Build me a Killer!

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Abstract:

The purpose of this action proposal is to encourage students to utilize their scientific processing skills by providing the students to collaborate, infer, predict and make a model of a pathogenic prototype to include virulence factors to make a "killer." Through this activity, students will possess a better understanding of how to use the skills of scientific inquiry to come up with a plausible solution.

Rationale:

This activity is targeted to 10th grade regular students, who have various levels of achievement. Since it is the beginning of the year, students are coming off of summer vacation with the lack of rigor a school day provides. This activity will be a great way to allow me to get an easy assessment of the student's various levels of previous knowledge of scientific inquiry-based challenges (in this case with the relevance to pathogens), and engage them in a fun inquired based activity that is allows for movement within the classroom, collaboration with peers and promotes problem solving skills to create a "killer" emerging pathogen. As a back-to-school, ice breaker activity, students will become engaged to use the scientific process of inquiry to develop an emerging pathogen with various virulence factors. The students will be introduced to virulence factors prior to the activity through a brief lecture with incorporated discussion questions and a TedED video. Students will be able to utilize common prefixes and suffixes, which will become of use throughout the year. Through this activity, students will make their learning become more of a social, allowing for greater understanding, minimizing isolation and enables greater participation in later activities. The students will use a rubric-based grading scale to assess the success of the groups emerging pathogens they have built by comparing the group virulence factors.

Description of teaching unit or module(s), including expected outcomes:

<u>Standards:</u>

1. SC.912.L.14.6: Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health
2. SC.912.N.1.3 Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented
3. SC.6.N.1.4 Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation. (Prior Knowledge- foundations

Learning Goals:

Students will be able to:

1. recognize that scientific argumentation is a necessary part of scientific inquiry
2. explain the role that scientific argumentation plays in the generation and validation of scientific knowledge
3. Using appropriate prefixes and suffixes as to be used for modeling virulence factors
4. Assess the success of certain virulence factors
5. Recognize that diseases can be caused by infections, or from exposure to environmental factors
6. Discuss how diseases affect both individual & public health

Description of teaching unit:

The purpose of this unit is to encourage students to utilizing their scientific processing skills by providing the students to collaborate, infer, predict and make a model of a pathogenic prototype. This activity will be used as the ice breaker, fostering an inquiry-based activity allowing students to use their prior knowledge on a topic they know vaguely about, emerging pathogens. This lesson will take place during one 50-minute class period, where all learning styles will be accommodated by allowing all learning styles to be reflected throughout the various activities. Students will have the opportunity to participate in an altered traditional lecture (Nearpod ppt), incorporating introductory discussion questions, media news, and reflection questions. All this is to prepare them for the team-inquiry activity of "building a killer." Students will close the activity by presenting their creative emerging pathogens to the class. At the end of the presentations, their classmates will vote on the best "killer"

Data Collection Techniques and/or student assessment

1. Discussion Pre-Question
2. TedED Individual Post-test video
3. Peer Rubric Grading Scale

Equipment

1. Poster Paper
2. Colored pencils/ markers
3. Chromebooks

CATALySES Summer Institute Elements

Topics from Dr. Jo Marie Bascusmo – Pathogenic Prototype, Student Worksheet (prefixes and suffixes), Bad Bacteria lecture

Differs from my norm

Usually I do an experiment with various random lab equipment that is not inquiry-baseed, rather simply following a procedure. I think this activity, using something students vaguely know (pathogens), to make them think more in depth and come up with a creative idea will benefit the students. Students will be practicing collaborative group learning, communication skills and using their previous knowledge, along with new knowledge to answer the question, how to build the best killer?

SCIENCE LESSON PLAN

Christina Mulhern; Palm Beach Central High School

TITLE: Build a Killer!

KEY QUESTION: How to virulence factors contribute to the success of pathogenic bacteria?

SCIENCE SUBJECT: Biology

GRADE AND ABILITY LEVEL: 9^{th} and 10^{th} grade. Many students are historically from underrepresented population and perform below grade level on reading and math assessment.

SCIENCE CONCEPT: Pathogenesis, Genetic Evolution, Biochemistry

OVERALL TIME ESTIMATE: 50-mintue class period

LEARNING STYLES: Visual, auditory, kinesthetic and collaborative

VOCABULARY:

1. Antibiotic resistance: the drug is no longer effective against the infecting bacteria
2. Adhesin: appendages(arm) to allow bacteria to attach to host cell
3. Apoptosis: cell death as either a normal event or the result of the bacteria
4. Capsule: outer layer of cell and protects the bacteria against host cell
5. Flagella/ Cilia: whip-like structure used for movement
6. Host Cell: a living cell in which the bacteria lives
7. Motility: move towards or away from stimulus
8. Toxin: made by microorganisms to promote infection, damage host cell or disable immune system
9. Virulence Factors: factors that enhance the ability of bacteria to cause disease
10. Proteins: major functions within cells, allowing transport (in and out of the cell), receptor (to be recognized by immune system), and enzymes
11. Enzymes: helps a reaction (breaking things down, building a product, or helping move things) faster
12. Plasmids: loop of DNA (genetic information) that can easily be shared to another cell.

LESSON SUMMARY:

The purpose of this lesson is to encourage students to utilize their scientific processing skills by providing the students to collaborate, infer, predict and make a model of a pathogenic prototype to include virulence factors to make a “killer.” Through this activity, students will possess a better understanding of how to use the skills of scientific inquiry to come up with a plausible solution.

STUDENT LEARNING OBJECTIVES WITH STANDARDS:

The students will be able to…

1. SC.912.L.14.6: Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health
2. SC.912.N.1.3 Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented
3. SC.6.N.1.4 Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation. (Prior Knowledge- foundations

MATERIALS:

1. Post-it Note Easel Size.
2. Colored pencils/ markers
3. Chromebooks

ADVANCE PREPARATIONS:

Watch the TEDEd Video: Bacteria vs. Antibiotics.

The questions embedded in the presentation will come from this video.

PROCEDURE AND DISCUSSSIONQUESTIONS WITH TIME ESTIMATES:

One Day Lesson Plan

- Lesson introduction (~3 Minutes)
    - Bell-ringer question: What are some of the symptoms you have when you are sick?

    - Get creative! Decorate the classroom door with biohazard/ caution tape, wear a lab coat, play ominous music.
- Presentation of the Knowledge Needed for Lesson Activity (~14 Minutes) https://share.nearpod.com/Abgh7jNNPX
    - Review factors a "killer' would need to thrive.
    - TEDEd Video Presentation (4.35 Minutes)
    - Post TEDEd video review questions (3 Questions= 3 Minutes)
    - Killer Toolbox- the items found on a "killer"
- Activity Procedure (~2 Minutes)
    - Review the directions (found on the slide) & pass out worksheet and materials
    - Make groups
    - Present the example
- Student-Based Learning (~20 Minutes)
    - Students will use their knowledge gained from the lesson and the vocabulary worksheet provided to build a "killer" (see attachment)
        - They should include virulence factors and utilize the suffixes and prefixes provide on the worksheet handout.
- Exit Activity (~10 Minutes)
    - One student from a group will present the various factors.
    - Peers will rate the various "killers" (see attachment)

ASSESTMENT SUGGESTIONS:

Have the students identify the variulence factors from the video and generate their own list of factors needed.

RESOURCES/REFERENCE:

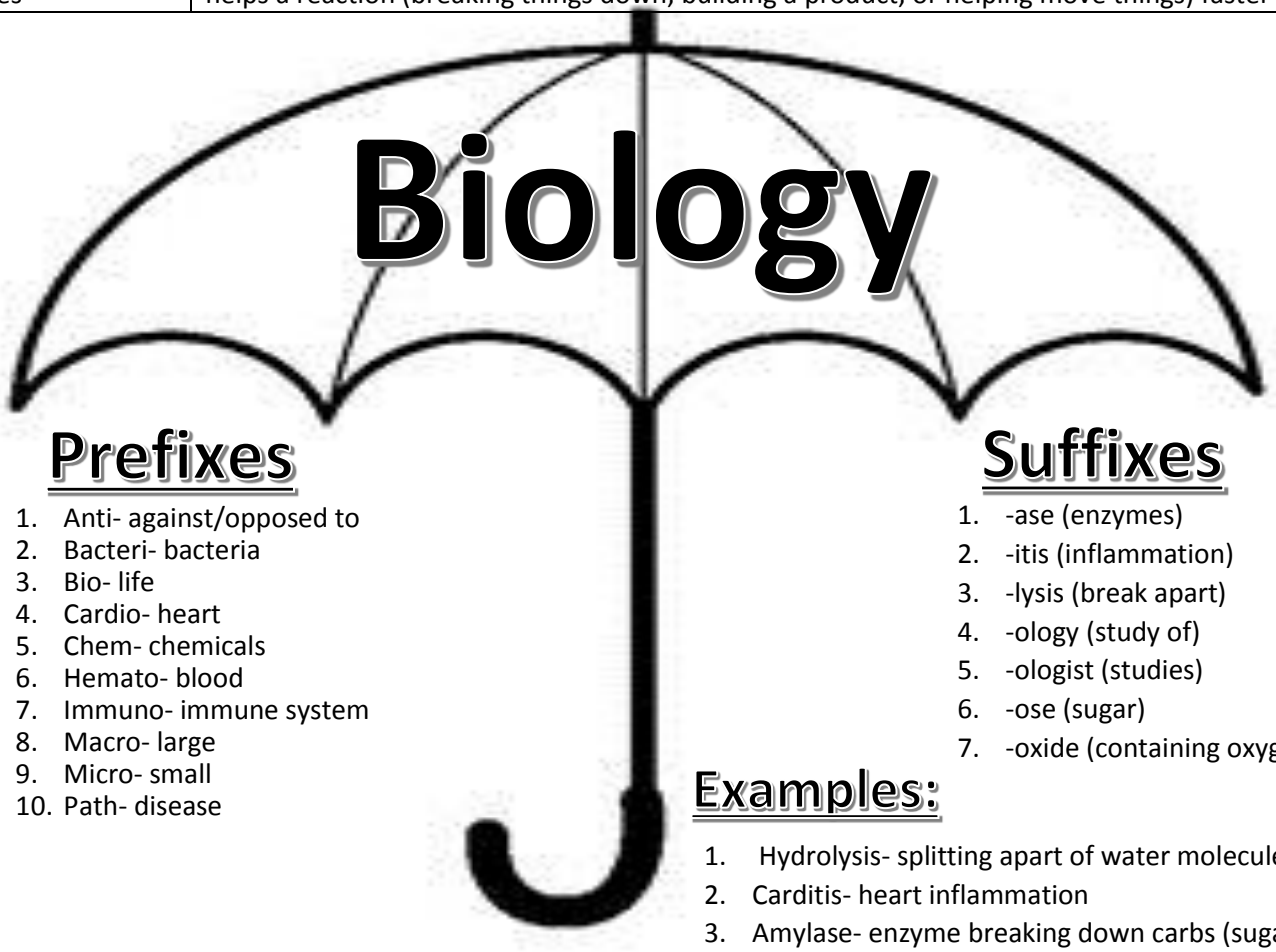
1. Topics from Dr. Jo Marie Bascusmo – Pathogenic Prototype, Student Worksheet (prefixes and suffixes), Bad Bacteria lecture

2. Virulence Factors: https://www.slideshare.net/TarekMahbubKhan/pathogenesis-i-bacterial-virulence-factors

3. Video: https://youtu.be/znnp-lvj2ek

You will use this as a reference sheet. This sheet will review the factors needed to build me a "killer." You can be as creative as you would like. You can create your own words using the appropriate prefixes and suffixes below. Have fun!

Terms	Definitions
Antibiotic Resistance	the drug is no longer effective against the infecting bacteria
Adhesin	appendages(arm) to allow bacteria to attach to host
Apoptosis	cell death as either a normal event or the result of the bacteria
Capsule	outer layer of cell and protects the bacteria against host cell
Flagella/ Cilia	Flagella (tail-like)/ Cilia (hair-like); whip-like structure used for movement
Host Cell	a living cell in which the bacteria lives
Motility	move towards or away from stimulus
Toxin	made by microorganisms to promote infection, damage host cell or disable immune system
Virulence Factors	factors that enhance the ability of bacteria to cause disease
Plasmids	loop of DNA (genetic information) that can easily be shared to another cell.
Proteins	major functions within cells, allowing transport (in and out of the cell), receptor (to be recognized by immune system), and enzymes
Enzymes	helps a reaction (breaking things down, building a product, or helping move things) faster



Prefixes

1. Anti- against/opposed to
2. Bacteri- bacteria
3. Bio- life
4. Cardio- heart
5. Chem- chemicals
6. Hemato- blood
7. Immuno- immune system
8. Macro- large
9. Micro- small
10. Path- disease

Suffixes

1. -ase (enzymes)
2. -itis (inflammation)
3. -lysis (break apart)
4. -ology (study of)
5. -ologist (studies)
6. -ose (sugar)
7. -oxide (containing oxygen)

Examples:

1. Hydrolysis- splitting apart of water molecule
2. Carditis- heart inflammation
3. Amylase- enzyme breaking down carbs (sugar)

Name: _____

Period:_____

Peer-Review of "Killers"

Directions: Complete the following tables below. Be sure to calculate the total number. In virulence factor tables, check yes of no as to whether those factors are present. (Total of 6 points) In the creativity table, rate the factors on scale by circling the appropriate numbers. Provide feedback at the bottom of the page.

Killer 1: _____ **TOTAL**: _____

Virulence Factors Table

Factors	YES	NO
Does the killer enter the cell?		
Does the killer attach to the cell?		
Can the killer avoid the immune system?		
Can the killer make more of themselves?		
Does the killer have a toxin?		
Can the killer exit the cell?		

Creativity Scales

Name

5	4	3	2	1
Creative				Uninspired

Structural Drawing

5	4	3	2	1
Creative				Uninspired

Symptoms

5	4	3	2	1
Lethal				Non-lethal

Killer 2: _____ **TOTAL**: _____

Virulence Factors Table

Factors	YES	NO
Does the killer enter the cell?		
Does the killer attach to the cell?		
Can the killer avoid the immune system?		
Can the killer make more of themselves?		
Does the killer have a toxin?		
Can the killer exit the cell?		

Name: _____

Period:_____

Creativity Scales

Name

5	4	3	2	1
Creative				Uninspired

Structural Drawing

5	4	3	2	1
Creative				Uninspired

Symptoms

5	4	3	2	1
Lethal				Non-lethal

Killer 3: _____ **TOTAL**: _____

Virulence Factors Table

Factors	**YES**	**NO**
Does the killer enter the cell?		
Does the killer attach to the cell?		
Can the killer avoid the immune system?		
Can the killer make more of themselves?		
Does the killer have a toxin?		
Can the killer exit the cell?		

Creativity Scales

Name

5	4	3	2	1
Creative				Uninspired

Structural Drawing

5	4	3	2	1
Creative				Uninspired

Symptoms

5	4	3	2	1
Lethal				Non-lethal

Killer 4: _____ **TOTAL**: _____

Virulence Factors Table

Factors	**YES**	**NO**
Does the killer enter the cell?		
Does the killer attach to the cell?		
Can the killer avoid the immune system?		
Can the killer make more of		

Name: _____

Period: _____

themselves?		
Does the killer have a toxin?		
Can the killer exit the cell?		

Creativity Scales

Name

5	4	3	2	1
Creative				Uninspired

Structural Drawing

5	4	3	2	1
Creative				Uninspired

Symptoms

5	4	3	2	1
Lethal				Non-lethal

Killer 5: _____ **TOTAL**: _____

Virulence Factors Table

Factors	**YES**	**NO**
Does the killer enter the cell?		
Does the killer attach to the cell?		
Can the killer avoid the immune system?		
Can the killer make more of themselves?		
Does the killer have a toxin?		
Can the killer exit the cell?		

Creativity Scales

Name

5	4	3	2	1
Creative				Uninspired

Structural Drawing

5	4	3	2	1
Creative				Uninspired

Symptoms

5	4	3	2	1
Lethal				Non-lethal

Feedback:

Build me a Killer

Christina Mulhern

CATALySES 2019

Abstract

- Encourage students to utilize their scientific processing skills
  - Students will be expected to collaborate, infer, and experiment with original ideas
- Students will a model of a pathogenic prototype to include virulence factors to make a "killer."
- Through this activity, students will possess a better understanding of how to use the skills of scientific inquiry to come up with a plausible solution.

Rational

- Students will be incoming biology students
  - Regular students with various levels of achievement.
  - Introduction of scientific inquiry to
- Introduction to Inquiry-based activity to foster scientific thought at the beginning of the year.
  - allows for movement within the classroom
  - collaboration with peers
  - promotes problem solving skills
- Through this process, students will used something they vaguely know about and use newly introduced information on emerging pathogens and their various virulence factors.

Overview

- The students will be primed with an easy question :
  - “how do you get sick?”
- Followed with;
  - a brief lecture on virulence factors
  - TedED video about Antibiotic Resistance & Review Questions (3)
- Students will be able to utilize common prefixes and suffixes, which will become of use throughout the year.
- Through this activity, students will make their learning into their own hands by:
  - become more of a social
  - allowing for greater understanding
  - minimizing isolation
  - enabling greater participation in later activities.
- The students will use a rubric-based grading scale to assess the success of other groups emerging pathogens

Example from CATALySES 2019

Morgan$_{tm}$ & Chem Team