INFECTIOUS DISEASE LECTURES: NATIONAL STANDARDS CORRELATIONS

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Explanation of the individual lecture guide format and notation

1. "Unit/Subject Areas" are in correlation with a general Biology course outline.
2. "National Standards Alignments" are based on the "Content Standards: 9-12" of the National Science Education Standards, 1996, published by National Academy Press, Washington, D.C., ISBN 0-309-05326-9. Standards are identified according to the following notations:

Content Standard A: "As a result of activities in grades 9-12, all students should develop

1) Abilities necessary to do scientific inquiry
2) Understandings about scientific inquiry"

Content Standard C: "As a result of their activities in grades 9-12, all students should develop an understanding of

1) The cell
2) Molecular basis of heredity
3) Biological evolution
4) Interdependence of organisms
5) Matter, energy, and organization in living systems
6) Behavior of organisms"

Content Standard E: "As a result of activities in grades 9-12, all students should develop

1) Abilities of technological design
2) Understandings about science and technology"

Content Standard F: "As a result of activities in grades 9-12, all students should develop understanding of

1) Personal and community health
2) Population growth
3) Natural resources
4) Environmental quality
5) Natural and human-induced hazards

6) Science and technology in local, national, and global challenges”

Content Standard G: “As a result of activities in grades 9-12, all students should develop understanding of

1) Science as a human endeavor
2) Nature of scientific knowledge
3) Historic perspectives”

(The numbers have been added for specific identification.)

Curricular Connections

Lecture 1:

1. Biography of Dr. Ganem is useful to show students the "human" side of scientific research, and the collaborative aspect of doing research.
2. Aspects of the lecture explore experimental design/nature of scientific research: epidemics, genomic methods, Koch's Postulates.
3. Epidemiology, as an area of study, as well as public health issues, is addressed.
4. Epidemics as part of the human condition and the evolution of disease causing agents are discussed.
5. Molecular aspects of host/infective agent: cell receptors, replication, viral lytic and lysogenic cycle.

Lecture 2:

1. Biography of Dr. Finlay. See # 1 above.
2. Measurement in science (size proportion).
3. Ecological roles/niche aspects of bacteria. Limiting factors in population growth.
4. Evolution of antibiotic resistant strains of bacteria. Selection forces in environment.
5. Analyzing data- processes in science (antibiotic resistance)
6. Technical advancements in molecular biology.

Lecture 3:

1. Biography of Dr. Finlay: Careers in biology/research.
2. Adaptations and immune system response (What is a pathogen?).
3. Cell Biology: good animation of cell membrane modifications by bacterial proteins/role of proteins.
4. Immunology: antibiotics, vaccines, and immune system response.
5. Molecular aspects of evolution: Gene acquisition in bacteria.

Lecture 4:

1. Biography of Dr. Ganem: Careers in biology/research.
2. DNA, mutation rate and evolution. (How epidemics arise)
3. Ecological changes lead to emergence of disease.
4. Replication and translation.
5. Epidemics and pandemics: genetic aspects of drift vs. shift.
6. Ecological aspects of epidemics and pandemics (interspecies exchange),
7. Ecological aspects of epidemics- how changes in environment can cause emergence of disease (Hantavirus).
8. Experimental design and analysis (rabbit experiment in Australia).
9. Coevolution/symbiosis of pathogen and host.

INFECTIOUS DISEASES 2000 AND BEYOND

Lecture 1: Microbe Hunters: Tracking Infectious Diseases

Chapter	Unit/Subject Area	National Standards Alignment
1		
2		
3	Careers; Process of Science	A1, A2, E2, F1, F6, G1, G2
4	Disease Discovery; Diversity & Taxonomy	A1, A2, C4, E2, F1, F5, F6, G3
5	History of Plague; Infectious Agents; Diversity & Taxonomy	C4, G2, G3
6	Process of Science; Historical Advances	A2, G1, G3
7	AIDS symptoms	F1, F5
8	Process of Science; Understanding epidemics	A2, G3, F6,
9	Chart of bacterial, fungal, viral parasites; Agents of disease	C1, C5, F5
10	Description of virus structure	C5
11	Size comparison of microbes (demo)	C5
12/13	Viral infection mechanism; Cell membrane receptor function (video animation)	C1, C6, F5
14	Evolution of viral replication	C3
15/16	Evidence of infectious agents (diagram); Process of Science	A2, E1, E2, F5, G1, G2
17	HIV epidemiology (diagram); Process of Science	C4, F1, G1
18	Job of epidemiologist/careers (diagram)	A1, G1,
19	Process of Science	
20	Molecular methods; Process of Science	A2, C5, E2
21	Molecular subtraction/experimental design; DNA, RNA manipulation	A2, C2
22	Kaposi's sarcoma	A1, E2, F6
23	Epidemiology of K.S.; Ecological role/niche	C4, F1, F5
24	Molecular subtraction; Process of Science	A2, C2
25	Lytic vs. Lysogenic infection (Herpes; diagram)	C2, C4, C5, C6
26		
27	Koch's postulates; Process of Science (diagram)	A2, E2, G2, G3
28	Tracking KSHV; Process of Science (diagram)	F1
29/30	Kaposi's sarcoma; epidemiology of KSHV; Ecological niche; Cellular interaction	C1, C4, F1, F5
31	Future studies	A2, E2, F6, G2
32-38	Student Questions	

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Lecture 2: The Microbes Strike Back

Chapter	Unit/Subject Area	National Standards Alignment
1		
2		
3	Careers, Process of Science	A2, G3
4	Introduction to lecture	
5	Size analogy, Cell structure	C1, C4
6	Differentiation of bacteria by Gram stain	C1
7	Bacteria diversity	C4
8	Role of bacteria	C4
9	Gram stain of cheek cell (demo)	C1
10/11	Bacterial reproduction/ binary fission (video)	C1, C6
12	Mortality rate & loss of productivity estimate (diagram)	F1, F5
13	% illness occurrence (diagram)	F6
14	Aspects of susceptibility	F1
15	Comparison of mortality: bacteria infections vs. war	F5
16	Bacterial diseases (chart)	F5
17	Ulcers and Helicobacter pylori, discovery/diversity	A2, C4, F6, G1, G2
18	Bacterial transmission (chart)	F1
19	Aerial transmittance (audience demo)	F1
20	Methods of fighting bacteria: antibiotics & vaccines (chart)	C5
21	Antibiotic explanation	C1, C5
22	History of antibiotics	A2, C4, C5, G6
23	Mechanism of antibiotic action (diagram)	C1, C5
24	Zone of inhibition- *E.coli* plate	A2
25	Penicillin action on *E.coli* in vitro (video)	A2, C1
26	Life expectancy increase correlates with antibiotic use	F1, F6
27	Antibiotic resistance and evolution	C3
28	Reasons for antibiotic resistance (chart)	C4, F1, F5
29	"Super bugs" (diagram)	
30/31	Bacterial conjugation (animation) and resistance	C2, C3
32	"Shelf life of antibiotics" (slide)	A2
33	Use of antibiotics	
34	Vaccines- background and public health issues	A2, F1
35	Ethical aspects of vaccination programs	F1, F5
36	Vaccinations available- current and historical	E2, G1, G3
37	Vaccine development	A2
38	Use of genomics (gene expression, bioinformatics, HGP) and vaccines	A2, C2, E2, F6
39	Bioinformatics, careers	A2, E2, G1, G2
40	Humans and bacteria, ecology/evolution	C3, C4
41-47	Student questions	

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Lecture 3: Outwitting Bacteria's Wiley Ways

Chapter	Unit/Subject Area	National Standards Alignment
1		
2		
3	Career aspects, personal biography	A2, F6, G1
4	Bacteria	C1
5	Pathogens	C1, C3, C4
6	Bacteria diversity	C3, C4
7	*E.coli* types	
8	Source of infection	F1, F5
9	How disease can spread	C4, F5
10	Virulence factors (v.f.) (chart)	C3, C5
11/12	Structure of Pilus, attachment to host (*E.coli*) (animation)	C1, C4
13	Injection of v.f. (student demo)	C1
14/15/16	Cell/molecular aspects of v.f.	C1, C5
17/18	Bacterial adherence, tyrosine phosphorylation (animation)	C1, C2, C5
19	Pedestal formation by *E.coli* (animation)	C1, C4, C5
20	Types of studies to confirm Pedestal formation needed to cause disease	A2, E3, G2
21	Toxins as virulence factors	C1, C5
22	Evolution of pathogenic *E.coli*, , molecular aspects	C2, C3
23	Strategies for fighting bacteria, antibiotic resistance	C2, C3, F5
24	*Salmonella* spp.	C3, F5
25	Microscopy of *Salmonella* (live culture)	E2
26	Virulence factors for *Salmonella*	C1, C4
27	*Salmonella* invasion (student demo with jello)	
28	*Salmonella* invasion (videoclip)	
29	*Salmonella* invasion (animation)	
30/31	Strategies by Salmonella to evade host detection (spec. lysosomal) (animation)	C1, C3
32	3 pathways for adaptation to pathogen survival in host cell	C3
33	*Listeria* intercellular invasion and evasion of host's detection (diagram)	C1, C3
34	*Listeria* invasion (student demo)	C1
35	Mechanism of *Listeria* infection (diagram)	
36	*Listeria* moving in host (videoclip)	E2
37	Virulence factor modulation/regulation	C5
38	Future of infectious bacterial diseases	A2, F6, G2
39-44	Student questions	

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Lecture 4: Emerging Infections: How Epidemics Arise

Chapter	Unit/Subject Area	National Standards Alignment
1		
2		
3	Careers/Biography	A2, G1
4	Where do epidemics emerge?	F4
5	Disruption of ecological equilibrium	C3, C4, C6, F5
6	Genomic changes in virus/mutation/recombination	C2, C3
7/8	Mutation rate in Retroviruses vs. other (chart)	C2
9/10	Proofreading in DNA as preventative to mutations	C2
11	Increase of mutation rate correlates with increase in drug-resistant variants	C2, C3, F1
12	Influenza virus, envelope proteins (diagram)	C5
13	Genome of influenza virus	C2
14/15	Antigenic drift and epidemic (annual)/ pandemic (10-40 year), immunology	C2, C3, C6, F1
16	Genetic aspects of drift/ point mutations	C2
17	Antigenic hemaglutinin types (diagram)	C5
18	Antigenic hemaglutinin types related to pandemic	C4
19	Origin of H3 via migratory fowl	C6
20/21	Recombination of viral genome, aspects of interspecific viral transfer (animation, diagram)	C2, C3, C4, C6
22	Genetically unaltered virus (Hantavirus) causes epidemic by ecological disturbance	C6
23	Pathway of ecological changes that lead to epidemic	C5, F1
24	Human migration patterns lead to smallpox epidemics	C6, F1, F5, G3
25	Evolutionary aspects of smallpox in humans	C3
26/27	Myxoma virus in rabbits, experiment illustrates selective force of host's immune system	A2, C3,
28	Evolution of less virulent strains of myxoma virus (data chart)	A2, C3, C4
29/30	Genetic basis for selection (chart)	C2, C3, C4
31/32/33	Forces that could shape future epidemics, reemergence of Dengue fever in U.S., coevolution, (chart)	C3, C4, F1, F5, G1, G2
34-38	Student questions	