Course Title: Chromosomal & Extra-chromosomal Inheritance		
Course Code: Zool.M.631	**Course Type:** Theory (Core Course, Mandatory)	**Credits:** 4
Full Marks: 100	**Total Lecture hours:** 60	**Exam Hours:** 4

Course Description

This course has been designed to introduce the students with chromosomal and extra-chromosomal basis of heredity in *Drosophila*, man and other animals. It will provide detailed description on the types of eukaryotic chromosomes, and inheritance of autosomal and sex chromosomal genes in various animals. Elaborate aspects of multiple alleles and pseudoalleles, and mutations along their practical applications are also included. In addition, mechanisms of extra-chromosomal or cytoplasmic inheritance in model animals, various mechanisms of sex determination and sex differentiation will be dealt with, which would help the learners understand the nature of inheritance of various traits in a wide range of animals.

Course Learning Objectives:

1. To provide the graduate students an in-depth knowledge of the chromosomal basis of heredity, multiple alleles vs. pseudoalleles and mutations with ample examples;
2. To present detailed information on extra-chromosomal inheritance and various mechanisms of sex determination in animals; and
3. To fortify the students' knowledge and understanding of the classical genetics already achieved from the undergraduate courses.

Course Learning Outcomes (CLOs)

After completion of the lectures on **Chromosomal basis of heredity, Multiple alleles and pseudoalleles, Mutations, Extra-chromosomal inheritance and Sex determination**, the learners will be able to:

Note: Lectures 1-7 will be taken by Dr. Sharmin Mustari; Lectures 8-15 by Prof. Dr. M. S. Islam

1. Differentiate autosomes from sex chromosomes; distinguish between autosomal and X-linked recessive and dominant traits.
2. Compare the inheritance of Y-linked and Z-linked genes in different animals.
3. Describe the sex-influenced and sex-limited traits in man and other animals.
4. Explain the genetic basis of ABO blood groups (multiple alleles) and Rh antigens (pseudoalleles) and understand the medico-legal applications of blood groups in man.
5. Discuss the multiple alleles associated with the coat colour inheritance in rabbits.
6. Classify gene mutations, understand their molecular mechanisms and describe various methods of detecting gene mutations.
7. Identify chromosomal mutations and their sub-types, compare gene and chromosomal mutations and demonstrate practical applications of mutations and their role in evolution.
8. Contrast nuclear genes vs. plasmagenes and explain the inheritance of kappa particles in *Paramecium*.
9. Explain the inheritance of sigma particles in *Drosophila* and mammary carcinoma (MCa) gene in lab mice.
10. Demonstrate maternal effect of shell coiling in the land snail *Limnaea peregra.*
11. Classify types of chromosome and various mechanisms of sex determination in a wide range of animals.
12. Identify different sexual abnormalities in man and other animals.
13. Explain sex differentiation in man and disorders associated with sex differentiation.
14. Describe the role of Y chromosome and SRY gene in sex differentiation.
15. Understand Lyon's hypothesis, dosage compensation and its mechanisms in man and other animals, and the importance of Barr body in confirming the genetic sex of an individual.

Course contents, teaching-learning processes and alignment of topics with CLOs

Course contents	Teaching-learning processes	Alignment of topics with CLOs	LH

Chromosomal basis of heredity			
	• Lecture • Open discussion	CLO 1 CLO 2	2
	• Lecture • Group discussion	CLO 3	2
Multiple alleles and pseudoalleles			
	• Lecture • Open discussion • Exercise	CLO 4	2
	• Lecture • Open discussion • Exercise	CLO 5	2
Mutations	•		
	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 6	2
	• Lecture • Open discussion • Exercise	CLO 7	2
Extra-chromosomal inheritance	•		
Nuclear genes vs. plasmagenes; Inheritance of kappa particles in *Paramecium*.	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 8	2
Inheritance of sigma particles in *Drosophila*, Mammary carcinoma (MCa) gene in lab mice	• Lecture • Open discussion • Exercise	CLO 9	2
Maternal effect of shell coiling in the land snail *Limnaea peregra*	• Lecture • Open discussion	CLO 10	2
Sex determination			
Classification of chromosomes and various mechanisms of sex determination in animals	• Lecture • Open discussion • Exercise	CLO 11	2
Various sexual abnormalities in man and other animals	• Lecture • Group discussion • Exercise	CLO 12	2
Sex differentiation in man and disorders associated with it	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 13	2
Role of Y chromosome and SRY gene in sex differentiation	• Lecture • Open discussion	CLO 14	2
Lyon's hypothesis, dosage compensation and its mechanisms in man and other animals; importance of Barr body	• Lecture • Group discussion • Debates	CLO 15	2

Assessment Strategies			
Types of Assessment	**Components**	**Marks**	**Methods of Assessment**
Final Written Examination	Broad Questions	35	As mentioned in Zool.M.611 (Page No.)
	Short Questions	35	
Continuous Assessment	Attendance	10	
	Tutorial	20	

Learning Resources:

Ahlusalia, K.B. : Genetics
Alberts *et al*. : Molecular biology of the cell.
Altenberg, E. : Genetics
Auerbach, C. : Mutation Research
Ayala, F.J & Kiger, Jr. : Modern Genetics
Burns, G.W. : The Science of Genetics
Darke, J.W. : The molecular basis of mutation
Darlington, C.D. & Lacour, L.F. : The handling of chromosomes
Dupraw, T.E.J. : DNA and chromosome
Emery, AEH & Mueller, R.F. : Elements of Medical Genetics
Freifelder, D. : Molecular Biology
Islam, M.S. 2018 : Selected Lectures on Genetics
Klung, S.W. & Cummings, R.M. : Essentials of Genetics
Lowey, A.C. & Siekevitz, P. : Cell Structure and Function.
Novitski, E. : Human genetics
Rashid, K. M. *et al.* : Text book of community medicine and public health.
Singleton, W.R. : Elementary Genetics
Sinnott, *et al*. : Principles of Genetics
Snyder, A.L. *et al.* : General Genetics
Stern, E. : Principles of human Genetics
Strickberger, M.W. : Genetics
Sutton, H.E. : An introduction to human Genetics
Suzuki, D.T. & Griffiths, A.J.F. : An introduction to Genetic analysis
Swanson, C.P. : The Cell Structure.
Verma, P.S. & Agarwala, V.K. : Genetics / Cytology
Watson, J.D. *et al.* : Molecular Biology of the Gene.
Winchester, A.M. : Genetics.
ইসলাম, এম.সা. ও অন্যান্য (২০১৭) : জেনেটিক্স: মিল ও অমিলের বিজ্ঞান।
খান, হা.সা. ও ইসলাম, এম.সা. (২০১১) : জৈবপ্রযুক্তি ও জীন প্রকৌশল।

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