Introductory Biotechnology Workshop for High School Teachers

Monday, June 24, 2013 – Friday, June 28, 2013

**Workshop Activities Schedule**

# Day 1: Monday, June 24, 2013

9:00 – 9:30 Registration/Welcome/Workshop Overview

9:30 – 10:10 Lecture/Discussion: Introduction to biotechnology; DNA structure and function

10:10 – 10:50 Activity: Constructing a paper DNA model

10:50 – 11:10 Break

11:10 – 12:00 Lecture/Discussion: Introduction to gene expression and gene regulation, and their relationship to cell differentiation/specialization; Protein structure and function and their relationship to specific phenotypes/traits

12:00 – 1:00 Lunch

1:00 – 3:00 Laboratory: Laboratory biosafety issues (including safely growing, storing and disposing of *E. coli* in the lab; proper handling of cultures and disinfection of materials and work areas); Sterile technique; Making and sterilizing solutions and media needed for classroom experiments; Classroom preparation for wet labs; Practice pipetting;

3:00 – 3:20 Break

3:20 – 4:30 Activity: From genes to proteins

4:30 – 5:00 Review/Discussion

# Day 2: Tuesday, June 25, 2013

9:00 – 9:30 Review/Discussion

9:30 – 10:30 Lecture/Discussion: Introduction to recombinant DNA technology; Restriction enzymes and their role in recombinant DNA technology; Restriction analysis of DNA

10:30 – 10:50 Break

10:50 – 11:30 Activity: DNA Scissors: Introduction to Restriction Enzymes; DNA Goes to the Races

11:30 – 12:00 Laboratory: Preparing, handling, and staining agarose gels; Restriction mapping of plasmid DNA: Part 1 (Pour gels)

12:00 – 1:00 Lunch

1:00 – 2:40 Laboratory: Restriction mapping of plasmid DNA: Part 2 (Digest DNA, load and run gels)

Activity: Restriction analysis of Lambda DNA; Restriction analysis challenge worksheets (while gels are running)

2:40 – 3:00 Break

3:00 – 4:30 Laboratory: Restriction mapping of plasmid DNA: Part 3 (Capture digital images and analyze gels)

4:30 – 5:00 Review/Discussion

# Day 3: Wednesday, June 26, 2013

9:00 – 9:20 Review/Discussion

9:20 – 10:00 Lecture/Discussion: Organization of prokaryotic DNA; How bacteria acquire antibiotic resistance; Transformation of *E. coli*

10:00 – 10:40 Activity: Transformation of *E. coli*; Recombinant paper plasmids

10:40 – 11:00 Break

11:00 – 12:00 Laboratory: Transformation of *E. coli* to generate streptomycin-resistant and GFP-expressing cells*:* Part 1 (Transform colonies and plate to detect transformants)

12:00 – 1:00 Lunch

1:00 – 1:40 Activity: Recombinant paper plasmids

1:40 – 2:20 Lecture/Discussion: The molecular biology of gene cloning; Difference between gene cloning and somatic cell nuclear transfer; stem cells and cloning to harvest embryonic stem cells

2:20 – 2:50 Break

2:50 – 3:50 Lecture/Discussion: Societal issues related to applications of biotechnology, including genetically engineered plants, stem cell research, and ramifications of the Human Genome Project

3:50 – 4:50 Activity: Sizes of the *E. coli* and human genomes

4:50 – 5:00 Review/Discussion

# Day 4: Thursday, June 27, 2013

9:00 – 9:20 Review/Discussion

9:20 – 10:00 Laboratory/Activity: Transformation of *E. coli* to generate streptomycin-resistant and GFP-expressing cells: Part 2 (Examine plates, p. 303)

10:00 – 10:20 Break

10:20 – 11:00 Lecture/Discussion: The polymerase chain reaction in theory and practice

11:00 – 12:30 Laboratory: Using a thermal cycler (specifically the thermal cycler available through the Center’s Equipment Loan Program); “[Using a single nucleotide polymorphism (SNP) to predict bitter tasting ability](http://www.carolina.com/product/ptc+pcr+dna+extraction+and+amplification+kit+with+0.5-ml+tubes.do?keyword=pcr&sortby=bestMatches): Part 1” (Isolate DNA, amplify DNA by PCR)

12:30 – 1:30 Lunch

1:30 – 2:30 Activity: DNA amplification by PCR; Paper PCR activity

Computer Activity: PCR and gel electrophoresis simulation (from the University of Utah Genetics Learning Center)

Computer Activity: Introduction to bioinformatics to examine the genomic organization of the PTC taste receptor

2:30 – 3:00 [Using a single nucleotide polymorphism (SNP) to predict bitter tasting ability](http://www.carolina.com/product/ptc+pcr+dna+extraction+and+amplification+kit+with+0.5-ml+tubes.do?keyword=pcr&sortby=bestMatches): Part 2 (Digest DNA and store overnight)

3:00 – 3:30 Break

3:30 – 5:00 Teacher directed open forum

# Day 5: Friday, June 28, 2013

9:00 – 9:20 Review/Discussion

9:20 – 10:50 Laboratory: [Using a single nucleotide polymorphism (SNP) to predict bitter tasting ability](http://www.carolina.com/product/ptc+pcr+dna+extraction+and+amplification+kit+with+0.5-ml+tubes.do?keyword=pcr&sortby=bestMatches): Part 3 (Load, run and analyze gels; test phenotypes; compare genotypes and predicted phenotypes)

10:50 – 11:00 Break

11:00 – 12:00 Lecture/Discussion: Current commercial applications of biotechnology and Biotechnology careers and their education requirements

12:00 – 1:00 Lunch

1:00 – 2:00 Lecture/Discussion: Teaching science on a budget, moving away from kits, and other practical aspects of classroom implementation

2:00 Workshop conclusion

Workshop is based in part on activities from *Molecular Biology and Biotechnology: A Guide for Teachers by Kreuzer and Massey (2008)*. A copy of this book will be distributed to participants at the workshop.