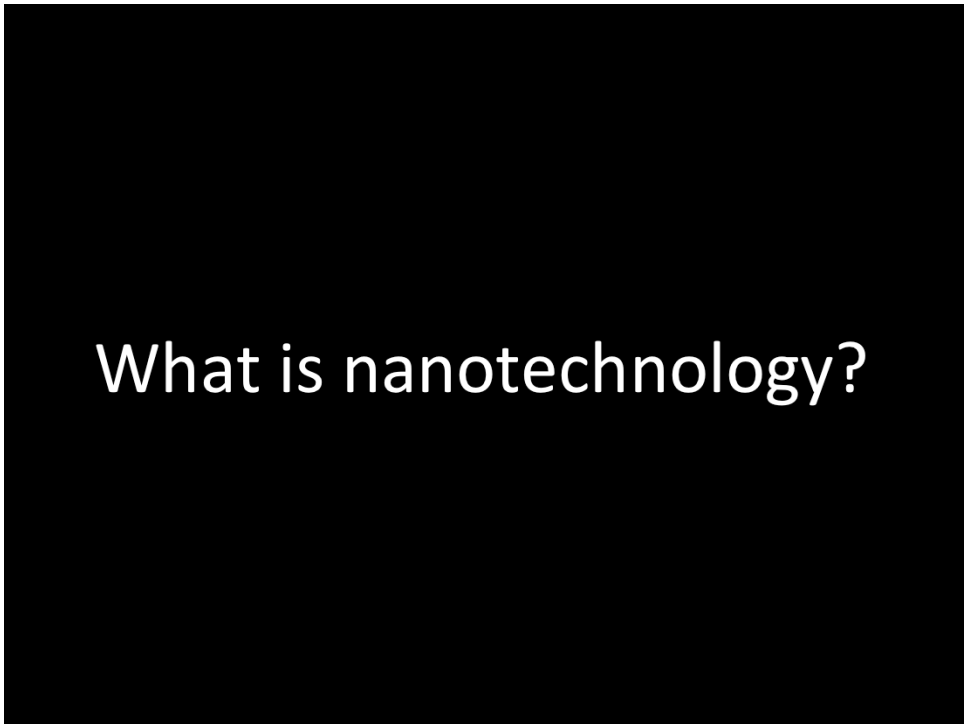
Welcome to Nanotechnology Spin-a-Prize, a game show about nanoscale science, engineering, and technology! My name is_____ and I'll be your host.

Nanotechnology Spin-a-Prize consists of two rounds. Before each round, I'm going to share some information with you. *Listen closely because the answers to the game will be revealed!*

You will all be contestants! The teams are divided by this row. [Gesture]
This is Team A. [Gesture]
This is Team B. [Gesture]
Who's on Team C? Just kidding—there is no Team C!

Let's get started with Round 1 of Nanotechnology Spin-a-Prize!



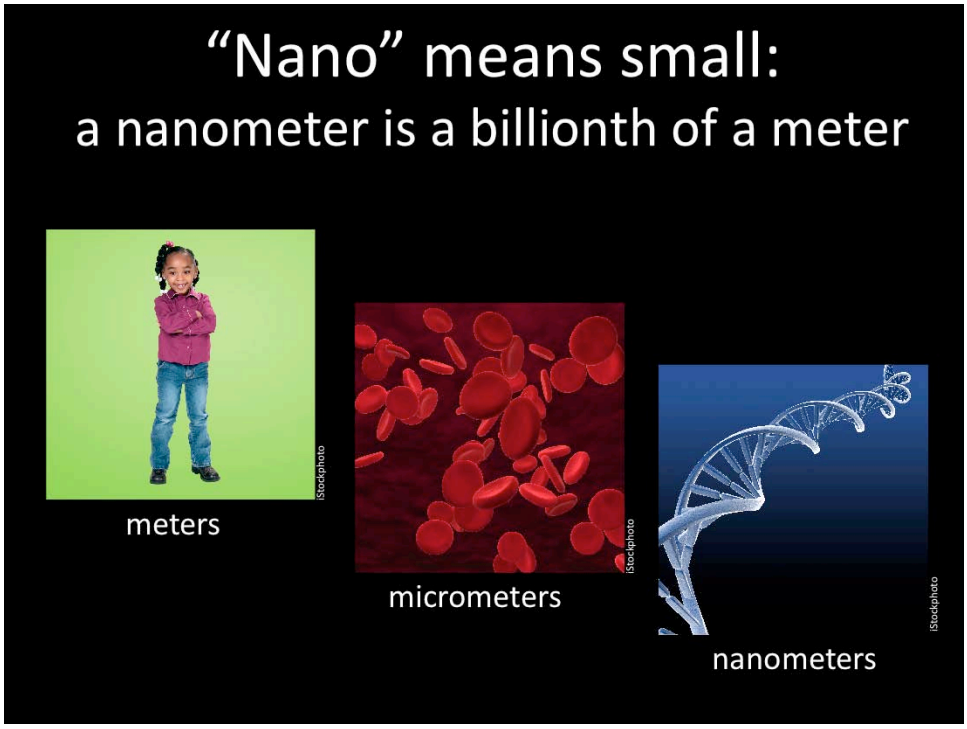
How many of you have heard of nanotechnology, or nano-anything?

[Show of hands]

Great!

In the field of nanotechnology, scientists and engineers make new materials and tiny devices. Sometimes they build things out of individual atoms! It sounds like science fiction, doesn't it? But nanotechnology is very real. It will affect all of our lives.

Some say new nanotechnologies will have a greater impact than any previous invention—more than electricity, more than cars, more than television, more than computers, even more than the internet! So we should all be paying attention to nanotechnology.



Nano- is a prefix, like mega- or micro-. You've probably heard of megabytes or microscopes. Nano basically means super small.

In nanotechnology, researchers measure things using nanometers. A nanometer is a billionth of a meter. That's very, very, very small!

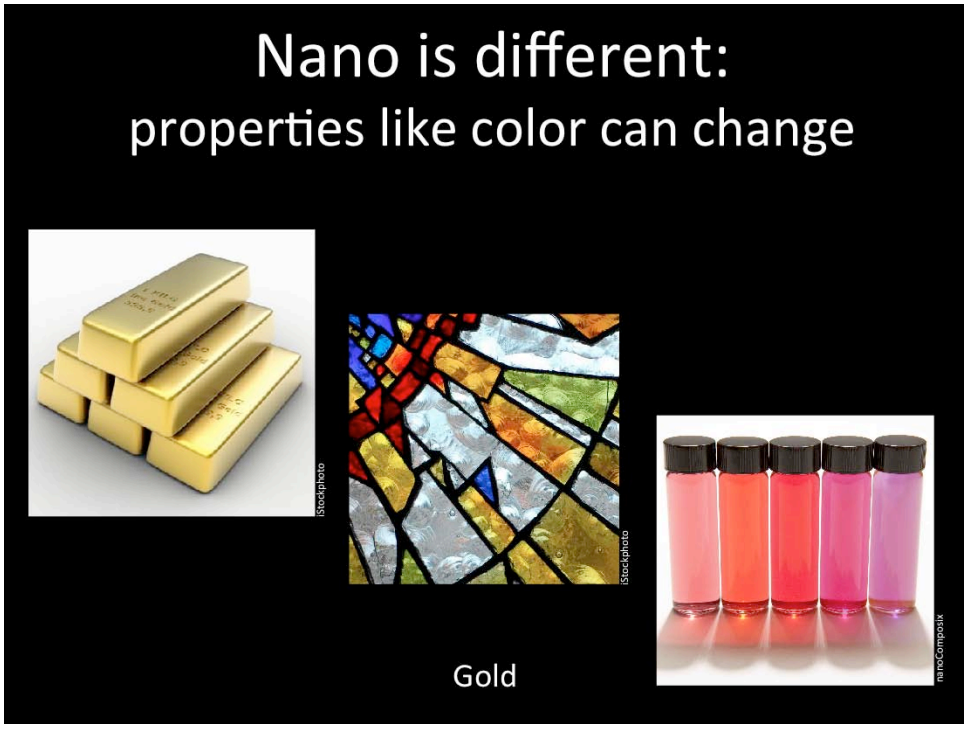
A 6-year-old child is about one meter tall—like the girl in the picture on the left.

The picture in the middle is of a red blood cell. A red blood cell is about a millionth of a meter, or one micrometer across. That's pretty small, but a nanometer is a thousand times smaller than that.

The picture on the right is a DNA molecule. DNA is found in your cells. A DNA molecule is two nanometers wide. That's two-billionths of a meter!

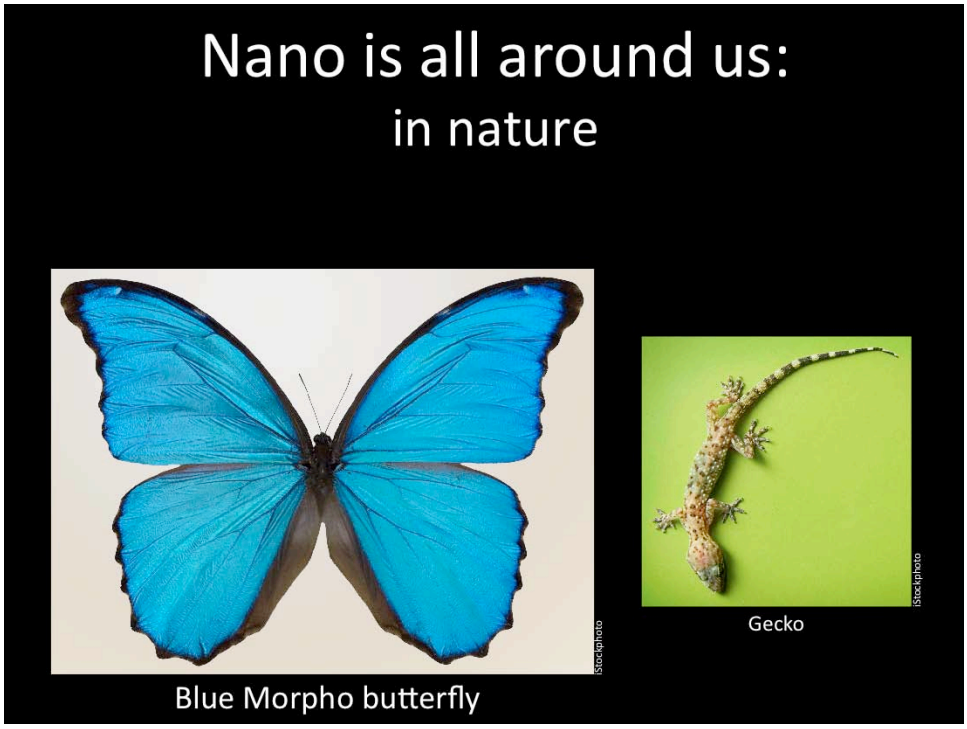
So nanotechnology is technology at the scale of atoms and molecules.

Remember to keep listening closely because the answers to the game will be revealed!



Some things behave differently when they're nano-sized than they do when they're bigger. For example, colors can change! A gold brick is yellow, but nanoparticles of gold reflect light differently and can look red or purple.

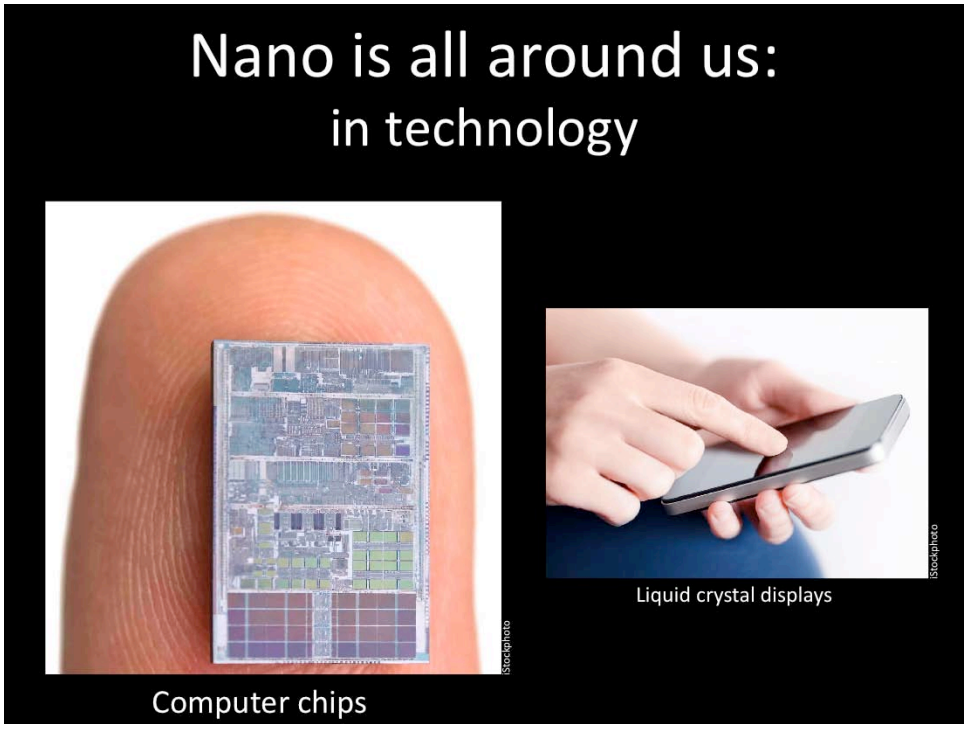
The photo on the right is of nano-sized gold particles. The different colors are because the gold nanoparticles are different sizes. The middle picture is of a stained glass window. Since the Middle Ages, nano gold has been used to make red stained glass.



And there are other surprising nano properties that occur in nature.

For example, Blue Morpho butterflies get their iridescent color from tiny nano-sized structures in their wings. The nanostructures are colorless, but they're precisely spaced so they reflect blue light back to your eyes.

Geckos can walk up walls, but they don't have glue on their feet! Instead, their feet have millions of tiny nano-sized "hairs" that temporarily bond with the wall.



Nanotechnology takes advantage of special properties at the nanoscale to create new materials and devices.

For example, computer chips have tiny transistors that are only nanometers across. The smaller the transistors are, the smaller and faster the computer chips can be.

Many cell phones and laptops have displays that use nano-sized liquid crystals. These liquid crystal displays let us create thinner, lighter devices.

Nano-sized things are so small that we cannot see them with our eyes, or even with powerful light microscopes.

Scientists and engineers have special tools they use to study and make things on the nanoscale. A tool called an *atomic force microscope* (AFM) can "feel" things on the nanoscale and then create an image of them.

You're familiar with another special nano-detector: your nose! Nanoparticles are too small to see, but we can smell some of them. The tiny scent molecules that make things smell are measured in nanometers. So your nose is your very own nanosensor!

Are you ready to answer the questions for Round 1 of Nanotechnology Spin-a-Prize?

[Audience cheers]

First, I need an official scorekeeper—someone who can write on the board and is good at adding up numbers.

[Have the volunteer stand by the scoreboard.]

Next, I need a representative from each team to spin the wheel!

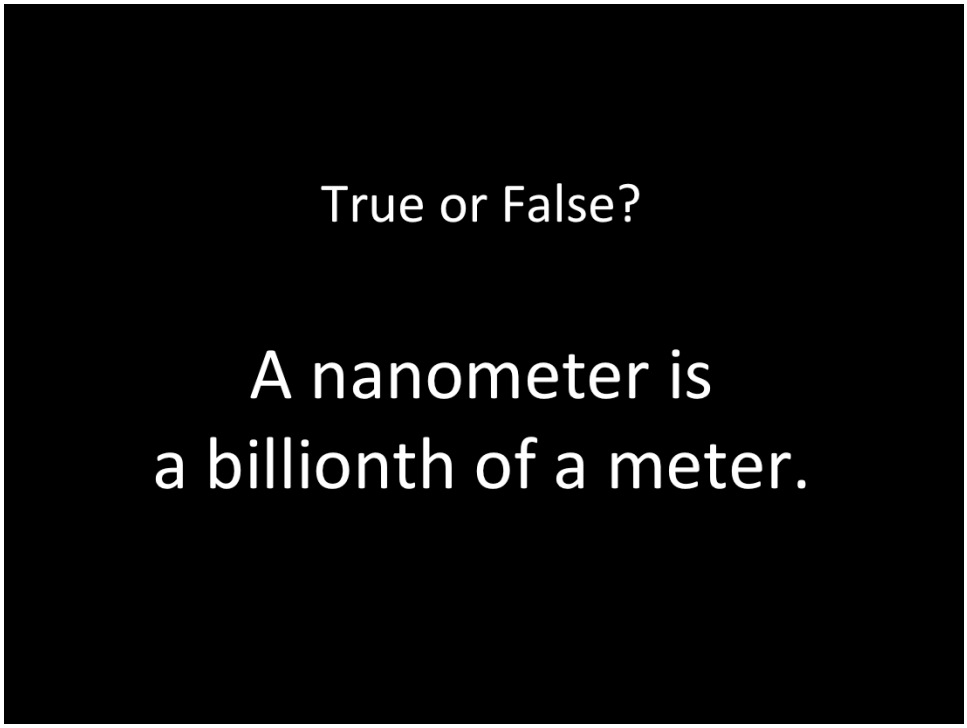
[Get the names of the volunteers and have them stand by the wheel.]

All right, you will spin the wheel to find out how many points the question is worth.

The questions are True or False. Teams, shout out the answer to your representative.

We'll start with Team A. Spin that wheel!

[Volunteer spins the wheel.]

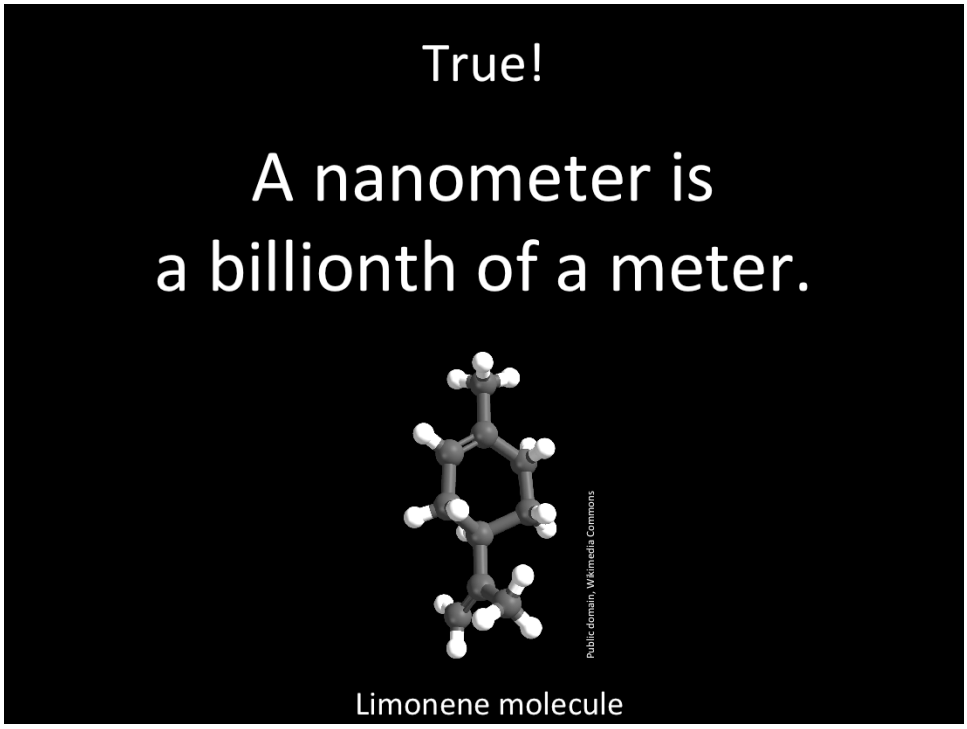


True or false? A nanometer is a billionth of a meter.

Team A, what's your answer?

[Audience response.]

The correct answer is…



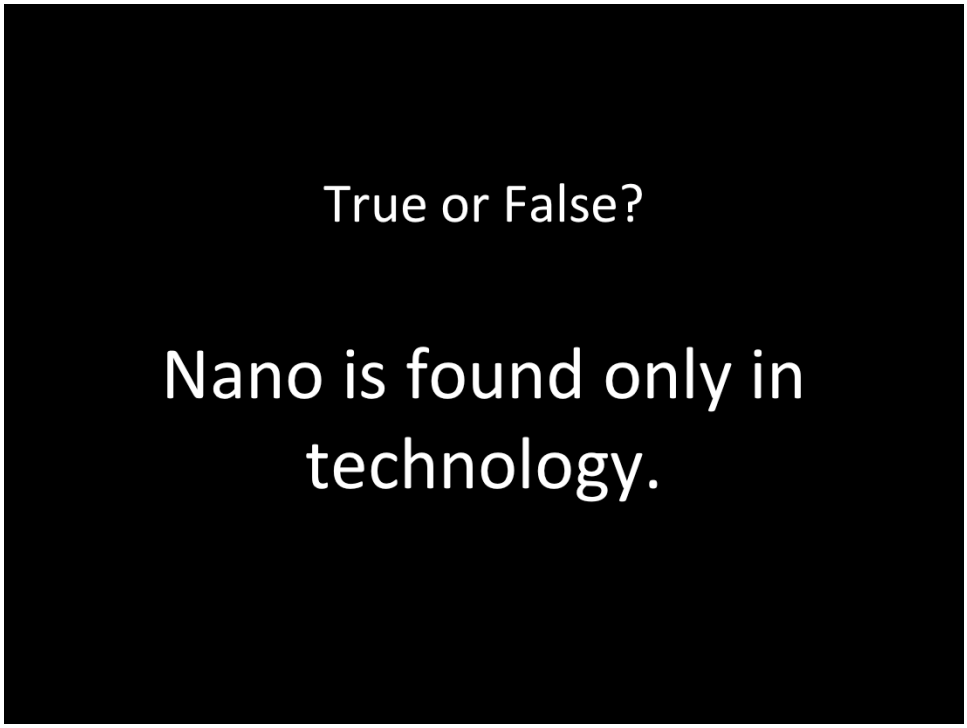
True! A nanometer is a billionth of a meter.

That's so small that nanometers can be used to measure individual atoms and molecules. Nano-sized things are way too small to see, but we can smell some of them.

[Scorekeeper marks score.]

OK, Team B, your turn.

Spin the wheel! [Volunteer spins the wheel.]



True or false? Nano is found only in technology.

Team B, what do you think?

[Audience response.]

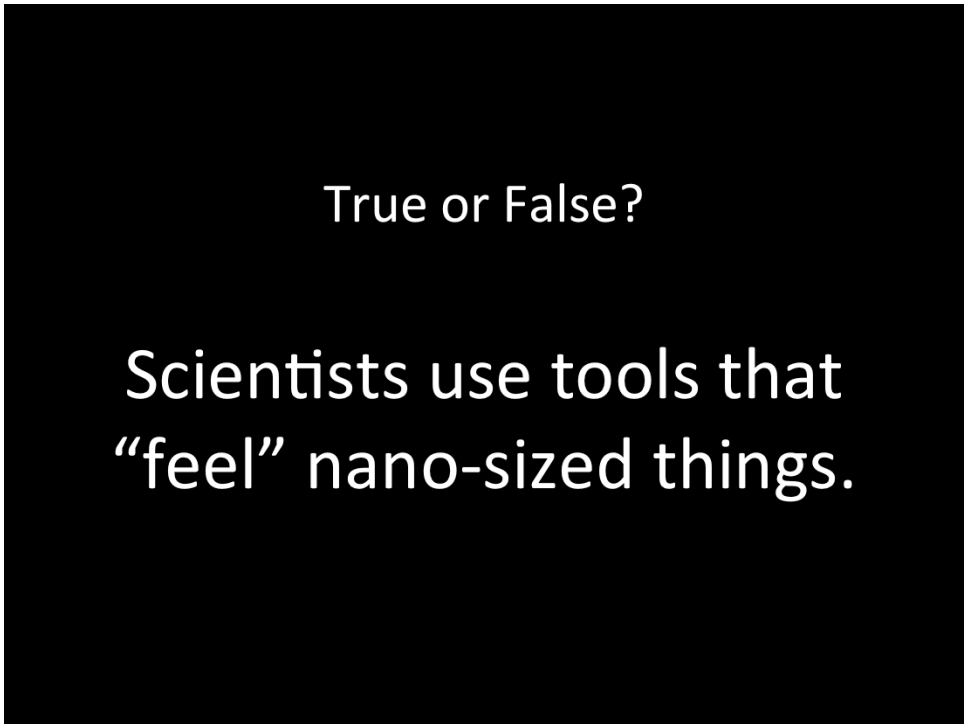
The correct answer is…

False! There are nanoscale effects everywhere, in nature and in technology. For example, lotus leaves stay clean even in muddy water because their leaves have nano-sized structures that repel water.

[Scorekeeper marks score.]

All right, back to Team A.

Spin the wheel! [Volunteer spins the wheel.]



True or false? Scientists use tools that "feel" nano-sized things.

Team A, what's your answer?

[Audience response.]

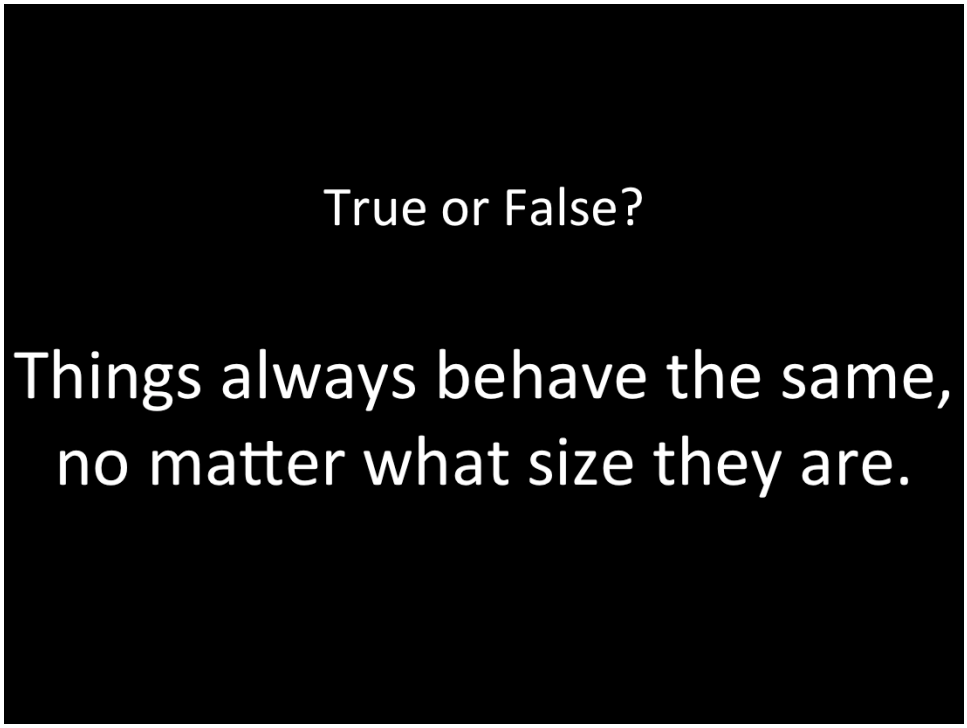
The correct answer is…

True! Scientists use tools that "feel" nano-sized things. Nano-sized things are way too small to see. Scientists study and make things on the nanoscale using special instruments such as the atomic force microscope.

[Scorekeeper marks score.]

And we end the round with Team B.

Spin the wheel! [Volunteer spins the wheel.]



True or false? Things always behave the same, no matter what size they are.

Team B, what's your answer?

[Audience response.]

The correct answer is…

False! Things can behave differently when they're nano-sized.

For example, chemical reactions often go faster when a material is nano-sized. That's because reactions occur on the surface of objects, and nanoscale objects have a lot of surface area for their volume. Aluminum, used everyday in drink cans, can be explosive when the aluminum particles are nano-sized!

[Scorekeeper marks score and adds them up.]

What a great Round 1! The score stands at_____.

Thanks very much to our scorekeeper and team representatives! You can have a seat. Please give them a round of applause, and we'll head into Round 2!

[Applause]

Our second and final round is about nano and society—how nanotechnology affects our lives.

Remember to listen closely because the answers for this round are about to be revealed!

Nanotechnology is already part of our lives, and it will become even more important in the future. So as individuals and as a society, we need to think about the kind of future we want and how nanotechnology will be part of it.

Let's see some of the ways nano may be part of our future.

Nanotechnology is helping us to create new sources of energy.

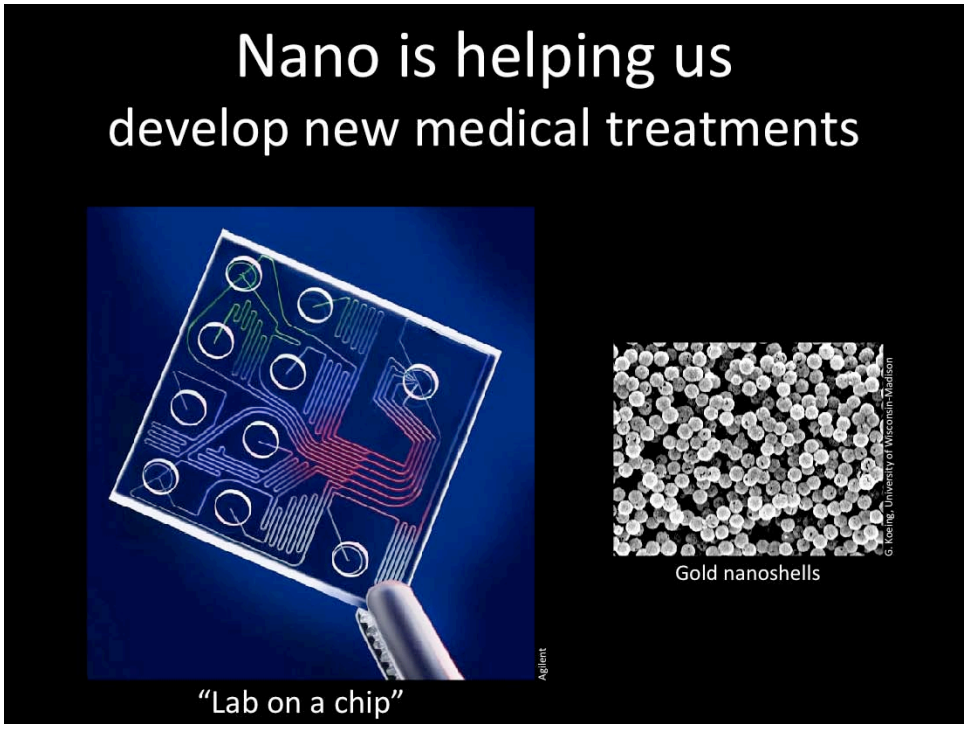
Thin-film solar panels are made of bendable nano-layers of material. These small, portable panels can provide a personal power source anywhere in the world. They produce almost as much electricity as traditional photovoltaic panels.

Fuel cells convert chemical energy into electrical energy without combustion, so they're a clean, efficient way to generate power. As more efficient catalysts are developed using nanoparticles, the use of fuel-cell cars may become more widespread.

Another use of nanotechnology is in water filters.

On the left you can see a picture of a water filter that's packaged like a tea bag! It can be taken anywhere in the world and stuffed into the neck of a water bottle to purify water.

On the right, you can see a picture of another portable nanotechnology water filter. Many water filters can get out relatively big things like dirt and bacteria, but only filters with nano-sized pores can remove tiny things like viruses and salt ions.



Nanotechnology might also lead to improvements in healthcare.

In the picture on the left, you can see a "lab on a chip." In the future, small chips the size of a postage stamp might need only a drop of blood and a few minutes to run a whole variety of medical tests. These "labs on a chip" will use nano-sized sensors.

Remember the red-colored nano gold? One day, tiny gold nanoshells might be used to treat cancer! In an experimental therapy, nano gold and near-infrared light are being used to destroy tumors with few side-effects.

Nanotechnology might also help us to create innovations we can hardly imagine today.

For example, some scientists think nanotechnology might allow us to create an elevator to space! Tiny carbon nanotubes are super-strong for their size, so they could be used to create a cable between a base station on earth and an anchor in space.

Another possibility is quantum computers. We might be able to greatly increase computer memory and processing power by using quantum bits, rather than our current binary system.

All right, listen up! Remember, you're learning the answers to the game!

I've talked a lot about the possible benefits of nanotechnology. But what about the risks?

Many technologies can be viewed as either good or risky, depending on the circumstances. Let's consider fire, one of the oldest technologies. Fire is useful when we want to get warm or cook our food. But fire can also burn things down.

We have to think ahead and protect ourselves from the risks related to any technology. For example, we build fires in a safe place, we have a fire extinguisher or water handy, and we have fire fighters to respond if a fire gets out of control.

Just like other technologies, nanotechnology has potential to provide great benefits, but we also have to think about potential risks and how to protect ourselves.

Everyone has a role in shaping nanotechnology. Companies and governments decide which technologies to invest in and how to regulate them. Individuals can help shape nano research and development by deciding whether to use products containing nanotechnology.

You're already making decisions about whether or not to use nanotechnologies, though you may not always know it.

How many of you use sunblock?

[Audience response.]

Many sunblocks contain nano-sized particles of zinc oxide or titanium dioxide. Manufacturers don't have to label whether the sunblock contains nano-sized particles, so you could be using nanoparticle sunblock without realizing it.

Hopefully, Nanotechnology Spin-a-Prize will help you start thinking about how nanotechnology is part of our lives today and in the future.

But for now, are you ready to play the final round?

[Audience cheers!]

I need another scorekeeper—who would like to help with that?

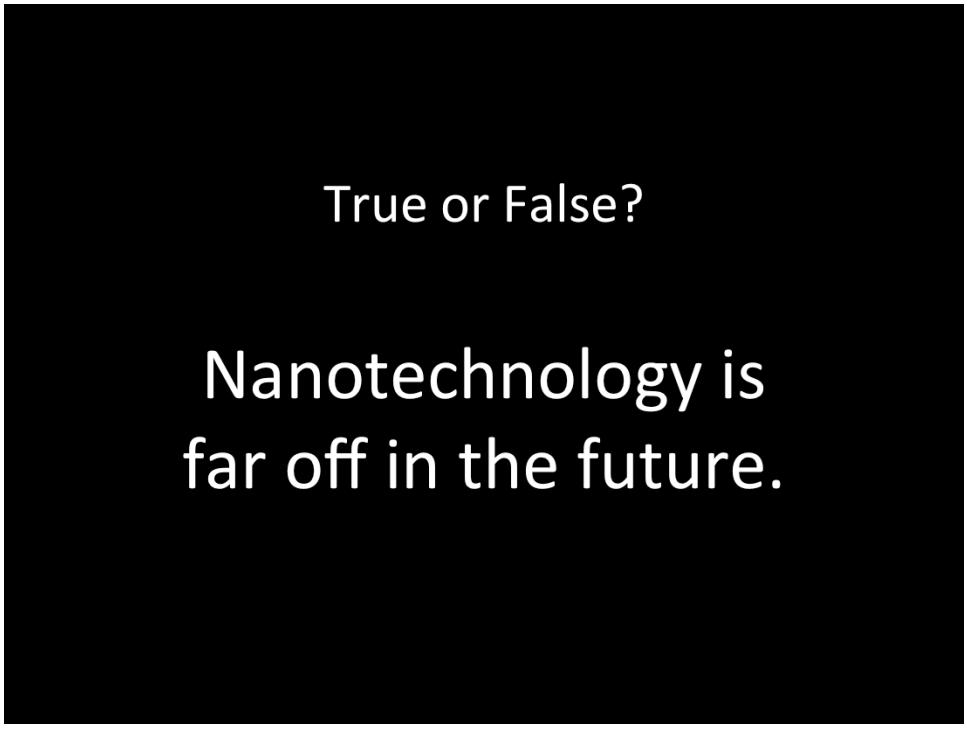
[Have the volunteer stand by the scoreboard.]

And now I need two new team representatives to spin that wheel!

[Choose volunteers.]

We'll start with Team B this round.

Spin that wheel! [Volunteer spins the wheel.]



True or false? Nanotechnology is far off in the future.

Team B, what's your answer?

[Audience response.]

The correct answer is…

False! Nanotechnology is already part of our lives.

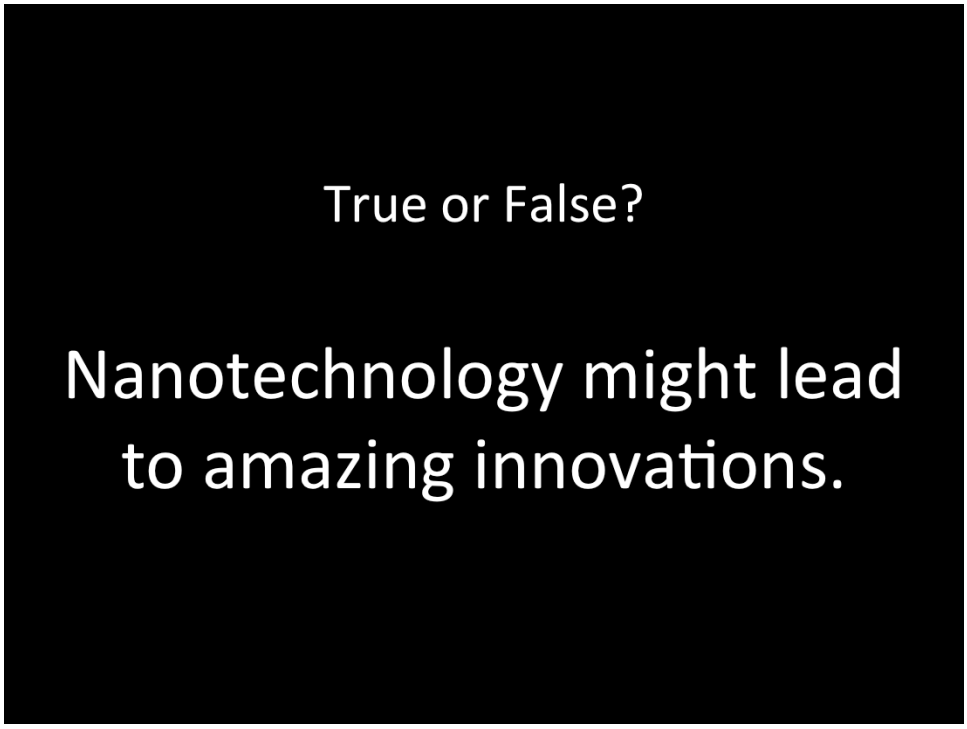
Many products containing nanotechnology can already be found on the shelves of sports stores, supermarkets, and electronics stores.

Nano-sized silver particles are one of the most common nanomaterials used in consumer products. There are socks, for example, that use nanosilver to kill the bacteria that make feet smell. Some people wonder what happens when you wash the socks and the nanosilver particles go down the drain.

[Scorekeeper marks score.]

OK, this one is for Team A.

Spin that wheel! [Volunteer spins the wheel.]



True or false? In the future, nanotechnology might lead to amazing innovations.

Team A, what's your answer?

[Audience response.]

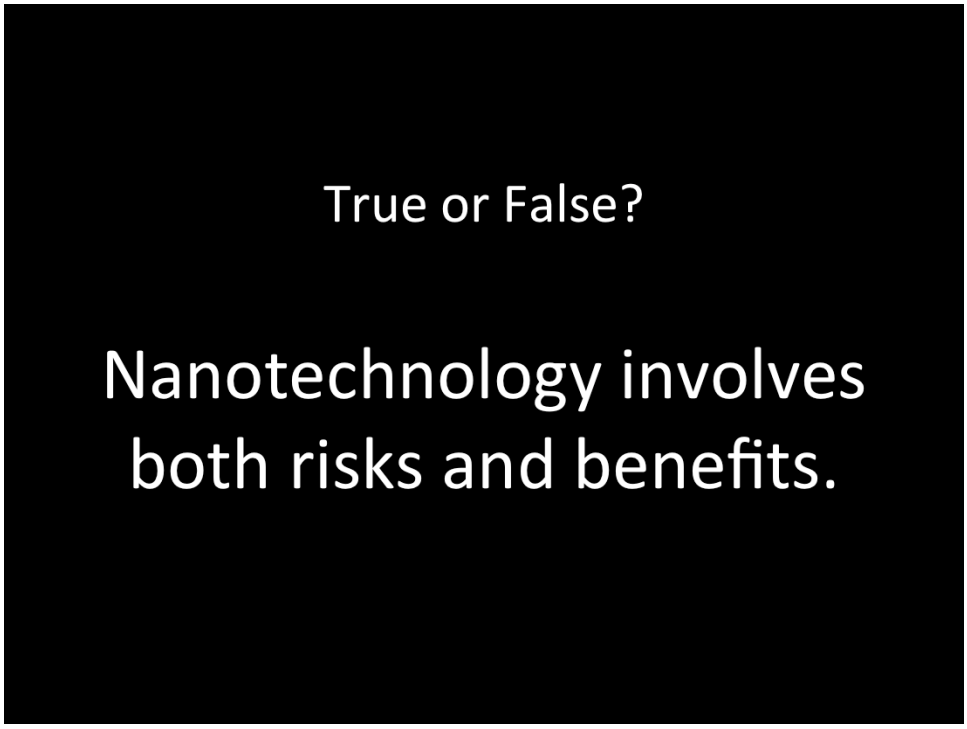
The correct answer is…

True. In the future, nanotechnology might lead to amazing innovations.

For example, researchers are working on invisibility cloaks! Many nanotechnologies are smaller than the wavelength of visible light, so they can interact with light in special ways. Researchers are experimenting with ways of bending light to cloak objects—making them invisible to the human eye or to surveillance devices.

[Scorekeeper marks score and adds them up.]

OK, we're back to Team B. Spin that wheel! [Volunteer spins the wheel.]



True or false? Nanotechnologies involve both risks and benefits.

Team B, what's your answer?

[Audience response.]

The correct answer is…

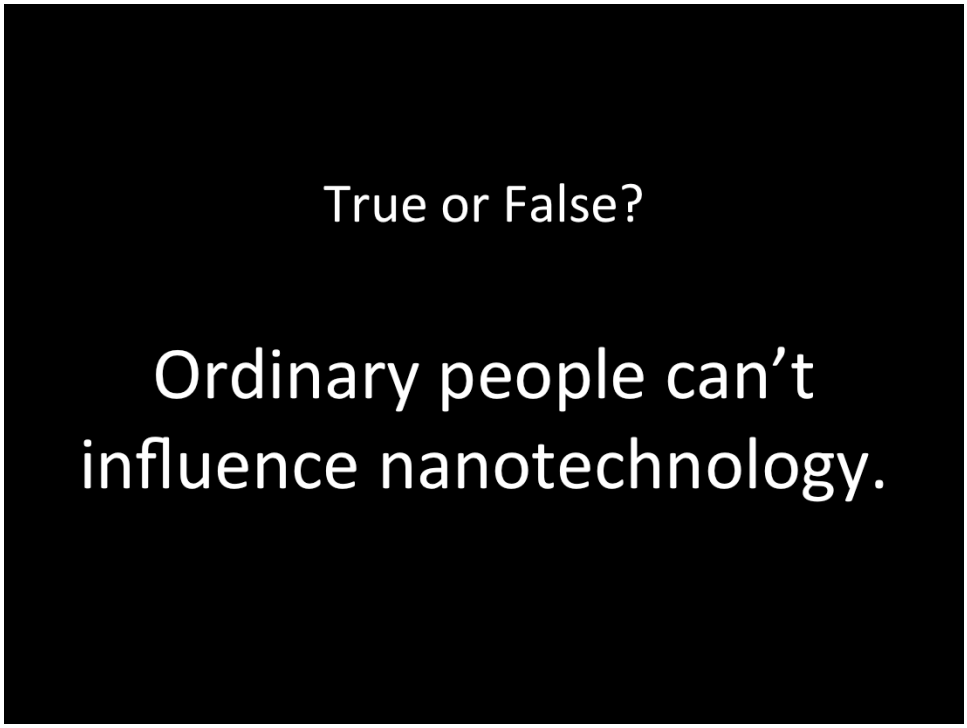
True. All technologies involve both risks and benefits. For example, gasoline is toxic and flammable. But it's also useful, so we have regulations for producing, transporting, and using it safely.

As we develop and use new nanomaterials and technologies, we can try to maximize the benefits of nanotechnology and minimize the risks. And we can also try to share the risks more equally across different people.

[Scorekeeper marks score.]

OK, Team A, it's your turn for the final question of our game! Spin that wheel!

[Volunteer spins the wheel.]



True or false? Ordinary people can’t influence nanotechnology.

Team A, what’s your answer?

[Audience response.]

The correct answer is…

False. We all have a role in shaping our nano future.

Companies and governments decide which technologies to invest in and how to regulate them. Individuals can help shape nano research and development by deciding whether to use products containing nanotechnology.

[Scorekeeper marks score and adds them up.]

That ends our game of Nanotechnology Spin-a-Prize! Congratulations everyone and thank you for playing. Give yourselves a round of applause!

The final score is_____. Well done!

There's a lot more to learn about nanoscale science, engineering, and technology—and today's NanoDays event is the perfect place to begin.

Since you all worked so hard, here's a special prize for everyone! Enjoy the rest of your day!