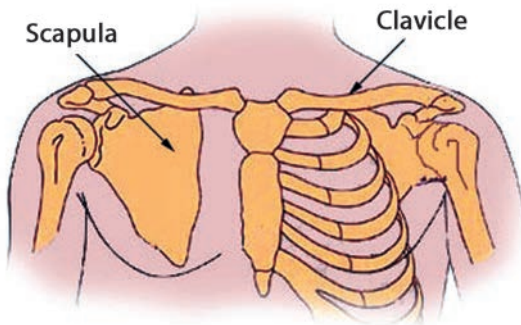
The lower leg is made up of two bones called tibia and fibula. Small bones form the ankles and toes.



Forelimbs

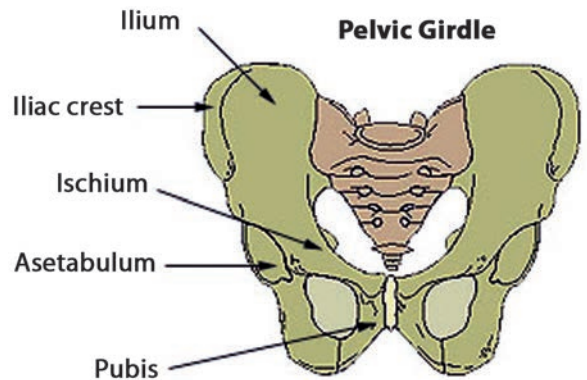
Girdles

The forelimbs are attached to the pectoral girdle. A pectoral girdle consists of the collar bone and the shoulder blade.



Pectoral Girdles

Pectoral girdles



Pelvic girdle

The hind limbs are attached to the pelvic girdles. It protects the kidneys and urinary bladder.

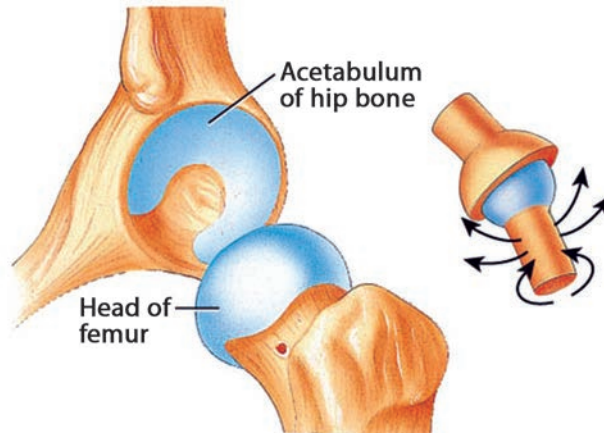
Joints

Joint is the place where two bones meet. Our ability to bend our arms and legs makes it easy for us to do different things. The bones bend at joints. Our body has many joints. All

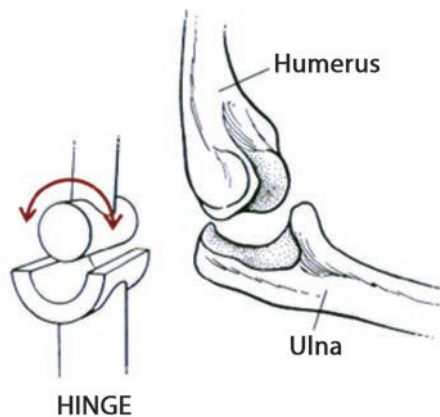
joints except those in the skull can move. The joints in the skull are called **immovable joints**. All other joints are called **movable joints**.

The following are the various types of movable joints:

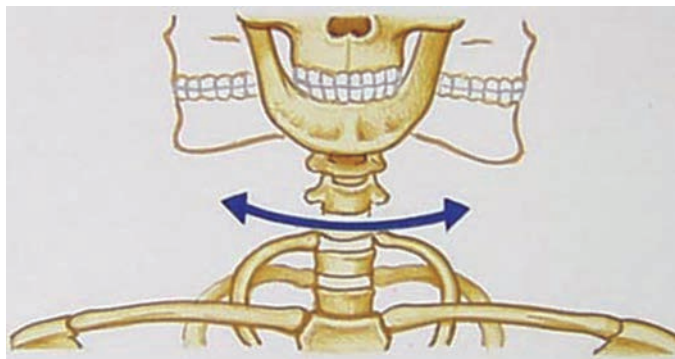
◆ Ball and socket joint



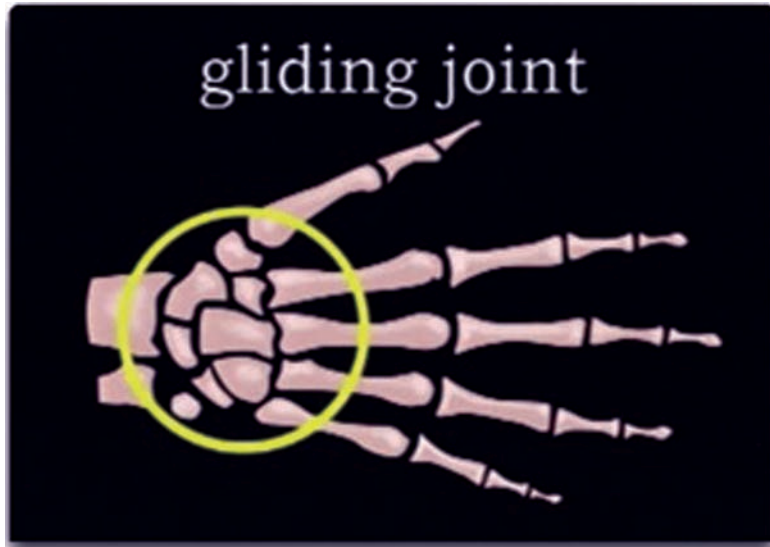
◆ Hinge joint



◆ Pivot joint



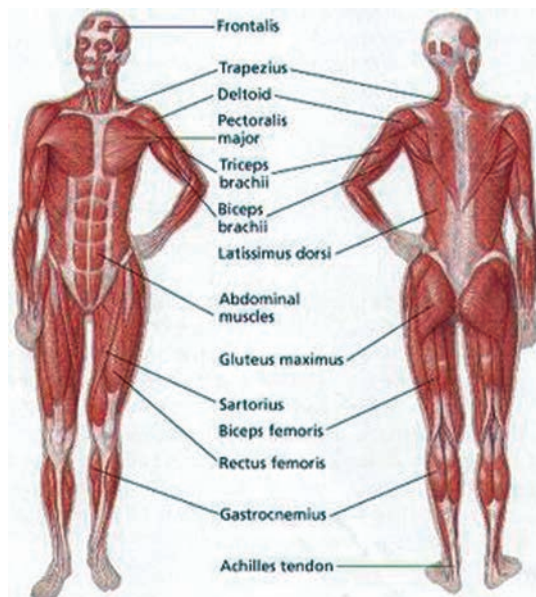
◆ Gliding or ellipsoidal joint



Muscles

Muscles are the fleshy material present under our skin and in different parts of our body. Bones cannot move on their own. Muscles are attached to the bones by strong fibres called tendons that help muscles to move bones.

Muscle cells have the ability to control and relax. We cannot move any part of our body without using our muscles.



Muscular system

Types of muscles

Our muscular system consists of three different types of muscles:

Voluntary muscles

These are under our control so we call them voluntary muscles.

Involuntary muscles

These are not under our control and are called involuntary muscles.

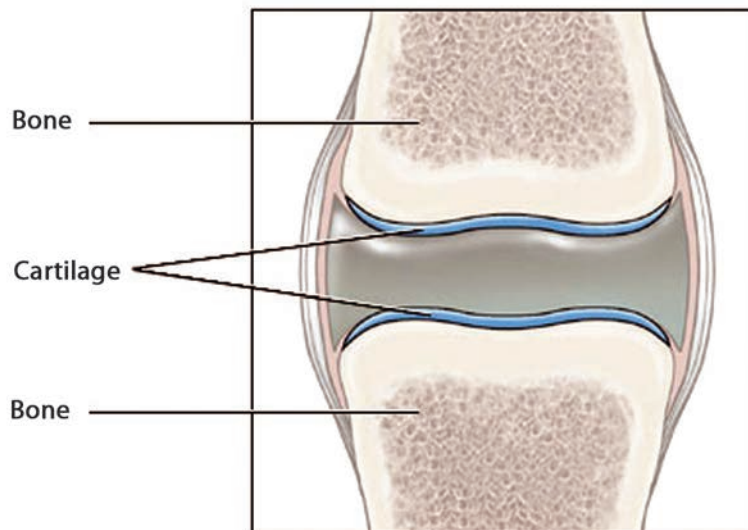
They control actions like movement of food in the alimentary canal, the flow of blood, and the movement of eye muscles.

Cardiac muscles

The third type of muscles are found in the heart. They are involuntary in function, but are structured like voluntary muscles.

Do you know?

Cartilage is a type of hard, thick, slippery tissue that coats the ends of bones where they meet with other bones to form a joint. Examples: vertebrae, knee, hip, ribs.



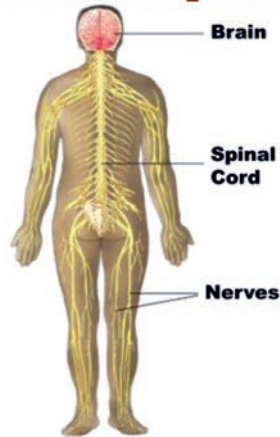
Cross section of a joint

Nervous System

The nervous system is the most complex of all the body systems. It is also the most important system as it controls all the other body systems and the sense organs. Everything we do is controlled by our nervous system.

The brain, the spinal cord, and the nerves form the nervous system.

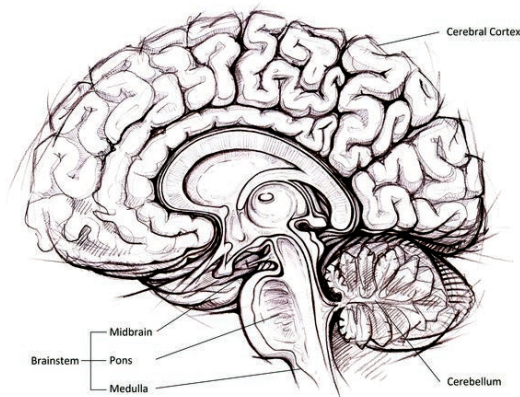
The Nervous System



The nervous system

The brain

The brain is the control centre of our body. It is a delicate organ that lies inside the hard, bony skull. The brain consists of three parts.



1. Cerebrum

Cerebrum is the topmost part of the brain, forming the roof of the brain.

It is the biggest part of the brain, with many grooves and folds on its surface.

It controls our ability to learn, remember, and think. It receives messages from the sense organs.

2. Cerebellum

The cerebellum lies below the cerebrum and is called the “little brain”. It helps to keep our balance and coordinates muscular activities.

3. Medulla

The medulla joins the brain to the spinal cord and is called the brain stem. It controls involuntary actions like beating of the heart, movement of lungs, digestion of food, etc.

Spinal cord

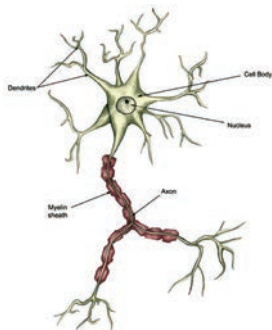
The spinal cord is a cylinder of nerves that is as thick as your finger. It starts from below the medulla and goes down to the middle of the back till the waist. It is protected by the backbone or the spine. All messages travel from the brain to the spinal cord and then to different parts of the body. Messages from different parts of the body also enter the spinal cord and travel up to the brain.



Nerves

Nerves carry messages from the sense organs to the brain and spinal cord. They also take messages from the brain and deliver them to all parts of the body.

Nerves are made up of nerve cells called **neurons**.



There are three types of nerves and all of them perform a specific function.

Sensory nerves: They carry messages from the sense organ to the brain or to the spinal cord.

Motor nerves: These nerves carry messages from the brain or the spinal cord to the muscles or the glands.

Mixed nerves: These nerves carry out both the functions done by the sensory and motor nerves.

Reflex Actions

The nervous system controls all our actions. Some of our actions are automatic. We do not have to think before doing them. These actions are called **reflex actions**.

The reflex actions are controlled by the spinal cord. For example, when your finger comes too close to a hot object, the sensory nerves immediately pass a message to the spinal cord. The spinal cord sends orders through the motor nerves for the muscles to tighten up, and we pull our hand away from the hot object even before we feel the pain.

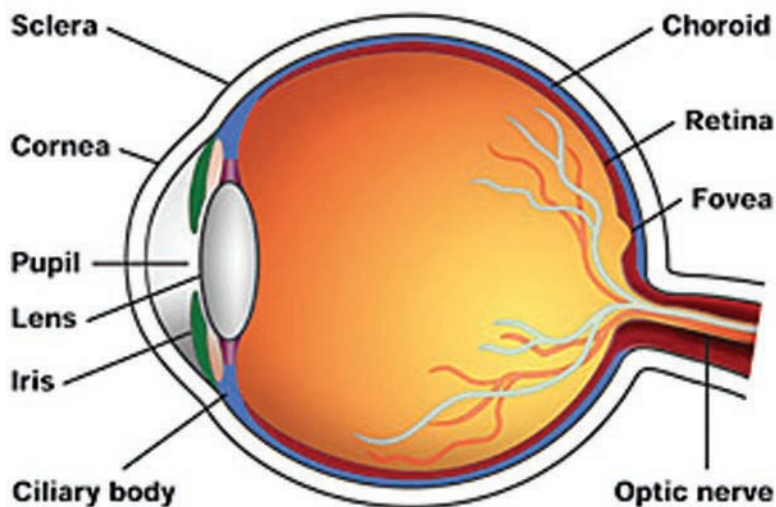
Sensory Organs

Sensory organs are our windows to the outside world. They help you to be aware of your surroundings. These sensory organs allow us to see, hear, smell, taste, and feel.

The following are our sensory organs:

Eyes

The eyes are present in the eye sockets in the skull. The eyelids and eyelashes protect the eyes from dust and dirt. The eyes are connected to the brain by the optic nerve.



Eyeballs have three layers:

- (i) **Cornea:** It is the first, transparent layer.
- (ii) **Iris:** It is the second, coloured layer. Within it lies a black spot called the pupil. The pupils enlarge in dim light and dilate in bright light.
- (iii) **Retina:** It is the third layer that acts as a “screen” on which the image of what we are seeing is formed.