### **Agricultural Biotechnology for High School Teachers**

Meredith College, Raleigh, NC

July 15-19, 2013

### Agenda

#### Monday, July 15<sup>th</sup> Meredith College

0745 0800	College van picks up participants at hotel Registration & Pre-workshop Surveys; continental breakfast available
0845	Setting the stage Introductions of Participants and Instructors Workshop Scope and Objectives Agbiotech company tours: Initial announcements Kathleen Kennedy
0930	"Will You Eat This?": Icebreaker activity Workshop Introduction and Overview – Karthik Aghoram
1015	Class Lecture/Activity: Essential Standard concept "How DNA and RNA code for proteins and determine traits;" and how these basic cellular processes are used in biotechnology. – <i>Karthik Aghoram</i>
1045	Break
1055	Setting the stage A day in the life of a crop plant – How do crop plants function? What phenotypes are we trying to alter and why? Lecture/Classroom discussion - <i>Karthik Aghoram and Cathy Berrier</i>
1135	Case study: Origins of agriculture and strategies for altering genotypes to obtain desired phenotypes - From classical breeding to transgenics – Karthik Aghoram and Jon Davis
1235	Lunch

We are grateful to the following agricultural biotechnology companies for their support of this workshop:







#### Monday, July 15 (Continued)

1330	Lights, Camera, Action – Starting Experiments
	Lab Activity: Micropipette Skills – Davis
1400	Introduction to DNA extraction – Aghoram
	Lab Activity: Identification of Foods made from GM Crops DNA extraction from GM plants and foods – <i>Aghoram</i>
1445	Lab Activity continued: Setting up polymerase chain reactions (PCR) – Aghoram
1500	Break
1515	What is happening to the DNA now? The polymerase chain reaction – a method for amplifying (making multiple copies of) specific DNA sequences, and the applications of this technology Aghoram
1545	Identifying and isolating genes that confer a desired phenotype/trait Teachers choose one of two activities:
	(a) "Restoring the American Chestnut" – Berrier and Davis
	(b)" GenBank & Primer Design Exercise": Given the identity of a gene that confers a desired trait, design primer sequences to isolate it – <i>Karthik Aghoram and Catherine Dieck</i>
1615	Company Tour Organization - <i>Kennedy</i> Homework assignment - <i>Aghoram</i>
1645	Adjourn









### Tuesday, July 16<sup>th</sup> Meredith College

0815 0830	College van picks up participants at hotel Hot Breakfast
0900	Taking stock
	Jeopardy! Team-based quiz to review concepts from Monday - Aghoram
	Open Q/A time to clarify key concepts - Aghoram
	Introduction to Tuesday's activities - Aghoram
	Class Discussion: How do we best support you in taking concepts discussed on Monday to the classroom? - Kennedy
0945	Case study: Whom do you trust? Identifying the Source: Finding Evidence-Based and Peer-Reviewed Literature - Davis
1030	Break
1040	How do you get a gene for a desired trait into a crop plant and have it expressed? Lecture: Elements of the DNA molecules (plasmids) used in gene transfer
	Model Building Activity: Designing a plasmid that you can use in plants - Aghoram
1120	Lab Activity: Bacterial transformationan example of gene transfer - Berrier
	Step 1: Prepare <i>E. coli</i> and commence transformation with pGREEN. 15 min incubation.
	Step 2: Heat shock and follow with 15 minute incubation.
	Step 3: Leave plates overnight for bacterial growth.
	During incubation times, proceed with the following:
	Lab Activity: Identification of Foods from GM Crops—Continuation -Davis
	We will pour 2% agarose gels for analysis of PCR reaction products (gels will be run on Thursday).
	We will also make cell spreaders using Pasteur pipetsDieck
1230	Lecture/Demonstration: Plant cell culture and transformationHow we get from totipotent plant cells to transgenic field crops – <i>Berrier</i>

#### **Tuesday, July 16 (Continued)**

1300	LUNCH Hosted by School of Natural and Mathematical Sciences, Meredith College
1400	<b>Current Issues in agriculture</b> Discussion/Case Study: Issues Facing Agriculture in NC and the World by 2040 - Davis and Berrier
1500	Break
1515	<b>Guest Lecturer:</b> Kurt Creamer, Novozymes, Franklinton, NC Novozymes is an international corporation based in Denmark that makes enzymes for industrial uses. The North American headquarters are in Franklinton. Kurt will discuss enzymes used for biofuels production.
1615	Greenhouse Activity: "Spot the Roundup Ready Plant" 1 <sup>st</sup> step: spraying Roundup on plants. – Aghoram and Berrier
1630	Q/A about day's topics and issues
	Write down questions for site visits and Pam Ronald conversation
	Company tour announcements and reminders
1700	Adjourn





MONSANTO imagine Syngenta

### Wednesday, July 17<sup>th</sup> North Carolina Biotechnology Center

0720	Participants car pool to the Biotechnology Center. LEAVE HOTEL AT 0720.
0800	Center opens. Hot breakfast available.
0830	Teams assemble for tours.
0845	Leave for companies: BASF, Bayer Crop Science, Monsanto, Syngenta
0900- 0915	Arrive at companies, check in.
0930	Company hosts will provide an introductory talk, then a tour of the facility including labs and greenhouses, then opportunities to visit with employees about what they do.
1130	(Approximately) Leave companies and return to Biotechnology Center
1215- 1350	<b>LUNCH with company representatives</b> , followed by Q&A session. <i>Moderator: Dr. Deborah Thompson</i>
1400	Phone conference with Pamela Ronald (Tomorrow's Table author) – Davis
1440	Break
1450	What Did You Learn? Consolidating Knowledge Gained So Far Each tour group will compile its "Top Ten" list of concepts or facts learned during tours and other workshop activities up to now and share these with the group as a whole Schy
1530	New STEM Curriculum Strand—Agriscience and Biotechnology—Davis Jon Davis is a co-developer of this new four-course sequence for grades 9-12 being funded through North Carolina's Race to the Top grant.
1630	Adjourn







### Thursday, July 18<sup>th</sup> Meredith College

0815 0830	College van picks up participants at hotel. Continental breakfast and review of previous days' topics
0900	You put the gene in what happens now?
	Lab activity: Identification of Foods Made from GM CropsContinued Load and start gel runs from GMO-test kit PCR <i>Davis</i>
	Lab activity: Bacterial TransformationContinued Observe and discuss pGREEN resultsBerrier
	Lab activity: Plants that Glow in the Dark Observe roots of plants transformed with the gene for Green Fluorescent Protein <i>Dieck</i>
	Lecture: Proteinsexploring their structure and function using herbicide resistance as an exampleAghoram and Davis
1100	Break
1115	Lab activity: Identification of Foods from GM CropsContinued
	Take pictures of gels and discuss interpretation of GMO PCR dataDavis
1145	Lunch
1245	Guest Lecture: GM Crops: Are They Safe? – Hope Hart, Syngenta
1400	You put the gene in what happens now? How do you track it?
	Lab activity: Spot the Roundup Ready Plan Continued
	We will observe Roundup treated soy and corn in the greenhouse, and perform strip tests to detect the transgenic protein, a glyphosate-tolerant EPSP synthase enzyme. <i>Aghoram and Berrier</i>

#### Thursday, July 18 (Continued)

1500	You put the gene in. You have a trait. You can track it. Now what? Label all foods that contain it? Debate-style Class Activity/Discussion: Labeling of GM crops, Pros and Cons - Davis and Berrier
1545	Classroom Implementation
	Teachers will share their best practices and help each other build/improve lesson plans and classroom/laboratory activities based on concepts covered in the workshop. Teachers will also discuss limitations that they face in this endeavor and ideas to overcome them.
	Science teachers: Best practices in teaching the Essential Standard concept - "How DNA and RNA code for proteins and determine traits." - Moderator: <i>Davis</i>
	Ag teachers: Best practices in teaching Biotechnology and Agriscience Research– Moderator: <i>Berrier</i>
1645	Adjourn





## Friday, July 19<sup>th</sup> North Carolina Biotechnology Center

0800	Continental Breakfast
0830	<b>Classroom Technology Expo:</b> Display of materials, models, experimental setups and ideas for classroom teaching of biotechnology. – <i>All instructors &amp; NCBC staff</i>
0945	Coffee Break
1000	<b>Grower's Panel: The View from the Field</b> A dialog among organic and conventional growers and educators about agricultural practices and sustainability. <i>Moderator: Dr. Deborah Thompson</i>
1200	Lunch
1300	NC Biotechnology Center Presentation: Resources for Teachers
1400	Post-Workshop Evaluations
1500	Adjourn





