

# Difference Between Staph and MRSA

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## Key Difference – Staph vs MRSA

Microbes cause many diseases. Staphylococcus is one such organism that causes different clinical conditions in humans. It is usually found in the nasopharynx and skin of up to 50% of people in the population. On the other hand, methicillin resistant staphylococcus aureus or MRSA is one variety of staphylococcus that is resistant to methicillin. **Staph is not resistant to methicillin while MRSA is resistant to methicillin.** This is the key difference between staph and MRSA.

## What is Staphylococcus?

Staphylococcus is usually found in the nasopharynx and the skin of up to 50% of people in the population. There are 3 main pathogenic species of staphylococcus as *Staphylococcus aureus*, *Staphylococcus epidermidis* and *Staphylococcus saprophyticus*. It is important to know that staphylococcus and [streptococcus](#) are two different species of organisms that can be differentiated from each other by the [gram stain](#), catalase test and culture.

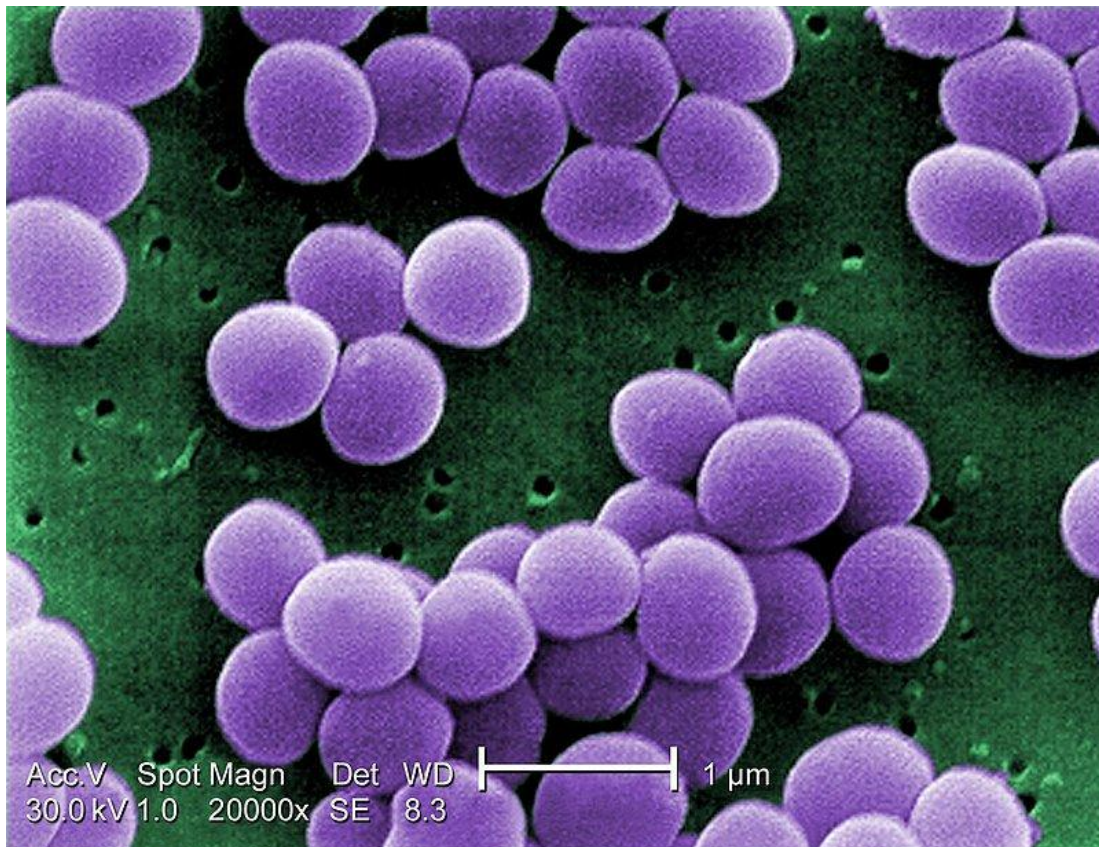
Under the Gram stain, staphylococcal colonies forming grape-like clusters can be clearly observed. All staphylococcal species have the enzyme catalase. When a wire-loop containing gram positive cocci is inoculated on a slide with [hydrogen peroxide](#), if bubbles appear, it indicates that hydrogen peroxide is broken down into oxygen bubbles and water by these organisms.

## *Staphylococcus aureus*

This category has a microcapsule surrounding its huge [peptidoglycan](#) cell wall, which in turn surrounds a cell membrane containing [penicillin](#) binding protein. *Staphylococcus aureus* has several proteins on the cell wall that can disable the immune defenses. Protein A has sites that can bind to the Fc portion of IgG. This protects the organism from opsonization and [phagocytosis](#). Coagulase enzyme can lead to fibrin formation around the organism, preventing it from been phagocytosed. Four types of hemolysins are present as alpha, beta, gamma and

delta; they are capable of destroying red blood cells, neutrophils, macrophages and platelets.

Staphylococcus also have a chemical called leukocidin which is capable of destroying [leukocytes](#). CA-MRSA produces a special leukocidin called Pantone-Vlentine Leukocidin(PVC). Beta lactamase produced by these bacteria can break down penicillin and other similar antibiotics.



**Figure 01:** *Staphylococcus aureus*

## Proteins that Degrade Tissues

- Hyaluronidase
- Staphylokinase
- [Lipase](#)
- [Protease](#)

Staphylococcus is capable of causing a wide range of diseases, which can be categorized into 2 groups, as the diseases caused by exotoxins and the diseases resulting from direct organ invasion by bacteria.

Diseases caused by exotoxin release;

- [Gastroenteritis](#) (food poisoning)
- Toxic Shock Syndrome
- Scaled Skin Syndrome

Diseases resulting from direct organ invasion;

- [Pneumonia](#)
- [Meningitis](#)
- [Osteomyelitis](#)
- Acute bacterial endocarditis
- [Septic arthritis](#)
- Skin infections
- Bacteremia/sepsis
- Urinary Tract Infections

## ***Staphylococcus epidermidis***

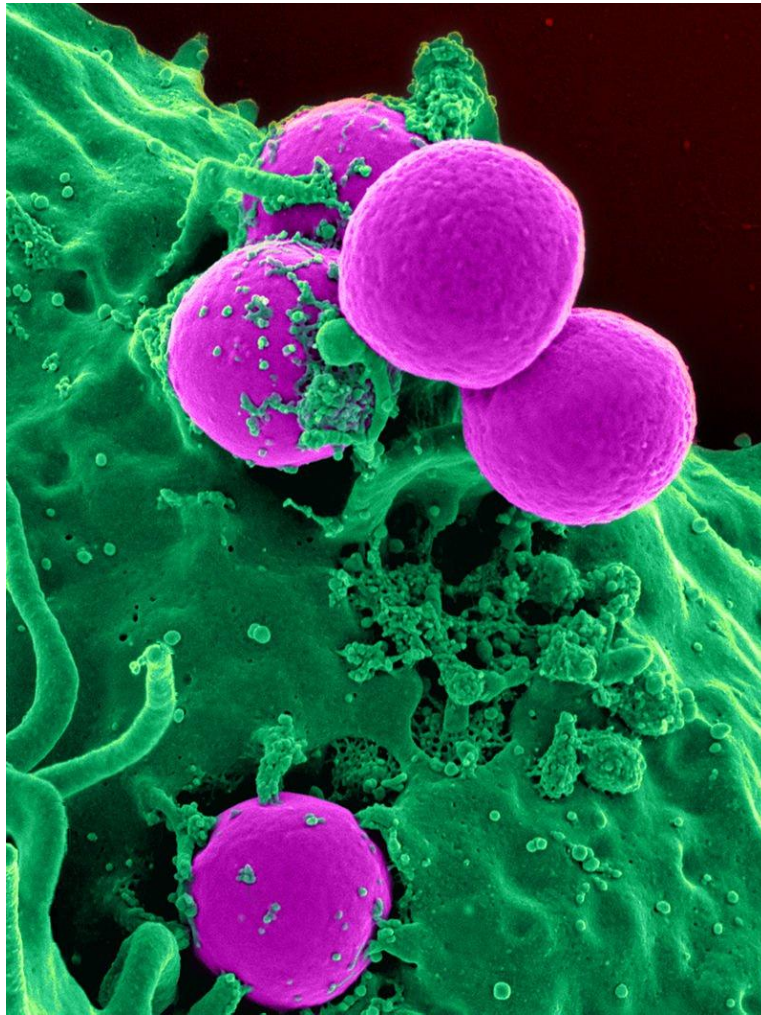
This category of organisms is a member of normal bacterial flora. *Staphylococcus epidermidis* is catalase positive and coagulase negative. This organism causes nosocomial infections, especially in patients who are on Foley urine catheters or intravenous lines and is a frequent skin contaminant on blood cultures. *Staphylococcus epidermidis* causes infections of prosthetic devices of the body, such as prosthetic joints, prosthetic heart valves and peritoneal dialysis catheters. This is caused by a polysaccharide capsule that allows adherence to these prosthetic devices. Attacks of this organism can be treated with Vancomycin.

## **What is MRSA**

Since most staphylococci secrete penicillinase, they are penicillin resistant. Methicillin, Nafcillin and other penicillinase-resistant penicillins are not broken down by penicillinase. Therefore, these drugs are used to kill most strains of *Staphylococcus aureus*. MRSA is a group of *Staphylococcus aureus* that has acquired multi-drug resistance against methicillin and nafcillin which is mediated by an acquired chromosomal DNA segment (*mecA*). This chromosome encodes a new penicillin binding protein 2A that can take over the job of peptidoglycan cell wall assembly. Until recently, under the influence of heavy antibiotic pressure, most strains of MRSA developed in the nosocomial environments. These strains had



been categorized as health care or hospital acquired MRSA or HA-MRSA. HA-MRSA generally shows extensive antibiotic resistance. In these cases, Vancomycin becomes one of the most useful antibiotics. But now, strains of *Staphylococcus aureus* resistant to Vancomycin have also been identified.



**Figure 02: Scanning electron micrograph of a human neutrophil ingesting MRSA**

## **Community Acquired MRSA**

Emergence of multiple clones of MRSA outside the hospital set up has given rise to community acquired MRSA. Highly publicized outbreaks of CA-MRSA infections are seen among sports teams. Humans are prone to develop skin and soft tissue infections caused by these bacteria. CA-MRSA produces a toxin called Panton Valentine Leukocidin toxin which is associated with the formation of skin abscesses. The genes encoding methicillin resistance are carried on a genomic strand called SCCmec. CA-MRSA has a much smaller SCCmec transferable element that is easily transferred among staph bacteria. Therefore, CA-MRSA is

much more efficient at spreading and it is now the most predominant methicillin resistant staphylococcus bacterium acquired both in and out of hospital. Fortunately, CA-MRSA can be treated with oral antibiotics such as clindamycin and trimethoprim-sulfamethoxazole.

## Similarity Between Staph and MRSA

Both Staph and MRSA are bacteria that cause different diseases in humans.

## What is the Difference Between Staph and MRSA?

### Staph vs MRSA

Staphylococcus is a bacterium commonly seen as a part of the normal flora on the skin and in the nasopharynx.

MRSA is one type of staphylococcus that is resistant to Methicillin.

### Methicillin

Not resistant to methicillin.

Resistant to methicillin.

## Summary – Staph vs MRSA

Staphylococcus is a commensal that is usually found in the nasopharynx and on the skin of humans whereas MRSA is one variety of staphylococcus that is resistant to methicillin. The indiscriminate use of antibiotics is the main reason for the emergence of this kind of antibiotic resistant pathogens.

### References:

1. Gladwin, Mark, et al. *Clinical microbiology made ridiculously simple*. MedMaster, Inc., 2011.

### Image Courtesy:

1. “Staphylococcus aureus VISA 2” By Content Providers(s): CDC/ Matthew J. Arduino, DRPHPhoto Credit: Janice Haney Carr – This media comes from the Centers for Disease Control and Prevention’s Public Health Image Library (Public Domain) via [Commons Wikimedia](#)
2. “Human neutrophil ingesting MRSA” By National Institutes of Health (NIH) – National Institutes of Health (Public Domain) via [Commons Wikimedia](#)

## How to Cite this Article?

**APA:** Difference Between Staph and MRSA. (2017, October 24). Retrieved (date), from <http://www.differencebetween.com/difference-between-staph-and-vs-mrsa/>

**MLA:** " Difference Between Staph and MRSA" Difference Between.Com. 24. October 2017. Web.

**Chicago:** " Difference Between Staph and MRSA." Difference Between.Com. <http://www.differencebetween.com/difference-between-staph-and-vs-mrsa/> (accessed [date]).



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