

Exploring the Microbial World Beyond the Text Using Print and Internet Resources

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Abstract

These activities encourage students to explore print and Internet resources and learn about contemporary topics in microbiology beyond the text or lecture materials. Several approaches can be used for this activity and each can foster critical thinking, writing, and public speaking skills.

Activity

Invitation for User Feedback. If you have used the activity and would like to provide feedback, please send an e-mail to MicrobeLibrary@asmusa.org. Feedback can include ideas which complement the activity and new approaches for implementing the activity. Your comments will be added to the activity under a separate section labeled "Feedback." Comments may be edited.

Editor's Note (2008): This Curriculum Resource was published prior to establishment of current criteria of submission, and as such, does not contain all criteria required of current publications. However, the Editorial Committee felt that the activity itself remained worthwhile and relevant, and encourages potential users to contact the authors for clarification as needed. If you do update this activity for use with your students, and are interested in updating the resource for distribution in the library, please contact ASM at MicrobeLibrary@asmusa.org.

INTRODUCTION

Background.

This activity can be used to collect information about a myriad of classroom topics, including specific microorganisms, current epidemiological data, or recent advances in biotechnology, medicine, infectious diseases, genetic engineering, and immunology. By including an oral presentation of the work, these approaches allow students to share their findings with their peers.

PROCEDURE

Materials.

1. *"Hot Topics!" Report:* computers with Internet access, current periodicals.
2. *Microbe Hunting on the World Wide Web:* computers with Internet access.
3. *"Meet the Microbe!" Poster:* computers with Internet access, current periodicals, instructor copies of texts, library holdings, posterboard, double-stick tape or glue pen, scissors.
4. *WWW site:* computers with Internet access, current periodicals.

Instructor Version.

Four different strategies can be used.

1. *"Hot Topics!" Report and Presentation:* News about major breakthroughs in microbiology and related fields are discussed in newspapers and periodicals daily. The purpose of the "Hot Topics!" report is to encourage students to read about and discuss contemporary issues in microbiologically related sciences. Microbiology is far from being a stagnant science. In fact, advances in medicine, genetics, immunology, and molecular biology, have accelerated this discipline into a Renaissance Period! Students write a brief paper using references such as Internet sources and current periodicals. Students provide a brief (1-3 minutes) presentation to their classmates about their report with an opportunity (1-2 minutes) for questions and discussion. Presentations could be made in either lecture or laboratory sections, but the smaller size of lab sections and the familiarity that students have with their labmates makes the laboratory a better forum for presentations. It may be helpful to request the student to submit a copy of the article with the report so that a "library" or primary sources is built from that semester. During the following semester, the instructor can integrate the information into lecture or laboratory discussions. An example set of guidelines are provided in the Sample Applications section below.

2. *Microbe Hunting on the World Wide Web!* The World Wide Web (WWW) is an excellent resource for current information related to microbiology. However, many students acknowledge that they rarely use the WWW for locating information. If students master the skills for Internet information retrieval on this assignment, they can apply these skills toward other courses. This assignment allows students to document sites relevant to microbiology and establishes a database of resources for others to peruse. The selected format is similar to an approach used for review of movies and restaurants

(except that the students serve as "critics" and *their* observations and opinions are being read!). The reviews allow students to espouse their opinions about the efficacy (or inefficacy) of specific sites and stimulates exploration of Internet resources. To share the basic information about each site, each student can submit a *brief* WWW "mini-review" (50 words or less) with a site "rating". The mini-reviews and ratings can be easily compiled and disseminated to the entire class as a handout or posted on the course home page. Example guidelines for this type of assignment are provided in the Sample Applications section below.

3. *"Meet the Microbe!" Poster Presentation:* Bergey's Manual of Systematic Bacteriology is a comprehensive "catalog" of well-studied microorganisms. It contains descriptions of over 5,000 bacterial species, which may represent less than 0.1% of the bacteria on this planet! Many described species have medical and commercial importance. Bacteria profoundly influence our world, whether they are producing nitrogen-rich compounds in the soil, fermenting food and beverage products for human consumption, causing diseases in plants and animals, or simply causing last week's leftovers to become rancid. Keep in mind other types of microorganisms exist such as fungi (like molds, yeasts, and mushrooms), protozoa (like the agents that cause malaria), helminths (parasitic tapeworms and flukes), viruses (agents like HIV and influenza), viroids ("RNA-like things" that cause potato spindle disease and coconut kdang-kdang), and prions ("self-replicating proteins" that cause kuru and mad cow disease). Certain arthropods (vectors such as ticks and mosquitoes) merit study in microbiology because they can spread infectious agents. Only a few specific microorganisms can be studied in one semester, but students learn many concepts that describe how various forms of life survive and affect humans. How can students possibly get to know some of the many microorganisms on this planet? Have a day where they "meet the microbes"! This exercise is meant to help students learn about various microorganisms through an alternative form of presentation. When you have been to a doctor's or dentist's office, you may have seen wall posters about microorganisms. Even breweries, pharmaceutical plants, and agriculture extension agencies have posters about microorganisms. Such materials educate the public about a topic without additional resources or instructors. The poster assignment should offer the same result. Students are encouraged to use numerous visual references to design posters that attract the interest of students not enrolled in microbiology. This activity works very well when discussing microbial diversity or infectious diseases. Example guidelines are provided in the Sample Applications section below.

4. *"Build a Web Site" Class Web Site Project:* If a course WWW site is maintained, students can work individually or in groups to create a page for the site about a specific topic. Appropriate software could be used to convert document files submitted by students (either electronically or on disk) into HTML formats. For example, each student or group of students could develop a page about a particular microorganism. References and links to additional resources about the microorganism could included in the page.

Safety Issues. Not applicable

SUPPLEMENTARY MATERIALS

Sample Applications

- A. ["Hot Topics!" Report Guidelines](#)
- B. [Guidelines for Microbe Hunting on the World Wide Web](#)
- C. ["Meet the Microbe!" Presentation Guidelines](#)

"HOT TOPICS!" Report Guidelines

News about major breakthroughs in microbiology and related fields is discussed in newspapers and periodicals daily. The purpose of the "Hot Topics!" report is to encourage you to read about and discuss contemporary issues in microbiologically related sciences. Microbiology is far from being a stagnant science. In fact, advances in medicine, genetics, immunology, and molecular biology, have accelerated this discipline into a Renaissance Period! Examples of recent issues include:

- the discovery of anticancer compounds in tomatoes
- the use of defective retroviruses to kill cancer cells
- the increased incidence of infections with antibiotic-resistant *Mycobacterium tuberculosis* strains (the causative agent of tuberculosis) and *Bordetella pertussis* (the causative agent of whooping cough)
- the use of protease inhibitors to slow the onset of HIV
- the high incidence of meningitis in Arkansas
- the identification of an HIV cofactor that is required for infection

Selecting Articles. Read at least three brief articles from magazines or newspapers (such as USA Today, Newsweek, Science, Nature, Time, Arkansas Democrat Gazette, Scientific American, Discover, etc.) that report topics related to microbiology. Your choices must be published within the past twelve (12) months. The article should be readable by anyone in the class. Stay away from technical articles, non-refereed publications, brochures, and "FYI" articles. If the article is from a WWW site, the site must be a legitimate source that publishes only peer-reviewed work. No personal home page information allowed! The article can be about medical microbiology, industrial microbiology, cancer research, epidemiology, food microbiology, virology, etc. Each article should be at least one-half page in length (roughly 500 words or more). The topic can reflect a national or regional issue. I recommend that you grab a stack of recent back issues of magazines or newspapers at the library and look through them. Excuses such as "I couldn't find anything" or "I couldn't find any magazines" are rubbish! Plenty of microbiology-related items are published daily.

Be sure to record the complete citation for each article. Each component of the citation must be included in your final report to receive full credit. A complete citation includes:

- the names of all authors
- the publication date
- the title of the article
- the name of the newspaper or periodical
- the volume number (usually located on the table of contents page)
- the inclusive page numbers (for newspaper articles, include the section number)

An example of a complete citation is provided below:

Sternberg, S. 1996. Cholera hides a sinister stowaway. Science News 149:404-405.

Article Approval. Bring your articles to me so that you can get one approved for your report. Read the articles before you bring them in!!! You should know what they are about before discussing which one you would like to submit with your report. I also think you should have some idea of the subject before you begin your work. You must have your article approved by me before you begin writing the report!

Because I cannot permit duplicate articles, you must get approval or I cannot accept your report. When you write your name and the citation information on the sign-up sheet, I have a record of your chosen topic. The sooner you seek approval...the less likely your article has been taken. I recommend bringing all three articles to avoid return trips to the library. You must get your article approved at least two weeks before the submission date. Otherwise, you will receive a zero on this exercise.

Writing The Report. Once the article is approved, write a brief synopsis (between 300-500 words) about the article. Your synopsis should provide sufficient background about the topic so that anyone will understand what you are discussing. Summarize major points in the article, but do not plagiarize! State the significance of the information in the article (ie., explain why the topic is HOT!). Lastly, state why you selected the article. This assignment is entirely your own work, so work independently. Do not solicit or receive assistance (other than typing services) from others.

Format For The Submitted Report. The report must be typed and double-spaced, and void of grammatical and spelling errors. Both your report and the article must be attached securely (taped or stapled) inside the folder. Write the title of the report and your name on the flap of the folder. My advice to you - *do not wait until the last minute to work on this report!!* The submitted report is graded (80%) based on subject content, grammar, and completeness. It should be written so that any student in the class could read your report, understand its contents, and appreciate why the topic is hot! Read your work before you submit your report! If you miss your submission date, you will receive a zero on this assignment.

Presenting Your Report. You will make a brief and informal presentation (3-5 minutes) about your article to your laboratory section at the end of the semester. Provide a brief description about the article, why the topic is important, and why you selected the article. Please practice your talk before you make your presentation. You may have note cards to help you, but do not read to your audience. Remember, you read the article and wrote a report on it, so you should be able to talk to the class about it. Questions from the class can be answered at the end of your presentation. A portion of your grade (20%) will reflect your presentation. All students submitting a report must make a presentation to receive any credit for the report.

Listening To Other Student Presentations. Just as your classmates will listen respectfully during your presentation, you are asked to listen to their work with attentiveness and courtesy. The final lecture exam will contain questions that ask you to write about "Hot Topics!" reports that were submitted. You pick the articles that were most interesting to you. Reports will be available for you to peruse during the week before the exam.

Curriculum Resources

Guidelines for Microbe Hunting on the World Wide Web

This assignment allows students to document sites relevant to this course and establishes a database of resources for others to peruse. Some sites may contain information that will be useful for later assignments. The selected format is similar to an approach used for review of movies and restaurants (except YOU are the critic and YOUR observations and opinions are being read!). The reviews allow students to espouse their opinions about the efficacy (or inefficacy) of specific sites and stimulates exploration of Internet resources. Reviews will be compiled into a collection on reserve in my office. To share the basic information about each site, each student will submit a *brief* WWW "mini-review" (50 words or less) with a site "rating" on a provided form. These will be compiled and disseminated to the entire class.

The World Wide Web (WWW) is an excellent resource for current information related to microbiology. However, very few of my former students acknowledge that they have used the WWW for locating information. If you master the skills for Internet information retrieval on this assignment, you will apply these skills toward other courses and even toward non-UCA related searches.

Helpful Tips for Selecting a Web Site. Listed below are a few guidelines.

- *Select a site that interests you!* Do not settle for the first item that comes along. Look through several choices and pick a site that captures your interest.
- *The site must be a legitimate source.* Avoid personal home pages and non-peer-reviewed material!
- Be sure to *record the title and complete universal resource locator (URL) for the site on the sign-up sheet.* These items also must be included in your final report to receive full credit. Examples of complete citations are provided below.

- Brown, J. 1995. Bugs in the news! URL at <http://falcon.cc.ukans.edu/~jbbrown/bugs.html>.
- American Society for Microbiology. 1998. ASM Biofilms Collection. URL at <http://www.asmsa.org/edusrc/biofilms/index.html>.
- UNAIDS and WHO. 1996. HIV/AIDS: The Global Epidemic December 1996. URL at <http://www.us.unaids.org/highband/document/epidemiio/situat96.html#top>.

Web Site Approval: You must have your WWW site approved by me before you begin writing the review! Because I cannot permit reviews of the same site, you must get approval or I cannot accept your review. Your selection must be approved at least two weeks before the review submission date. I strongly recommend that you bring 2-4 choices for possible approval to avoid additional searches. **Explore each Web site** before you seek approval!!! You should know generally what is at each site before discussing which one you would like to review. When you write your name and the URL on the sign-up sheet, I have a record of your chosen WWW site. The sooner you seek approval...the less likely your site has been taken.

*****If you fail to get a site approved or miss the assignment submission date, you will receive a zero on this exercise.*****

Writing the Review. The following points should be addressed in your review. This assignment is

entirely your own work, **so work independently**. Do not solicit or receive assistance (other than typing services) from others.

- At the top of your review, provide your name, lab section, review title, site title, and the full URL.
- Begin your review with a brief synopsis about the site (Who created it? Why? Who is the intended audience?). This type of introduction should provide sufficient information about the site so that anyone will understand what you are discussing.
- "Walk" the reader through the links and their contents as you explore a site. The majority of your review should summarize major points about the site, but do not go into detail about every aspect or link.
- Describe strengths and weaknesses of each link. Critique the creators use of language, color, and graphics. Is the site organized? Are links useful? Can you move easily through the site or do "dead ends" appear frequently? Do not feel restricted to writing only a good review. Honesty and accuracy are important features in a review. Certainly some opinion can be interjected throughout the review. However, substantiate praise or harsh criticism with evidence.
- Use examples and evidence within the site to illustrate and justify your points.
- The significance and applications of the Web site should be stated explicitly (ie., explain why the site is useful, pertinent, or needs improvement).
- State why you selected the Web site (personal interest, relates to class materials, pertinent to work-related issues, etc.).
- Justify your rating! A perfect "10" requires strong convincing evidence. Similarly, a dismal rating (such as a "3") requires justification. Avoid generic words such as "interesting" and "informative". Be very specific about why a site is stellar or below expectation.

Format for the Submitted Review. My advice to you - *do not wait until the last minute to work on this review!!* It is not meant to be a challenging assignment but it will take a little time to write a good review.

- The review must be typed (single-spaced or double-spaced). Handwritten reports are not acceptable.
- A page limit is difficult to define because each site will be unique. A reasonable review should be 2-4 pages at most.
- The review must be void of grammatical and spelling errors. Read your review before you submit it! Ask a friend, roommate, or spouse to explore the Web site and read your review for clarity, content, and errors.
- Print the title page of the Web site and submit it with your review. This page should display exactly what appears on screen when someone enters the URL you provided.
- Submit your review, Web site title page, and 50-word mini-review inside a manila folder. Do NOT staple these documents together. Write the title of the review and your name on the flap of the folder.

How We Will Share Our Reviews. I cannot procure a computer lab for every section of this course, so we will use two techniques to help share your expertise and insights about a specific WWW site with others. Plus I can predict that most folks would get very bored hearing about sites if they cannot explore them. The review that you submit will be maintained in my office and made accessible to all students. It cannot leave my office or the microbiology lab, but it can be perused during an appointment.

The WWW "mini-review" will be submitted on a form that is provided, and each mini-review will be incorporated into a document that is disseminated to all enrolled students. The mini-review must be brief (50 words or less - I will count them too)! The mini-review will include the site title, URL, and a score (1-10) that reflects the usefulness, creativity, beauty, or efficacy of the site.

Grading Criteria. The submitted review is graded based on accuracy, clarity, and completeness. It should be written so that any student in the class could read your review, and understand why you formulated your opinion. A sweeping score (2-3 values establish a range) for each item is used in some cases. The sum of scores is not used rigidly to calculate a grade. If you have questions regarding your grade, see me ASAP!

CATEGORY	SCORE
REVIEW:	
Title page provided / absent	5 4 3 2 1 0
Requested information is provided at top of report / partial / absent	5 4 3 2 1 0
An informative synopsis is provided / unsubstantiated / too brief	5 4 3 2 1 0
The review is thorough / cursory / choppy / suggests a last minute effort	5 4 3 2 1 0
The applications of the site are explicit / unclear / absent	5 4 3 2 1 0
The reason for selection is provided / unclear / absent	5 4 3 2 1 0
Suggested site rating is justified / weakly justified / unjustified	5 4 3 2 1 0
The language is well written / choppy / unintelligible gibberish	5 4 3 2 1 0
Review is typed and double-spaced / improperly spaced / hand-written	5 4 3 2 1 0
Review length is appropriate / too long (5+ pages) / too short (< 1 page)	5 4 3 2 1 0
Review is free of grammatical and spelling errors / few errors / sloppy	5 4 3 2 1 0
Review and WWW site title page are submitted in a folder / no folder	5 4 3 2 1 0
Review title and student name is written on folder tab / scribbled / missing	5 4 3 2 1 0
50-WORD MINI-REVIEW:	
Mini-review is clear / informative / confusing / absolutely lame	5 4 3 2 1 0
Requested info (name, title, URL) are provided / absent	5 4 3 2 1 0
Mini-review contains 50 or fewer words	5 4 3 2 1 0
Mini-review is typed and in correct format / incorrect format	5 4 3 2 1 0
Mini-review is free of grammatical and spelling errors / few errors / sloppy	5 4 3 2 1 0
Suggested site rating is justified / weakly justified / unjustified	5 4 3 2 1 0

Curriculum Resources

"Meet The Microbe" Presentation Guidelines

Bergey's Manual of Systematic Bacteriology is a comprehensive "catalog" of well-studied microorganisms. It contains descriptions of over 5,000 bacterial species, which may represent less than 0.1% of the bacteria on this planet! Many described species have medical and commercial importance. Bacteria profoundly influence our world, whether they are producing nitrogen in the soil, fermenting food products for human consumption, causing life-threatening diseases in plants and animals, or simply causing last week's leftovers to spoil. Keep in mind other types of microorganisms exist such as fungi (like molds, yeasts, and mushrooms), protozoa (like the agents that cause malaria), helminths (parasitic tapeworms and flukes), viruses (agents like HIV and influenza), viroids ("RNA-like things" that cause potato spindle disease and coconut kdang-kdang), and prions ("self-replicating proteins" that cause kuru and mad cow disease). Certain arthropods (vectors such as ticks and mosquitoes) merit study in microbiology because they can spread infectious agents. During this semester we will study only a few specific microorganisms, but we will learn the concepts that describe how various forms of life survive and affect humans. How can we possibly get to know some of the many microorganisms on this planet? We'll have a day where we will "meet the microbes"!

This exercise is meant to help students learn about various microorganisms through an alternative form of presentation. When you have been to a doctor's or dentist's office, you may have seen wall posters about microorganisms. Even breweries, pharmaceutical plants, and agriculture extension agencies have posters about microorganisms. Such materials educate the public about a topic without additional resources or instructors. Your poster should offer the same result. This exercise will encourage independent research, develop critical thinking skills, foster class discussions, and promote collegiality.

Work Individually or with a Partner. This assignment can be completed individually or with a lab partner. If you work as a team, inform me about any difficulties. All students enrolled in this course are adults, so I anticipate few (if any) problems. This assignment is restricted to your own team's work. Do not solicit or receive assistance (other than typing services) from others. Organize your work before you begin and distribute work loads equitably; do not place all responsibility on your partner and do not accept all responsibility. The grade you receive for this assignment will reflect your own presentation and your own contributions to the presentation.

Selecting a Microorganism. The choices of microorganisms and similar entities that can be described through this exercise are enormous. I will allow you to randomly draw a selection from a pool of choices. Because microbiology encompasses more than just bacteria, possible selections also include microorganisms such as small fungi (eg., yeasts), protozoa, viruses, viroids, and prions.

Collecting Sources and Information. An infinite amount of information is available about common microorganisms. Excuses such as "I couldn't find anything" or "I couldn't find any magazines" are rubbish!

- Use your text, newspapers, magazines, or library resources to find information about your selected microorganism. I have many resources such as textbooks available in my office. Stay away from technical and research articles - many students do not know the meaning of the information in these papers.
- If the information is from a WWW site, the site must be a legitimate source that publishes only peer-reviewed work. Many university courses and research facilities maintain updated online reference libraries about specific microorganisms. Avoid personal home pages.
- You will need at least three (3) citations for your poster, but more citations are better!

Format for the Submitted Poster. My advice to you - *do not wait until the last minute to work on this assignment!!* You will need time to acquire your resources, design the poster, write the text, and assemble the poster.

- The entire poster presentation must be contained on the front side of ONE sheet of poster board.
- The poster can take any creative form you choose. You may make it colorful, include three-dimensional attachments, include a brochure holder to dispense literature, or however you wish.
- Use a word processor to prepare your text - hand-written submissions will not be accepted.
- Check your work to make certain no grammatical or spelling errors are present. Read your work before you submit your poster!
- DO NOT PLAGIARIZE!!!
- The poster must be written in first person voice. You may use a character or modified drawing of your microorganism to "walk" your audience through the poster's content.
- *Keep the text brief but informative.* Partition the text into small manageable sections that a reader can quickly understand.
- Carefully consider appearance, design, organization, and content. Organize information in a logical and uncongested procession. Because most people are visual learners, incorporate several helpful visual aids such as pictures, diagrams, drawings, etc.

Content for the Submitted Poster. Regardless of design, make certain that the poster is informative. Anyone reading your poster should learn all about your selected microorganism without requiring additional resources. Your poster should be written so that any student in the class could read your poster, understand its contents, and appreciate why the microorganism is significant (test subjects could include your roommate, mom, fraternity/sorority friends, etc.). Suggested information for all posters includes:

- A brief abstract. State briefly "Who is this microorganism?" and address what the poster is about. This section should be 100-250 words. Provide an additional copy of the abstract page with your name, lab section, and poster title written at the top of the page. This will be used to create a poster symposium program for each lab section.
- A few brief sections that succinctly describe the microorganism. Include basic physiological characteristics: Is it a prokaryote or eukaryote? What is its shape? Is it aerobic? What is its Gram reaction? Is it motile? Does it have any unique physical features? For disease-causing microorganisms, each team should describe major characteristics about the pathogen and describe transmission, disease symptoms, pathogenicity, epidemiology, treatment, and prevention. For microorganisms with medical, industrial, or biotechnological importance, each group will present major characteristics about the microorganism and describe development, applications, and impact.
- A statement about why you selected the microorganism. Why did you choose to make a poster about this microorganism?
- A citation list. Be sure to record all required information for each citation. Each component of the citation must be included in your poster to receive full credit. A complete citation includes:
 - the names of all authors
 - the publication date
 - the title of the article
 - the name of the newspaper or periodical
 - the volume number (usually located on the table of contents page)
 - the inclusive page numbers (for newspaper articles, include the section number)

Examples of complete journal citations are provided below. A full URL must be provided with each citation from the WWW.

- Sternberg, S. 1996. Cholera hides a sinister stowaway. Science News 149:404-405.
- Christensen, B. 1998. Cholera prompts shellfish warning. URL at <http://www.hs.state.us/healthlink/oct97/shrimp.html>.

If you work with a partner, each student must submit a separate document that identifies the person's contribution and effort to the poster. I must have this information so I can grade your work!

Presenting Your Poster to Your Lab Section. Presentations will be made during lab. Each person will make a brief and informal presentation (~3 minutes) about the poster to your laboratory section. Provide a brief description for each section you authored. Please practice your presentation before coming to class. You may have note cards to help you, but do not read to your audience. Remember, you wrote the poster, so you should be able to talk to the class about it. Questions from the class can be answered at the end of your presentation. All students submitting a poster must make a presentation to receive credit. Please display your poster to your lab section and peruse the posters that were written by other students in your lab section.

Listening to Other Student Presentations. Just as your classmates will listen respectfully during your presentation, you are asked to listen to their work with attentiveness and courtesy. You may not leave after presenting your own poster!!! After hearing each presentation, you will have ample time to visit other posters.

How Your Poster Will Teach Others. I will collect the abstract forms and assemble a poster symposium program for each lab section. This document will help you to review the contents of posters from your lab section. The lecture exam will contain questions about the posters that were submitted. You will answer questions about posters only from your own lab section. The questions will be developed from suggested questions submitted by the authors of the posters.

Grading the Poster. If you miss the submission date, you will receive a zero on this assignment. The poster is graded on subject content, grammar, and completeness. Visual appearance, creativity, and organization have a small impact. I will use a "sweeping" score (ie., 2-3 values establish a range) for each item. The sum of scores is not used rigidly to calculate a grade. If you have questions regarding your grade, see me ASAP!

CATEGORY	SCORE
CONTENT:	
Title and Microorganism name (easily identifiable, creative title, or hard to find)	5 4 3 2 1 0
Spelling and grammar (no errors, complete sentences, language)	5 4 3 2 1 0
Written in first person	5 4 3 2 1 0
Author names (easily identifiable, hidden, absent)	5 4 3 2 1 0
Written abstract (brief and informative, vague, or absent)	5 4 3 2 1 0

Abstract for program (correct format, partial compliance, absent)	5 4 3 2 1 0
Sufficient written or visual descriptions provided for:	
Identity (prokaryote /eukaryote / virus / prion)	5 4 3 2 1 0
Physical appearance (size, shape, Gram rx, etc.)	5 4 3 2 1 0
Unique physical features (spore production, capsule, toxins, etc.)	5 4 3 2 1 0
Distribution (where is it found?)	5 4 3 2 1 0
Commercial applications (food, soil, industry, environment, biotech)	5 4 3 2 1 0 n/a
Transmission (for pathogens)	5 4 3 2 1 0 n/a
Epidemiology (for pathogens)	5 4 3 2 1 0 n/a
Disease symptoms (for pathogens)	5 4 3 2 1 0 n/a
Diagnosis (for pathogens)	5 4 3 2 1 0 n/a
Treatments (for pathogens)	5 4 3 2 1 0 n/a
Prevention (for pathogens)	5 4 3 2 1 0 n/a
Statement about why this microbe was chosen (clear, unclear, absent)	5 4 3 2 1 0
Complete citation list	5 4 3 2 1 0
VISUAL:	
Originality (creative, novel, innovative, or uninspiring, bland)	5 4 3 2 1 0
Color schemes (appealing, eye-catching, or ugly)	5 4 3 2 1 0
Design (effective backgrounds, appealing shapes for sections, uninspiring)	5 4 3 2 1 0
Organization (flow and order of information logical, random distribution)	5 4 3 2 1 0
Appropriate figures, tables, drawings or visuals (good / weak / absent)	5 4 3 2 1 0
Text size and font selection (easy to read, too small, or slop)	5 4 3 2 1 0
Boundaries (all contents within poster, correct poster size)	5 4 3 2 1 0