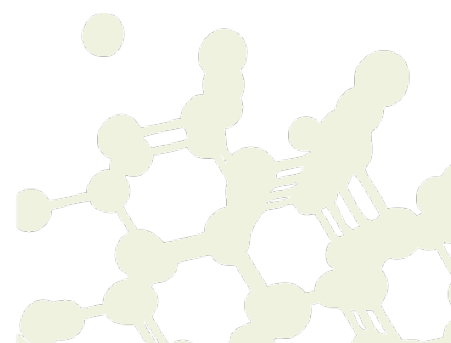


# Exploring Tools— Probe Microscopes

*What do nanostructures look like?*

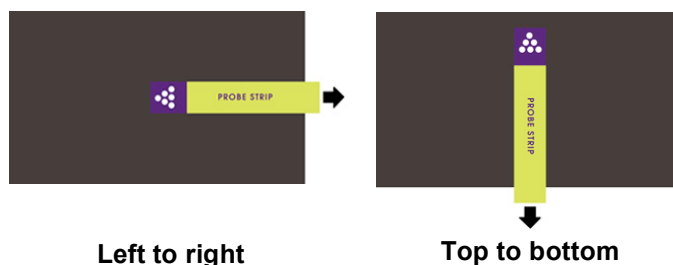




# Exploring Tools—SPMs

## Try this!

1. Take a magnet. You're going to pretend it's a *scanning probe microscope*, a tool that “feels” a surface to find out what it's like.
2. Remove the “probe strip” from the side of the magnet.
3. Turn the magnet over so it's black side up. This is the surface you're going to feel.
4. Hold the probe strip the way it's shown in the picture, and pull it slowly across the magnet from left to right. What do you feel?
5. Now pull the strip across the magnet from top to bottom, again holding it the way it's shown in the picture. Does it feel different?



## What's going on?

The magnet is a model for how a scanning probe microscope (SPM) works. It lets you “feel” something that you can't see: in this case, a magnetic field. The north and south poles run in alternating bands across the magnet.

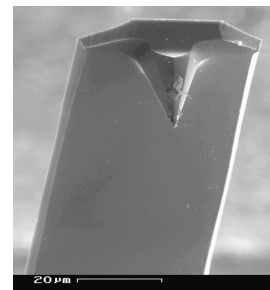
You feel the strip bump across the surface when it's pulled across the bands, because it's alternately attracted to and repelled by the poles it encounters. When the strip is pulled parallel to the bands, you don't feel the bumps because it's always attracted to the surface.

A scanning probe microscope similarly works by “feeling” something you can't see with your eyes. But in addition to detecting magnetic fields, an SPM can also detect lots of other kinds of things about a surface: nanometer-sized hills and valleys, atoms, conductivity, friction, stiffness, and more.

SPMs use a super sharp tip to move across a nanoscale surface. By dragging this tip around on different surfaces and recording the bumps and grooves, scientists are able to piece together what a surface looks like at the atomic level.

These tools can even detect and make images of individual atoms, which are much too small to be seen with a regular microscope.

## How is this nano?



Tip of an SPM, magnified 1000x

**Scientists use special tools and equipment to work on the nanoscale.** Scanning probe microscopes allow researchers to detect and make images of individual atoms and other things that are too small to see.

The invention of scanning probe microscopy was a great breakthrough in the field of nanotechnology. Once scientists could make pictures of individual atoms and the world of the nanometer, they could begin to manipulate and study things at this super tiny scale. (A nanometer is a billionth of a meter.) Without the SPM, nanotechnology wouldn't be where it is today!