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Genetics is the science concerned with the structure and function of all genes in different organisms.

Genetics has a significant influence on the dentoalveolar and craniofacial development.

- Studies on genetic interest were traced back to 6000 B.C.
- Pythagoras, Aristotle, Empedocles, Harvey, Adams Drawin etc. were the forerunners of genetics.
- Joseph Adams is known as the founder of human genetics.

- Gregor Mendel is known as the founder of modern genetics.
- Mendel gave the famous “Law of segregation”.
- In 1903 Sulton and Boveri gave the “chromosome theory of inheritance”
- In 1935 Thomas Hunt Morgan was awarded the noble prize for the extensive studies on the arrangement of genes along the chromosomes.

- Watson and Crick in 1953 demonstrated the structure of the DNA model .
- Finch and Klung proposed the “ Solenoid model” of the chromosome.

Molecular basis of inheritance.

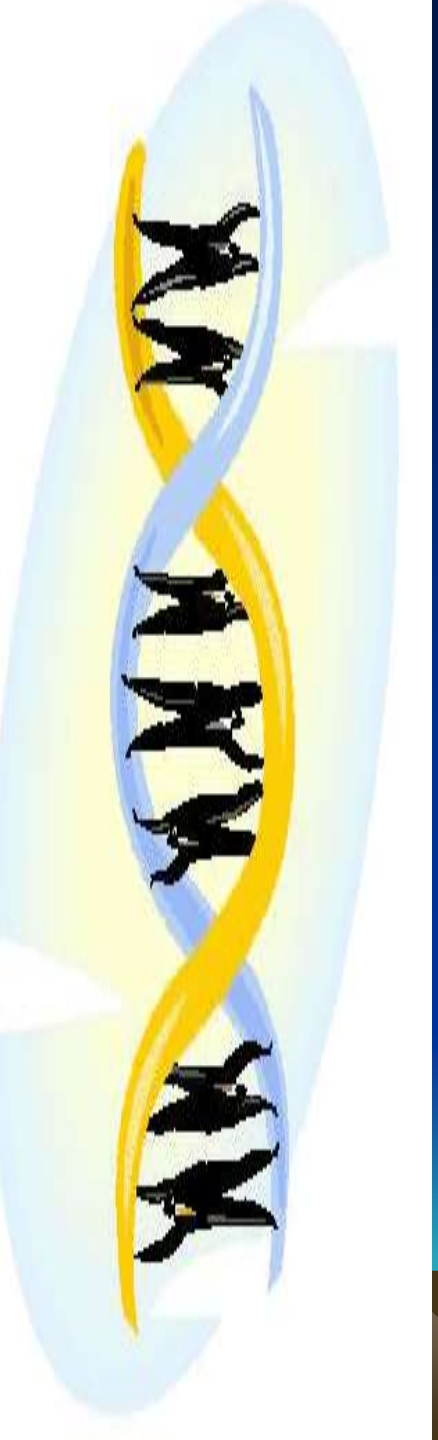
Cell

- Basic unit of living body
- Made up of different organelles i.e.

The cell wall , cytoplasm, endoplasmic reticulum, ribosome, mitochondria, nucleus, etc.,.

Chromosome

- Thread like structure present in the nucleus
- Chromosome contains a single molecule of DNA spooled around histone protein cores forming beads on a single string called nucleosomes.
- This combination of the protein and DNA is called as the chromatin.



DNA (Deoxyribo-nucleic acid)

- It forms long chains of genetic material organized into chromosomes.
- Each chromosome contains a single long molecule of DNA.
- DNA consists of nucleotides.
- Nucleotides consists of Deoxyribose sugar, a phosphate molecule and one protein either a purine or a pyrimidine.

- Nucleotides form a pair by a weak hydrogen bond between the proteins. At the same time sugar molecules on both the sides get attached to an adjacent pair by means of phosphate bonds
- This structure resembles a step ladder
- The step ladder undergoes primary, secondary, tertiary and quaternary coiling to form the chromatic loops which get tightly wound to form the chromosome

- Every strand of DNA is bound to a second strand whose base complements to the first..
- Human genome contains 3,000,000,000. base pairs packed into 23 chromosomes.

- The genetic code is in the form of these bases.

1. Adenine
2. Guanine
3. Thmine
4. Cytosine

Gene

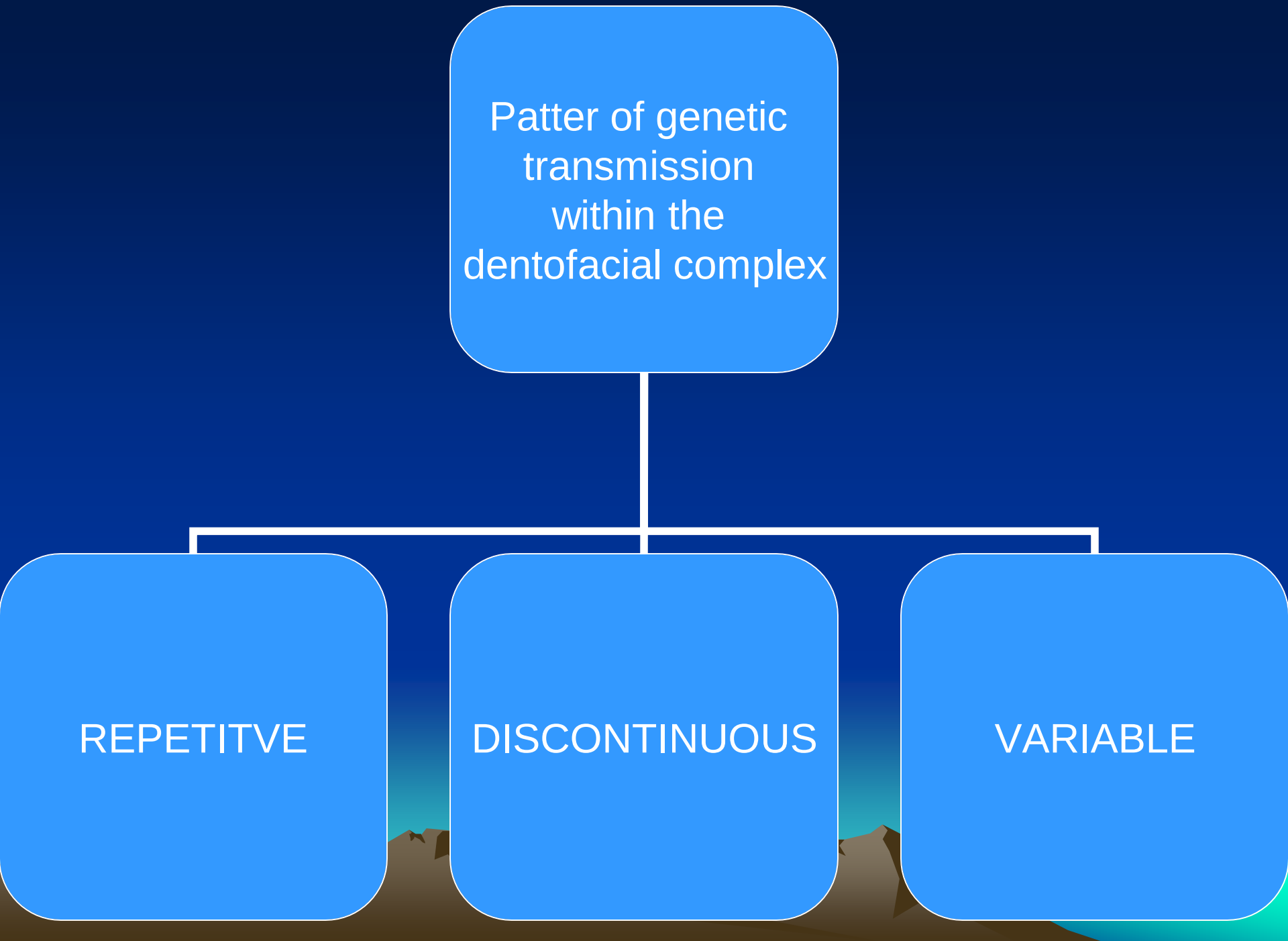
- Basic unit of inheritance.
- Gene consists of a portion of the double stranded DNA molecule with 300 to 1000 nucleotide pairs.

TRANSCRIPTION:-

The process by which the information is transmitted from DNA to messenger RNA at the initial stage of replication.

TRANSLATION:-

The process by which the genetic information is actually converted into protein synthesis.


Patter of genetic transmission within the dentofacial complex
REPETITVE
DISCONTINUOUS
VARIABLE

GENE MUTATION

A change induced by certain agents in the composition of the DNA base pair leading to an altered protein synthesis is known as a mutation.

Mutation can be visible, detrimental, lethal, etc.

Mutagens can be ionizing radiation, drugs, chemicals, certain viruses, high temperature etc.

Genetic disorders can be two types

NUMERICAL

1. Polyploidy
2. Monosomy
3. Trisomy
4. Klinefelters syndrome
5. Turner,s syndrome

STRUCTURAL

1. Translocation
2. Deletions
3. Ring chromosomes

- In 1836 Frederick G. Kussel after extensive study reported that malocclusion, both skeletal and dental can be transmitted from one generation to another .

Dentofacial disturbances of genetic influence are:-

- Micrognathia
- Macrognathia
- Cleft lip and palate
- Down’s syndrome
- Bimaxillary protrusion
- Open bite
- Hypodontia, anodontia, oligodontia.
- High arched palate
- Cherubism
- Gardner’s syndrome

- Relapse , occlusal mannerisms, jaw positioning, and abnormal pressure habits which induce untoward forces that tend to move the orthodontically treated teeth back into malocclusion can also be genetic in origin.

BUTLER'S FIELD THEORY

- Mammilian dentition divided into various developmental fields
- The fields are molar/premolar, canine and incisor field.
- Dental variability manifests itself strongly in the distal than in the mesial direction.
- For e.g. lateral incisor more prone to variation than central incisor.

Methods of studying role of genes

Twin studies

These are done by analyzing the monozygotic or dizygotic twins in a specific manner.

MONOZYGOTIC TWINS:-

- Two individuals developed from same ovum.
- Genetic make-up identical

DIZYGOTIC TWINS:-

- Two indivisuals developed from two different ovum .
- Environmental conditions same

PEDIGREE STUDIES:-

- Definite trait is studied along a family tree.
- Dominant and recessive traits can be studied

INBREEDING:-

- Mode of transmission of dominant and recessive traits can be analyzed by studying certain communities where practices like polygamy and marriages within the family still exist.

Polymerase chain reaction (PCR)

- PCR is a study where the investigator can amplify a single copy of a DNA segment into billions of identical copies to study the genetic sequence.
- The PCR is carried out with the help of sophisticated instruments and the ingredients to carry out PCR are target DNA, DNA primers, free nucleotides and taq polymerase enzymes.

Conclusion

- Research into genetic influence of the dento-facial complex has thrown light on the new vistas of thoughts .
- We can hope that the innovative field of genetics in the near future can help us solve the unanswered questions .