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| Clarifying objective: 8.L.2.1  Summarize aspects of biotechnology including:  • specific genetic information available  • careers  • economic benefits to NC  • ethical issues  • implications for agriculture | | |
| What came first:  **4.L.1.1** Give examples of changes in an organism’s environment that are beneficial to it and some that are harmful.  **4.L.1.4** Explain how differences among animals of the same population sometimes give individuals an advantage in surviving and reproducing in changing habitats. | | |
| What comes next:  **Bio.3.3.2** Summarize how transgenic organisms are engineered to benefit society.  **Bio.3.3.3** Evaluate some of the ethical issues surrounding the use of DNA technology (including: cloning, genetically modified organisms, stem cell research, and Human Genome Project). | | |
| 5E Lesson Cycle | Lesson ideas | |
| Engage | Show students the short film [" Heal, Feed, Sustain: How Biotechnology can Help Save the World"](http://www.google.com/url?q=http://vimeo.com/17125052&sa=U&ei=K888UMLII4n48gT00YH4Aw&ved=0CBIQtwIwAA&sig2=13YKK7evBkQ-Bw6wNInggQ&usg=AFQjCNHeEWhDnVLwuWJ6ZqcyS_iJIT66Rw).  Students may complete the [Biotechnology and You](http://www.google.com/url?q=http://www.ncabr.org/downloads/supplemental/healFeedSustain_teacherGuide.pdf&sa=U&ei=6888UK2COofq8wS8p4GIDw&ved=0CBoQFjAC&sig2=4mffGwIcp1xNwUFrcKdQFw&usg=AFQjCNFfeYVhmXPZNz2HdM5yUZV9a7ReEw) activity that goes with the video. | |
| Explore & Explain | Students will conduct a [web quest on biotechnology](http://dnafordinner.blogspot.com/). Students will identify what biotechnology is, ethical issues in the area of biotechnology and various areas of the study of biotechnology. | |
| Elaborate | Have students write a paper explaining the pros and cons of biotechnology. Their paper should include information about genetically modified food, human genome mapping, economic benefits, and ethical issues.  Invite a scientist from one of the many biotech companies in the Raleigh area.  SAS [Quick launch #55](http://www.sascurriculumpathways.com/portal/Launch?id=55&bhcp=1)- Is that tomato safe for me to eat? | |
| Evaluate | Use the [rubric](http://cmapp.wcpss.net/uploads/files/ms_science/g8_science/8.l.2.1_evaluate.docx) to evaluate the Explore activity | |
| Additional Resources | | |
| CK12 textbook: [Genetic Advances](http://www.ck12.org/book/CK-12-Life-Science-For-Middle-School/r7/section/6.3/) | | Discovery Ed lesson: n/a |
| **Teacher Notes:**   * **technology is essential to science for such purposes as sample collection and treatment, measurement, data collection and storage,**   **computation, and communication of information**   * **traditional biotechnology was (and still is) the use of living organisms to solve problems and make useful products**   Domesticating crop plants and farm animals through selective breeding, and using yeast to make bread rise and produce wine are examples of traditional biotechnology. New biotechnology involves the use of living cells and their molecules to solve problems and make useful products.   * **biotechnology is not just one technology, but many**   Biotechnology is a toolbox filled with many different kinds of living cells and their component molecules, and different ways to use them. Because there are millions of different species of plants, animals, and microorganisms in the world, each having cells and molecules with unique characteristics, there are a lot of potential tools in this toolbox. This is why biotechnology is so powerful and can be applied in so many different ways. There are three basic kinds of biotechnology tools: working with cells, working with proteins, and working with genes.   * **many industries are finding uses for the new tools provided by biotechnology**   The health care industry is developing better ways to diagnose, treat, and prevent disease. The food and agriculture industries are rapidly adopting the tools of biotechnology. The “third wave” of biotechnology applications is just beginning to emerge in energy and the environment, where living cells and their molecules can help us develop new methods to clean up our environment, detect environmental contamination, and reduce our dependence on petroleum.   * **the microbial world has led to the emerging field of biotechnology which has given us many advances and new careers in medicine, agriculture, genetics, and food science**   Biotechnology, while it has benefited North Carolina in many ways, has also raised many ethical issues for an informed community to consider. As we increase our knowledge and make advances in technology we are able to reduce the threat of microbial hazards.   * **biotechnology affects us in every area of our lives: our food, water, medicine and shelter**   Uses of modern biotechnology include: making medicine in large quantities (e.g. penicillin) and human insulin for the treatment of diabetes, combating crime through DNA testing and forensic testing, removing pollution from soil and water (bioremediation), and improving the quality of agricultural crops and livestock products. Some new areas such as Genetic Modification (GM) and cloning are controversial. | | |