EDVOTEK®

THE **BIOTECHNOLOGY EDUCATION** COMPANY®

Edvo-Kit #

166

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Detection of a Simulated Infectious Agent

Experiment Objective:

The objective of this experiment is to develop an understanding of how an infectious agent can be spread through a population.

See page 3 for storage instructions.

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Safety Data Sheets can be found on our website: **www.edvotek.com/safety-data-sheets**

Experiment Components

Component *Store entire experiment at room temperature.*		**Check (√)**
A	Simulated Infectious Agent Powder	❑
B	Control Powder	❑
C	Glycerol Solution	❑
•	Medium Gloves	❑
•	Transfer pipets	❑
•	Long wave UV "black light"	❑

This experiment is designed for 25 students.

All experiment components are intended for educational research only. They are not to be used for diagnostic or drug purposes, nor administered to or consumed by humans or animals.

Requirements

- U.V. Safety goggles
- Lab coats or protective clothing
- Optional - alternate size gloves
- AA batteries for UV light

Background Information

Throughout history people have been studying the spread of pathogen-caused diseases and inventing ways to prevent getting sick from them. These pathogens, which can be living (bacteria and microorganisms, etc.) or non-living (fungi, prions, etc.), are commonly/collectively known as germs. Today it's well accepted that germs cause disease and illness, but it wasn't always that way. During the Middle Ages and even during the Enlightenment doctors believed that many diseases were caused by miasma, or "bad air". This theory was so entrenched that it remained popular even after the first vaccines were invented. Finally, in the late 1800's scientists came up with an alternative explanation - the germ theory of disease. This theory states that pathogens and microorganisms can cause disease.

How does an infectious microorganism spread throughout a population? Microbes can be transmitted by direct or indirect contact. Direct contact transmission occurs when there is human-to-human physical contact between a host (infected person) and a susceptible person. Examples include holding hands after sneezing and kissing. A subdivision of direct contact is vertical transmission, the spread of disease from parent to offspring. Vertical transmission usually occurs when infectious microbes cross from the mother's bloodstream through the placenta to the fetus.

Indirect transmission often occurs by means of contaminated, inanimate objects such as bed sheets, clothing, towels, etc. Food handlers in restaurants can also transmit disease by serving contaminating food to patrons. For example, in 1993 the restaurant Jack in the Box served undercooked burgers that were contaminated with E.coli. Over 700 people were affected, and of those 4 died and 178 were left with permanent organ injury. This type of disease spreading is the basis for the strict regulation of eating establishments by local health departments. Indirect transmission may also occur through the actions of vectors. Vectors are secondary organisms that do not themselves infect a host but can transfer a disease-causing microorganism from one host to another. Vectors include mice, mosquitoes, ticks, and cockroaches. A well-known example of a vector-transmitted disease is malaria, which is propagated in tropical climates by mosquitos.

Disease also spreads when airborne infectious particles travel from one person to another. This is also categorized as indirect transmission. One example of this is the common cold, which is caused by the rhinovirus. Aerosol droplets from sneezes or coughs contain hundreds to thousands of viral particles that remain airborne or deposit themselves on surfaces. When susceptible persons inhale the droplets or touch a contaminated surface and then rub their eyes or nose, they can become infected. This type of transmission underscores the importance of frequent hand washing during cold and flu season.

Some pathogens can be transmitted both through direct and indirect contact, such as measles. Measles is caused by the Rubeola virus and is one of the most contagious diseases in the world. It can be spread through direct contact with an infected person or by indirect transmission through airborne droplets when an infected person breaths or coughs. Measles is able to remain infectious in the air for up to two hours after an infected person leaves the area they were in. Luckily, scientists have developed a robust and effective vaccine towards measles. Vaccinated people will not contract the disease, and thus will not be able to spread it. This not only protects the vaccinated people, but if enough people are vaccinated then the chances of an unvaccinated person coming into contact with the disease is also very rare. This concept is called herd immunity and can protect individuals who are unable to receive a vaccine due to health conditions such as chemotherapy for childhood cancer.

Given that some pathogens can be very contagious, such as measles, the global community has become increasingly aware/concerned that they could be intentionally used as biological weapons. Researchers look at many models to determine a community's readiness to withstand an "attack". For example, if smallpox was released in Oklahoma city, it would take less than two months to kill approximately 1 million people worldwide. The likelihood of such an event remains arguable. The quantity of material required, the skill and technology involved to produce it, and the delivery methods are extremely difficult objectives to accomplish. Though unlikely, this is still a global concern. Unlike measles, most people are not vaccinated against smallpox, anthrax, or the plague (routine smallpox vaccination was stopped after the disease was eradicated in the U.S. in 1972). Moreover, the few vaccines that do defend against these diseases can take weeks to be effective, but the flu-like symptoms of the disease make diagnosis difficult and slow. Thankfully, scientific research is being performed to monitor, detect, prevent, and combat biological weapons. This research also provides better diagnoses for diseases, improved vaccine production, and new tools to stop the natural spread of many diseases.

In this experiment, you will simulate the spread of an infectious agent by using a fluorescent powder to demonstrate how such a material or disease can be transmitted through a population. You and your classmates will use "shaking hands" as the basis of the horizontal spread of infection. A few individuals will start the infection using a fluorescent powder while non-infected individuals will use a non-fluorescent powder. The challenge will be to trace the infection to the primary source. You might be surprised by how quickly an infection can spread!

Experiment Overview

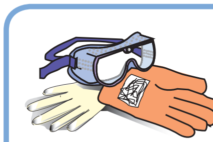
EXPERIMENT OBJECTIVE:

The objective of this experiment is to develop an understanding of how an infectious agent can be spread through a population.

LABORATORY SAFETY:

Be sure to READ and UNDERSTAND the instructions completely BEFORE starting the experiment. If you are unsure of something, ASK YOUR INSTRUCTOR!

- Wear gloves and goggles while working in the laboratory.
- Always wash hands thoroughly with soap and water after working in the laboratory.



Wear gloves and safety goggles

LABORATORY NOTEBOOKS:

Scientists document everything that happens during an experiment, including experimental conditions, thoughts and observations while conducting the experiment, and, of course, any data collected. Today, you'll be documenting your experiment in a laboratory notebook or on a separate worksheet.

Before starting the Experiment:

- Carefully read the introduction and the protocol. Use this information to form a hypothesis for this experiment.
- Predict the results of your experiment.

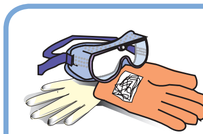
During the Experiment:

- Record your observations.

After the Experiment:

- Interpret the results – does your data support or contradict your hypothesis?
- If you repeated this experiment, what would you change? Revise your hypothesis to reflect this change.

Student Procedures



1. Instructors should assign a transmission code number to each student. Record your number in Table A.
2. Place a glove on the hand you don't use for writing.
3. Use a transfer pipet to apply a small amount of glycerol solution to the palm of your gloved hand. ***Use care not to get the glycerol on your skin.***
4. Sprinkle your powder sample on the sticky area of your gloved hand.
5. Use the fingers of your gloved hand to spread the mixture on the same hand. You are now ready to perform the experiment.
6. Randomly select a student to be “contact 1” and shake hands. (At this point, you will not be aware if they or you are a carrier of the infection).
7. Register the code of your contact 1 in Table A.
8. Randomly select a second student to be "contact 2". Shake hands and record their code in Table A.
9. Randomly select a third student to be "contact 3". Shake hands and record their code in Table A.
10. Review Table A. At this point, you should have recorded your code and the codes of the three "contacts" you made. It is possible that you and/or some of your contacts were carriers of the infectious agent. Your Instructor knows the identity of the carrier(s) and it’s up to you to determine who it is.
11. Use a long wave U.V. fluorescent black light to determine if you have contracted the “infectious agent”. Record the results in Table A. ***NOTE: Do not use a short wave U.V. light source (254-302 nm).***
12. If your gloved hand fluoresces under the U.V. light, you or one of your contacts are a carrier of the "infectious agent".
    a) How many students have contracted the infectious agent?
    b) What percentage of the student groups does that cover?
    c) Who are the suspected carriers (they would be common among the groups whose hand fluoresced)?
    d) Can you determine the primary source(s), i.e. the spreading point(s), of the infection?

TABLE A

Contact	Transmission Code Number	Fluoresce Under UV Light?
You		
Contact 1		
Contact 2		
Contact 3		

Study Questions

1. What are the most likely bioweapons that would be used in a large-scale terrorist attack?
2. Describe how indirect transmission of an infection occurs.
3. What are the differences between direct and indirect transmission?
4. How would being vaccinated against the fluorescent powder have changed the outcome of the experiment?

Instructor's Guide

Pre-Lab Preparations

1. Assemble the following materials for 25 students (one each per student):
   - 1 Glove
   - 1 Tube of control powder or simulated infectious agent powder
   - 1 Transfer pipet
2. Either aliquot 0.4 mL of glycerol per student or transfer glycerol to a beaker and set up a pipetting station. Each student only requires a few drops of glycerol.
3. Students will need to record the contacts they make in Table A on page 7.
4. Make sure that you know the identity of the infectious agent carrier. Do not inform the students of their sample type.
5. Have a station set up in a dark area of the lab for U.V. visualization with the long wave black light(s).

Safety Data Sheets can be found on our website:
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Please refer to the kit insert for the Answers to Study Questions