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DBT STAR COLLEGE SCHEME

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Cell biology and Genetics lab Manual

STUDY OF CELL TYPES

Columnar Epithelium

· These are cubical cells which are flat.
· The intestinal lining is a columnar epithelium.
· The primary function of these cells is **absorption** of nutrients.
· As you examine the slide, note the large, oval shaped nuclei that are positioned near the basal edge of the cells.
· They form the epidermis of the invertebrates.

Ciliated Epithelium

· These are ciliated cubical flat cells.
· The cilia are nothing but protoplasmic outgrowth.
· These are lined with border lining.
· The cells lined genital duct, trachea of animals.
· These cells will vibrate and help to drive the fluid in one direction. · It forms the lining of body in vertebrates.

Squamous Epithelium

· Squamous epithelium is a tissue.
· It is mass of similar cells carrying out similar function.
· It is a continuous layer of tissue covering the body externally or internal surfaces. Eg. Inner lining of buccal cavity, outer skin of frog.
· It is a simple epithelial tissue as it is made up of a single layer of cells. · The cells are hexagonal in shape.
· The cells are flat, thin and tile – like.
· The cells are in close contact with one another.
· There are no intercellular spaces.
· They are situated on a basement membrane.
· They have no vascularization, but they contain nerve fibres.

Glandular Epithelium

· These are flattened secretary cells.
· They resembles as squamous epithelial cells but arranged in series or rows. · These cells contain more ribosomes.

· These cells are secretory centres of proteins and hormones.
· These cells occupy the glands and secretary regions of the body.

Hyaline Cartilage

· It is a form of skeletal and modified connective tissue.
· Hyaline cartilage is found in the rib cage, the nose, the trachea, and the ends of long bones.
· It provides structural support (but is more flexible than bone) and has cushioning properties.
· Hyaline cartilage has a firm matrix with abundant collagen fibers, but the individual fibers cannot be seen under the microscope.
· When viewed under the microscope the matrix an amorphous quality (no discernable structures).
· The cells, which are known as chondrocytes, reside in small cavities within the matrix called lacunae.

Striated Muscle Fibre

· These are long and cylindrical sheath with blunt ends.
· It is surrounded by a thin sheath called sarcolemma.
· There are many contractile filament called myo-fibrils are present in sarcoplasm. · Sarcoplasm also has dark and light bands alternately.
· The nucleus is conical and spindle shaped.
· They are attached to the bands.
· Its main function is to produce voluntary movement of the body.

Non-striated Muscle Fibre

· They are long and spindle shaped with pointed ends.
· The outer sarcolemma is absent.
· Sarcoplasm is granular without bands.
· The nucleus is oval and in centre.
· Its main function is involuntary action of the body.
· Hence they are called as involuntary muscle.

Cardiac Muscle Fibre

· They are cylindrical with branches.
· The branches united with neighbouring fibres.
· The sarcolemma is absent.
· Sarcoplasm has light cross striations.
· The nucleus is at the centre and round shaped.
· It is present in a heart and another type of involuntary muscles.

Medullated Nerve Tissue

· It consist of neuron and nerve fibre.
· The neuron has dendrons granules and axons.
· The nerve fibre has central axis called axis cylinder.
· The axis cylinder has two coverings namely medullary sheath and neurilemma. · It present in the central nervous system.
· Neurons communicate with each other via electrical and chemical signals. · They have nucleated cell bodies and two types of elongated cellular processes: dendrites –receive signals, and axons –send signals.

Non-medullated Nerve Tissue

· It consist of neuron and myelin sheaths are absent.
· It appears grey in colour due to absent of myelin sheath.
· The conduction of nerve impulse is slower.
· These are found in sympatric and para sympathetic nerves.

OBSERVATION OF LIVING CELLS IN ONION PEELING

Aim:

Study of the cell type from onion peelings.

Background:

Preparation of temporary mount of cells involves the process of spreading, fixing and staining the cells to study the cell in living condition. Special type of staining is required known as vital staining. Lugol's iodine is a vital stain. Which helps in study of the epidermal cells of onion under the living condition.

Material required:

Onion peelings, scalpel, slide, compound microscope, lugol's iodine solution and the cover slip.

Procedure:

From the fresh onion the skin is peeled off using a fine forceps care must be taken. Such that the peeled skin does not wrinkled the peeled skin is than out into a square shape and placed on a clean glass slide, a drop of lugol's iodine is added to the skin. A cover slip is placed over it. Then this preparation is viewed under the low power compound microscope.

Observation:

I observed hexagonal cells of onion peeling.

HUMAN CHEEK CELLS

Aim:

To prepare a squamous epithelium from human cheek cells.

Background:

Robert hook in the year 1665 observed honey combed structure while examining the thin slide of cork under a compound microscope. He named those honey combed as cells.

Robert brown (1831) found the nucleus. Described the nucleus as central future of the cells.

Preparation of temporary mount of the cell involves the process of spreading of the cheek. Methylene blue is a neutral stain which stain both nucleus and cytoplasm.

Materials required:

Alcohol, tooth pick, glass slide, methylene blue stain, cover glass and compound microscope.

Procedure:

With the help of a sterile tooth pick the inner lining of cheek is gently scraped. A considerable mask of the cells are collected and placed at a clean glass slide. The placed is spread on the glass slide to form a thin smear a drop of methylene blue stain is added to the cells and a cover glass is placed over it. The cheek cells are observed from the smear under low and high power compound microscope.

Sketches are drawn to show the details of the cell. Field of view are selected where an only a

few cells.

Observation:

I observed irregularly arranged squamous epithelial cells.

MITOSIS STAGES FROM ONION ROOT TIP

Aim:

To study the cell divisions of various stages of mitosis.

Materials required:

Onion root tip, Compound microscope, slides, watch glass, test tube, test tube stand

Reagents required:

Acetocarmine stain, 100%, 95% and 75% of alcohol.

Background information:

All cells arise from the preexisting cell by a process of cell division in ordinary growth. This division usually involves the duplication of chromosome and separation of identical chromosome into new cell. This process of cell division is known as mitosis.

Even though biologist have recognized several stages of mitosis. It is a continuous process there is no distinction between one stage and another stage.

Principle:

Cell undergoing division source clear their stages these chromosomes can be easily stained by acetocarmine stain.

Procedure:

Onion bulks are obtained from the market. Then the bulks put on the bottle containing enough water. Now the bottle kept in a dark place in the room temperature. In the early morning of the practical the onion bulks are removed from the bottle and the root tip also cut off. The root tips are kept in a watch glass containing fixative for fixation at least 20 minutes. Then the root is passed through the decreasing series of (100%, 95%, 75%) alcohol allowed for 2minutes in each.

Then the root tip is passing to the solution in 1N Hcl kept in a test tube in to the water both in 60°C for 5 minutes. This help to soften of the material. Then the material is transferred into 70% alcohol for 2 minutes. A piece of 2mm is cut off and pour a few drops of acetocarmine stain and kept for 5 minutes. Now root tip is placed in the glass slide and teased with rusted needle and covered with cover slip. After that the cover slip is pressed with fingertip excess of stain is removed and now we should view the slide into the low power of the compound microscope.

Then to fixed under the high power of compound microscope to observe the various stages of mitosis cell division.

Observation:

I observed the stages of mitotic cell division.

SQUASH OF GRASSHOPPER'S TESTIS TO STUDY STAGES OF MEIOSIS

Aim:

To prepare the meiosis stage from the Grasshopper's testis to study the meiotic cell division in the testis squash of the grasshopper.

Background:

Gamete formation involve the kind of reduction division in the gonad cells called meiosis. In meiotic cell division the number of chromosome are reduced to half in number of daughter. This is

genetically significally in a sexually reproducing animal or plant. For convenience the biologist divides the meiotic cell division in to different stages namely first meiotic division. But in facts it is continuous process like that of mitosis.

Principle:

Any dividing cell the nucleus and its chromosomes play a major role. The deeply staining and its behavior at various stages helps one to recognize the various type of meiotic cell division.

Materials required:

Carnoy's fixative, 1N Hcl, Acetocarmine stain, water bath, glass slide, cover slip, embryo cup, dissection needle, compound microscope.

Procedure:

The male grasshopper can identify by the absence of ovipoisters. The testis are removed from the body cavity and fixed with cornay's fixative in embryonic cup for at least 20 minutes. Then it is passed along a descending of alcohol (95%, 70%, 50%) 2 minutes in each. The testis are treated with 1N Hcl which is kept in water bath at 60°C. When it is transferred into 75% alcohol on 2 minutes and stained with aceto carmine stain in the embryo cup for 5 to 10 minutes. Then transferred in to clean galss slide. Teased with needle and a cover glass is fixed and heated gently among the flame.

After cleaned excess of stain around the cover glass the stain is placed under the compound microscope in the high power. It shows the stage of meiosis cell division.

Observation:

I observed the various stages of meiotic cell division.

GIANT CHROMOSOMES IN CHIRONOMOUS LARVA

Aim:

To identify the giant chromosomes in salivary gland cells of chironomous larva.

Background information:

Chromosomes are hereditary character carries and in a few cases they are giant in size. This is because of repeated duplication of the chromosomes. In chironomous larva the cell nucleus of salivary gland and intestinal cells contain four giant chromosomes. The chironomous larva commonly occur in the bottom of pond and ditches. These larva are identify easily because they have haemoglobin in their blood and therefore they are coloured in red.

Materials required:

Chironomous larva, watch glass, dissection needle, glass slide, dissection microscope, cover slip, acetocarmine stain, saline solution, acetic acid and the compound microscope.

Procedure:

An alive chironomous larva is placed on a clean glass slide with a drop of water. Keeping the glass slide under the dissecting microscope the head of the larva is pulled with the help of one needle.

While pressing the body at the fifth segment using another needle. Along with the separate head a portion of digestive tract with salivary glands on either side it comes out. If not the body segment behind head to fourth segment is pressed with the needle so that the salivary gland is released. All other tissue except salivary gland is released that are removed. A drop of acetocarmine stain added. This tissue preparation is left for about half an hour. Periodically checking is done to avoid over staining.

After staining is completed a drop of acetic acid is placed over the gland and it is covered with cover glass. The cover slip is slightly pressed and it is examined under the high power compound microscope.

Observation:

I observed the giant chromosome form the chironomous larva.

WATSON AND CRICK MODEL OF DNA

Identification:

The given spotter A is Watson and Crick model of DNA.

Comments:

1. DNA is the deoxyribonucleic acid.
2. It is the genetic material.
3. It is present inside the chromosomes.
4. It is a macromolecule.
5. Watson and Crick explained the structure of DNA and it is called Watson and Crick model.
6. It is in the form of a double helix.
7. It looks like a spirally coiled ladder.
8. It consists of two polynucleotide chains.
9. Each polynucleotide chain is made up of many units called nucleotides. 10. Each nucleotide is made up of three molecules, namely a sugar, a phosphoric acid and nitrogenous base.
11. The sugar present in DNA is Deoxyribose sugar and hence the name DNA. 12. The nitrogenous bases present in DNA are purines and pyrimidines.
13. The purines present in DNA are adenine and guanine.
14. The pyrimidines present in DNA are thymine and cytosine.
15. The two polynucleotide chains are linked by Hydrogen bonds.
16. The bonding is between adenine and thymine and between guanine and cytosine. 17. The DNA helix has two grooves, namely major grooves and minor grooves.

DNA REPLICATION

Identification:

The given spotter A is DNA Replication.

Comments:

1. Replication is the duplication process by which a DNA molecule produces exact copies of its own structure.
2. It occurs both in single standard DNA and double standard DNA. 3. In replication the parent DNA strands function as templates.
4. The newly synthesized strand is complementary to the parental strand. 5. The DNA replication is a semi conservative process because, of the two strands produced, one strand is the parental strand and the second strand is newly synthesized.
6. The replication is semi discontinuous because in one strand the DNA is synthesized in short fragments and in the other strand it is synthesized continuously. 7. Replication is bidirectional because it occurs in opposite directions in the two strands. 8. Replication involves three steps namely:
   Initiation, Elongation, Termination
9. During replication deoxyribonucleotides are added one by one resulting in the formation of a polynucleotide chain.
10. The formation of polynucleotide chain by the addition of Nucleotides is called polymerization.
11. The addition of nucleotides is catalyzed by an enzyme DNA polymerase. 12. The synthesis occurs always from the 5' to the 3'direction.

LAC OPERON

Identification:

The given spotter A is LAC Operon.

Comments:

1. Lac operon is a set of genes responsible for the metabolism of lactose in E.coli 2. The lac operon was discovered by the Nobel Prize winners Jacob and Monod. 3. It explains the regulation of gene expression in prokaryotes.
4. It is the regulation of gene expression at the transcriptional level. 5. It explains that the gene, whose

product is required, is switched on and when its product is not required, it is switched off.

6. The operon consists of four genes namely, Structural genes, Regulator gene, Operator gene, Promoter gene

7. The structural genes produce enzymes for the metabolism of lactose, the milk sugar. 8. The regulator gene produces a repressor protein.

9. The operator gene has a binding site for repressor protein

10. The promoter has a binding site for RNA polymerase.

11. When there is no lactose in the culture medium of E.coli, the repressor protein binds to the operator gene. This prevents the binding of RNA polymerase to the promoter gene. 12. Hence the transcription does not occur. Enzymes are not produced. 13. When lactose is provided to the culture medium, the lactose diffuses into the bacterium. 14. It binds with repressor protein.

15. Hence the operator is freed from the repressor protein.

16. As a result RNA polymerase binds to the promoter and reads the structural genes. 17. The structural genes produce mRNA which produces enzymes to degrade the lactose. 18. When the entire lactose is used up, there is no lactose to bind with the repressor protein.

19. Hence repressor protein binds to the operator to block transcription. 20. In lac operon, the operator functions as a switch. When repressor protein binds to it, it is switched off. When it is freed from repressor protein the operator is switched on.

CLOVER LEAF MODEL OF tRNA

Identification:

The given spotter A is Clover Leaf Model of tRNA.

Comments:

1. The tRNA is the transfer RNA.
2. During protein synthesis it transports amino acids in the cytoplasm to the site of protein synthesis and hence its name.
3. It is present in the cytoplasm.
4. It is a macromolecule.
5. It is nucleic acid containing ribose sugar and hence the name RNA. 6. It is clover leaf shaped.
7. It is a single stranded nucleic acid. The single strand is folded into a clover leaf. The two ends lie side by side.
8. The tRNA has two terminal ends, four arms, three main loops and one mini loop. 9. The four arms are acceptor arm, D arm, T and C arm and anticodon arm. 10. The single strand is a Polynucleotide chain.
11. The polynucleotide chain is made up of many nucleotide units.
12. Each nucleotide is made up of three molecules namely, a sugar, a phosphoric acid and a nitrogenous base.
13. The sugar present in RNA is ribose sugar and hence the name RNA. 14. The nitrogenous bases present in RNA are purines and pyrimidines. 15. The purines present in RNA are adenine and guanine.
16. The pyrimidines present in RNA are cytosine and uracil.

CODING DICTIONARY

Identification:

The given spotter A is Coding Dictionary.

Comments:

1. The genetic code is the sequence of nitrogen bases in mRNA which contain information for protein synthesis.

2. A codon is the sequence of three nucleotides of mRNA specifying an amino acid hence it is called as triplet code.

3. The codon is universal same in all organisms from bacteria to man. 4. The codons in the mRNA and the amino acid in polypeptide chain have a linear arrangement (Co-linearity)

5. There is a comma or space between the adjacent codon.

6. The codon is non-overlapping.

7. The polypeptide synthesis is initiated by initiation codon I is AUG. 8. The synthesis of polypeptide is completed by termination codon UAA, UGA these are non-sense codons.

MICRO TECHNIQUE

Aim:

To prepare the microtome is to study the histology of a tissue. A part from histology cytological and biological studies can be undertaken.

Background:

The tissue must be sectioned and stained for a detailed investigation. The tissue is to be taken out from the body and cut into small pieces. These are fixed in a fixative to prevent post mortem. Then dehydration is being done to remove water molecule from the tissue. Then the tissue is cleared in a clearing solution and taken for infiltration. Infiltration is a process of stretching the tissue with liquid paraffin wax.

Later the tissue block is brought to microtome for making this section. The sections are mounted using a mutant with a cover slip. Thus are will get a permanent slide. The above produce is categorized into following sub headings.

1. Fixation:

The animal is dissected for the tissue is taken out with maximum speed physiological stain is added on the tissue. After the removal of the tissue from the body it is cut into small piece. The small piece are put into a fixative. The function of the fixative is to keep the tissue as if it many alive condition. The pest Morton changes like decomposition will it many alive presented and prevented in the procedure the physical structure of the tissue will be more or less in intact condition aqueous bowin's solution is a fixative which is considered as a universal one. This tissue can be left in a solution for a longer period of time. However it is desirable to give and even night fixation time for bowin.

2. Pest fixation treatment:

Materials fixed in aqueous bowin's fluid acquires a deep yellow colour it is necessary therefore to remove the colour in the solution of 70% alcohol and lithium carbonate powder. The materials washed until the yellow colour disappear from the material.

3. Dehydration:

The material is now transferred to the solution of 30%, 50% and absolute alcohol in the serial order. At least 30 minutes time duration may be given for each solution. In absolute alcohol to change of 30 minutes time may be given. Since the water is not mixable in the paraffin wax.

4. Dealchololization:

The removal alcohol in the tissue by a process is called dealcoholization. This can be alone by keeping the tissue in a solution of methyl benzonate for a period of 24 hours.

5. Clearing:

After alcoholization is completed the tissue cleared in a solution of benzene for half hour in this solution the tissue looks highly transparent indicating removal of water molecule.

6. Infiltration:

Infiltration is the process of allowing liquid paraffin wax to move the inter space of the tissue.

So as to enable the tissue so as the strength and dry wax will in whereas the benzene present inside the tissue will move out. Set the oven for 58 to 60°C and select a suitable wax showing the same molting point keep the wax piece in a 3 copper cups inside the oven. When the wax become lipid transport the material into first cup and wait for 35 to 45 minutes for infiltration with the heated to cups transferred for 30 –
45 minutes. Later the same process is followed for third cup.

7. Embedding:

Pure method wax is kept ready rectangular or square shaped proper boxes are also kept ready. These boxes are breed on the glass plate boring water drops at the bottom liquid paraffin wax is poured into the cup and wait for some times coding the base. Transfer the material from the third base of copper cup the material placed in paper. Allow some tissue for gradual for coding of wax from the side to the centre by using a heated needle. Case should be taken the material in placed in the centre and the top surface should be shallow in nature than after complete cooling in paraffin wax block is immersed in a cup of the water.

8. Trimming:

In the next day the block is taken out and the paper is removed and the block is trimmed with a sharp knife or scalpel all the sides. It must be parelle to each other. In this way the excess of wax is removed and the trimmed block is after the block is mounted. If put in a cold water for 2 minutes.

9. Sectioning:

The section of the tissue will be carried out with the help of micrometer a mechanical machine having the different motor parts.

The drive which is used for the mounting block holder towards the knife. Block holder

is into a block holder section.

Knife section

Micro adjuster

The knife is used for the section must be bended resulasles and then the knife fitted into the knife holder. The block holder is fitted to the block holder section. The front edge to do paraffin block is parallel to the knife edge now start to the rotating drive wheel as soon as the paraffin wax will be cut. As each section is cut impart to the knife edge to the block. Slightly mask the same and the subsequent. Sectioning absorbed to the earlier one. A continuous ribbon will follow with the help of needle and section is supported into a great length and kept on the sheet do paper in the wax can cut the under material.

10. Affixing the section on glass slide:

Now the sections are cut into small piece with the help of forceps then are transferred into a clean glass slide is rubbed with one or two drop of albumins and equal volume of glycine and 0.75gm of sodium salicylate the section is placed on the water can make slide into two rows or into a single row. Add a few drop of water to the solution will float on the water. We can move all sorts of manipulation at this time. So that the section will be in a float heat straight order after the slide is put on a flame of sprit lamp for a fraction of seconds the slide should be of flame when the wax begin to mark.

By this technique material is timely adhered to the slide.

Staining Procedure:

A staining procedure involving the following steps.

Dewaxing

Staining

Xylol I 15 mins

Xylol II 08 mins

Xylol + absolute alcohol 05 mins

Absolute alcohol 08 mins

90% alcohol 05 mins

70% alcohol 05 mins

50% alcohol 05 mins

30% alcohol 05 mins

Distilled water I 05 mins

Distilled water II 05 mins

NH3SO4 mordant paste gum and nuclear material – retrogressive fluid Haemoto xylene nucleus stain 20 – 30 mins

30% alcohol 05 mins

50% alcohol

GENETICS

STUDY OF SIMPLE MENDELIAN TRAITS IN MAN

Aim:

To study the frequency distribution of Mendelian traits in human population. **Principle:**

A large number of human character are ground to follows Mendel laws of inheritance. Attention of all the geneticists a survey at different phenotypic structure of the population at the different allelic point in the gene pool.

Procedure:

Each student in the class is used to take a survey in random sampling in the population. The phenotype is noted in the table. The frequency is calculated and each and every phenotype character can be analysed for further studies. In the case of dominant character in an individual it is difficult to find out whether due to homozygosity or heterozygosity.

However a pedigree analysis at the given the result by such studies. It is possible to study the frequency distribution at different allelic gene in the gene pool.

MONO HYBRID CROSS

Aim:

To determine the monohybrid cross using the colour beads.

Materials Required:

The different colour beads, bowls, reference books, towels.

Background information:

The Austrian monk gregorjogan Mendel is appropriately called the father of genetics. Mendel

performed certain heredity experiments on pea plant and he published his result in 1865. In annual proceeding of natural historical society of Bruno.

The cross between the two parents that differ with respect to one pair of alleles is called Monohybrid cross. Monohybrid cross are basic to Mendelian genetics. Such cross may occur in all major groups of sexually reproducing organisms. Dominance is the major form of interaction between the alleles become dominant allele is usually the one that produce a functional product while the recessive allele does not therefore the normal phenotype is produce if the dominant allele is present.

Mendel reared genetically pure variety of pea plant for a single character (Tall and Dwarf).

He cross pollinated these two variety and get all the plants in F1 generation the allowed self-pollinated the off spring of F1 generation. This was authorized to note both tall and dwarf offspring in the second generation in the ratio 3:1.

Principle:

A pair of allele determining the trait are represented by two different colour beads namely red colour for dominant and blue colour for recessive gene. Each pure line parents (TT and tt) produce a single type of units and these combine to form the hybrid (Tt) which is heterozygous. These phenotypically produced tall plant. These are analogous to mixing the red and the blue colour beads and F1 is self-crossed. In F1 generation two types of gametes (T & t) are formed with equal frequencies. The union of F1 gametes is at random. In the F2 generation 3 types of gametes (TT, Tt, tt) are observed. They occur in ratio of 1:2:1 phenotypically 2 classes will be seen (Tall and Dwarf) which occur in the ration 3:1.

Procedure:

200 red beads and 200 blue beads are taken in 2 separate bowls. The red beads represents the homozygous dominant parents. Blue beads represent homozygous recessive parent. These two different beads are now mixed equal to mating. The mixed beads constitute the F1 generation. From these 2 beads are taken at a bowl must be well shaken well before each with traits. The two beads drawn at a time represent an F2 individual.

200 such draws are made and nature of genotypically and phenotypically are recorded simultaneously the genotype are recorded simultaneous and phenotypic ratio are found out and deviation if any are found.

Inference:

The difference of P value, the observed ratio can be taken as 1:2:1.

DIHYBRID CROSS

Aim:

To demonstrate the law of independent assortment using “Dihybrid Cross”. **Materials Required:**

4 different colour beads, bowls, reference books, etc..

Background information:

Mendel crossed plants having round yellow seeds with plant having wrinkled green seeds. The F1 progeny from such a cross between homozygous parent and hybrids (heterozygotes) for 2 gene pair. The F1 progeny are dihybrid alleles for both round and yellow are dihybrids. Alleles for both round and yellow are dominant and recessive are wrinkled and green - seeds.

All the F1 seeds resulting from the cross were round and yellow as expected when F1 hybrid were allowed in a self-fertilize of F2 phenotype were absorbed in a definite pattern. From the total 556 seeds the following distribution was obtained. 315 round yellow,108 round green,101wrinkled yellow, 32 wrinkled green. The result clearly fit the ratio 9:3:3:1. Mendel recognized there as a result of monohybrid crosses. Each expected to result in a 3:1 ratio, operating together. The product of 2 monohybrid ratio that is $(3+1)^2 = 9+3+3+1$. Thus confirmed to law of dominant which takes a chance of 2 or more independent events appeared together if the product of the chance of a separate.

The result show the assortment of the two laws or two pair of independent allele each showing dominant of members. Not only has the member of each allele segregated but the allelic pairs of different pairs behind independently with. Respect to each other show Mendel concluded that members of different pair of alleles assort independently into gametes. This concept of independent assortment is designed has these second principle.

Principle

In these experiment beads are considered to be as genes. Red beads represent alleles for round condition brown bead represent gene for wrinkled condition. Rose bead represent gene for yellow colour and blue bead represent gene for green colour.

To explain independent assortment of gene. They selfing of F1 hybrid considered. They have the genotype RrYy they produce four different type of gamete. Namely Ry, Ry, rY and ry in equal number since the assortment of genes in independent. Both the male and female parent produce 4 kind of gamete each. Thus a cross between two such dihybrid bring about it possible. Combination amount the gametes producing 4 type of phenotypes.

9 plant with round peas and yellow cotyledons
3 plant with round peas and green cotyledons
3 plant with round peas and yellow cotyledons
1 plant with round peas and green cotyledons

Procedure

The red and 96 brown beads are taken in a bowl and mixed. 96 rose and 96 blue beads are taken in another bowl and mixed from each bowl two beads are drawn at a time. The four beads thus drawn represent the genotype of the individual forming the next generation. From the genotype, phenotype is found out and recorded. 96 such drawn are made.

Inference

The observed ratio can be taken as 9:3:3:1.

Mono Hybrid Test Cross

Aim:

To conduct the cross with the double recessive genotype for testing the purity of the gametes.

Background information:

The crossing F1 with the double recessive genotype for the testing purposes is called a test cross. A cross between an F1 that can heterozygous pair of alleles and either of the parent type is called **"Back cross"**

A population of cross breeding organisms usually includes all 3 genotypes such as (AA,Aa,aa) but it has more heterozygous (Aa) than homozygous individual is not detectable phenotypically, but recessive allele can be identified with a test cross.

Principle:

The heterozygous tall individual (Tt) is crossed with homozygous dwarf individual (tt). The progeny of the cross consist of heterozygous tall (Tt) and homozygous recessive dwarf (tt) individuals in about equal numbers in 1:1 ratio. Mendel verified thus **P** through back cross or test cross. According to the principle of segregation the homozygous allele segregate so that approximately half of the gametes will carry dominant gene. The test cross made by mendel produced 1:1 ratio in the offspring.

In this experiment the coin is considered as F1 hybrid (Tt) and the 2 sides of the coin head and tall represent the two types of gametes are produced in equal frequency. Since recessive parent gives one type of gamete. i.e; one tall it is kept as a constant factor.

If the head is after tossing. It is considered as heterozygous and the tall is considered as homozygous recessive.

Procedure:

Tally sheet in monohybrid test cross. A coin is tossed for 200 times and the order in which the coins falls are recorded uniformly to obtain the correct result.

DISTRIBUTION OF TASTER AND NON-TASTER IN CLASS POPULATION

Aim:

To study the distribution of Mendelian traits the taster and non-taster of PTC in the class

population.

Background:

The ability to taste phenylthio carbomide (PTC) a bitter chemical has been long known to be a bimodal autosomal trait inherited in a simple Mendelian recessive parent not pattern which is used for both chemical widely as the genetic and anthropological studies. The frequency of taster and non-taster allele is found to vary in different population. We have taken a survey of gene frequency of PTC taste ability class population. PTC solid serial dilution method was used to assess the PTC taster and non-taster to determine allele frequency.

Procedure:

1. 50ml of Phenylthio carbomide is dissolved in 50ml of warm water. 2.
Triangular strips of filter paper are soaked in the solution.
3. The students in the class are subjected to taste the filter paper containing PTC. 4. The results were observed and recorded in a table.

Polygenic Inheritance of Quantitative Traits by Height and Weight of Students

Aim:

To study the polygenic inheritance in human being by using the height and weight variation in the student population.

Principle:

The inheritance of Polygenic traits depends on the accumulation in a small proportion in human beings is controlled and polygenic inheritance through environment by influence to some extent.

Procedure:

The height and weight of the student are measured respectively and tabulated the measurement can be statistical analysis. The absolute frequency calculated from the table II which show the height and weight of the student arranged in order to a magnitude.

GYANDROMORPHISM

Identification:

The given spotter A is Gyandromorphism.

Comments:

1. Gyandromprphs are individuals which show male character on some part of the body and female character on other parts of the body. They are also called gynanders.

2. The gyandromrophs are sterile.

3. It is rare, occur in drosophila, butterflies, wasps, bees etc.

4. These are three types - Bilateral gyanders, Anteroposterior gyanders, Sex pie bales.

5. Gyandromorphism is produced in two ways – loss of X chromosome, binucleated egg.

SHELL COILING IN LIMNAEA

Identification:

The given spotter A is Shell coiling in Limnaea.

Comments:

1. In the snail limnaea, the nature of shell coiling is a cytoplasmic inheritance. 2. The phenotype of the offspring is determined by the genotype of the female parent. This phenomenon is called maternal inheritnce.

3. In shell coiling, the genotype of the female parent is not expressed in its own body, but expressed in the offspring of the F_1 generation. Hence it is called delayed inheritance.

4. In reciprocal crosses, the results are different.

5. There are two types of shell coiling, namely Dextral and Sinistal. 6. In dextral, the coiling is in the clockwise direction when viewed from the apex. In sinistral, the coiling is in the anticlockwise direction.

7. The dextral shell is dominant and is controlled by dominant genes DD. The sinistral shell is recessive and is controlled by recessive genes dd.

8. When a female dextral snail (DD) is crossed with a male sinistral snail (dd), all the F_1 snails (Dd) are dextral like the female parent.

9. When a female sinistral snail (dd) is crossed with a male dextral snail (DD), all the F_1 snails (Dd) are sinistral like the female parent.

10. In the above two crosses, the F_1 snails have the same genotypes, but they have different phenotypes. Here, the Phenotype of the offspring is determined by the genotype of the mother.

11. In the first cross, the offspring has dextral shell because the mother's genotype is DD. In the second cross, the offspring has sinistral shell because the mother's genotype is dd. Thus in reciprocal crosses, the results are different.

12. The F_2 generation is obtained by self-fertilization of a single snail as the snail is hermaphrodite.

KLINEFELTER SYNDROME (22AA+XXY=47)

Identification:

The given spotter A is Klinefelter syndrome

Comments:

1. It is a sexual abnormality in males discovered by Harry in the year of 1942. 2. It is a genetical disease caused by an additional X chromosome in human male. 3. It is caused by chromosomal aberration.

4. It is caused by Trisomy (aneuploidy) where one chromosome is added to a set (2n+1).

5. This abnormality is due to presence of 47 chromosomes instead of 46. 6. The victims possess an additional X chromosome with XY. So the chromosomal make up is 22AA+XXY.

7. It is caused by non-disjunction of XX chromosomes.

8. When an abnormal egg with XX chromosome is fertilized with the sperm with Y chromosome, the

resulting baby contains XXY.
9. They are sterile males.
10. The testes are small. There is no spermatogenesis.
11. Male sex glands are poorly developed.
12. The breasts are enlarged.
13. They are tall.
14. Amount of male hormone is low.
15. Genitalia are poorly developed.
16. They are mentally affected.

DOWN SYNDROME (21AA+A+XX)

Identification:

The given spotter A is Down syndrome

Comments:

1. This abnormality was described by Down in 1866.
2. It is caused chromosomal aberration.
3. It is due trisomy in 21stpair of autosome.
4. It is due to 47 chromosomes instead of 46; chromosome number 21 is represented by three copies. Hence it is caused by autosomal aneuploidy (21-trisomy). 5. It arises by the non-disjunction of chromosomes of pair 21 during meiosis. Hence both autosomes of this pair enter the same egg. When this egg is fertilized by a normal sperm, Down's syndrome results.
6. The facial features of the victims resemble Mongolian race.
7. The mouth is constantly open and the tongue is protruded.
8. They are mentally retarded.
9. The neck is short and broad. She is dwarf.
10. The nose is oblique.
11. The ears are malformed.
12. The syndrome appears much more frequently in children born to women in the later part of the reproductive life.

TURNER'S SYNDROME (22AA + X = 45)

Identification:

The given spotter A is Turner's syndrome

Comments:

1. Turner's syndrome is a genetical disease in human female caused by the absence of one X chromosome.
2. It is a sexual abnormality in female discovered by Turner in 1938. 3. It is caused by a chromosomal aberration.
4. It is caused by monosomy (aneuploidy) where one chromosome is lost from one pair (2n-1).
5. This abnormality is due to 45 chromosomes instead of 46.
6. The missing chromosome is one X chromosome. Hence the chromosomal make up is 22AA+XO=45.
7. It is caused by non-disjunction of XX chromosomes.
8. When an abnormal egg without any chromosome is fertilized by a sperm with X chromosome, the resulting baby contains XO chromosomes.

9. The baby develops into a sterile female. She has female phenotypes. But there is no menstruation. Ovaries are represented by ridge of whitish tissue called streak gonad. 10. Female hormones are low. The chest is broad. Breasts are poorly developed. They are dwarf and mentally retarded.

COLOUR BLINDNESS

Identification:

The given spotter A is Colour blindness

Comments:

1. Colour blindness is a sex linked character discovered by Wilson in 1911. 2. It is a hereditary disease and the affected persons cannot distinguish red colour and green colour.
3. The red blindness is called Protanopia.

4. The green blindness is called Deuteranopia.
5. Colour blindness is a recessive character, caused by the recessive gene cc. The recessive genes prevent the proper development of cells in the retina. 6. The normal persons contain the genes CC (female) or C (man). 7. The genes for colour blindness are located on the X chromosomes. Their alleles are absent from Y chromosome. So man has only one gene. So man is hemizygote for colour blindness.
8. This character is common in man but rare in women.
9. Colour blindness follows criss-cross inheritance. i.e, it appears only in alternate generations.
10. The daughter carrying one recessive gene for colour blindness is called carrier. The carriers are normal in their vision.

HYPERTRICHOSIS

Identification:

The given spotter A is hypertrichosis.

Comments:

1. The hypertrichosis is the development of hair on the pinna.
2. It caused due to y-linked genes called holandric genes.
3. They are present only in the male sex.
4. They are transmitted from father to son and never to daughter.
5. It is sex linked inheritance of y-linked genes.