

CURRICULUM TRANSACTIONAL STRATEGY

Course Title: **Genetics**

Course Code: **ZOO-CC-202**

Units	Topic	Method	Activity	No. of Classes Needed
I	Mendel's laws of inheritance (monohybrid and dihybrid crosses with examples);	Lecture, PPT, Discussion	Library/Lab consultation/presentation & assignment	06
	Incomplete dominance and Co-dominance;	do	do	01
	Multiple alleles, lethal alleles,	do	do	04
	Epistasis and Pleiotropy.	do	do	02
	Sex linked inheritance in human beings	do	do	02

Learning Outcomes

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

- Define monohybrid and dihybrid cross.
- Which characters Mendel studied.
- Explain law of purity of gametes.
- Difference between test cross and back cross.
- Distinguish between incomplete dominance and co-dominance.
- Explain multiple alleles with examples
- Define epistasis and pleiotropy.
- Discuss sex linked inheritance in humans with examples.

Points for the discussion:

- How pure gametes are formed.
- Incomplete and co-dominance a limitation of law of Dominance.
- How multiple alleles evolved
- How a normal allele become lethal allele and how it will kill possessor.
- How one gene will mask the phenotypic effect of other gene.
- What are sex linked characters in humans.

References

- Gardner, E. J. , Simmons, M. J. , Snustad, D.P. (2008). Principles of Genetics. VIII. Ed. Wiley India.
- Snustad, D.P. , Simmons, M.J. (2009). Principles of Genetics. V. Ed. John Wiley and sons
- Klug, W.S. , Cummings, M.R., Spencer, C.A. (2012). Concepts of genetics. X Ed. Benjamin Cummings.
- Russell, P.J. (2009). Genetics a molecular approach. III Ed. Benjamin Cummings.
- Griffith, A.J.F., Wessler, S. R. , Lewontin, R.C. and Carroll, S.B. Introduction to Genetic analysis. IX Ed

Unit	Topic	Method	Activity	No. of classes needed
II	Linkage	Lecture, Interaction Discussion with the active involvement of students, power point presentation	Question & Answer Session, Library/presentation	01
	Crossing over and cytological basis of crossing over	Do	do	01
	Molecular basis of crossing over	Do	do	01
	Two factor cross and three factor cross	Do	do	02
	Interference and Coincidence	Do	do	02
	Somatic cell hybridization	Do	do	01

Learning Outcomes

After going through this unit you should be able to:

- Describe the historic background of Linkage
- Define the basic concept of linkage and how it is different from the Mendelian inheritance
- Determine the types of crossing over and the mechanism of recombination
- Determine the cytological and molecular basis of crossing over
- Differentiate between two point and three point cross with examples
- Define Recombination coefficient and how it is related to gene mapping
- Explain the concept of interference and coincidence
- Determine the procedure of somatic cell hybridization and describe the advantages of SCH.

Points for discussion

You may like to dwell upon and try to find answers to some of the following points:

- Define linkage with suitable examples. Describe different types of linkages
- Why Mendel was unable to report the linkages in his famous pea plant experiment?
- What is Crossing over and what are different types of crossing over?
- Explain the cytological and molecular mechanism of crossing over?
- How is three point cross different from two point cross? Explain with examples?
- What is interference and Coincidence. Explain them in detail with examples?

References:

1. Gardner (2000) Principles Genetics. 8th Ed. John Wiley & Sons Inc
2. PS Verma and AK Agarwal (2004) Cell Biology, Genetics, Molecular Biology, Evolution & Ecology S. Chand
3. Power, C.B. (2016), *Cell Biology*, India, Himalayan Publishing House
4. Daniel L. Hartl and Maryellen Ruvolo (2011) Genetics: Analysis of Genes and Genomes. 8th Edition. Laxmi Publications
5. Susan Elrod, William Stansfield and G Bhowmik (2011) GENETICS. McGraw Hill Education; 4 edition
6. Anthony J.F. Griffiths, Susan R. Wessler, Sean B. Carroll, John Doebley (2011) Introduction to Genetic Analysis
7. Encyclopedia of Genetics, Genomics, Proteomics, and Informatics. <http://www.springer.com/in/book/9781402067532>

Unit	Topic	Method	Activity	No. of classes needed
III	Mutation and Quantitative genetics	Lecture, Interaction Discussion with the active involvement of students, power point presentation	Question & Answer Session, Library/presentation	03
	Gene mutation	do	do	02
	Induced and spontaneous mutations	do	do	01
	Chemical genes	do	do	01
	Detection of mutations			01
	Polygenic inheritance	do	do	01
	Transgressive variations	do	do	01

Learning Outcomes

After going through this unit you should be able to:

- Give the background of mutation with detailed historic perspective
- Explain the emergence of modern mutation theory
- Describe the main characteristics of mutations
- Provide information about the general pattern of mutations
- Give detailed information about mutational disorders in humans
- Explain the various types of mutations
- Differentiate between Induced and spontaneous mutations
- Explain different types of chemical mutagens and their mechanism of initiation of mutation
- Describe the methods used to detect mutation in living organisms
- Know about the inheritance and mechanism of polygenic traits

Points for discussion

You may like to dwell upon and try to find answers to some of the following points:

- What is mutation? How mutations play an important role in evolution?
- Describe different types of mutations.? How are base substitution mutations different from other mutations?
- What are the main characteristics of mutations?
- How are induced mutations altering the phenotypic variations among populations?
- Explain in detail the methods used for the detection of mutations with emphasis on CIB method?
- Describe the various aspects of polygenic inheritance?
- What is transgressive variations and explain their advantages?

References:

1. Gardner (2000) Principles Genetics. 8th Ed. John Wiley & Sons Inc
2. PS Verma and AK Agarwal (2004) Cell Biology, Genetics, Molecular Biology, Evolution & Ecology S. Chand
3. Power, C.B. (2016), *Cell Biology*, India, Himalayan Publishing House
4. Daniel L. Hartl and Maryellen Ruvolo (2011) Genetics: Analysis of Genes and Genomes. 8th Edition. Laxmi Publications
5. Susan Elrod, William Stansfield and G Bhowmik (2011) GENETICS.McGraw Hill Education; 4 edition
6. Anthony J.F. Griffiths, Susan R. Wessler, Sean B. Carroll, John Doebley (2011) Introduction to Genetic Analysis

7. Encyclopedia of Genetics, Genomics, Proteomics, and Informatics.
<http://www.springer.com/in/book/9781402067532>

Unit	Topic	Method	Activity	No. of classes needed
IV	Extra Chromosomal Inheritance and Human Genetics	Lecture, PPT, Discussion	Library / Lab consultation/ assignment & presentation	15
	Criteria for extra chromosomal inheritance	do	do	01
	Mitochondrial mutation and maternal effects	do	do	02
	Genetic disorders – Down syndrome, Turner & Klinefelter syndrome, Chronic Myeloid Leukemia, Cystic Fibrosis, Phenylketonuria	do	do	08
	Sex determination in Man and Animals	do	do	02
	Organization of Human Genome	do	do	01
	Genetic Counseling	do	do	01

Learning Outcomes

After going through this unit the students should be able to:

- Define what is extra-chromosomal inheritance?
- Criteria used for extra-chromosomal inheritance.
- How mitochondrial mutations are transmitted?
- Differentiate various genetic disorders, what is the cause?
- Understand the role of chromosomes, hormones, environment in the sex determination of Man and Animals.
- Define Human Genome.
- Define Genetic counseling and what is the use of genetic counseling in Medical Sciences?

Points for discussion

- We discussed about extra-chromosomal inheritance and differences between cytoplasmic and maternal inheritance with examples. We also discussed human genetics with different syndromes.

References:

1. **Principles of Genetics** by Gardner (Author), Simmons (Author), Snustad (Author) Lindquist, E. F. (ed), (1951), Educational Measurement, Washington D C; American Council on Education.
2. **Concepts of Genetics** by Klug/Cummings/Spencer.
3. **Essentials of Genetics** by Renu Chauhan.
4. **Genetics: Analysis of Genes and Genomes: 8th Edition** by Daniel L. Hartl and Maryellen Ruvolo.
5. **Genetics** by Strickberger