

NATIONAL GEOGRAPHIC ENTERTAINMENT PRESENTS

MYSTERIES OF THE UNSEEN WORLD

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Fun Facts

Our eyes can't see everything. And how much they see—or don't see—comes down to three things: *light*, *speed* and *size*.



LIGHT

Electromagnetic radiation is all around you. Don't worry—it is just energy from light! Radiation travels in waves, like an ocean. Some wavelengths are long. Others

are short. The whole range of energy waves is called the **electromagnetic spectrum**. Our eyes see only visible light, the rainbow light waves found around the middle of the spectrum. With bare eyes, we can't see the other wavelengths on the spectrum, called invisible light. But some animals and technologies can.

- Bees see **ultraviolet** (UV) light waves from the sun. Flowers have UV markings called pollen guides. Bees see a bull's eye for nectar. We just see pretty patterns on a flower.
- It's all about light from heat with mosquitoes. They see in **infrared**, and easily find you and your warm blood. Slurp!
- **Radio waves** have the longest waves on the spectrum, so they have the lowest energy. An MRI machine uses these waves to see tissues and bones up close.
- **Microwaves** have long waves and low energy, too. The Doppler-radar images you see on your local weather are made from these.
- **X-ray** wavelengths, at the other end of the spectrum, are much shorter, so they are high energy. Machines of the same name use the waves to see inside people.
- **Gamma rays** have the shortest wavelengths and the highest energy on the spectrum. We can use them to see inside of buildings.



SPEED

Even within our visible light, things can happen too slow or too fast to see. So how do we know they are happening?

Time-lapse photography—taking photos at regular intervals over time—helps us speed up a process that happens slowly, like a seed growing. A *stroboscope*—a super speed camera—takes pictures 1,000 to one million times faster than our eyes see! By capturing so many pictures, we can see what our eyes misses, like lightning striking, flowers opening or fruit ripening.



SIZE

Some things are just too small to see. A compound microscope can magnify things up to 2,000 times. It can show us something as small as a scale on a

butterfly's wing. But what if you want to see what that scale is made of?

A scanning electron microscope can magnify up to one million times. We can see nature's tiniest building blocks. This "nano world" can help us create new technologies for use in our regular-sized world. Of course, that means we can also see what lives on us. There are more *organisms*, or living things, on each one of us than there are people on earth. Don't freak out! They might look like aliens when magnified a million times, but most are harmless. And many help us. But I'm glad they are too small to see with our bare eyes!

NATURE'S INVENTORS

Understanding how these animals do what they do can help scientists create new technologies. Can you think of things these three animals have already helped invent? Think of things they could inspire you to invent, too!

- Dragonfly: This world's greatest flyer has 4 wings and can fly in ANY direction.
- Gecko: That grip—they can even walk upside down!
- Spider silk: A spider's web is elastic and, pound-for-pound, stronger than steel. It's also nearly weightless.



ANSWER KEY: (NATURE'S INVENTORS inventions at different stages of production include flying robotics; "gecko tape;" bulletproof vests made from genetically engineered spiders' webs)

ZOOM!

What does something so small your eyes can't see it look like when it is magnified 1,000-one million times? Yikes! See if you can match these things to their close-ups: marine worm, aphid, pollen, mosquito eyes, tick.

