

Recombinant DNA: Part II. Examples of Genetic Engineering of microorganisms

US275 Scientific Ethics
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Microorganisms have been used
for a variety of purpose for years.

- Bacteria convert milk into
 - cheese
 - yogurt
- Bacteria in/on human body
 - 1000 species
 - assist in digestion
 - compete with pathogenic bacteria



Cheese platter
Wikimedia commons

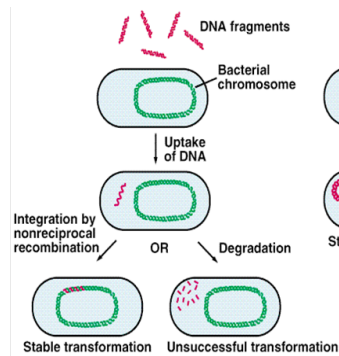
Yeast are a similar microorganism that is
used for a variety of human purposes.

- type of Fungus
 - converts sugar into alcohol and carbon dioxide
- Baker's yeast
 - cause bread to rise
- Brewers yeast
 - ferment alcohols



Bacteria are continually evolving and changing.

- Natural exchange of genes between bacteria.
- Pick up characteristics from other bacteria
 - antibiotic resistant bacteria such as MRSA



Bioremediation is a natural process to break down pollutants into harmless molecules

- Biodegradable
 - often natural bacteria can do this process slowly
 - genetically modified bacteria are faster and more effective



Some deep sea bacteria use oil as a food source.



- specific bacteria can be used in pollution control
 - e.g. Deep Horizon Oil Spill, Gulf of Mexico, 2010

Humulin, a recombinant form of human insulin, was the first biotechnology product available.

- Cloned in 1978
- approved by FDA in 1982
- marketed in joint venture by Eli Lilly and Genentech
- Replaces insulin from animal sources



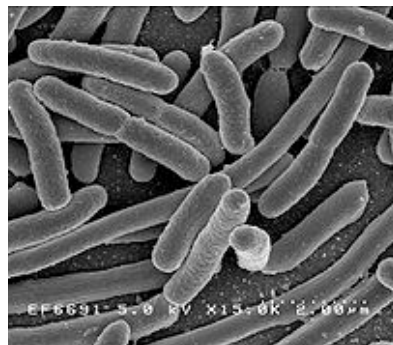
Recombinant blood clotting factor VIII can now be produced safely.

- treatment for hemophilia
 - bleeding disorder
- previous source
 - concentrated from human blood from multiple donors
 - extremely high risk of blood borne infectious disease such as HIV and hepatitis B.



Bacteria are being studied for a variety of human needs.

- Biofuel
- chemical manufacturing
- drug production
- pollution control



Scanning electron micrograph of E. coli bacteria
Wikimedia Commons



Assignment

Bacterial factories.

In your discussion group:

Discuss the following statement:

Microorganisms such as bacteria have been used for generations as a human tool for food preservation (ex. bread, wine, and cheese production). Recently bacteria have been discovered that control pollution (ex. oil eating bacteria). Normal evolutionary processes allow the transfer of genes and characteristics between bacteria, but strains bacteria with a specific desired trait may not be easily found. Is it appropriate to use genetic engineering to create strains of bacteria to fulfill specific functions?

Readings

Pray (2008) Recombinant DNA technology and transgenic animals. Nature Education 1(1).

<http://www.nature.com/scitable/topicpage/recombinant-dna-technology-and-transgenic-animals-34513>

Biello (2008) Turning bacteria into plastic factories. Scientific American.

<http://www.scientificamerican.com/article.cfm?id=turning-bacteria-into-plastic-factories-replacing-fossil-fuels>



Man Reading
John Singer Sargent, 1908

Any Questions?

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<http://www.vipitbullkennels.com/images/animated-question-mark.gif>