Lesson #1

What is Microbiology?

Objectives:
- The learner will demonstrate knowledge of important advances in microbiology by creating a timeline of microbiological milestones.
- The learner will demonstrate application of the many milestones in microbiology by researching and reporting on the current work being done by microbiologists.

National Science Education Standards:
SAI 1, LS 1, ST 2, SPSP 5, HNS 1, HNS 2, HNS 3

Benchmarks:
1C, 1D, 2B, 3A, 3C, 7G, 10I, 12D

Materials:
- Internet access
- Student research sheets
- Books (optional)
- Colored pencils
- Timeline poster sheet

Background:
Many students are unaware of the varied areas of science. Because there is so much diversity within scientific fields, it is important for scientists to know about fields other than their own so that they can more easily communicate with other scientists. This is also important for students, as they can not only explore new areas of science, but also have an awareness of the struggles and accomplishments which have made our world what it is today.

The first part of this activity allows students to look into the roots of microbiology and see how the discipline has grown. Using a timeline format will help students to see the order in which scientific discoveries occurred, allowing them to make connections from one discovery to the next and see how these discoveries build upon each other.

In the second part of this activity, students will have the opportunity to look into the science of today. Students will be asked to focus on a specific area of microbiology. They will then be asked to find scientists who are currently doing research in their chosen area. This is important for students to see that many discoveries are being made in colleges, universities and institutes all around the world, with some near them. It is important to appreciate the achievements of all researchers who are helping to make a difference in our world, whether they are “famous” or not.

Preparation:
The preparation for this activity depends on how you will be organizing your timeline. If you have more than one class that will be working on the project, you may want to have one large timeline for all of your classes. This activity will work well no matter how long you decide
to make your timeline. You can use the list of microbiologists as a guide. If you will be working with just one class, please consider your choice of microbiologists so that the timeline will span the history of microbiology. There is a suggested list of microbiologists for use with single classes.

Along with the list of microbiologists, there is also a list of six of the main areas of microbiology. Review this list with students when they are choosing the branch of microbiology that they will be researching.

**Warm-Up:**
Ask your students “What is microbiology? What do microbiologists do?” Discuss different kinds of microorganisms and how they affect our lives.

**Procedures:**
1. Students will each be assigned a microbiologist to research. They will use their findings to create a piece of the class microbiology timeline.
2. After creating the timeline pieces, students will assemble the timeline and discuss the major milestones which they researched.
3. Students will then be asked to pick one of six different areas in microbiology. They will use a website to gather information on that branch of microbiology and research a scientist currently working in that area.

**Variations and Follow-Up Activities:**
As described in the background section, there are many options for putting the timeline together. This may be a project using the work of students from many different classes or from just one class. The location of this timeline will vary by teacher, but these may be displayed in the classroom, cafeteria, hallway, or in a school display case.

Because each student will be creating his/her own piece of the timeline it is very easy to assemble all of their pieces to make the timeline. A piece of string may be used as a “line” and students posters may be hung on that string, or attached to the wall below the line. Alternatively, the posters can be attached to a large piece of roll paper and displayed. The method used will depend on the needs of the students and the locations available to you.

The activities that follow in this module will serve as a follow-up to this lesson as students can refer back to the timeline while they are learning about specific microbial processes.

**Assessments:**
While constructing the timeline, students’ interpersonal skills may be observed as they may work together in placing each of the posters chronologically on the timeline. This will depend on the way that you structure the activity.

Students’ research skills and writing skills can be assessed through the individual timeline pieces that the students create as well as through the “Microbiology Today” research that they conduct and report on.

Two separate grades can be given on this assignment, one for the timeline poster and the other for the “Microbiology Today” research sheet.
Observations:

I found that it was very helpful to have some books on hand for the research portion of this lesson. While many of my students were able to use the internet as a research tool with very little difficulty, some students found the information on the internet to be too much to look at all at once. The use of books provided a more concise format for students with perceptual difficulties as well as for my Limited English Proficiency students. It is not necessary to go out and buy special books for these students to use. Encyclopedias, comprehensive dictionaries, and printed copies of simple web pages can be a great help.

It is STRONGLY recommended that you check all websites you are planning to use with students before beginning work. The internet is ever changing and what is there one year may not be there the next. Taking a few minutes to check the sites the day before an activity can save a lot of class time if those sites are not up and running.

Consider using some examples in your classroom. I have found that my students produce a higher quality of work when an example is shown. This will give students some expectations to consider when working. I found that a sample was helpful for both the microbiologist poster and the timeline. When my students know I expect quality work from them, they don’t let me down.

You may want to consider doing some research of your own and look for microbiologists in your area. While you may not have a microbiologist next door, students can feel a sense of pride in researching a microbiologist who works in their state or region. Look to local colleges and universities for information about any microbiologists who may be of interest to your students.

The following page gives examples of some of the work which my students produced.
David Baltimore

**Noble Prizes in Medicine and Physiology**

- 1975 Nobel Prize in Medicine for work in virology
- 1999 National Medal of Science at White House

**Schooling/Training**
- Stanford College
- Massachusetts Institute of Technology
- Summer at Cold Spring Harbor Laboratories

**Interesting Fact**
- He researched how cancer-causing RNA viruses manage to infect healthy cells.

David Baltimore was interested in Biology when he was in high school and since he spent a summer at Jackson Memorial Laboratory.

Edward Tatum

December 14, 1909 Boulder, Colorado
November 9, 1975 New York, New York

**Most Notable Accomplishments**
- He shared the 1958 Nobel Prize in Physiology or medicine with G. W. Beadle and Joshua Lederberg.
- In 1958 helped discover that genes act by regulating definite chemical events.
- Earned his Doctorate from the University of Wisconsin in 1934.

**School or special training**
- University of Chicago, Stanford University, Yale University, University of Wisconsin and Rockefeller Institute for Medical Research

**Description of Microbiologist**
- Edward Tatum is married and has two kids. He is a professor and educator at Rockefeller University.

**Interesting Fact**
- Edward Tatum received the Remsen Award of the American Chemical Society in 1953.

Craig Venter

Born October 14, 1946 in Salt Lake City, Utah

- In 1995, he elucidated the first complete genome sequence of a microorganism: Haemophilus influenzae.
- In 2002, he sequenced all of the 3.5 billion "letters" that make up human DNA.

- Venter was very determined. He said he unfinished a project two years before he was supposed to finish. His biology teacher, which annoyed he cared about other things besides his work and it also showed that he likes to share his results.

Craig Venter got his PhD in Physiology and Pharmacology from the University of California.

Venter worked for a decade to decipher all of the 3.5 billion "letters" of DNA.
### List of Famous Microbiologists

<table>
<thead>
<tr>
<th>Name</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oswald Avery</td>
<td>David Baltimore</td>
</tr>
<tr>
<td>George Beadle</td>
<td>Emil von Behring</td>
</tr>
<tr>
<td>Martinus Beijerinck</td>
<td>Herbert Boyer</td>
</tr>
<tr>
<td>Sydney Brenner</td>
<td>Thomas Brock</td>
</tr>
<tr>
<td>Elizabeth Bugie Gregory</td>
<td>Annie Chang</td>
</tr>
<tr>
<td>Martha Chase</td>
<td>Stanley Cohen</td>
</tr>
<tr>
<td>Ferdinand J. Cohn</td>
<td>Rebecca Craighill Lancefield</td>
</tr>
<tr>
<td>Francis Crick</td>
<td>Max Delbruck</td>
</tr>
<tr>
<td>Gerhard J. Domagk</td>
<td>Hendrick Jean Louis Donker</td>
</tr>
<tr>
<td>Paul Ehrlich</td>
<td>John Franklin Enders</td>
</tr>
<tr>
<td>Alice Catherine Evans</td>
<td>Alexander Fleming</td>
</tr>
<tr>
<td>Giralamo Fracostoro</td>
<td>Claire Fraser</td>
</tr>
<tr>
<td>Robert Gallo</td>
<td>Walter Gilbert</td>
</tr>
<tr>
<td>Hans Christian J. Gram</td>
<td>Fredrick Griffith</td>
</tr>
<tr>
<td>Robert Helling</td>
<td>Alfred Hershey</td>
</tr>
<tr>
<td>Dmitri Ivanowski</td>
<td>Louis Jablot</td>
</tr>
<tr>
<td>Francois Jacob</td>
<td>Holger Jannasch</td>
</tr>
<tr>
<td>Edward Jenner</td>
<td>F.L. Kilbourne</td>
</tr>
<tr>
<td>Shibasaburo Kitasato</td>
<td>Albert Jan Kluyver</td>
</tr>
<tr>
<td>Robert Koch</td>
<td>Georg Kohler</td>
</tr>
<tr>
<td>Joshua Lederberg</td>
<td>Antonie van Leeuwenhoek</td>
</tr>
</tbody>
</table>
Joseph Lister      Salvador Luria
Colin MacLeod      Luc Mantagnier
J.H. Matthaei       Maclyn McCarty
Matthew Meselson   Ilya Ilich Metchnikoff
Cesar Milstein     Peter Mitchell
Jacques Monod       Ruth Ella Moore
Kary Mullis         Marshall Nirenberg
Louis Pasteur      David Perrin
Julius Richard Petri Margret Pittman
Stanley Prusiner     Walter Reed
Francis Reyton Rous Howard Ricketts
Carmen Sanchez      Fredrick Sanger
Albert Schatz       Ignaz Semmelweis
Kiyoshi Shiga       Hamilton Smith
Theobald Smith      John Snow
Wendell Stanley     Edward Tatum
John Tyndall        C.B. van Neil
Craig Venter        Selman Waksman
James Watson        Thomas H. Weller
Maurice Wilkins     Sergei Winogradsky
Carl Woese          Charles Yanofsky
Norton Zinder
| List of Famous Microbiologists (for one class, add from the main list as necessary) |
|------------------------------|----------------|
| Robert Koch                  | Joseph Lister  |
| Louis Pasteur                | Martinus Beijerinck |
| Sergei Winogradsky           | Alexander Fleming |
| Selman Waksman               | Hans Christian J. Gram |
| Julius Richard Petri         | Thomas Brock    |
| Edward Jenner                | Antonie Van Leeuwenhoek |
| Howard Ricketts              | Robert Gallo    |
| Ronald Ross                  | Walter Reed     |
| Elizabeth Bugie Gregory      | C.B. van Neil   |
| Ilya Ilich Metchnikoff       | Albert Schatz   |
Branches of Microbiology

Bacteriology

Virology

Mycology

Protozoology

Epidemiology

Immunology
In this activity you will be researching a microbiologist who has made an important contribution to the study of microbiology. You will then compile your findings into a data page which will be used to create a timeline of the major milestones in microbiology. Next you can choose an area of microbiology to research and find out about the scientists who are carrying on that type of research today.

Use this sheet to help you in your research before putting together your piece of the timeline. You may use books and internet sites, but you must record these sources. Here are some sites to try:
http://www.historique.net/microbes/history.html
http://www-micro.msb.le.ac.uk/109/History.html
http://www.microbes.info/resources/General_Microbiology/History/
http://www.microbeworld.org/htm/aboutmicro/timeline/tmln_0.htm
When researching your chosen area of microbiology, it is suggested that you start at http://www.microbeworld.org

Microbiologist __________________________________________________________

Birth/Death/location_____________________________________________________

Most notable accomplishments (including years)
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Schooling or special training _____________________________________________
_____________________________________________________________________
_____________________________________________________________________

Interesting Fact _________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Description of person ___________________________________________________
Use this format for organizing your microbiologist’s information

Name of Microbiologist

Birth & Location

Death & Location

Most Notable Accomplishments
(be sure to include years)

Use this space to draw a picture of
your microbiologist or a drawing of
his/her work.

Schooling / Special Training

Description of Microbiologist

Interesting Fact
Name __________________
Date __________________

**What is Microbiology**

**Microbiology Today Research Form**

Use this form to record your findings on the microbiologists of today.

Branch of Microbiology ____________________________________________

Brief description of this branch ______________________________________

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

How this branch is important in today’s world? __________________________

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

Name of current researcher in this field ______________________________

Born/location _____________________________________________________

Education/Special Training __________________________________________

_________________________________________________________________
_________________________________________________________________

Most notable accomplishments ________________________________________

_________________________________________________________________
_________________________________________________________________

Interesting Facts _________________________________________________

_________________________________________________________________
_________________________________________________________________

List all of your sources on the back of this page!