Famous Relationships – Science is Full of Them: Engaging MS Students

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Today’s presentation

- Project background and history
- Overview of elementary materials
- Preview of middle school materials
  - Progression of content, including key questions
  - Previews of activities and resources, including sampling of animations and videos
- Overview of high school materials
- NSTA 2018 – Additional opportunities
The Vaccine Education Center was launched in October 2000 to provide accurate, comprehensive and up-to-date information about vaccines and the diseases they prevent.
About vaccine safety concerns

• Many vaccine safety concerns can be addressed through science.

• But, the people who create vaccines are often personally attacked. They are portrayed as selfish, profit-driven individuals who are more concerned about themselves than children.

• Lack of understanding about how science works leaves people susceptible to misinformation.
The Vaccine Makers Project

Documentary Film

Educational Resources
The science is clear, but the message is debated among sectors of society.

• Vaccines
• Genetically-modified food
• Evolution
• Climate change
Students have experience with vaccines.

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Ages 11-12</th>
<th>Ages 13-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meningococcus</td>
<td>1st dose at 11-12yo*, 2nd dose at 16-18yo</td>
<td>13-15yoc 1 dose, followed by a booster at 16-18yo, 16-18yo: 1 dose</td>
</tr>
<tr>
<td>Type B</td>
<td></td>
<td>16-18yo: 2 doses</td>
</tr>
<tr>
<td>Tdap</td>
<td>1 dose</td>
<td>1 dose if not previously received</td>
</tr>
<tr>
<td>HPV</td>
<td>2nd dose 6-12 months after first</td>
<td>13-14yo: 2 doses 6 to 12 months apart</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15-18yo: 3 doses if not previously received, Remaining doses if immunization was started</td>
</tr>
</tbody>
</table>

Meningococcus:
- Conjugate version:
  - 1st dose at 11-12yo*
  - 2nd dose at 16-18yo
- Type B:
  - 16-18yo: 2 doses

Tdap:
- 1 dose
- 1 dose if not previously received

HPV:
- 2nd dose 6-12 months after first
- 13-14yo: 2 doses 6 to 12 months apart
- 15-18yo: 3 doses if not previously received
- Remaining doses if immunization was started

Influenza:
- 1 dose annually

Hepatitis A:
- 2 doses

Hepatitis B:
- 2 or 3 doses

Polio:
- 3 doses

Measles, mumps, rubella (MMR):
- 1 or 2 doses

Chickenpox:
- 1 or 2 doses
Vaccines touch on a broad array of content.
Overview of content

Elementary
- What are germs?
- How viruses were discovered
- “Meet” scientists
- Activities based on the scientific method

Middle
- Focus on relationships
  - Relative cell sizes
  - Ecological interactions
  - Research teams
- Activities about how science is done

High/College
- Immune system
- How diseases adapt to survive
- Vaccine science
- Bioethics
  - Vaccine science
  - Working with animals
- Quality of information
Elementary-Level Materials

- How viruses were discovered
- Difference between viruses and bacteria
- How smallpox vaccine was made
- Scientific method
Middle-Level Materials

• Structure and Size: Comparing Viruses, Bacteria, & Eukaryotic Cells (Lesson 1)

• Ecology of Disease: Comparing Viruses, Bacteria, and Eukaryotes (Lesson 2)

• On the Shoulders of Heroes: Toward a World without Polio (Lesson 3)
Lesson 1 - Structure and Size: Comparing Viruses, Bacteria, and Eukaryotic Cells

Lesson questions:

1. What are the similarities and differences in structure between viruses, bacteria, and eukaryotic cells?

2. How does the size and structure of viruses, bacteria, and eukaryotic cells relate to their functions?
A Virus Attacks a Cell

Lesson 1 classroom resource
Novel animation
1:43 length
Relationship: Relative Size

Dendritic Cell: 100
S. pyogenes: 16
Influenza virus: 1
Lesson 2 – Ecology of Disease: Comparing Viruses, Bacteria, & Eukaryotes

Lesson questions:

1. How do scientists characterize interactions between organisms?

2. What are the similarities and differences between diseases caused by viruses, bacteria, & eukaryotic microorganisms?
How Do Viruses Reproduce?
Relationship: Ecological Interactions

- Mosquito-borne diseases
- Ecological relationships

<table>
<thead>
<tr>
<th>Type</th>
<th>Organism 1</th>
<th>Organism 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amensalism</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Commensalism</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>Competition</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mutualism</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Parasitism</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Predation</td>
<td>+</td>
<td>- -</td>
</tr>
</tbody>
</table>

+ (benefit); - (harm); 0 (no effect)
Lesson 3 – On the Shoulders of Heroes: Toward a World without Polio

Lesson questions:

1. What are the causes and consequences of polio?
2. How did scientists apply the scientific method to creating a polio vaccine?
I am a Polio Survivor

Lesson 3 classroom resource
Video
5:46 length
Relationship: Scientists & Their Research

- Polio research teams
Relationship: Scientists & Their Research

Class discussion about how science is a societal undertaking, yet a competitive race for knowledge.
Student Experience (Lesson 3)

Between 70 - 80% of students felt lessons:

- Helped them better understand how science is done
- Made them more interested in learning about polio or how the polio vaccine was made
- Made them more interested in learning about diseases or vaccines in general
What was your favorite part of today’s activities and why?

Students:
• “I liked reading about the different people and watching the video because they were interesting.”
• “Doing the map and timeline because it was interesting.”
• “I liked the video because it showed us a real life experience of polio.”
• “Learning about polio and how so many scientists worked on it.”

Teacher:
• “The map and timeline activity was a great way to drive home the idea of scientists teaming on research.”
High School-Level Materials

• Biology content
  Immune system, disease, and vaccine science

• Bioethics
  Hepatitis B vaccine versions & working with animals

• Evaluating online information
  Vaccine safety concerns & WHO evaluation criteria
Unit 1: The Human Immune System

Lesson 1: The organs & tissues of the immune system
Lesson 2: The innate immune system
Lesson 3: The adaptive immune system
Unit 2: Diseases and Vaccination

• Lesson 1: Development of disease and infection
• Lesson 2: Case studies: Influenza and HIV
• Lesson 3: The discovery & development of vaccines
• Lesson 4: Vaccine History & Research
• Lesson 5: Vaccine Safety
Bioethics: Hepatitis B Vaccine

Unit 2, Lesson 4 classroom resource

Hilleman: A Perilous Quest to Save the World’s Children film clip

10:50 length
Bioethics: Biomedical Research and Animals

Collaborating in Science Partner

Pennsylvania Society for Biomedical Research
Evaluating Online Information: World Health Organization

Lesson 5 classroom resource

Vaccine Safety Net program provides criteria for evaluating web sites for credibility and content quality.

www.vaccinesafetynet.org
• Classroom materials
• Vaccine information
• Giveaways
• Meet our team
Thank you!

Exhibit Hall Booth: 343

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Websites:
VaccineMakers.org – classroom materials
HillemanFilm.com – film information
vaccine.chop.edu – vaccine information