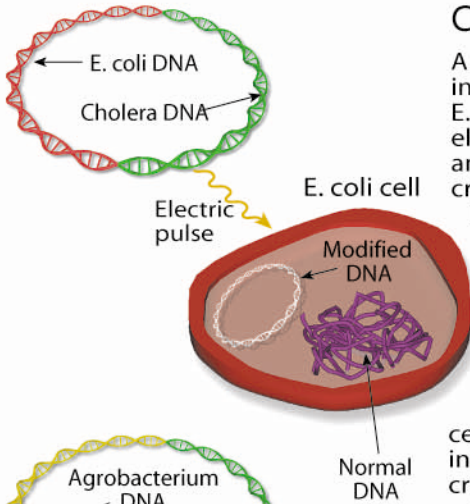


Incredible edible vaccines

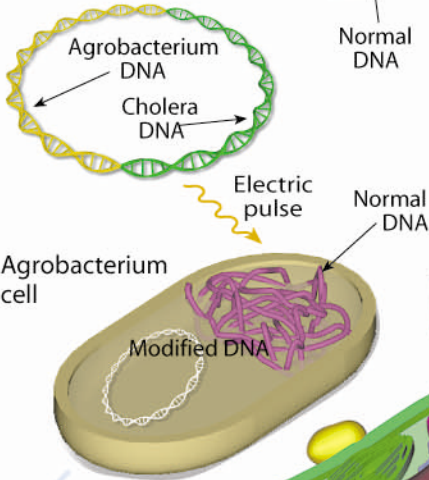
Scientists at the Boyce Thompson Institute in Ithaca are using an experimental process called transgenic implantation to create an edible vaccine. They are doing this by creating genetically engineered bananas that carry proteins from disease-causing organisms. One disease that such a vaccine might protect against is the often fatal diarrhea caused by the cholera bacterium. Here is how the process works:



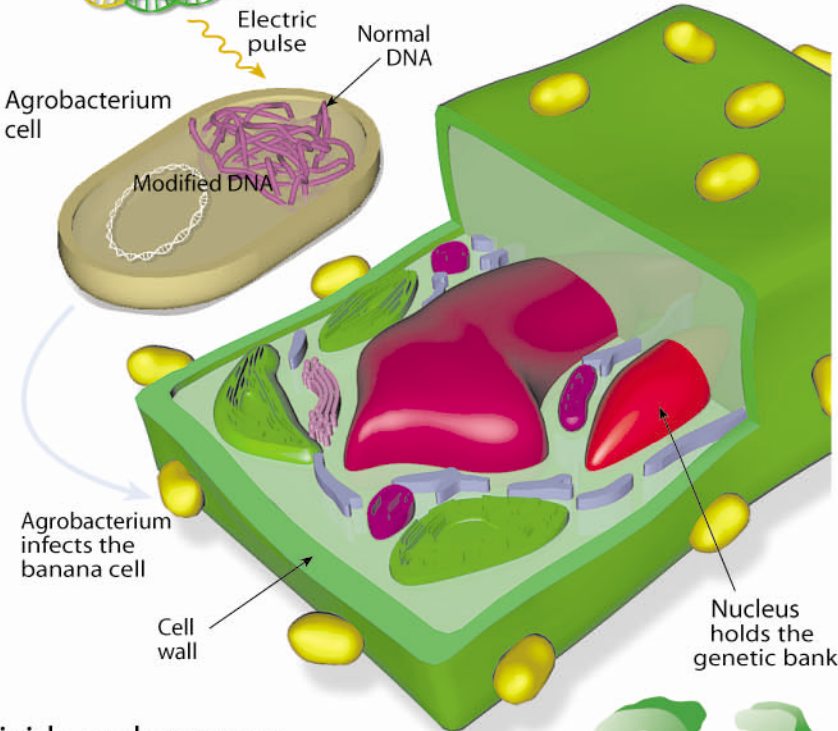
Cutting and pasting

A strand of the cholera DNA is spliced into a ring of DNA from a benign E. coli bacterium. With the help of an electric pulse, the ring is inserted into an E. coli cell. The cell multiplies, creating millions of copies of the DNA.

The modified DNA is spliced again, this time into the DNA ring of a single-celled organism called Agrobacterium, which naturally infects bananas and other plants. When the Agrobacterium attacks a banana cell, the bacterial DNA is introduced into the plant cell and causes it to create proteins like those found in the original cholera bacterium.

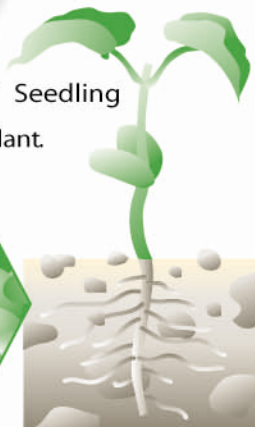
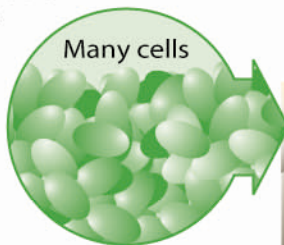


Banana cell cross-section



Divide and conquer

Now the banana cell is cloned it divides into many cells, with each new daughter cell inheriting the modified DNA and grows into a complete banana plant. When bananas from this plant are eaten, the cholera proteins cause the body to respond as if it were being invaded by the cholera bacterium. The immune system reacts, providing immunity to the original disease.



Why a banana?

According to the World Health Organization, each year 8 million to 10 million children die from infectious diseases that could be prevented with vaccines.

Researchers hope that vaccines packaged in bananas may be made more readily available to those who need them. Bananas are a common food staple in many countries, do not need to be refrigerated, and are usually eaten raw. Medicinal bananas might even sport a differently colored peel thanks to engineered pigmentation genes.



SOURCE: Boyce Thompson Institute and staff research

IAN AUCH and KEVIN M. SMITH staff artists