BIOREMEDIATION

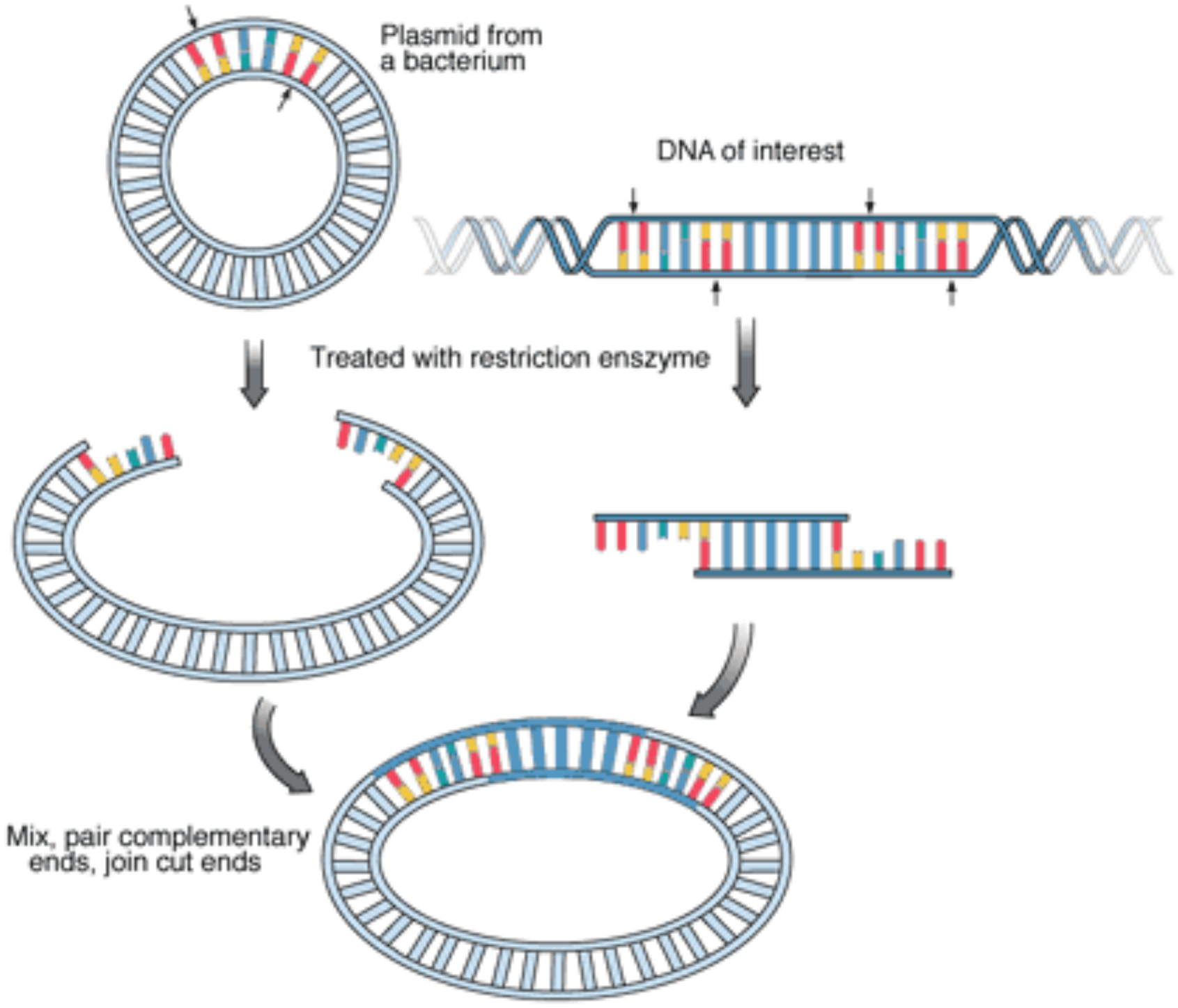
Rachel Tumlin & Maddie Green

HOW BIOREMEDIATION WORKS & IS CREATED

- Bioremediation is the use of living organisms to detoxify and restore polluted and degraded ecosystems using recombinant plasmids which are DNA molecules that are extracted from different sources and chemically joined together.
- In order for bioremediation to occur, the organisms have to attack the pollutants and make them harmless.
- For bioremediation to work best the following conditions should be met:
- 1. Organisms that can biodegrade all of the contaminants
- 2. Enough oxygen to support aerobic biodegradation
- 3. Soil moisture should be 50%-70% of the water holding capacity of soil
- 4. Nitrogen, sulfur, and phosphorus are good supporters of microbial growth
- 5. 0-40 degrees Celsius are good temperatures
- 6. The best pH range is 6.5 to 7.5

STEPS OF USE

- 1. Isolation of plasmid DNA and DNA containing gene of interest
- 2. Gene inserted into plasmid
- 3. Plasmid put into bacterial cell
- 4. Cells cloned with gene of interest
- 5. Identification of desired clone
- 6. Copies of gene are made
- 7. Gene is used to alter bacteria for cleaning up toxic waste


Plasmid from
a bacterium
DNA of interest
Treated with restriction enszyme
Mix, pair complementary
ends, join cut ends

HISTORY

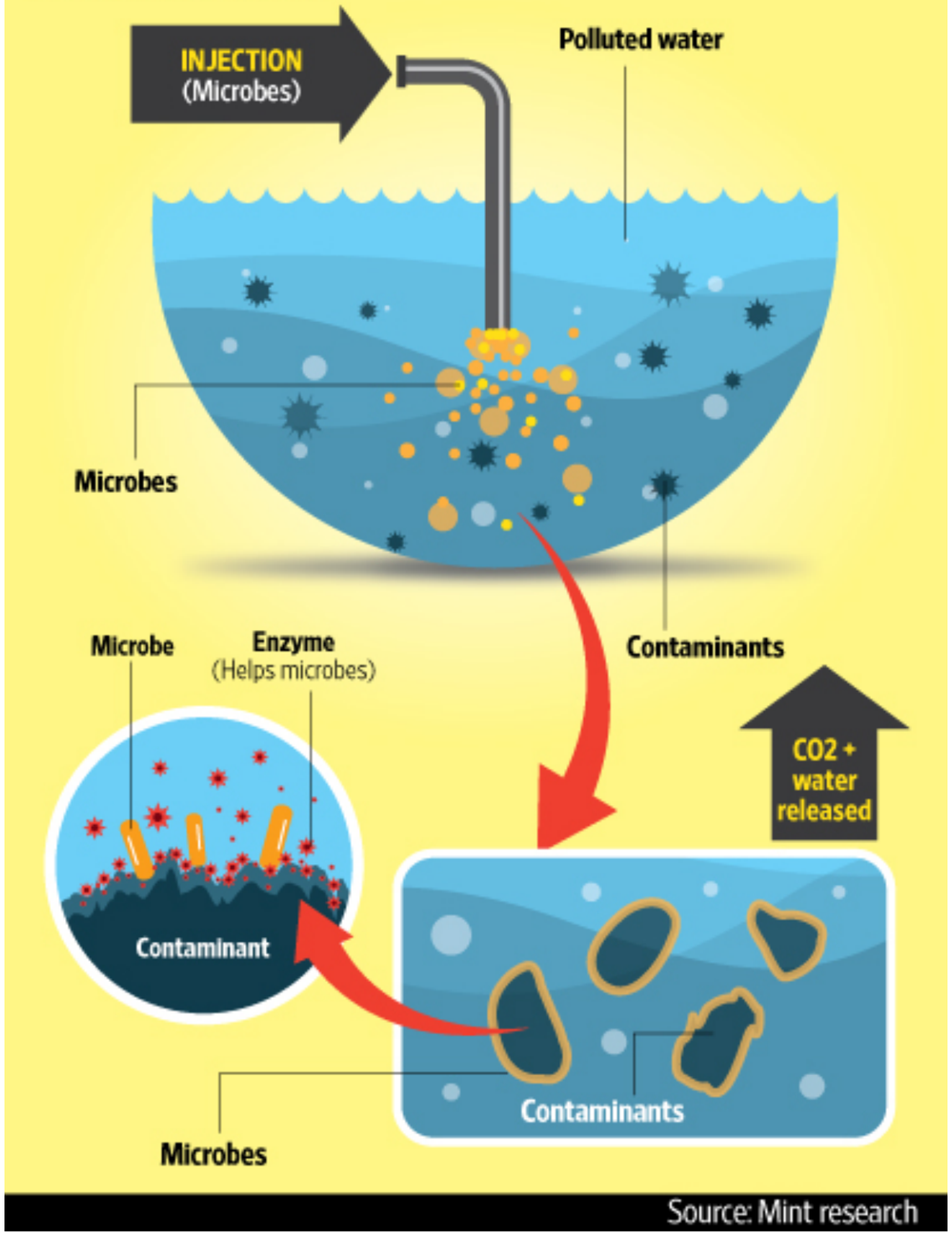
- Supposedly the Romans were the first to discover bioremediation, but the first microbiologist to experiment with the process is George M Robinson.
- Robinson was working as an assistant county engineer in California who helped create the first large cleanup of an oil spill in 1968 using bioremediation.
- He also used this process to clean up other spills, sewage, leach fields as well as odor and pest control.

CURRENT USES

- The whole purpose of bioremediation is to get rid of toxic material, chemicals, and pollutants found in our environment.
- This process has helped remove chemicals such as pesticides and fertilizers used in agriculture that seep from the soil into the groundwater.
- Selenium and arsenic metals are toxic and have found to be removed through water by bioremediation.

THE CLEANING PROCESS

The microbes eat up contaminants such as oil and organic matter. letting off carbon dioxide and water.



Source: Mint research

BIOETHICS, LAW, AND SOCIETY

- Pros:
- Inexpensive
- Works over large areas
- Has been used effectively on oil spill clean ups
- Bacteria continues to feed on toxic waste as long as it's still there

- Cons:
- Concerns about having lots of germs spreading
- Concerns that the germs can harm people
- People think it is an unnatural process

BIOETHICAL CONSIDERATIONS

- Some people believe that it isn't right for humans to try and control the environment so that it benefits us.
- There are others who think that the new technology could have a negative impact and just make things worse.

CASE STUDY: TAR BALLS

- Dr. Cova Arias and 2 of her lab members discovered large amounts of Vibrio Vulnifcus, which is a type of flesh eating bacteria, in tar balls.
- V. vulnificus causes severe wound infections and is the leading cause of seafood-borne fatalities nationwide.
- From July to October 2010, Arias and her colleagues collected sand, tar balls and seawater from three beaches in Alabama and two in Mississippi. They analyzed these samples for the presence of V. vulnificus.

- Arias found that V. vulnificus numbers are 10× higher in tar balls than in sand, and up to 100× higher in tarballs than in seawater.

- Vv is using the byproducts of the microbial communities that are degrading the tar (bioremediation) as source of food. Tar Balls contain a much higher concentration of organic carbon (bacteria food) than sand or water