

Developmental Curriculum for Base Pair 2004-2005

First Semester Course Guideline (Molecular Biology and Biomedical Research)

Course Philosophy: The intent of this course is to prepare students to participate in advanced research activities in a medical setting. Therefore, the students must:

- A. Learn to work as a team
- B. Work with self-discipline
- C. Study collectively
- D. Be thorough in academic pursuits
- E. Be prompt and dedicated to the course

Course Outline:

1st Week:

State Framework (Molecular Biology and Biomedical Research) Competencies:

- Utilize critical thinking and scientific problem in designing and performing biological research and experimentation. (Molecular and Biomedical)
- Investigate the use of the WWW, through the Internet, to identify current, topical advances in biomedical research and healthcare areas. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)
- Describe key areas of human physiology towards which major commitment of United States federal funding of biomedical research is applied. (Biomedical)
- An orientation to the Base Pair Program will be given and required paperwork completed.

The student will:

- 1) Read expectations of course and complete required paperwork including:
 - a) Student information
 - b) Parental consent
 - c) Safety contracts
- 2) Actively participate in an overview of computer skills and complete one document from each Microsoft application:
 - a) Word (define Base Pair as it relates to biomedical uses)
 - b) PowerPoint (presentation Biotechnology and Me - 6 slides minimum)

2nd – 3rd Week:

State Framework (Molecular Biology and Biomedical Research) Competencies:

- Utilize critical thinking and scientific problem in designing and performing biological research and experimentation. (Molecular and Biomedical)
- Investigate the use of the WWW, through the Internet, to identify current, topical advances in biomedical research and healthcare areas. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)

- Describe key areas of human physiology towards which major commitment of United States federal funding of biomedical research is applied. (Biomedical)
- Explore the processes and technologies by which biomedical scientific literature is stored, catalogued and retrieved. (Biomedical)
- Investigate the use of the WWW, through the Internet, to identify current, topical advances in biomedical research and healthcare areas. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)

The student will:

- 1) Actively participate in an overview of writing scientific papers and receive training in the proper format of the following writing applications.
 - a) Abstracts
 - b) Lab Reports
 - c) Research Papers
 - d) Lab notebook
 - e) Critiques
- 2) Begin work in *Molecular Biology* text chapters 1-2 as study groups and discuss
- 3) Receive orientation at Rowland Medical library
- 4) Utilize library orientation at the Rowland Medical Library. Methods of gathering materials through electronic database search will be stressed.
 - a) Employ traditional and computer-based library search
 - b) Readers guides
 - c) CD-ROM information data bases
 - d) ERIC
 - e) Psych Lit
 - f) Medline
 - g) CINAHL
 - h) Health
- 5) Observe specific areas of library research
 - a) Biomedical Science
 - b) Biotechnology
 - c) Bioethics
- 6) Research UMMC faculty mentors through various applications
 - a) Citations from the mentors' research
 - b) Telephone interviews
 - c) Visits (by appointment only)
- 7) Discuss summer required reading (*The Hot Zone*)

4th and 5th Weeks:

State Framework (Molecular Biology and Biomedical Research) Competencies:

- Utilize critical thinking and scientific problem solving in designing and performing research and experimentation. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)
- Explore the basic elements of genetics and molecular biology that are fundamental to modern biomedical research. (Biomedical)

- Describe key areas of human physiology towards which major commitment of United States federal funding of biomedical research is applied. (Biomedical)
- Demonstrate proficiency in the application of fundamental and technical procedures related to biomedical research activities. (Biomedical)
- Review the structure, functions, and processes of the cell involved in maintaining life. (Molecular)
- Describe the mechanisms of gene expression in prokaryotic and eukaryotic cells. (Molecular)

The student will:

- 1) Read Chapters 3 - 4: *Molecular Biology*
- 2) Continue research on mentors
- 3) Research and discuss: *The Human Genome Project*
- 4) Observe HHMI - *Scanning Life's Matrix* – Reading Genes and Genomes
- 5) Distinguish between *Molecular Biology* and *Molecular Genetics*
- 6) Explain the terminology *Genetically Engineered*
- 7) Discuss: *The Advantages/Disadvantages of Genetic Engineering*
- 8) Complete lab techniques – Making gels
- 9) Complete lab techniques – Pipetting
- 10) Complete lab techniques – DNA fingerprinting (CSI Murrah)
- 11) Complete lab techniques – Reading DNA
- 12) Complete lab techniques – Electrophoresis
- 13) Construct lab reports on Reading DNA and CSI Murrah

6th – 7th Week:

State Framework (Molecular Biology and Biomedical Research) Competencies:

- Utilize critical thinking and scientific problem solving in designing and performing research and experimentation. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)
- Describe key areas of human physiology towards which major commitment of United States federal funding of biomedical research is applied. (Biomedical)
- Demonstrate proficiency in the application of fundamental and technical procedures related to biomedical research activities. (Biomedical)
- Describe important principles of organic chemical reactions that form the basis of life processes. (Biomedical)
- Review the structure, functions, and processes of the cell involved in maintaining life. (Molecular)
- Investigate the structure and function of DNA. (Molecular)
- Analyze the roles of DNA and RNA in Protein Synthesis. (Molecular)
- Investigate the basic tools and techniques used to manipulate DNA. (Molecular)
- Utilize critical thinking and scientific problem solving in designing and performing research and experimentation. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical))
- Review the structure, functions, and processes of the cell involved in maintaining life. (Molecular)

The student will:

- 1) Research and Discuss: *Organic Molecules*
- 2) Complete Interactive Biology CD-Rom: *Organic Chemistry*
- 3) Research biochemistry and applications related to biomedical science
- 4) Design models of Basic Organic Molecules
- 5) Complete Interactive Biology CD-Rom: *Biochemistry*
- 6) Complete Interactive Biology CD-Rom: *DNA: The Molecule of Life*
- 7) Design a model of DNA
- 8) Demonstrate DNA Replication
- 9) Read Chapters 5-7: Molecular Biology
- 10) Discuss: *Protein Synthesis*
- 11) Research and debate the biethical implications of DNA registration
- 12) Complete a PowerPoint presentation on organic molecules (6 slides minimum)
- 13) Rowland research on biochemistry related biomedical research
- 14) Observe HHMI - *Scanning Life's Matrix* – Probing Genes and Genomes
- 15) Present mentor research projects to class

8th Week:

State Framework (Molecular Biology and Biomedical Research) Competencies:

- Utilize critical thinking and scientific problem solving in designing and performing research and experimentation. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)
- Explore the basic elements of genetics and molecular biology that are fundamental to modern biomedical research. (Biomedical)
- Describe key areas of human physiology towards which major commitment of United States federal funding of biomedical research is applied. (Biomedical)
- Demonstrate proficiency in the application of fundamental and technical procedures related to biomedical research activities. (Biomedical)
- Review the structure, functions, and processes of the cell involved in maintaining life. (Molecular)
- Investigate the basic tools and techniques used to manipulate DNA. (Molecular)

The student will:

- 1) Read Chapter 8-10: *Molecular Biology*
- 2) Discuss: Protein synthesis and products from biotechnology
- 3) Complete Interactive Biology CD-Rom: *Mendel's Principles of Heredity*
- 4) Read Chapter 26: *History of Molecular Biology and Genetics*
- 5) Outline the History of Genetics 1800 – 2002
- 6) Construct a Timeline of the History of Genetics 1800 – 2002
- 7) Research DNA interactive DVD – Plasmid Insertion
- 8) Complete lab – Bacterial Transformation
- 9) Write lab report on bacterial transformation
- 10) Research and discuss bacterial transformation pros and cons (FEAR factor)

9th -10th Weeks:

State Framework (Molecular Biology and Biomedical Research) Competencies:

- Utilize critical thinking and scientific problem solving in designing and performing research and experimentation. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)
- Explore the basic elements of genetics and molecular biology that are fundamental to modern biomedical research. (Biomedical)
- Analyze contemporary issues related to the practice or application of Biomedical research that pose and ethical dilemma for society. (Biomedical)
- Describe key areas of human physiology towards which major commitment of United States federal funding of biomedical research is applied. (Biomedical)
- Demonstrate proficiency in the application of fundamental and technical procedures related to biomedical research activities. (Biomedical)
- Review the structure, functions, and processes of the cell involved in maintaining life. (Molecular)
- Describe the mechanisms of gene expression in prokaryotic and eukaryotic cells. (Molecular)
- Investigate the basic tools and techniques used to manipulate DNA. (Molecular)

The student will:

- 1) Read Chapters 8-10: *Messing with DNA*
- 2) Discuss: *Gene Expression and Manipulation*
- 3) Complete Interactive Biology CD-Rom: *Genetic Engineering*
- 4) Complete Interactive Biology CD-Rom: *Exploring Biology: Careers and Issues*
- 5) Conduct Investigation: *Paper Gene Splicing*
- 6) Conduct Investigation: *pGLO Transformation*
- 7) Complete Lab Report
- 8) Conduct Investigation: *Green Fluorescent Chromatography*
- 9) Complete Lab Report
- 10) Watch and Discuss Video: *Medicine Man*
- 11) Discuss: *Marketing Genetically Engineered Proteins/Drugs*
- 12) Conduct Investigation: *Secrets of the Rainforest*
- 13) Complete Lab Report
- 14) Debate #1: *Advantages/Disadvantages of Marketing a Recombinant Protein/Drug*
(25 points)
- 15) Read Chapter 16,17 & 23: *Techniques, PCR, Sequencing*
- 16) Role play PCR
- 17) Conduct Investigation: *PCR*
- 18) Complete Lab Report on Investigation #16

11th – 12th Weeks:

State Framework (Molecular Biology and Biomedical Research) Competencies:

- Utilize critical thinking and scientific problem solving in designing and performing research and experimentation. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)
- Analyze contemporary issues related to the practice or application of Biomedical research that pose and ethical dilemma for society. (Biomedical)

- Describe key areas of human physiology towards which major commitment of United States federal funding of biomedical research is applied. (Biomedical)
- Demonstrate proficiency in the application of fundamental and technical procedures related to biomedical research activities. (Biomedical)
- Review the structure, functions, and processes of the cell involved in maintaining life. (Molecular)
- Investigate the basic tools and techniques used to manipulate DNA. (Molecular)

The student will:

- 1) Conduct Investigation: *Analysis of Precut Lambda DNA*
- 2) Complete Lab Report on Investigation
- 3) Conduct Investigation: *Restriction Digestion and Analysis of Lambda DNA*
- 4) Complete Lab Report on Investigation #18
- 5) Read Chapter 18: *Whodunit?*
- 6) Conduct Investigation: *DNA Fingerprinting*
- 7) Complete Lab Report on Investigation
- 8) Debate #2: *DNA Evidence is accurate and reliable*
- 9) Narrow Mentor List

13th -14th Weeks:

State Framework (Molecular Biology and Biomedical Research) Competencies:

- Utilize critical thinking and scientific problem solving in designing and performing research and experimentation. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)
- Analyze contemporary issues related to the practice or application of Biomedical research that pose an ethical dilemma to our society. (Biomedical)
- Describe key areas of human physiology towards which major commitment of United States federal funding of biomedical research is applied. (Biomedical)
- Review the structure, functions, and processes of the cell involved in maintaining life. (Molecular)

The student will:

- 1) Read Chapter 22: *The Immune System at Work*
- 2) Observe HHMI- Confronting Microbes: *Lecture 3 Chapter 5*
- 3) Conduct Investigation: *Does This Building Have Safe Water?*
- 4) Complete Lab Report on Investigation
- 5) Debate #3: *Does This Building have Safe Water?*
- 6) Design Presentation or Informative Bulletin
- 7) Narrow Mentor List

15th Week:

State Framework (Molecular Biology and Biomedical Research) Competencies:

- Utilize critical thinking and scientific problem solving in designing and performing research and experimentation. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)
- Describe key areas of human physiology towards which major commitment of United States federal funding of biomedical research is applied. (Biomedical)
- Review the structure, functions, and processes of the cell involved in maintaining life. (Molecular)

The student will:

- 1) Read Chapter 22: *Biological Warfare*
- 2) Watch and Discuss Video: *Outbreak*
- 3) Observe HHMI- Confronting Microbes: *Lecture 1 Chapter 1-20,27*
- 4) Discuss: *How Diseases are Transmitted*
- 5) Observe HHMI- Confronting Microbes: *Lecture 2 Chapter 13-37*
- 6) Observe HHMI- Confronting Microbes: *Lecture 4 Chapter 4-5,22,25,31-32*
- 7) Conduct Investigation: *Elisa Test*
- 8) Complete Lab Report on Investigation
- 9) Read Book: Demon in the Freezer

16th - 17th Weeks:

State Framework (Molecular Biology and Biomedical Research) Competencies:

- Utilize critical thinking and scientific problem solving in designing and performing research and experimentation. (Biomedical)
- Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)
- Analyze contemporary issues related to the practice or application of Biomedical research that pose and ethical dilemma for society. (Biomedical)
- Describe key areas of human physiology towards which major commitment of United States federal funding of biomedical research is applied. (Biomedical)
- Review the structure, functions, and processes of the cell involved in maintaining life. (Molecular)

The student will:

- 1) Read Chapters 12-14: *Mutations and Diseases*
- 2) Discuss: *Molecular Basis of Cancer*
- 3) Conduct Investigation: *Mutations and Cancer*
- 4) Complete Lab Report on Investigation
- 5) Narrow Mentor List to One
- 6) Discuss: Demon in the Freezer
- 7) Summarize Demon in the Freezer

18th Week:

State Framework (Molecular Biology and Biomedical Research) Competencies:

- *Utilize critical thinking and scientific problem solving in designing and performing research and experimentation. (Biomedical)*
- *Communicate the scientific background of, technical approach to, major results from, and conclusions pertaining to contemporary professional biomedical research publications. (Biomedical)*
- *Analyze contemporary issues related to the practice or application of Biomedical research that pose an ethical dilemma to society. (Biomedical)*
- *Describe key areas of human physiology towards which major commitment of United States federal funding of biomedical research is applied. (Biomedical)*
- *Review the structure, functions, and processes of the cell involved in maintaining life. (Molecular)*

The student will:

- 1) Read Chapter 15: *Down on the Farm*
- 2) Debate *Transgenic Food Products*
- 3) Submit Selected Mentor Name