17.2 NEURONS

Neurons are the basic structural and functional unit of the nervous system.

17.2.1 Structure of Neuron

Although neurons vary considerably in size and shape, they all have three basic components: a cell body, dendrites and an axon.

Cell body

The cell body is called **neuron cell body**. It contains a mass of granular cytoplasm and cell membrane. The single large nucleus is centrally placed with a prominent nucleolus. Golgi apparatus, mitochondria and other organelles are present. The cytoplasm is characterised by the presence of Nissl's bodies and neurofibrils. **Nissl's bodies** or **granules** are group of ribosomes and rough ER associated with protein synthesis.

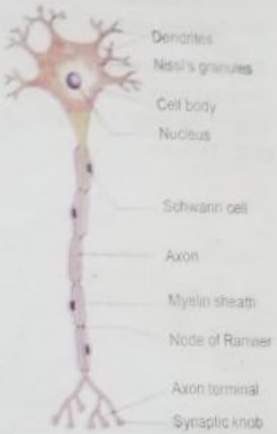

Fig. 17.1 Structure of neuron

Dendrites

Dendrites (Gr. *dendron*, tree) are short and thin, often highly branched cytoplasmic extensions that are gradually tapered from their bases to their tips. Axons of other neurons form synapses with the dendrites. The function of the dendrite is to receive stimuli and conduct impulses to the cell body.

Axon

An **axon** is comparatively a long and thick nerve fibre which has a constant diameter and can vary in size from a few mm to more than a metre length. It may be branched or un-branched. The cytoplasm of the axon is called **axoplasm** and its cell membrane is called **axolemma** Greek, *lemma*, sheath). Axons terminate by branching to form small extensions with enlarged ends called **presynaptic terminals**. Functionally, axons conduct action potentials from the neuron cell body to the presynaptic terminals, i.e., conduct signal (information) away from the cell body.

Myelin sheath and Schwann cells

Beside neuron, nervous system also consists of **neuroglia** or **glial cells**, which support, protect and nourish the neurons. **Schwann cells** or neurolemmocyte are neuroglial cells in peripheral

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Unipolar neuron has a single process an axon that extends from the cell body and divides into two. In bipolar neurons, the cell body is located between the two processes: an axon and a dendrite e.g., retina of the eye. Multipolar neurons have three or more processes i.e., the several dendrites and one axon.
Velocity of impulse in axon fibre depends upon the diameter, length and myelin sheath. The larger and thicker the axon, the faster it transmits information. The myelinated axons transmit information much faster than other

It cannot be modified.	It should be developed with experience
It may or may not have the direct involvement of the brain	It can easily be modified.
These are more common in the animals having short life span.	It has the direct involvement of the brain
It is economical as animals require no time to adapt them.	These are more common in the animals having long life span
	It is not economical as animals require more time to adapt them

19.4 SOCIAL BEHAVIOUR

Many species of insects and most vertebrates show a variety of (hostile or friendly) group behavioural activities associated with numbers of individuals living together. This is known as **social behaviour**. The cooperation achieved as a result of social behaviour has adaptive significance. It increases the efficiency and effectiveness of the species over that of the other species.

19.4.1 Hostile and Helpful Intraspecific Interaction

In bees hive, hostile interaction is seen among the worker bees. Old worker bee which is unable to perform its duties in hive is killed by other worker bees. On the other hand helpful interaction is found among these bees as different bees have specific duties to perform over all functions of the hive. Worker bees collect nectar and transform it into honey, drones are specific to perform the duty to fertilize the eggs and queen lays eggs.

19.4.2 Animal Society and Aggregation

Organisms living together in organized groups are said to live in societies. A **society**, or social group, is a group of individuals of the same species that interact with each other and influence each other's behaviour in different ways. This behavioural interaction is a key characteristic of society. A hive of bees, a pack of wolves and a school of fishes are examples of societies. Characteristics of a well-organized society include cooperation and division of labour among animals of different sexs, age groups or castes. Such as some members are specialized for finding food, reproduction, rearing and defence

A simple **aggregations** is a group of animals that may be together but do not interact behaviourally. For example huge flocks of birds of many species roosting together in trees are aggregations or a group of zebras, buffaloes are not societies.

19.4.3 Agonistic Behaviour

Agonistic behaviour includes a variety of threats or actual combat that settles disputes between individuals in a population. Agonistic interaction uses a great deal of energy, may cause

In case of lager stone PCNL is preferred in which a tube is inserted from the patient's back to the kidney to create a tract. A scope is run through the tract to directly visualize the stone inside the kidney. Ultrasound equipment can then be inserted to breakup the stone. While catching the stone through the scope, the stone fragments can be grasped with special equipment and pulled through the tract out from the kidney. Open surgery is now almost never needed except for large bladder stone.

15.5.3 Kidney Failure

A general term for a decline kidney function particularly the efficiency of the filtering process is called **kidney failure** or **renal failure**. **Chronic renal failure** is the irreversible deterioration in renal function. It is a gradual, slowly progressive and occurs over a period of years.

Chronic renal failure may be caused by: (a) Bacterial infection of the pelvis and surrounding tissue. (b) Nephritis (inflammation of glomeruli). (c) Damage due to high blood pressure. (d) Diabetes mellitus.

Acute renal failure may be caused by: (a) Haemorrhage due to trauma. (b) Vomiting, diarrhoea. (c) Diuresis (excess excretion of urine), sweating. (d) Obstruction of the ureters, bladder or urethra e.g., kidney stone. (e) Severe nephritis.

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Chronic kidney failure can progress to **end-stage renal disease (ESRD)** and uraemia, which is fatal unless artificial filtering (dialysis) or a kidney transplant.

15.5.4 Dialysis: Mechanism

A procedure to filter toxins from the blood by artificial methods when the kidneys are unable to perform this function is called **renal dialysis**. Dialysis works on the principle of kidneys although it is not as effective, efficient or thorough as the natural processes performed by the kidneys. There are two general types of renal dialysis: haemodialysis and peritoneal dialysis.

Haemodialysis

Haemodialysis removes wastes and water by circulating blood outside the body through an external filter, called a **dialyzer**, which consists of tubes of semipermeable membrane. In this process, a **catheter** is inserted into a blood vessel, usually in the arm. It routes the blood circulation externally through a machine that removes wastes. The cleansed blood then returns to the body through a second catheter. The haemodialysis machine consists of a pump and a container in which a network of synthetic tubes made up of cellophane membrane, called the **dialyzer**, is situated. The blood moves into the tubes of dialyzer from the top through blood pump. After circulating through the dialyzer, blood leaves the machine from the bottom and transfuses (to pour out into another vessel, to transfer to another's vein) back to the body. On the other hand, **dialysate** (dialysis fluid) pour into the machine from bottom, which after

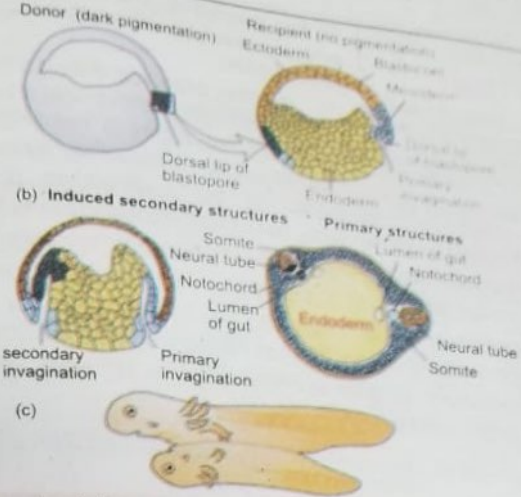

Fig. 21.6 Spemann's experiment showing the demonstration of embryonic induction (a) The blastopore lip from an early gastrula of a pigmented newt embryo was transplanted to the ventral vegetal side of an unpigmented recipient embryo. Because of the differences in pigmentation, the donor and recipient tissues could be distinguished visually. (b) The donor tissue induced the recipient tissue to form a secondary embryonic axis containing a notochord, neural tube, somites, and gut. (c) Eventually, a twinned embryo developed.

21.3 HUMAN EMBRYONIC DEVELOPMENT

Embryonic development begins with fertilization. After fertilization, zygote undergoes changes which leads the formation of foetus and then ultimately to an adult.

Fertilization of an egg by a sperm (also called conception in humans) normally occurs in the proximal part of oviduct. As the zygote passes down oviduct it undergoes **cleavage** which leads to the formation of **blastocyst.** Pregnancy is usually established when blastocyst is implanted into the **endometrium.** If the implantation is successful the embryo begins to secrete **human chorionic gonadotropin** (hCG). This hormone forces the corpus luteum in the ovary to continue to secrete progesterone, thereby maintaining the endometrium and inhibiting FSH production. The **chorion**, one

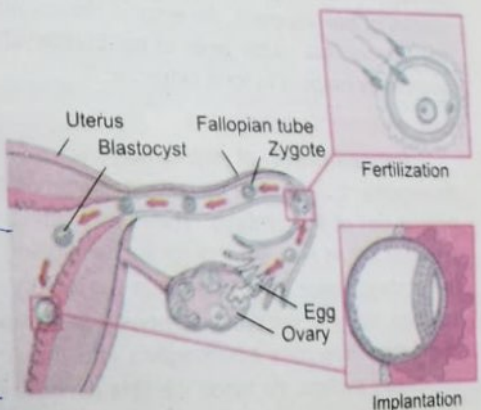

Fig. 21.7 Fertilization and implantation in human

Morula and Blastula

The first division results in the formation of two identical cells called **blastomeres**. DNA replication and mitotic division occur repeatedly. The cells get smaller and smaller with each division. Finally a solid ball of small cells, the **morula** is formed. The morula is still about the same size as the zygote. As cleavage or division continues, cells begin to move apart, so that spaces appear among cells in the centre of mass. Cells keep pulling away from the central area, forming a fluid cavity known as **blostocoel**. This hollow-sphere embryo which develops at the end of cleavage is called **blastula**. This embryonic stage in mammals is called **blastocyst**. The blastocyst is a fluid-filled hollow sphere composed of a single layer of large, flattened cells called **trophoblast cells** and a small cluster of 20 to 30 rounded cells, called the **inner cell mass**, located at one side.

Different patterns of cleavage based upon amount of yolk

Many animal eggs contain yolk. The yolk is a mixture of proteins, phospholipids and fats and serves as food for developing embryo. The amount and distribution of yolk vary among different animal groups. Most invertebrates and simple chordates have eggs with relatively small amounts of yolk uniformly distributed through the cytoplasm. Many vertebrates have large amounts of yolk concentrated at one end of the cell known as the **vegetal pole**. The opposite pole is called the **animal pole**. The amount of the yolk in the egg affects the pattern of cleavage. The cleavage is of two types: holoblastic cleavage, meroblastic cleavage.

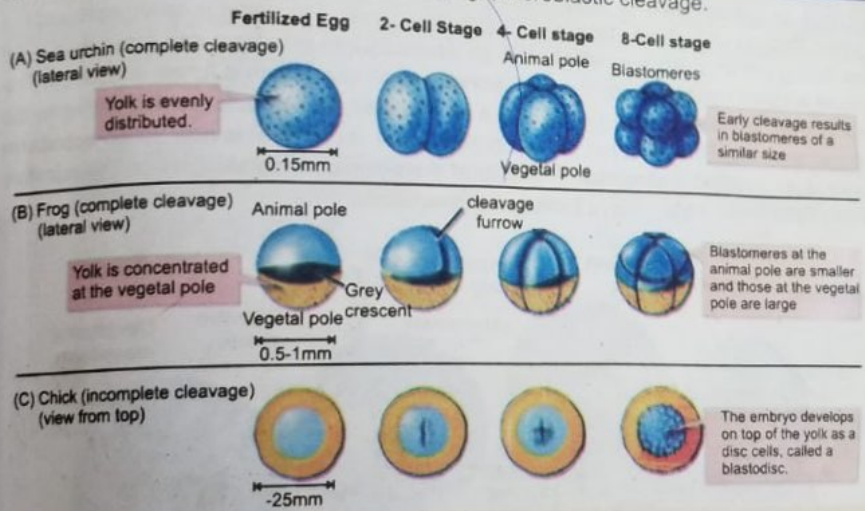

Fig. 21.2 Different patterns of cleavage

Holoblastic cleavage

In eggs with evenly distributed yolk, the entire egg divides, producing cells of roughly the same size. This type of cleavage is termed **holoblastic**, e.g., bony fishes and amphibians.