

# **COURSE OUTLINE**

## **SOCR 330, Spring 2013**

- | <u><b>Chapter</b></u> | <u><b>Topic</b></u>  |
|-----------------------|--|
| 1.                    | <b>“An Introduction to Genetics”</b> <ul style="list-style-type: none"><li>1.1 Genetics has a rich history</li><li>1.2 From Mendel to DNA</li><li>1.3. The era of molecular genetics</li><li>1.4 Recombinant DNA technology</li><li>1.5 Impact of Biotechnology</li><li>1.6 Genomics, Proteomics and Bioinformatics</li><li>1.7 Model Organisms</li></ul>  |
| 2.                    | <b>“Mitosis and Meiosis”</b> <ul style="list-style-type: none"><li>2.1 Cell structure</li><li>2.2 Homologous chromosomes, haploidy and diploidy</li><li>2.3 Mitosis and the cell cycle</li><li>2.4 Meiosis</li><li>2.5 Spermatogenesis and Oogenesis</li><li>2.6 Significance of meiosis</li><li>2.7. Electron microscopy of mitotic chromosomes (covered briefly)</li></ul>   |
| 3.                    | <b>“Mendelian Genetics”</b> <ul style="list-style-type: none"><li>3.1 Gregor Johann Mendel</li><li>3.2 Monohybrid cross</li><li>3.3 Dihybrid cross</li><li>3.4 Trihybrid cross</li><li>3.5 Rediscovery of Mendel’s work</li><li>3.6 Independent assortment</li><li>3.7 Probability and genetic events</li><li>3.8 Evaluating genetic data-Chi square</li><li>Read page 54 Online Mendelian Inheritance in Man</li></ul>  |
| 4.                    | <b>“Modifications of Mendelian Ratios”</b> <ul style="list-style-type: none"><li>4.1 Alleles</li><li>4.2 Function and symbols of an allele</li><li>4.3 Incomplete dominance</li><li>4.4 Codominance</li><li>4.5 Multiple alleles</li><li>4.6 Lethal alleles</li><li>4.7, 4.8 Combinations of two gene pairs and gene interaction</li><li>4.9 Complementation</li><li>4.10 Pleiotropy</li><li>4.11 Genes on the X-chromosome</li><li>4. 12 Sex limited and sex influenced inheritance</li><li>4.13 Genetic background and environmental effect on gene expression</li><li>4.14 Extranuclear inheritance</li></ul> |

5. **“Sex Determination and Sex Chromosomes”**
  - 5.1 Sexual differentiation
  - 5.2 X and Y chromosomes
  - 5.3, 5.4 Chromosome composition and sex determination
  - 5.5 Dosage Compensation
  - 5.6, 5.7 Sex Determination other controlsRead page 107 A Question of Gender: Sex Selection in Humans
  
6. **“Chromosome Mutations: Variation in Number and Arrangement”**
  - 6.1 Variation in chromosome number
  - 6.2 Monosomy and Trisomy
  - 6.3 Polyploidy and its origins
  - 6.4 Variations in chromosome structure
  - 6.5, 6.6, 6.7 Deletions, duplications, inversions
  - 6.8 Translocations
  - 6.9. Fragile Site in the Human genome (covered briefly)Read page 128 Down syndrome, prenatal testing
  
7. **“Linkage and Chromosome Mapping in eukaryotes”**
  - 7.1 Linkage versus independent assortment
  - 7.2 Incomplete linkage/crossing over
  - 7.3 Three point mapping
  - 7.4 Mapping and distance between genes
  - 7.5, 7.6 Mapping in Drosophila and Humans
  - 7.9 Mendel and LinkageRead page 152 Why didn't Mendel find linkage?
  
9. **“DNA Structure and Analysis”**
  - 9.1 Characteristics of the genetic material
  - 9.2-9.4 Early Studies/Historical evidence
  - 9.5 RNA as genetic material
  - 9.6 The structure of DNA
  - 9.7 Alternative forms of DNA
  - 9.8 The structure of RNA
  - 9.9 Analysis of nucleic acids and Nucleic Acids can be separated using electrophoresis
  
10. **“DNA Replication and Synthesis”**
  - 10.1 The mode of DNA replication
  - 10.2 Synthesis of DNA in Microorganisms
  - 10.3, 10.4 DNA synthesis: A model
  - 10.5 Control of replication
  - 10.6 Eukaryotic DNA synthesis
  - 10.7 DNA replication, telomerase, and telomeresRead page 221 Telomerase: The Key to Immortality?

11. **“Chromosome Structure and DNA Sequence Organization”**
  - 11.1 Viral and Bacterial Chromosomes
  - 11.2 Mitochondrial and Chloroplast DNA
  - 11.3 Specialized Chromosomes
  - 11.4 Organization of Chromatin in Eukaryotes
  - 11.5, 11.6 DNA Sequence Organization in Eukaryotes
  
12. **“The Genetic Code and Transcription”-**
  - 12.1-12.2 The genetic code an overview
  - 12.3 Deciphering the code
  - 12.4-12.6 The coding dictionary/Universality of the code
  - 12.8-12.9 Transcription: RNA synthesis
  - 12.10 Transcription in Eukaryotes
  - 12.11 Intervening sequences and split genes

Read page 257 Gene Silencing: Attacking the Messenger
  
13. **“Translation and Proteins”**
  - 13.1 Translation-components
  - 13.2, 13.3 Translation-the process in Prokaryotes
  - 13.4 Translation in Eukaryotes
  - 13.5 Proteins, heredity and metabolism
  - 13.6 One-gene: one-enzyme hypothesis
  - 13.7 One-gene: one polypeptide
  - 13.8 Protein structure and biological diversity
  - 13.9 Protein function in many roles
  
14. **“Gene Mutation, DNA Repair and Transposable Elements”**
  - 14.1 Classification of mutations
  - 14.2 Spontaneous mutation rate
  - 14.3 Induced mutation, UV radiation/skin cancer
  - 14.4 Repair of DNA
  - 14.8 Transposable genetic elements

Read page 303 Sequence alignment to identify a mutation
  
15. **“Regulation of Gene Expression”**
  - 15.1 Genetic regulation in prokaryotes
  - 15.2, 15.3 Lactose metabolism: Inducible system
  - 15.4, 15.5 “Tryptophan metabolism: Repressible system
  - 15.6 Genetic regulation in eukaryotes
  - 15.7, 15.10 Eukaryotic gene expression and transcription factors/gene regulation
  15. 11 Post transcriptional modification and gene regulation
  - 15.12 RNA induced gene silencing

Read page 330 Tissue specific gene expression

16. **“Cell-Cycle Regulation and Cancer”**
  - 16.1, 16.2 What is cancer
  - 16.3 The cell cycle and cancer
  - 16.4 Tumor suppressor genes and Proto-oncogenes
  - 16.5 Cancer cells metastasize
  - 16.6 Inheritance of cancer
  - 16.7, 16.8 Viruses and environmental agents contribute to cause cancerRead page 347 Breast Cancer: The Double-Edged Sword of Genetic Testing
  
17. **“Recombinant DNA Technology”**
  - 8.1, 8.2 Growth and Genetic recombination in bacteria
  - 8.4 Plasmids
  - 8.5 Transformation in bacteria
  - 8.6 Bacteriophage
  - 17.1, 17.2 Recombinant DNA technology
  - 17.3 Cloning in host cells
  - 17.4 Polymerase chain reaction cloning of DNA molecules
  - 17.5, 17.6 DNA libraries
  - 17.7 Characterizing cloned sequences
  - 17.8 DNA sequencingP 177 Cholera and edible vaccines
  
18. **“Genomics Bioinformatics and Proteomics”**
  - 18.1 Genomic analysis
  - 18.2 Bioinformatics
  - 18.3 Functional genomics
  - 18.4 Human Genome Project
  - 18.5 Omics revolution
  - 18.6-18.7 Comparative Genomics
  - 18.8 Metagenomics
  - 18.9 Transcriptome analysis
  - 18.10 Proteomics
  
19. **“Application and Ethics of Genetic Engineering”**
  - 19.1 Genetically engineered organisms
  - 19.2 Genetic engineering has revolutionized agriculture
  - 19.3 Transgenic animals
  - 19.4 Medical diagnosis and genetic engineering
  - 19.5 Medical therapies
  - 19.6 DNA profiling
  - 19.7 Ethical issues and gene therapyP. 429 Personal Genome Projects
  
22. **“Quantitative Genetics”**
  - 22.1 Continuous variation and quantitative inheritance

22.2 Quantitative genetics in Mendelian terms

22.3 Analysis of polygenic traits

21.4 Heritability (covered briefly)

P. 477 The Green Revolution Revisited

23. **“Population Genetics”**

23.1 Allele frequencies in populations

23.2 Hardy-Weinberg law

23.3 Extension and use of Hardy-Weinberg law

23.4-23.9 Natural selection and forces that drive allele frequency  
(covered very briefly)

24. **“Conservation Genetics” (If time allows)**

24.1 Genetic diversity and conservation genetics

24.2 Population size and species survival

24.3 Genetic effects on decreased population size

24.4 Genetic erosion (covered briefly)

24.5 Conservation of genetic diversity (covered briefly)

Read page 550 Gene Pools and Endangered Species: The Plight of the  
Florida Panther