Food Safety: A Microbiology Lesson Plan

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1. Title: Using food safety as the approach and DVD video clips from the HHMI Confronting the Microbe Menace DVD to enhance lecture presentation on Microbiology.

2: Overview & Rationale: To try to present a Biology 1 Unit in a way that is more relevant (food-poisoning and bioterrorism) and engaging (frequent enhancements of DVD videoclips, animations) to high school students. Traditional presentation has been a scientific logical lecture approach; structure, classification, metabolism, reproduction, adaptation of the organism type followed by practical affects on humans; diseases, protections, treatments. This approach, teaching the traditional biology of virus' and bacteria in the context of foodborne illness, is relevant. The CDC estimates (1999) that there are annually 76,000,000 cases of food-related gastrointestinal illness, 325,000 hospitalizations and 5,000-9,000 deaths. It is all around us: Listeria in hot dogs stopping production of SaraLee meats for a year, 9 million pounds of hamburger destroyed due to Ecoli 0157:H7. Our food supply is a worrisome channel of bioterrorist attack; consider the deliberate contamination of salad bars in Oregon with Salmonella in an attempt to influence a political election.

3. Objective & Outcome:

The objective of the unit on microbiology is that at the end the students will have knowledge about virus' and bacteria structure, classification, metabolism, reproduction and adaptations which will be assessable on the end of unit exam(s). Another expected outcome is that students will understand and be able to apply themes and concepts regarding these organisms and the diseases, including treatments and prevention, caused by them.

4. Time Frame: Total of two to three weeks for the Microbiology Unit

5. Content Area:

See attached Unit Plan Sheet

6. Content of DVD Used:

See attached Unit Plan Sheet.

7. Correlation With Standards:

National Science Education Standards (grades9-12):

Unifying Concepts and Processes; organization, form & function
Science as Inquiry; epidemiologists detective work, Koch's Principles
Physical Science; graph interpetation

Life Science; the cell, evolution, interdependence of organisms, organization of living systems
Science & Technology;new molecular techniques in epidemiology, biowar
Science in Personal and Social Perspectives; epidemiology, exponential growth of bacteria, foodborne illnesses, HIV, bioterror
History and Nature of Science; historical smallpox,flu, antibiotics, vaccines

Massachusetts Curriculum Frameworks (Grade 10 assessment)

Inquiry
Design Investigation; make measurements, collect data
Analysis and Interpretation of Data; graph and come to conclusion

Life Science Domain
Characteristics of Organisms; structure/function
Heredity & Evolution; natural selection, bacterial plasmid transfer, antibiotic resistance in bacteria

Technology
Global transportation of people and products
Molecular Biology technology

Science, Technology, and Human Affairs
technological impacts on social, environmentaland polital events

Boston Science Standards (Grade 9,10)
Biology Topic is Organic Inheritance; how antibiotic resistance inherited.

8. Materials:

HHMI Holiday Lectures on Science December 1999, 2000 and Beyond; Confronting the Microbe Menace DVD
Science and Our Food Supply; Investigating Food Safety from Farm to Table Curriculum

9. Procedure:

See Unit Plan Sheet, with traditional syllabus and Food/DVD listing of topics to be covered.

10. Homework:

Appropriate questions to be selected from appropriate sections of whatever textbook is being utilized. Utilize all types of appropriate questions: review, multiple choice, critical thinking, etc.
Along with chapter questions, reports due on a weekly basis can be assigned, such as

A report/play/skit/poster on a specific topic, method described on the DVD, such as (the teacher should have sufficient copies of the DVD, the CD-ROM, and the VHS tape on the 1999 Holiday Lecture so that each student can have one to take home in the type of technology available to him/her at home.):

Bubonic Plague Lect.1 #4&5
Kaposi's Sarcome Lect.1 #21-31
Listeria Lect. 3 #34-37
Influenza Lect.4 # 12 &13
Rabbit Myxoma Lect.4 #27-30

A Report on a specific virus or bacteria which could be used as a weapon of bioterror, such as one of those listed on the attached sheet.

Each of the Lab Activities will require a Lab Report with Data, Graph(s), discussion, and a conclusion.

11. Assessment:

To assess the effectiveness of this approach, food science approach with DVD enhancement the best way would be to have two ninth grade (or tenth) Introductory Biology classes and use the traditional curriculum for one and the foodscience / DVD curriculum and then compare results on traditional exams for this unit.

12. Modification for Honors,Gifted/SPED:

The present educational fad followed by most involves heterogeneous grouping where each heterogeneous class is subdivided into learning group consists of a heterogeneous mix of a few honors students, many average students, and a few included SPED students. The teacher acts as coach directing each group in its performance of activities designed to allow group members to learn through the shared performance of the activity. In this environment modification for honors and SPED subgroups is not necessary.

To help SPED students learn the biological themes and concepts activities could be modified to make the abstractions more concrete by including more skits, demonstrations, models, simulations, drawings, etc.

To offer more opportumities to the honors/gifted students, further readings could be assigned, independent research activities could be developed, or they could prepare for and present a debate on a topic discussed in class.

13. Extension:

Extension of the classroom material could be offered in the form of voluntary extra credit. Some examples of Extra Credit opportunities could be:

Writing an report on one of the specific species of organism which causes human foodborne illness which was not discussed in class, such as: Norwalk Virus, Campylobacter jejuni, Clostridiun botulinum, Shigella sp., Staphylococcus aureus.

Writing a report on the ways foods can get contaminated by an infectious bacteria

Writing a report on how we can treat food to prevent it becoming contaminated with bacteria which may make us ill.

Writing a report on the danger of bioterrorism using virus' or bacteria in our food.

A play, skit, poster, or power-point presentation on any of the above topics would also be appropriate.

14. References/Resources:

HHMI Holiday Lectures on Science December 1999, 2000 and Beyond; Confronting the Microbe Menace DVD (also in VHS, CD-ROM) available at:
Howard Hughes Medical Institute
4000 Jones Bridge Road
Chevy Chase, MD 20815-6789
www.hhmi.org
www.holidaylectures.org

Science and our Food Supply; Investigating Food Safety from Farm to Table Curriculum consisting of:

Teachers Guide for Middle Level Science Classrooms
Teachers Guide for High School Science Classrooms
Food Safety AtoZ Reference Guide
Dr. X and the Quest for Food Safety Video (VHS), etc.

available from codevelopers:

Food and Drug Administration (FDA)
Center for Food Safety and Appplied Nutrition

Washington, DC
www.cfsan.fda.gov
www.foodsafety.gov/~fsg/teach.html

National Science Teachers Association (NSTA)
Arlington, VA
www.nsta.org

Date: **Name:**

1. Title: Hamburger Safe Cooking Temperature

2. Purpose: To determine the internal cooking temperature at which all microorganisms in a hamburger are killed.

3. Equipment & Materials: Frying pan, hamburger meat, spatula, digital thermometer, sterile petri dishes with general media and with coliform growth media. individually wrapped sterile cotton tipped swabs.

4. Procedure: make a series of hamburg patties about 2 inches in diameter and cook them in the frying pan.

When the hamburger interior reaches 100 degrees F break it open and hold a sterile cotton-tipped swab in the center for 5 seconds

Gently wipe the swab across the general media 10 times back & forth.

Turn the swab over and swipe 10 times the coliform specific media.

Repeat at 110 F, 120 F, 130 F, 140 F, 150 F, 160 F, and 170 F.

Incubate all labelled petri dishes (upside-down) at 37 degrees C.

In two (2) days count colonies, graph, and analyze your results.

5. Data:

Date: **Name:**

1. Title: Infection Spread Simulation

2. Purpose: To measure the rate at which an infection is spread through a community

3. Equipment & Materials: 0.1 Molar NaOH solution, weak Clear vinegar solution(1 capfull per liter), Dropper bottles of phenolphthalein indicator solution,
Each student needs a testtube half full of 'bodyfluid' prepared ahead by teacher.
and 6 plain microscope slides.

4. Procedure: Label a sheet of paper '0' to '5' and place a slide beside each number.
Acquire a 'body fluid' tube from the teacher and place a drop on slide # 0.
Exchange 'body fluids' with another student by placing a dropperful of your fluid in another students tube at the same time that (s)he places a dropperful in your tube. mix your tube and place a drop on slide # 1
Repeat this process with four (4) other students each time placing a drop on slide
When all are done test your slide drops for infection by adding a drop of indicator.
Do each numbered drop when your teacher says to recording how many in the class are infected (drop turns pink!!!) at each step. Graph the results.
If everyone in the class didn't get infected, would they all if continued longer?

5. Data:

Date: **Name:**

1. Title: Microbial Distribution in Boston Latin School (spore distribution by air)

2. Purpose: To determine the distribution of microbial spores within BLS

3. Equipment & Materials: Petri dishes with nutrient agar, marker pen, tape, watch

4. Procedure: Take a sterile petri dish containing nutrient agar
mark your name, date and room tested on the bottom of the dish
put two pieces of tape on opposite sides sealing the dish, one tape folded over on the end forming a tab which will allow you to open the petri dish
Open the dish on the desk in the assigned room. Leave it exposed for ten (10) minutes then seal it (never to open again) and return to incubator in 326.
Two days later record the number of bacterial colonies on the dish
Combine your data with all others. Analyze whole class data.

5. Data:
Room tested: _____; Colonies counted: _____

Introductory Biology

Microbiology Unit (Virus' & Bacteria)

Traditional Plan:	Modern Biology by Towle Pages:		Foodborne Illness Approach using HHMI Microbe Menace DVD	DVD Time: (See Track/Chap List)
Virus Structure	486-490	1	Microbes: Virus	7:52
Virus Replication	491-495	2	Microbes: Bacteria	4:32
Virus' and Disease	496-501	3	Disease(s): Foodborne(Ecoli,Salmonella)	27:12
HIV and AIDS Epidemic	Handout	4	Our Natural Protection	13:30
Bacteria Structure & Classif.	467-473	5	Epidemics	6:53
Biology if Bacteria	474-477	6	HIV	3:27
Bacteria & Disease; Koch	477-479	7	Evolution Resistance to Antibiotics	10:57
Bacteria and Human Disease	479-481	8	Biowarfare	1:03
Lab1 Bacteria around us	handout	9	Lab 1 Spread of Bacteria in Enviromental	Handout
Lab2: Microbe Distrib. in BLS	handout	10	Lab 2 Safe Cooking Temperature Hamburg	Handout
Lab3: Antibiotic Resistance	handout	11	Lab 3 Epidemic Simulation Contagion	Handout
Exam: Virus'		12	Exam: Virus'	
Exam: Bacteria		13	Exam: Bacteria	

Item#	Characteristic:	DVD:	LaserDisc	VHS:
1	Each Frame has a locator #	N	Y	N
2	Can go to area of contents quickly	Y	YY	NN
3	Equipment readily available in most schools	N	N	Y
4	Sound tracks that can go with each clip	8	2	1
5	Large Quantity of available products	NN	N	Y
6	Lot of teacher time required to create own lessons	YY	Y	Y
7	Cost per unit of product in this format	Hi	Hi	Lo
8	Number of formats currently available in this genre	5	1	1
9	Computer Software available to manage presentations	N	Y	N
10	Better for movie clips or stills	Movie	Both	movie
11	Pause gives clear picture of single frame	Y	Y	N
12	Can Slow Motion clearly	y	Y	N
13	hours of stored video per unit disc/tape with good clarity	2	1	2
14	Barcode control	Y	Y	N
15	Multi Angle Viewing	to 9 (if included)	N	N

HHMI Holiday Lectures on Science December 1999
2000 and Beyond; Confronting the Microbe Menace

DVD Chapter/# and Track/#

Topic	Chapter	Number		Track	Number	Clip Time:	
Microbes; Virus'							
Definition	1	10		2	10	1:20	
Size Deom	1	11		2	11	1:05	
How Infect Cell	1	12		2	12	0:58	
Animation Infect Cell	1	13		2	13	3:29	
Why virus' replicate way do	1	14		2	14	1:00	
							7:52
Microbes; Bacteria							
Demo; Size	2	5		5	5	1:03	
How Study Bact.	2	6		5	6	1:00	
Bacteria Everywhere	2	7		5	7	0:59	
Role Bact in the body	2	8		5	8	1:01	
Rate of bact reprod	2	10		5	10	0:29	
							4:32
Disease(s) General							
How know if microbe caused disease	1	16		2	16	1:35	
Genomic way find disease agent	1	19		2	19	1:09	
Classical way find disease agent	1	20		2	20	1:00	
Koch's Principles	1	27		2	27	2:00	
List leading deadly bact	2	13		5	13	0:56	
Susceptibility to disease	2	14		5	14	0:43	
Disease kills more than bullets	2	15		5	15	0:36	
bact cause many diseases	2	16		5	16	1:56	
Ulcers and other caused by bact	2	17		5	17	1:39	
Stud ? Flesh eating bact	2	46		5	46	0:53	
							12:27
Escherichia coli							
What is a pathogen	3	5		12	5	2:36	
E coli intro	3	6		12	6	0:35	
Types of E. coli, ex 0157:H7	3	7		12	7	1:11	
infection via grnd beef / vegs	3	8		12	8	1:34	
What does E. coli do	3	9		12	9	0:52	
virulence factors of E. coli	3	10		12	10	1:09	
pilus attaches to host	3	11		12	11	0:28	
Animation, pilus attachment	3	12		12	12	0:43	
Demo:virulence factor injected	3	13		12	13	2:01	
Toxins as virulence factors	3	21		12	21	1:19	
Evolution pathogenic E. coli	3	22		12	22	2:10	

							14:38
Salmonella							
Intro	3	24		12	24	2:07	
Microscopic view	3	25		12	25	0:46	
Virulence factors	3	26		12	26	1:00	
Demo: invasion of Salmonella	3	27		12	27	1:22	
Video: live Salmonella enters cell	3	28		12	28	0:43	
Animation: Salmonella enter cell	3	29		12	29	0:30	
Needs to survive in cell	3	30		12	30	1:48	
Animation: Salmonella in cell	3	31		12	31	1:02	
Strategies for survival in cells	3	32		12	32	0:49	
							10:07
Our Natural Protection							
How we fight bact.	2	20		5	20	0:37	
Antibiotics; penicillin structure	2	21		5	21	0:51	
origin antibiotics	2	22		5	22	1:08	
Antibiotic mode of action	2	23		5	23	0:30	
Culture plate shows antibiotic action	2	24		5	24	0:24	
Video; penicillin killing E. coli	2	25		5	25	0:42	
Antibiotics increase life span	2	26		5	26	0:49	
Vaccines; basic facts	2	34		5	34	2:04	
Should everyone be vaccinated	2	35		5	35	0:43	
List available vaccines	2	36		5	36	1:05	
How develop vaccines	2	37		5	37	1:35	
Potential therapies against bact.	3	23		12	23	1:36	
Stud? Jungles as source antibiotics	3	46		12	46	1:26	
							13:30
Epidemics							
Bubonic Plague	1	4		2	4	0:30	
Historical acct Bubonic	1	5		2	5	1:20	
job of epidemiologist	1	18		2	18	0:25	
How epidemics arise	4	4		20	4	0:59	
New disease development	4	5		20	5	1:40	
genetic changes in virus'	4	6		20	6	0:49	
What forces shape future epidemics	4	31		20	31	1:10	
							6:53
HIV / AIDS							
Descr. HIV and AIDS	1	7		2	7	1:52	
HIV in Karposi's Sarcoma	1	22		2	22	1:35	
							3:27
Evolution Antibiotic Resistance							
Stud? Evolutionary advantage latency	1	33		2	33	1:01	
STUD? What activates a latent virus	1	34		2	34	0:59	
Bact. can develop antibiotic resistance	2	27		5	27	0:35	
How develop antibiotic resistance	2	28		5	28	1:41	
Superbugs	2	29		5	29	2:13	
Bact. can share resistance	2	30		5	30	0:58	

Animation: Conjugation	2	31		5	31	0:34	
Stud? How do resistances initially dvlp	2	47		5	47	1:19	
Stud? Can we use antibiotics years later	2	49		5	49	0:45	
Stud? Modify antibiotics overcome resist	2	50		5	50	0:52	
							10:57
Biowarfare							
Stud? how deal with biowarfare?	2	45		5	45	1:03	
							1:03

Total DVD Time: **84:23**

Biology 1 assignment **Student Name:**_____

Bioterrorism Agents

Agent:_____

Type of Agent:_____ Incubation Period:_____

Infective Dose:_____ Duration of Illness:_____

Method of Distribution:_____ How Enter the Body:_____

Molecular Weight of Agent:_____ Source of Agent:_____

Transmissable person to person:_____ Persistence in the Environment:_____

Volatility:_____ Solubility in Water:_____

Chemo-Prophylaxis:_____

Chemical Formula of Agent:

Toxic Effect at the Cellular / Molecular Level:

Symptoms:

Lethality (approximate fatality rate):_____

Vaccine Efficacy:_____

Treatment:

Historical Use:

Other: