S.Y.B.Sc. Life Sciences Paper I Semester III ATKT March 2019

Answer Key

Q. P Code 00051986 **26th March 2019**

Q. 1. A) Define / Explain the following terms: (07)

1. Neuron: A neuron is a cell that carries electrical impulses. Neurons are the basic units of the nervous system.

2. Broaca's Area: a region in the frontal lobe of the cerebral hemisphere, usually the left, of the brain with functions linked to speech production.

3. Phototaxis: The bodily movement of a motile organism in response to light, either towards the source of light (*positive phototaxis*) or away from it (*negative phototaxis*).

4. Nutation: Nutation is the bending movements executed by some plant organs, such as stems, leaves, roots, etc., by which the part is inclined successively in various directions.

5. Amoebiosis: Random movement seen in the cells towards or away from stimulus.

6. Fixed Action Pattern: A fixed action pattern is a series or sequence of acts that occur behaviorally in animals.

7. Orthokinesis: A form of kinesis in which the speed of movement of the individual is dependent upon the intensity of the stimulus.

Q.1. B) Match the columns: (07)

Column A	Column B	Answer
a) Seminal vesicle	i) Birth control	v) Male reproductive system
b) Copper –T	ii) Embryo	i) Birth control
c) Sertoli cells	iii) Archenteron	vii) Seminiferous tubule
d) Gastrula	iv) Ovule	iii) Archenteron
e) Micropyle	v) Male reproductive system	iv) Ovule
f) Cotyledon	vi) Maize	ii) Embryo
g) Tassel	vii) Seminiferous tubule	vi) Maize

Q.1. C) Explain whether True or False: (06)

1. Homeostasis allows the body's cells to work at their optimum.Ans. True

2. Vasoconstriction leads to heat gain.Ans. False

3. Gibberlins stimulate stem elongation in plants.Ans. True

4. Ecdysone is a molting hormone in Molluscs. Ans False

5. Over production of Growth hormone leads to Acromegaly.Ans. True

6. Cholesterol is the precursor of Estrogen synthesis.Ans True

Q.2. A) Answer any one of the following: (10)

1. Explain elaborately the hormones secreted by the anterior and the posterior pituitary glands.

The pituitary gland is pea-sized structure located at the base of the brain. In humans, it consists of two lobes:

- the **Anterior Lobe** and
- the **Posterior Lobe**

The Anterior Lobe

The anterior lobe contains six types of secretory cells, all but one of which (#2 above) are specialized to secrete only one of the anterior lobe hormones. All of them secrete their hormone in response to hormones reaching them from the hypothalamus of the brain.

Thyroid Stimulating Hormone (TSH)

TSH (also known as thyrotropin) is a glycoprotein consisting of:

- a **beta** chain of 118 amino acids and
- an **alpha** chain of 92 amino acids. The alpha chain is identical to that found in two other pituitary hormones, FSH and LH as well as in the hormone chorionic gonadotropin. Thus it is its beta chain that gives TSH its unique properties.

The secretion of TSH is

- stimulated by the arrival of **thyrotropin releasing hormone** (**TRH**) from the hypothalamus.
- inhibited by the arrival of **somatostatin** from the hypothalamus.

As its name suggests, TSH stimulates the thyroid gland to secrete its hormone **thyroxine** (**T_4**). It does this by binding to transmembrane G-protein-coupled receptors (GPCRs) on the surface of the cells of the thyroid.

Some people develop antibodies against their own TSH receptors. When these bind the receptors, they "fool" the cell into making more T_4 causing **hyper**thyroidism. The condition is called thyrotoxicosis or Graves' disease.

Hormone deficiencies

A deficiency of TSH causes **hypo**thyroidism: inadequate levels of T_4 (and thus of T_3 [Link]).

Physicians occasionally encounter patients who are homozygous for mutant TSH **receptors** or mutant TRH **receptors**. In either case, they suffer from hypothyroidism.

A deficiency of TSH, or mutant TSH receptors, have also been implicated as a cause of osteoporosis. Mice, whose TSH receptors have been knocked out, develop increased numbers of bone-reabsorbing osteoclasts.

Follicle-Stimulating Hormone (FSH)

FSH is a heterodimeric glycoprotein consisting of

- the same alpha chain found in TSH (and LH)
- a beta chain of 118 amino acids, which gives it its unique properties.

Synthesis and release of FSH is triggered by the arrival from the hypothalamus of **gonadotropin-releasing hormone** (**GnRH**). The effect of FSH depends on one's sex.

FSH in females

In sexually-mature females, FSH (assisted by LH) acts on the follicle to stimulate it to release **estrogens**.

FSH produced by recombinant DNA technology (Gonal-f®) is available to promote ovulation in women planning to undergo in vitro fertilization (IVF) and other forms of assisted reproductive technology.

FSH in males

In sexually-mature males, FSH acts on spermatogonia stimulating (with the aid of testosterone) the production of sperm.

Luteinizing Hormone (LH)

LH is synthesized within the same pituitary cells as FSH and under the same stimulus (**GnRH**). It is also a heterodimeric glycoprotein consisting of

- the same 92-amino acid **alpha** subunit found in FSH and TSH (as well as in chorionic gonadotropin);
- a **beta** chain of 121 amino acids that is responsible for its properties.

The effects of LH also depend on sex.

LH in females

In sexually-mature females,

- a surge of LH triggers the completion of meiosis I of the egg and its release (**ovulation**) in the middle of the menstrual cycle;
- stimulates the now-empty follicle to develop into the **corpus luteum**, which secretes **progesterone** during the latter half of the menstrual cycle.

Women with a severe LH deficiency can now be treated with human LH (Luveris®) produced by recombinant DNA technology.

LH in males

LH acts on the interstitial cells (also known as Leydig cells) of the **testes** stimulating them to synthesize and secrete the male sex hormone, **testosterone**.

LH in males is also known as **interstitial cell stimulating hormone** (**ICSH**).

Prolactin (PRL)

Prolactin is a protein of 198 amino acids. During pregnancy it helps in the preparation of the breasts for future milk production.

After birth, prolactin promotes the synthesis of milk.

Prolactin secretion is

- stimulated by **TRH**
- repressed by **estrogens** and **dopamine**.

In pregnant mice, prolactin stimulates the growth of new neurons in the olfactory center of the brain.

Growth Hormone (GH)

Human growth hormone (HGH; also called somatotropin) is a protein of 191 amino acids. The GH-secreting cells are stimulated to synthesize and release GH by the intermittent arrival of **growth hormone releasing hormone** (**GHRH**) from the hypothalamus. GH promotes body growth by:

- binding to receptors on the surface of liver cells.
- This stimulates them to release **insulin-like growth factor-1** (**IGF-1**; also known as **somatomedin**)
- IGF-1 acts directly on the ends of the long bones promoting their growth

Things that can go wrong.

- In childhood,
    - **hypo**secretion of GH produces a short but normally-proportioned body.
    - Growth retardation can also result from an inability to **respond** to GH. This can be caused by inheriting two mutant genes encoding the **receptors** for
        - **GHRH** or
        - **GH** (causing Laron syndrome, a form of dwarfism) or
        - homozygosity for a disabling mutation in *STAT5b*, which is part of the "downstream" signaling process after GH binds its receptor.
    - **hyper**secretion leads to **gigantism**
- In adults, a **hyper**secretion of GH or GHRH leads to **acromegaly**.

Hormone-replacement therapy

GH from domestic mammals like cows and pigs does not work in humans. So for many years, the only source of GH for therapy was that extracted from the glands of human cadavers. But this supply was shut off when several patients died from a rare neurological disease attributed to contaminated glands [Link].

Now, thanks to recombinant DNA technology, **recombinant human GH** (r**HGH**) is available. While a benefit to patients suffering from GH deficiency or the short stature associated with Turner syndrome, there has also been pressure to use it to stimulate growth in youngsters who have no deficiency but whose parents want them to grow up tall. And so, in the summer of 2003, the U.S. FDA approved the use of human growth hormone (HGH) for

- boys predicted to grow no taller than 5′3″ and
- for girls, 4′11″

even though otherwise perfectly healthy.

ACTH — the adrenocorticotropic hormone

ACTH is a peptide of 39 amino acids. It is cut from a larger precursor **proopiomelanocortin** (**POMC**).

ACTH acts on the cells of the **adrenal cortex**, stimulating them to produce

- **glucocorticoids**, like **cortisol**;
- **mineralocorticoids**, like **aldosterone**;
- **androgens** (male sex hormones, like **testosterone**).
- In the fetus, ACTH stimulates the adrenal cortex to synthesize a precursor of estrogen called **dehydroepiandrosterone sulfate** (**DHEA-S**) which helps prepare the mother for giving birth.

Production of ACTH depends on the intermittent arrival of **corticotropin-releasing hormone** (**CRH**) from the hypothalamus.

Hypersecretion of ACTH is a frequent cause of Cushing's syndrome.

Alpha Melanocyte-Stimulating Hormone (α-MSH)

Alpha MSH is also a cleavage product of proopiomelanocortin (POMC). In fact, α-MSH is identical to the first 13 amino acids at the amino terminal of ACTH.

MSH is discussed in a separate page. Link to it.

The Posterior Lobe

The posterior lobe of the pituitary releases two hormones — both synthesized in the hypothalamus —

- **vasopressin** and
- **oxytocin**

into the circulation.

Vasopressin

Vasopressin is a peptide of 9 amino acids (Cys-Tyr-Phe-Gln-Asn-Cys-Pro-Arg-Gly). It is also known as **arginine vasopressin** (AVP) and the **antidiuretic hormone** (ADH).

Vasopressin acts on the collecting ducts of the kidney to facilitate the reabsorption of water into the blood. Thus it acts to reduce the volume of urine formed (giving it its name of antidiuretic hormone).

- A deficiency of vasopressin or
- inheritance of mutant genes for its **receptor** (called **V2**)

leads to excessive loss of urine, a condition known as **diabetes insipidus**. The most severely-afflicted patients may urinate as much as 30 liters (almost 8 gallons!) of urine each day. The

disease is accompanied by terrible thirst, and patients must continually drink water to avoid dangerous dehydration.

Vasopressin and the Circadian Clock

Mice are nocturnal and become active at the start of the night. This is a circadian rhythm that persists for a time even after the lights in the lab are turned off each day 8 hours sooner (like arriving in London after a flight from Los Angeles, California). Only after 8–10 days do the mice overcome their "jet lag", adjusting to the new dark-light schedule. (It also takes us about one day to reset our circadian rhythms for each hour that our day-night schedule is shifted.)

It turns out that arginine vasopressin, acting on the suprachiasmatic nucleus (SCN), plays a role in this resistance to resetting their circadian clock. Mice with their genes for the V1a and V1b receptors knocked out adjust much more quickly (2–4 days) to the change. What evolutionary advantage this resistance to resetting the circadian clock confers is not clear, but understanding the mechanism raises the possibility of using drugs to speed getting over jet lag and also to help those whose work shifts are periodically altered. (Read about this work in Yamaguchi, Y., *et al.* in the 4 October 2013 issue of **Science**.)

Oxytocin

Oxytocin is a peptide of 9 amino acids (Cys-Tyr-Ile-Gln-Asn-Cys-Pro-Leu-Gly).

It acts on certain smooth muscles:

- stimulating contractions of the uterus at the time of birth;
- stimulating release of milk when the baby begins to suckle.

Oxytocin is often given to prospective mothers to hasten birth.

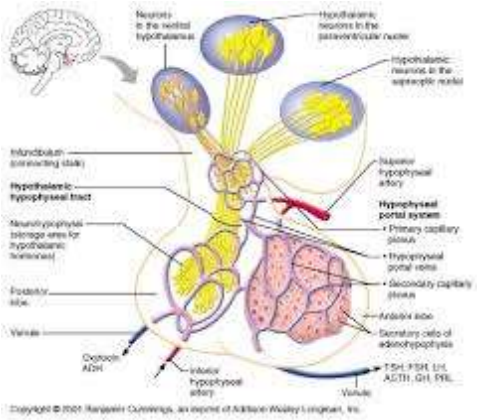
In rodents, oxytocin also acts on the nucleus accumbens and amygdala in the brain where it enhances:

- bonding between males and females after they have mated;
- bonding between a mother and her newborn.

In mice, oxytocin acts on striated muscle stem cells to promote repair after they have been injured.

In humans, oxytocin increases the level of one's trust in other people.

2. With neat labeled diagram of the Hypothalamus, describe the various hormones produced by it.



HYPOTHALAMIC HORMONE	EFFECTS ON THE ANTERIOR PITUITARY
Thyrotropin-releasing hormone (TRH)	Stimulates release of TSH (thyrotropin) and Prolactin
Corticotropin-releasing hormone (CRH)	Stimulates release of ACTH (corticotropin)
Gonadrotropin-releasing hormone (GnRH)	Stimulates release of FSH and LH (gonadotropins)
Growth hormone-releasing hormone (GHRH)	Stimulates release of growth hormone
Growth hormone release inhibiting hormone (GHRIH)	Inhibits release of growth hormone
{Prolactin-releasing hormone (PRH)	Stimulates release of prolactin
Prolactin release inhibiteryhormone (PRIH)-	Inhibits release of prolactin

Q. 2. B) Answer any two of the following: (10)

1. Describe the physiological role of Ecdysone.

Ecdysone is a steroidal prohormone of the major insect molting hormone 20-hydroxyecdysone, which is secreted from the prothoracic glands. Insect molting**hormones** (ecdysone and its homologues) are generally called ecdysteroids.

Ecdysone is the major steroid hormone in insects and plays essential roles in**coordinating** developmental transitions such as larval molting and metamorphosis through its active metabolite 20-hydroxyecdysone (20E).

Ecdysone is a steroidal prohormone of the major insect molting hormone 20-hydroxyecdysone, which is secreted from the prothoracic glands. Insect molting hormones (ecdysone and its homologues) are generally called ecdysteroids. Ecdysteroids act as moulting hormones of arthropods but also occur in other related phyla where they can play different roles. In *Drosophila melanogaster*, an increase in ecdysone concentration induces the expression of genes coding for proteins that the larva requires, and it causes chromosome puffs (sites of high expression) to form in polytene chromosomes.

2. Give biochemical role of androgens.

An **androgen** (from Greek *andr-*, the stem of the word meaning "man") is any natural or synthetic steroid hormone that regulates the development and maintenance of male characteristics in vertebrates by binding to androgen receptors.This includes the embryological development of the primary male sex organs, and the development of male secondary sex characteristics at puberty. Androgens are synthesized in the testes, the ovaries, and the adrenal glands

Androgens increase in both boys and girls during puberty. The major androgen in males is testosterone. Dihydrotestosterone (DHT) andandrostenedione are of equal importance in male development DHT *in utero*causes differentiation of penis, scrotum and prostate. In adulthood, DHT contributes to balding, prostate growth, and sebaceous gland activity.

Although androgens are commonly thought of only as male sex hormones, females also have them, but at lower levels: they function in libido and sexual arousal. Also, androgens are the precursors to estrogens in both men and women.

In addition to their role as natural hormones, androgens are used as medications; for information on androgens as medications, see the androgen replacement therapy and anabolic steroid articles.

3. Discus the biosynthesis and mechanism of action of Abscisic acid.

Abscisic acid (**ABA**) is a plant hormone. ABA functions in many plant developmental processes, including seed and bud dormancy, the control of organ size and stomatal closure. It is especially important for plants in the response to environmental stresses, including drought, soil salinity, cold tolerance, freezing tolerance, heat stress and heavy metal ion tolerance

ABA was originally believed to be involved in abscission. This is now known to be the case only in a small number of plants. ABA-mediated signaling also plays an important part in plant responses to environmental stress and plant pathogens. The plant genes for ABA biosynthesis and sequence of the pathway have been elucidated.ABA is also produced by some plant pathogenic fungi via a biosynthetic route different from ABA biosynthesis in plants.

Abscisic acid owes its names to its role in the abscission of plant leaves. In preparation for winter, ABA is produced in terminal buds. This slows plant growth and directs leaf primordia to develop scales to protect the dormant buds during the cold season. ABA also inhibits the division of cells in the vascular cambium, adjusting to cold conditions in the winter by suspending primary and secondary growth.

Abscisic acid is also produced in the roots in response to decreased soil water potential (which is associated with dry soil) and other situations in which the plant may be under stress. ABA then translocates to the leaves, where it rapidly alters the osmotic potential of stomatal guard cells, causing them to shrink and stomata to close. The ABA-induced stomatal closure reduces transpiration(evaporation of water out of the stomata), thus preventing further water loss from the leaves in times of low water availability. A close linear correlation was found between the ABA content of the leaves and their conductance (stomatal resistance) on a leaf area basis.

Seed germination is inhibited by ABA in antagonism with gibberellin. ABA also prevents loss of seed dormancy

4. Mention the abnormalities of thyroid glands.

Through the hormones it produces, the thyroid gland influences almost all of the metabolic processes in your body. Thyroid disorders can range from a small, harmless goiter (enlarged gland) that needs no treatment to life-threatening cancer. The most common thyroid problems involve abnormal production of thyroid hormones. Too much thyroid hormone results in a condition known as hyperthyroidism. Insufficient hormone production leads to hypothyroidism.

Although the effects can be unpleasant or uncomfortable, most thyroid problems can be managed well if properly diagnosed and treated.

What Causes Thyroid Problems?

All types of hyperthyroidism are due to an overproduction of thyroid hormones, but the condition can occur in several ways:

- Graves' disease: The production of too much thyroid hormone.
- **Toxic adenomas**: Nodules develop in the thyroid gland and begin to secrete thyroid hormones, upsetting the body's chemical balance; some goiters may contain several of these nodules.
- **Subacute thyroiditis**: Inflammation of the thyroid that causes the gland to "leak" excess hormones, resulting in temporary hyperthyroidism that generally lasts a few weeks but may persist for months.
- **Pituitary gland malfunctions or cancerous growths in the thyroid gland**: Although rare, hyperthyroidism can also develop from these causes.

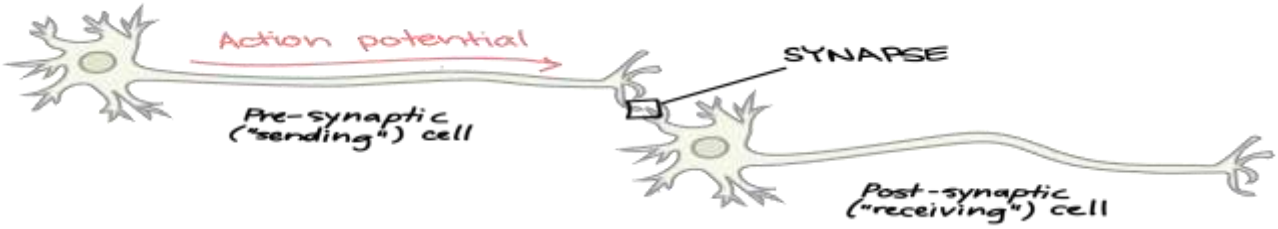
Hypothyroidism , by contrast, stems from an underproduction of thyroid hormones. Since your body's energy production requires certain amounts of thyroid hormones, a drop in hormone production leads to lower energy levels. Causes of hypothyroidism include:

- **Hashimoto's thyroiditis** : In this autoimmune disorder, the body attacks thyroid tissue. The tissue eventually dies and stops producing hormones.
- **Removal of the thyroid gland**: The thyroid may have been surgically removed or chemically destroyed.
- **Exposure to excessive amounts of iodide**: Cold and sinus medicines, the heart medicine amiodarone, or certain contrast dyes given before some X-rays may expose you to too much iodine.You may be at greater risk for developing hypothyroidism if you have had thyroid problems in the past.

Q.3. A) Answer any one of the following: (10)

1. What is a synapse? Give the role of synapse in conduction of nerve impulse.

Neurons communicate with one another at junctions called **synapses**. At a synapse, one neuron sends a message to a target neuron—another cell.
Most synapses are **chemical**; these synapses communicate using chemical messengers. Other synapses are **electrical**; in these synapses, ions flow directly between cells.
At a chemical synapse, an action potential triggers the presynaptic neuron to release **neurotransmitters**. These molecules bind to receptors on the postsynaptic cell and make it more or less likely to fire an action potential.
The action happens at the **synapse**, the point of communication between two neurons or between a neuron and a target cell, like a muscle or a gland. At the synapse, the firing of an action potential in one neuron—the **presynaptic**, or sending, neuron—causes the transmission of a signal to another neuron—the **postsynaptic**, or receiving, neuron—making the postsynaptic neuron either more or less likely to fire its own action potential.



2. Explain paratonic plant movement and its types with suitable examples.

A movement exhibited by a plant or plant part in response to an external stimulus. Taxes, *tropisms , and *nastic movements and mechanical hygroscopic and turgor movements are all examples of paratonic movements.

Paratonic or Induced Movements of Locomotion or the Tactic Movements or Taxes:

(1) Phototactic Movements or Phototaxis:

These movements occur in response to an external stimulus, the light and are exhibited by zoospores and gametes of certain algae e.g., Chlamydomonas, Volvox, Ulothrix, Cladophora etc. They show a positive phototactic movement under diffused light and a negative phototactic movement under intense light.

(2) Chemotactic Movements or chemo-taxis:

These movements occur in response to an external chemical stimulus. Such movements are exhibited most commonly by the antherozoids in bryophytes and pteridophytes where the archegonia secrete some chemical substances having a peculiar odour towards which the antherozoids are attracted chemotactically.

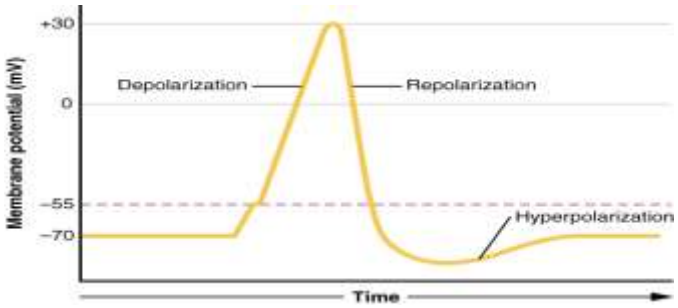
(3) Thermotatic Movements or thermotaxis:

Such movements result due to an external heat stimulus. For instance, if a large vessel containing some Chlamydomonas in cold water is warmed on one side, the Chlamydomonas cells will move and collect towards the warmer side (positive thermotaxis). However, a negative thermotaxis will occur if the temperature becomes too high.

Q. 3. B) Answer any two of the following: (10)

1. Explain Depolarizing phase w.r.t Action potential.

Depolarization is a change within a cell, during which the cell undergoes a shift in electric charge distribution, resulting in less negative charge inside the cell. Depolarization is essential to the function of many cells, communication between cells, and the overall physiology of an organism.



2. Explain Gravitropism with suitable example.

The gravity-directed growth process, called gravitropism, dictates upward shoot growth to ensure a proper positioning of the leaves for efficient photosynthesis and gas exchange. It also directs roots to grow downward in soil, where they can reach out to take up the water and mineral ions required for plant growth and development.Gravitropism has an important impact on agriculture. It allows plants to compete for the limited resources available in their immediate environment and ensures that crop shoots resume upward growth after prostration by the action of wind and rain Consequently, plants can keep their seeds away from soil moisture and pathogens and are more amenable to mechanical harvesting.

At the end of the 19th century, **Ciesielski (1872)** and **Darwin (1880)** demonstrated that a structure at the tip of the roots, the cap, is essential for root gravitropism. They postulated that the root cap could perceive a change in root-tip orientation within the gravitational field

(gravistimulus). Graviperception would then produce a physiological signal that, upon transmission to the elongation zone, would promote a differential cellular elongation on opposite flanks, which is responsible for the development of a curvature. The resulting curvature would allow the root tip to resume growth along a gravitropically more acceptable vector.

3. Give the difference between CNS and PNS.

The nervous system has two different major parts. The two parts are the central nervous system and the peripheral nervous. The central nervous system or the CNS contains the brain and the spinal cord. All together, the brain and the spinal cord serve the nervous system's command station. When the sensory input reaches the CNS, the spinal cord and the brain figure outs what it exactly means. After, they quickly orders out the body parts that needs to move faster.

Everything else but the CNS it is known as the peripheral nervous system. The peripheral nervous system or PNS contains the nerves, which leave the brain and the spinal cord and travel to certain areas of the body. The peripheral nervous system's main job is to send information gathered by the body's sensory receptors to the CNS as quickly as possible. Once the CNS has understood the information, the PNS will relay the specific orders back out the body. These nerves which carry information in a way of nerve impulses to and from the brain are called cranial nerves. The nerves that carry impulse to and are carrying information from the spine are called spinal nerves.

The PNS has two important parts. They are the motor division and the sensory division. The sensory division collects the impulses from the sensory receptors in areas like skin, muscles, and organs, and also carries those impulses through the nerves to the CNS. The motor division collects the outgoing messages from the CNS and delivers them to the appropriate body organs, telling them what to do. The motor division does the opposite from the sensory division.

4. Write a note on Habituation.

Study of the gill-withdrawal reflex in the sea slug *Aplysia* has provided insight into short-term learning processes . This simple behavior exhibits three of the most elementary forms of learning familiar in vertebrates: habituation, sensitization, and classical conditioning. Habituation is a *decrease* in behavioral response to a stimulus following repeated exposure to the stimulus with no adverse effect. Aplysia exhibits a reflexive withdrawal of its gill and siphon in response to weak or moderate tactile stimulation of its skin. Repeated tactile stimulation causes this defensive withdrawal reflex to habituate. Both short-term habituation, lasting < 30 min, and long-term habituation, which can last > 24h, have been reported in Aplysia. Habituation of the withdrawal reflex correlates with, and is in part due to, depression of transmission at the monosynaptic connection between mechanoreceptive sensory neurons and motor neurons within the abdominal ganglion. Habituation-related short-term depression of the sensorimotor synapse appears to be due exclusively to presynaptic changes. However, changes within the sensory neuron, by themselves, do not account for more persistent depression of the sensorimotor synapse.

Q.4. A) Answer any one of the following: (10)

1. What is sex determination? Explain chromosomal sex determination. Explain role of SRY in sex determination of mammals.

Determination of the sex of an individual during the development is known as sex determination. Sex determined on the basis of sex chromosomes, is known as chromosomal sex determination. In animals and plants sex chromosomes have been identified along with pattern of sex determination. Sex chromosomes combination XX female and XY male is in mammals. While in birds female are heterogametic ZW and males are homogametic. Drosophila shows sex determination with sex chromosomes to autosomes ratio. Discuss with examples.

Role of SRY in sex determination- Describe SRY structure, how it influences the development of bipotential gonad in details. Discuss in details

2. Explain plant-animal interaction for reproduction in Fig wasp.

Fig wasp female enters through ostiole in the hypanthodium inflorescence. She is dusted with pollen grains from the syconus from where she escapes. She lays eggs in the ovaries of female flowers. Haploid eggs develop into males.They fertilization may or may not take place. The fertilized egg develope into female

Q. 4. B) Answer any two of the following: (10)

1. What is Alternation of generation? Give schematic representation of life cycle of Adiantum.

Alternation of generation is the alternate appearance of diploid sporophyte and haploid gametophyte in the life cycle.

In the schematic representation the following stages should be mentioned

Sporophyte(2n), sporophyll(2n), sori(2n), sporangia(2n), spore mother cells(2n) Meiosis, Spores(n), gametophyte(n), antheridia(n) archegonia(n), antherozoids(n) egg((n), fertilization zygote/oosphore(2n), embryo(2n) back to sporophyte

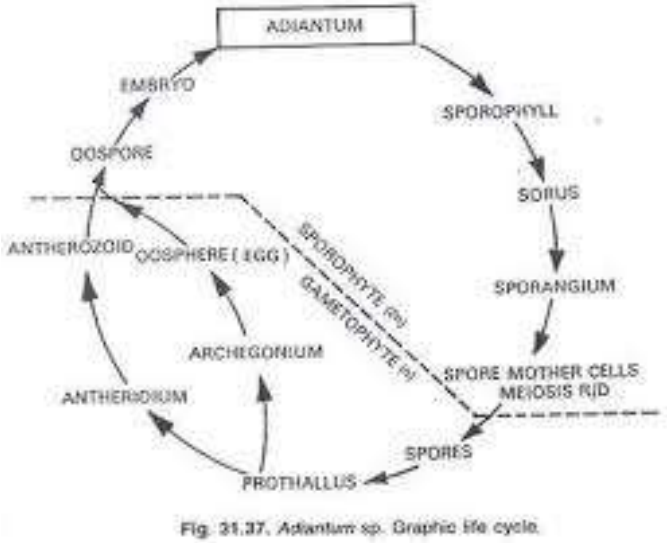
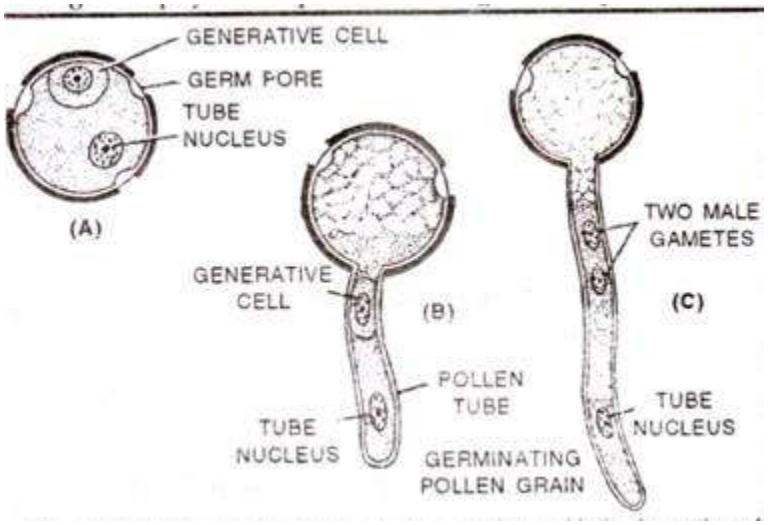


Fig. 31.37. Adiantum sp. Graphic life cycle

2. Describe Male gametophyte in Angiosperms.

Development of male gametophyte is endosporic. Pollen grain(microspore) is in 2 celled stage with small, lenticular generative cell and large tube cell. When the pollen falls on a suitable stigma, it germinates to give rise to male gametophyte. Intine extends through germ pore as initiation of germ tube. Tube nucleus is at the tip of germ tube, it guides the path of germ tube. The generative cell is behind the tube nucleus. On its way it divides and gives rise to two male gametes. Pollen tube at this stage is regarded as male gametophyte. Later the tube nucleus disintegrates. Diagram should be drawn.



3. Explain Internal structure of mammalian Ovary.

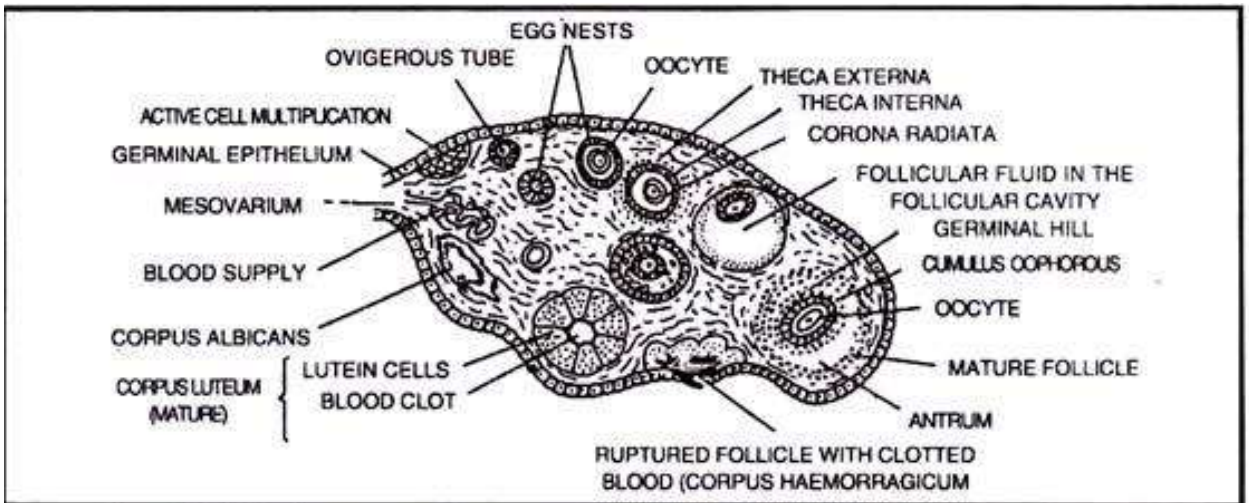


Fig. 2.8 T.S. of a mammalian ovary to show graafian follicle and corpus luteum.

Description of all parts of ovary.

4. Describe Blastula of Frog.

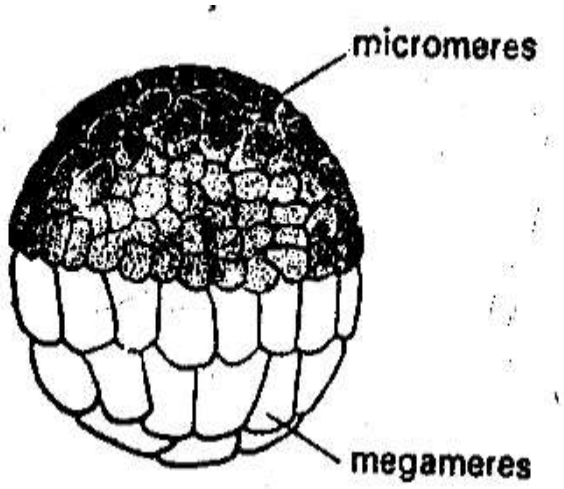


Fig. 37.14

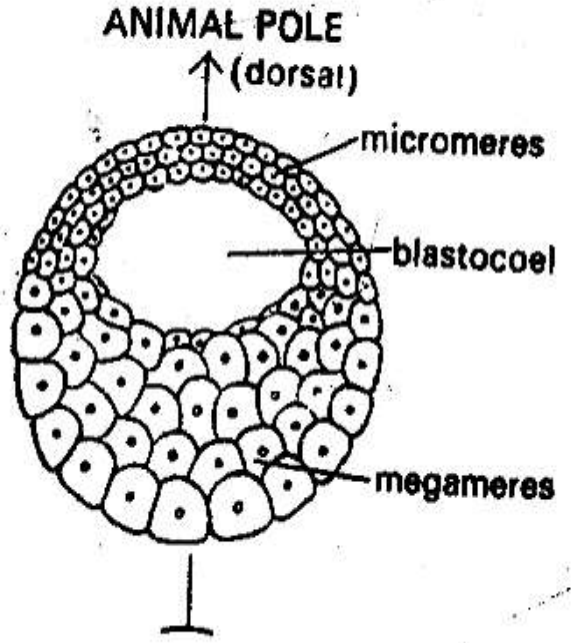


Fig. 37.15

Description of micromeres, megameres, blastocoel.

Q.5. Write short notes on any four of the following: (20)

1. Biochemical function of Adrenal medulla.

Adrenal Medulla	**Adrenalin**	Prepares the body for 'fright, fight or flight' ('FFF') and has many effects: Action of heart increased. Rate and depth of breathing increased.

	Metabolic rate increased. Force of muscular contraction improves. Onset of muscular fatigue delayed. Blood supply to the bladder and intestines reduced, their muscular walls relax, the sphincters contract.
Noradrenalin	Similar effects to adrenalin: Constriction of small blood vessels leading to increase in blood pressure. Increased blood flow through the coronary arteries and slowing of heart rate. Increase in rate and depth of breathing. Relaxation of the smooth muscle in the intestinal walls.

2. Mechanism of G-protein mediated cAMP synthesis.

G protein-coupled receptors (GPCRs) are a large family of integral membrane proteins that respond to a variety of extracellular stimuli. Each GPCR binds to and is activated by a specific ligand stimulus that ranges in size from small molecule catecholamines, lipids, or neurotransmitters to large protein hormones. When a GPCR is activated by its extracellular ligand, a conformational change is induced in the receptor that is transmitted to an attached intracellular heterotrimeric G protein complex. The G_s alpha subunit of the stimulated G protein complex exchanges GDP for GTP and is released from the complex

In a cAMP-dependent pathway, the activated G_s alpha subunit binds to and activates an enzyme called adenylyl cyclase, which, in turn, catalyzes the conversion of ATP into cyclic adenosine monophosphate (cAMP). Increases in concentration of the second messenger cAMP may lead to the activation of

- cyclic nucleotide-gated ion channels
- exchange proteins activated by cAMP
- popeye domain containing proteins
- an enzyme called protein kinase A (PKA)

The PKA enzyme is also known as cAMP-dependent enzyme because it gets activated only if cAMP is present. Once PKA is activated, it phosphorylates a number of other proteins including:

- enzymes that convert glycogen into glucose
- enzymes that promote muscle contraction in the heart leading to an increase in heart rate
- transcription factors, which regulate gene expression

Also phosphorylate AMPA

Specificity of signaling between a GPCR and its ultimate molecular target through a cAMP-dependent pathway may be achieved through formation of a multiprotein complex that includes the GPCR, adenylyl cyclase, and the effector protein

3. Lobes of cerebrum.

There are four **Lobes**. The **cerebral** cortex can be divided into four sections, which are known as **lobes**. The frontal **lobe**, parietal **lobe**, occipital **lobe**, and temporal **lobe** have been associated with different functions ranging from reasoning to auditory perception. The frontal lobe is important for cognitive functions and control of voluntary **movement** or activity. The parietal lobe processes information about temperature, taste, touch and **movement**, while the occipital lobe is primarily responsible for vision.

4. Nastic movements in plants.

The four types are: (1) Seismonastic Movements (2) Photonastic Movements (3) Thermonastic Movements and (4) Nyctinastic Movements.

Type # 1. Seismonastic Movements:

These movements are brought about by mechanical stimuli such as contact with a foreign body, fast wind and rain drops etc. Seismonastic movements are seen in stigmas, stamens and leaves of many plants. For instance, movements of leaf lets in Mimosa pudica, Biophytum sensitivum and Neptunia, etc.

Stigma lobes in certain plants such as Mimulus, Martynia and Bignonia, etc., encircle the pollengram as soon as it falls over them Stamens of Berberis, Portulaca and Opuntia respond instantly when touched by the body to any insect. The extent of the seismonastic movement depends upon such factors as the intensity of the stimulus, the vigour and age of the plant, and the time elapsed since the last stimulus.

Type # 2. Photonastic Movements:

These movements are induced by fluctuations in the intensity of light Such movements are exhibited by flowers of several plants. Many flowers open with the increasing illumination of the day and close up with the decrease in light intensity. Flowers of Cestrum nocturnum open at night, and close up with the dawn of the day.

Type # 3. Thermonastic Movements:

Such movements are brought about by changes in temperature. Many of the flower movements are thermonastic. Such flowers open with a rise and close with a drop in temperature. Sometimes thermonastic movements are associated with photonastic movements. In both types of responses the mechanism may be either differential growth, or changes in turgor on upper and lower sides of the petiole, leaf blade, or perianth part.

Type # 4. Nyctinastic Movements:

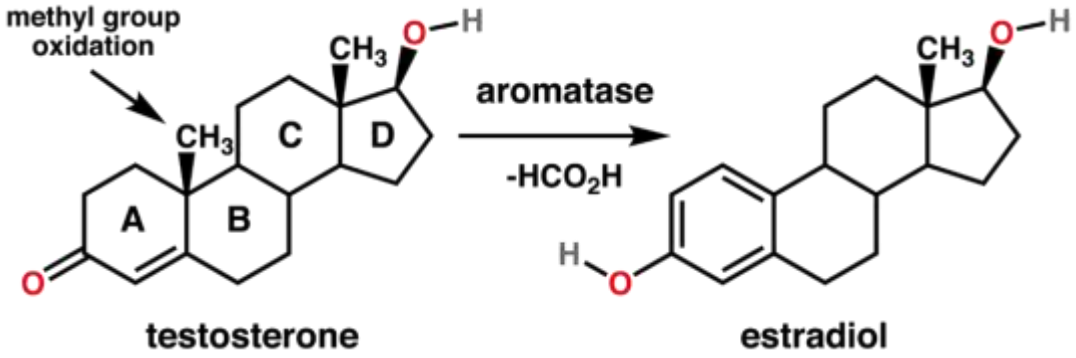
These movements are commonly called ‘sleeping movements’. Some authors have classified such movements under the category of photonastic or thermonastic movements. These movements are induced by alternation of day and night. The leaves of some plants like Enterobium, clover and oxalis, growing approximately horizontal during the day, begin to droop and close toward evening and do not rise again until the next morning.

Conclusion:

Various kinds of movements are exhibited by plants and their organs. Smaller plant organisms and naked protoplasmic bodies show movements of locomotion where as higher plants, being fixed in a position, show movements of curvature. All such movements may be tactic, tropic or nastic.

5. Aromatase.

Aromatase: An enzyme involved in the production of estrogen that acts by catalyzing the conversion of testosterone (an androgen) to estradiol (an estrogen). Aromatase is located in estrogen-producing cells in the adrenal glands, ovaries, placenta, testicles, adipose (fat) tissue, and brain. It is **CYP19A1**, a member of the cytochrome P450 superfamily (EC 1.14.14.1), which are monooxygenases that catalyze many reactions involved in steroidogenesis. In particular, aromatase is responsible for the aromatization of androgens into estrogens. It is an important factor in It is an important factor in sexual development.



6. Parthenogenesis

It is the development of a female gamete without fertilization. It occurs commonly among lower plants and invertebrate animals(particularly rotifers, aphids, ants, wasps, and bees) and rarely among higher vertebrates. An egg produced parthenogenetically may be either haploid (i.e., with one set of dissimilar chromosomes) or diploid (i.e., with a paired set of chromosomes). Parthenogenic species may be obligate (that is, incapable of sexual reproduction) or facultative (that is, capable of switching between parthenogenesis and sexual reproduction depending upon environmental conditions). The term *parthenogenesis* is taken from the Greek words *parthenos*, meaning "virgin," and *genesis*, meaning "origin." More than 2,000 species are thought to reproduce parthenogenically.

Any one example honey bee/ant.
