

Microbiology 101 – Part III

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

In Microbiology Parts I and II, you learned about microbes, their needs, how they reproduce and the shapes and categories of microorganisms. This module will complete Microbiology.

Problem Areas – the areas of concern in the microbe world are:

Emerging infectious disease – This is a disease that results from newly identified, previously unknown infections, which cause public health problems locally or internationally.

■ **Re-emerging infectious disease** – the reappearance of and increase in the number of infections from a disease which is known but which formerly was not a public health threat.

Diseases which once plagued us since early man are once more becoming a threat in the US and around the world. Pneumonia and influenza-combined the sixth most common cause of death in the US are on the rise. Old diseases are no longer responding to old drugs (e.g. TB). Diseases once not considered to be infectious have been proved to be pathogenic (e.g. staph epidermitis). Because we do not know what new disease will present, we must always be prepared for the unexpected.

For example, the IE 1997 – strain of influenza that had never before attacked humans began to kill previously healthy people in Hong Kong. The **Ebola Virus** had its first outbreak in 1976; the virus was discovered in 1977. The cases are mainly confined to four countries in Africa. Through June 1997, 1,054 cases identified and reported to the World Health Organization (WHO); 754 were fatal. It was recently discovered that a strain of the virus that causes HIV/AIDS has been circulating at least since 1959. This illustrates the way in which emerging infectious agents can insinuate themselves into human populations and remain undetected for years before emerging as a public health problem. **This is a reminder that we are only one step ahead of the bugs!**

In the 1970's the following diseases were identified: Legionnaires' disease; Ebola hemorrhagic fever; Lyme disease; toxic shock syndrome; AIDS; and multiple drug resistant TB finalized the assault.

About 10 years ago, scientists were saying, "with vaccines and antibiotics, infectious diseases were under control. We now know life is not that simple". A major cause of the problem is drug resistance – the ability of infectious microorganisms to evade the drugs designed to stop them. These drug resistant strains now include some pneumonias, TB,

malaria, and AIDS. The second problem is the emergence of new infectious diseases. While AIDS and Lyme disease are obvious examples, more than 30-new disease-causing organisms have been discovered since 1976.

About 15% of the population gets the flu each year, which usually occurs from October through May. About 20,000 Americans die from flu each year. On the horizon is a nasal spray for flu protection. It appears promising. More than 100 different organisms can cause pneumonia (acute or chronic inflammation of the lungs). The viral type is not as serious as bacterial pneumonias, which can be life threatening. Antibiotics have helped eliminate pneumonia as the leading cause of death in the US. Up to 3 million cases of infectious pneumonia occur each year resulting in about 75,000 deaths. The increased deaths attributed to an aging population that is more susceptible to the disease (Pneumonia spreads more rapidly among people who are crowded together (i.e. office, day care centers and schools); poorly ventilated spaces (i.e. offices, aid in the transmission. Children and healthcare workers play a major role in spreading *Streptococcus pneumoniae* pneumonia-the most common form-since 35% carry the bacteria even though they are healthy and have no signs of illness. Excessive and often unnecessary use of antibiotics, especially in children, has led to a rapid rise in drug-resistant pneumococcal bacteria.

In some cities up to 35% of patients no longer respond completely to antibiotics because some strains of bacteria are now resistant to penicillin. There is concern now that pneumonia will become resistant to vancomycin, considered the antibiotic of last resort.

Hepatitis C - There are 3.9 million Americans with hepatitis C - most don't know they have it; most often there are no symptoms. As many as 10,000 people who are infected die each year. The people at risk are IV drug users but healthcare workers are also at risk as well as hemodialysis patients and sexually active homosexuals. Anyone who received a blood transfusion before 1992-when an effective screening for hepatitis C in the blood supply was developed—should be tested for the disease. There is no vaccine. Current treatment is with interferon, which works only in a small percentage of patients.

Staph Aureus - Has been a common cause of nosocomial infections from 1990-1996. It is the leading cause of nosocomial pneumonia and surgical site infections and the second leading cause of nosocomial bloodstream infections. More than 95% of patients with *Staph. aureus* infections do not respond to first-line antibiotics such as penicillin or ampicillin. Methicillin is the next antibiotic in line for treatment.

Methicillin Resistant Staph Aureus (MRSA) - was first reported in 1960s. It has become increasingly prevalent since the 1980s. Now it is prevalent in many hospitals and even epidemic in some facilities. With this strain of *Staph*, the bacteria has learned to become resistant to Methicillin, the treatment of choice. The resistance in approximately 30% of all *S. aureus* infections. It was previously found in Nursing Homes and when these patients were transferred to a hospital, the hospital dealt with it. However, MRSA is now in the general community (e.g. ear piercing parlors) **outside of hospitals and Nursing Homes**. Recently a young boy who fell on a ball field playing softball, scrapped his knee. He developed a severe MRSA infection. This is a serious concern for all of the medical

community. Vancomycin is the only drug that can consistently treat MRSA and is considered the antibiotic of last resort. However Vancomycin is now showing some resistance.

Another Vancomycin resistant microbe is Vancomycin Resistant Enterococcus (VRE). In 1989 hospitals reported a rapid increase in VRE. It is thought that even a small increase in the incidence of VRE infection could lead to cross-resistance in *S. Aureus* Vancomycin Resistant Staphylococcus Aureus. Three vancomycin resistant cases have shown up in the US and Japan. In the fourth case, the infection proved fatal. Three initial cases showed a moderate resistance to Vancomycin. All four cases appeared in patients who had received repeated and prolonged treatment with Vancomycin. This is the tip of the iceberg and such cases are very rare. However, staph is giving us a warning sign that it is changing and to be prepared. Some tests suggest that similar staph bacteria, already found in hospitals in the NY metropolitan area, have accumulated the raw material needed to develop full-blown resistance to Vancomycin. One small mutation may be enough to complete the process. The appearance of vancomycin resistant staph aureus threatens to return us to the era before antibiotics.

E. Coli O157:H7 - This is a new, and more virulent pathogen. Original E. Coli is present in all humans intestines. There was a multi-state outbreak in 1993 where the E.Coli was transmitted by hamburger meat used by a fast food restaurant chain causing 700 people to become ill and four children died of kidney failure. E. Coli O157:H7 was found to be the cause of another smaller outbreak involving fruit juices which were not pasteurized. Unlike other food borne pathogens, this E. Coli has no margin for error; even a microscopic amount can cause serious illness and even death

Cryptosporidium - This microbe caused a major outbreak of gastrointestinal (GI) illness in Milwaukee when it invaded the water supply in 1993. More than 400,000 people became ill.

Others

Hantavirus - This illness was first identified in 1993 in US. It is a pulmonary (lung) syndrome resulting from rodent (rats, mice) excrement. **SARS** was first identified in 2003 in Asia and is now worldwide. **Bird Flu** was first identified in 2005, and it may result in worldwide pandemic. **West Nile Fever** was initially identified in Russia and the US; now it is found all over the world. In 2003, there were 115 deaths and 6000 human cases of West Nile Fever reported. It has now been learned that West Nile Fever can be transmitting by transplanted organs (2003); transfused blood (23 confirmed cases in 2002); and via the human placenta.

Dr. Francis Waldvogel of University Hospital in Geneva said "The adaptive potential of the microbial world is such that for each new antibiotic that is introduced, several escape mechanisms are soon developed. It was naïve to believe for 40 years that vancomycin would remain an exception to this law".

Re-emerging Infectious Diseases

Cholera - In 1991, the seventh cholera pandemic reached the Americas where cholera had not been registered for a century. It occurred due to deteriorating water and sanitation systems. **Dengue fever** increased due to deteriorating mosquito control measures. **Diphtheria** - re-emerged in Russia in 1994 and culminated with over 50,000 cases reported. It was caused by a dramatic decline in immunization programs.

Creutzfeldt-Jakob Disease - this disease is uncommon; however due to a new variant strain that has been transmitted through contaminated meat, it has brought a renewed interest. The causative agent for CJD is the prion, an infectious protein. These proteins are virtually indestructible to virtually all known forms of sterilization and disinfection. There is some new research indicating high alkaline detergents may inactivate prions. For now, however, health care facilities need to focus on patients having surgery involving "high risk" tissue. Prions have an affinity for spinal cord, eye and brain tissue so these are high risk. Prions are not transmitted casually, only infected tissue to infected tissue. Instruments used on high risk tissue should be steam sterilized (pre-vacuum for 18 minutes at 270° F (132°C).

REMEMBER.....

The only thing that remains constant with microorganism is their ability to change to adapt to adverse changes in their environment. If we are prepared for they may not get an upper hand.

POST TEST QUESTIONS: Microbiology 101 - Part III

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.

1. Which of the following tissues would be considered high risk for prion contamination?
 - A) muscle
 - B) bones
 - C) brain
 - D) liver
2. At this time, the best way to inactivate prions is to:
 - A) Discard the items after use
 - B) Discard items after disinfection in alcohol
 - C) pre-vac steam sterilize for 8 minutes
 - D) pre-vac steam sterilize for 18 minutes

3. MRSA is of great concern today because
 - A) It cannot be killed by steam sterilization
 - B) It cannot be killed by disinfection
 - C) It is in the general community
 - D) It is a fast growing microbe

4. E. Coli outbreaks occurred due to
 - A) improperly cooked meat and unprocessed fruit juices
 - B) improperly cooked desserts
 - C) improper cleaning of stoves
 - D) improper cleaning of cooking utensils

5. In the 1970s, which of the following diseases were first identified?
 - A) measles and mumps
 - B) polio and mumps
 - C) scarlet fever and measles
 - D) AIDS and Lyme disease

6. One of the major problems with controlling disease is:
 - A) lack of access to healthcare
 - B) microbial resistance to drugs
 - C) not taking medication as directed
 - D) lack of proper diet

7. Which antibiotic is considered the antibiotic of last resort?
 - A) penicillin
 - B) streptomycin
 - C) methicillin
 - D) vancomycin

8. A major problem with hepatitis C is there
 - A) is insufficient medication for everyone that has it
 - B) is no known vaccine or cure
 - C) is little knowledge about the disease
 - D) is a long period of time for the treatment to work

9. Which bacteria is the leading cause of surgical site infections in the US?
 - A) pseudomonas
 - B) streptococcus
 - C) mycobacterium tuberculosis
 - D) staph aureus

10. Healthcare workers are at risk for hepatitis C because
- A) there is no vaccine like there is for hepatitis B
 - B) it can be transmitted by indirect contact
 - C) they cannot destroy the bacteria through usual means
 - D) they are not at risk if they have received the hepatitis B vaccine
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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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Thank you!