DIRECTIONS AND GRADING RUBRIC FOR THE FORMAL PAPER
ON A SELECTED PROTOZOAN OR FUNGAL INFECTION

This paper must be written on a **PROTOZOAN OR FUNGAL INFECTION**. Papers **not** on a protozoan or fungal infection will be given a “0.” You **cannot** submit a new paper or resubmit a paper after the deadline date stated in your syllabus!

Each student will write a **formal paper on a selected protozoan or fungal infection**. This handout contains the **instructions and format that must be followed in writing the paper**, as well as the rubric that will be used in its grading. The paper is worth **50 points**.

The paper should be written at a level that would provide a student taking BIOL 230 a **thorough but basic understanding of that infection**, such as might be found in an introductory microbiology text. Selected student papers with the student listed as author may be incorporated in your instructor’s website as a “Highlighted Infections” in Unit 3.

**You will be submitting your paper to the anti-plagiarism site Turnitin.com**, so be sure it is your own original work!

You will have the opportunity to submit your paper to Turnitin.com as often as you want prior to the deadline date to get an originality report and rewrite the paper accordingly.

- **To get started with Turnitin**, **read over and follow the directions in the Student Quickstart Guide** that can be downloaded at [http://turnitin.com/resources/documentation/turnitin/training/en_us/gs_student_en_us.pdf](http://turnitin.com/resources/documentation/turnitin/training/en_us/gs_student_en_us.pdf)

- **To create your user profile** that is required to submit papers:
  - Go to turnitin.com and click on “new user” at the top of the page under e-mail.
  - Follow instructions under "New students start here."
  - First, click on "Create a user profile."
  - Then click on "Student" under “Create a New Account.”
  - Enter the 7-digit class ID number for your lab section that can be found below. Type in bacillus as the password.
  - Fill in all information under “User Information” and click on "I agree - Create Profile."

- **Your 7-digit class IDs** for the **Spring 2011 semester**:
  - CNA = 3926754
  - CNB = 3926760
  - CRA = 3926761
  - CRB = 3926762
  - WCH = 3926763

- **Your enrollment password** will be bacillus.

- When you save and submit your paper, use the following format:

  **Your last name_first name_protozoan or fungal disease**

- The paper should be submitted as a **Word document** if at all possible.

- **Make sure your name and your lab section** is on the submitted paper.

- **To avoid plagiarism issues** with your instructor, do your paper early enough in the semester that you have time to submit it to Turnitin to receive an Originality Report and make any necessary modifications **prior to the paper’s deadline date**.

- **With your first submission**, the originality report is usually returned within **15-20 minutes**.
Each re-submission, however, will take up to 24 hours to receive an originality report, so plan accordingly.

- I will print off the last paper submitted to Turnitin.com by the deadline date. No papers or revisions will be accepted after the deadline date so submit your paper early enough to get your originality reports and send in revisions before that date.

- In general, I would expect a final paper 3-4 pages long with an Originality Report of 15% or less, excluding the bibliography but including quoted material, with no more than 4% coming from any one source.

Instructions and Format for Your Protozoan or Fungal Paper

Keep in mind that this is a formal paper written in standard English style. It should be grammatically correct, have proper sentence structure, and have correct word usages with correct spellings. Also remember that when writing the scientific name of an organism, the genus name begins with a capital letter, the species name with a lower case letter, and both names must be italicized throughout the paper.

If you have trouble or need help writing a formal paper, make sure you start the paper early enough to take it to the college’s Student Success Center or one of the college’s writing labs for help.

- To find out how to make an appointment with the college’s Writing Lab, go to [http://www.ccbcmd.edu/services/index.html](http://www.ccbcmd.edu/services/index.html) and click on “Guide to Writing,” and click on “Writing Centers.”
- Contact the Catonsville Student Success Center in the Catonsville campus library. Their site can be found at [http://www.ccbcmd.edu/tutoring/cat/index.html](http://www.ccbcmd.edu/tutoring/cat/index.html).
- To contact the Online Writing Lab, go to [http://ccbcmd.edu/distance/support.html](http://ccbcmd.edu/distance/support.html), scroll down, and click on “Online Writing Lab.”

The paper must be written using the following format:

Your name

Your lab section

**Disease** (See the paper at the end of this handout for an example.)
Name the disease your paper is on, e.g., Histoplasmosis, Dermatophyte Infections, Giardiasis, Malaria, etc.

**Causative Agents** (See the paper at the end of this handout for an example.)
In this section you will name the protozoan or fungus causing that infection and describe that organism.
Make sure you give the correct scientific name for the causative organism and that it is written correctly. Also make sure you describe the protozoan or fungus. If it is a fungus, include such factors as its size, whether it is a yeast or mold or dimorphic fungus, and how it reproduces (types of asexual reproductive spores produced, budding, etc.). If it is a protozoan, include such factors as its size, its phylum, its means of motility, how it reproduces (fission, budding, schizogony, etc.), its life cycle, etc. Place *(def)* after any terms you are defining in the glossary.

**Epidemiology** (See the paper at the end of this handout for an example.)
In this section you will include - if available – information related to the frequency and severity of the infection. This can include such information as the number of reported or estimated cases per year or the number cases per 100,000 of population. Is the infection more prevalent among a certain race, age group, or sex? Relative facts such as “This organism is the most frequent cause of pneumonia requiring hospitalization.” What is the estimated number of people per year in the
US that die from this infection? Are there certain times during the year when the infection is more prevalent? Are there certain geographic locations where the infection is more prevalent? Place \( \text{def} \) after any terms you are defining in the glossary.

**Transmission** (See the paper at the end of this handout for an example.)
In this section you will indicate where the protozoan or fungus is normally found and the ways in which it is transmitted to humans or from person to person. Include what is actually being transmitted (macroconidia, microconidia, conidiospores, cysts, trophozoites, etc.). Place \( \text{def} \) after any terms you are defining in the glossary.

**Signs and Symptoms** (See the paper at the end of this handout for an example.)
In this section you will describe where in the body the protozoan or fungus can infect, common physical and medical symptoms, possible complications, etc. Place \( \text{def} \) after any terms you are defining in the glossary.

**Prevention and Treatment** (See the paper at the end of this handout for an example.)
In this section you will describe how transmission of the disease may be prevented (good sanitization, routine hand washing, condoms, etc.), the anti-protozoan or anti-fungal drugs used to treat this organism and the mechanisms by which these drugs work, treatment of symptoms, etc. Place \( \text{def} \) after any terms you are defining in the glossary.

**Glossary** (See the paper at the end of this handout for an example.)
Make sure all medical and scientific terms that an average introductory microbiology student may not be familiar with are defined in the glossary.

**Bibliography** (See the paper at the end of this handout for an example.)
List the sources you used in researching your paper.
Several Suggested Resources

E-Medicine from Web MD
http://www.emedicine.com/
Registration is free and there are many excellent articles on infectious diseases designed for health professionals.

Medscape from Web MD
Registration is free and registration for Medscape now also registers you for E-medicine.

Wikipedia
http://en.wikipedia.org/wiki/Main_Page
Good for definitions, etc.

MicrobeWiki
http://microbewiki.kenyon.edu/index.php/MicrobeWiki
A free wiki resource on microbes and microbiology.

The Centers for Disease Control and Prevention/Diseases and Conditions
http://www.cdc.gov/DiseasesConditions/

MMWR (Morbidity and Mortality Weekly Report)
http://www.cdc.gov/mmwr/about.html

Medical Microbiology edited by Samuel Baron
A free on-line Microbiology textbook.

Infectious Disease News
http://www.infectiousdiseasenews.com/
Registration is free.
Rubric for Grading Your Viral Paper

The paper was saved and submitted using the correct format. (2 points)

Your last name_first name_name of the disease, eg, Kaiser_Gary_adenoviruses

Your Name (1 point)

Your Lab Section (1 point)

Disease (1 point)

• The disease is correctly named.

Causative Agents (3 points)

• The protozoan or fungus causing that infection is correctly named and correctly written.
• The protozoan or fungus is sufficiently described. If it is a fungus, include such factors as its size, whether it is a yeast or mold or dimorphic fungus, and how it reproduces (types of asexual reproductive spores produced, budding, etc.). If it is a protozoan, include such factors as its size, its phylum, its means of motility, how it reproduces (fission, budding, schizogony, etc.), its life cycle, etc.

Epidemiology (5 points)

• The epidemiology is adequately described based on availability of such information.

Transmission (5 points)

• The source or sources for the protozoan or fungus is indicated and the ways in which it is transmitted to humans or from person to person is described. Includes what is actually being transmitted (macroconidia, microconidia, conidiospores, cysts, trophozoites, etc.).

Signs and Symptoms (8 points)

• Common physical and medical symptoms are described.
• Definitions of medical terms are given.
• Possible complications are given.

Prevention and Treatment (6 points)

• How transmission of the disease may be prevented is described.
• The anti-protozoan or anti-fungal drugs used in treating the infection is indicated along with the modes of action of those drugs.

Glossary (4 points)

• All medical and scientific terms that an average introductory microbiology student may not be familiar with are defined in the glossary. Any words in the text that are defined in the glossary are followed by (def).

Bibliography (2 points)

• A bibliography correctly cited is included.

Spelling and Grammar (12 points)

• The paper is grammatically correct, has proper sentence structure, and has correct word usages with correct spellings. Scientific names are written correctly. The genus name begins with a capital letter, the species name with a lower case letter, and both names are italicized throughout the paper. The paper was adequately proof read.

Originality Report

• In general, I would expect a final paper with an Originality Report of 15% or less, excluding the bibliography but including quoted material, with no more than 4% coming from any one source. Up to 40 points can be deducted for plagiarism.
SAMPLE PAPER

This paper was written by a former student, Dr. Cathy Wolkow and is used with her permission.

Name
Cathy Wolkow

Lab Section
BIOL 230 Section WCH

Disease
Amoebic dysentery

Causative Agents
Amoebic dysentery is bowel infection and ulceration caused by invasion of the intestinal mucosa by Entamoeba histolytica, a species of parasitic protozoan. There are many species of Entamoeba which can infect a wide range of organisms, including all vertebrate species, a few invertebrates and some unicellular eukaryotes. Six species of Entamoeba are known to infect humans, along with other genera of amoeba. However, only E. histolytica causes disease in humans.

Entamoeba species are classified on the basis of (1) host specificity; (2) sizes of trophozoite (def) and cyst (def); (3) nuclear structure; (4) number of nuclei in the cyst and (5) chromatoid (def) body morphology. Entamoeba histolytica trophozoites have a diameter of 10-60 μm, are motile and contain one karyosome (def) in center of the nucleus. Within the karyosome can be detected small beads of peripheral chromatin. E. histolytica are erythrophagocytic (def), and trophozoites may contain engulfed erythrocytes in the cytoplasm. E. histolytica cysts are round and 10-20 μm in diameter. They contain 4 nuclei. During excystation (def) in the small intestine, the cyst cytoplasm divides to form 4 cells which undergo one additional round of cell division to produce 8 amoeba.

Epidemiology
Entamoeba infection is the third highest cause of morbidity and mortality among parasitic diseases. The frequency of this disease is only surpassed by malaria and schistosomiasis. Amoebic dysentery is estimated to affect 36-50 million people per year worldwide and causes approximately 70,000 deaths/year. In the US, most disease is seen in immigrants and travelers who have recently arrived from developing countries with poor sanitation. Outbreaks are also found in residents of institutions with inadequate sanitation.

Six species of Entamoeba can infect humans, but E. histolytica is the only species to cause human disease. It has been estimated that three morphologically identical species, E. histolytica, E. dispar and E. moshkovskii, infect 10% of world population (500 million people), but 90% of these infections are not E. histolytica, but are infections by E. dispar and, less commonly, E. moshkovskii, which are both asymptomatic. Since most forms of amoebiosis (def) are not serious, it is important to be able to accurately and rapidly diagnose E. histolytica.

Transmission
Transmission is by fecal-oral route, commonly through fecally-contaminated drinking water. The amoeba is transmitted in the hardy cyst form which can survive for long periods outside of the body. Intestinal amoeba can also be transmitted by anal sex. Transmission is most common in areas with poor sanitation allowing fecal contamination of water supplies.

Ingested cysts carry out excystation in the small intestine to release 8 small trophozoites which migrate to the large intestine. In the body, the trophozoites replicate by binary fission and develop into cysts which are passed in the stool. Cysts can survive for weeks outside of the body. In contrast, trophozoites die quickly once passed out of the body. They are also susceptible to stomach acid, if ingested. In non-invasive disease, trophozoites stay in the intestinal lumen and act as a reservoir for cyst production which are passed out in the stool. In invasive disease, the trophozoites invade the intestinal mucosa, enter bloodstream and journey to liver, brain and lungs to form abscesses.
Signs and Symptoms
Amoebic dysentery usually begins with mild symptoms (loose stools, stomach pain, stomach cramps) or with acute diarrhea. Disease symptoms are delayed and can begin 1-4 weeks after cyst ingestion. Early stages of disease are due to trophozoite growing within the intestine. As time passes, *E. histolytica* can adhere to the intestinal mucosa and will begin to colonize the tissue. Colonization allows *E. histolytica* to form ulcers and abscesses in the intestinal mucosa, causing amoebic dysentery, which is a severe disease. Amoebic dysentery causes symptoms of stomach pain, bloody stools and fever. Additional symptoms include weight loss, anemia, indigestion and dehydration. If left untreated, amoeba will perforate the intestinal mucosa and enter the bloodstream. Once in the bloodstream, amoeba colonize the liver, causing liver abscesses, and other organs, such as lungs and brain. Symptoms such as fever, chills and pain can be associated with the presence of amoebic abscesses. *E. histolytica* can also cause ulcers under the skin and in the perianal region.

The host has few defenses to combat *E. histolytica* infection. First, the gastric acid and rapid intestinal clearing can help prevent initial colonization. Subsequently, the host may combat *E. histolytica* with humoral antibodies and cell-mediated immunity.

Prevention and Treatment
Amoebic dysentery is diagnosed by the presence of trophozoites or cysts in the stool. It may be necessary to examine several stool samples over time for adequate diagnosis since cysts can be difficult to detect. False-positive diagnosis for *E. histolytica* and unnecessary treatment are common due to confusion with *E. dispar* and *E. moshkovskii*, which are more common but do not cause disease. In addition, nonspecific signs of dysentery, such as large white cells in the stool, can be easily misidentified as trophozoites. Therefore, *E. histolytica* infection is often misdiagnosed. Serological tests for *E. histolytica* can be used in diagnosis of invasive disease. Various species are distinguished on the basis of isoenzyme analysis, antigenic diagnosis and DNA diagnostics. Once the infection has progressed to amoebic dysentery or abscess formation, an abscess aspirate must be collected for identification of the causative agent. *E. histolytica* will be found lining the walls of the abscess and, therefore, specimens will be found among the last volume of material aspirated from the abscess.

Amoebic dysentery is treated with 5-nitroimidazoles, which are the only class of agents available to treat amoebiosis. The primary treatment for amoebic dysentery is metronidazole (Flagyl), which is the most widely available drug. Alternatively, patients can be treated with tinadazole (Fasigyn). *In vivo*, these drugs are reduced to form the toxic nitroradical (def) anion which randomly damages cellular proteins and DNA by forming adducts (def). There is concern that appearance of nitroimidazole resistance would lead to a serious worldwide outbreak in amoebic dysentery. In the case of intestinal ulceration and abscess formation, patients are hospitalized for treatment.

Primary efforts for prevention are improvements in standards of personal and public hygiene. Travelers in tropical areas are warned to consume only purified or boiled water and to refrain from consumption of fresh fruits and vegetables unless the purity is confirmed. Travelers should also avoid ingesting ice cubes, which could be made from contaminated water. Public health education campaigns are designed to remind people to wash hands after using the toilet and changing diapers and before preparing food.

Glossary
- **Adducts**: A chemical produced by addition of two starting compounds.
- **Amoebiosis**: Amoebic infection
- **Chromatoid**: Chromatin-like structure inside a cell.
- **Cyst**: The protective form of certain protozoa that enables them to survive harsh environments outside the body.
- **Erythrophagocytic**: Capable of engulfing erythrocytes.
- **Excystation**: Recovery from cyst form into vegetative growth as trophozoite.
- **Karyosome**: DNA structure within the nucleus.
- **Nitroradical**: Reactive nitrogen-based chemical, NO₂.
- **Trophozoite**: The vegetative form of a protozoan.

Bibliography


The London School of Hygiene and Tropical Medicine. The Entamoeba Homepage; Entamoeba Basics. Retrieved Nov. 12, 2010 from http://entamoeba.lshtm.ac.uk/


