

Microbiology 101 – Part I

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****This in-service has been Approved by the CBSPD, Inc. for 1 CEU.**

Background

One of the major responsibilities of the Sterile Processing Technician is to properly clean and sterilize devices. Too often, however, we do not realize what is hiding on those instruments that we just “swich” in the water. It is critical for sterile processors to know about microbes and how they impact on our world.

In 2000 the Centers for Disease Control & Prevention prepared a report that documented a 36% increase in hospital infections over the previous. Over 2 million hospitalizations result in healthcare acquired infections, also known as nosocomial infections.

Bacteremia (the presence of bacteria in the blood) increased hospital stays in the Intensive Care Units by 8 days and hospital days by 14 with a death rate of 35%!

Post operative wound infections increase hospital stays by the average of 7.4 days.

Nosocomial infections claim over 100,000 lives annually and approximately 14-16% of these are **directly related to surgical site/surgical instruments**. In addition, there is an increasing prevalence of antibiotic resistant microorganisms (43% increase). (These are microorganisms that become resistant to antibiotics).

A report in the Chicago Tribune (2003) revealed that 90,000 deaths in 2002 were linked to nosocomial infections in the US, making it the leading cause of death in the US behind heart disease, cancer and strokes. Many of the deaths were caused by unsanitary facilities, **germ laden instruments** and unwashed hands.

There are approximately 70% of hospital infections which are now resistant to at least one drug and a growing number are resistant to many or all approved antibiotics.

Leading Infections/Causes of Death 2001

- Lower respiratory. Infections (e.g. pneumonia)
- HIV/AIDS
- Diarrhea
- TB
- Malaria

HIV Infections in Adults 1997

- US - approximately. 1 million
- Latin America 1.5 million
- Europe/Middle East - ¾ million
- Africa - 14,000,000 +
- Asia 5,000,000

Eurasia-AIDS - It is estimated there will be 66 million cases by 2025. To complicate matters more, China is accused of selling contaminated blood which adds to the issue. Russia has high IV drug use problem and India's increase is caused by sexual transmission.

Some of the Infection Control measures proposed to confront the issues. Obviously something has to be done. Some of the measures recommended are:

- **Mandatory auditing of antibiotic usage** - hospitals are now looking at antibiotic usage and making sure antibiotics are only given when necessary
- **Controlling antibiotics** - not giving antibiotics when they will not work (e.g. when you have a cold - antibiotics do not work against viruses.
- **Strict enforcement of hand washing** - it is sad that in today's world that we still have to remind people to wash their hands. Not only to wash their hands to perform it correctly! Ever watch people "wash" their hands? Its amazing we do not have more diseases.
- **More public education about the hazards of antibiotics**

Approximately 1 in 10 hospitalized patients will acquire an infection after admission, resulting in substantial economic cost. Hospitals are being paid less and less money to treat patients. When a patient gets an infection in the hospital, the hospital will have to cover all the costs themselves. This leaves less money for salary increases, new equipment, etc.

The primary cost is that patients with hospital-acquired infections have their stay prolonged, during which time they occupy scarce bed-days and require additional diagnostic and therapeutic interventions (tests, medications, x-rays, etc).

Estimates of the cost of these infections, in 2002 prices, suggest that the annual economic burden is **\$6.7 billion** per year in the United States alone.

In order to confront this issue, we need to understand the "enemy". The enemy is microorganisms. In order to deal with the enemy, we must know more about them. Microorganisms can be long to a number of "families"; bacteria, viruses, protozoa, rickettsiae and a special group called prions.

So, what are some of the basic characteristics of microorganisms?

- 1) They are not visible with the naked eye - bacteria can only be seen with a microscope. This makes it difficult since people tend to ignore what they cannot see.

- 2) They are colorless - in order to "visualize" bacteria scientists have to color them with a dye so they will show up under the microscope
- 3) They are single celled (one cell) and all of life's processes take place in the one cell.

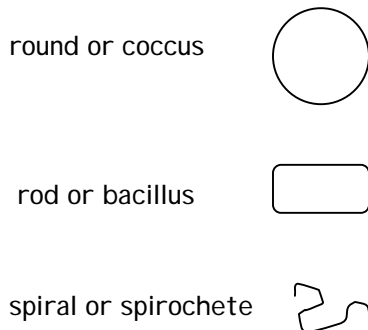
Microorganisms are everywhere-in the food we eat, the water we drink and the air we breathe. Bacteria may have a single cell, but they are very complex and even fascinating. Bacteria have been found that can live in temperatures above the boiling point and in cold that would freeze your blood. Bacteria can live on or in just about every material and environment on Earth from soil to water to air, and from your house to arctic ice to volcanic vents. Each square centimeter of your skin averages about 100,000 bacteria. Bacteria can shed from your skin as well. This is why it is so important to practice good personal hygiene.

Not all microorganisms are pathogenic (cause disease). Approximately 15% of all known microorganisms are pathogenic. The others are non-pathogens (do not cause disease). The "good" microorganisms are used for food production (beer, cheese) or are required by the body (e.g. in intestines and nasal passages. These are called normal flora are not harmful to us unless they get out of their usual area and get into another part of our body or into someone else's body! Then, these non-pathogenic microorganisms can become pathogenic!

Let's Talk about Bacteria

Size - Bacteria are measured in microns and one micron equals 1/25,000th of an inch. It is said that millions of microorganisms can pass through a pin hole because of their small size. This is why a single hole in a package upsets the end user (OR).

Shape - Bacteria are classified by shape. The three common shapes of bacteria are:



As mentioned before, bacteria are colorless. In order for scientists to study bacteria they need to first see what shape they are. To see the bacteria they stain them using a process known as the Gram Stain. The Gram stain is a multi-step process in which different color dyes are placed on the bacterial cells to see what color dye the cell "picks up or stains". If the cells stain purple or blue the bacteria are classified as Gram Positive. If the cells stain pink or red they are classified as Gram Negative. Once the cell takes on the stain, the shape can be seen. So, if the looking into the microscope, red stained round cells are found, we know the microorganism is a Gram Negative coccus. The investigation goes on from there.

Bacteria can also group together.

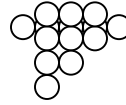
When 2 coccus cells divide and they stay attached they are called diplococcus meaning 2 coccus cells.



When a chain of coccus cells forms it is called streptococcus



When a cluster form (like a cluster of grapes) it is called staphylococcus.



This can also happen with bacillus; diplobacillus (2 bacillus cells); streptobacilli (chain of bacilli) and staphylobacilli (cluster of bacilli).

Bacteria need certain things to survive:

Food (in the form of carbohydrates, protein, etc.), which they get from their host (the patient!)

Warmth - bacteria prefer 98.6F (body temperature., So the human body provides the ideal "incubator" for bacteria.

Moisture - generally dryness is deadly to bacteria. They depend on moisture to get nutrients into the cell and wastes out of the cell.

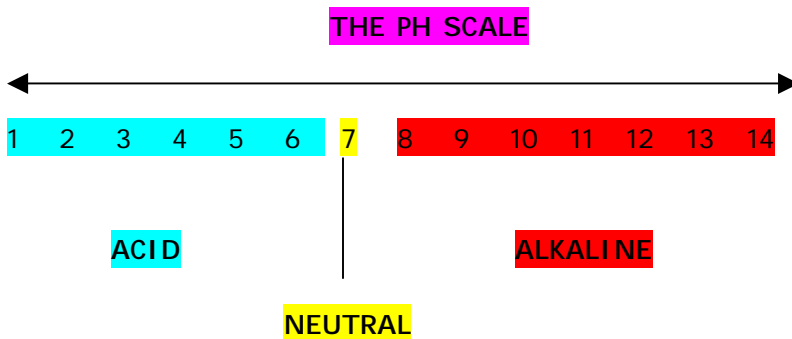
No accumulation of wastes

Indirect light - bacteria prefer darkness

Oxygen - some bacteria require free oxygen; these are called aerobes. Those that do not require free oxygen are called anerboes.

Slightly alkaline environment

To understand what a "slightly alkaline" environment means, one has to know the pH scale. The pH scale is a means of measuring the acidity or alkalinity of a solution.



So, if a solution has a pH of 3 it would be acid and if a solution had a pH of 11 it would be alkaline. Since bacteria like a slightly alkaline environment, they prefer a pH of about 8-9.

We will learn more about these tiny creatures in Microbiology 101 - Part II

POST TEST QUESTIONS: Microbiology 101 - Part I

This in-service is Approved by the CBSPD for 1 CEU. Complete this post test and follow the directions at the end of the test for payment and results.

Bacteria can be in the form of three shapes. Match the name with the shape:

1. Round _____ A) Spirochete
2. Spiral _____ B) bacillus
3. Rod _____ C) coccus
D) spore

4. Your skin has how many bacteria per square centimeter?
A) 1,000
B) 10,000
C) 100,000
D) 1,000,000

5. The term pathogenic means:
A) Friendly
B) Acid fast
C) Non-disease causing
D) disease causing

6. Which of the following requirements is not needed by **ALL** bacteria?
A) food
B) slightly alkaline pH
C) oxygen
D) indirect light

7. If a solution has a pH of 13 it would be considered:
A) pathogenic
B) neutral
C) acid
D) alkaline

8. When bacteria form a chain it is called
A) streptococcus
B) staphylococcus
C) diplococcus
D) pseudomonas

9. Bacteria are measured in microns. One micron equals:
- A) $1/25^{\text{th}}$ of an inch
 - B) $1/250^{\text{th}}$ of an inch
 - C) $1/25,000^{\text{th}}$ of an inch
 - D) $1/250,000^{\text{th}}$ of an inch
10. Bacteria are made visible when they are stained using the Gram stain method. Gram positive bacteria stain which color?
- A) yellow-white
 - B) green-blue
 - C) red-pink
 - D) purple-blue
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Directions for Payment and Results

This in-service = \$10

Re-do's = \$10 each

No refunds (all sales are FINAL), prices subject to change.

Payment is accepted in the form of a Credit Card, Facility Check, or Money Order only. Sorry, no personal checks.

Please see the form on the following page.

Upon passing this in-service, your certificate will be mailed to you within 7-10 business days.

Please fill out the form below and submit it with your payment and the quiz to:

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If you have any questions, please email heidi@spdceus.com

Thank you!