SAVITRIBAI PHULE PUNE UNIVERSITY , PUNE

T.Y.B.Sc. Botany

(Sem-III)

SUBJECT

Genetics and Evolution(Paper-III)

PowerPoint Presentation

Topic-Genetics-Introduction

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Definition of Genetics

- Genetics is branch of biology concerned with the study of gene, heredity, and genetic variation in living organism.

or

- Genetics can be define the branch of biology which deals with the study of heredity and variation among organism.

Concept of heredity and variation

The process of transmission on (transfer) of characters (traits) from one generation to another generation is known as heredity or inheritance. In other words, the transmission of traits from parents to offspring is referred to as heredity and hence the organisms tend to resemble their ancestors and relatives. Whereas, the differences among the individuals of a species are referred to as variation.

Heredity:

The offspring of all the organisms (plants and animals) resemble their parents in several aspects. This is only due to the phenomenon of heredity. Hereditary literally means "tendency of like begets like" i.e. all living organisms tend to produce offspring's like themselves

Hereditary may be defined as the transmission of characters from one generation to successive generations or from parents to their offspring's. Thus, heredity is the cause of similarities between the offspring's, so that the individuals of the same parents resemble each other in many aspects. Heredity involves the transfer of genetic characters from parents to the offspring's via the egg and sperm. These transferable characters are called "hereditary characters

Variation:

Though offspring's receive all the characters from their parents, they are not exactly alike. Differences are found even between the offspring's of the same parents. It is difficult to find out the identical individuals. The progeny differs not only in itself but also with the parents. These differences are called variations. Thus, variations may be defined as the visible differences between the parents and the offspring's or between the offspring's of the same parents.

Branches of Genetics

In recent years, the science of genetics has proliferated into numerous distinctive branches. Some of the significant branches of genetics are as follows:

1) Plant Genetics:

This branch concerned with all genetic and hereditary aspects followed by plants species Plant genetics is a very broad term. There are many facets of genetics in general, there are many facets to plants.

2) Animal Genetics:

Animal Genetics, the largest private provider of genetic testing services for horses offers a variety of reliable, state-of-the art DNA test to identify certain genetic traits in breeding horses and to determine the likelihood that these traits will be passed to offspring.

3) Human Genetics:

Human genetics is the study of inheritance as it occurs in human beings. Human genetics encompasses a variety of overlapping fields including classical genetics, cytogenetic, molecular genetics, biochemical genetics, genomics, population genetics, developmental genetics, clinical genetics, and genetic counseling

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4) Microbial Genetics:

It deals with the genetics of microorganisms (in virus of bacteria, unicellular plant and animals)

5) Fungal Genetics or Mycogentics:

This branch deals with the study of genetical aspects of all fungi. Their reproductive biology and hereditary characters which they follows during all types of reproduction.

6) Viral Genetics:

Genetics of virus.

7) Drosophila Genetics:

Genetics of fruit fly, Drosophila sp.

8) Mendelian Genetics

It involves the study of heredity of both qualitative and quantitative traits and the influence of environment on their expressions.

9) Quantitative Genetics:

It involves the study of heredity of quantitative traits such as height, weight and IQ in human beings and milk production in cattle.

10) Morganian Genetics:

It includes study of recombination (crossing over) in all kinds of organisms such as higher plants, animals, fungi, bacteria and virus. It also involves the preparation of linkage maps of chromosomes.

Application of Genetics

Agriculture

Application of genetic engineering in field of agriculture is

1.Creation of Resistance Varieties of Plants:

Transfer of specific genes from one species to another may be of great significance in exploiting diseases, insects and pest resistance mechanisms more efficiently. Various genes responsible for resistance to diseases have been Identified, cloned and incorporated or manipulated into another species. For example, *Bacillus thuringiensis* is a bacterium that has ability to destroy stem borer pest in rice and maize. Keeping this view in mind, scientists isolated Bt gene from a bacterium *Bacillus thuringiensis* and clone and then incorporated it into rice or maize genome. As a result rice or maize shows the resistance against stem-borer due to presence of Bt gene in rice genome. Various novel plants with resistance to various diseases pests and stresses have been created using recombinant DNA technique.

2. Bio-Fertilization:

Molecular nitrogen in the atmosphere is converted into biologically usable form by nitrogen fixing micro-organisms eg. *Rhizobium*. The most sophisticated approach to bio-fertilization is to create plants that possess genetic capacity for nitrogen fixation. Attempts are being made to transfer genes for nitrogen fixation gene called nif gene from bacteria to rice or other non leguminous crops)

3. Increase the Protein Content:

One of the major sources of protein for human and animals consumption is constituted by the proteins contained in seeds of many plant species. The cereals and legumes which are major sources of storage proteins contain limited amount of certain amino acids which are essentials for human beings. Majority of these cereals are deficient in lysine whereas legumes are deficient in sulphur amino acids.

Medicine:

Because of this, genetics has become an iIntegral part of primary care medicin. Whereas at one time, medical genetics was devoted to the study of relatively rare genetic disorders, the Human Genome Project has established a genetic contribution to a variety of common diseases. It is therefore incumbent upon all physicians to have a working knowledge of the field. Genetics is an area of medicine with enormous medical, social, ethical and legal implications

Forensicc

DNA, or deoxyribonucleic acid, contains all the genetic information about a person.It's the instructions for the body's entire genetic makeup. DNA is unique to each Individual person. A person has the same DNA throughout his entire body, and it's located in every cell. Cells are the basic building blocks of all people. A sample of DNA from a crime scene can be used as a template for amplification

Clinical Evaluation Cardiomyopathy:

Inherited forms of cardiomyopathy are common causes of heart failure. Applications of genetics in the evaluation and management of heart failure include the determination of inheritance patterns within families with cardiomyopathy, the evaluation of affected patients for syndromic features, the determination of people within families who are at risk of heart failure, and the identification of responsible gene mutations.

Dissect Plant Secondary Pathways:

Plant secondary metabolism comprises an enormous diversity in compounds and enzymes, and wide spectra of mechanisms of gene regulation and of transport of metabolites and enzymes. Genetic approaches using the model plant *Arabidopsis thaliana* have contributed Importantly to recent progress in understanding glucosinolate biosynthesis and its intricate linkage with auxin homeostasis


Thank You