

# PADASALAI'S - TENTATIVE FULL ANSWER KEY

PUBLIC EXAM 2020 - 12<sup>th</sup> - ZOOLOGY

MARCH 2020 (B TYPE)

PART – A

ANSWER ALL THE QUESTIONS

1. a) SCID
2. b) Jacob and Monad
3. a) ia io and ib io
4. d) Both A and R are true and R is the correct explanation of A
5. c) i) true ii) false iii) true iv) false
6. c) Ideonella sakaiensis
7. c) Chromosome 19
8. a) Foetoscope
9. d) Plasma cells
10. b) Copper
11. c) Amenorrhea - absence of menstruation
12. c) The black buck ,The Indian spiny tailed lizard, The white footed fox
13. d) Zoological park
14. d) Gall fly
15. b) Individuals mate selectively

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PART -B

ANSWER ANY SIX OF THE FOLLOWING. QUESTION NO 24 IS COMPULORY

**16. What is colostrum? Write any one significance.**

The mammary glands secrete a yellowish fluid called colostrum during the initial few days after parturition.

It has less lactose than milk and almost no fat, but it contains more proteins, vitamin A and minerals.

Colostrum is also rich in IgA antibodies.

### **17.Placenta is an endocrine tissue. Justify.**

the placenta acts as a temporary endocrine gland and produces large quantities of human Chorionic Gonadotropin (hCG), human Chorionic Somatomammotropin (hCS) or human Placental Lactogen (hPL), oestrogens and progesterone which are essential for a normal pregnancy.

### **18.what is Huntington's chorea?**

It is inherited as an autosomal dominant lethal gene in man.

It is characterized by involuntary jerking of the body and progressive degeneration of the nervous system, accompanied by gradual mental and physical deterioration.

The patients with this disease usually die between the age of 35 and 40.

### **19.Differentiate divergent evolution and convergent evolution.**

Structures which are similar in origin but perform different functions are called homologous structures that brings about divergent evolution.

Similarly the thorn of *Bougainvillea* and the tendrils of *Curcubita* and *Pisum sativum* represent homology.

Organisms having different structural patterns but similar function are termed as analogous structures. For example, the wings of birds and insects are different structurally but perform the same function of flight that brings about convergent evolution

### **20. What is known as cytological isolation?**

Fertilization does not take place due to the differences in the chromosome numbers between the two species, the bull frog *Rana catesbiana* and gopher frog *Rana areolata*.

### **21.how does chemical mediators act as physiological barriers?**

Lysozyme acts as antibacterial agent and cleaves the bacterial cell wall.

Interferons induce antiviral state in the uninfected cells.

Complementary substances produced from leucocytes lyse the pathogenic microbes or facilitate phagocytosis.

### **22.write the key features of organic farming**

Protecting soil quality using organic materials and encouraging biological activity.

- Indirect provision of crop nutrients using soil microorganisms.
- Nitrogen fixation in soils using legumes.

- Weed and pest control based on methods like crop rotation, biological diversity, natural predators, organic manures and suitable chemical, thermal and biological interventions.

### **23. What are the eight categories of species in Red List?**

Red list has eight categories of species i) Extinct ii) Extinct in wild iii) Critically Endangered iv) Endangered v) Vulnerable vi) Lower risk vii) Data deficiency viii) Not evaluated.

### **24. By 2025, two thirds of the world's Population may face water shortages. So, what are the preventive measure to be taken to reduce water pollution?**

Regulate or control of pollutant(s) discharge at the point of generation.

- Wastewater can be pretreated by scientific methods before discharge to municipal treatment sources.
- Setting up of Sewage Treatment Plants (STP) and Effluent Treatment Plants (ETP).
- Regulate or restrict the use of synthetic fertilisers and pesticides.
- Public awareness and peoples' involvement is essential.

## **PART -C**

**ANSWER ANY SIX OF THE FOLLOWING. QUESTION NO 33 IS COMPULORY**

### **25. What is regeneration? Explain its types.**

Regeneration is regrowth in the injured region. Regeneration was first studied in Hydra by Abraham Trembley in 1740.

Regeneration is of two types, morphallaxis and epimorphosis. In morphallaxis the whole body grows from a small fragment e.g. Hydra and Planaria.

When Hydra is accidentally cut into several pieces, each piece can regenerate the lost parts and develop into a whole new individual.

The parts usually retain their original polarity, with oral ends, by developing tentacles and aboral ends, by producing basal discs.

Epimorphosis is the replacement of lost body parts. It is of two types, namely reparative and restorative.

**26. Describe any three of the Viral STI and mention their symptoms.**

Viral STI			
Genital herpes	Herpes simplex virus	Sores in and around the vulva, vagina, urethra in female or sores on or around the penis in male. Pain during urination, bleeding between periods. Swelling in the groin nodes.	2- 21 days (average 6 days)
Genital warts	Human papilloma virus (HPV)	Hard outgrowths (Tumour) on the external genitalia, cervix and perianal region.	1-8 months
Hepatitis-B	Hepatitis B virus (HBV)	Fatigue, jaundice, fever, rash and stomach pain. Liver cirrhosis and liver failure occur in the later stage.	30-80 days
AIDS	Human immunodeficiency virus (HIV)	Enlarged lymph nodes, prolonged fever, prolonged diarrhoea, weight reduction, night sweating.	2 to 6 weeks even more than 10 years.

**27. Write the main goal of Human Genome Project.**

The main goals of Human Genome Project are as follows

- Identify all the genes (approximately 30000) in human DNA.
- Determine the sequence of the three billion chemical base pairs that make up the human DNA.
- To store this information in databases.
- Improve tools for data analysis.
- Transfer related technologies to other sectors, such as industries.
- Address the ethical, legal and social issues (ELSI) that may arise from the project.

**28. Compare and contrast bacillary dysentery and amoebic dysentery**

S. No	Diseases	Causative agent	Site of infection	Mode of transmission	Symptoms
1	Shigellosis (Bacillary dysentery)	<i>Shigella sp.</i>	Intestine	Food and water contaminated by faeces / faecal oral route	Abdominal pain, dehydration, blood and mucus in the stools

**Amoebiasis** also called amoebic dysentery or amoebic colitis is caused by *Entamoeba histolytica*, which lives in the human large intestine and feeds on food particles and bacteria. Infective stage of this parasite is the **trophozoite**, which penetrates the walls of the host intestine (colon) and secretes histolytic enzymes causing ulceration, bleeding, abdominal pain and stools with excess mucus. Symptoms of amoebiasis can range from

diarrhoea to dysentery with blood and mucus in the stool. **House flies** (*Musca domestica*) acts as a carrier for transmitting the parasite from contaminated faeces and water.

### **29.What is Commensalism? Explain with an example.**

COMMENSALISM (+, 0): This defines the interaction in which two or more species are mutually associated in activities centering on food and one species at least, derives benefit from the association while the other associates are neither benefited nor harmed.

The concept of commensalism has been broadened in recent years, to apply to coactions other than those centering on food such as cover, support, production, and locomotion. Examples:

- Barnacles attached to Whales travel thousands of miles collecting and filtering food from the moving water. The whales are not affected by the barnacles.

### **30.Explain the role of Cry genes in genetically modified crops.**

During sporulation *Bacillus thuringiensis* produces crystal proteins called **Delta-endotoxin** which is encoded by **cry genes**. Delta-endotoxins have specific activities against the insects of the orders **Lepidoptera, Diptera, Coleoptera** and **Hymenoptera**.

When the insects ingest the toxin crystals their alkaline digestive tract denatures the insoluble crystals making them soluble.

The *cry* toxin then gets inserted into the gut cell membrane and paralyzes the digestive tract. The insect then stops eating and starves to death.

### **31.Deliberate release of GMOs (Genetically Modified Organisms) into the environment could have negative ecological effects. Write the possible risks of GMOs.**

Creating new or more vigorous pests and pathogens. Worsening the effects of existing pests through hybridization with related transgenic organisms. • Harming non-target species such as soil organisms, non-pest insects, birds and other animals.

- Disrupting biotic communities including agro ecosystems.
- Irreparable loss or changes in species diversity or genetic diversity within species.
- Creating risks for human health.

### Risks of GMOs

Environmental	Health	Agricultural
Toxins in pest-resistant GMOs could negatively impact non-target organisms and harm ecosystems.	Proteins transcribed and translated from transferred genes could cause allergic reactions in humans or other animals – <i>currently GM foods are not properly labeled.</i>	GMOs with pest toxins could increase evolution of resistance in certain pest populations.
Cross-species pollination could spread herbicide resistance genes and create 'super-weeds'.	Antibiotic resistance genes used as markers during gene transfer could spread to pathogenic bacteria.	Big biotech companies hold monopolistic legal rights (patents) over GM seeds.
Biodiversity could be negatively affected by destruction of pests, weeds, and even competing plants.	Transferred genes could mutate and cause unexpected risks.	GMOs do present two major agricultural problems in the forms of pesticide- and herbicide-resistance.

### 32. How would be the earth without green house effects?

Without this greenhouse effect, the average surface temperature would be **0 degrees Fahrenheit**.

Because CO<sub>2</sub> trap the heat energy and reflect to the earth

.Absence of CO<sub>2</sub> a temperature is low so that all water on Earth would freeze, so life not exist.

### 33. Imagine. If atrophy of thymus occurs in a child. What would be the serious consequences the child would face? Explain briefly

Atrophy of thymus will affect the maturation of T lymphocyte. Because thymus medulla is sparsely populated with thymocytes.

One of its main secretions is the hormone **thymosin**. It stimulates the T cell to become mature and **immunocompetent**.

So, the Baby's immune competent system will be affected. T lymphocyte is responsible for the cell mediated immune response (Natural Immunity) it is also affected.

### PART :D

### ANSWER ALL THE QUESTIONS

### 34. Explain the role of oxytocin and relaxin in parturition and lactation.

A hormone called **relaxin** is also secreted during the later phase of pregnancy which helps in relaxation of the pelvic ligaments at the time of parturition.

**Parturition** is the completion of pregnancy and giving birth to the baby. The series of events that expels the infant from the uterus is collectively called "labour". Throughout

pregnancy the uterus undergoes periodic episodes of weak and strong contractions. These contractions called **Braxter-Hick's contractions** lead to false labour.

As the pregnancy progresses, increase in the oestrogen concentration promotes uterine contractions. These uterine contractions facilitate moulding of the foetus and downward movement of the foetus. The descent of the foetus causes dilation of cervix of the uterus and vaginal canal resulting in a **neurohumoral reflex** called **Foetal ejection reflex** or **Ferguson reflex**. This initiates the secretion of oxytocin from the neurohypophysis which in turn brings about the powerful contraction of the uterine muscles and leads to the expulsion of the baby through the birth canal. This sequence of events is called as **parturition** or **childbirth**.

Relaxin is a hormone secreted by the placenta and also found in the corpus luteum. It promotes parturition by relaxing the pelvic joints and by dilatation of the cervix with continued powerful contractions. The amnion ruptures and the amniotic fluid flows out through the vagina, followed by the foetus. The placenta along with the remains of the umbilical cord called "**after birth**" is expelled out after delivery.

**Lactation** is the production of milk by mammary glands. The mammary glands show changes during every menstrual cycle, during pregnancy and lactation. Increased level of oestrogens, progesterone and **human Placental Lactogen (hPL)** towards the end of pregnancy stimulate the hypothalamus towards prolactin – releasing factors. The anterior pituitary responds by secreting **prolactin** which plays a major role in lactogenesis.

Oxytocin causes the "**Let-Down**" **reflex**- the actual ejection of milk from the alveoli of the mammary glands. During lactation, oxytocin also stimulates the recently emptied uterus to contract, helping it to return to pre - pregnancy size.

**OR**

### **Define infertility. Write causes**

Inability to conceive or produce children even after unprotected sexual cohabitation is called infertility. That is, the inability of a man to produce sufficient numbers or quality of sperm to impregnate a woman or inability of a woman to become pregnant or maintain a pregnancy.

The causes for infertility are tumours formed in the pituitary or reproductive organs, inherited mutations of genes responsible for the biosynthesis of sex hormones, malformation of the cervix or fallopian tubes and inadequate nutrition before adulthood. Long-term stress damages many aspects of health especially the menstrual cycle. Ingestion of toxins (heavy metal cadmium), heavy use of alcohol, tobacco and marijuana, injuries to the gonads and aging also cause infertility.

#### **Other causes of infertility**

Pelvic inflammatory disease (PID), uterine fibroids and endometriosis are the most common causes of infertility in women.

Low body fat or anorexia in women. i.e. a psychiatric eating disorder characterised by the fear of gaining weight.

Undescended testes and swollen veins (varicocele) in scrotum.

- Tight clothing in men may raise the temperature in the scrotum and affect sperm production.
- Under developed ovaries or testes.
- Female may develop antibodies against her partner's sperm.
- Males may develop an autoimmune response to their own sperm.

All women are born with ovaries, but some do not have functional uterus. This condition is called Mayer-Rokitansky syndrome.

### **35. Give an account of allosomal abnormalities in human beings**

Mitotic or meiotic non-disjunction of sex chromosomes causes allosomal abnormalities. Several sex chromosomal abnormalities have been detected. Eg. Klinefelter's syndrome and Turner's syndrome.

#### **1. Klinefelter's Syndrome (XXY Males)**

This genetic disorder is due to the presence of an additional copy of the X chromosome resulting in a karyotype of 47,XXY. Persons with this syndrome have 47 chromosomes (44AA+XXY). They are usually sterile males, tall, obese, with long limbs, high pitched voice, under developed genitalia and have feeble breast (gynaecomastia) development.

#### **2. Turner's Syndrome (XO Females)**

This genetic disorder is due to the loss of a X chromosome resulting in a karyotype of 45,X. Persons with this syndrome have 45 chromosomes (44 autosomes and one X chromosome) (44AA+XO) and are sterile females. Low stature, webbed neck, under developed breast, rudimentary gonads lack of menstrual cycle during puberty, are the main symptoms of this syndrome.

OR

### **'Darwin's finches and Australian marsupials are suitable examples of adaptive radiation'- Justify this statement.**

The evolutionary process which produces new species diverged from a single ancestral form becomes adapted to newly invaded habitats is called adaptive radiation. Adaptive radiations are best exemplified in closely related groups that have evolved in relatively short time. Darwin's finches and Australian marsupials are best examples for adaptive radiation. When more than one adaptive radiation occurs in an isolated geographical area, having the same structural and functional similarity it is due to convergent evolution.

#### **Darwin's finches**



Their common ancestor arrived on the Galapagos about 2 million years ago. During that time, Darwin's finches have evolved into 14 recognized species differing in body size, beak shape and feeding behavior. Changes in the size and form of the beak have enabled different species to utilize different food resources such as insects, seeds, nectar from cactus flowers and blood from iguanas, all driven by Natural selection. Genetic variation in the ALX1 gene in the DNA of Darwin finches is associated with variation in the beak shape. Mild mutation in the ALX1 gene leads to phenotypic change in the shape of the beak of the Darwin finches.

Marsupials in Australia and placental mammals in North America are two subclasses of mammals they have adapted in similar way to a particular food resource, locomotory skill or climate. They were separated from the common ancestor more than 100 million year ago and each lineage continued to evolve independently. Despite temporal and geographical separation, marsupials in Australia and placental mammals in North America have produced varieties of species living in similar habitats with similar ways of life. Their overall resemblance in shape, locomotory mode, feeding and foraging are superimposed upon different modes of reproduction. This feature reflects their distinctive evolutionary relationships.

Over 200 species of marsupials live in Australia along with many fewer species of placental mammals. The marsupials have undergone adaptive radiation to occupy the diverse habitats in Australia, just as the placental mammals have radiated across North America.

### **36. List out the Salient feature of Genetic Code.**

- The genetic codon is a **triplet code** and 61codons code for amino acids and 3 codons do not code for any amino acid and function as **stop codon** (Termination).
- The genetic code is universal. It means that all known living systems use nucleic acids and the same three base codons (triplet codon) direct the synthesis of protein from amino acids. For example, the mRNA(UUU) codon codes for phenylalanine in all cells of all organisms. Some exceptions are reported in prokaryotic, mitochondrial and chloroplast genomes. However similarities are more common than differences.
- A non-overlapping codon means that the same letter is not used for two different codons. For instance, the nucleotide sequence GUU GUC represents only two codons.
- It is comma less, which means that the message would be read directly from one end to the other i.e., no punctuation are needed between two codes.
- A degenerate code means that more than one triplet codon could code for a specific amino acid. For example, codons GUU,GUC, GUA and GUG code for valine.
- Non-ambiguous code means that one codon will code for one amino acid.
- The code is always read in a fixed direction i.e. from 5'→3' direction called polarity.
- AUG has dual functions. It acts as a initiator codon and also codes for the amino acid methionine.
- UAA, UAG (tyrosine) and UGA(tryptophan) codons are designated (stop) codons and also are known as “non-sense” codons.

OR

Explain the process of transcription in eukaryotes.

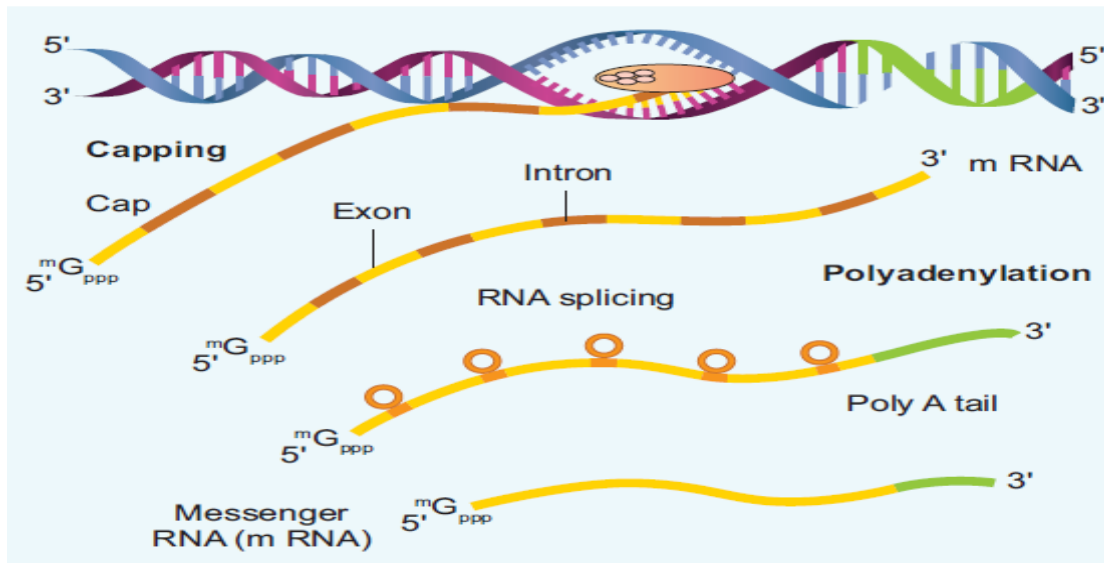


Fig. 5.9 Process of transcription in eukaryotes

In Eukaryotes, there are at least three RNA polymerases in the nucleus (in addition to RNA polymerase found in the organelles). There is a clear division of labour. The RNA polymerase I transcribes rRNAs (28S, 18S and 5.8S), whereas the RNA polymerase III is responsible for transcription of tRNA, 5srRNA and snRNA.

The RNA polymerase II transcribes precursor of mRNA, the hnRNA (heterogenous nuclear RNA). In eukaryotes, the monocistronic structural genes have interrupted coding sequences known as **exons** (expressed sequences) and non-coding sequences called **introns** (intervening sequences). The introns are removed by a process called **splicing**. hnRNA undergoes additional processing called as **capping** and **tailing**.

In capping an unusual nucleotide, methyl guanosine triphosphate is added at the 5' end, whereas adenylate residues (200-300) (Poly A) are added at the 3' end in tailing. Thereafter, this processed hnRNA, now called mRNA is transported out of the nucleus for translation.

The split gene feature of eukaryotic genes is almost entirely absent in prokaryotes. Originally each exon may have coded for a single polypeptide chain with a specific function. Since exon arrangement and intron removal are flexible, the exon coding for these polypeptide subunits act as domains combining in various ways to form new genes.

Single genes can produce different functional proteins by arranging their exons in several different ways through alternate splicing patterns, a mechanism known to play an important role in generating both protein and functional diversity in animals. Introns would have arisen before or after the evolution of eukaryotic gene. If introns arose late how did they enter eukaryotic gene? Introns are mobile DNA sequences that can splice themselves out of, as well as into, specific 'target sites' acting like mobile transposon-like elements (that mediate transfer of genes between organisms - Horizontal Gene Transfer - HGT).

HGT occurs between lineages of prokaryotic cells, or from prokaryotic to eukaryotic cells and between eukaryotic cells. HGT is now hypothesized to have played a major role in the evolution of life on earth.

### 37. How is amplification of gene sample of interest carried out using PCR?

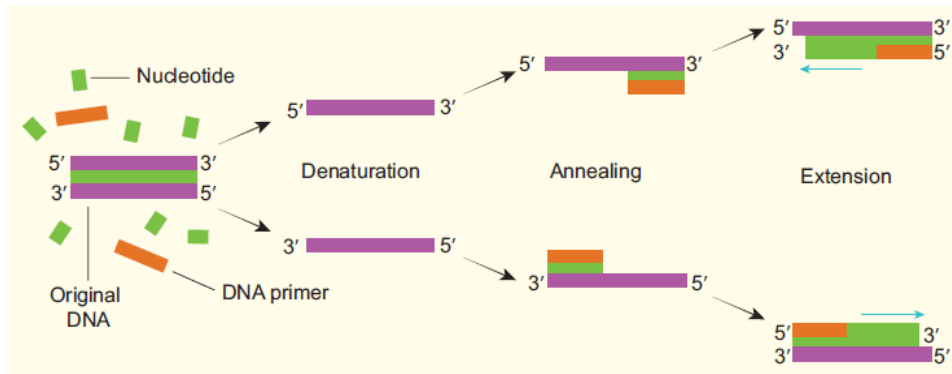


Fig. 10.7 Steps involved in PCR

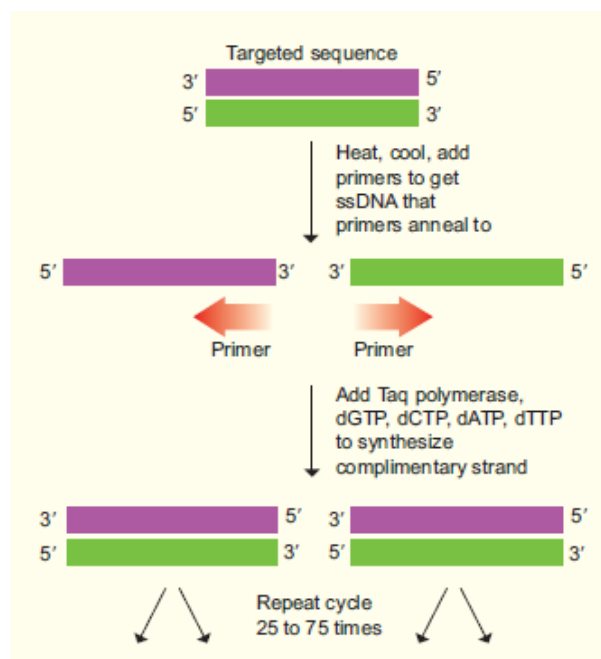


Fig. 10.8 Polymerase chain reaction

The polymerase chain reaction (PCR) is an invitro amplification technique used for synthesising multiple identical copies (billions) of DNA of interest. The technique was developed by Kary Mullis (Nobel laureate, 1993) in the year 1983.

Denaturation, renaturation or primer annealing and synthesis or primer extension, are the three steps involved in PCR. The double stranded DNA of interest is denatured to separate into two individual strands by high temperature. This is called denaturation. Each strand is allowed to hybridize with a primer (renaturation or primer annealing).

The primer template is used to synthesize DNA by using Taq – DNA polymerase. During denaturation the reaction mixture is heated to 950 C for a short time to denature

the target DNA into single strands that will act as a template for DNA synthesis. Annealing is done by rapid cooling of the mixture, allowing the primers to bind to the sequences on each of the two strands flanking the target DNA.

During primer extension or synthesis the temperature of the mixture is increased to 75°C for a sufficient period of time to allow Taq DNA polymerase to extend each primer by copying the single stranded template. At the end of incubation both single template strands will be made partially double stranded.

The new strand of each double stranded DNA extends to a variable distance downstream. These steps are repeated again and again to generate multiple forms of the desired DNA. This process is also called DNA amplification.

The PCR technique can also be used for amplifications of RNA in which case it is referred to as reverse transcription PCR (RT-PCR). In this process the RNA molecules (mRNA) must be converted to complementary DNA by the enzyme reverse transcriptase. The cDNA then serves as the template for PCR.

**OR**

**What are two most prevent helminthic diseases in human beings? Explain them.**

Helminthes are mostly endoparasitic in the gut and blood of human beings and cause diseases called helminthiasis. The two most prevalent helminthic diseases are Ascariasis and Filariasis.

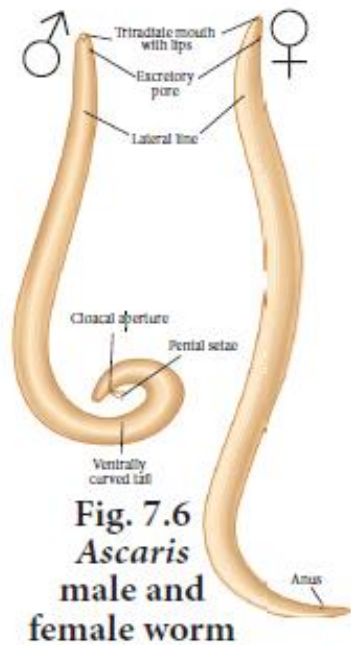
Ascaris is a monogenic parasite and exhibits sexual dimorphism. Ascariasis is a disease caused by the intestinal endoparasite *Ascaris lumbricoides* commonly called the round worms. It is transmitted through ingestion of embryonated eggs through contaminated food and water.

Children playing in contaminated soils are also prone to have a chance of transfer of eggs from hand to mouth. The symptoms of the disease are abdominal pain, vomiting, headache, anaemia, irritability and diarrhoea. A heavy infection can cause nutritional deficiency and severe abdominal pain and causes stunted growth in children. It may also cause enteritis, hepatitis and bronchitis.

**Filariasis** is caused by *Wuchereria bancrofti*, commonly called **filarial worm**. It is found in the **lymph vessels** and **lymph nodes** of man. *Wuchereria bancrofti* is sexually dimorphic, viviparous and digenic.

The life cycle is completed in two hosts, man and the female *Culex* mosquito. The female filarial worm gives rise to **juveniles** called **microfilariae larvae**. In the lymph glands, the juveniles develop into adults.

The accumulation of the worms block the lymphatic system resulting in inflammation of the lymph nodes. In some cases, the obstruction of lymph vessels causes elephantiasis or filariasis of the **limbs**, **scrotum** and **mammary glands**



**Fig. 7.6**  
***Ascaris***  
**male and**  
**female worm**



**Fig. 7.7** *Wuchereria bancrofti*

**Fig. 7.8** Chronic inflammation of the lower limbs

### 38. Explain the exotic species invasion.

Exotic species (non-native; alien) are organisms often introduced unintentionally or deliberately for commercial purpose, as biological control agents and other uses. They often become invasive and drive away the local species and is considered as the second major cause for extinction of species. Exotic species have proved harmful to both aquatic and terrestrial ecosystems.

Tilapia fish (Jilabi kendai) (*Oreochromis mosambicus*) introduced from east coast of South Africa in 1952 for its high productivity into Kerala's inland waters, became invasive, due to which the native species such as *Puntius dubius* and *Labeo kontius* face local extinction.

Amazon sailfin catfish is responsible for destroying the fish population in the wetlands of Kolkata. The introduction of the Nile Perch, a predatory fish into Lake Victoria in East Africa led to the extinction of an ecologically unique assemblage of more than 200 nature species of cichlid fish in the lake.

African apple snail (*Achatina fulica*) is the most invasive among all alien fauna in India. This mollusc was first reported in the Andaman and Nicobar Islands. It is now found across the country and threatens the habitat of several native species. Moreover it is becoming a vicious pest in vegetable farms.

Exotic earthworms compete for food with native varieties and deplete their population in soil. Papaya Mealy Bug (*Paracoccus marginatus*) is native of Mexico and Central America, is believed to have destroyed huge crops of papaya in Assam, West Bengal and TamilNadu.

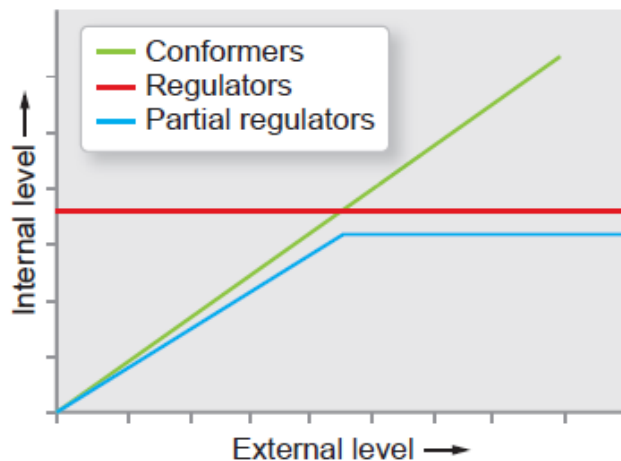
**OR**

**Every living organisms responds to its environment. Explain the various types by which organisms respond to abiotic conditions.**

Every living organism responds to its environment. There are various ways by which organisms respond to abiotic conditions. Some organisms can maintain constant physiological and morphological conditions or undertake steps to overcome the environmental condition, which in itself is a response

The types of responses observed are

- **Regulate:** Some organisms are able to maintain homeostasis by physiological means which ensures constant body temperature, ionic / osmotic balance. Birds, mammals and a few lower vertebrate and invertebrate species are capable of such regulation.
- **Conform:** Most animals cannot maintain a constant internal environment. Their body temperature changes with the ambient temperature. In aquatic animals like fishes, the osmotic concentration of the body fluids changes with that of the ambient water osmotic concentration. Such animals are called Conformers. In case of extreme condition, the inhabitants relocate themselves as in migration.
- **Migrate:** Organisms tend to move away temporarily from a stressful habitat to a new, hospitable area and return when the stressful period is over. Birds migrate from Siberia to Vedanthangal in Tamilnadu to escape from the severe winter periods.
- **Suspend:** In certain conditions, if the organisms is unable to migrate, it may avoid the stress by becoming inactive. This is seen commonly in bears going into hibernation during winter. Some snails and fish go into aestivation to avoid summer related problems like heat and desiccation. Some lower animals suspend a certain phase of their life cycle, which is referred to as diapause.



**Fig. 11.12 Organisms' response to environmental stressors**



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