Germ Transmission

Introduction

Infections and parasitic diseases may be spread from person to person through air, water, and physical contact. Show students how easily germs can spread and emphasize the importance of good hygiene using fluorescent lotion.

Concepts

- Disease control
- Disease prevention
- Fluorescence
- Proper hygiene

Background

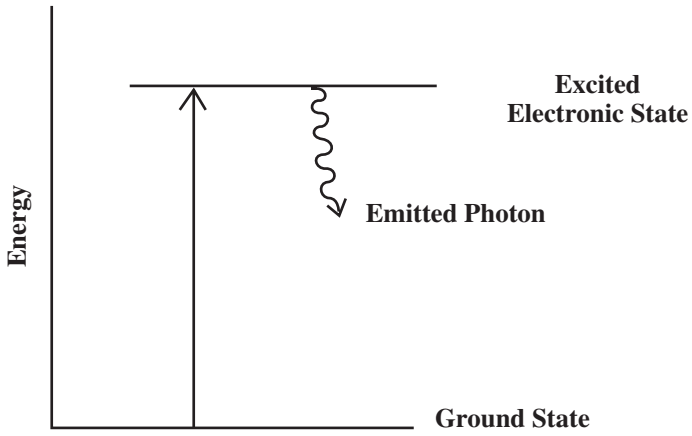
Contagion, *causal agent*, and *pathogen* are broad terms used to describe any virus, bacteria, prion (protein), protozoa, worm or genetic mutation that causes harm to living things. Most of these potential disease agents are invisible to the naked eye and also fairly widespread—the majority of surfaces are covered with both beneficial and pathogenic microbes. The type and concentration of pathogenic microbes, combined with the health and immune capabilities of the human host, determine how, when and if a person will get sick. The study of how and why people and animals become ill and how to prevent and control illness is called *epidemiology*.

Epidemiologists define an infectious disease as any disease easily transmitted by contact between a host and a victim. Contact can be direct between two individuals through kissing, hugging or shaking hands. Contact can also be indirect. In this case the contagion is transmitted by contact with an inanimate object that harbors the pathogen. These inanimate objects are called *formites*. Toys, money, kitchen sponges, cups, toothbrushes, and pencils are just a few examples of formites. Formites become infected by touch, through droplets created by coughing, sneezing, or talking, and also through airborne particles that float in the air for a long time before eventually settling on the surface of various objects. Formites can be contagious for minutes or days, depending on the contagion. Disinfecting formites frequently, avoiding the sharing of formites, cleaning hands after touching a formite, and staying away from other people when they are (or you are) contagious are the best methods of controlling mild illnesses.

Glowing Germ lotion is a handy tool to demonstrate the spread of disease by physical contact. In incandescent light Glowing Germ appears the same as regular hand lotion. However, in the presence of a black light it fluoresces. Fluorescence only occurs in the presence of an exciting source. In this case the exciting source is an ultraviolet "black" light.

In fluorescence, when a light source is shined on a material, a photon is absorbed. The energy from the photon is transferred to an electron that makes a transition to an excited electronic state. From this excited electronic state, the electron naturally wants to relax back down to the ground state. When it relaxes back down to the ground state, it emits a photon (symbolized by the squiggly arrow in the diagram). This relaxation may occur in a single step or in a series of steps. If it occurs in a single step, the emitted photon will be the same wavelength as the exciting photon. If the relaxation occurs in a series of steps emitting a photon along the way, the emitted photon will have a greater wavelength (lower energy) than the exciting photon.

Energy Level Diagram



If the emitted photon's wavelength is in the visible portion of the spectrum, we observe a colorful, glowing effect. Emission of this form is termed fluorescence. This process is practically instantaneous so the fluorescence is observed as soon as the exciting source is present, and it disappears as soon as the exciting source is removed.

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Materials

Glowing Germ fluorescent lotion
Nitrile gloves
Ultraviolet light source

Safety Precautions

Glowing Germ is a consumer product with minimal safety hazards. Any lotion may cause skin irritation to individuals with extremely sensitive skin. Wear chemical splash goggles whenever chemicals, heat or glassware are used. Wash hands thoroughly with soap and water before leaving the laboratory. Please review current Material Safety Data Sheets for additional safety information.

Procedure

1. Put on a clean pair of nitrile gloves.
2. Place Glowing Germ on the hands of one participant. Rub it over the gloves similar to hand lotion.
3. Each participant should shake hands with every other individual in the demonstration.
4. Turn off the lights so the room is dark.
5. Turn on an ultraviolet light and observe where the "germs" have spread.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures, and review all federal, state and local regulations that may apply, before proceeding. Place the used gloves as well as the empty bottle of Glowing Germ in the trash for solid waste disposal according to Flinn Suggested Disposal Method #26a.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Evidence, models, and explanation
Content Standards: Grades 5–8
Content Standard B: Physical Science, properties and changes of properties in matter, transfer of energy
Content Standard F: Science in Personal and Social Perspectives, personal health
Content Standards: Grades 9–12
Content Standard B: Physical Science, structure of atoms, structure and properties of matter, chemical reactions
Content Standard F: Science in Personal and Social Perspectives, personal and community health

Tips

- This demonstration may be done at the beginning of the school year to illustrate why eating or drinking in a lab setting should not be allowed and why students should always wash their hands before leaving the lab.
- The demonstration is also highly relevant in biology courses to illustrate the spread of bacteria and microorganisms and the importance of following sterile technique.
- An alternative procedure for this demonstration involves placing Glowing Germ on an object such as a door handle that will frequently be touched by students. Regular lotion can be used in other locations so it is not as obvious where the "germs" originated.
- Glowing Germ lotion is used in hand-washing exercises to show rigorous washing for at least 20 seconds is needed to rinse away microbes. Place lotion on students' hands and then have them wash for varying amounts of time from 5–20 seconds before testing under black light.

Materials for *Germ Transmission* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP9080	Glowing Germ—Demonstration Kit
AP9030	Ultraviolet Light Source, 18″

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.