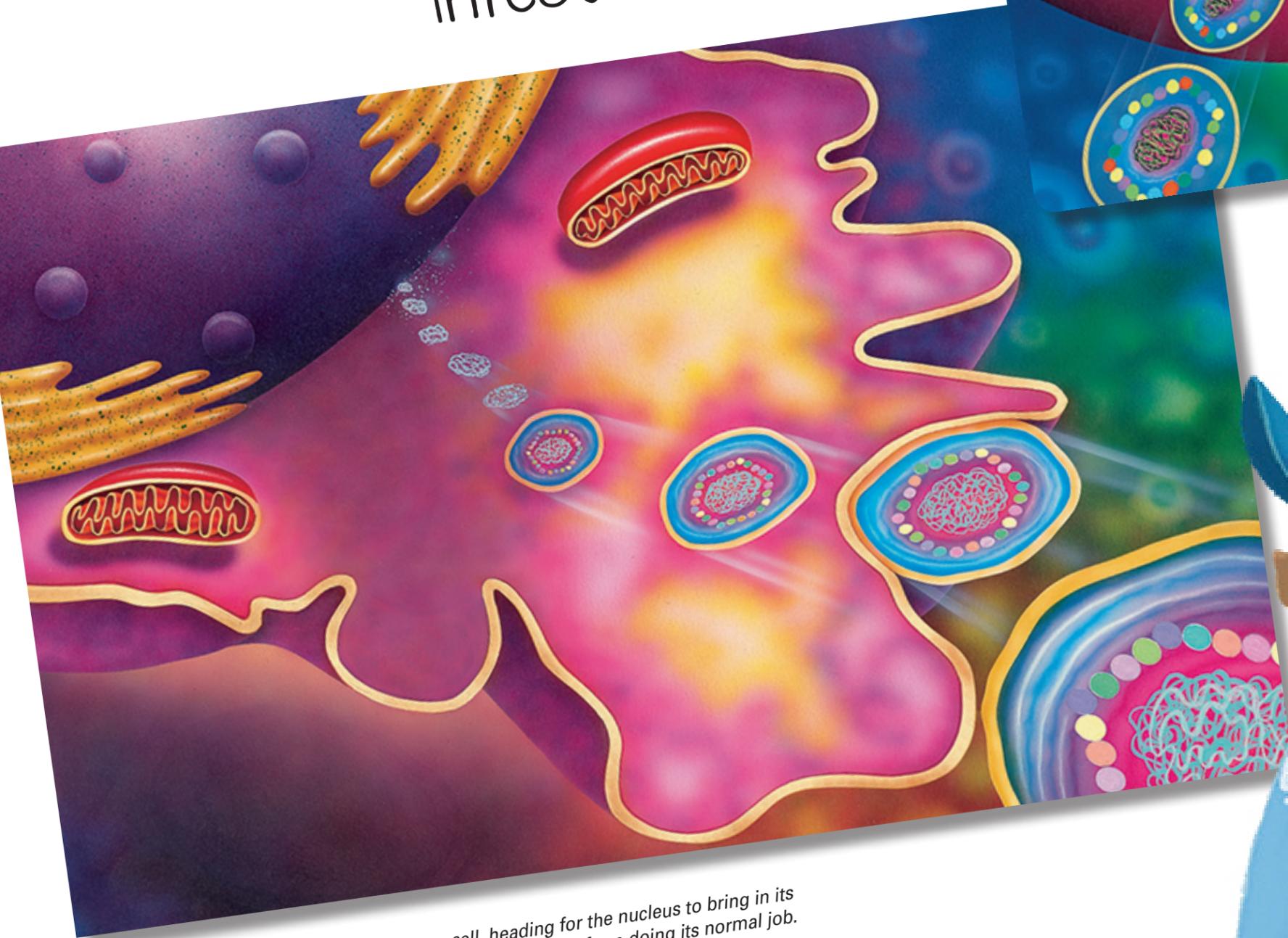
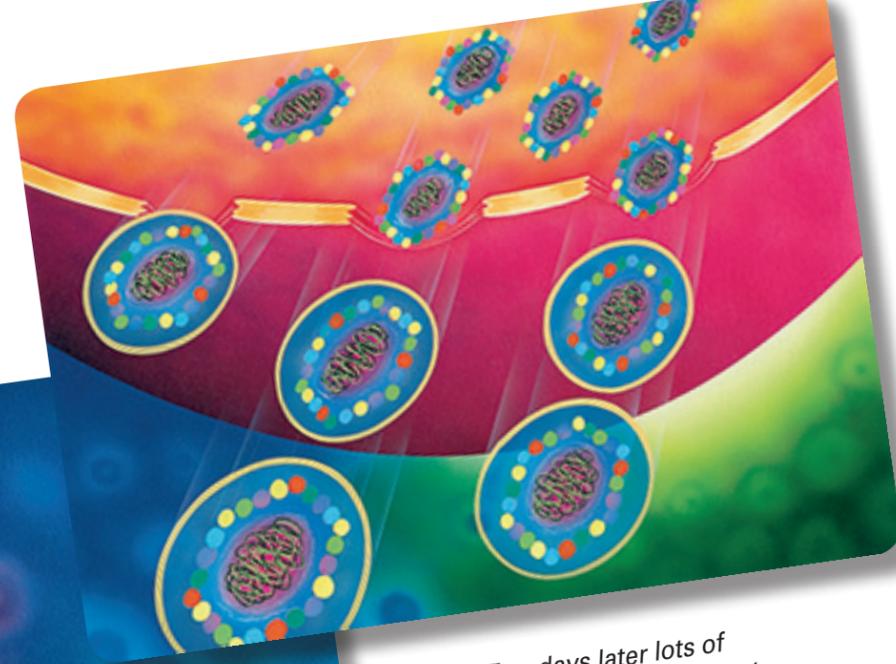


# How a **VIRUS** infects a cell



A virus invades a cell, heading for the nucleus to bring in its viral genes. This will stop the cell from doing its normal job. Instead it starts to make viral proteins and DNA.



Two days later lots of fresh viruses swarm out of the infected cell into the bloodstream.



Our cells are really good at protecting themselves from invaders. They got gatekeeper proteins on the membrane that normally just open the cell to friends with the right protein key. Viruses are not welcome!

## SO, HOW DOES A VIRUS GET INTO A CELL?

A virus with the right key can trick a gatekeeper. Then it happily floats into the cell heading for the nucleus. That is the first part of viral infection, as we can see in the image on the right.

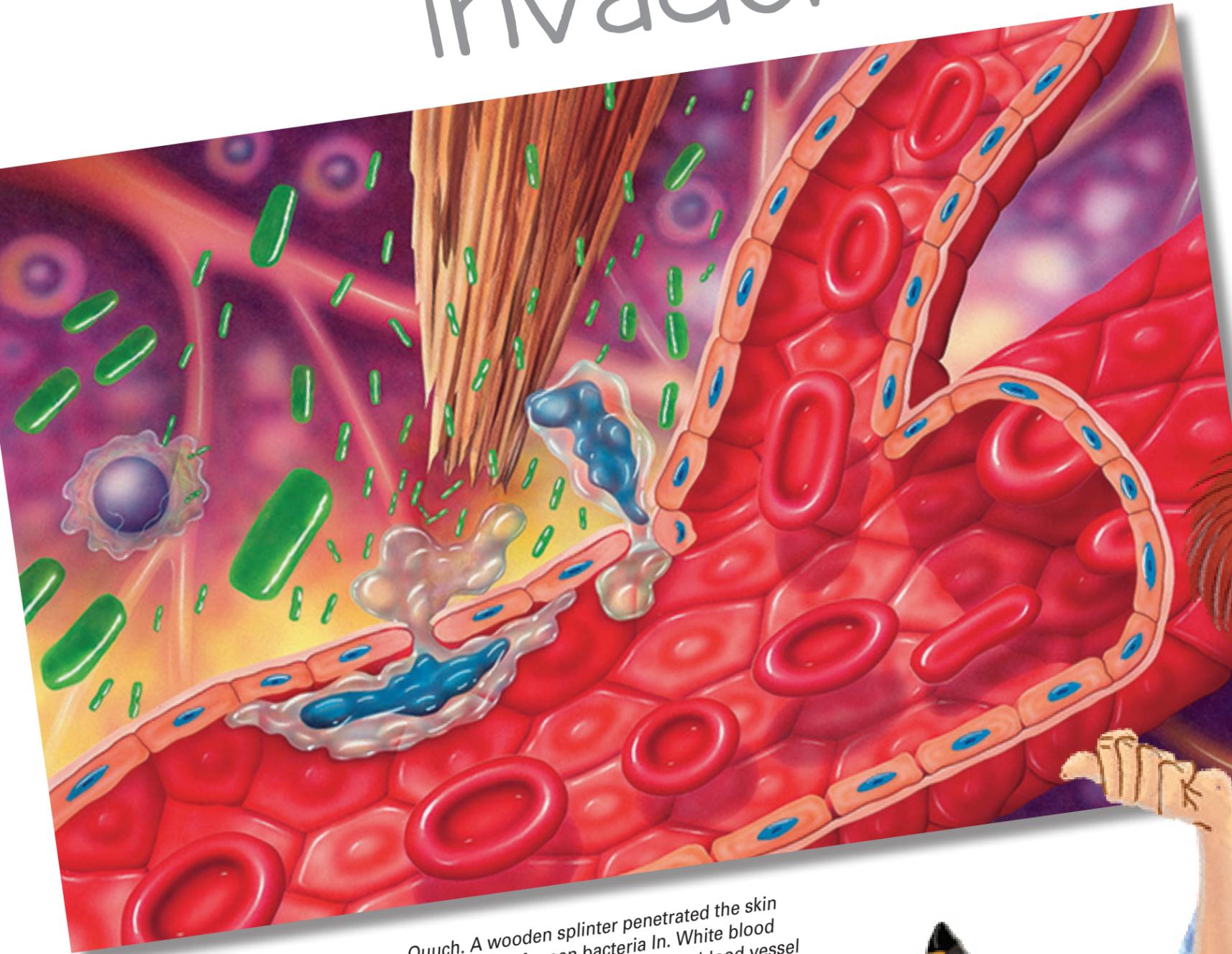
Next comes the really bad news. The viruses carry their own genes into the cell's nucleus: recipes for making fresh viruses. The virus has taken control, and the host cell becomes a slave to the virus. It starts to make viral proteins and DNA, which join together to make many new viruses. Soon masses of fresh viruses swarm out, ready to infect many more cells, and more people.

## AND WHY ARE COLDS ONLY IN OUR NOSES AND THROATS?

Because different cells have different gatekeeper proteins and therefore need different keys. A cold virus has the key only to nose and throat cells. So it cannot infect cells in other parts of the body. Unfortunately, other viruses can.

Each virus has its particular shape and genes. They infect different cells and can therefore cause a lot of different diseases.

# Here come the invaders!



Ouuch. A wooden splinter penetrated the skin and let a lot of green bacteria in. White blood cells instantly squeeze through the blood vessel wall to fight the invaders outside.



Outside the body most microbes are harmless. They only become dangerous after they get inside with the food we eat and the air we breathe. For some other microbes, however, a small cut or a splinter is all they need to get in and—oops—they swim away in our blood.

See the splinter in the skin? It made a hole in our body's first line of defense. The first thing to do is fix the hole. Blood clots make a solid scab that stops more blood from flowing out and more invaders from getting in. At the same time, local nerves sound a pain alarm. Messenger proteins tell the blood vessel cells to widen, so more blood can reach the hurt cells. That is why the skin turns red, gets warm and swells.

## BUT WHERE ARE THE DEFENDERS?

Just wait a minute, the hurt cells have already sent out messages with which they call in white blood cells that normally swim in the bloodstream. But now they squeeze their way through tiny gaps between the blood vessel cells. One kind of incoming white blood cells are called macrophages, meaning big eaters. And that is exactly what they are really good at: eating microbes and damaged or sick and old cells.

# Defenders at work!

There are 300 times more defender cells in our blood than people on Earth. These white blood cells are constantly made in the soft bone marrow inside our bones. They mostly hang out in the bloodstream, lymph nodes and lymph. Lymph is a clear body liquid flowing in its own system of vessels throughout the body.

Macrophages and another kind of white blood cells called granulocytes are the first ones to fight microbes. The pus coming out of an infected wound contains dead skin cells, white blood cells and bacteria that are still fighting.

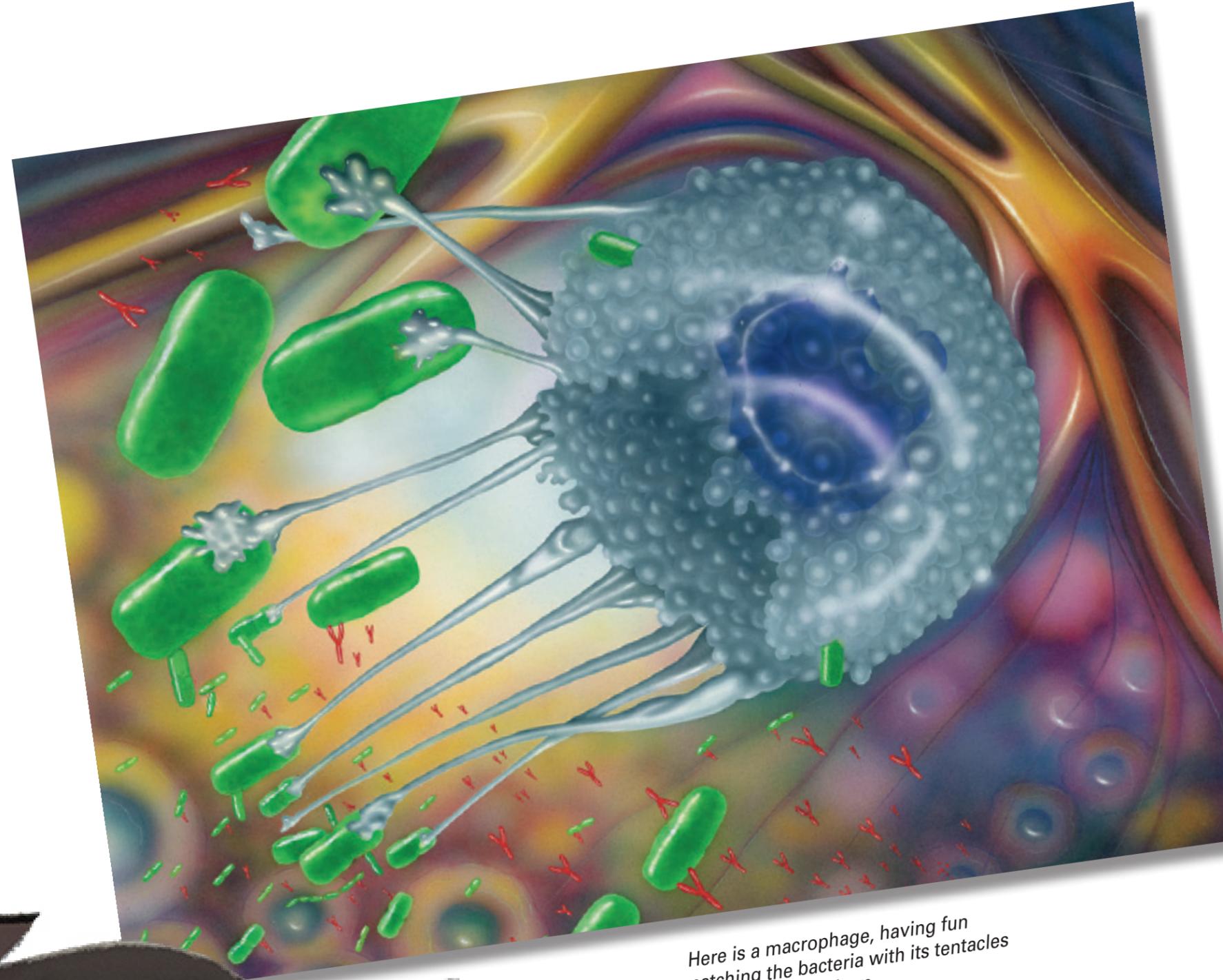
Later on other defender cells with special weapons will join the fight of white blood cells. One kind are B cells making antibodies, tiny protein particles flagging microbes, such that macrophages can detect them right away.

Another kind are T cells that kill infected body cells by injecting poison. But the right B and T cells need some days to build up their defense and to finally stop the infection.

## HOW CAN CELLS EAT THINGS, GENE?

Here we have a heroic macrophage ready to gobble up bacteria. First it pulls them in with its tentacles and then it will take one invader at a time in a deadly hug, suck it inside, break it down into little pieces, and digest it.

See the tiny Y-shaped particles sticking to the bacteria? These are antibodies marking them as food for the macrophages, the "big eaters." They not only fight invaders but also eat sick and old body cells, for instance, tired red blood cells.



Here is a macrophage, having fun catching the bacteria with its tentacles and then eating them.

