APPLIED BIOLOGY

Aquaculture

Very Short Answer Questions

1. What is a fishery?

Ans. Exploitation of fish and other related aquatic organisms is called as Fishery.

2. Distinguish between culture fishery and capture fishery.

Ans.

Culture fishery	Capture fishery
1. Culturing of selected aquatic organisms under regulated conditions	1. Capture of aquatic organisms from natural waters.
2. Natural habitat is created.	2. Live in natural habitat.
3. Artificial food is given.	3. Depend on naturally available feed.

3. Distinguish between Lentic and Lotic freshwater habitat.?

Ans.

Lentic habitat	Lotic habitat
1. Stagnant water habitat. e.g. Ponds, Lakes, Reservoirs	1. Running water habitat. e.g. Rivers, Streams, Canals

4. Distinguish between Fin fishery and Shell fishery.?

Ans.

Fin Fishery	Shell Fishery
1. Capture or culture of aquatic organisms with fins. E.g. Fishes	1. Capture or culture of aquatic organism with a shell. e.g. Prawns, Crabs, Oysters.

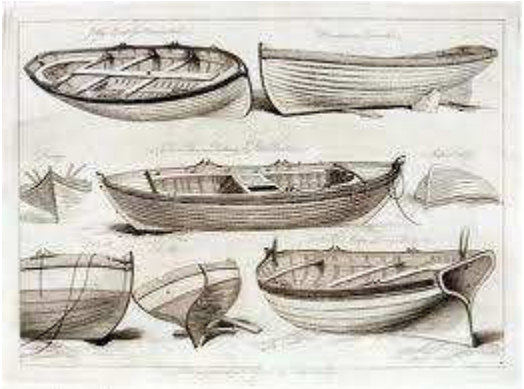
5. Distinguish between craft and gear in fishery.

Ans.

Craft	Gear
1. The boats used to capture aquatic organisms.	1. The nets used to capture the aquatic organisms.

6. What are the nets used to capture the Fresh water fishes?

Ans. Traps, cast nets, stake nets and bag nets are used to capture fishes in fresh waters.
Dip nets are used to capture *Hilsa* in rivers.
Gamcha is used to capture fish spawn from flowing waters.



7. What are the nets used to capture the marine fishes?

Ans. Long lines, Gill nets, Boat sieves, Shore sieves, Trawl nets are used to capture fishes in marine waters.

Long lines used to capture Tunas.

Gill nets used to capture Oil sardines.

8. Name any two Indian major carps and two exotic carps that are cultured in India.?

Ans. **Indian major carps are:** (1*) Catla catla*, (2) *Labeo rohita*.

Exotic carps are: (1) *Cypinus carpio* (common carp)



(2) *Ctenopharyngodon idella.* (grass carp)



(3) *Hypophthalmichthys molitrix* (silver carp)



9. Name any two Indian organizations that are concerned with fishery development in India. Where are they located?

Ans. 1) CMFRI: Central Marine Fisheries Research Institute – Cochin.

2) CIFA: Central Inland Freshwater Aquaculture – Kausalyaganga, Orissa.

3) CIBA – Central Institute of Brackish water Aquaculture, Chennai

4) CICFRI – Central Inland Fisheries Research Institute, Barrackpore, Kolkata

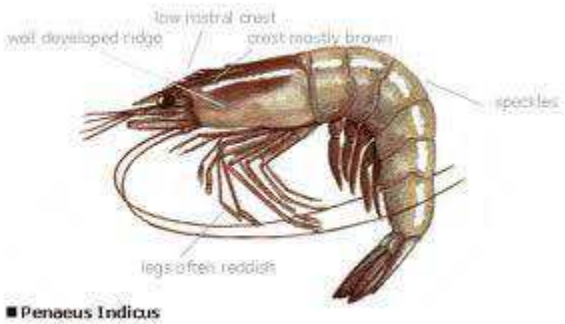
5)MPEDA : Marine Products Export Development Authority

10. Name any two Freshwater prawns cultured in India.

Ans. 1) *Macrobrachium resenbergi* (Giant river prawn) (Scampy)



2) *Macrobrachium malcomsoni* (Monsoon river prawn).



11. Name any two shrimps cultured in India.?

Ans. (1) *Penaeus monodon* (Tiger shrimp),



Penaeus monodon



Penaeus indicus

(2) *Penaeus indicus* (White shrimp).

12. What is the importance of Omega-3 (ω_3) fatty acid? Name any two sources.

Ans. ω_3 fatty acid reduces the blood cholesterol.

ω_3 fatty acid is found in the oil extracted from Sardines and Tunas.

13. What is Shagreen?

Ans. The skin of Sharks is used as an abrasive.

14. Why are elasmobranches not used as food fishes?

Ans. Elasmobranchs or cartilaginous fishes store urea in their tissues as an adaptation to marine life. So these fishes give bad or foul smell.

15. Name any two organisms used in Pearl Oyster culture.?

Ans. *Pinctada fucata* and *Pinctada vulgaris* are the two organisms used in Pearl Oyster culture.





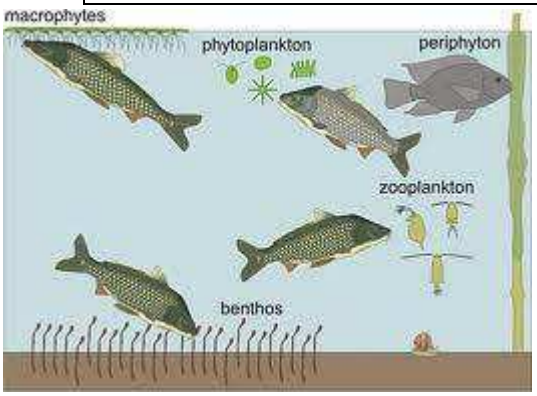
Recently scientists of CIFA developed a fresh water pearl oyster, *Lamellidens marginalis*.



16. Distinguish between monoculture and polyculture.?

Ans.

Monoculture	**Polyculture**
1. Culture of single species in a pond. e.g. Culture of Cat fishes.	1. Culture of compatible species together in one pond. e.g. Culture of Indian major carps along with exotic carps.



17. What is integrated culture? Give its importance.?

Ans. Culturing of two or more economically important organisms together on a common infrastructure base. E.g. Fish Poultry culture. It is multi commodity farming.

The importance of this culture is to minimize the cost of feed and fertilizers.

18. What is induced breeding? Explain its significance.

Ans. Making the fishes to breed artificially to meet the demand of carp speed.

i) This technique is also known as Hypophysation. It involvs the injections of pituitary extracts with gonadotropin hormones FSH and LH.

ii) The significance is to get more carp seed through out the year.

19. Distinguish between semi intensive and intensive methods of culture fishery.

Ans.

Semi-intensive	Intensive
1. Food given is formulated feed along with natural food.	1. Total food given is only formulated feed.
2. Aeration and water exchange done.	2. Aeration and water exchange at a higher rate.
3. Number of organisms cultured are less than intensive system.	3. Number of organisms cultured are very high than all the culture systems.

20. What is ablation in prawn culture? Write its significance.

Ans. Ablation is the removal of one eye stalk of penaeid prawns.

Ablation is generally practiced in all commercial practiced prawn hatcheries to induce gonad maturation and spawning .

Short Answer Questions

1. Explain the importance of craft and gear in aquaculture.?

Ans. Different types of nets used in fishery are dealt in craft gear.

i)Craft :

All the vessels used for catching and the transport of fish are referred to as fishing craft. It includes raft, dugout canoes and boats.

Dugout canoes include

a) donga (made by hollow of a palm tree),

b) sangadam (a pair of dugout palm trees are fixed parallel by bamboo poles) and

c) odam.

Catamaran, masula boat, Kakinada nava, dhingi, padhva (bar boat) and theppa (kattumaram) are the boats used in inshore fishing and inland fishing.

Coracle is simple boat with circular frame work of bamboo or cane.

Mechanized boats, trawlers and ships are used in offshore fishing.

II) Gear:

Different types of nets used for capturing fish are included under gear.

a) Traps are used in inland waters.

b) Drafts, spears and barbed heads are used in game fishery.

c) Lines with hooks are used in inland fishery.

d) Cast nets and stake nets are mostly used in inland fishing.

e) Long lines are used to capture tuna fishes.

f) Gill nets are used to capture the oil sardines.

g) Boat seines, inshore seines, drift nets and wall nets are used in inshore fishing.

h) Dip nets are used to capture Hilsa in rivers.

i) Scoop nets are used to capture the shrimp seed in estuaries.

j) Gamcha is used to capture fish spawn from flowing water.

k) Trawl nets are used in mechanized craft to capture the bottom fish.

l) Stake nets are also used to capture the fish in brackish waters.

2. What is Mariculture? Explain the culture of oysters, mussels and pearl oysters.

Ans. The culture of marine organisms is called Mariculture.

Culture of Oysters:

Rafts are constructed by using solid bamboos or wood logs for the culture of mussels edible oysters and pearl oysters.

Antifouling paints are applied to avoid fouling.

Rafts are tied to the poles on the sore to avoid any drifting due to waves. 5 to 7 meter deep-water column is used to place required for rafts.

The larval forms of these organisms are called spat. Spat feed on plankton.

Pinctada fucata and *P.vulgaris* are the pearl oysters.

CIFA are actively undertaking the culture of fresh water pearl oyster, *Lammelidens marginalis.*

3. Explain the different practices of aquaculture based on management practices methods.?

Ans. Fin fish culture involved many practices like (1) monoculture (2) polyculture (3) integrate culture.

1) Monoculture – Culture of single species. E.g. Catfish culture.
2) Polyculture – Culture of different species which do not show any competition among them.
   E.g. Culture of Indian major carps and eoxitic carps.
3) Integrated culture – It is the method involving culture of two or more economically important organism on a common infra structure base.
   e.g. Fish and Poultry.

   The culture practices are of various types like

   a) Traditional method: Which is an unscientific method. No management methods are followed.

   b) Extensive method: The method in which seed is obtained from natural source. Only fertilizers are added and no artificial food is used.

   c) Semi-intensive method: Seed is obtained from Hatcheries, Natural and Artificial food is gien, water exchange and aeration being done.

   d) Intensive method: Scientifically well developed, seed from Hatcheries only Formulated seed, water exchange and aeration done. The number of organisms rared are very high in a small tank.

   The other culture management of fishery is

   i) **Breeding:** To meet the demand for seed, the fishes are made to breed artificially by using the technique hypophysation. The chemical ovaprim is also used in induced breeding.
      Chinese circular hatchery or Jar hatchery is used for fish breeding.

   ii) **Pond management:** The pond is filled with water and is allow for the algae to grow. Making the pond ready for stocking is known as Pre-stocking management.
      - Introducing the seed into the pond is known as stocking.
      - Taking care of the seed after stocking is known as Post stocking management.

Long Answer Questions

1. Explain the fish culture management methods.

Ans. The important cultivable fishes in India are major carps like Catla, Labeo, Cirrhinus and Exotic carps like common carp, silver carp, and grass carp. Catfishes like Clarias batrachus are cultured. Culture of Murrels is discontinued due to heavy losses incurred by epizootic ulcerative syndrome.

1. **Breding:** Brooders are collected from neural water. These are kept in a hapa. Hatcheries are used for artificial breeding. Induced breeding or hypophysation technique is followed in artificial breeding. The pituitary extracts containing the gonadotropin hormones FSH and LH are injected to stimulate the brood fish. Chemical ova prim also used in induces breeding. Ova prim is a synthetic analogue of gonadotropin releasing agent and a dopamine inhibitor.

2. **Pond management:** The pond used in culture is nursery ponds, rearing ponds and stocking ponds.

   i) in the nursery pond fish pawn is grown for the first 15 to 20 days.

   ii) Rearing ponds are used to grow the spawn into fry and fingerlings. This takes 2 to months.

   iii) Stocking pond is used to produce the marketable fish form the fingerling. It takes 8 to12 months.

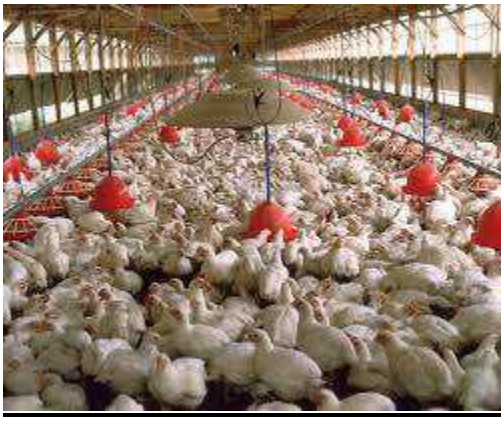
   Pre-stocking management involves drying of pond, eradication of weed plants and weed fish, liming of pond, water storing and maintenance.

   Stocking management involves judicious combination of species and their ratios according to the size of the pond.

   Post-stocking management includes the fertilization of pond water and supplementary feeding to stocked fish and maintenance of optimum water parameters.

Poultry

Very Short Answer Questions



1. What is poultry?

Ans. Raising of economically important birds like Chickens, Turkeys, Ducks, Geese, Guinea fowls, Pigeons, Pea fowls, Qualies, Pheasants and Emus is poultry.

2. Write any four important advantages of poultry.

Ans. 1) Poultry products have good biological value and protein efficiency ratios.
2) It provides employment throughout the year.
3) It can be started with less capital investment.
4) Returns are quick and continuous.
50 Feed consumption is low.
6)poulty buildup litter is a fertilizer with 3 % nitrogen, 2 % phosphorus and 2 % potash.

3. What are the nutritive values of Egg , meat of Chick and fish ?

Product	**Proteins %**	**Fats %**	**Ca mg**	**P mg**	**Others**	**Energy K.cal.**
1.FISH	15--22	0.5 -- 20	150 —800	230 —700	4--20 Iron	100 —900
2.EGG	13.3	11.5	27	102	Vitamin A, D ,B	173
3.Meat of chicken	20	2.5	14	200		109

4. Distinguish between biological value and protein efficiency ratio.?

Ans.

Biological value	**Protein efficiency ratio**
1. Percent of the nitrogen retained by the body for maintenance and growth.	1. It is the ratio between the amount of protein consumed by a growing animal and the growth of the indiviSdual.

5. What is artificial brooding?

Ans. Rearing of one-day old chicks till the eighth week is known as brooding.

Care and management of the young chicks in the absence of mother is known as artificial brooding. Artificial brooding is done in a brooding hoover.

6. What are Foundation stocks?

Ans. Foundation stocks are those birds which are selected for crossing.

E.g., i) White Leghorn and Rhode Island Red are foundation stocks to produce Hybrid layer birds.



White leg horn



Rhode Island Red

ii) Plymouth Rock or New Hampshire and Cornish birds are foundation stocks to produce Hybrid broiler birds.



Plymouth Rock



New Hampshire



Cornish

7. Name the commercial hybrids used in raising the layer and broiler poultry birds in India?

Ans. Commercially important hybrids used in India are

a) Layers: Babcock, Hyaline and Hisex.

b) Broilers: Vencobb, Hubbard and Ross.

8. Name two breeds of American class.?

Ans. American class of breeds is:

1) Rhode Island Red (meat bird)
2) Plymouth Rock (dual purpose bird).
3) New Hampshire (dual-purpose)
4) Wyandotte (dual-purpose)

9. Write any one advantage of deep litter system poultry housing.

Ans. 1) Coccidiosis and worm infections are less common as bird droppings are decomposed quickly in deep litter..
2) Maintains constant temperature.

10. What are brooders?

Ans. A brooder is the device which supplies the required heat from the days old to five weeks of age. It contains a light reflector known as hover under which birds gather.

11. Distinguish between natural hatching and artificial hatching in poultry farming.

Ans. Natural hatching is a primitive process in which brooding hen incubates the eggs in 21 days.

Incubators are used for temperature maintenance in artificial hatching.

12. What is Litter? What are the management practices to maintain the litter in poultry farming?

Ans. Covering on the floor of housing area (PEN) with husk, ground nut shell or with saw dust is known as litter.

Management of litter:

1) Litter has to be changed periodically.
2) Proper ventilation is to be provided to keep the litter dry.
3) Litter should be stirred regularly.

13. Distinguish between deep litter system and cage system of poultry housing.?

Ans.

Deep litter system	**Cage system**
1. Birds are kept in large pens.	1. Birds are kept in cages.
2. Bird droppings accumulate in litter.	2. Bird droppings are collected on an iron plate beneath the cage.
3. Number of birds reared is less when compared to cage system.	3. Large number of birds are reared.





14. What are the advantages of cage system of poultry housing?

Ans. **The advantages of cage system of poultry housing:**

1) Wastage of feed is less
2) Performance of each bird can be observed.
3) Culling of unproductive and sick birds is easy.
4) More number of birds can be accommodated.
5) Birds utilise minimum energy.
6) less manual labour is sufficient.

15. What are the disadvantages of cage system of poultry housing?

Ans. Disadvantages of poultry farming are:

1) High initial capital investment is required.
2) Birds suffer from the diseases like cage layer fatigue and fatty liver syndrome.

16. Distinguish between a layer and a broiler.

Ans. **Layer**: the bird reared for egg purpose.





LAYER BROILER

Broiler: the bird reared for meat purpose.

17. What is debeaking? When are the poultry layer birds debeaked?

Ans. Cutting of the upper beak of poultry birds is debeaking. It is conducted to avoid cannibalism

First debeaking is done on 10^{th} day.

Second debeaking is done on 13^{th} or 14^{th} week.



Properly Debeaked Pullet



Properly Debeaked Adult Bird



Figure 11

18. What is Cannibalism? List out the control measures.

Ans. **Cannibalism or Bird pecking:** Sometimes some birds pull the feathers of other birds or vent pecking, egg pecking. This is controlled by separating them and placing them in separate cages and providing with bright light.

19. What is a mash? Name the different mashes used in raising the Layers and Broilers..?

Ans : The feed given to birds is known as Mash. Various types of mashes in poultry are

Type of Mash	Age of birds	Proteins(%)	Calcium %	Energy(K.cal)
LAYERS **1)Brooder mash or chick mash**	**Upto 8 weeks**	**21%**	**------**	**2900---3000**
2)Grower mash	**9^{th} week to 16^{th} week**	**17.5%**	**-----**	**2700**
3)Prelayer mash	**17^{th} week to 20^{th} week (pullets)**	**16.5 %**	**2.5 %**	**2500**
4)Layer mash	**21^{st} week onwards**	**16.5%**	**3.7 --- 3.8 %**	**2500**
BROILERS **1)Prestarter mash**	**1^{st} week to 3^{rd} week**	**22%**		**3200**
2)Starter mash	**Upto 6^{th} week**	**25 %**		**3200**
3)Finish mash	**7^{th} to 10^{th} week**	**19%**		**3400**

20. What are the two identification characters of poor layer birds?

Ans. These are long, thin, sharp and pointed body.

- Skin is thick, dry and rough.
- They do not lay eggs at the time of shedding feathers.
- These birds shed feathers early and slow.
- Vent is small, round and dry.
- Breast bone small
- Abdomen is small, hard and with fat.
- Feathers are clean and perfect.

Short Answer Questions

1. List out the advantages of poultry over other practices activities related to live stock.?

Ans. 1) It provides employment to the farmers throughout the year.

2) Poultry requires minimum investment and a small space to start farming.
3) It brings early and continuous source of income.
4) Rearing broilers, brings back the principle amount of investment quickly in eight months.
5) There is a great demand for eggs and poultry meat in the society. So, they have good marketing value.
6) Poultry produces highly nutritious food, with less investment. This nutrient value of egg is 13.3% of protein, 11.5% of fat, 173 k.cals of energy, 60 mg of calcium, 20 mg of phosphorus, vitamins and other substances. About 100 g of flesh of chicken contains 20% of protein, 2.5% of fat, 109 k.cals of energy, 25 g of calcium, 20 mg of phosphorus and other substances.
7) Proper management of poultry farming improves production, so that loans can be cleared very soon.
8) Eggs are highly nutritious containing proteins, fats, vitamins and minerals. Country bird lays 120 eggs per year whereas exotic bird yields 260 eggs per year.
9) Poultry manure is rich source of nitrogen to plants.
10) Marketing facilities are available for the sale of poultry products with NECC..

2. What is artificial brooding? Explain brooding practices and procedures.?

Ans. Brooding is the rearing of one-day old chicks till the eighth week.

- Mother hen takes care of the young chicks. It is called Natural brooding.
- In Poultry farms, artificial brooding is conducted by temperature-controlled brooders.
- Brooders are of two types… Basket brooders and battery brooders.
- Basket brooders can accommodate small number of chicks.
- Battery brooders are used for large number of chicks.
- Basket brooders have hanging brooding hove, fitted with an electric bulb. Chick guard is used to retain the chicks. It is placed 1.2 m away from hover's edge.
- Each battery brooder is fitted with adjustable waterers, feeders and thermostatic heat regulators. It can accommodate upto 30 chicks.
- A layer of 5 cm thick litter is to be made with husk or saw dust. It shoud be stirred frequently.

- The temperature has to be maintained at 95^0 F during first week, 90^0 F second week, 85^0F third week, 80^0F from the fourth week to eight week.
- The feed given to these chicks is Brooder mash or chick mash. It has 21% protein and provides 2900-3000 k.cal energy.
- The first de beaking is conducted on 10^{th} day.
- One day old chick have to be vaccinated against Marek's diseas.
- 16^{th} day old chicks against fowl ox and booster dose for fowl pox at 6 weeks of age.
- The first de worming is usually done at the age of 8 weeks.



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3. Explain any two viral and two bacterial diseases in Poultry.

Ans. The viral diseases are (1) Ranikhet disease (New castle disease) and (2) Marek's disease.

1) **Ranikhet disease:** It is caused by paramyxo virus.
   - This disese occurs in all ages and causes mass mortality.
   - Respiratory (coughing) and nervous disorders (complete or partial paralysis) occur.
2) **Marek's disease:**
   - Caused by Herpes group.
   - Mostly affects birds of 2 to 4 months old.
   - Enlargement of sciatic nerve and enlargement of spleen are the symptoms.

The bacterial diseases are (i) Fowl cholera, (ii) Infectious coryza.

i) **Fowl Cholera:**
   - It is caused by *Pasteurella avicida.*
   - Symptoms are pin point foci on liver and pin point haemorrhages on pericardium and bluish discoloration of combs,yellowish coloaation of the droppings followed by greenish diarrhoea.

ii) **Infectious coryza (Roup disease):**
   - It is caused by *Haemophilus gallinarum.*
   - It occurs in all stages of birds.
   - Symptoms are discharge of bad smell emitting fluid from nasal and eye.
   - Acute respiratory problems.
   - Spread by contamination of water and food.

4. Explain the terms Prolapse, Deworming, Cannibalism, culling, Dubbing,Broodiness in poultry.?

Ans. A)**Prolapse :** Falling down of the oviduct with eggs is called prolapse.

It is due to diet with more fat and less fibre and over size of eggs.

B)Deworming : Treating the sick birds for the expulsion of intestinal helminth parasites is called deworming.

First deworming is to be done at 8^{th} week.

Second deworming at 16^{th} to 17^{th} week and repeated for every 8 weeks

C) Cannibalism: It is also known as pecking.

Pecking includes feather pecking, vent pecking, egg pecking.

-- Protein deficiency, high energy diet over crowding, hereditary insufficient housing equipment are responsible for cannibalism.

D) Dubbing: Prunning (Removal) of combs and wattles in the poultry birds.

E) Broodiness: Instinct of the female animal to brood eggs is known as broodiness. Hens do not lay eggs during this period. It can be prevented by injecting oestrogens.



F**) CULLING**:

Separation of unproductive, cannibalistic and sick birds from the flock is known as culling.

5. Explain the broider management.

- A broiler of fryer is young chicks of either sex below the age of 8^{th} to 10^{th} week, Weighing 1.5 kg with smooth textured breast. These are mainly used for meat purpose..
- Deep litter system of housing is followed in India for raising broilers.
- Initial temperature is 95°F and is slowly reduced to 70°F at the rate of 5°F per week.
- Proper ventilation shall be maintained to provide more oxygen, to remove ammonia and to keep CO_2 at low level.
- Feed given is pre starter mash with 22% proteins and 3200 k.cal of energy is given initially.
- Then starter mash with 20-25% proteins and 3200 k.cal of energy is given up to 6^{th} week.
- Finish mash containing 19% protein and 3400 k.cal energy is given from 7^{th} week to 10^{th} week.

5. What is mash? Explain the various mashes used in layer and broiler management practices?

Ans : The feed given to birds is known as Mash. Various types of mashes in poultry are

Type of Mash	Age of birds	Proteins(%)	Calcium %	Energy(K.cal)
LAYERS **1)Brooder mash or chick mash**	**Upto 8 weeks**	**21%**	**------**	**2900---3000**

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Long Answer Questions

1. Explain the layer management.

Ans. **Management practices for Raising layer-birds:**

Layers are the birds used, exclusively, for the production of eggs.

The following management practices are required for layers.

❖ **Management practices in Hatching the Eggs :**

► In 21 days, a fertilized egg develops into a chick through a process of hitching. It may be natural or artificial.

► Natural hatching is a primitive process in which brooding hen hatches the eggs.

► Incubators (electrical instrument for maintaining required temperature) are used for temperature maintenance in artificial brooding, which is following in hatcheries.

2) Management of birds at different Ages:

a) Brooding Management of Young Chicks:

❖ Rearing of one-day-old chicks till the eighth week is called brooding. Brooding is either a natural or artificial practices.

❖ Desi hens with strong material instinct brood the day old chicks till the eighth week. Brooding by hens is known as *natural brooding*.

❖ Artificial brooding is accomplished by temperature controlled brooders. These are of two types.

❖ Basket brooders for small number of chicks and battery brooders for large number of chicks. Basket brooders have hanging brooding hover, fitted with an electric bulb.

❖ Chick guard is used to retain the chicks. Each battery brooder (cage brooder) is 30″ × 15″ × 15″ in size and is fitted with adjustable waterers, feeders and thermostatic heat regulators. It can accommodate upto 30 chicks.

❖ Brooder house has to be cleaned properly by using suitable disinfectants. A layer of 5 cm thick litter is to be made with husk or saw dust. It should be stirred frequently.

- ❖ The temperature has to be maintained at 95°F during the first week, 90°F second week, 85°F third week, 80°F from the fourth week to eighth week. Temperature can be reduced by adjusting the height of the hover.
- ❖ Chick guard is placed 1.2 m away from the hover's edge. Uniform light and temperature are required for brooding.

b) Raising Management of Pullets:

- ► The objective of grower management is to produce a pullet, which starts laying eggs from 17 to 20 weeks of age.
- ► The feed given is *grower mash* containing 17.5% protein, 2700 k.cal energy. Subsequent deworming practices are necessary for every 8 weeks to remove the intestinal parasites.
- ► 2nd *debeaking* is to be done at 13 to 14 weeks of age.

c) Raising Management of Laying – Stage Birds:

- ► From 17th to 20th week of age the pullets start laying eggs. One laying nest is required for every four birds.
- ► Prelayer mash containing 16.5% protein, 2.5% calcium and 2,500 k.cal energy should be supplied from 17th to 10th week. Then onwards layer mash containing 16.5% proteins, 3.7 to 3.8% calcium and 2500 k.cal energy is required.

I) Housing and Housing systems :

- ❖ Open sided poultry houses are very popular in India. The poultry house must be well ventilated.
- ❖ The distance between two sheds should be 20 m.
- ❖ The *stock house* (use for growers) should be 50 to 100 m away from the *layer house* (used for layers) to avoid easy spread of infections.
- ❖ The shed has to face east to west along its length. This directions allows good sunshine in winter and reduces direct sunlight in summer months.
- ❖ Housing systems are of two types. Battery and deep litter systems.

1) Battery system (Cage system) : It is the most intensive system of poultry farming. A cage of the size 15″ × 10″ × 17″ can accommodate three birds. Cage floor is set in a slope, so that the eggs laid roll out of the cage into the gutter. Below the cage, floor tray is arranged to receive the droppings. Both feed and water receptacles are arranged out side the cage. These cages are assembled into a multitiered structure.

A. Advantages:

a) Wastage of feed is less.
b) A bird raised in the battery system utilizes minimum energy.
c) Performance of each bird can be assessed very easily.
d) Culling of unproductive and sick birds is easy.
e) More birds can be accommodated.
f) Cage system involves less manual labour.

B. Disadvantages:

a) Cage system requires high initial investment.
b) Birds suffer from cage fatigue and fatty liver syndrome.

2) Deep litter system: Birds are kept in large pens. Each pen can accommodate a maximum of 250 birds. Floor is covered with litter of 8″ to 12″ thickness and is

prepared using sawdust or husk or groundnut shells. Litter is to be stirred regularly. Bird droppings accumulate in the litter. Hence, this litter (build up) has to be changed periodically. Each bird requires a floor space of 1.8 to 2.0 square feet. Proper ventilation is required to keep the litter dry.

Advantages:

a) Coccidiosis and worm infections are less common in deep litter system, as bird droppings are decomposed quickly in the deep litter.
b) Litter maintains constant temperature.

II) Housing Equipment:

1) **Feeders:** Circular trough and long feeders are used in deep litter system. Circular feeders are the hanging hoppers, which are suitable for the birds of all ages. Long feeders and trough feeders are to be provided with non-roosting devices to prevent the roosting (resting) of birds. Iron grills, or galvanized sheets with holes are used as non-roosting devices.
2) **Waterers :** Chickens consume large quantity of water. So water has to supplied to the birds all times. Fountains, covered containers and water troughs with non-roosting device are used as waterers in the deep litter system.

2. Explain the bacterial, viral and fungal diseases in poultry.?

Ans. The bacterial diseases are : Fowl Cholera, Infectious coryza, CRD Viral diseases are Ranikhet, Marek's Gumboro disease, Fungal diseases are Aspergillosis, Aflotoxicosis, Thrush.

<u>Bacterial diseases</u>:

1) Fowl cholera:

a) It is caused by *Pasteurella* maltocida.
b) Symptoms include pin point foci on liver and pin point haemorrhages on Pericardium.
c) Bluish colouration of comb.
d) Effective drugs are Penicillin and Tetracyclin.

2) Infectious Coryza :

a) It is caused by Haemophilus gallinarum.
b) It effects chicks of all stages.
c) Infection is due to contamination of food and water.
d) Symptoms include nasa land eye discharge with foul smell.
e) Acute respiratory problem is also reported.
f) Effective drugs are streptomycin and tetracycline.

3) Chronic Respiratory Disease (CRD) :

a) It is caused by Mycoplasma gallisepticum.
b) Trasmission is through eggs, nasal discharge and droppings.
c) Symptoms include sneezing, swollen sinuses, respiratory distress inflamative eyes and snoring.

<u>Viral diseases</u>:

1) Ranikhet diseases (New castle disease) :

a) It is caused by paramyxo virus.
b) It occurs in all ages and causes mass mortality.
c) Respiratory symptom is coughing.
d) Nervous symptom is complete or partial paralysis.
e) 5 days old chicks should be vaccinated to prevent the disease.

2) **Marek's disease:**
a) It is highly infectious disease caused by the viruses of Herpes group.
b) It effects mostly chicks of 2-4 months old.
c) Symptoms include enlargement of sciatic nerve, enlargement of glands like spleen etc.
d) Vaccination of day old chicks with HTV (Herpes virus of Turkey) prevents this disease.

3) **Gumboro disease:**
a) It is contagious affecting 2 to 12 week old chicks.
b) Spreads through contaminated feed and water.
c) It is caused by Infectious Bursal Disease (IBD) virus.
d) Loss of appetite, white diarrhea, enlargement of bursa fabricii are the symptoms.
e) Vaccination of day old chick prevents the disease.

<u>Fungal diseases</u>:

1) **Aspergillosis (Brooder pneumonia) :**
a) It is caused by Aspergillus fumigatus.
b) Caused by inhalation of fungal spores.
c) Symptoms are difficulty in breathing, gasping, congested lungs with nodules.
d) Mostly effects brooders.
e) Effective substance is copper sulphate.

2) **Aflotoxicosis :**
a) It is caused by Aspergillus flavus.
b) It is spread by contaminated food and water.
c) Body immunity is lost and bird becomes susceptibility to infection.

3) **Thrush or Moniliasis :**
a) It is caused by Oidium albicans (Monilia).
b) It is an intestinal disorder.
c) Symptoms are lesions in mouth and gut.
d) Effective drug is Nystalin.

Disease	**Caused by**	**Spreads by & age**	**Symptoms**	**treatment**
I)**VIRAL** a)Ranikhet (new castle)	*Paramyxo* Virus	All ages	Coughing & paralysis	Vaccination

b)Marek's	Herpes	2-4 months	Enlargement of sciatic nerve & spleen	
c)Gumboro (Infectious bursitis)	IBD virus	2-4 months Contaminated feed & water	Loss of appetite, white diarrhea, Enlargement of Bursa of Fabricius.	vaccination
II)Bacterial a)Fowl cholera	*Pasteurella Avicida*		Yellowish colored Droppings and greenigh diarrhea, Pin point foci on liver,pin point haemorrhages on pericardium, bluish discoloration of combs	Pencilin, Tetracycline
b)Infectious Coryza (Roup)	*Hemophilus Gallinarum*	All stages	Foul smell from nasal and eye discharge. Acute respiratory problem, inflamed and swollen eyes	Streptomycin, Tetracycline
c) Chronic Respiratory Disease (CRD)	*Mycoplasma gallisepticum*	Eggs. Nasal discharge &droppings	Sneezing, swollen sinuse, respiratory stress, snoring & Infammed eyes.	Erythromycin, tetracycline

III)FUNGAL a)Aspergillosis (Broder pneumonia)	*Aspergillus fumigates*	Brooders. Inhalation of fungal spores	Difficulty in breathing, congested lungs with nodules	Copper sulphate
b) Aflatoxicosis	*Aspergillus flavus*	Contaminated food & water	Reduced immunity	
c)Thrush (Moniliasis)	*Oidium albicans (monilioa)*	Intestinal disorder	Lesions in mouth and gut	Nystatin
IV)Coccidiosis	*Eimeria tenella*			

APPLIED BIOLOGY

Biotechnology

Very Short Answer Questions

1. What is biotechnology?

Ans. Biotechnology is the controlled used of Biological agents such as micro-organisms or certain cellular components for beneficial purposes.

2. What is recombinant DNA technology?

Ans. Recombinant DNA technology involves a complex sequence of reactions that allows manipulation of the genetic nature of the gene or organism and is popularly referred to as genetic engineering.

3. What are restriction endonucleases?

Ans. Restriction endonucleases are proteins that work like molecular scissors which break or cut the DNA at the specific site, wherever there is palindromic sequence.

4. What are vectors?

Ans. A vector is a cloning vehicle which carries the DNA molecule and helps in replication of gene to be cloned.

5. What are Palindromes?

Ans. Palindromes are the sequence of nitrogen bases which read the same when observed from 3′ to 5′ end vice versa.

6. What is use of gene marker?

Ans. It is useful in rDNA technology.
Identification of recipient bacteria containing chimeric DNA(transformed bacteria)

7. What is Cosmid?

Ans. There are hybrid vectors, which had the combined features of plasmid and bacteriophages. They have cos sequence of phage lambda and plasmid DNA of bacteria. Cos sequence helps to incorporate longer foreign DNA. Plasmid sequence is useful in replication.

8. Write any two applications of rDNA technology.

Ans. rDNA technology is used in the preparation of Alcohols, Enzymes,Antibiotics, vitamins etc.
rDNA technology is used in the basic research and in the production of drugs, hormones, synthetic vaccines etc.

9. Distinguish between sticky ends and blunt ends.?

Ans.

Sticky ends	Blunt ends
1. Both the strands cut asymmetrically.	1. Both the strands break at the centre of symmetry.

10. What is ligase? Explain the importance of ligase in rDNA technology.

Ans. Ligase means enzymes used to join two fragments of DNA. DNA ligases are proteins that work like a molecular glue or gum. They recognize the free ends of two separate DNA chains are in contact and cause a chemical reaction that ligates them together into a single chain.

11. Name the two micro-organisms involved in the production of vinegar.

Ans. Vinegar or 3-5 % acetic acid is produced from Corn starch, molasses etc. by using yeast, *Saccharomyces cervisiae* for fermentation and bacterium Acetobacter for oxidation of ethanol.

12. Distinguish between primary metabolic products and secondary metabolic products of micro organisms.

Ans. Primary metabolic products: Products that are used by micro-organisms like vitamins.

Secondary metabolic products: Products that are not used by microbes like antibiotics.

13. What are designer enzymes?

Ans. Designer enzymes are produced by rDNA technology and are meant for specific activities and are used in detergents, in manufacturing photographic products and rubber products and in industries like baking, brewing dairy, fruit juice and paper.

14. Name any two phases that can be used as vectors.

Ans. Vectors like Lambda and M13 bacteriophges are phage vectors.

15. What is the use of streptokinase enzyme?

Ans. It is used in dissolving the blocks of coronary and cerebral blood vessels to prevent attacks or strokes. It is produced by the bacterium *Streptococcus pyogenes.*

16. Name any two micro-organisms involved in the production of enzymes and the commercial use of their products.

Ans.

Micro-organism	**Enzyme produced**	**Commercial use**
1.*Bacillus licheniformis*	Alkalene serene protease	To remove protein stains.
2.*Thermus aquaticus*	DNA polymerase	Polymerase Chain Reactions.

17. What are interferons?

Ans. Interferons are small glycoproteins produced by the viral infected animal cells to produce antiviral state in other cells.

18. Name any two hormones produced by rDNA technology?

Ans. *Insulin, Human* growth hormone, somatostatin, erythropoietin etc are hormones produced by rDNA technology.

19. What is the technique used to identify the DNA fragment?

Ans. Southern blotting technique is used to identify the restriction fragment of DNA containing desired base sequence.

20. Name any two microbes that are used in the production of vitamins.

Ans. 1) *Ashbya gosyspii* for the production of vitamin B_2 (Riboflavin).

2) *Streptomyces olivaceus* for the production of vitamin B_{12} (cyano cobalamin).

21. What are monoclonal antibodies? How are they different from natural antibodies?

Ans. Antibodies produced by a clone of specific lymphocyte are called monoclonal antibodies.

Natural antibodies are produced against the entry of antigens into the body any time.

22. What are the applications of monoclonal antibodies?

Ans. Monoclonal antibodies are useful in detecting Chlamydia, (a streptococcal bacterium), HIV causing AIDS, measuring protein, toxin and drug levels in the body, blood and tissue.
These are useful in the suppression of rejection reaction in the organ transplantation, neutralizing the exotoxins produced by bacteria, inhibition of platelet clumping the patients underwent angioplasty and in the treatment of autoimmune diseases.

23. Name any two microbes and the antibiotics they secrete.

Ans. 1) *Pencilium notatum* ---- Pencilin
2) *Streptomyces griseus* ---- streptomycin.
2) *Penicillium chrysogeneem* ----- penicillin.

24. What do you mean by denaturation of DNA?

Ans. Melting of the double stranded DNA by breaking hydrogen bonds to produce single stranded DNA. Short chains at 94°C in automated cycler in PCR is called denaturation.

25. What do you mean by annealing in PCR method?

Ans. In PCR at 54°C the primers move around by Brownian motion. Ionic bonds are constantly formed and broken between the single stranded primer and single stranded template.
The more stable bonds last a little bit longer form template + primer of double stranded DNA.
The polymerase can attach and starts copying the template.

Short Answer Questions

1. Explain the steps involved in rDNA technology.

Ans. The steps involved in rDNA technology are:
Step 1: Isolation of Donor DNA fro cloning: Restriction endonucleases cut double strand DNA at specific places and produce restriction fragments of DNA. These are separated by gel electrophoresis. The desired fragment can be identified by southern blotting technique.

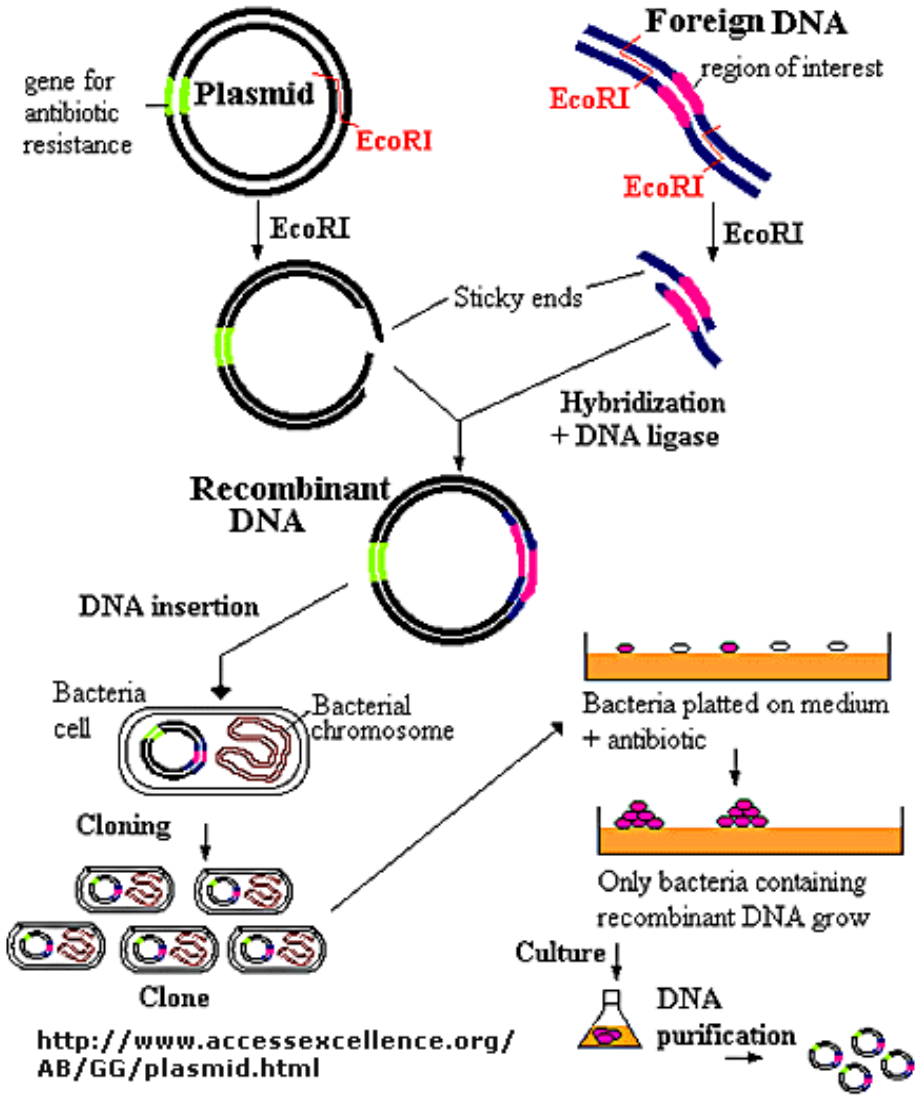
Step 2 : Isolation of Vector : Find a suitable cloning vector which is a self replicating genetic material than can carry the donor DNA. The cloning vector serves as the carrier for the donor DNA..

Step 3: Formation of Chimeric DNA. Cleaving of vector DNA at specific sites with same restriction endonucleases with which the donor DNA is cut. To the sticky ends of cloning vehicle the sticky ends of the gene to be cloned is joined by using the enzyme Ligase to form a hybrid DNA known as r DNA or chimeric DNA..

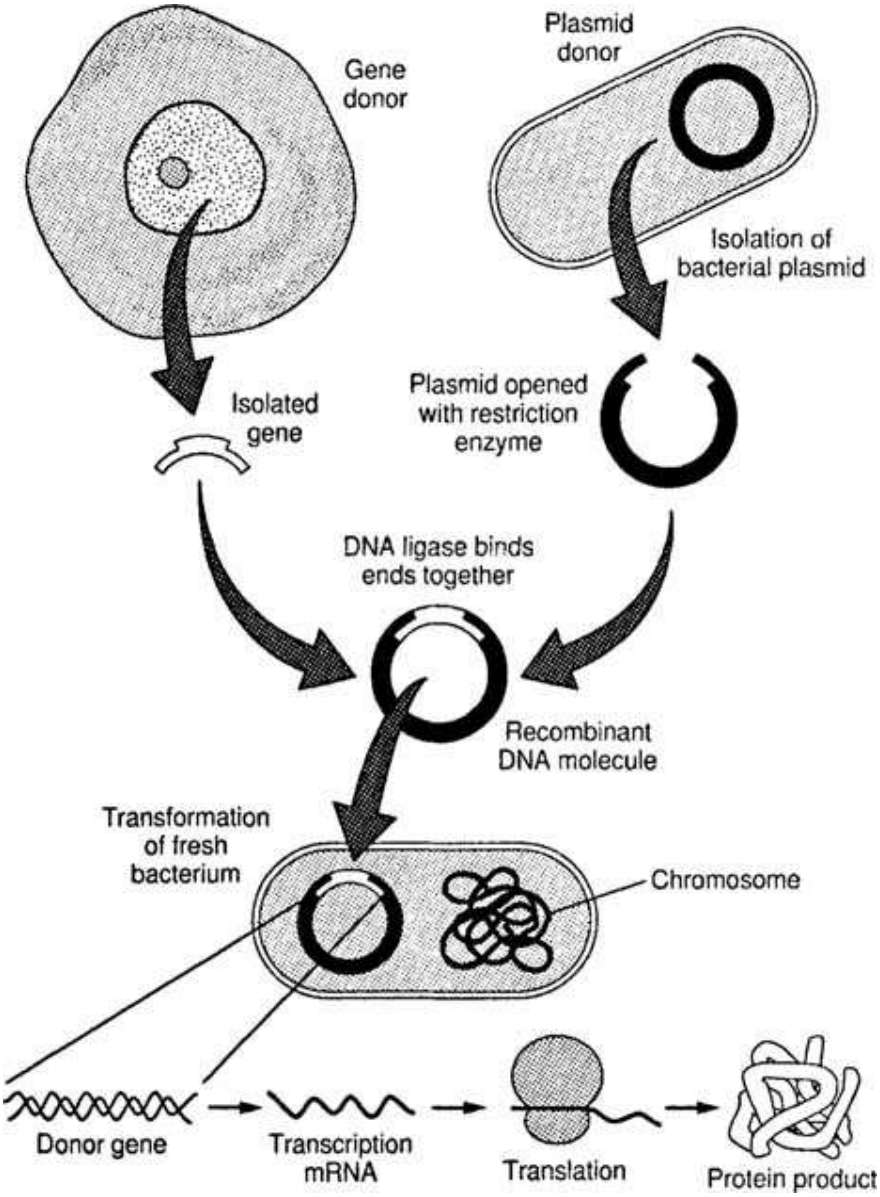
Step 5 : Uptake of Chimeric DNA : The hybrid DNA is added to a suspension of suitable recipient bacterial to take up the r DNA by phase mediated transduction or by using calcium chloride.

Step 6 : Identification and isolation of the bacteria having rDNA by using genetic markers or by colony hybridization technique.

Step 7: The bacteria with rDNA are propagated in large quantities and the product is recovered from the culture.



Cloning into a plasmid



2. Describe the various vectors used in rDNA technology.

Ans. The various vectors used in rDNA technology are

(1) Plasmids, (2) Bacteriphages, (3) Cosmids.

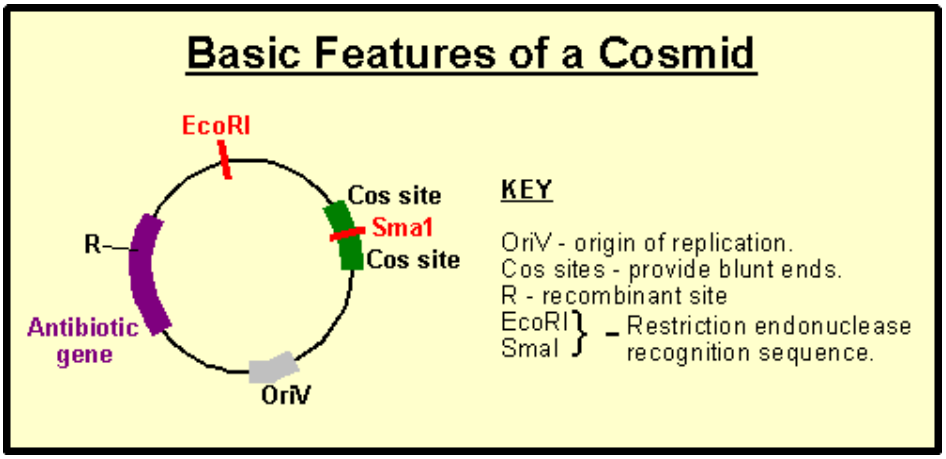
1) Plasmids : These are circular DNA material other than the bacterial chromosome. They can replicate independently $p^{BR\ 322}$ is one of the earliest genetically engineered plasmid.

2) Bacteriophages : These are small particles (viruses) capable of infecting bacteria. They contain protein molecules that form a coat or phage head.

E.g. Lambda and M13 Bacteriopahge.

3) Cosmids : These are hybrid vectors, which exhibit the features of plasmid and baceriophages. They have cos sequence of phage lambda and plasmid DNA of bacteria.

Cos sequence helps to incorporate longer foreign DNA. Plasmid sequence is useful in replication.

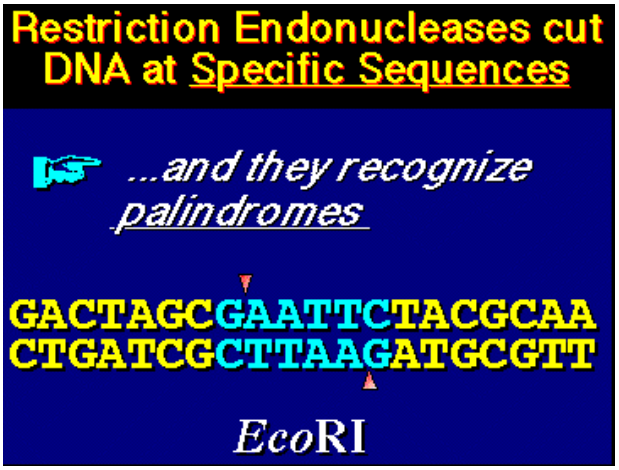


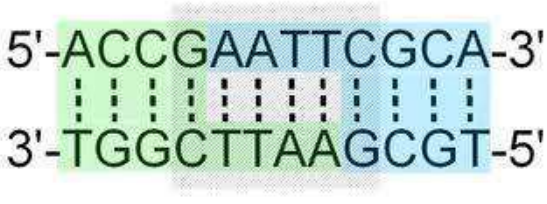
3. What are restriction endonucleases? Describe their role in r DNA technology.

Ans. Restriction endonucleases are a type of enzymes or proteins which cut the DNA at a nucleotide sequence called restriction sites of bacteriophages.

Restriction endonucleases recognize a specific base sequence in DNA molecule and makes two cuts, one on each strand. Another importance of these restriction endonucleases is they produce limited number of cuts in DNA molecule as a particular enzyme recognizes unique sequences. The cuts could be either sticky ends or blunt end cuts.

Sticky ends	Blunt ends
1. Both the strands cut asymmetrically.	1. Both the strands break at the centre of symmetry.







4. What are monoclonal antibodies? How are they produced?

Ans. Antibodies produced by a clone of specific lymphocyte are called monoclonal antibodies.

Monoclonal antibodies are produced by Hybridoma technology developed by Kohler and Milstein.

- This technique is based on somatic cell hybridization.
- In this technique antibody producing B-lymphocytes are fused with a myeloma cell (cancer cell) to produce a hybridoma cell.
- This hybridoma cell retains the properties of both the parent cells i.e. like B-lymphocyte produced antibodies and like cancer cell undergoes uncontrolled cell divisions. These events occur in the following manner…

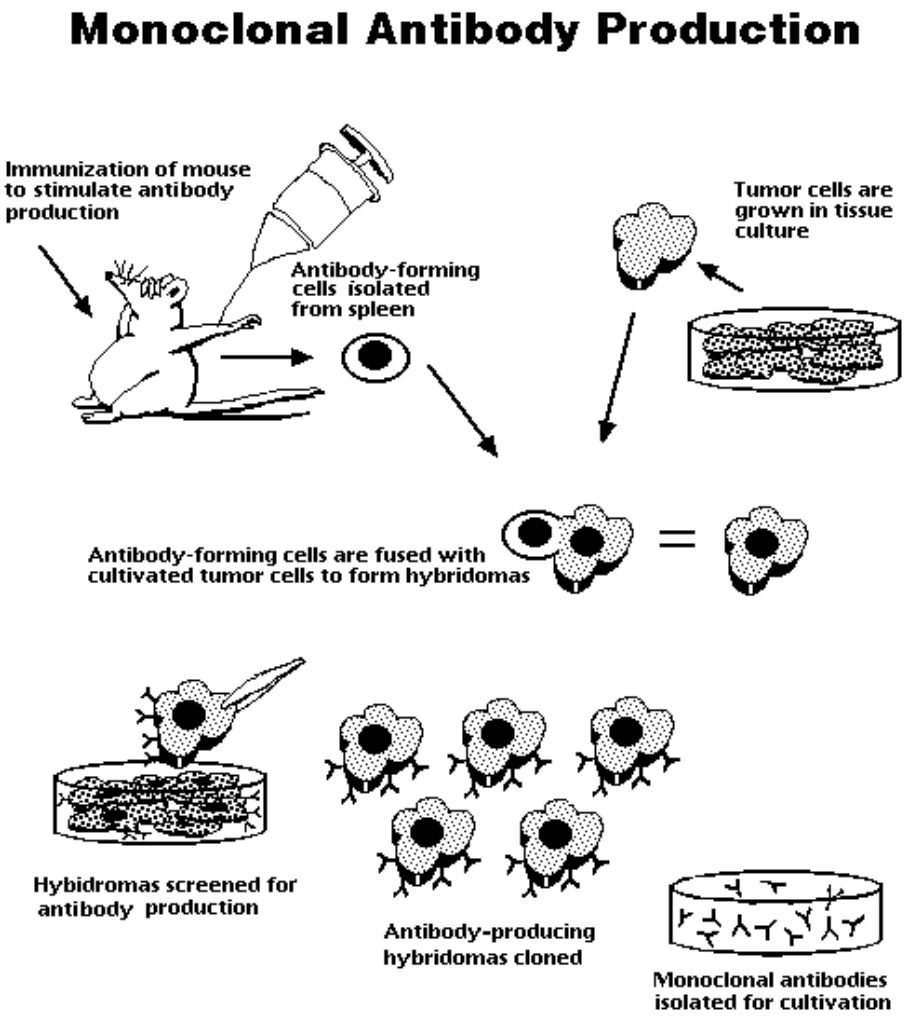
a) Collection of B-lymphocytes from spleen of rat. Collection of Myelom acels from tumours of rats.

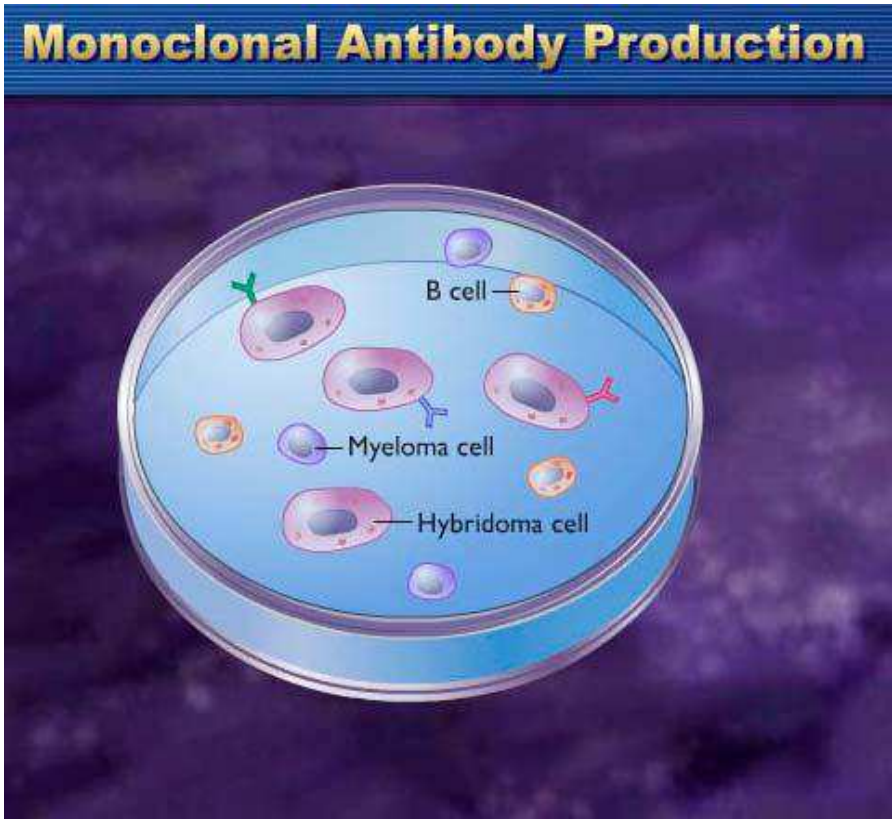
b) Mixing of both types of cells in the presence of fusogens like polyethylene glycol (PEG).

c) Placing of mixture in a medium for identification and selection. This medium is HAT medium (Hypoxanthine, aminopterin and thymidine)

d) Spleen cells and hybrid cells are HAT resistant, but myeloma cells die due to HAT. Spleen cells also die in one or two days.

e) Collection of hybridoma ells and used to produce more number of antibodies.





5. What are vaccines? Describe the various types of vaccines. ?

Ans. Vaccines are used in the prevention of diseases.

Vaccines are several types. They are:

1) Attenuated whole agent Vaccines: They have live microorganisms that have been cultured under conditions that disable their virulent properties. They induce more durable immunological responses.

Examples:: vaccines against yellow fever, measles, rubella and mumps.

2) Inactivated whole agent Vaccines: Contain previously virulent micro-organisms that have been killed with chemicals or heat.

Examples are vaccines against flu, cholera, bubonic plague and hepatitis A.

3) Toxoid vaccines: They contain toxoids which are inactivated exotoxins from micro-organism. These are used against tetanus and diphtheria.

4) Component Vaccines or Subunit vaccines: A fragment of microorganism can create an immune response.

E.g., Subunit vaccine against HBV which is composed with surface proteins of virus.

Virus like particle vaccine (VLP) against Human Papilloma virus (HPV) that iscomposed of the viral major capsid protein.

5) Conjugate vaccine: E.g., Haemophilus influenza type B vaccine.

6) Recombinant vector vaccines : By combining the physiology of one microorganism and the DNA of the other, immunity can be created against diseases with complex infection processes.

7) DNA vaccines :

6. Describe the steps involved in PCR technology?

Ans. Polymerase Chain Reaction (PCR) is to make a huge number of copies of a gene. Generally they are three steps in a PCR, repeated by 30 or 40 cycles.

Step 1 : Denaturation at 94°C :

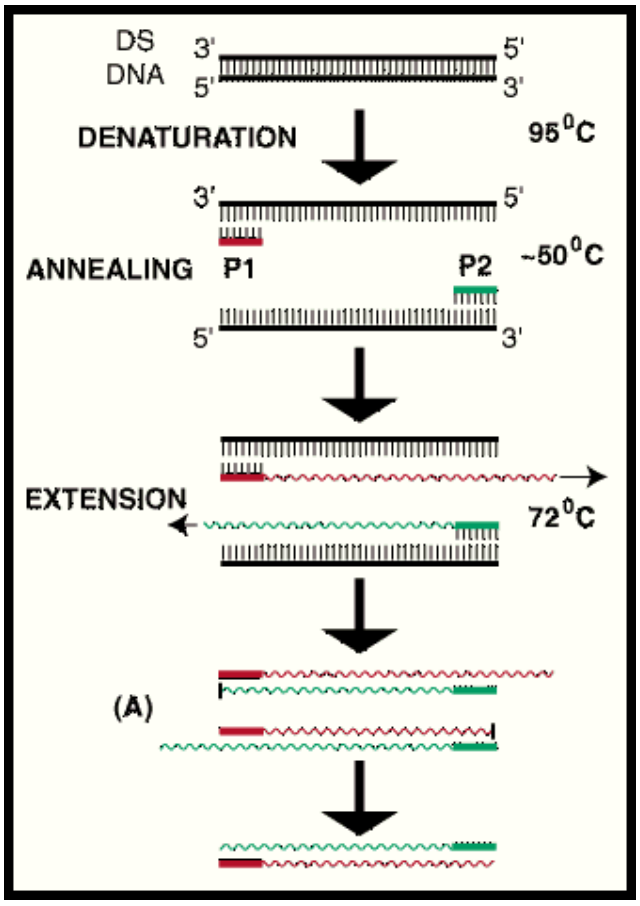
The double strand DNA melts by breaking hydrogen bonds. Single stranded DNA short chains are formed.

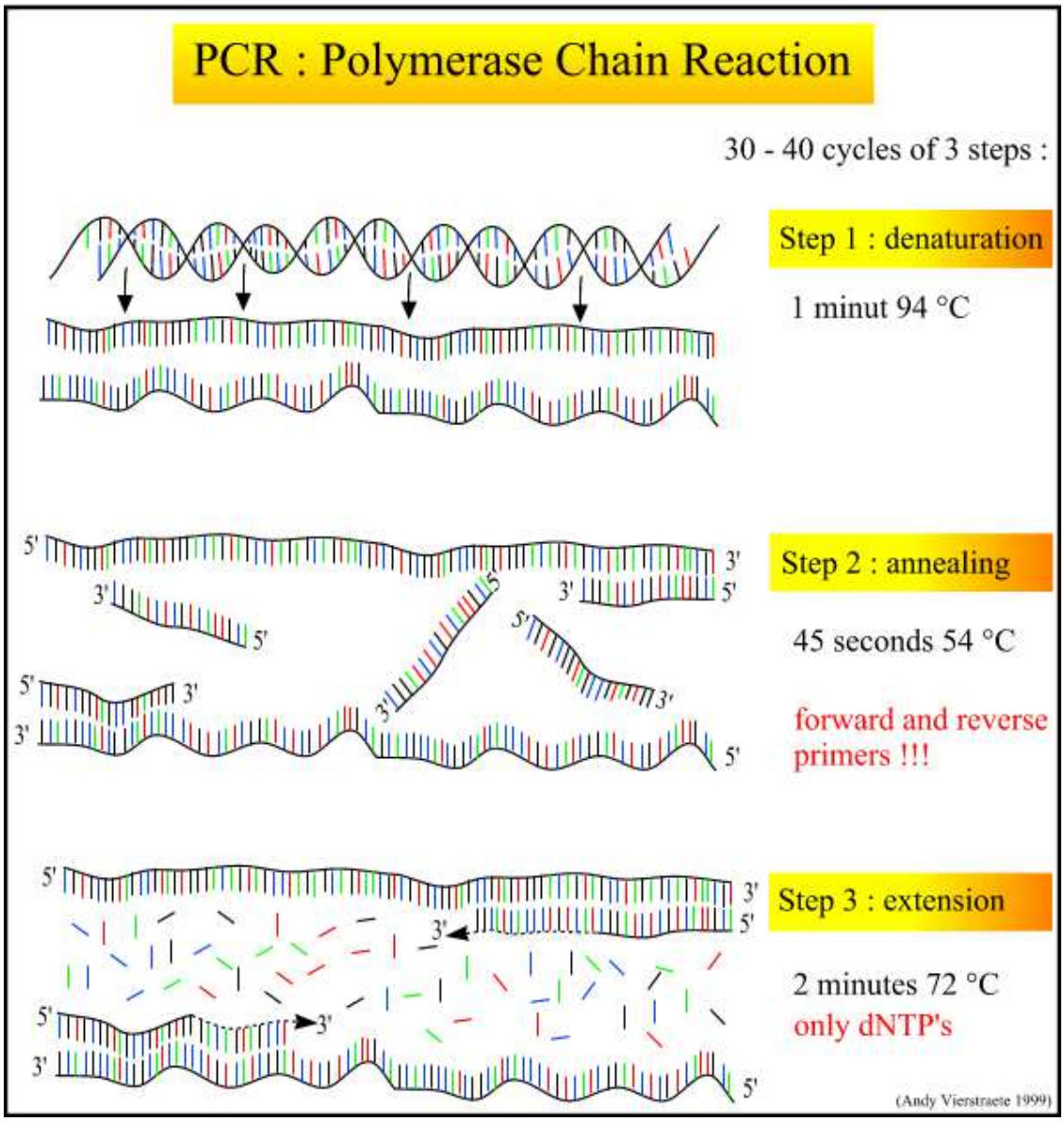
Step 2 : Annealing at 54°C :

Ionic bonds are constantly formed and broken between the single stranded primer and the single stranded template.More stable bonds last a little bit longer and form template + primer of ds DNA. The polymerase attaches and starts copying the template.

Step 3 : Extension at 72°C :

The primers that have a stronger ionic attraction to the template are with a few bases built in. The bases are coupled to the primer on the 3′ adds dNYPs from 5′ to 3′, reading the template from 3′ to 5′ side.





Long Answer Questions

1. Describe the industrial application of microbes.

Ans. Microorganisms are considered as "Miniature chemical factories".

- They have the capacity to convert a raw material into useful and valuable end product..
- The important microbial products are :

1) The microbial cells are used as immunizing agents and food supplements.
2) They can produce large molecules like enzymes
3) Production of primary metabolic products like vitamins.
4) Production of secondary metabolic products like antibiotics.

Microbial technology involves two major types of chemical activities. They are (a) Fermentation, (b) Distillation.

a) **Fermentation:** It is the process of reduction of organic substrates by anaerobic methods.

b) **Distillation:** It is the process of reduction of organic substrate by aerobic methods.

Microbial technology is involved in the production of

i) Alcohols, Acids and Vitamins:

- Alcohols like ethyl alcohol are produced industrially by using yeast. *Saccharomyces cervisiae* from corn starch, molasses, sugar beets etc. Ethyl alcohol or Ethanol is used in the preparation of Gasohol which is used as a motor fuel.
- Beverages like whisky, brandy and rum by distillation process.

The following acids are prepared by using different types of microbes

PRODUCT	MICRO ORGANISM	SOURCE
1.Vinegar (3-5 % acetic acid)	Saccharomyces cerevisiae (fermentation) *Acetobacte*r (oxidation)	Corn starch, molasses
2.Citric acid	*Aspergillus niger*	Corn starch
3.lactic acid	*Lactobacillus bulgaricus*	Molasses,dairy whey
4. Glutamic acid	*Micrococccus glutamicus*	Alpha ketoglutaric acid of citric acid cycle.
5. Vitamin B_2 6. Vitamin B_{12}	*Ashbya gossypii* *Streptomyces olivaceus*	

ii) Antibiotics: Antibiotic is the substance produced by one micro-organism which destroys or inhibits the growth of other micro-organism.

e.g.a) *Penicillium notatum* produces penicillin.

b)*Streptomyces griseus* produces streptomycin.

- Probiotic is either the healthy flora of the gut or supplements of beneficial intestinal bacteria. They are friendly germs/bacteria.
- Two groups like Lactobacili and Bifidobacteria are mainly used as probiotics.

iii) Hormones: Hormones like insulin, human growth hormone (hGH) or somatotropin, somatostatin, erythropoietin etc produced biotechnologically at low cost using generically engineered micro-organisms.

iv) Interferons: Interferons are small glycoproteins produced by the viral infected cells to produce antiviral state in other cells. Now days genetically engineered bacterial cells, fungal cells etc. an used to produce interferons

v) Pollution control:

(i) *Pseudomonas putida* is used in the control of oil pollution.

ii) Bacterium *Bacillus thuringiensis* is used as biopesticide to control certain insects in cabbage, potatoes and other crops

(iii) Heterotrophic bacteria like *Achromobacter, Arthrobacer, citromonas*, *Flavobacterium, pseudomonas* etc.

iv) Autotrophic bacteria like Nitrobacter and Nitrosomonas, Sphaerotilus natans and Zoogloea *sp.* ciliate protozoans that feed on bacteria are used in the treatment of sewage.

vi) Enzymes : Enzymes are the biological catalysts.

ENZYME	MICROORGANISM	ROLE OF ENZYME
1.Streptokinase	*Streptococcus pyogenes*	Dissolving of coronary and cerebral blood vessels to prevent attacks or strokes
2.DNA polymerase	*Thermus aquaticus*	Polymerase chain reactions
3.Cellulase	*Trichoderma reesi*	Fabric softening and brightening
4.Alkaline serene Protease	*Bacillus liheniformis*	To remove protein stains
5.Rennin	*Mucor pusilus*	Coagulation of milk and cheese preparation.

vii) **VACCINE**S: Vaccines are several types. They are:

1) Attenuated whole agent Vaccines: They have live microorganisms that have been cultured under conditions that disable their virulent properties. They induce more durable immunological responses.

Examples: vaccines against yellow fever, measles, rubella and mumps.

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6) Recombinant vector vaccines: By combining the physiology of one microorganism and the DNA of the other, immunity can be created against diseases with complex infection processes.

7) DNA vaccines :

viii) **Monoclonal antibodies**:

- Antibodies produced by a clone of specific lymphocytes are known as monoclonal antibodies.
- They are formed by hybridoma technology which is based on somatic cell hybridization.
- Antibody producing B.lymphocytes are fused with a myeloma cell to produce a hybridoma cell. This hybridoma cell can produce large number of antibodies with uncontrolled division property.

.

2. Describe the various steps involved in rDNA technology. Discuss the various enzymes and vectors used in this technology.

Recombinant DNA technology involves a complex sequence of reactions that allows manipulation of the genetic nature of the gene or organism and is popularly referred to as genetic engineering.

The steps involved in rDNA technology are:

Step 1: Isolation of Donor DNA fro cloning: Restriction endonucleases cut double strand DNA at specific places and produce restriction fragments of DNA. These are separated by gel electrophoresis. The desired fragment can be identified by southern blotting technique.

Step 2: Isolation of Vector: Find a suitable cloning vector which is a self replicating genetic material than can carry the donor DNA. The cloning vector serves as the carrier for the donor DNA..

Step 3: Formation of Chimeric DNA. Cleaving of vector DNA at specific sites with same restriction endonucleases with which the donor DNA is cut. To the sticky ends of cloning vehicle the sticky ends of the gene to be cloned is joined by using the enzyme,e Ligase to form a hybrid DNA known as r DNA or chimeric DNA..

Step 5: Uptake of Chimeric DNA: The hybrid DNA is added to a suspension of suitable recipient bacterial to take up the r DNA by phase mediated transduction or by using calcium chloride.

Step 6: Identification and isolation of the bacteria having rDNA by using genetic markers or by colony hybridization technique.

Step 7 : The bacteria with rDNA are propagated in large quantities and the product is recovered from the culture.

VECTORS:

The various vectors used in rDNA technology are

(1) Plasmids, (2) Bacteriphages, (3) Cosmids.

1) **Plasmids :** These are circular DNA material other than the bacterial chromosome. They can replicate independently $p^{BR\ 322}$ is one of the earliest genetically engineered plasmid.
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E.g. Lambda and M13 Bacteriopahge.

3) **Cosmids :** These are hybrid vectors, which exhibit the features of plasmid and baceriophages. They have cos sequence of phage lambda and plasmid DNA of bacteria.

Cos sequence helps to incorporate longer foreign DNA.

Plasmid sequence is useful in replication.

ENZYMES : Nucleases and ligases are used in r DNA technology

1. **Nucleases**:
   - ♦ Exonucleases cleave nucleotides from the ends of polynucleotide molecule. They hydrolyse phosphodiester bonds of terminal nucleotides.
   - ♦ Restriction endonucleases are a type of enzymes or proteins which cut the DNA at a nucleotide sequence called restriction sites of bacteriophages.
   - ♦ Restriction endonucleases recognize a specific base sequence in DNA molecule and make two cuts, one on each strand.
   - ♦ Another importance of these restriction endonucleases is they produce limited number of cuts in DNA molecule as a particular enzyme recognizes unique sequences.
   - ♦ The cuts could be either sticky ends or blunt end cuts.

Sticky ends	**Blunt ends**
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2. **Ligases :**

- **DNA** ligases are proteins that work like a molecular glue or gum.
- They recognize the free ends of two different DNA chains and causes a chemical reaction that ligates (binds) them together into a single chain.

Cell Cycle Regulation, Cancer Biology and Stem Cells

Very Short Answer Questions

1. What is cell cycle?

Ans. A series of events occur in a Eukaryotic cell that leads to the duplication of chromosomes and division of cell is known as cell cycle.

2. What are the different stages in cell cycle?

Ans. The different stages in cell cycle are G_1, S_1,G_2 and M phases.

3. What is G_0 cycle?

Ans. The stage of the cell in which the cell do not divide or the stage in which the cell permanently enter into a non-dividing state is G_0 cycle. E.g. Nerve cells, muscles after completing G_1 phase enters G_0 phase.

But some

4. What are the changes that occur in G_1 stage of cell cycle?

Ans. G_1 is an active preparatory phase in which the cytoplasmic elements like ribosomes, membrane bound organelles, substrates and enzymes necessary for DNA replication are synthesized.

5. What are the changes that occur in G_2 stage of cell cycle?

Ans. In G_2 phase, the volume of nucleus increases and the proteins required for spindle formation are produced in this phase.

6. What are the changes that occur in S stage of cell cycle?

Ans. In S phase DNA replication occurs, so that the total content of DNA gets doubled. Hence it is known as synthesis phase.

7. What is interphase?

Ans. Interphase is present between division phases of the cell. Interphase is the longest phase of the cell cycle. This interphase is divisible into G_1, S and G_2 phases.

8. What are Cyclins?

Ans. These are cell cycle regulatory subunits. These regulate the cell cycle. The levels of cyclins rise and fall with the phases of the cell cycle. The cyclins are of different types like cyclin A, cyclin B, cyclin D and cyclin E.

9. What are Kinases?

Ans. These are the phosphorylating enzymes which participate in cell cycle regulation. The levels of kinases remain stable in a cell. These kinases cannot act independently until they are associated with cyclins.So they are known as Cyclin –dependent kinases (Cdk). These are different types like Cdk 1, Cdk 2, Cdk 4 and Cdk 6.

10. Which are unchanged and which are changed in their concentration in the cell cycle?

Ans. The concentration of cyclins changes, but the concentration of kinases remains unchanged.

11. What is the importance of P^{53} protein in cell cycle regulation?

Ans. p^{53} protein functions as a transcriptional activator. In a damage cell this protein level is increased and acts as cyclin kinase inhibitor, CKI which blocks the cell cycle at restriction checkpoint by inhibiting the synthesis of cyclin D. It allows time to repair DNA.

If the damage is severe, this protein causes Apoptosis (programmed cell death)

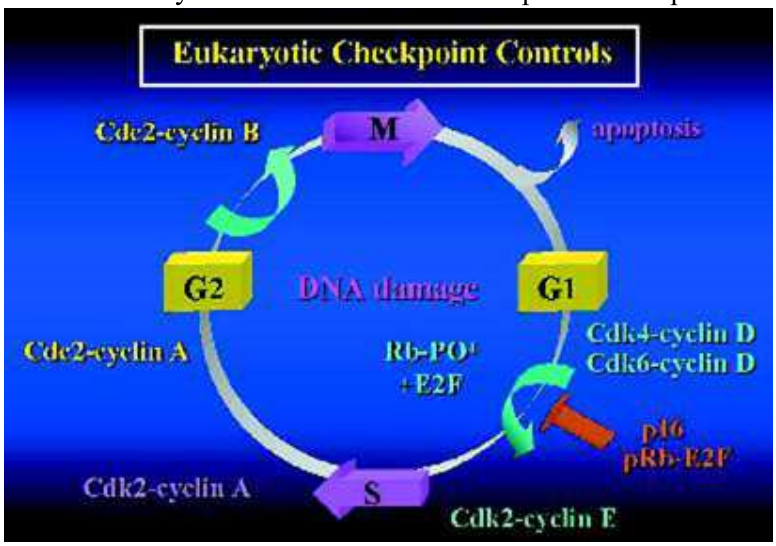
12. What are checkpoints in cell cycle regulation?

Ans. Check points supervise and regulate various activities occur during cell cycle. They are of different types like G_1 check point, G_2 check point and M check point or final check point.

a) G_1 check point: it is the critical check point known as restriction Check point. It allows the transition of G_1 phase in to S phase.

b) G_2 check point: Through this, cell cycle enters division phase.

c) Final check point: Regulates the attachment of spindle fibre to centromere and allows cycle the transition from metaphase to anaphase.



13. What is the importance of Anaphase Promoting Complex?

Ans. APC is activated by MPFs.

APC also called cyclosome . It triggers destruction of the co**he**sins to allow the sister chromatids to separate during mitosis. It also stimulates the degradation of the Mitotic cyclin B by activating the protein Ubiquitin.

14. What are the functions of G_1 – Cdk – cyclin complex (Cdk 4/6 cyclin D)?

Ans. Cdk 4/6 cyclin D complexes appear first. They

a) prepare the cell for S phase,
b) activates the factors required for DNA replication in S phase,
c) inactivates APC (Anaphase – promoting complex),
d) Degrades the inhibitor of Cdk2 cyclin A complex by phosphorylation.
e) Assemble pre replication complex at origin site.

15. What are the functions of Cdk2 – Cyclin A complex?

Ans. It phosphorylates the protein necessary for DNA replication in S phase.

16. What are the functions of Cdk 1 – cyclin B and Cdk 1-cyclin A complexes ?

Ans. **Cdk 1 – cyclin B and Cdk 1-cyclin** complexes are known as Mitotic promotion factors (MPFs) are synthesized during S phase and G_2 phase but its activation is under the check till the ends of DNA replication. Activated MPFs induce

i) Condensation of chromosome
ii) Breakdown of nuclear membrane
iii) Formation of mitotic spindle
iv) Activates APC(cyclosome)

17. What are cohesion molecules?

Ans. Cohesins are the proteins which bind the sister chromatids of chromosomes. This cohesion is destroyed by cyclosome to allow the sister chromatids to be separated during mitosis.

18. Distinguish between malignant and benign tumors.

Ans.

Malignant tumors	**Benign tumours**
1. cells from this tumours detach and migrate to other parts and give rise to secondary tumours.	1. Cells never migrate to other parts of the body. These are small, localized with a fibrous outer capsule
2. These tumors are harmful and Lethal.	2. These tumors are harmless and can be removed by surgery.
3. Tumors exhibit metastasis.	3. Do not exhibit metastasis.

19. What is Metastasis?

Ans. The phenomenon in which the malignant tumor forming cells detach from one part of the boy and develop secondary tumors at other parts of body is known as Metastasis.

20. What are Sarcomas?

Ans. Sarcomas are the malignant tumors formed in the connective tissues or organs originate from mesoderm.
E.g. Osteosarcoma of bone

21. What are Carcinomas?

Ans. These are malignant tumours of the epithelial cells. They are solid; originate from the epithelial tissues of skin, linings of the respiratory, digestive, urinary and genital system or cells from various glands, breast, and nervous tissue.

22. What are Leukemias?

Ans. These are the malignant tumours of stem cells of haemopoietic tissues. They are liquid tumors affecting blood cells particularly WBC growing the bone marrow.

23. What are Lymphomas?

Ans. These are malignant tumor of secondary lymphoid organs like spleen and lymph nodes.
E.g. Burkitt lymphoma.

24. What is neoplasm?

Ans. . Abnormal mass of cells is referred to as neoplasm.

25. What is telomerase?

Ans. It is an enzyme that adds specific DNA sequence repeats, TTAGGG in all vertebrates to the 3' end. is called telomerase. Telomerases are found at the ends of eukaryotic chromosomes.

26. What is apoptosis?

Ans. The damage during the cell cycle is severe, p^{53} protein can cause apoptosis or programmed cell death.

27. What is contact inhibition?

Ans. In cancer cells, cadherin portion molecules are either partly or entirely missing. This allows cancer cells to detach from each other and from the matrix. This enables cancer cells to spread to other area.

28. What are cadherin proteins?

Ans. The intercellular adhesion protein molecules that play a part in keeping cells together is called cadherin protein.

29. What are the lineages of stem cells?

Ans. Different derivatives of cells formed from the single stem cells are known as lineages of stem cells.

30. What are progenitor cells?

Ans.Common Progenitors are the secondary stem cells which are going to differentiate into committed progenitors.

31. What are Megakaryocytes?

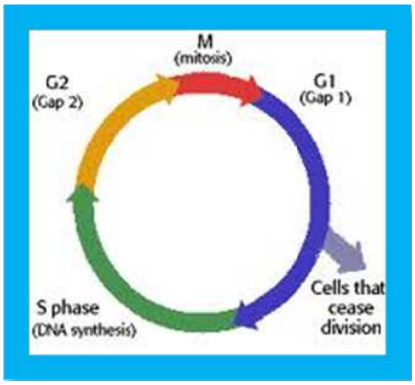
Ans. Megakaryocytes are the cells of myeloid lineage which produce the blood platelets by fragmentation.

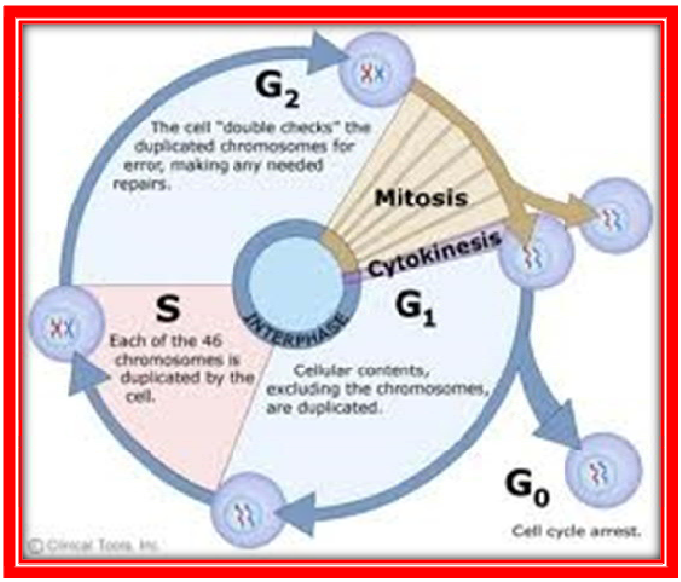
Short Answer Questions

1. Explain the cell cycle.

Ans. A sequence of events occurring in a eukaryotic cell leading to duplication of chromosomes and division of cell is the cell cycle.

- The cell cycle consists of two phases, division phase and interphase.
- Interphase is the longest phase of the cell cycle. During interphase many changes occur in the cell. Based on these changes the interphase is divisible into G_1, S and G_2 phases.
- G_1 phase is an active preparatory phase that begins after mitosis.Many cytoplasmic elements like ribosomes, membrane bound organelles, substrates and enzymes necessary for DNA replication are synthesized.
- In S phase, DNA replication occurs by activation of prereplication complexes. During this phase, the total content of DNA doubles up.
- In G_2 phase the nuclear volume increases and proteins required for spindle formation occurs.
- The division phase of the cell cycle is termed as M phase. During this M phase the cell completes mitotic division.





2. Describe the regulation of cell cycle.

Ans. All the events during cell cycle are regulated by two proteins called the cyclins and kinases.

- Cyclins are the regulatory sub-units. These cyclins are of three types like Cyclin A, Cyclin B, Cyclin D and Cyclin E. The level of these cyclins rise and fall with the pahses of the cell cycle.
  Kinases cannot act independently until they are associated with cyclins hence kinases
- Kinases are the phosphorylating enzymes. The levels of kinases remain stable. are known as cylcin dependent kinases (Cdk). They adds phosphate group to various proteins that control the process of cell cycle. These kinases are Cdk 1, Cdk 2, Cdk 4, and Cdk 6.
- A Cdk associates with a specific cyclin and form Cdk-cyclin complex. They are Cdk 4/6-cyclin D, Cdk 2-cyclin E, Cdk 2 –Cyclin A, Cdk 1 – cyclin B and Cdk 1 – cyclin A complexes.

Type of complex	**When it is formed**	**Role**
1.Cdk4/6-cyclin D	When cells stimulate to divide	Prepares cell for S phase. Activates the transcriptional factors, Inactivate APC, degrades the inhibitor of Cdk2-cyclin A.
2.Cdk 2- cyclin E	Late G_1	Completes the transition of G_1 to S
3. Cdk 2-cyclin A	Synthesized in G_1 but functional in S phase	Phorporylates the proteins necessary for DNA replication
4.Cdk 1-cyclin B & Cdk 1-cyclin A (Mitotic(maturation) Promotion factors	Synthesized in S & G_2 , but become active after DNA replication	Induce chromosome condensation. Breakdown of nuclear membrane, Formation of mitotic spindle, Activates APC.
5.Anapahse Promoting Complex (APC) or Cyclosome		Destroys Cohesin and help in the separation of sister chromatids during mitosis. Degrades cyclin B by activating Ubiquitin.

3. What do cause of cancers? Explain in brief.

Ans.

I) **ONCOGENES**.

There are several genes that can cause cancer. They are called as oncogenes or tumor inducing genes (Ti genes).

The Ti oncogenes are normally present in the viruses (V-onc) and also in the host cells cellular oncogenes (C-onc).

a) Viral oncogenes (V-onc) :

- These are normally carried by retroviruses.
- They induce tumour formation.
- Avian sarcoma virus can induce sarcoma tumor in chicks. It was demonstrated by Peyton Rous.

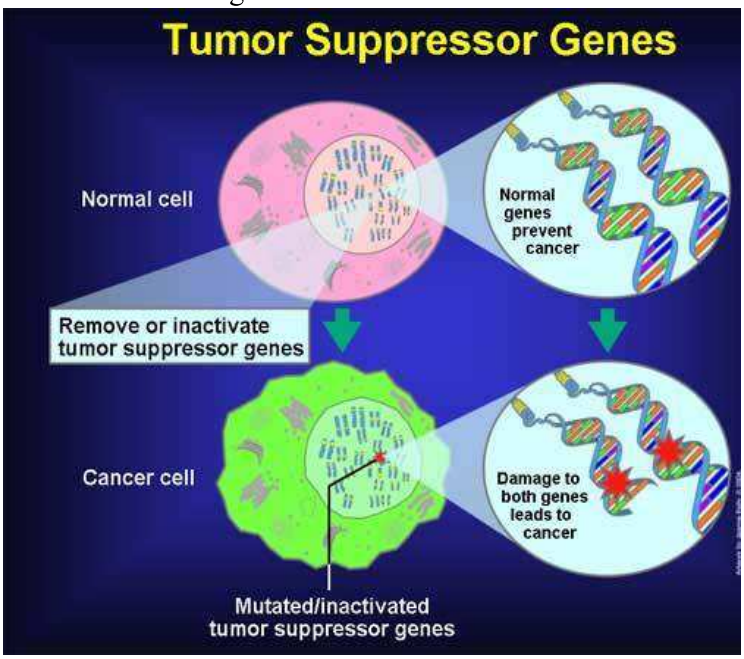
b) Cellular oncogenes (C-onc) :

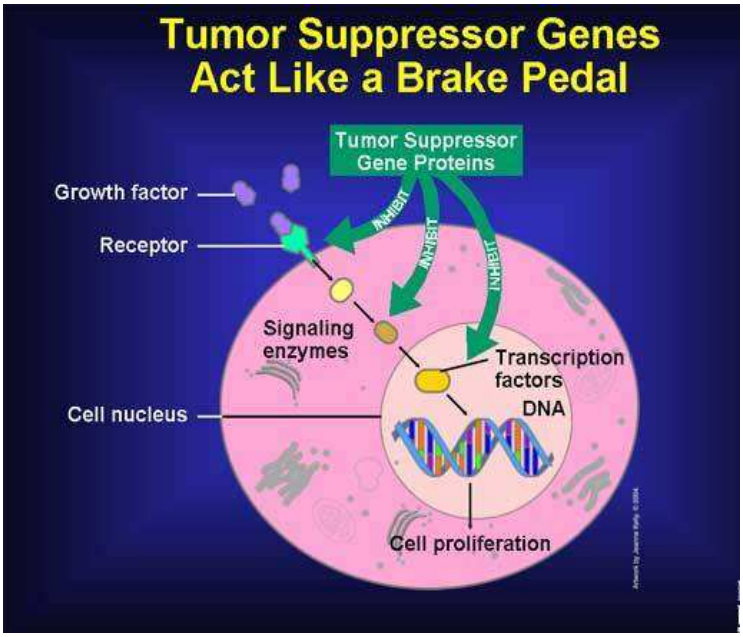
- These are also known as proto-oncogenes or cellular oncogenes.
- These code for proteins that help to regulate cell growh and differentiation.
- Proto oncogenes will be in an inactive state. But mutations make them to become active and transforms into a tumour inducing agent (oncogene)

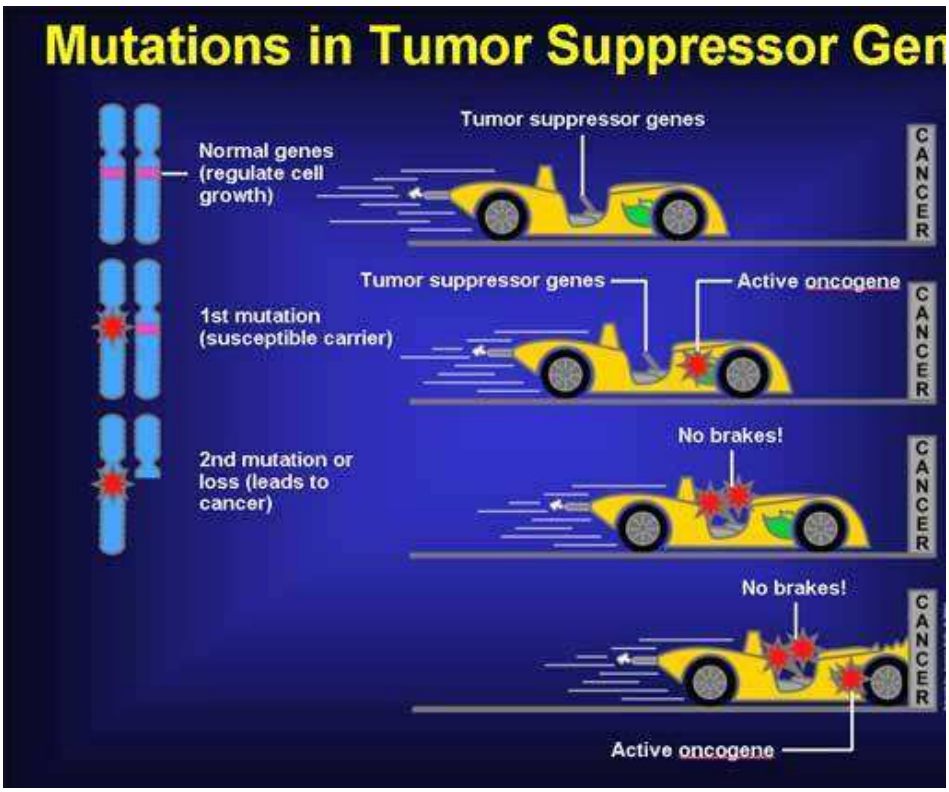
II) Inactivation of Tumor suppressor genes :

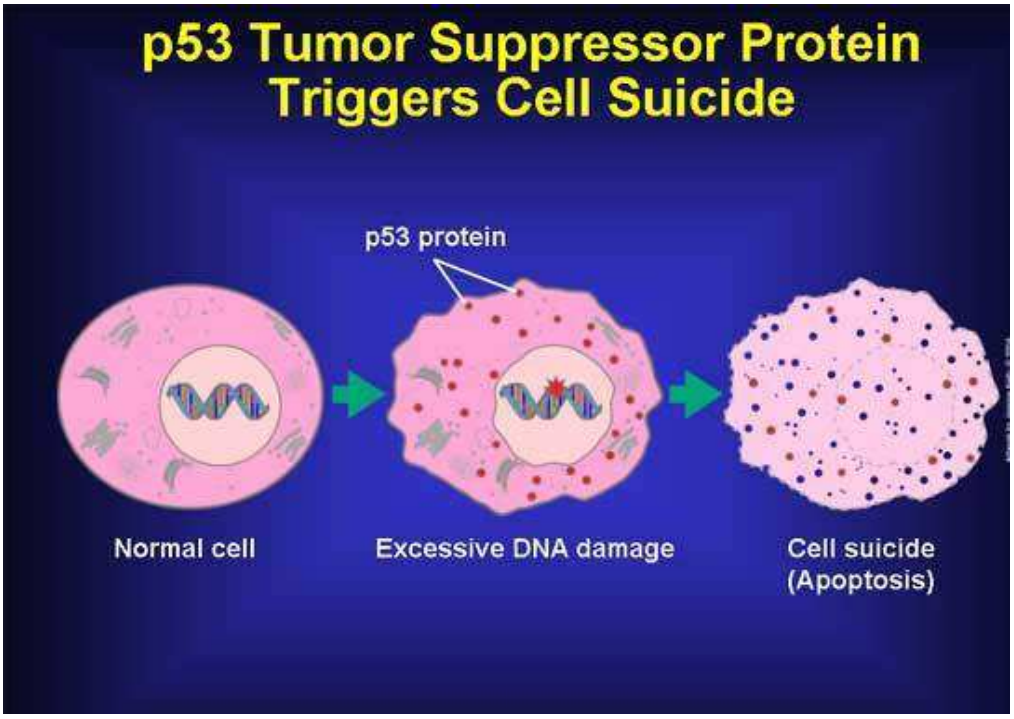
- Genes which suppress the activity of oncogenes are known as tumor suppressor genes.
- E.g., P^{53} gene codes for aprotein P^{53} that suppresses the tumor formation.
- These genes are dominant and suppress the expression of oncogenes.

- Whem tumor suppressor genes are mutated or deleted, it results in the failure of dactivatiio of oncogens. It results in the failure of deactivation of oncogenes.




Tumor Suppressor Genes
Act Like a Brake Pedal
Tumor Suppressor
Gene Proteins
Growth factor
Receptor
INHIBIT
INHIBIT
INHIBIT
Signaling
enzymes
Transcription
factors
DNA
Cell nucleus
Cell proliferation


Mutations in Tumor Suppressor Gen
Tumor suppressor genes
Normal genes
(regulate cell
growth)
CANCER
Tumor suppressor genes
Active oncogene
1st mutation
(susceptible carrier)
CANCER
No brakes!
2nd mutation or
loss (leads to
cancer)
CANCER
No brakes!
CANCER
Active oncogene



III) Mutations in DNA repair genes :

- DNA is subjected to point mutation. These mutations are rectified by specific DNA repair mechanism.
- These mechanisms are controlled by a cluster of genes. When these cluster of genes become non-functional due to mutation. They lead to DNA repair syndromes and can cause variety of cancers.
- Sometimes neutrophil granules secrete free radicals that damage DNA.

4. Describe the various types of cancers.

Ans. There are more than 200 types of human cancers. A few of them are heritable (familial) and many are non-heritable (sporadic).

Based on their origin they are classified as:

1) Carcinoma :

- ❖ 85% of cancers are carcinomas.
- ❖ These are malignant tumor of the epithelial cells.
- ❖ They are solid, originating from the epithelial tissues of skin, lining of the respiratory, digestive, urinary and genital systems or cells from various glands, breast and nervous tissue.

e.g. Adeno carcinoma (Cancer of adenoids),
Glioblastoma (Cancer of nerve tissue-brain tumors)
Squamous cell carcinoma (skin)
Renal cell carcinoma (kidney tubules)

2) Sarcoma :

- ❖ About 2% of tumors are of sarcoma type.
- ❖ These are malignant tumors of connective tissue or organs that originate from mesoderm.

e.g. Anglo sarcoma (Cancer of blood vessels)
Chondro sarcoma (Cancer of cartilage).
Osteo sarcoma (bone)
Cancers of muscles.

3) Leukemia :

- About 4% of cancers are Leukemia type.
- These are malignant tumors of stem cells of haemopoietic tissues.
- They are liquid tumors affecting blood cells particularly WBC growing in bone marrow.

e.g. Acute T-cell Leukemia,
Chronic myelocytic Leukemia.

4) Lymphoma :

- About 4% of cancers are lymphoma type.
- A malignant tumor of secondary lymphoid organs like spleen and lymph nodes.

e.g. Burkitt lymphoma.

5. Distinguish between normal cells and cancerous cells.

Ans.

Normal cells	**Cancerous cells**
1.controlled growth	Uncontrolled growth
2. Limited growth potential	Unlimited growth potential
3.under go apoptosis	Evading apoptosis
4.normal shape due to sufficient number of microfilaments	Speherical shape due to less number of microfilaments
5. normal antigens on surface	Abnormal antigens on surface
6. Cadherins are present among the cells for adhesion	Cadherins is absent.

6. What are lineages? Describe the various lineages of stem cells.

Ans. Derivatives formed from the pleuripotent stem cells are called as cell lineages.
Basing of the specific cell that is going to be differential the name is being given as Lymphoid lineage, Myeloid lineage, Erythroid lineage.

A) Lymphoid lineage: In lymphoid lineage the progenitors like Pre-T cell, Pre-B cell and Pre-NK cells differentiate to T-cells, B-cells and NK-cells.

i)The pre-T cell is formed in bone marrow and migrate to thymus and mature into T cells.

ii) The pre-B cells mature into B cells in bone marrow.

iii) The B cells thus formed are non-functional but they move to the secondary lymphoid organs like spleen and differentiate into antibody producing plasma cells and memory cells.

iv) The pre NK cells mature into large granular lymphocytes or Natural killer cells in bone marrow.

B) Myeloid lineage: The myeloid secondary stem cells produce committed cells like monoblasts, myeloblasts and megakaryocytes.

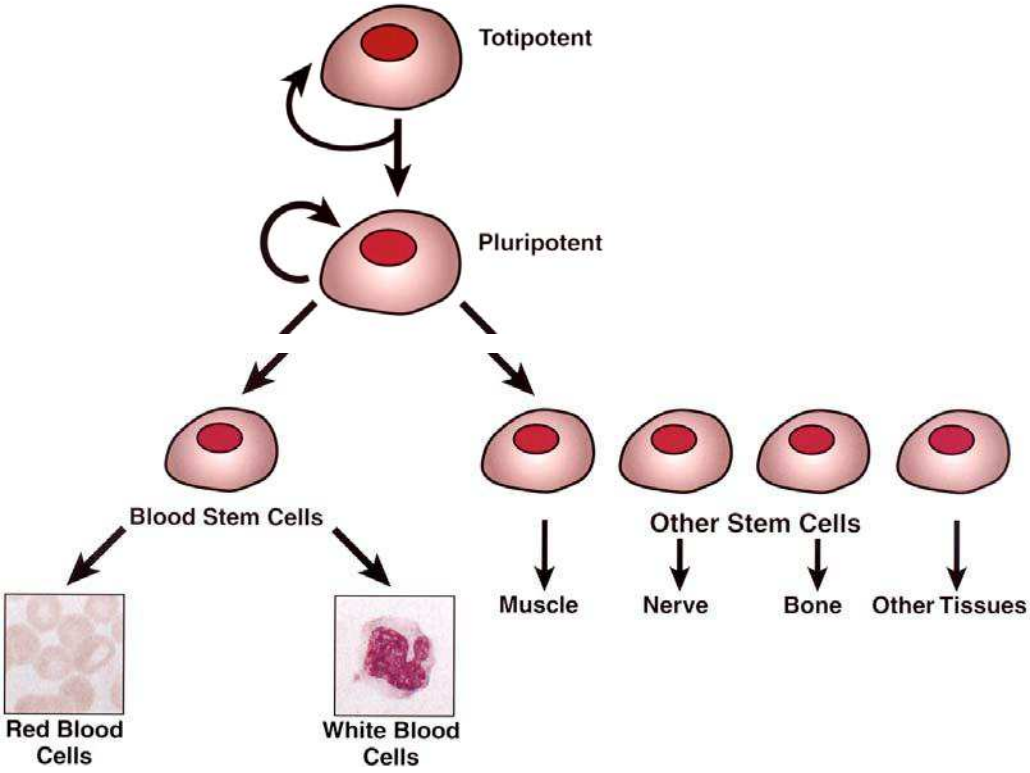
i)Monoblasts differentiate into monocytes of blood and also become macrophages in tissues.

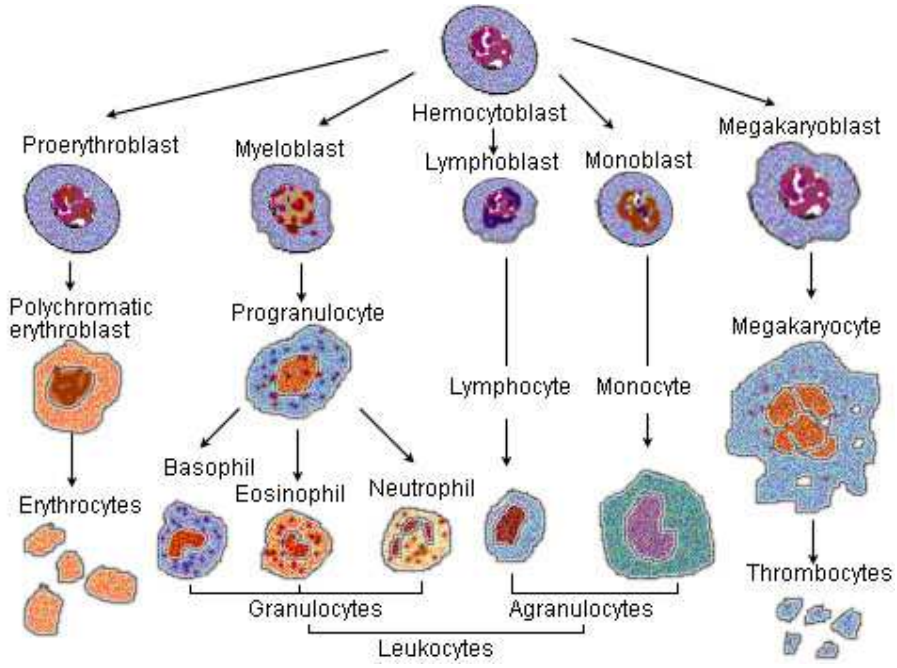
ii) Myeloblasts develop into granular leucocytes like neutrophils, eosinophils and Basophils.

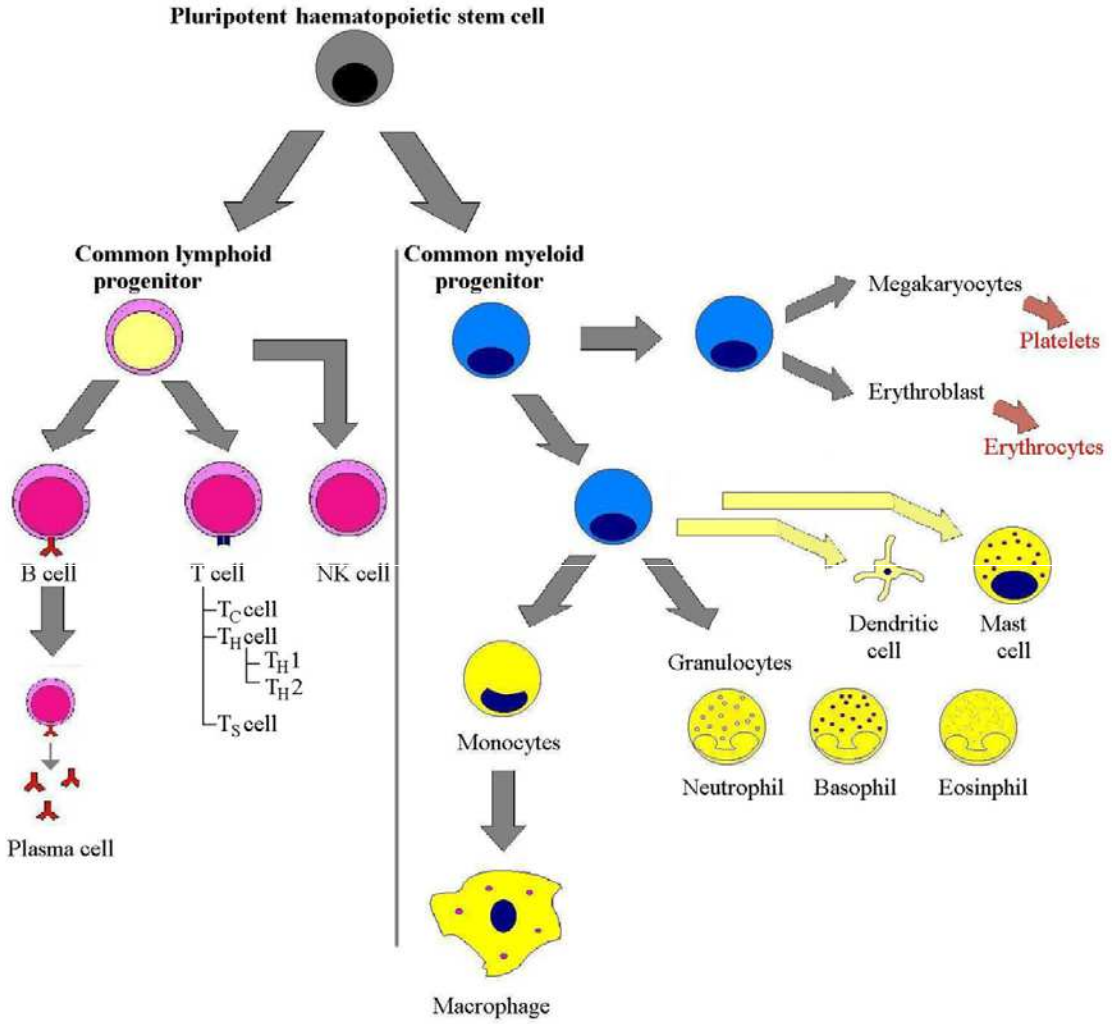
iii)Megakaryocytes produce platelets.

C) Erythroid lineage: Erythroid secondary stem cells produce committed progenitors erythroblasts that differentiate into erythrocytes through various stages like pro-erythroblst, erythroblast and reticulocyte.

Hierarchy of Stem Cells






Pluripotent haematopoietic stem cell
Common lymphoid progenitor
Common myeloid progenitor
B cell
T cell
NK cell
T_C cell
T_H cell
T_H1
T_H2
T_S cell
Plasma cell
Monocytes
Macrophage
Megakaryocytes
Platelets
Erythroblast
Erythrocytes
Granulocytes
Dendritic cell
Mast cell
Neutrophil
Basophil
Eosinphil

Biomedical Technology

Very Short Answer Questions

1. What is Biomedical Technology?

Ans. Application of engineering and technology principles to the biological systems.
It is the combination of Biomedical Engineering and Biotechnology.

2. What is diagnostic imaging?

Ans. Diagnostic imaging is one important tool in medical practice; diagnose the ailment of the patient.

3. What is the principle involved in X-ray radiography?

Ans. Wilhelm Conrad Rontgen discovered X-rays.
These are a form of electromagnetic radiation with a wavelength in the range of 0.01 to 10 nanometers.

4. Why is a pregnant woman not advised to go for a X-ray radiography?

Ans. Woman should always inform their physician or X-ray technologist when she was a pregnant X-rays affect the foetus.

5. List out two benefits of X-ray radiography?

Ans. 1. X-rays usually have no side effects.
2. X-rays imaging is fast and easy.
3. It is particularly useful in emergency diagnosis and treatment.

6. What is the importance of angiography?

Ans. The importance of angiography is useful in observing the flow of blood in blood vessels and tracing the blocks in blood vessels.

7. What is the principle involved in MRI scanning?

Ans. MRI is a radiology technique that uses nuclear magnetic resonance of protons to produce proton density images of body parts. The principle involved in MRI scanning is a radiology technique that uses magnetism, radio waves and computer to produce images of the body structures.

8. What is ECG?

Ans. Electro Cardio Graphy or electrocardiogram (ECG or EKG) is a noninvasive test that is used to detect the heart conditions by measuring the electrical activity of the heart.

9. What is a P-wave? What is its significance?

Ans. P-wave indicates atrial depolarization that spreads from SA nod through contractile fibres in both atria.
Enlarged P wave indicates enlargement of atrium.

10. What is T-wave? What is its significance?

Ans. T-wave indicates the repolarization of the ventricles. T-wave refers to as the refractory period.
T – wave is inverted in Myocardial ischemia, tall in hyperkalemia and flat in myocradial ischemia or hypokalemia.

11. What is QRS complex? What is its significance?

Ans. The QRS complex represents the time between activation of electrical activity in the ventricles and their return to the resting state. It indicates the rapid ventricular depolarization as the action potential spreads through ventricular contractile fibres.

12. What is a P-R interval? What is its significance?

Ans. P-R interval is measured from the beginning of the P-wave to the beginning of the QRS complex.

A prolonged Pr interval indicates coronary artery disease (CAD) due to arteriosclerosis, rheumatic fever, first degree heart block.

13. What is S-T segment? What is its significance?

Ans. S-T segment connects the QRS complex and T wave.It is between the end of of QRS complex and the beginning of T wave.

It is elevated (above the base line) in acute myocartial infraction, depressed in coronary ischemia.

14. What is a Q-T interval? What is its significance?

Ans. Q-T interval is measured from the beginning of each QRS complex to the end of the T-wave.

Q-T interval is lengthened in myocardial damage, coronary ischemia.

15. What is an EEG?

Ans. Electroencephalogram or EEG is a test used to detect abnormalities related to electrical activity of the brain..

16. Distinguish between autograft and allograft?

Ans. i) Autograft means a self tissue transferred from one body site to another in the same individual.

e.g. Use of a healthy blood vessel to replace the blocked coronary artery.

ii) Allograft means transplanted organ or tissue from a genetically non- identical member of the same species.

17. What is split transplantation?

Ans. An organ of a diseased patient is shared by two patients, the transplantation is split transplantation.

18. What is domino transplantation?

Ans. Transplantation of the whole organ or complete set of organs is called as domino transplantation.

19. Distinguish between life saving and life enhancing transplantations.

Ans. Life enhancing transplantation means while tissue transplantation.

Life saving transplantation means organ transplants.

20. How are rejection reactions suppressed in transplantation?

Ans. In transplantation, Monoclonal Anti Bodies (MAB) directed against the various surface molecules on the cells of the immune system have been used successfully to suppress the rejection reactions.

Certain fungal metabolites are also used as suppressors.

21. What are the two tests-requires of an ELISA test?

Ans. Sandwich test and competitive tests are the two tests required for ELISA test.

22. Distinguish between sandwich ELISA and competitive ELISA?

Ans. Sandwich ELISA test – In this test the enzyme coupled antibodies are used.

Competitive ELISA test – In this test the substrate coupled antigens are used.

23. What is meant by ELISA test?

Ans. ELISA is an enzyme linked immuno sorbent assay test. It requires an antibody, antigen, enzyme and a substrate.

24. What is the basic procedure involved in conducting ELISA test?

Ans. The most basic type of ELISA consists of an antibody attached to a solid surface. This antibody has affinity for the substrate of interest.

Short Answer Questions

1. **Explain the importance of X-ray radiography in diagnostic imaging.**
   - ❖ X-rays are primarily used for diagnostic radiography and crystallography.
   - ❖ Radiology is a specialized field of medicine, which deals with the application of radiations in medicine.
   - ❖ The X-rays are useful in the detection of pathology.
   - ❖ Chest X-ray is used to identify lung diseases such as pneumonia, lung cancer or pulmonary edema.
   - ❖ Abdominal X-ray is used to detect ileum (blockage of the intestine) free air (from visceral perforations) and free fluid (in ascites).

   An image is recorded on photographic film or a special image recording plate. As a result, bones appear white on the X-ray, soft tissues appear in shades of gray and air appears black. X-ray images are maintained as hard film copy or as a digital image that is stored electronically.

2. **How is a CAT scan more useful in diagnostic imaging?**



Ans. CAT (Computerized Axial Tomography) scan is an X-ray procedure which combines many X – ray images with the aid of a computer ot generate cross-sectional views.

Three dimensional images of the internal organs and structures of the body can be taken with CAT scan. A computer to produce cross-sectional pictures of the body processes these images.

CAT scan are performed to analyze the traumatic injuries in head such as blood clots or skull fractures, tumours, to know the bony structure of the vertebrae, toe detect the infections, and to know the anatomy of liver, gallbladder, pancreas, spleen, aorta, kidneys, uterus, ovaries, intervertebral discs and spinal cord.

In fact, the CAT scan methods can be used to accurately measure the density of bone in evaluating osteoporosis. It can also used in the chest to identify tumors, cysts or infections that may be suspected on a chest X-ray.

3. **What is the importance of MRI scanning in diagnostic imaging?**



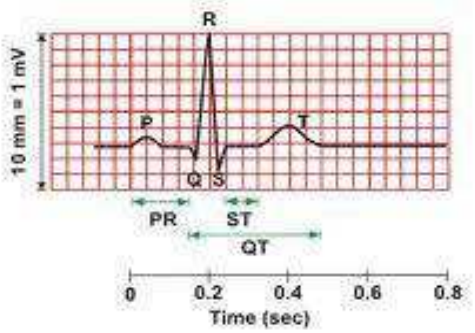
Ans. MRI (Magnetic Resonance Imaging) scan is a radiology technique.

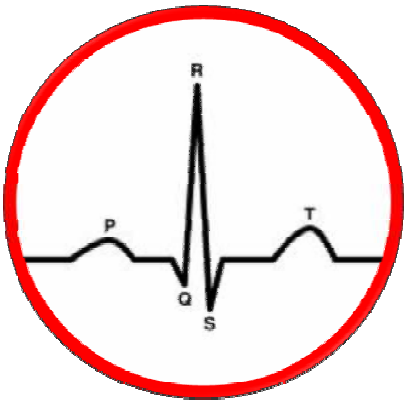
- ❖ It can be used as an extremely accurate method of disease detection throughout the body.
- ❖ In the head, trauma to the brain can be seen as bleeding or swelling, brain aneurysms (ballooning of blood vessel due to weakening of wall),, stroke, tumors of the brain a swell as tumors or inflammation of the spine.
- ❖ Neurosurgeons use MRI scan not only in defining brain anatomy but also in evaluating the integrity of the spinal cord after trauma.
- ❖ It can value the structure of the heart and aorta, where it can detect aneurysms or tears..

4. Explain the importance of ECG in monitoring the vital function of the heart.?

Ans. ECG (Electro Cardio Graph) is a noninvasive test that is used to detect the heart conditions by measuring the electrical activity of the heart. The recorder is electrocardiogram.

i) P-wave indicates atrial depolarization.
ii) Q – wave indicates the depolarization of the interventricular septum.
iii) R – wave represents early ventricular depolarization.
iv) S – wave represents the later ventricular depolarization.
v) QRS complex denotes the ventricular depolarization.
vi) T-wave represents the repolarization of the ventricles.
vii) A normal QRS complex is 0.06 to 0.10 sec in duration.
viii) P- R interval is measured from the beginning of the P wae to beginning of the QRS complex. It It is 0.12 to 0.20 s long.
ix) The P –R interval shortens at high heart rates during exercise or fever and increases at lower heart rates during sleep.
x) S-T segment connects the QRS complex and the T wave means it is between the end of QRS complex and beginning of T wave. It duration is 0.08 to 0.12 s.
xi) Q-T interval is measured from the beginning of the QRS complex to the end of the T wave. It represents the time period between activation of electrical activity in the ventricles and their return to the resting state..

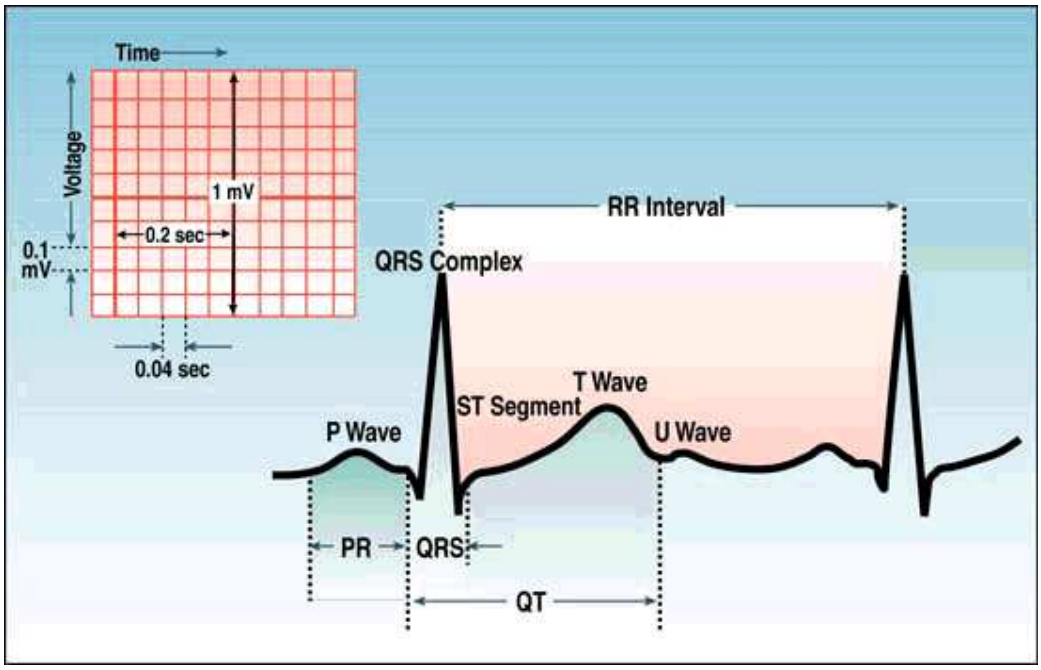




P wave (0.08 - 0.10 s) QRS (0.06 - 0.10 s)

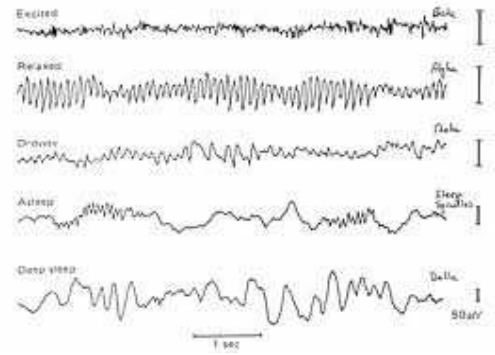
P-R interval (0.12 - 0.20 s) Q-T_C interval (≤ 0.44 s)*

*$QT_C = QT/\sqrt{RR}$



5. Explain the importance of EEG in monitoring the vital function of the brain.?

Ans. EEG (Electro Encephalo Gram) is a test used to detect abnormalities related to electrical activity of the brain.



- ► The recording machine converts the electrical impulses into wave pattern that can be seen on a computer screen.
- ► Small metal discs with thin wires (electrodes) are placed on the scalp, and then signals are send to a computer to record the results.
- ► The activity measured by EEG es electrical potentials created by the post-synaptic currents.
- ► Different types of waves record from EEG are… alpha, beta, theta and delta.

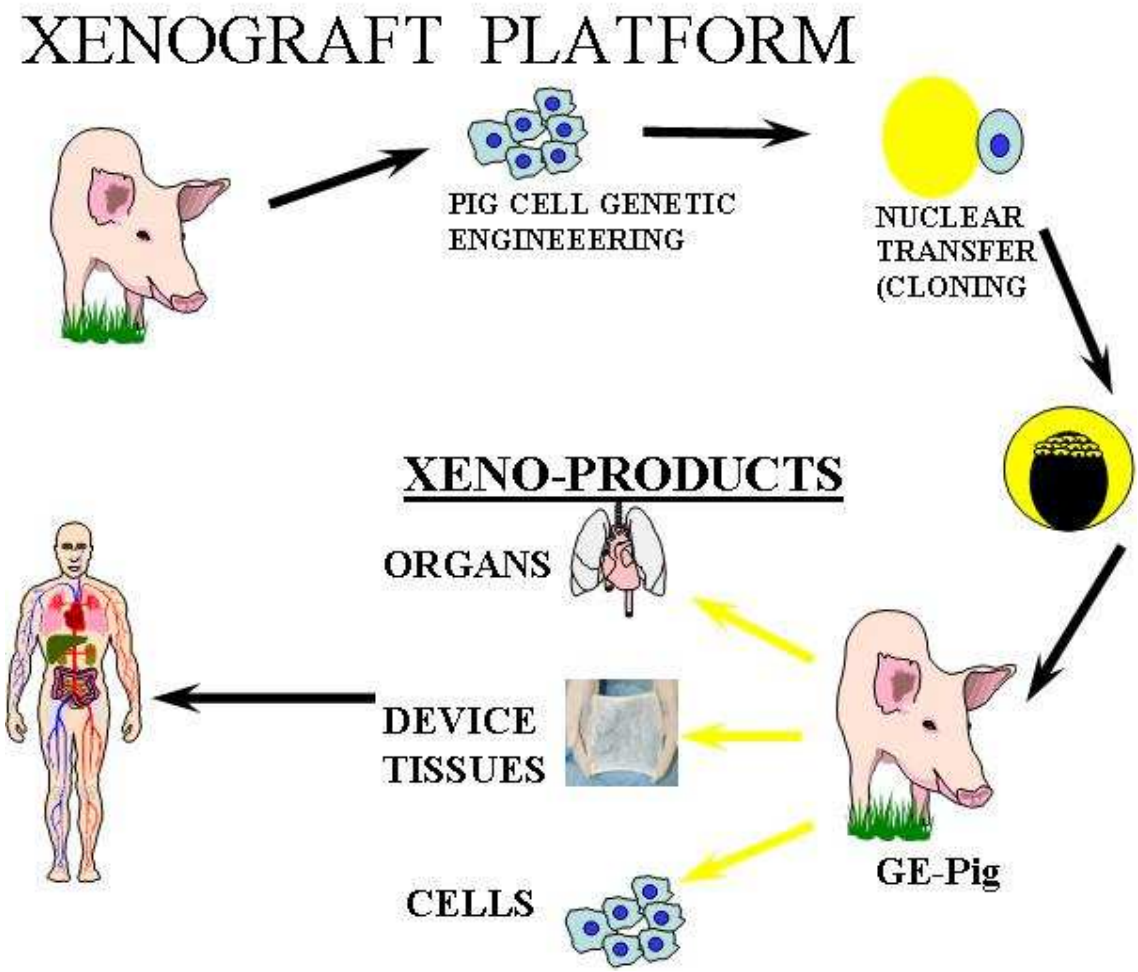
Type of wave	nature	Recorded in
1. ALPHA	higher amplitude	Normal relaxed adults.
2. BETA	fast activity	patients in alert or anxious or with open eyes ;
3. THETA	slow	children up to 13 years & in sleep
4. DELTA	highest amplitude Slowest wave	infants up to one year

6. Explain different methods of transplantation.?

Ans. Transplanations are the following methods,

1) **Autograft :** Autograft is a self-tissue transferred from one body site to another in the same individual. E.g. Use of a healthy blood vessel to replace the blocked coronary artery.
2) **Isograft :** It is the tissue transferred between genetically identical individuals. In human beings an Isograft can be performed between two monozygotic twins.
3) **Allograft :** It is a transplanted organ or tissue from a genetically non-identical member of the same species.
4) **Xenograft and Xenotransplantation :** It is a transplant of organs or tissue from one species to another.

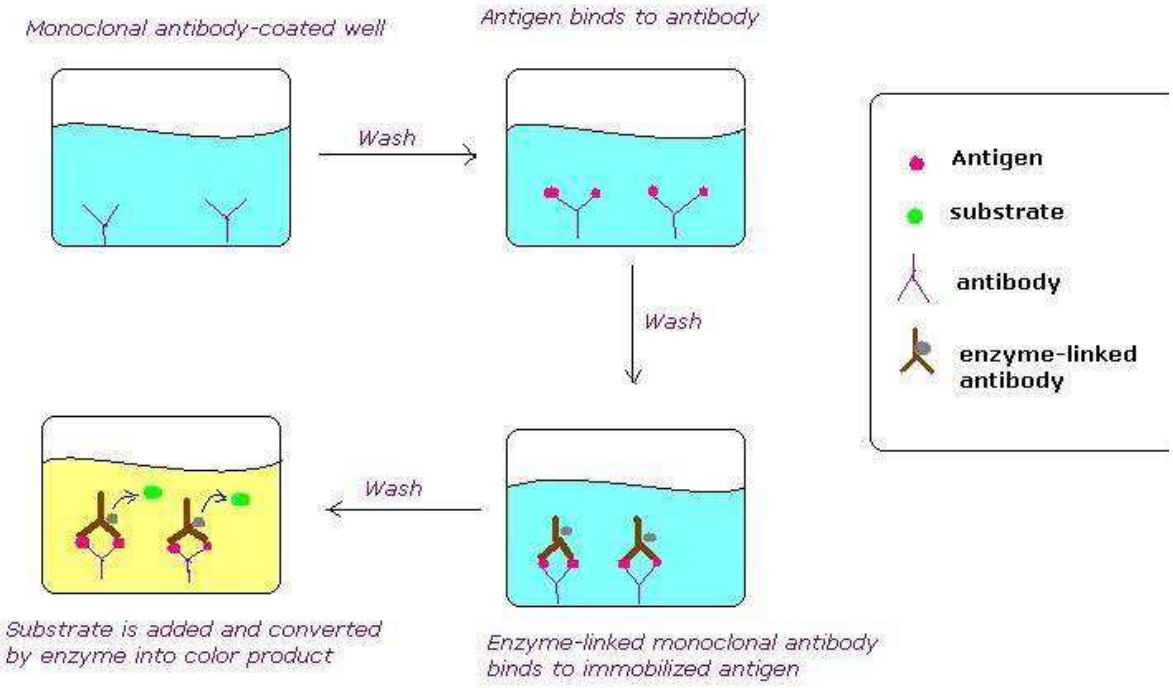
   Xenotransplantation is often an extremely dangerous type of transplant. It includes porcine heart valves, which are quite common and successful.



7. Explain the importance of ELISA test.?

Ans. ELISA tests mainly used in the test of the AIDS.

ELISA means enzyme linked immunosorbent assay test. It requires an antibody, an antigen, an enzyme and a substrate. The most basic type of ELISA consists of an antibody attached to a solid surface. For example, human chorionic gonadotropin (HCG), the commonly measured protein that indicates pregnancy. ELISA test are generally relatively accurate tests. An enzyme-conjugated anti-immunoglobin is added, consisting of an antibody against the antibodies being tested. For example if humans anti HIV antibodies are to be assayed, then antibodies are conjugated to the enzyme.


Monoclonal antibody-coated well
Antigen binds to antibody
Wash
Wash
Wash
Antigen
substrate
antibody
enzyme-linked antibody
Substrate is added and converted by enzyme into color product
Enzyme-linked monoclonal antibody binds to immobilized antigen

Indirect ELISA

Numbers correspond to steps in text

