Size and Scale: Activity 2

Where's Nano?

Finding Nano

It's a science camp reunion with Regina, Linda, Harrison, Jared, Lorenz, and Randi at the **Morehead Planetarium and Science Center** in Chapel Hill, North Carolina. We visited the Zoom In exhibit and were surprised to learn that even mucus has something to do with the nanoscale.

Our question:

What examples of nanoscale science and technology can we find in our everyday lives?

We broke up into two teams and set out on a nano scavenger hunt. We did some research and found nanoscale examples everywhere from a sporting goods store to a botanical garden. At the **University of North Carolina Chapel Hill**, a scientist helped us get a closer look at the nanoscale structures in some of our items. When we got back together, we created a display for the science center that grouped our findings into the following three categories: nature, technology and the future. Our quest for all things nano was complete!

Nano Matters

In general, children tend to care more about something if it has a direct impact on their daily lives. Awareness of the world around them can spark interest in the science responsible for the phenomena. Kids should be able to distinguish nanoscale objects found in nature from those made by humans. Even though nanoscale features are invisible to the naked eye, the resulting properties can be experienced, studied and mimicked.

Icebreaker

Discover what you can learn about objects without seeing them!

20 minutes

DragonflyTV Skill: Predicting

Preparation

Before you begin, prepare several clay balls (about 3" in diameter) and place one small object in the center of each.

1) Children can work alone or in groups. Give them a clay ball and about 20 round toothpicks. (The flat ones are too flimsy for this activity.)
2) Challenge the kids to figure out what object is hidden inside the clay without seeing it. They can use the toothpicks as tools to probe each ball and then predict what's inside.
3) Have kids share their predictions and how they came to these conclusions before opening the ball to see how close their predictions were. (Kids can get clues to the size and shape of the object by examining the depth the toothpick is inserted. The firmness of the object is revealed when the toothpick actually touches—or goes through—the object.)

You'll need:

- clay or Play-Doh
- round toothpicks
- several small objects such as: penny, marble, rubber band, raisin, marshmallow, paper clip, bead, etc.

Are you a nano-bit curious?

Many times, scientists must investigate things they cannot see. In 1911, Ernest Rutherford conducted a famous experiment in which he shot alpha particles (helium nuclei) at gold atoms. He found that most of the particles went straight through (because atoms are mostly empty space), but some particles were deflected back as if they hit something very dense. This led to our current model of the atom as a small, dense, positively charged nucleus with circling electrons. Just because scientists cannot see things at the nanoscale doesn't mean they cannot learn about them and make revolutionary discoveries as Rutherford did! Nanoscientists have developed special tools such as scanning probe microscopes that have special probes (similar to the toothpicks in this activity) to "feel" for bumps on the surface and map out the arrangement of atoms.

Investigation

Hunt for the nano in your world.

1 afternoon to 1 week

Guide your kids as they

1) Conduct a NanoBlitz! We think of nanotechnology as a science of the future, but there are many products currently on the market today containing nanoparticles. Break into groups and challenge the kids to spend a set amount of time taking a complete inventory of "all things nano" around them. Some great places to start are discount stores (like Target and Walmart), sporting goods stores and drugstores. Search in books or on the Internet for examples of nano in nature or even exciting applications for the future. Kids can take pictures, draw pictures or bring in actual objects. Regardless, they should share how they determined it was a nanoproduct.
2) Assemble all of the items and create a chart. On the show, the DFTV investigators organized their objects into the following categories: nature, technology and the future. You could use these categories or invent your own based on the specific objects you've found.
3) Discuss the use of advertising in promoting a product. Are all these items really nano? Take a vote: nano or not? How would you know? How might you test the product's claim? Would you want to know if a product was made using nanotechnology? Would it influence whether or not you purchased it? Does the type of product make a difference—e.g., toothpaste versus a baseball bat?

You'll need:

- reference books and/or the Internet
- paper, markers, pens, etc.
- location to display the results

DFTV Adult Tip

According to the National Nanotechnology Initiative, the definition of nanotechnology is "the understanding and control of matter at dimensions between approximately 1 and 100 nanometers, where unique phenomena enable novel applications." This means the "action" of nanotechnology is occurring on the same scale as individual molecules. The problem is that almost everything can be described as "nano." The field of chemistry is inherently "nano," for example. Biological molecules are "nano" as is the field of genetics and so on. You may observe that it is actually harder to find non-nano objects than nano ones, but defining the difference is not always easy. Do not feel pressured to have all of the answers! Even scientists are debating where to draw the line and it brings up an excellent opportunity to model the process of science by generating questions and researching answers as a group. Kids may not find an "answer" and this is an important teaching moment as well.

nano

View the "Hey, Wait a Nanosecond!" segment from show 702: Structure of Matter to hear kids' opinions on nanoproducts. Use this video as a jumping off point for your own group discussion.

Are you a nano-bit curious?

Since nanotechnology is such a new field, products are being marketed that may contain nanoparticles without our knowledge or consent. The number of nanobased consumer products available is growing rapidly. At the time this guide was printed, approximately 800 nanotechnology products were on the market. This upsurge of nanoproducts in stores stresses the need to inform the public of both the risks and benefits of this emerging technology. Some people have concerns as to the safety of nanoparticles—especially in products like vitamins, creams and make-up that are ingested or make direct contact with the skin. Since nanoparticles are smaller than cells, some question whether or not they can disrupt cellular behavior. No clear evidence exists yet either way, but making young people intelligent consumers is a step in the right direction toward scientific literacy.

DFTV Science Helper

Currently, the most comprehensive inventory of nanotechnology-based consumer products is from The Project on Emerging Nanotechnologies at: nanotechproject.org/inventories/consumer.

DFTV Adult Tip

Our NanoBlitz is a spinoff of a BioBlitz. A BioBlitz is a rapid (usually 24 hour) inventory of all living organisms in a given area to establish the degree of biodiversity found there. It's a great way to get people involved in their communities and promote ecological awareness. Your NanoBlitz will help promote awareness of the emerging field of nanotechnology and how it may affect both people and the environment in the future.

Keep Exploring!

Have the children design their own nano-ventions they would like to see in the future and share them with the group. When will the product be available? How does nanotechnology play a role? Why is this product better than its non-nano counterpart? How would you advertise the product? Design a product label, packaging, commercial or magazine advertisement to sell your nanoproduct.

For additional ideas on how to expand this activity, please visit the National Nanotechnology Infrastructure Network at: nnin.org/nnin_k12nanotechproducts.html.