

# BACTERIA EVOLVING:

## Tracing the Origins of a MRSA Epidemic

### PASSAGE ONE

## What is MRSA?

We often think of the human body as one organism, but in fact, our bodies are home to a complex ecosystem of microorganisms. Right now more than 8,000 species of bacteria are living in and on your body, and about 1,000 of those are living on your skin. And that's just the number of *species*. All of these bacteria reproduce very quickly, producing a new generation in as little as every twenty minutes. We can only estimate the total number of bacteria in and on your body, but it might be as many as 100 trillion individual organisms.

Along with bacteria, there are other microscopic organisms living on us, including viruses and fungi. Together, these organisms form a **microbiome**, a microscopic ecosystem. Not only that, within the microbiome are many different microscopic habitats or environments. Each habitat has its own unique population of microorganisms.

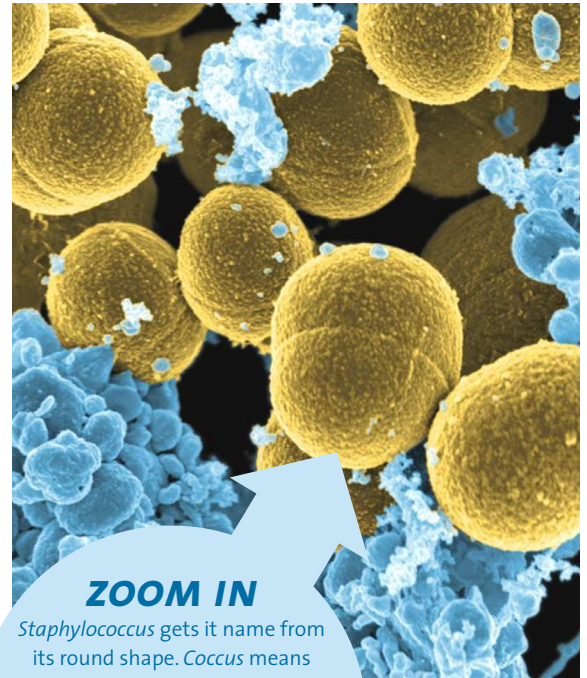
Some bacteria thrive in your hair follicles, others in your sweat glands, others in the relatively moist areas of your face and back.

The relationship between your skin and these microorganisms is quite complex. Your skin is a barrier that keeps these organisms out of your body. At the same time, it also interacts with them. For example, some bacteria on your skin help to “educate” your immune system so it will be better able to recognize dangerous bacteria that invade the body.

However, sometimes bacteria on our skin can become harmful or even deadly. One example is a group of bacteria called **MRSA** or **Methicillin-Resistant Staphylococcus Aureus**.

### What is MRSA?

*Staphylococcus* or staph is a large group of bacteria. Within that group is a species called *Staphylococcus aureus* that has adapted to live on our skin and in our nostrils. About one in three people have staph on their bodies, usually without even knowing it.



### ZOOM IN

*Staphylococcus* gets its name from its round shape. *Coccus* means “little ball” and *staphylo* means “bunch of grapes” (shown here in yellow). That’s what staph bacteria look like under the microscope – a bunch of grapes. The word *aureus* refers to its golden pigment.



A staph infection can occur when the bacteria gets under human skin.

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### What is MRSA?

When bacteria live on us without harming us, it's called *colonization*. However, sometimes bacteria attack healthy cells and make us sick, causing *infection*.

Doctors can usually cure bacterial infections with antibiotic medicines. And that's why MRSA is so dangerous. As you can tell from its name, MRSA is *methicillin-resistant*. Methicillin used to be the antibiotic that was most effective in treating staph infections. But methicillin and other related antibiotics do not kill MRSA. As a result, MRSA infections are very difficult to treat and sometimes fatal.

There are about 100 different types of MRSA, and about one to five percent of people carry MRSA colonies. Within that group, only a tiny percentage will get a MRSA infection. Like other *S. aureus*, a MRSA bacterium by itself does not make you sick, but can get under your skin and become quite serious.

### A New Type of MRSA

MRSA bacteria *strains* (subtypes within a species) have been around for a long time. In fact, only two years after the introduction of methicillin in the 1950's, the first cases of methicillin-resistant *S. aureus* appeared in hospitals. This is called *hospital-acquired-MRSA*. It seems to spread mainly through hospital equipment and personnel.

Then, in the late 1990's, a new type of MRSA began showing up. The new strains, unlike hospital-acquired-MRSA, were causing infections in healthy people outside of hospitals. This was called



### UNDER THE MICROSCOPE

Researchers take a close look at *Staphylococcus aureus* in a petri dish at Columbia University Medical Center in New York City.

### FAST FACTS



*Staphylococcus aureus* is the leading cause of surgical wound infections



MRSA can spread in two ways: between patients and health-care workers in a hospital, or individuals living and working together in close community



Over 2 million patients in the United States get an infection in the hospital each year

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## What is MRSA?

*community-acquired-MRSA.*

The most common community-acquired-MRSA strain was called USA300. Although it was more susceptible to antibiotics, USA300 was somehow much better at spreading from person to person than hospital-acquired-MRSA.

It's clear why this new type of MRSA was so troubling to doctors and public health workers. They feared its ability to spread outside of hospital settings would lead to dangerous epidemics. And in fact, cases of MRSA, though still relatively rare, have increased dramatically in past decades.

Scientists and health workers knew that MRSA had evolved. Somehow, the strain called USA300 had gained the ability to spread more easily from person to person. But how was it able to do that? And how had it gotten this new ability? That was the mystery that scientists set out to solve. If they could find the answer, they just might be able to find a way to stop MRSA from causing serious infections, even fatalities.

## HOSPITAL STAYS WITH MRSA 1993 - 2005



## TRACKING THE EPIDEMIC

Cases of MRSA reported in U.S. hospitals have skyrocketed over the past two decades, prompting researchers to track the evolution of this rapidly changing epidemic.

## STOP AND THINK

Based on the text:

- What are the medical implications of antibiotic resistance?
- What factors make USA300, a MRSA strain, of special concern?
- What are some of the questions that scientists ask about USA300?

Looking ahead:

- What kind of data do you think scientists might collect to answer those questions?