# Medmyst Resources

## Mission 1: Orientation at O.R.B.

### Enemy Agents Summary

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Picture</th>
<th>Interview</th>
</tr>
</thead>
</table>
| **Bacterium** | ![Bacterium Image] | **Name:** *Bacillus anthracis*  
**AKA:** “The Powder”  
**Acquired from:** Dead cow  
**Personal Interview:** Yeah, I’m a bacterium. What about it? I cause *anthrax*, so what. It’s not that deadly, if you don’t inhale me. My bacteria relatives can cause *botulism, tuberculosis* and *typhoid*. Now those are some mean diseases. Come on, let me out! I won’t hurt anyone. |
| **Fungus** | ![Fungus Image] | **Name:** *Tinea pedis*  
**AKA:** “The Itch”  
**Acquired from:** Foot of a 17 year-old football player.  
**Personal Interview:** He! He! He! What’s up? I am a fungus. I am one of the fungi that cause *athlete’s foot*, just a little itch between the toes. My fellow fungi are just waiting to cause *histoplasmosis, ringworm, and thrush*. He! He! He! You just wait; fungi are everywhere!!! |
| **Virus** | ![Virus Image] | **Name:** Influenza Virus Type A  
**AKA:** “The Flu”  
**Acquired from:** Throat of a 12 year-old student.  
**Personal Interview:** Hey, it’s cold in this freezer! If I thaw I’ll invade your cells and take them over! You’ll be sorry if my friends find out! They cause trouble worldwide with *AIDS, measles, hepatitis, and Ebola*. You better be afraid! Not all of us can be prevented with a vaccine!!! |
| **Protozoan** | ![Protozoan Image] | **Name:** *Trypanosoma cruzi*  
**AKA:** "Chagas disease"  
**Acquired from:** Gut of a Reduvid bug or "kissing bug".  
**Personal Interview:** Hi ‘ya, good looking! Would you like a kiss from my friend? One kiss, come on. While he captures your attention with his kiss, he can deposit me on your skin though his feces. If I can make it to your mouth, eyes or an open wound then you’ll get *Chagas Disease*. Maybe you’d be more interested in getting a disease that my fellow protozoa can cause like *amoebic dysentery* and *malaria*. All perfectly parasitic, I assure you. |
Table of infectious agents, how they are transmitted and how to fight them

<table>
<thead>
<tr>
<th>Level</th>
<th>Pathogen</th>
<th>Objects that spread disease</th>
<th>Objects that kill infectious agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bacterium</td>
<td>direct contact</td>
<td>air</td>
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<tr>
<td></td>
<td></td>
<td>food, water</td>
<td>animal, indirect contact</td>
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<td></td>
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<td>medicine, soap, vaccine</td>
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<tr>
<td>2</td>
<td>Fungus</td>
<td>direct contact</td>
<td>animal, indirect contact</td>
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<tr>
<td></td>
<td></td>
<td>water</td>
<td>medicine, soap, vaccine</td>
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<tr>
<td>3</td>
<td>Virus</td>
<td>direct contact</td>
<td>air</td>
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<td>food, water</td>
<td>animal, indirect contact</td>
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<td></td>
<td>medicine, soap, vaccine</td>
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<tr>
<td>4</td>
<td>Protozoan</td>
<td>food, water</td>
<td>animal</td>
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<td></td>
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<td></td>
<td>medicine</td>
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<tr>
<td>5</td>
<td>Helminth</td>
<td>direct contact</td>
<td>air</td>
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<tr>
<td></td>
<td></td>
<td>food, water</td>
<td>indirect contact</td>
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<td></td>
<td>medicine, soap</td>
</tr>
<tr>
<td>6</td>
<td>Prion</td>
<td>food</td>
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</tbody>
</table>

Name: *Enterobus vermicularis* AKA: “The End”
Acquired from: The sand box in a local park.
Personal Interview: Oh, a victim! I mean a visitor. I am a *pinworm*. I exit through the back end of people so it’s nice to see a face now and then. My helminth cousins, the *tapeworm, roundworm*, and *hookworm* would so enjoy your company. You should give them a call. I promise you’ll never forget a visit from a helminth.

Name: Prion Protein PrPsc: AKA “The crazy cow”
Acquired from: Brain of a cow with mad cow disease.
Personal Interview: Hello, there. Don’t waste time with the other infectious agents. If you want to see something new, talk to me. I am a prion, discovered in the 1980s. There is no cure for the diseases such as *scrapie, Creutzfeldt-Jakob Disease (CJD)*, and *mad cow disease* that we prions cause. Doesn’t that just make you mad?
Relevant Scientist Biographies

Scientist Biographies

Robert Koch (1843 – 1910) Robert Koch was born at Clausthal in the Upper Harz Mountains of Germany. He earned his MD degree in 1866. Dr. Koch made numerous contributions to early microbiology, working on the human diseases anthrax, tuberculosis, cholera, and malaria. He also studied tropical disease in cattle. In 1905, he received the Noble Prize for his work on tuberculosis.

His major contributions include identifying the cause of each disease along with recommendations to prevent their spread. Koch was very methodical and persistent in his experiments.

John Snow (1813-1858) Famous for discovering that a water pump was the source of a cholera outbreak in London in 1854. Closing the pump stopped the outbreak.

Louis Pasteur (1822 -1895) Father of Germ Theory. Proved that microorganisms are responsible for fermentation. His series of experiments led to pasteurization - heating to kill microbes in liquids to keep milk and wine from spoiling.

John Lister (1827-1912) Applied Pasteur’s theory to human health and encouraged surgeons to sterilize their instruments and hands between patients.
Vocabulary Terms that are relevant to Mission 1:

**agar (A-gar)** - a jelly-like substance made from seaweed that is used to grow bacteria and fungi.

**Anthelmintic (an-then-MI-N-tik)** - A remedy that is destructive to worms and used for removing internal parasitic worms in animals and humans.

**antibiotic** - a drug that inhibits the growth or kills an infectious agent. Antibiotics are effective against bacteria. Some of these antibacterial drugs can be used to fight certain protozoa and fungi as well.

**antibodies** - molecules produced by a B cell in response to an specific pathogen. Antibodies bind to the pathogen and mark them for destruction.

**antifungal medication** - a drug that kills or slows the growth of fungus.

**antiviral medication** - Drugs that interfere with the ability of a virus to reproduce and cause disease.

**B cell** - a white blood cell derived from the bone marrow. B cells are responsible for the production of antibodies.

**bacterium (singular) bacteria (plural)** - Very small, unicellular microorganisms that multiply by cell division. Cell is typically contained within a cell wall. Found as spherical, rod, and spiral shapes. Bacteria can spread through direct contact, indirect contact, food, water, air, and animals.

**bodily fluids** - liquids associated with the body, such as blood, urine, saliva, and mucus from the nose.

**control** - A standard of comparison for checking or verifying the results of an experiment. It is the part of the experiment in which no change is made.

**fungus (singular) fungi (plural)** - an organism that has a cell wall and a cell membrane. They include molds (filamentous multicellular type) and yeast (unicellular spherical type). Fungi can spread through direct contact, indirect contact, water, air, and animals.
helminth - Multicellular worms that can be parasites in the intestine, blood, or body tissue.
   Helminths can spread though direct or indirect contact, food, water, and air.

immune system - a complex network of specialized cells, tissues, and organs that defends
   the body against attacks by disease-causing microbes.

immunity - resistance to a specific pathogen.

infectious agents - Organisms or particles that cause an infectious disease. Bacteria,
   viruses, fungi, protozoa, helminthes, and prions are infectious agents.

inoculate - a. introduce a substance into a person or animal to produce immunity; b. to pass
   on a disease from one organism to another by passing on the pathogen.

Koch's Postulates - A set of rules for proving that a microorganism causes a specific disease.

Lymphoid (lim-FOID) organs - organs concerned with the growth, development and
   deployment of white blood cells (lymphocytes). Examples include the spleen, thymus,
   lymph nodes, and appendix.

Mucous (MYOO-kuhs) membrane - the moist inner lining of the mouth, nose, vagina, and
   urethra.

nonspecific defense - immune system response where a white blood cell constantly patrols
   the body, gobbling up many different types of pathogens.

Pathogen (PATH-o-gen) - disease-producing agents.

Penicillium italicum - *Penicillium italicum* is a type of fungus called a mold. Molds can cause
   plant diseases and food spoilage. Some molds can be used to make antibiotics.

phagocytes (FAG-uh-sites)- cells that surround and gobble up invading microbes. These
   cells are used in the nonspecific defense by the immune system.

prion (PRAHY-on or PREE-on) - Extremely small particles that consist only of protein. Prions
   are resistant to heat and disinfectants and can only be spread through food.

protozoan (singular) protozoa (plural) - Simple, single-cell organisms such as the
   amoeba and paramecium. Some have flagella or cilia and are capable of rapid movement.
   Protozoas can spread though food, water, and animals.

specific defense - immune system response where white blood cells mount a directed attack
   against a specific pathogen.
Mission 2: Peril in Prokaryon

Scientist Biographies

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John Lister (1827-1912) Applied Pasteur’s theory to human health and encouraged surgeons to sterilize their instruments and hands between patients.
Relevant Vocabulary for Mission 2

bacilli - rod-shaped bacteria.

bacteria - one-celled microscopic organisms that multiply by cell division or binary fission. Cell is typically contained within a cell wall. Found as spherical, rod, and spiral shapes. Bacteria can spread through direct contact, indirect contact, food, water, air and animals.

case-control study - an epidemiological study that compares people with the disease (cholera) to those without the disease, cases versus controls. This can determine how the disease is being contracted. For example, cholera is an infectious disease that can be spread in food or water contaminated with the bacterium *Vibrio cholerae*. By knowing which food and water sick people consumed compared with those who did not get the disease, epidemiologists can identify the source of the contamination.

cocci - sphere-shaped bacteria.

contaminate - to make unclean, usually from contact with an impure source.

diarrhea - frequent, watery bowel movements.

epidemic - Increasing numbers of disease cases in a given area. The word comes from the Greek word epi meaning “upon” and the demos meaning “the people.” Thus, an epidemic is a disease on or among the people.

epidemiology - a branch of medicine that studies how and why diseases spread.

Germ Theory - proposed by Louis Pasteur, the Germ Theory states that germs cause infectious diseases.

Koch’s Postulates - a set of rules to test whether a specific germ causes a particular infectious disease.

1. The pathogen must be present in every case of the disease.
2. The pathogen must be isolated from the host and grown in pure culture.
3. The disease must be reproduced when a pure culture of the pathogen is inoculated into a healthy, susceptible host.
4. The same pathogen must be recovered from the newly infected host.
microorganism - A very small organism. Examples include bacteria, fungi, some parasites, and viruses.

oral rehydration solution (ORS) - a simple treatment for cholera and other diarrheal diseases consisting of a solution of salts, sugar, and water.

pathogen - an organism that can cause an infection or disease.

spirilla - spiral-shaped bacteria.

rice-water stool - the classic symptom of cholera; watery diarrhea containing electrolytes and bits of tissue that look like rice.

stool - excrement; waste eliminated from the body through the anus. “Feces” or “poop” are other words for stool.
Mission 3: Nemesis in Neuropolis

Relevant Vocabulary

antibiotic - a drug that kills an infectious agent by inhibiting its growth. Antibiotics are effective against bacteria. Some antibiotics can be used to fight certain protozoa and fungi as well.

bioterrorism - the use of biological agents, such as pathogenic organisms or agricultural pests, for terrorist purposes.

electron microscope - a microscope that uses a beam of negatively-charged particles (electrons) to produce images of extremely small objects. With certain types of electron microscopes, objects as small as 0.2 nanometers can be seen. One nanometer is one billionth of a meter.

immunity - the body's defense mechanism that protects it against infectious agents.

monkeypox - a pox disease that presents with symptoms similar to smallpox but with a lower death rate. Although the disease can be spread from person to person, monkeypox is usually acquired by contact with the blood of or through the bite of an infected animal. From 1-10% of people who get monkeypox die from it.

nemesis - an extremely difficult opponent that inspires both fear and respect.

nucleic acid - a component of DNA which is the genetic material that contains instructions to make all organisms including viruses.

protein coat - outer layer of a virus which gives a virus its shape and helps it attach to a cell.

quarantine - to restrict the movement of people who may have been exposed to a contagious disease in order to prevent them from spreading it.

smallpox - an infectious disease caused by the smallpox virus whose symptoms include a rash of blisters (pocks) on the body. Smallpox is contagious and can easily spread directly from person to person or through the air. With the discovery of the smallpox vaccine, this disease was eliminated in the 20th century.

virus - a very small pathogen consisting of nucleic acid covered by a protein coat. A virus can only reproduce within a living cell.

vaccine - a substance made out of dead or weakened viruses or bacteria used to prevent a specific disease by producing an immune response in the body.
Mission 4: Malady at Mabufo

Relevant Vocabulary:

**Anemia** - a condition in which there is a reduction in the number of healthy red blood cells to carry oxygen to the body's tissues. It can result from blood loss, iron deficiency, and from certain infectious and inherited diseases. Some symptoms of anemia are fatigue, pale skin, dizziness, shortness of breath, chest pain, and coldness in the arms and legs.

**Anopheles mosquitoes** - a genus of mosquito that has several hundred species. Only mosquitoes of this species can transmit malaria to humans. Worldwide there are over 370 species of *Anopheles* mosquito, yet fewer than 40 species are responsible for transmitting malaria.

**Antibody** - also known as an immunoglobulin, it is a protein produced in response to a foreign substance or germ.

**Anti-malarial medication** - drugs used to prevent or treat malaria. The right medicine depends on a variety of factors.

**Endemic** - a disease that is constantly present to some degree in a population of a particular location or region. Malaria is endemic currently in parts of Africa, Latin America and Asia and was once endemic in the United States.

**Immune system** - The body's principal defense network. The immune system defends the body in many ways. Some of its defenses are classified as nonspecific because they work against all pathogens. The immune system also has specific defenses that can target a particular germ.

**Infectious disease** - a disease caused by an infectious agent. The currently known types of infectious agents are bacteria, viruses, helminthes, protozoa, fungi, and prions.

**Liver** - the largest organ inside the body, it is about the size of a football in adults and about the size of a grapefruit in children. The liver controls cholesterol, makes bile, processes vitamins, removes toxins from the blood, produces hormones, as well as performs hundreds of other important functions.
Malaria – a vector-borne disease common in hot, tropical areas. It is caused by a single-celled parasite (plasmodium) carried by the *Anopheles* mosquito. Chills, recurrent high fever, and anemia are some of its symptoms. Malaria was eradicated from the United States in the 1950s, but it remains a major health problem in many developing countries.

Parasite – an organism that lives in or on another organism (the host) and causes it harm. Leeches, malaria plasmodia, pinworms, and athlete’s foot fungus are examples of this type of organism.

Phagocyte – a type of white blood cell that engulfs and digests germs. Examples of phagocytes are monocytes and macrophages. Monocytes circulate in the blood. When they migrate into tissues, these cells turn into macrophages.

Plasmodia - one-celled parasites that cause malaria. The singular is plasmodium. There are four types of plasmodia that can infect humans: *Plasmodium ovale*, *P. falciparum*, *P. vivax*, and *P. malariae*. *Plasmodium falciparum* can cause severe complications and even death. Between 700,000 and 2.7 million people a year are killed by this organism. The majority of these deaths occur in young children in Africa.

Protozoan – a type of simple single-celled organisms such as the amoeba and paramecium. Some have flagella or cilia and are capable of rapid movement. Protozoans can spread through food, water, or animals.

Toxin – any poisonous substance. Malaria parasites make glucose phosphate isomerase (GPI) and other toxic chemicals that act to produce the chills, shaking, and fever characteristic of the disease.

Vector – An organism, often an insect or rodent, which carries disease. Some examples are mosquitoes, ticks, flies, fleas, mites, and rats.

Vector-borne disease – a disease transmitted to a human by an organism. Examples of vector-borne diseases include malaria, West Nile virus, dengue fever, and Lyme disease.