

## Teaching with Primary Sources (TPS) Lesson Plan

**Title: History of the Microscope and Microscopic images: Impacts in the fields of Modern Histology, Biology and Medicine**

### Overview

Modern histology, biology and medicine are based on pivotal innovations and observations of many individuals. In the 17<sup>th</sup> century, the unknown world of cells was discovered, changing scientific views. As scientists learned about the “micro” world, society was uncertain of how cellular knowledge would affect them. This lesson plan involves the exploration of various primary sources to understand the historical impacts of the microscope and microscopic images to modern biological and medical fields.

### Objectives

- Investigate the history of microscopy and its importance in the fields of histology, biology and medicine
- Compile and analyze primary source materials written and drawn about the microscope and microscopic images
- Determine the impacts of primary source evidence on modern biological and medical fields
- Synthesize the influences of primary source information and current primary scientific literature on modern microscopic/biological/medical technology into an oral presentation

### Time Required

One 90-minute lab period, two 60-minute lecture or lab periods; students continue investigation on their own time (may be modified for high school)

### Recommended Grade Range

Undergraduate college biology courses, introductory or advanced;  
May also be used in a 12<sup>th</sup> grade advanced (cell) biology course

### Subject / Sub-Subject

Histology, Cellular Biology and Introductory Biology

### Standards (Common Core for High School)

[CCSS.ELA-Literacy.RST.11-12.2](#)

Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

[CCSS.ELA-Literacy.RST.11-12.4](#)

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*.

[CCSS.ELA-Literacy.RST.11-12.5](#)

Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

[CCSS.ELA-Literacy.RST.11-12.7](#)

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

[CCSS.ELA-Literacy.WHST.11-12.8](#)

Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

[CCSS.ELA-Literacy.RL.11-12.1](#)

Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

## Credits

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## PREPARATION

### Materials and Resources

- PowerPoint slides with excerpts from: Color Textbook of Histology. Gartner LP and Hiatt JL. 2007, 3<sup>rd</sup> edition (Histology course) or Biology. Mader S, 2015, 12<sup>th</sup> edition (Introductory Biology or 12<sup>th</sup> grade advanced biology courses)
  - Chalkboard or white board
  - Rubrics
  - Printed copy or access to interactive tool online
    - Analysis tool for books and images:  
<http://www.loc.gov/teachers/primary-source-analysis-tool/>
  - Stripling model of inquiry:
    - [http://www.loc.gov/teachers/tps/quarterly/inquiry\\_learning/article.html](http://www.loc.gov/teachers/tps/quarterly/inquiry_learning/article.html)
  - Printed copies and/or online access:
    - Images (Robert Brown's microscope) compared to modern microscope:  
<https://www.loc.gov/resource/cph.3c10443/>,  
[https://www.loc.gov/preservation/scientists/instrumentation/compound\\_dig\\_microscopy.html](https://www.loc.gov/preservation/scientists/instrumentation/compound_dig_microscopy.html)
    - Image: (Look before you eat) Opper,  
<https://www.loc.gov/resource/ppmsca.28300/>
  - Internet/computer access:
    - Video: [http://www.dailymotion.com/video/x11pe80\\_bbc-the-cell-1-of-3-the-hidden-kingdom\\_shortfilms](http://www.dailymotion.com/video/x11pe80_bbc-the-cell-1-of-3-the-hidden-kingdom_shortfilms)
    - Book (The use of the microscope):  
<https://archive.org/stream/useofmicroscopei00frie#page/n7/mode/2up>
    - Book (normal histology):  
<https://archive.org/stream/illustratedsynop00pier#page/n7/mode/2up>
    - Book (pathological histology):  
<https://archive.org/stream/manualofpatholog00corn#page/n7/mode/2up>
    - Modern microscopic images:  
<https://www.youtube.com/watch?v=OmHGwDy51PQ&index=5&list=PLDEQMJ4WTcWq1AhfYMzem7NoireqJUDo6>
    - Database searches for primary literature: NCBI PubMed  
<http://www.ncbi.nlm.nih.gov/pubmed> and Google scholar  
<https://scholar.google.com/>, and historical primary sources: Library of Congress (LOC) <https://www.loc.gov/>
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### Procedure - Stripling Model of Inquiry

1. Connect: In the 17<sup>th</sup> century, the microscope was used to discover the unknown world of cells. Students will watch a documentary video (60 min) introducing the history and use of the microscope, and the early beginnings of understanding cells:

[http://www.dailymotion.com/video/x11pe80\\_bbc-the-cell-1-of-3-the-hidden-kingdom\\_shortfilms](http://www.dailymotion.com/video/x11pe80_bbc-the-cell-1-of-3-the-hidden-kingdom_shortfilms).

2. Students should note the historical figures, advancements of the microscope, the microscopic images produced, and contributions to the cell theory.

- Use PowerPoint slides to help connect the ideas from the video and the introduction from the book, Color Textbook of Histology.

3. Provide students with the image of Robert Brown's microscope:

<https://www.loc.gov/resource/cph.3c10443/>

4. Have the students examine the image. Write down terms to describe their observations on chalkboard/white board. Discuss with students how the use of the microscope led to some advancements in science.

5. Wonder: Ask students whether modern medicine could be what it is today without the microscope.

\* \*6. Reflect: Using the Opper image from the LOC, discuss with students this investigative question: how did the field of biology and public views change since discovery of microscopic organisms and cells?

- Have students examine the Opper image:  
<https://www.loc.gov/resource/ppmsca.28300/>
- Why would people be afraid to see the images from a microscope?
- Would society welcome or believe in such an invention and/or the images obtained from these instruments?
- Discuss the meanings of this image in the contexts of the time and for today. Has anything changed today?
- How did viewing the cellular world affect scientists' thinking? Public views?
- How did the invention of the microscope and microscopic observations contribute to the formulation of the **Cell Theory**?

(1-6, class 1, 90 min lab period)

7. Investigate: Divide the class into groups of 2. Have each of the groups select a section from each chapter of the book: "The use of the Microscope":

<https://archive.org/stream/useofmicroscopei00frie#page/n7/mode/2up>

- Have the students read and analyze the section they chose from the chapter using the analysis tool: <http://www.loc.gov/teachers/primary-source-analysis-tool/>

8. Construct: Discuss findings with the whole class. Have students put up the main points of their section on the chalk board/white board.

- What was the importance in microscopy?
- What type of "language" was used and how did it apply to the section?
- How do you think the author determined these protocols/ideas for the microscope and microscopic images?

9. Create: Students will analyze the microscopic images in the book:

<https://archive.org/stream/illustratedsynop00pier#page/n7/mode/2up>

- Have students look for the same tissue (and similar image) in their text book
- Have students take pictures of their microscopic slides (from slide box) and compare them to the images in the 1880 book and their textbook
  - Do the images in the 1880 book compare to the images in their textbook and those that they had taken?

10. Express: Have students discuss the similarities and differences that they see.

- How do they look similar or different? Why?
- Have students compare Leeuwenhoek's and Hooke's microscopes to the modern microscope:
  - [https://www.loc.gov/preservation/scientists/instrumentation/compound\\_dig\\_microscopy.html](https://www.loc.gov/preservation/scientists/instrumentation/compound_dig_microscopy.html)
- How did microscopic technology improve and what advancements do we see in the modern technology?
- How did this technology impact scientific view? Societal view?

11. Reflect: Discuss the primary sources used.

- Are the sources used, primary or secondary sources? Why? How do you know?
- Is the textbook a primary or secondary source? Why? How do you know?
- Have students compare the images from the primary source, textbook and the top microscopic images of 2013:
  - <https://www.youtube.com/watch?v=OmHGwDy51PQ&index=5&list=PLDEQMj4WTcWq1AhfYMzem7NoireqJUDo6>
- Discuss the observations of these images. How does it contribute to knowledge today?

(7-11, class 2, 60 min lecture or lab period)

12. Further investigation and Extensions: Students (on their own) should be able to connect the importance of primary historical sources to modern histology, biology and medicine

- Using specific search terms from the previous exercises, students will search the Library of Congress website <https://www.loc.gov/> website to find additional historical microscopic images and/or books.
- Have students search current primary literature via <http://www.ncbi.nlm.nih.gov/pubmed> and Google scholar <https://scholar.google.com/> to examine the impacts of primary source materials on modern biology and modern uses of microscopes, including new types of microscopes and their images, impacts to modern medicine and new techniques for cellular staining
- Students will present their findings in an oral presentation (in class)

(12, student time; 60 min lecture or lab period)

## Evaluation

Formative Assessments: homework due dates for certain items: a) primary source, b) historical documents, c) historical images, d) modern uses, e) modern medicine, f) techniques for staining

Analysis tool for primary sources: <http://www.loc.gov/teachers/primary-source-analysis-tool/>

Summative Assessment: final oral presentation rubric below:

### EVALUATION: Oral Presentation

Presenter: \_\_\_\_\_

	Total section points	Breakdown	Poor					Excellent		Section Scores
			F	D	C	B	A			
<b>Title Slide (1 slide)</b>	4									
Descriptive title: Describes presentation concisely, adequately, appropriately		2								
Lists presenter's name, course number, date and professor's name & title		2								
<b>Introduction (2-3 slides)</b>	6									
Successfully introduces background information		3								
Effectively presents important facts and/or images		3								
<b>Body of presentation (7-9 slides)</b>	40									
Contains <b>specific</b> SUMMARIZED material about the topic		10								
Provides enough details to highlight information about the topic		10								
Includes supporting figures, images and/or tables		10								
Information is properly cited; no large quoted material		10								
<b>Summary/Conclusion(1-3 slides)</b>	5									
Summarizes/concludes important concepts		3								
Provides main take home message		2								
<b>Use of References</b>	5									
Citations noted on slides		3								
Use of LOC primary sources		2								
<b>Overall Presentation</b>	20									
Dressed semi-formally		5								
Well paced and well organized		5								
Presenter stays within time limit		6								
Presenter was audible and clear		4								
	80									

Points deducted   
 Total Possible Points 80  
 Total Points earned