Answer Key
S.Y.B.Sc. Life Sciences
Paper I
QP code 20176
Date : 13th November 2017

Q1. DO AS DIRECTED: **(20)**

A] Fill in the blanks:

a) Feed forward

b) Ductless

c) Steroid

d) Suprachiasmatic nuclei (SCN)

e) Hypo secretion

f) Catabolism

g) Auxins (IAA)

Q.1.(B) Match the column:

a.(vi) b.(i) c.(v) d.(viii) e.(ii) f.(iii) g.(iv)

Q.1.C Explain the terms:

a) **Gametogenesis**: The development and production of the male and female germ cells required to form a new individual. i.e., it is the development of mature haploid gametes from either haploid or diploid precursor cells. The precursor cells undergo cell division in order to become gametes.

Q.1.C b) Aromatase, also called estrogen synthetase or estrogen synthase, is an enzyme responsible for a key step in the biosynthesis of estrogens. The aromatase enzyme can be found in many tissues including gonads, brain, adipose tissue, placenta, blood vessels, skin, bone, and endometrium, as well as in tissue of endometriosis, uterine fibroids, breast cancer, and endometrial cancer.

Q.1.C c)**Megasporogenesis** :The process of formation of the megaspore from the megaspore mother cell is called megasporogenesis. Ovules generally differentiate in to a single megaspore mother cell in the micropylar region of the nucellus, One megaspore is functional, while the other three degenerate. Only the functional megaspore develops into the female gametophyte.

Q2 A]

a) Define role of a Hormone and feedback mechanism

Need for a feedback regulation mechanism in endocrine system.

Represent diagrammatically the positive and negative loop.

Mention it can be long loop e.g.: target organ, pituitary and Hypothalamus

Shor loop feedback e.g.: pituitary. And Hypothalamus.

b) What is meant by Metamorphosis in Insects?

c) Nature of JH and Ecdysone. Source of the hormone with a diagram representation

d) Function of the hormones.

e) What happens once insect emerges as an adult?

Q2. B]

a) Cytokinin: Two types common: Zeatin and Kinetin a major source in Endosperm of seeds. Its role is seen in cell division and cell elongation, cell differentiation, Apical dominance and axillary bud growth, cotyledon expansion, delay in leaf senescence.

(Any five functions).

b) Homeostasis; Definition, what is meant by steady state and why not a equilibrium state. Example can be regulation of body temperature, salts, water (any one example) to explain the biological state of Homeostasis.

c) Any two function of male reproductive organ: Gametogenesis and production of Testosterone.

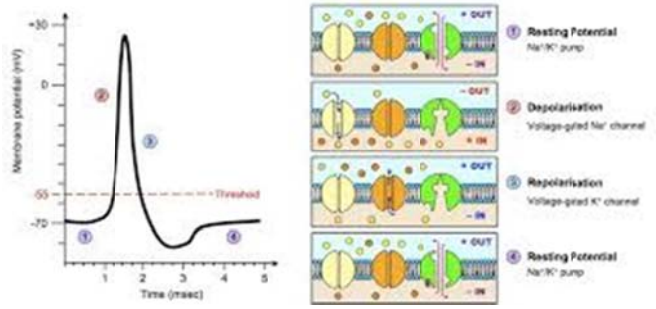
Diagram labelling: Sertoli cells, sperms, Spermatogonial cells and Leydig cells with neat demarcation of seminiferous tubules.

d) Receptors and Hormones: explain using example of peptide hormone/Steroid hormone. A diagram representation or a flow chart to explain the event is a complete answer.

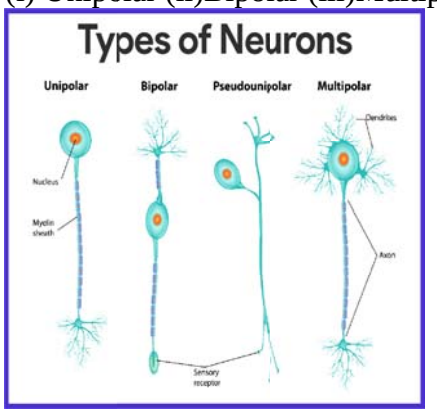
Q.3.(A)

(a) Innate Behaviour: Behaviour is the way the organism acts.
There are two types of behaviours: Innate and Acquired.
Innate behaviour is also known as stereotyped behaviour wherein the same pattern of behaviour is repeated and it is the outcome of inherent properties of nervous system of the animal.
Types: Any one of the following can be considered as example:
1.Fixed Action Pattern: Eg.Egg rolling behaviour of Graylag goose;Male Stickleback(Red underbelly).

2.Kinesis: Orthokinesis - Eg.Woodlice and Humidity ; klinokinesis – Flatworm and Light Source.
3.Taxes:
Phototaxis/Chemotaxis/Hydrotaxis/Thigmotaxis/Rheotaxis/Galvanotaxis/Thermotaxis/Pharotaxis /Menotaxis/Mnemotaxis/Phonotaxis/Anemotaxis.
4.Reflexes:Tonic and Phasic:
Exteroceptor;Enteroreceptor;Propioreceptor;cranial;conditional;unconditional.
Instinct : Eg.Food begging behaviour in gull chicks/Nest building.
(b)Actional Potential: Rapid change in the membrane potential of an excitable cell due to triggering of a stimulus and selective opening and closing of voltage-sensitive ion channels.
Phases: (i)Depolarization (ii)Repolarization (iii)After hypolarization phase
Diagram/Graph representing the Action potential phases.



Q.3.(B)
(a) Types of neurons on the basis of structure:
(i) Unipolar (ii)Bipolar (iii)Multipolar (iv)Pseudo unipolar



(b) Ganglionated Nervous System:
Nervous sytem in earthworm- Central,peripheral and Autonomic/Sympathetic
(i)Central Nervous System: Nerve Ring and Ventral Nerve Cord
(ii) Peripheral Nervous System: 8-10 Pairs of Nerves arising from CNS to different parts of body.(Circumpharyngeal and sub pharyngeal)
(iii) Symapthetic: Nerve plexus of alimentary canal and other internal organs.
(c)Taxes Movement:

It is an example of stereotyped /innate behaviour which is orientated in the direction away/towards the source of stimulus.
Any one of the following can be explained:
Phototaxis/Chemotaxis/Hydrotaxis/Thigmotaxis/Rheotaxis/Galvanotaxis/Thermotaxis/Pharotaxis /Menotaxis/Mnemotaxis/Phonotaxis/Anemotaxis.

(d)Autonomic Movement of Locomotion:

These movements are due to internal causes.In such cases ,the entire organisms, the zoospores and the gametes move as a whole from place to place.
Types: Ciliary,Amoeboid,Cyclosis.

Q.4 A a) Development of dicot embryo

- The oospore divides transversely forming two cells, a terminal cell and basal cell.
- The cell towards the micropylar end of the embryo sac is the suspensor cell (i.e., basal cell) and the other one makes to the embryo .cell (i.e., terminal cell).
- The terminal cell divides by a vertical division forming a 4-celled 1-shaped embryo. In certain plants the basal cell also forms the hypocotyl (i.e., the root end of the embryo) in addition of suspensor. Now each of the four cells divides transversely forming the octant stage (8-celled) of the embryo.
- The four cells next to the suspensor are termed the hypo-basal or posterior octants while the remaining four cells make the epibasal or anterior octants. The epibasal octants give rise to plumule and the cotyledons, whereas the hybobasal octants give rise to the hypocotyl with the exception of its tip.
- The eight cells of the octant divide periclinally forming outer and inner cells.
- The outer cells divide further by anticlinal division forming a peripheral layer of epidermal cells, the dermatogen. The inner cells divide by longitudinal and transverse divisions forming periblem beneath the dermatogen and plerome in the central region. The cells of periblem give rise to the cortex while that of plerome form the stele.
- At the time of the development of the octant stage of embryo the two basal cells divide transversely forming a 6-10 celled filament, the suspensor which attains its maximum development by the time embryo attains globular stage. The suspensor pushes the embryo cells down into the endosperm.
- The distal cell of the suspensor is much larger than the other cells and acts as a haustorium. The lowermost cell of the suspensor is known as hypophysis. By further divisions, the hypophysis gives rise to the embryonic root and root cap.
- With the continuous growth, the embryo becomes heart-shaped which is made up of two primordia of cotyledons. The mature embryo consists of a short axis and two cotyledons. Each cotyledon appears on either side of the hypocotyl.

- Differences :- 1. In monocots, Basal cell produces a single celled suspensor.

2. It forms the whole of the embryo. 3. It is transverse. 4. There is a single cotyledon.

5. Plumule appears lateral due to excessive growth of the single cotyledon.

Q.4 A b) **Parthenogenesis** is a natural form of asexual reproduction found most commonly in lower organisms and plants. Sometimes known as virgin birth, parthenogenesis, involves the growth of an individual without fertilization.

- Discovered in the 18th century by naturalist and philosopher, Charles Bonnet, parthenogenesis is a progressive evolutionary strategy that some organisms have employed to maintain a colony.
- Just as there are benefits to organisms that utilize parthenogenesis, like reproduction without the need of male gametes.
- A few ants and bees are capable of producing diploid female offspring parthenogenetically.

(Any one example .. ants/ honeybee/wasps)

In the intricate eusocial organization of honeybees, there are three social classes –queen bee, worker bees and drone bees.

- The queen bee, as the name entails, holds the superior position in the colony. The queen bee lays all the eggs in the colony, being the only bee with a set of completely developed ovaries and having life-long fertility.
- After only one mating flight were the queen mates with a couple male drone bees, she stores the sperm to later fertilizes some of the eggs.
- The eggs that get fertilized develop into female worker bees and the eggs that develop without fertilization produce male drone bees.
- Due to the high maintenance of both the colony and its products, i.e. honey, most of the bees in a hive are female worker bees. These worker bees carry on a magnitude of different tasks, not including reproduction, which is reserved only for the queen.
- The male drone bees are reserved for mating with the queen bee. Following copulation, the drone dies because of their barbed sex organ.

Q.4 B a) A series of changes, converting the single-layered blastula into a two-layered embryo or gastrula, are collectively known as gastrulation. This complex process is the sum of migration of prospective areas to their definite positions in the embryo. All such movements are self-determined and interdependent, and are termed morphogenetic movements. These are analysed thus:

Epiboly:

The rapid and continuous division of micromeres compels their migration from the animal pole towards the vegetal pole. It completely encloses the megameres except in the region of yolk plug. This process of overgrowth is called epiboly.

2. Formation of blastopore:

In the beginning of epiboly, a small crescentic groove appears postero- dorsally on blastula a little behind the edge of grey crescent in the presumptive endoderm. The groove is the beginning of the archenteron or gastrocoel and its anterior margin is the dorsal lip of blastopore. Its backwardly projecting lateral horns are called the lateral lips which finally meet below forming the ventral lip. Thus the crescentic groove becomes a complete circle, or blastopore, through which is visible a tiny spot of yolky endodermal cells, called yolk plug.

3. Invagination of endoderm:

As the prospective ectoderm cells or micromeres advance, the future endoderm cells or megameres gradually migrate towards blastopore and gradually sink inside.

4. Formation of archenteron: The advancing archenteron pushes the floor of the blastocoel, till the blastocoel is nearly replaced by the archenteron.

5. Involution

The advancing future notochord cells, or chordal cells, continue to roll-in (involute) till all the prospective chordal cells have disappeared from the surface. They extend beneath the neural plate cells which however remain on the surface.

The three layers, the ectoderm, mesoderm and endoderm are also known as primary germ layers. The various organs of the larval body develop from these three layers.

Q.4 B b) Adiantum is a common fern. It is found in the plains of the Punjab. It grows in shady places. It is found on moist walls or rocky places. The common specie of this genus is *Adiantum Capillus-Veneris.*

- **Life Cycle:** life cycle of adiantum shows hetromorphic alternation of generation, sporophyte being dominant and gametophyete small and reduced but separate and independent.
- The diploid sporophyte produce large number of sori (singular-sorus). They are green, but when ripe they become dark brwn. Each sorus consists of a number of sporangia covered by false indusium. The leaves bearing sporangia are called sporophylls.
- Each sporangium is slightly flattened, biconvex body (capsule) born on a multicellular stalk. Inside the sporangia, haploid spores are formed by reduction division, from diploid spore mother cells. The annulus of the sporangium contracts in dry weather, the stomial cells being thin-walled rupture and spores are dispersed by wind.
- When a spore falls on a moist soil, it germinates at a suitable temperature and produces a haploid gametophyte or prothallus.
- It produces antheridia and archegonia. The union of antherozoid and oosphere produces diploid oospore. Oospore germinates to form diploid sporophyte.
- Alternation of generations : Adiantum shows a regular alternation of sporophytic and gametophytic generations. Both generations are independent. Sporophyte produces the haploid spores by meiosis. The spores germinate to form haploid prothallus or gametophyte. It produces antheridia and archegonia. The union of antherozoid and oosphere produces diploid oospore. Oospore germinates to form diploid sporophyte.

Q.4 B c) All fig trees are pollinated by very small wasps of the family Agaonidae Fig trees are tropical plants with numerous species around the world. The most common are the Florida strangler fig (*Ficus aurea*) and the shortleaf fig also called giant bearded fig or wild banyan tree (*Ficus citrifolia*). All fig trees are pollinated by very small wasps of the family Agaonidae

- These tiny wasp pollinators are so small and insignificant and so well hidden most of their lives that they go unnoticed, thus they don't have a common name, only a scientific one.
- The wasp finds the fig by its scent and struggles to get inside through the small opening at the end of the fig.
- A tiny female wasp enters an opening (ostiole) on the syconium to pollinate the flowers and lay her eggs inside the short-style female flowers. It is such a tight passage that the wasp usually loses its wings and pieces of antennae.
- This pollen will allow all seeds to grow, not just the ones where it has deposited eggs.She inserts her ovipositor down the stylar canal and deposits an egg inside the ovary of each short-style flower. The oviposition injures the stylar canal, thus inhibiting pollen tube growth and fertilization in short-style flowers. Because her ovipositor is too short, the fig wasp is unable to oviposit inside the long-style flowers. The latter flowers each develop a seed (with an embryo and endosperm) by normal pollination and double fertilization. Having fulfilled her life's mission the female wasp dies inside the fig.
- The eggs become grubs that grow inside the seeds. After completing their full development in a few weeks they emerge from inside the seeds.
- The males emerge first and start looking for females to mate with. They are smaller than the females and don't even have wings; they will never fly. After mating they, like their mother, die inside the fig that was their home all their lives.
- When the females emerge they are already fertilized and ready to find another fig in which to lay their eggs. At this point, the male flowers inside the fig are ripe and loaded with pollen. Before abandoning their home the females will remember to take a supply of such pollen to carry to the next

Q.4 B d) SRY gene

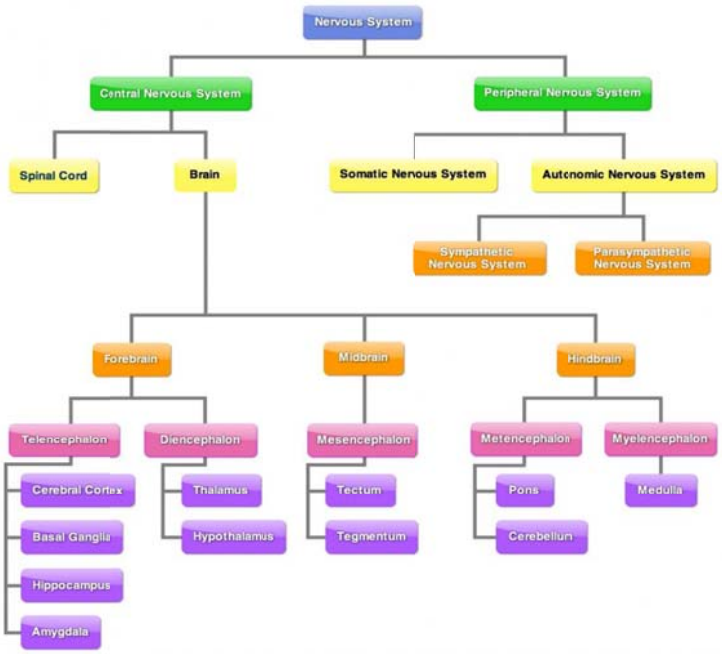
- In humans, the major gene for the testis-determining factor resides on the short arm of the Y chromosome. the position of the testis-determining gene has been narrowed down to a 35,000-base-pair region of the Y chromosome located near the tip of the short arm.
- In this region, Sinclair and colleagues (1990) found a male-specific DNA sequence that could encode a peptide of 223 amino acids.
- This gene is called ***SRY*** (sex-determining *r*egion of the *Y* chromosome), and there is extensive evidence that it is indeed the gene that encodes the human testis-determining factor.
- *SRY* is found in normal XY males and in the rare XX males, and it is absent from normal XX females and from many XY females. Another group of XY females was found to

have point or frameshift mutations in the *SRY* gene; these mutations prevent the SRY protein from binding to or bending DNA (Pontiggia et al. 1994; Werner et al. 1995). It is thought that several testis-specific genes contain SRY-binding sites in their promoters or enhancers, and that the binding of SRY to these sites begins the developmental pathway to testis formation

- . In several instances, the XX embryos injected with this sequence developed testes, male accessory organs, and penises .(Functional sperm were not formed, but they were not expected, either, because the presence of two X chromosomes prevents sperm formation in XXY mice and men, and the transgenic mice lacked the rest of the Y chromosome, which contains genes needed for spermatogenesis.) Therefore, there are good reasons to think that *Sry*/*SRY* is the major gene on the Y chromosome for testis determination in mammals
- SRY may have more than one mode of action in converting the bipotential gonads into testes. It had been assumed for the past decade that SRY worked directly in the genital ridge to convert the epithelium into male-specific sertoli cells.

Q.5. Write Short Notes on: Any four **(20)**

(a)General Organiztion of Nervous system:



(b)Seismonastic Movement:

The 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 stigma,stamens,leaves of amny plants.For eg. Leaflets of Mimosa pudica, Neptunia etc.

c) ABA: plant stress hormone, source is from mature leaves and translocated via phloem, released under stress conditions like drought, high salt, wound. Induce closing of stomata, inhibits fruit ripening, reduces photosynthesis, inhibits cell division.

d) Pars Nervosa: Location, Function: Neurosecretory cells, produce Oxytocin and Vasopressin. Functions of these two hormones.

e) Types of ovules

- Orthotropous or straight – funicle , chalaza and the micropyle lie in a straight line.eg Polygonaceae.
- Anatropous or inverted ovule : the micropyle lie close to the hilum and chalaza
- Amphitropus : The body of the ovule is straight and twisted in such a way that it is placed transversely at right angle to the stalk or funicle eg Ranunculus, Crucifers
- Campylotropus : ovule is curved or bent round so that the micropyle and chalaza do not lie in the same straight line . eg chenopodiaceae, caryophyllaceae, Graminae, Cruciferae.
- Circinotropus : The nucellus and the axis are in the same line. In the beginning, due to the rapid growth of the nucellus on one side, the ovule gets inverted. This curvature does not stop but continues with the result that the ovule turns completely and the micropyle again points upwards. Eg Opuntia

f) Role of environment in sex determination

The sex of most turtles and all species of crocodilians is determined by the environment after fertilization. In these reptiles, the temperature of the eggs during a certain period of development is the deciding factor in determining sex, and small changes in temperature can cause dramatic changes in the sex ratio. Often, eggs incubated at low temperatures (22– 27°C) produce one sex, whereas eggs incubated at higher temperatures (30°C and above) produce the other.If eggs are incubated below 28°C, all the turtles hatching from them will be male. Above 31°C, every egg gives rise to a female. At temperatures in between, the broods will give rise to individuals of both sexes. Variations on this theme also exist. The eggs of the snapping turtle *Macroclemys,* for instance, become female at either cool (22°C or lower) or hot (28°C or above) temperatures. Between these extremes, males predominate.