



## Twisting the Helix

### Unit Summary

*"Critical thinking is the essential foundation for adaptation to the everyday personal, social and professional demands of the 21st century and thereafter. The most inescapable imperative of the future is continuous change, change that involves complex adjustments to the increasingly complex systems that dominate our lives. Therefore, the distinguishing characteristics of those who will not only survive but thrive in the future, will be abilities and traits, both intellectual and emotional, that entail excellence in evaluating and responding to the conditions of change."*

- Richard Paul

The discovery of the structure of the deoxyribonucleic acid (DNA) molecule and how it functions in organisms have found application in a growing industry called biotechnology. The new products of biotechnology are generally made by transferring genes from one organism to another. The resulting organism is known as a **Genetically Modified Organism** or **GMO**. The production and use of GMOs may be the solution to a rapidly increasing population. However, GMOs may pose potential risks. Concerns have been raised about allergic reaction resulting from consuming genetically modified food.

The amount of knowledge on the science of genetics is rapidly increasing. Mankind has a powerful tool in its hands and with this power comes the responsibility of deciding wisely. By understanding and evaluating accurate information can we only make informed decisions concerning its uses.

This unit is designed with the central goal of improving students' understanding of genetically modified food (GMF), both their science content knowledge and their understanding of the issues related to it and, of making wise decisions concerning its uses. A variety of learning activities will be employed to help students locate appropriate information and resources concerning GMF and to critically evaluate the evidence they find. Ultimately, the students, as wise and informed consumers, will decide for themselves whether GMF are beneficial or harmful.

### Curriculum-Framing Questions

- **Essential Question**  
Just because we can, should we?
- **Unit Questions**  
Is genetic engineering beneficial or harmful?  
How much genetic modification is enough?
- **Content Questions**  
How are food genetically modified?  
How do genetically engineered crops affect us?  
What are some of the concerns involved with modifying food?

### Instructional Procedures

**Things that need to be done prior to the implementation of the Unit Plan in class:**

- To ensure access to the school's Computer Laboratory, the teacher will inform the School Head about the unit and will coordinate with the Computer Laboratory Person In-charge regarding the schedule of implementation.
- The teacher will arrange with the Technology and Livelihood Education teacher, for the latter to teach the students how to use word processing, multimedia presentation and desktop publishing software, and how to research and document information from the Web.
- The teacher will send a letter to parents informing them about the project so that they will be aware of what their children will be doing the following month and to ensure their full support.
- In the Computer Laboratory, the teacher, with the help of the Computer Laboratory Technician, will create folders on the desktop of each computer where students can save their files.

#### At a Glance

**Grade Level:** 8 (2nd year high school)

**Subject:** Science

**Time Needed:** 8 class meetings, where each meeting is for 60 minutes

#### Things You Need

[Standards](#)  
[Resources](#)

For things that need to be done during the Unit, please refer to the [implementation plan](#) (DOC 44KB).

### Meeting 1: Introducing the Unit

Venue: Computer Laboratory or a classroom with teacher computer and a multimedia projector

- At the beginning of the unit, students are asked whether or not they would eat genetically modified food. At this point, students may not be entirely certain of what genetically modified food are.
- Students then write an essay on their initial belief/knowledge of genetically modified food (GMF). Collect students' essays and ask a few students to share their initial belief about GMF.
- Using a teacher-developed [multimedia presentation on GMF](#) (PPT 287KB), the teacher discusses how food are genetically modified and also presents to the class the tasks students need to accomplish during the unit to fully understand what GMF are and to be able to take a stand on the issue: *Are GMF harmful or beneficial?*
- The teacher also presents to the class how the outputs of the groups will be evaluated and the important [rules in using the computers](#) (DOC 45KB) for them to be aware of the things they should avoid to minimize problems/accidents during their use of the laboratory in the coming meetings.
- The teacher also provides [sign up sheets](#) (DOC 38KB) to systematically organize the use of computers.
- The teacher groups the students and presents the [group contract](#) (DOC 45KB) on working cooperatively. Each group meets and plans for their project, reads the contract and signs it. At the end of the meeting, each group submits the signed contract.

### Meeting 2, 3, 4, 5, 6: Working on the Project

Venue: Computer Laboratory, Community

- The teacher presents to the class a [list of Web sites](#) (DOC 30.5KB) which students can refer to as they do their information search on the Web about facts and points of view about GMF.
- Each group then meets and makes further plans for their project. They also decide on the task of each member of the group and plan how to go about their survey, oral presentation and brochure.
- Afterwards, members of each group start gathering credible information pertinent to the topic assigned to them using the list of Web resources given by the teacher. They are not limited though to this set of resources. The groups are encouraged to look for other Web resources that they think will help them in their project.
- Members of each group assigned to do the survey, brainstorm together in consultation with the teacher, on the questions that will be included in the survey questionnaire and plans how they do the survey, which includes deciding who their respondents are.
- Once all relevant information are gathered and the survey is done, it is during these meetings that the groups do the following:
  - arrive at a consensus on whether GMF are beneficial or harmful based on the information presented by the members assigned to do information search about GMF,
  - consolidate, analyze and organize the information they gathered from their survey,
  - create a brochure outlining their ideas and information based on what they gathered from the Web which also supports their stand on the GMF issue, and
  - makes presentation on the results their survey.

### Meeting 7, 8: Presentation of Group Outputs

Venue: Computer Laboratory or a classroom with one computer and a multimedia projector

- These two days will be devoted to group presentations.
- Each group presents their [survey results](#) (PPT 100KB) to the class, their arguments in support of their stand of whether GMF is beneficial or harmful, and also submits their [brochure](#) (PDF 356KB) afterwards. Each group should also be ready to print a few copies which they give to the other groups. Each group also submits to the teacher the soft copy of the [worksheets](#) (XLS 24KB) they created which contains their processed survey data.
- The teacher facilitates the presentation and discussion afterwards.
- The teacher then recapitulates all the main points of this unit and poses the following question for students to reflect and asks a few students to share their answers:  
*Just because we can modify the helix, should we?*

### After Unit implementation, the things that need to be done are the following:

- Within one week after Unit implementation, require students to clean up favorites folder and files in each computer they used.
- Check if the Computer Laboratory was left clean and in proper order.
- After the oral presentation, the teacher ensures that all groups have submitted copies of their outputs to the teacher for compilation in a CD.
- Within one week after Unit implementation, the teacher makes sure that students receive award certificates for the tasks completed.
- Reflect on Unit implementation and think of another topic where technology can be integrated effectively.

## Prerequisite Skills

Students should be proficient in:

- using technology tools in creating presentations, publication materials, and in using spreadsheets to process data and create charts;
- gathering resources from the Web;
- citing references properly; and
- gathering, summarizing, and representing data in tables and charts.

## Differentiated Instruction

### Resource Student

- For resource students, limit learning activities to information search about the potential benefits and risks of GMF and creating a publication material on the information they have gathered to inform the public.
- The teacher can also develop a scaffolding tool like a worksheet that will guide students on what information particular information about GMF should they need to gather.
- Teacher can show students a video or a simulation of how biotechnologists genetically modify food so students can easily understand the process and visualize it.

### Gifted Student

- Gifted students can make a Web site informing a wider range of audience on the potential risks and benefits of GMF based on what they gathered from their information search. They can also include in their Web site a survey that asks for their site visitor's opinion on genetically modified food.
- Gifted students can also conduct seminars inviting experts on genetic engineering to talk about the potential benefits and risks of GMF.

### Other

- The projects in this unit are designed for students to work in small groups (maximum of 6 members per group). A lab with enough computers so that no more than 2 students need to work together, is recommended.

**Note:** If your lab does not have enough computers, you may want to consider alternatives to larger group size. Divide the class into two. One-half of the class works on the computers and the other half works on an offline activity, then they switch.

## Student Assessment

Student performance will be assessed based on how they process information, how they support their point of view, how they effectively communicate their ideas, and how they collaborate with their peers.

Project outputs of the groups will be assessed using the following rubrics developed by the teacher:

- [Multimedia Presentation Rubric](#) (DOC 48KB) and
- [Brochure Rubric](#) (DOC 58KB).

These rubrics will be presented to students on the first day of the unit to guide students on what they should focus on their presentations and brochures. Other groups also give rating to the outputs of their peers. This is 20 percent of the group rating.

## Key Word Search

- Biotechnology
- Genetic Engineering
- Genetically Engineered Organism (GMO)
- Genetically Modified Food (GMF)

## Credits

Maria Helen Catalan, a staff of UP NISMED who participated in the Intel® Teach to the Future Training last March 2003, developed this Unit Plan. After the training, Ms. Catalan had it content-reviewed and revised her training outputs based on the revisions suggested by the content reviewer. In 2007, additional enhancements were made by the Intel® Teach National Team from UP NISMED. This is the most recent enhanced version of Ms. Catalan's Unit Plan.

*Note: The hyperlinked support documents are not part of the PDF. They can be downloaded and printed individually.*

# Designing Effective Projects: Twisting the Helix

## Content Standards and Objectives

### Targeted Philippine Basic Education Curriculum Competencies Learning Competencies in Secondary Science and Technology 2002

#### For Second Year High School Biology

- Cite some pressing issues concerning advanced technologies in genetics
  - Analyze the effects of genetic engineering
  - Explain what Genetically Modified Organisms or Food are

#### Student Objectives/Learning Outcomes

At the end of this unit, students should be able to:

- write an essay on their prior knowledge/belief on genetically modified food;
- explain the process of genetic engineering;
- take a position on the genetically modified food issue;
- develop information literacy skills;
- conduct a survey on consumer's perception of genetically modified food;
- process data gathered from the survey;
- use tables and graphs in a multimedia presentation to present survey results in class; and
- develop a fact-based publication material using the a desktop publishing software to defend their stand.

# Designing Effective Projects: Twisting the Helix

## Resources

### Materials and Resources

#### Supplies

- Blank CD-Rs and other storage devices where students store the pictures, materials they gathered
- Bond paper which students can use to print draft and final copies of their publication materials
- Ink cartridge for printing

#### Internet Resources

- Genetics Science Learning Center  
<http://gslc.genetics.utah.edu/>\*
- The Biology Project – Mendelian Genetics  
[http://www.biology.arizona.edu/mendelian\\_genetics/mendelian\\_genetics.html](http://www.biology.arizona.edu/mendelian_genetics/mendelian_genetics.html)\*
- Genetics Education Center  
<http://www.kumc.edu/gec/>\*
- DNA: Heredity and Beyond  
<http://library.thinkquest.org/20830/>\*
- Biotechnology: An Information Resource  
<http://www.nal.usda.gov/bic/>\*
- What you need to know about biology  
<http://biology.about.com/cs/genetics/>\*
- Food and Environment – Union of Concerned Scientists  
[http://www.ucsusa.org/food\\_and\\_environment/biotechnology/index.cfm](http://www.ucsusa.org/food_and_environment/biotechnology/index.cfm)\*
- Risks of Genetic Engineering  
[http://www.ucsusa.org/food\\_and\\_environment/biotechnology/page.cfm?pageID=337](http://www.ucsusa.org/food_and_environment/biotechnology/page.cfm?pageID=337)\*
- Genetically Engineered Foods allowed on the market  
<http://www.dep.org.uk/globalexpress/14/page1.htm#anchor544127>\*
- Pros and Cons of Genetically Modified Food  
<http://wise.berkeley.edu/student/topFrame.php?projectID=4765&gotoStep=95856>\*
- What is genetic engineering? – Simplified Process  
<http://www.ncbe.reading.ac.uk/NCBE/GMFOOD/menu.html>\*

#### Technology – Hardware

- Camera
- Computer(s)
- Digital Camera
- Printer
- Projection System
- Scanner

#### Technology – Software

- Database/Spreadsheet
- Web Page Development
- Image Processing
- Encyclopedia on CD-ROM
- Multimedia
- Microsoft Word\* Processing
- Web Browser
- Desktop Publishing