

Meet a Scientist:
Dr. Sandra J. Bonetti



Dr. Bonetti teaches a forensic science course at CSU Pueblo. Her research topics in the laboratory are focused around fungi from the genus *Penicillium*. They are investigating how the fungus responds to its environment by changing its physiology and its chemical composition. They are also very interested in the enzymology of the fungus. Specifically their investigations examine how the fungus uses these protein enzymes to digest complex molecules in its environment that serve as its food sources. They are very interested in enzymes involved in the digestion of wood and paper products that may be used to breakdown landfill waste and in enzymes that recycle phosphorus, a biologically important element. This research has applications in the scientific areas including environmental sciences, energy production and human health.

4-H Projects:

- Any animal project (livestock, horses, dogs, etc.) you can isolate their DNA
- Plants and fungus have DNA too. Put them in a blender to break cell walls first, and then you can isolate their DNA!

STEM Connections

Connecting the Science, Technology, Engineering, and Math concepts to our everyday lives.

Colorado State University

Extension



DNA Fingerprinting

Learning the Basics



All life shares the need for water and DNA (in every organism except some viruses that use RNA instead). DNA is copied to RNA, and RNA makes proteins that make organelles, and the organelles are found in cells that help the cell function properly, and cells build organisms. DNA's code is like an alphabet that only has 4 letters. These 4 letters, in different sequences, can spell out all the proteins that are needed to make a tree, bread mold, or even you!

Forensic scientists that specialize in DNA fingerprinting can use a single cell to discover the identity of individuals who have perpetrated crimes. Some sequences of DNA are exactly like the sequences found in bacteria. These are codes for very important organelles that make the proteins. Other sequences, that don't code for anything (called "junk DNA"), can mutate (change) without harming the individual. Even identical twins (who share identical DNA), will gain slight differences in these sections of DNA. The scientists will break apart the DNA at very specific points, and then run it on a gel. The different sequences will break at different points, so that the DNA looks different for everybody (see the picture above)!

EXPLORE IT - DESIGN IT - DO IT

We are going to take the first steps done in DNA fingerprinting by forensic scientists—isolating the DNA. DNA has a charge, like electricity, and it can stick to water. We want to neutralize that charge before we isolate our DNA, so we add salt. Our DNA is located inside a membrane-bound nucleus that is located in the membrane-bound cell. We need to first break open those membranes, but in a way not to damage the DNA. We use dish soap. If you have ever added a drop of dish soap to greasy water, it does exactly the same thing to membranes—it breaks them up. Now bits of cell parts are in our water. DNA is organized like string wrapped around spools of thread. The spools are proteins called histones. We want to break down the histones without hurting the DNA. Meat tenderizer works because it breaks down proteins. Adding the meat tenderizer will dissolve the histones. We now have DNA in the water, but we can't see it. It floats on top of the water (less dense than water). To see it, we add ice cold (won't work with warm—density not right) isopropyl alcohol. Voila! There is your DNA! (It looks like clear snot!)

Materials:

- SMALL ¼ cup clear container with screw top lid
- Water
- Cotton swab
- Pinch of salt
- Drop of liquid dish soap
- Pinch of meat tenderizer
- 90 to 99% isopropyl alcohol in freezer (ice cold)

Directions:

- Add about 2 tablespoons water into your container
- Use the cotton swab, and scrap the inside of your mouth, all along the inside cheek, tongue, gums
- Gargle with the water in the container (swish water in your mouth) then spit in the container
- Put the cotton swab in spit water and stir
- Add 1 pinch of salt—just one pinch
- Screw on the top and GENTLY swirl the spit water to dissolve the salt into the water solution
- Remove the lid and add 1 drop of liquid dish soap—just one drop
- Screw on the top and GENTLY swirl to dissolve the dish soap into the solution
- Remove the lid and add 1 pinch meat tenderizer—just one pinch
- Screw on the top and GENTLY swirl to dissolve the meat tenderizer into the solution
- Let the container rest undisturbed for 10 min.
- Remove the lid and add about 2 tablespoons of ice cold isopropyl alcohol by GENTLY pouring it along the sides of the container
- Look carefully at the point where the water and alcohol meet—you will start to see something—that is your DNA!

Colorado State University Extension 4-H programs are available to all without discrimination.

By Dr. Barbara J. Shaw