LESSON – 6

APPLIED BIOLOGY

3x1= 3

2x3=6

1x10=10

19

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Lesson - 6 : Applied Biology

3 x 1 = 3
2 x 3 = 6
1 x 10 = 10
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(1)

1. ICAR → Indian Council for Agricultural Research

2. Animal husbandry and dairy → Mainly rural based

3. Dairying is the production and marketing milk and its products.

4. Dairy operation consists of proper maintenance of cattle and collection of milk, processing and its by products.

5. Milk forms a staple food, majority of the Indian population rely on milk for their protein supplement

6. Cattle belongs to the genus Bos (ruminant quadrepeds)
Important species → a) Bos indicus (humped cattle)
b) B. taurus (without hump) c) B. bubalis (the buffalo)

7. India → 26 breeds of cattle, 6 breeds of buffaloes.

8. Breed: (a) A group of animals of a species, which has for a long period been bred among themselves
(b) Breed members have closely related characters and transmitted to the subsequent generations (heriditary)

9. Classification of cattle - breeds

- a) Dairy breeds → high milk yielders, extended lactation. poor bullock quality
  eg: Sahiwal, Sindhi, Giv, umblachery
  - Strong limbs, loose skin.
- b) Dual purpose breeds: → Intermediate forms.
  Cows meant for both milk and drought.
  eg: Hariana, ongole, Kankrej, Tharparkar.
- c) Drought breeds: → Cows are poor milkers.
  Bullocks are good drought animals.
  well-built and the skin is well stretched.

10. Exotic breeds of cattle: a) These breeds are imported and reared in India. b) They are successfully crossed with indigenous breeds to obtain cross breeds.
Example: Ayreshire, Jersey, Brown swiss, Red Dane, Guernsy.

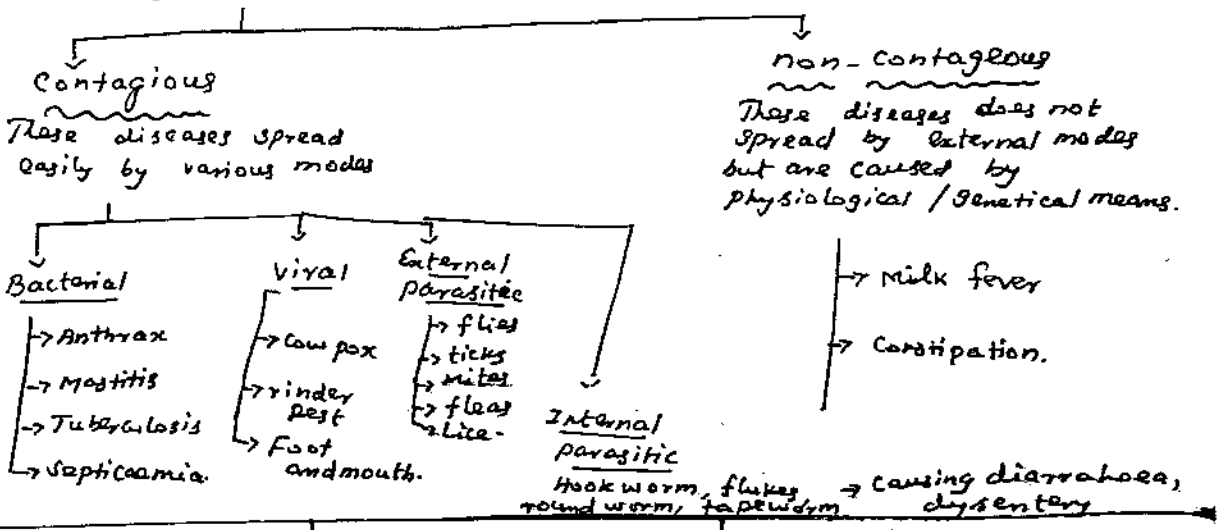
Jersey: a) oldest dairy breed b) originated from Jersy Island. c) Colour → white to dark grey → broken patches.
d) nervous and sensitive animals e) Lactational yield: 4950 kg, milkfat 5%.
f) Milk → yellow colour → due to high carotene content.
g) Cross breeds: Jersy + Sindhi, Jersy + Hariana.

Cattle breeds

S. NO	Type	origin, distribution	Distinguishing characters	Milk production.
1.	Milk breeds/ Dairy "			
	a) Sindhi/Red sindli/Red karachi	Karachi, Hyderabad	i) Dark red in colour ii) Thick horns emerging laterally and ending in blunt points. iii) Intelligent facial expression. iv) udder is large with medium sized teats v) Bullocks are steady workers, suited for road and field work.	5, 443 kg per lactation Average yield 1,700kg
	b) Gir / Surti/ Kathiawarli	Gir forest of South Kathia-war. Impure breed ↓ Baroda, Maharashtra	i) The animal is usually red, black and red, Red and white or white with red spots. ii) Very well built body with clear outlines iii) Ears are long like a leaf. long tail, and legs. iv) udder is large with matching teats. v) Bullocks are powerful, good for draught.	Maximum yield 3,715 kg Average 1,746 kg
2.	Dual purpose breeds			
	ONGOLE	Nellore (Guntur, Venukonda Kandukur Narasaraopet)	i) Larger form of breed. Male -700 kg female-400kg weight. ii) White in colour with Grey marking iii) Male:- Dark grey in colour. well developed and erect hump. iv) Bullocks → Suitable for cart and road work but are not fast.	1700 kg – 3500kg per lactation
3.	Draught breeds			
	a) Kangayam/ Kangayad/ Kongu	Kankayam division of Dharapuram taluk, Coimbatore	i) Moderate size. ii) White or grey in colour with black markings. iii) Horns - are strong, curved upward and outward. iv) Prominent forehead. v) Strong limbs, fine skin, tail. vi) udder - medium sized, small teats. viii) Bulls - Excellent for hard work.	Poor milkers 666 kg per lactation.
	b) Halikar	Karnataka (Hassan and Tumkur regions)	i) Dark grey / black in colour. ii) Long head with bulging forehead. iii) long horns terminates in a sharp point. iv) udder is medium sized with small teats. v) Bullocks are used for heavy ploughing, transport.	Poor milkers

Common diseases and control - (Cattle)

1. Normal cattle → Bright, alert and active in their movements with a shiny coat. They enjoy normal appetite and sleep.
2. Diseased cattle → Dull, restless and change postures frequently with a drop in milk yield.
3. Types of diseases



S.No	Disease	Symptoms	Control / prevention Precaution, first aid.
1.	**Contagious** a) **Anthrax** Caused by the bacterium B anthracis.	i) High temperature (41-45°C) ii) Swelling of the neck, thorax, lumbar region. iii) blood discharge from natural openings. iv) Animal dies in 10-36 hrs	i) Spore vaccine at 6 months of age and then annually. ii) Segregation of affected animals. iii) Carcasses to be burried deep.
	b) **Cow pox** Contageous disease attacking cows and buffaloes caused by pox virus.	i) rise in temperature ii) Retarded rumination iii) Swelling of udder, teats developing into vesicles, pustules. iv) Mastitis and loss of milk.	i) Segregation of affected animal. ii) giving saline laxative and diuretics. iii) Giving sloppy food. iv) Cow shed should kept clean.
2.	**non-Contageous** a) **Milk fever** Common in high milk producing cows and buffaloes during early part of lactation. Serum Ca, P levels-low more sugar.	i) Inability of the animal to assimilate Ca from the feed. ii) high pulse rate iii) Staggering, loss of appetite. iv) Below normal temperature.	i) feeding jaggery along with lime water, few days before calving. ii) cleaning the udder with warm cloth and preventing infection from the floor. iii) pumping clean air into the udder
	b) **Constipation** → due to over eating of coarse fibrous roughages, inadequate intake of water and lack of exercise.	i) Lack of appetite ii) Lack of chewing iii) dull appearance.	i) Affected animals can be given wheat bran meal / rice gruel and succulent fodder. ii) Plenty of drinking water with jaggery / salt. iii) to give warm soap water enema.

(4)

Techniques adapted in cattle breeding

1. Out breeding 2. Cross breeding 3. Artificial insemination.

1. Out breeding:- (Out breeding)
   a) Mating of less closely related/unrelated animals.
   b) The animals involved in breeding do not have a common ancestor in the Proceeding 4-6 generations.

2. Cross breeding:
   a) Mating of animals of different breeds.
   b) This method is used to introduce desirable characters into new breed.
   c) Cross breed animals exhibit increased growth and vigour.
   d) Crossbreeds are more vigour due to the blending of desirable dominant genes from two breeds in the first generation.

3. Artificial insemination
   a) The deposition of male gamet (spermatozoa) in the female reproductive tract by mechanical means rather than by natural mating is said to be artificial insemination
   Method
   b) i) Semen collection from male
      ii) Insemination into the female by placing a portion of semen/diluted form into the cervix of the uterus. (mechanical method) under hygienic condition
   c) Advantages:
      i) eliminate the need for maintenance of herdsire
      ii) permits long distance transport of semen.
      iii) Avoids spreading of genetical diseases.
      iv) Provides a chance of detecting genital abnormalities/ pathological infection in cows.
      v) Helps better recording

POULTRY

(5)

1. **Definition:** The rearing and breeding of avian species such as chickens, ducks, turkeys, geese and guinea fowls which have been domesticated is said to be poultry.

2. **Breeds:** More than 100 breeds and more variaties of fowls.

3. **classification**

- Based on their utility
  - Meat type
  - Egg type
  - Dual type
  - Games
  - ornamental
- Based on their origin.
  - → American breeds
  - → Asiatic
  - → English
  - → Mediterranean

4. **General characters of breeds:**

I. **American breeds:**
a) Dual purpose forms giving meat and egg.
b) **characters:** yellow feathers, red ear lobes and lay brown-shelled eggs.
c) **Examples:** Plymouth rock, Rhode Island reds, new hampshire, wyandotte.

II **Asiatic breeds:**
a) Dual purpose forms.
b) **Charcters:** Large body with heavy bones, yellow skin and red ear lobes.
c) **Examples:** Brahma, Cochin, Langshan

III **English breeds (England)**
a) Dual purpose forms.
b) **Character:** White plumage, pink coloured ear lobes.
c) Lay brown shelled eggs.
d) **Example:** Sussex, Corinsh, orpington, Australorp.

IV **Mediterranean breeds:** originated from European Countries which are by the side of mediterranean sea.
i) Light bodied with non-feathered shanks.
ii) non-sitters. iii) Lay white shelled eggs.
iv) **Examples:** leghorn, Ancone (Italy)
Minorca (Spain)

V Indigenous breeds of fowls:

i) Desi" The common county hen of India

ii) Desi → the best mother of hatching

iii) some Indian fowls resamble the leghorn, but have poor laying qualities.

iv) Types:- chitagong, Assel, Kavaknath, Bursa etc

Poultry breeds.

S.No	Type	Charactars
1.	Plymouth rock (American) oldest and most popular bread of America.	a) Birds are single combed with long and deep body. b) plumage is greyish white in colour. c) female - darker in colour than male. d) white plymouth rock - white plumage used in broiler production.
2.	Brahma (Asiatic)	a) Bird with massive body with heavy bones b) feathers are well developed. c) Bread character → pea comb. d) Varieties:- Light, Dark.
3.	Light brahma (Asiatic)	a) Light grey to white in colour. b) Hackle feathers are black. c) The beak and legs are light yellow in colour cockeral - 4.5 kg d) weight: Cock - 5.4 kg, Hen - 4.1 kg, Pullet - 3.6 kg
4	Dark brahma (Asiatic)	a) Light black/steel grey coloured with greenish hackle b) weight: Cock:-4.9, Hen 3.9 kg, cockerel 4 kg, pullet 3.1 kg.
5.	Leghorn (Mediterranian) Most popular and commercial bread in India.	a) Colours of plumage may be white/brown/black. b) These breeds thriving well in dry areas. c) Mature early and begin to lay eggs at the age of 5 or 6 months. d) weight:- 2.7, 2, 2.3, 1.8 kg
6.	Assel (Indigenous)	a) This bread is noted for its pugnacity. b) white/black in colour. but are excellent sitters. c) not good egg layer d) Location:- Andrapradesh.
7.	Chittagong (Indigenous) (West Bengal)	a) plumage with golden or light yellow shades. b) Long beak and yellow in colour. c) good egg layers. d) Ear lobes are red in colour
8.	Kavaknath (Indigenous) (Madhya pradesh)	a) Fowl with black flesh. b) Light brown coloured eggs. c) plumage - silver - gold / shades black d) The tongue, comb, wattles are purple in colour.
9.	Bursa (Indigenous) Gujarat, Maharashtra	a) Small to medium sized bird. b) Light feathered with white variation in body colour.

POULTRY FARMING METHODS

1. Poultry forming is recognised as an organised and scientifically based industry with tremendous employment potential.
2. It plays an important part in the rural economy of India.
3. Factors taken into consideration for the growth of poultry farming.

a) Small initial invesment b) availability of quality chicks c) Shorter generation interval d) Quick, assured and better returns e) Availability of trained man power f) Management and health control.

4. Rearing involves the following stages namely Selection of eggs, Incubation and hatching, brooding / care of new borns, housing and feeding of poultry.

* A) Selection of eggs

i) The egg should be fertile ii) It should not be either over / small sized. iii) Dark - brown shelled eggs hatch earlier iv) Freshly laid eggs are preferred.

B) Incubation and hatching

The maintanence of newly laid eggs in optimum condition till hatching is called incubation.

Time duration :- 21-22 days.

Types :- → Natural → eggs are subjected to the care of mother

→ Artificial incubation :- → The eggs are maintained in an incubator.

C) Brooding :- The care and management of young chickens for 4 - 6 weeks immediately after hatching is said tobe brooding.

Factors involved

i) Temperature :- hatched chicks → 36 hrs → Incubator. transferred to artificial brooder. optimum tem :- 33°C for three days. After three weeks 21°C.

ii) Fresh air movement iii) Floor space - Minimum 500 sq.cm in Litter :- beds of hay / saw dust (5-7.5 cm thick) iv) Light perchicken

D) Housing of poultry

i) Primary objective of housing to poultry is to protect them from sun, rain and predators and to provide comfort.

ii) It should be well ventillated

iii) The floor of the house should be moisture - proof, rat proof and durable.

E) Poultry feeding :-

i) The diets of chickens must contain adequate amount of water, carbohydrates, proteins, fats, vitamins and minerals.

ii) Maize, Barley, wheat, oil cake and rice etc are to be given in standard requirements.

POULTRY BY PRODUCTS

1. By products :- Blood, feathers, heads and feet.
2. Processing and using of this by products not only reduce the cost of poultry production but also solve the disposal problems
3. uses :- feather meal, poultry by products meal, egg shell meal, Albumin flake, dried and poultry manure.

Edible fishes of Tamilnadu

1. Fresh water fishes :- a) Location :- Reservoir, riverine, culture fisheries
   b) belongs to the order — Cypriniformis
   c) no teeth however Pharyngeal teeth may be present.
   eg :- Catla catla, Labeo rohita

2. Brackish water fishes :-
   a) Location :- river mouths (estuaries), back waters, mangrove swamps and Coastal lagoons.
   b) Examples :- Chanos chanos, Grey mullets.

3. Marine fishes :- a) Location :- Sea, ocean.
   b) Types :- → Elasmobranchiata — Cartilagenous fishes eg: Sharks, Skates.
   → Bony fishes — eg: Scrombodies, Sea fish, Tuna, Perches etc.

Pisciculture / Aquaculture :-

a) "The farming and husbandry of economically important fish, under Controlled Conditions"

b) uses of fishes :- i) Rich source of easily digestible proteins (essential aminoacids — lysine, Methionine)
   ii) minerals :- Ca, P, Fe, Na, K, Mg and Sulphur.
   iii) vitamins — A and D
   iv) Fishes contain health promoting fats.
   v) It also contain polyunsaturated fatty acids helpful in cholesteral regulation and promoting Cardiac health.

Fish forming :-

1. Raising of fish for personal income or profit.
2. Types :- Fresh water, brackish water and Marine fish farming (Mariculture)
3. Culturable fishes of India :-
   Carps, Cat fishes, Murrels, Tilapia etc.

Characters of Cultivable fishes :-

A) Rate of growth :- Grows to a larger size in shorter period eg: carps.

B) Adaptation to climate :- Fishes should be able to adapt to the climatic conditions of the farm.

C) Tolerance :- The fish should have the capacity to tolerate fluctuations in the physico chemical conditions (O_2, temperature etc.

D) Resistance :- towards diseases and attack of parasites.

(10)

(E) Conversion of efficiency:-
The species of fish give more edible flesh per unit of food consumed.

(F) Amiability and compatability:-
In polyculture the fishes should be able to live together without interfering or attacking other.

(G) Acceptance of artificial feed:-
accept compounded diets.

(H) Consumer's preference:-
The species cultured should be easily marketable locally / to the targeted consumers.

S.No	Type	Characters.
I.	Indian Major Carps (Kendai meen)	i) order: Cypriniformes. ii) Body with head, upturned mouth, devoid of barbells. non-fringed lip iii) Identification:- broad dorsal fin with 14-16 branched rays. iv) Feeding: young - Phytoplanktons Adult - Zooplanktons.
	a) Catla catla (catla) Size:- 1.8 m (40.5 kg) Growth: first year 35-45 cm (1.5-2.0 kg)	
	b) Labeo rohita (Rohu) Size:- 1 meter. fast growing species. first year growth 35-40 cm (900 g)	i) Tastiest fish ii) Body with small pointed head, small mouth, fringed lower lip. iii) Identification:- dorsal fin with 12-13 branched rays, reddish scales. iv) Feeding:- young:- Zooplanktons. Adult:- Phytoplanktons, Plant debris.
	c) Cirrhina mrigala (Mrigal) Maximum size 0.9 m. first year growth 30 cm (700 g)	i) Body with small head, blunt snout, non-fringed lips. ii) Identification:- dorsal fin with 12-13 branched rays, bright silvery body having golden tinge. iii) Feeding:- young -> Zooplanktons Adult -> decaying organic, vegetable debris.
II	CATFISHES (Keluthi) Air-breathing / live fishes capable of directly breathing atmospheric air.	order: Siluriformes i) Live long time without water. ii) Body -> without scales iii) upper, lower jaw with two pairs of long barbels in each. iv) Feeding:- All pond animals (Predatory / Cannibalistic)
III	MURRELS / Snake heads Air-breathing - Body - depressed head, protractile mouth. - culture:- irrigation wells, shallow swamps	order:- Channiformes - viral meen) a) Channa marulius (Giant Snake head) i) Dorsal, anal fins without spines. ii) Maximum size:- 1.2 m. iii) Feeding:- young ones of same species.
		b) Channa striatus (Striped Snake head / common murrel) i) size:- 90 cm. ii) Body with stripes
IV	Tilapia i) origin:- East coast of Africa. ii) Female keeps the fertilized eggs guarded in its mouth.	order:- Perciformes Oreochromis mossambicus (Jilabi kendai) i) Exotic fish. ii) character:- Breeds eight times in a year. Anterior spinous dorsal fin Posterior - soft dorsal fin.

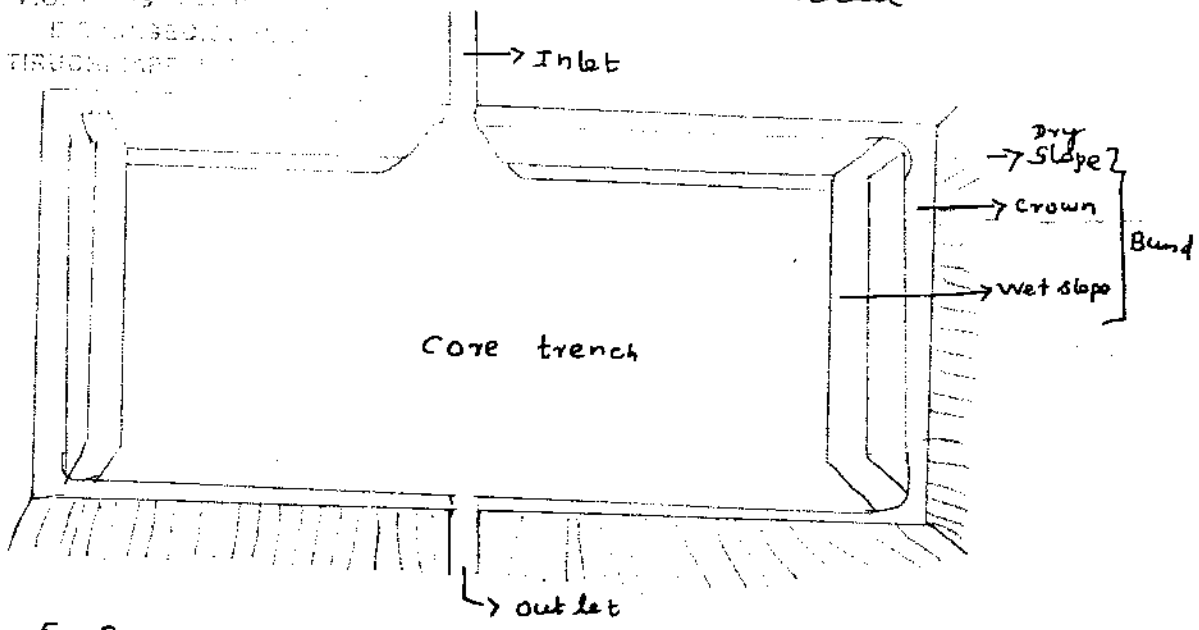
Lesson :- 6 :- APPLIED BIOLOGY (2)

(Continuation)

STRUCTURAL ASPECTS OF A FISH POND and POND CONSTRUCTION

1. Two methods of pond construction.
   a) Digging down from the ground level and depositing the soil at the margins to make a bund.
   b) Soil from outside is brought and dumped above the ground level to form the bund.
2. Depth of the pond :- 1.5 to 2.0 metres.
3. Rectangular Culture pond ~~depth~~ :-
   Size :- 0.5 - 1.0 hectare
4. A typical pond consists of the bunds/dikes, harvesting pit, inlet, outlet and core trench.

ENTIRE VIEW OF A POND



5. Bunds :- (a) Protecting Structures of the ponds.
   (b) Life span and strength of a bund depends on its slope and Crown width and quality of soil.
   (c) pond Size :- 0.5 hectares
   Slope :- wet slope :- 1 : 1.5 (height 1 meter, basal width - 1.5 metres)
   Dry side :- 1 : 1 (height - 1 meter, basal width 1 meter)
   d) Crown/Crest width → 1 meter.

⑥ Excavation of the pond:-

a) It is economical if the bund is formed out of the earth removed from the enclosing area.

b) Example:- pond with an area of 1000 m^2 (50m x 20m), with 140 m long bund (Crown width 1m, dry side slope, 1:1; wet side slope, 1:1.5 and bund height 1m) around it.

c) The total volume of soil needed → 315 m^3.

d) Earth taken from 0.315 m depth from the enclosed area.

e) To prevent soil erosion during rains, grasses may be grown on the slopes of the bund.

f) Before filling, the pond bottom should be cleared.

7. Inlet and outlet:-

a) It is for smooth water supply and drainage.

b) In and outlets are helpful in preventing the entry of wild fish from outside and escape of the fish from inside the pond.

c) Example:- pond size : 0.2 ha.
Inlet, outlet pipe:- 15 cm diameter.
Larger pond:- ~~For~~ 1 or 2 ha. pipe- 25cm diameter.

d) The pipes made up of asbestos cement provided with suitable screens/devices.

e) In larger ponds monk - type drainage system controls the level of water.

MONK - It is a concrete and brick structure, which is closed on three sides and open in the front.
- A drain pipe is attached to the closed side of the monk.

8. Seeling the pond bottom:-

a) ~~The~~ To prevent the leakage the pond bottom should be sealed.

b) Building a clay core into the wall and extending the clay over the bottom of the pond as a lining.

c) polyethylene sheet lining / hollow cement blocks may also be used (but expensive).

Types of fish ponds (13)

I Fish farming pond system: It composed of different pond components namely

a) Nursery pond 3% b) Rearing pond - 11%.
c) production pond - 60%. d) Segregation pond - 1%
and e) breeding pond - 25%.

f) Nursery ponds are shallow, while the others are moderately deep.

g) A fencing around the fish farm, may be constructed for protection.

II Preparation of pond:-

It involves conditioning, manuring, feeding, water quality, Routine management and diseases.

A. Conditioning:-

a) Before the culturing of fish, the pond should be conditioned.

b) Spreading of a layer of lime (calcium hydroxide) over the bottom for 2 weeks.

Reason: Lime removes the acidity of the soil, faciliates geochemical cycle and kills microbes.

c) After 2 weeks water may be let in slowly.

d) Before stocking the fish the quality parameters such as temperature, O_2 content, pH, turbidity etc should be checked.

B. Manuring:-

a) To develop the fish food organisms (Phyto and Zooplanktons), the fertilization is to be done

b) Manure: organic / inorganic / chemical in nature.

c) organic manure: urine / sewage rich in nitrogenous matter, Cow dung, poultry manure etc.

d) To increase organic carbon level Cow dung is applied. (2-3 tonnes / ha)

e) To enhance Zooplankton number poultry manure is added (5000 kg / ha)

f) chemical fertilizers:- Standard Combination of N P K as 18 : 10 : 4., recommended for freshwater ponds.

PTO

g) for production pond: (with medium fertile soil)
Urea - 200 kg/ha/yr (or)
Ammonium Sulphate 450 kg/ha/yr may be applied.

C. Water quality: It involves,
temperature at 25-33°c, dissolved oxygen, pH - 6.5 - 9.0, hardness, alkalinity, turbidity and plankton culture. etc.

D. Feeding:
a) Cultured species of fishes also need artificial feeds. (besides natural food)

b) chemical composition of artificial feed:- 30-40% protein, 5-10% fat, 50-60% $(CH_2O)_n$, 10% water, less than 5% cellulose, vitamins and minerals.

c) Animal and vegetable ingredients can be used in formulating feed pellets.

d) usually Indian farmers give rice bran and oil cakes in powder form to major crops.

e) For adult fish, daily supplementary feeding can be at 2% of its body weight.

E. Routine management and Diseases:-

a) Viral/bacterial diseases usually affect the fishes. Some times the diseases may be due to ecto/endoparasites.

b) We should analyse water parameters, aeration, regular feeding, observation of mortality.

c) Disease symptoms should be routine checks in the management of aquaculture ponds.

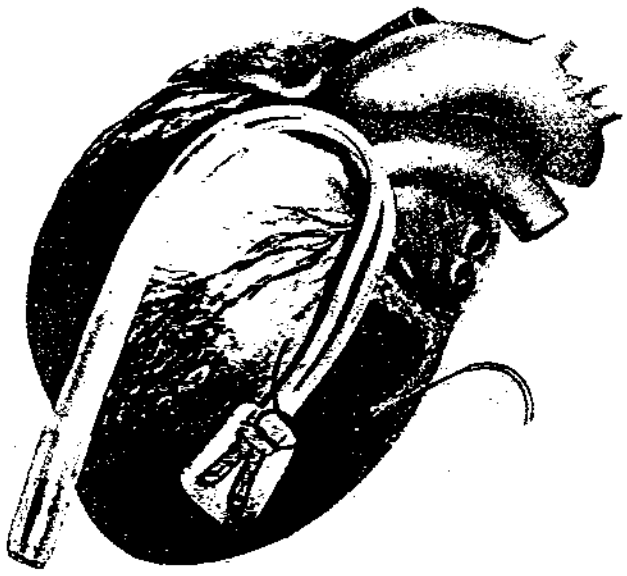
XII STANARD

BIO-ZOOLOGY

LESSON-6

APPLIED BIOLOGY

MEDICAL LAB TECHNIQUES



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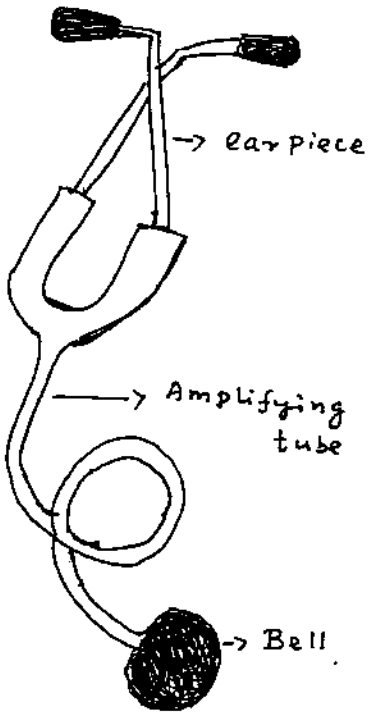
Medical Lab techniques:

1. Diagnosis and treatment → vital aspects of medical therapeutics.
2. Diagnosis → Identifying the nature of disease
3. Treatment → Curative aspects in order to eliminate the disease causing agent.
4. Laboratory test → help a Physician in correct diagnosis and treatment.

I. STETHOSCOPE :- (Amplifying instrument)

1. Stethoscope is an instrument used to hear the heart beat sounds.
2. Sound → due to Inhalation and exhalation of air in the lungs and also the stomach movement.
3. The first usuable binatural stethoscope was invented in 1855.
4. The modern electronic stethoscopes can be used to hear a patients heart and lung clearly even in high noisy environments even through layers of clothing
5. They are also used to hear even foetal sounds in mother's womb.



Uses :-

a) used to hear normal heart sounds (Lubb-dub) and abnormal heart sounds (heart murmurs)
b) To diagnose valve functions
c) To diagnose airway diseases like bronchitis and pleuritis.
d) They can indicate fluid in lungs in case of pneumonia and pulmonary edema
e) Compare the movements in the normal and overactive/under active intestinal tract.

11 SPHYGMOMANOMETER

1. Sphygmus means pulse
2. Sphygmomanometer is an instrument used to measure blood Pressure.
3. Arterial blood Pressure: The force of Pressure which the blood is exerting on the walls of the blood vessels in which it flows.
4. Cardiac cycle: The cycle of events that takes place during one Systole and diastole of the heart.
5. Systole :→ Contraction Diastole :→ relaxation.
6. Systolic Pressure: During ventricular Systole, when the left ventricle is forcing blood into the aorta, the Pressure rises to a peak known as Systolic Pressure.
7. During diastole the Pressure falls and the lowest valu reached is referred to as diastolic Pressure.
8. Blood Pressure depends on
   a) The force and volume of blood pumped by the heart
   and
   b) contraction of muscles in the walls of the arterioles.
9. Change in Bp takes place during
   a) Physical exercise
   b) Anxiety
   c) Emotion and
   d) Sleep.

10. Hypertension:

a) Prolonged / constant elevation of Blood Pressure is said to be hypertension.

b) Effects:- i) heart attack
ii) stroke
iii) heart and kidney failure.

11. B.P can be measured only a person is in a relaxed and in resting condition.

12. Normal Blood Pressure :-> 120/80 mm Hg
(Systolic -> 120, Diastolic -> 80)

13. Types of sphygmomanometer:-
a) Manometric b) Digital/modern type.

14. uses:-
a) helps to estimate the state of blood circulation
b) working of heart
c) Diagnose pathological conditions like hypertension and hypotension.

Diagram:

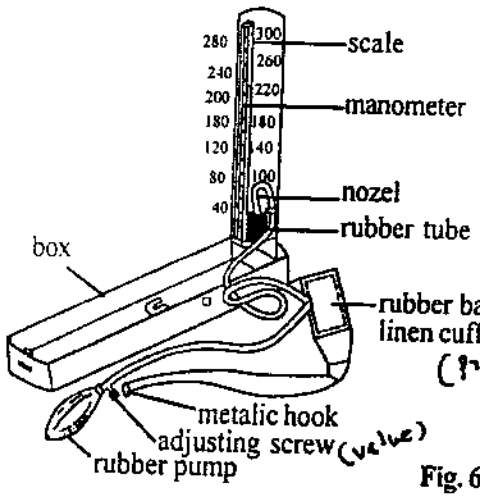


Fig. 6.4.2. Sphygmomanometer

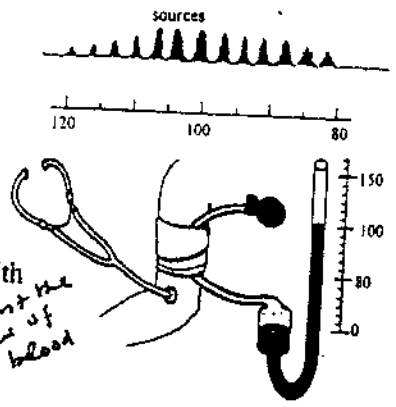


Fig. 6.4.3. Method of measuring blood pressure

III HAEMOCYTOMETER

1. Haemocytometer is an instrument used to count the blood cells.
2. The counting of blood cells after proper dilution is said to be haemocytometry
3. This instrument used to count RBC, WBC, Platelets, Bacteria, yeast and algae.
4. Instrument structure:-
   a) Instrument consists of a counting chamber a cover glass and diluting pipettes.
   b) Commonly used counting chambers in the laboratories are Neubauer and Fauchs Rosenthal
5. Method:-
   a) Usually venous blood is used in blood cell counting
   b) The blood cells are first diluted in a specific isotonic solution. The isotonic diluting fluid keeps up the cells intact.
   c) Hayem's solution is the diluting fluid of RBC
   d) Turk or Toisson solution - diluting fluid of WBC. This solution is responsible for lysis of RBC. The remaining nucleated WBC's are counted.
6. Normal range of RBC's in human
   a) Men -> 4.5 - 5.9 million/cu.m.m
   b) women -> 4.1 - 5.1 million/cu.m.m
   c) At birth -> 4 - 5.6 million/cu.m.m.
7. WBC in human
   a) Adult -> 4500 - 11,000/cu.m.m
   b) Neonates -> 10,000 - 25,000/cu.m.m.

Clinical significance of haemocytometry

a) Decrease in RBC indicates → Anaemia

b) Increased number of RBC → Polycythemia

c) Decrease in WBC count → Leukopenia

d) Increase in WBC count for a transient period indicates → Bacterial infection.

e) Abnormal, Progressive increase in WBC count indicates → possibility of Leukemia

Diagram

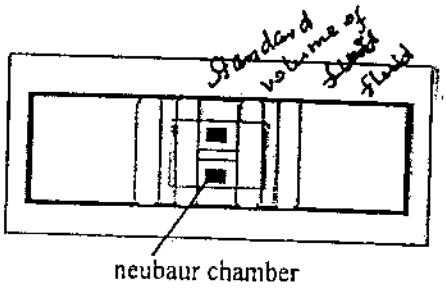


Fig. 6.4.4. Counting chamber front and side views

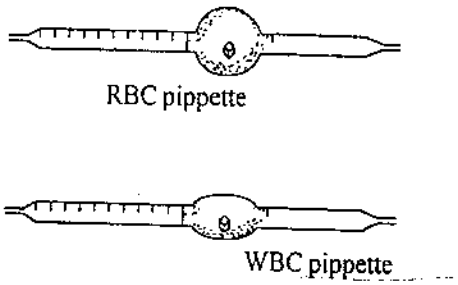


Fig. 6.4.5. RBC & WBC counting pipettes

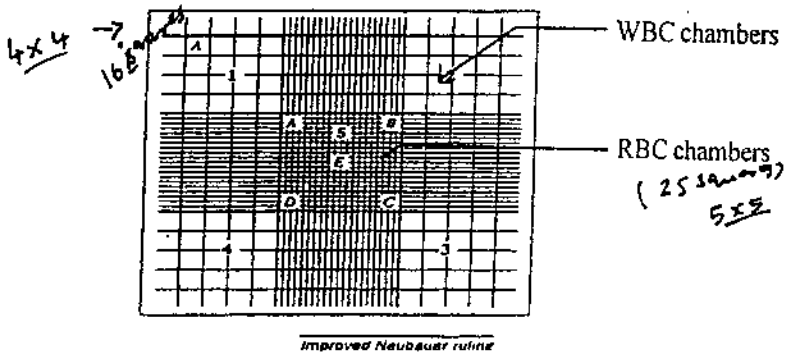
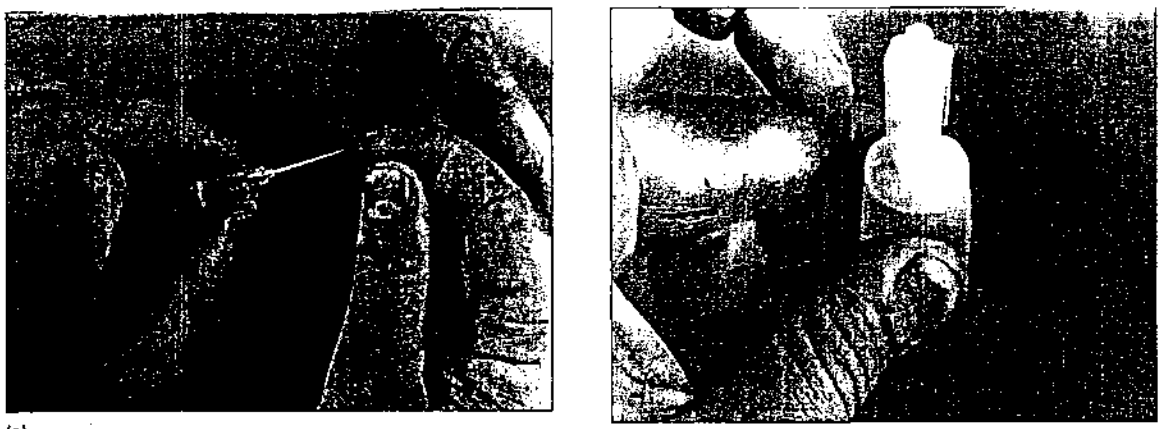


Fig. 6.4.6. Counting chambers



(a) (b)

Figure 6.3 The Unopette method for measuring a red blood cell count or hemoglobin concentration. (a) Fill the plastic capillary pipette with fingertip blood. Then (b), squeeze the reservoir to draw blood out of the pipette into diluent within the reservoir.

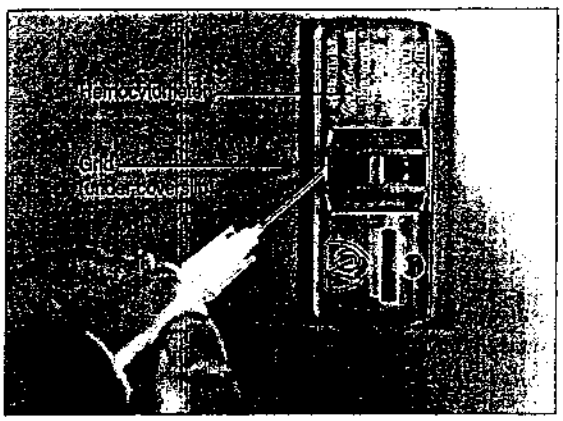


Figure 6.4 Procedure for filling a hemocytometer. A Unopette reservoir is used to fill the hemocytometer with diluted blood. The squeezing of the reservoir places a drop of diluted blood at the edge of the coverslip, whereupon the drop of blood moves under the hemocytometer grid by capillary action.

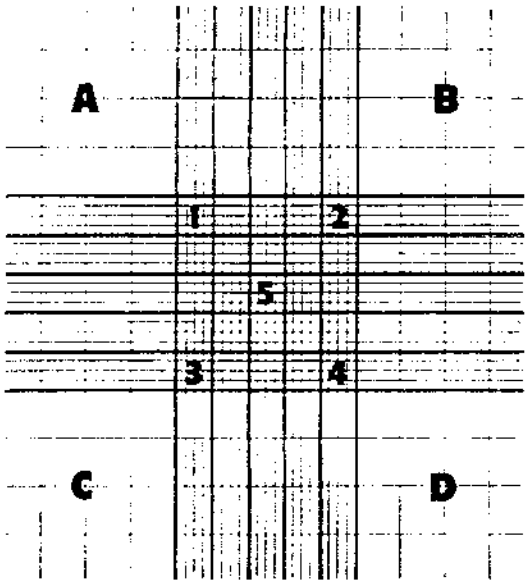


Figure 6.5 The hemocytometer grid. Squares 1–5 are used for red blood cell counts; squares A–D are used for white blood cell counts.

URINE - SUGAR ANALYSIS

1. Urinalysis / urine analysis:-

The Physical, chemical and microscopic examination of urine is said to be urinalysis. It provides a valuable picture of the general health pattern of a patient.

2. Reasons for doing urinalysis

a) To find out the state of kidneys and urinary tract.

b) To know the metabolic and systematic abnormalities

c) To test glucose, ketone bodies, bilirubin and urobilinogen level in the case of diseases like Diabetes and Jaundice.

3. Collection and Preservation of urine:-

a) Urine chemically composed of 95% water and rest being made of urea, uric acid, Creatinine, Sodium, potassium, chloride, Calcium, Phosphate etc.

b) Urine must be collected in a clean, dry Container and examined as soon as possible.

c) For testing glucose, urine collected 2-3 hours after food.

4. Sugar analysis:-

1. Sugars are generally known as reducing substances because they can reduce a heavy metal such as copper from a higher to lower oxidation state.

eg: Blue cupric sulphate to red cuprous oxide.

2. Reducing substances found in the urine are glucose, lactose, fructose, galactose, Pentoses, Sucrose etc.

3. The estimation of glucose is important because it indicates hyperglycemic condition.

5. Urine glucose testing:

a) ~~Quantitative~~ Quantitative and qualitative methods are used in the urine glucose estimation.

b) Qualitative test: Benedicts test used to indicate Presence/absence of sugars in the urine.

c) Quantitative test: Many methods are available namely Benedicts reagent method, Glucose oxidase method, O-tolidene method.

d) Superior method for identification of urine sugars → Thin layer chromatography.

e) Now a days instantaneous determination of blood glucose level done with the help of digital glucometer.

6. Significance of glucose:-

a) Normal urine contain trace amount of glucose

b) In the kidney glucose if filtered by the glomurali and reabsorbed by the tubules.

c) Above a certain limit the tubules cannot reabsorb all the glucose.

d) Glucosuria: It is a condition in which surplus glucose appears in urine.

e) Hyperglycemia AND Diabetes mellitus:

Increase in blood and urine glucose level is said to be hyperglycemia.

f) Elimination of urine with more glucose is said to be diabetes mellitus.

(280 m.mol/L of glucose in urine)

g) Diabetes mellitus indicates disturbances in carbohydrate, lipid and Protein metabolism.

V ELECTRO CARDIOGRAM - ECG

1. ECG is a record of the electric potential changes that occur in the heart during the cardiac cycle. It is recorded from the surface of the body.
2. Electrocardiogram is an instrument used to record the ECG.
3. The waves of ECG are due to depolarization and not due to contraction of the heart.
4. The wave of depolarization occurs first before the contraction of the cardiac muscles begins.
5. History:
   a) The electrical activity of the heart was first recorded by WALLER (1887) with the help of capillary electrometer.
   b) EINTHOVEN who recorded ECG with a strong galvanometer leads to the development of modern electrocardiography. Einthoven was awarded Nobel Prize in 1924.
6. ECG -> Basic concepts and explanation:
   a) When the cardiac impulse originating in sino aterial node (Pace maker), passes through the heart, electrical currents spreads in the tissues surrounding the heart. A small amount of this current spreads to the surface of the body.
   b) If electrodes are placed on the skin on the opposite sides of the heart, electric potentials generated by these currents cable recorded. This recording is said to be ECG

c) A normal ECG is composed of five waves designated from left to right with letters P, Q, R, S and T

d) P, R and T are normally upward / positive waves while Q and S are downward / negative waves

e) P - wave :-

i) It is atrial wave occurs in the auricle.

ii) P-wave due to the spread of depolarization in the auricle

iii) Time duration → 0.1 second
Amplitude → 0.1 - 0.3 mv.

iv) p wave occurs just before the atrial systole.

v) It is a guide to the activity of auricles. At the time submmision of the p wave cardiac impulses reaches the SA NODE

Diagram

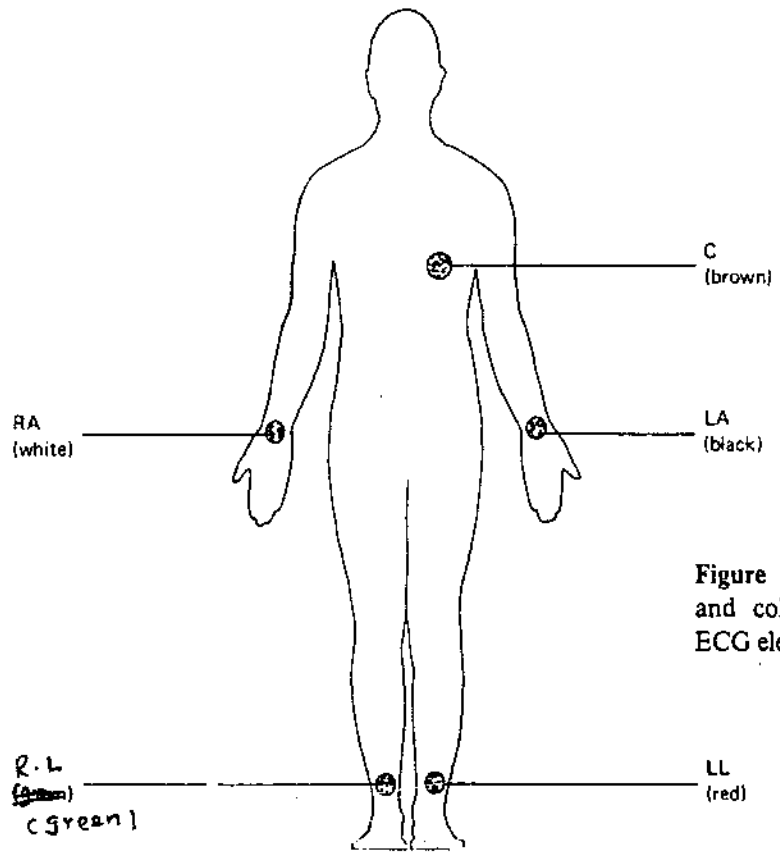


Figure 6.3. Abbreviations and color codes used for ECG electrodes.

f) Q, R and S waves:

i) After the completion of P wave, the isoelectric interval occurs. Then Q, R and S waves begin.

ii) Q wave: A small negative downward deflection due to atrial septal depolarisation. It is mostly indistinct.

iii) R-wave: is a Prominent positive wave and S-wave is a small negative wave. R and S waves due to depolarization of the ventricular muscles.

iv) Duration of Q, R and S waves – 0.08–0.1 second

v) Average amplitude of R wave is about 1 mv.

vi) various diagnostic informations can be gained from alteration in the Q, R and S complex.

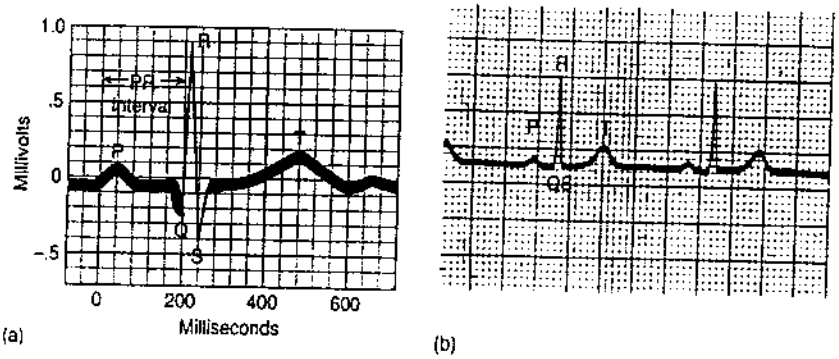
g) T-wave:

i) It begins after S wave and an isoelectric interval.

ii) T-wave is a broad wave due to ventricular repolarization.

iii) Time duration → 0.27 second.
Amplitude → 0.15 – 0.5 mv.

Diagram:

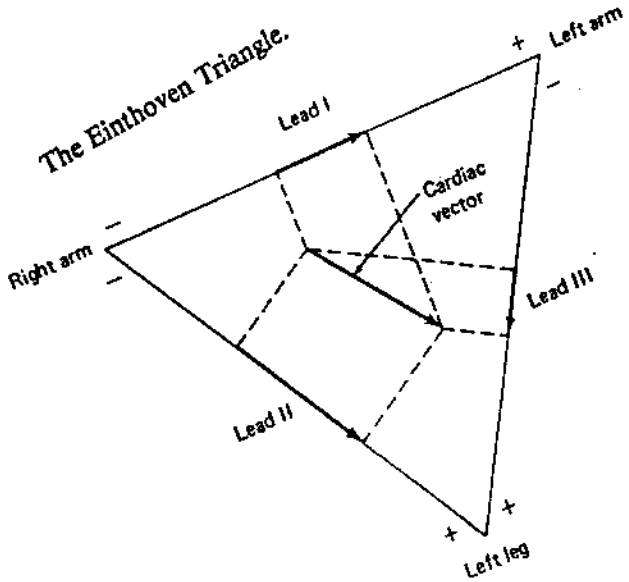


The normal electrocardiogram (ECG). (a) A labeled drawing, and (b) an ECG recording.

PROCEDURE

1. With the subject comfortably reclining (lying down), rub a silver dollar-sized amount of electrolyte gel on the medial surface, about 2 inches above the wrists and ankles. Attach electrode plates to these four spots, using the rubber straps provided (fig. 7.8).
2. Attach the four ECG leads to the appropriate plates.
3. The specific instructions for obtaining ECG tracings vary with the instrument being used. Your instructor will demonstrate the use of the recording equipment in your lab. The following instructions are valid only for a single-channel electrocardiograph.
   (a) Turn on the power switch.
   (b) Set the paper-speed selector switch to 25 mm (2.5 cm) per second.
   (c) Set the sensitivity to *1* (most sensitive).
   (d) Set the lead selector switch to the first dot to the left of the *STD* or *CAL* position.
   (e) Turn the control or knob to the *run* or *record* position.
4. Turn the position knob until the stylus is centered on the ECG paper.
5. Turn the lead selector switch to the *1* (lead I) position to measure the voltage difference between the right and left arms. As the paper is running, depress the *mark* button once—this makes a single dash at the top of the chart to indicate that the record is from lead I. Continue recording until an adequate sample of the tracing can be provided to each member of the subject's group; then stop the paper drive by turning the lead selector switch to the dot above the *1* position. Each dot is a "rest" position where the movement of the chart will stop between recording from each lead.
6. Turn the lead selector switch to the *2* (lead II) position to measure the voltage difference between the right arm and left leg. As the chart is running, depress the *mark* button twice—the two dashes produced at the top of the chart will indicate that this is the recording from lead II. Stop the chart by turning the lead selector switch to the dot above the *2* position.
7. Repeat this procedure with lead III to measure the voltage difference between the left arm and the left leg.
8. After recordings from leads I, II, and III have been obtained, turn the lead selector switch to the *STD* or *CAL* position. Run the recording out of the machine, allowing members of the group to cut sample tracings of each lead.
9. Remove the electrode plates from the subject's skin and thoroughly wash the electrolyte gel from both the plate and the skin.
10. Tape samples of the recordings in your laboratory report and label all the waves.
11. Determine the P-R interval of *lead II*. This can be done by counting the number of small boxes between the beginning of the P and the Q and multiplying this number by 0.04 sec.
12. Determine the cardiac rate by the following methods:
    (a) Count the number of QRS complexes in a 3-sec interval (the distance between two vertical lines at the top of the ECG paper) and multiply by 20.

Note: *If you use a multichannel recorder (such as a Physiograph), the amount of chart paper corresponding to a given time interval must be calculated and will vary with the paper speed. If you use a Cardiocomp, the cardiac rate will be provided automatically.*



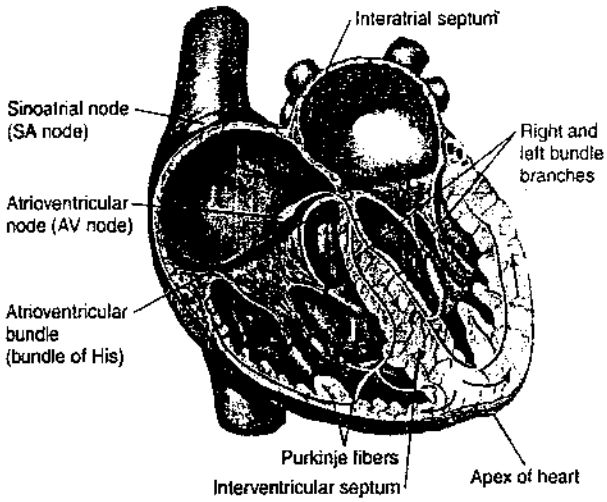


Figure 7.7 The conduction system of the heart. The conduction system consists of specialized myocardial cells that rapidly conduct the impulses from the atria into the ventricles.

(For a full-color version of this figure, see fig. 13.19 in *Human Physiology*, eighth edition, by Stuart I. Fox.)

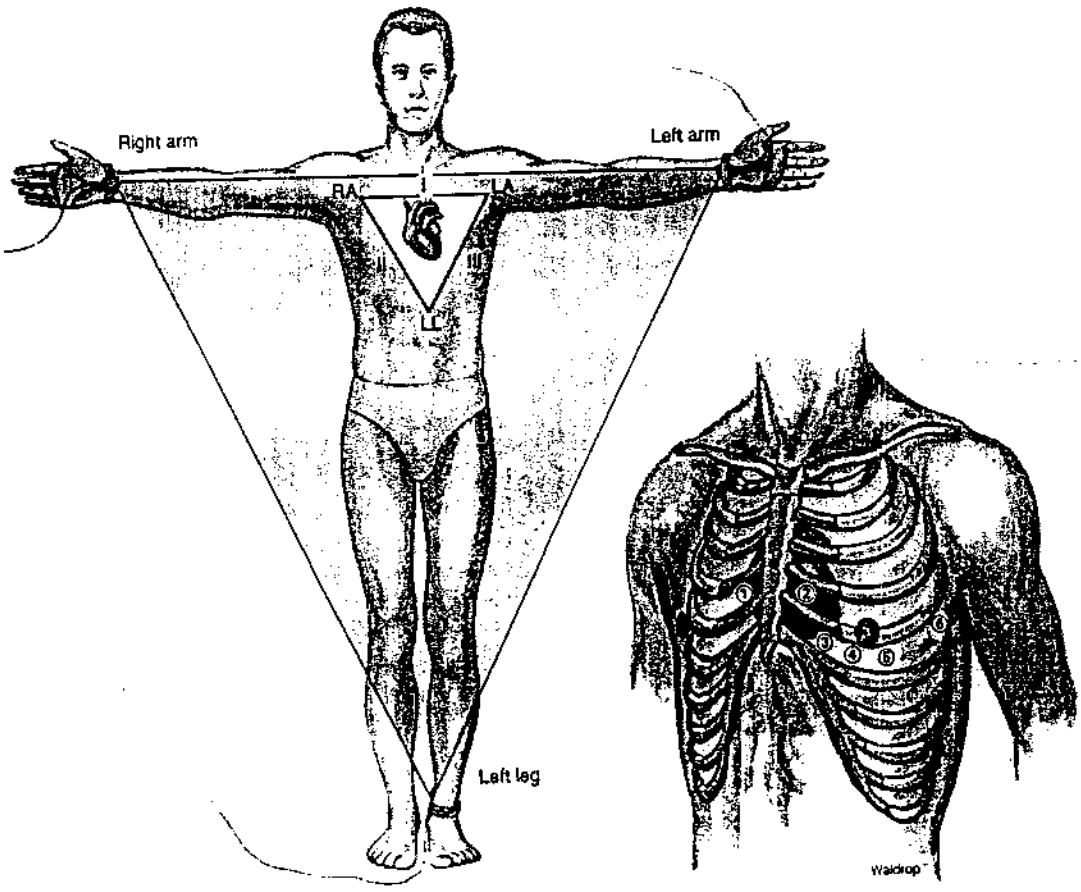


Figure 7.8 Electrocardiograph leads. The placement of the bipolar limb leads (RA, LA, LL) and the positions (1–6) for the unipolar chest leads (V_1–V_6) for recording electrocardiograms. (RA = right arm; LA = left arm; LL = left leg.)

(For a full-color version of this figure, see fig. 13.22 in *Human Physiology*, eighth edition, by Stuart I. Fox.)

COMPUTED TOMOGRAPHY (CT) (or) COMPUTERIZED AXIAL TOMOGRAPHY (CAT)

1. History of CT:

a) Invented by Godfrey Hounsfield, England (1972)

b) Independently invented by Allan Cormack, Massachusetts.

c) Clinical CT Scanners were installed between 1974 and 1976. CT became widely available by about 1980.

2. CT scan definition:

CT scanning combines the use of a digital computer together with a rotating x-ray device to create detailed cross sectional images or slices of the different organs / parts of the body.

eg: Lungs, Liver, Kidneys, brain, bone etc.

3. Principles of CT:

a) CT is based on the x-ray principle.

b) X-rays pass through the body, they are absorbed / attenuated / weakened at different levels creating a matrix / profile of x-ray beams of different strength.

c) This x-ray profile is registered on film, thus creating an image.

d) In CT, the film is replaced by a banana shaped detector, which measures the x-ray profile.

4. Advantages of CT over other imaging techniques.

a) Conventional x-ray image of the head can only show the dense bone structure of the skull not the soft brain tissue.

But CT has a unique ability to image a combination of soft tissues, bone and blood vessels.

Magnetic resonance (M.R) imaging done an excellent job of showing soft tissues and blood vessels. But it does not give as much detail of bony structure such as skull.

CT images used to see soft tissues, brain's ventricles and white grey matter.

c) CT Scan provide detailed cross sectional images and diagnostic informations for nearly every part of the body.

5. Uses of CT:-

a) It is an invaluable tool in the Cancer diagnosis process. (to diagnose lung, liver and Pancreatic (cancer)

b) To measure bone material density for the detection of osteoporosis.

c) CT has an excellent application in trauma cases and other internal bleeding in Patients.

d) CT imaging, CT angiography → greater role in the detection, diagnosis and treatment of Heart diseases, acute stroke and vascular diseases.

e) CT images are the basis for Planning radio therapy cancer treatment.

PTO

ENDOSCOPY (Laparoscopy) Techniques.

i) Endoscopy is a method of examining the interior of a body cavity or hollow organ like oesophagus, stomach using an Endoscope.

ii) Endoscope:- It is a narrow, flexible fibre optic instrument that conducts light.

Advantages of Endoscopy:-

a) It is a minimally invasive approach to surgery.

b) Endoscopy accomplishes traditional surgical goals while delivering less pain, faster recovery and happier patients.

c) The procedure does not require hospital admission and acute care, observation and may be performed outside the premises of a hospital.

d) The patient to go home or return to work with in a short Period while after endoscopy diagnosis.

P T O. Endoscopy types refer Book

PACE MAKER

1- Natural Pace maker:-

a) Sinu Atrial Node (SAN) is known as natural Pace maker.

b) The SAN situated on the right wall of the right atrium, where Cardiac impulses are initiated.

c) SAN is 1.5 cm long and 3 m.m wide muscle.

2. Artificial Pace maker:-

a) It is a small batery-operated electronic device, which is inserted under the skin. It is used to help the heart beat regularly at an appropriate rate.

b) Purpose of an artificial Pacemaker.

i) Stimulate the heart, when the natural pace maker is not fast.

ii) Blocks in the heart's electrical Conduction System.

(Blocks in the conduction system Prevent the Propagation of electrical impulses from natural pace maker to the ventricles)

3. Components of an Artificial pace maker:-

a) A pace maker consists of two parts namely the generator and the leads.

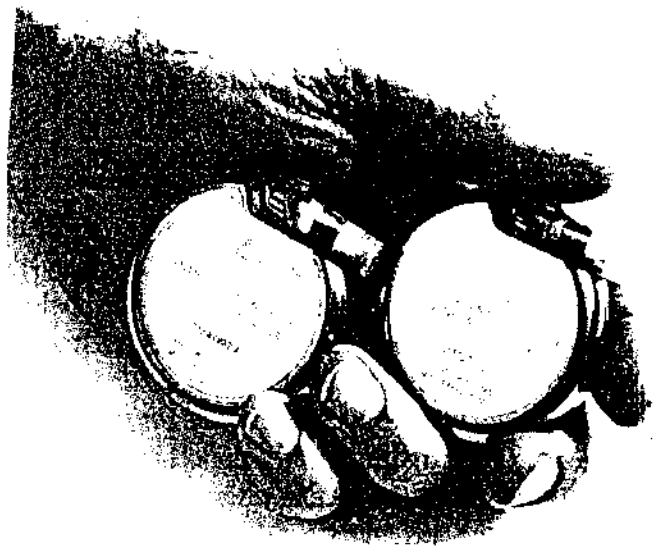
b) Generator:- It is an instrument where the battery and the information to regulate the heart beat are stored. The generators are very small in size and often weigh less than 30gms.

c) Battery:- Most pace makers run on lithium batteries. Life span of the battery is about 7-8 years. The battery willbe routinely monitored by doctors and replaced when necessory.

d) Leads:- The leads are wires that go from the generator through a large vein to the heart, where the wires are anchored.

e) The leads send the electrical impulses to the heart, to initiate it to beat.

Diagram:-



re 7.21. Internal pacemaker. (a) Photograph of two units.

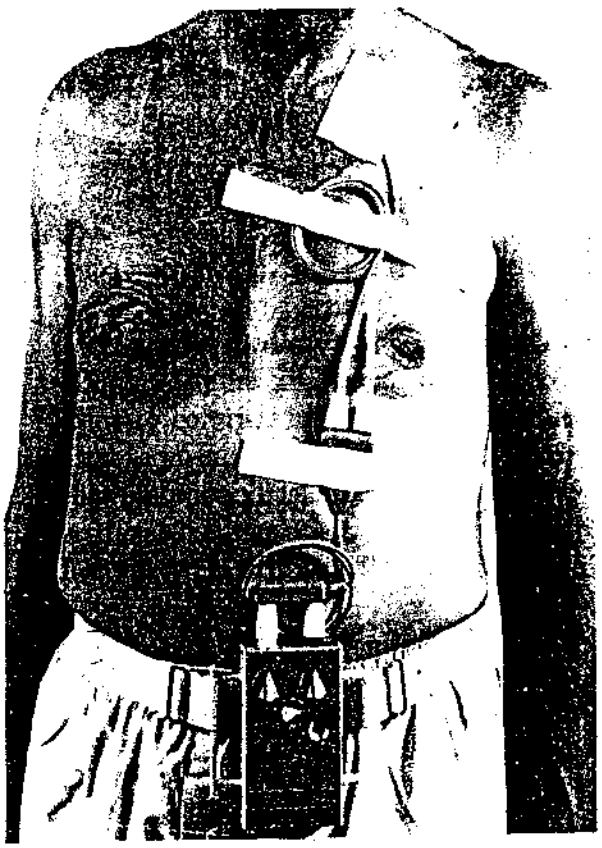
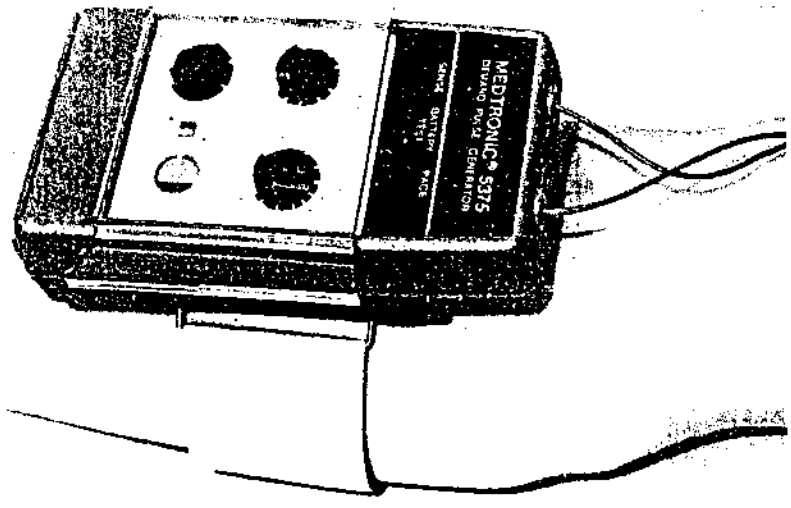


Figure 7.17. Portable external pacemaker. Patient is being temporarily paced with an external demand pacemaker and transvenous pacing catheter. (Courtesy of Medtronic, Inc., Minneapolis, MN.)



AUTOANALYSER

1. Autoanalyser is an instrument used to assist in the diagnosis of diseases and disorders and to monitor therapy and wide range of clinical test.
2. The use of autoanalyser, workload can be reduced rapidly with reproducible results.
3. To maintain the quality of results, standards (samples of known value) will be run along with every batch of test samples.
4. Parameters to be analysed by an autoanalyser.

   It is used to estimate the parameters such as glucose, protein, albumin, creatinine, Blood urea nitrogen (BUN), salts, enzymes (eg: transaminase), minerals and uric acid.

5. Advantages:-

   a) Large number of samples may be processed in minimal time.

   b) More accurate than manual method.

   c) Two or more assays may be performed simultaneously.

6. Disadvantages:-

   a) It is impractical for small number of specimens.

   b) Instrument may fail occasionally

   c) They are very expensive.

   d) Additional trainning for staff about the working, maintanance and potential problems of the machine is needed.

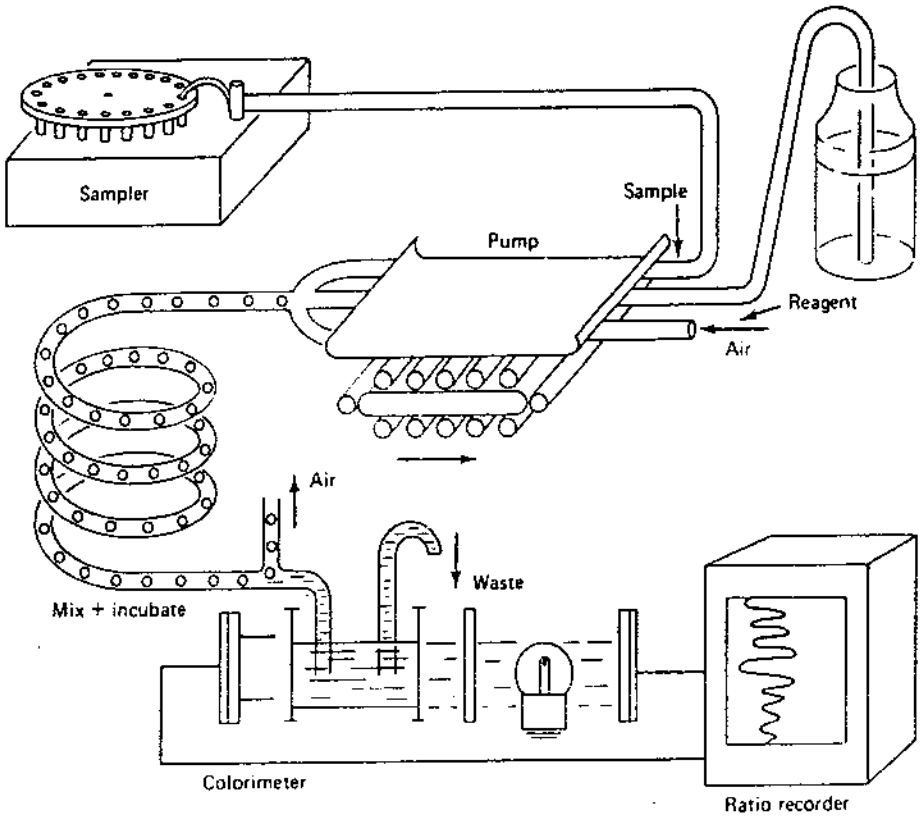


Figure 13.10. Continuous flow analyzer (simplified).