

BTCH-CC-301: Molecular Biology – I

Units	Topic	Method	No. of Classes Needed
I	DNA Structure	Lecture, PPT, Discussion	18
II	Replication	do	17
III	DNA damage & Mutations	do	15
IV	RNA Structure and Transcription	do	10

Learning Outcomes

After going through this course, a student will be able to:

- Learn about the structure of nucleic acids.
- Able to understand the complexities of the genome.
- Understand the organization of the pro and eukaryotic genomes.
- Learn about different types of transposable elements.
- Understand the process of replication and the differences between pro and eukaryotic replication processes.
- Understand how mutations occur, causes and implications of mutations and the repair systems involved.
- Understand the process of transcription in eukaryotes and prokaryotes
- Learn about the process of RNA splicing and processing.

Points for discussion

- Repetitive DNA and DNA finger printing.
- Replication of the ends of chromosome.
- Diseases due to defective repair system.
- Significance of processing of mRNA.

References:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008) Molecular Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.
5. Lewin Benjamin Lewin's Genes X (English) 10 Rev ed Edition

6. Goldstein, Kilpatrick, Krebs Lewin's Genes XI (English) Jones & Bartlett Publishers.
7. Harvey Lodish, Arnold Berk, Chris A. Kaiser Monty Krieger, Anthony Bretscher
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8. David Freifelder 2004 Molecular Biology, Narosa Publishers.

BTCH-CC-302: Genetics

Unit	Topic	Method	No. of classes needed
I	Historical developments in the field of genetics.	Lecture, Discussion	01
	Mendelian Laws of Inheritance: Dominance, segregation & independent assortment	do	05
	Chromosomal theory of inheritance, Allelic interactions	do	07
	Non allelic interactions	do	04

Learning outcomes

After going through this unit you should be able to:

- Define monohybrid cross and describe the following terms: genotype, phenotype, allele, locus, dominant and recessive trait
- Explain Mendel's laws of inheritance.
- Explain incomplete dominance and codominance
- Define test cross
- Define multiple alleles
- Define and describe the dihybrid cross
- Explain the independent assortment
- Master the process of solving genetic problems (inheritance of recessive, dominant and sex-linked traits)

Activities

1. Preparation of assignment on different topics by each student;
2. Preparation of PPT for presentation in the class;
3. Students delivered presentations on different topics.

Points for discussion

1. What are the fundamental Laws of Genetics?
2. Significance of test cross and back cross.
3. The process of ABO and Rh blood typing.

Unit	Topic	Method	No. of classes needed
II	Structural Organization of the Chromosome	Lecture, Discussion	05
	Euchromatin & Heterochromatin	do	01
	Giant Chromosomes (Polytene & Lampbrush chromosomes).	do	02
	Karyotype, Banding pattern of human chromosomes.	do	02
	Linkage & Crossing over – a brief account.	do	04
	One-gene-one-polypeptide-hypothesis.	do	01

Learning Outcomes

After going through this unit student shall be able to:

- Describe the levels of chromosomal structure and compaction.
- Describe the main differences between chromosomes in prokaryotic and eukaryotic cells.
- Define *Drosophila melanogaster* polytene chromosomes and amphibian oocyte chromosomes “lampbrush chromosomes”.
- Describe a normal human karyotype and discuss the various abnormalities that can be detected using this technique
- Define one gene one polypeptide hypothesis.
- Differentiate between heterochromatin and euchromatin.
- Describe chromosome banding and define G and R bands
- Discusses about linked genes and crossing over

Activities

5. Preparation of assignment;
6. Preparation of PPT for presentation in the class;

Points for discussion

- How chromatin is organized in eukaryotes and their effects on gene expression.
- What does the term polytene mean?
- Structure and function of telomeres and telomerase.
- Discussion on FISH method and types of probes that can be used..

Learning Outcomes

After going through this unit, you will be able to:

- Define sex determination in humans.
- Describe the process of X chromosome inactivation
- Identify sex linked diseases and describe main characteristics of X-linked recessive diseases, X-linked dominant diseases and Y-linked diseases
- Know about population genetics, finding the frequency of alleles.
- Discuss the influence of environment on sex determination.
- Know about sex determination and sex linkage.

Activities

6. Preparation of assignment on different topics;
7. Preparation of PPT for presentation in the class;

Points for the discussion:

- Problems on X-linked recessive inheritance e.g. colour blindness
- What are the main characteristics of sex chromosomes (chromosome X and Y)
- Protocol of Karyotyping

Units	Topic	Method	No. of Classes Needed
IV	Extra chromosomal inheritance	Lecture, Discussion	03
	Mechanisms of sex determination in man and other animals. Environmental factors affecting sex determination	do	04
	Barr bodies, dosage compensation, Fragile-X-syndrome, sex influenced dominance, sex limited gene expression, sex linked inheritance, Twins	do	06
	Population genetics	do	03

Learning Outcomes

After going through this unit, you will be able to:

- Know about mutation and classification of mutation.
- Describe clinical characteristics of chromosomal disorders: Down syndrome, Edwards syndrome, Patau syndrome, Turner syndrome, Klinefelter syndrome, 47, XYY syndrome, Cris du chat syndrome.
- Provide the examples of diseases caused by aneuploidy

- State Define terms related to chromosome aberrations and human health: mosaicism, genetic disorder, diploidy, polyploidy, aneuploidy, nondisjunction, deletion, ring chromosome, duplication, inversion, isochromosome, translocation .
- Describe the process of chromosomal nondisjunction during diploid gametes genesis.

Activities

1. Preparation of assignment;
2. Preparation of PPT for presentation in the class;

Points for discussion:

1. How point mutation occurs due to the mismatch base incorporation during replication.
2. What are the effect of mutation on protein development in case of: missense mutation, nonsense mutation, frameshift mutation and silent mutation

References

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). VIII ed. Principles of Genetics. Wiley India.
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3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. XI Edition. Benjamin Cummings.
4. Russell, P. J. (2009). iGenetics- A Molecular Approach. III Edition. Benjamin Cummings.
5. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinantDNA. ASM Press, Washington.
6. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis.