SEMESTER AT SEA COURSE SYLLABUS

Spring 2014
Discipline: Biology
BIOL 1559-102: Infectious Disease in Humans
Division: Lower
Faculty Name: Iain M. Campbell

Pre-requisites: A two-term high-school course that covered basic cell biology and human anatomy/physiology; one term of high-school chemistry that included basic atomic theory.

COURSE DESCRIPTION

Prior to the discovery of the 'sulpha' drugs, penicillin and streptomycin in the first half of the 20th century, infectious diseases regularly killed huge numbers of human beings. Epidemics of bubonic plague, consumption, dysentery, influenza, and typhoid fever swept across Europe and Asia. In the last seventy years improved public health and the availability of anti-pathogenic drugs have greatly reduced this loss of human life. Poor husbandry of our arsenal of antibiotics, however, has resulted in the development of massive and wide-spread pathogen resistance. Humankind thus now faces a return to the pre-1940 state-of-affairs; humanity is again at risk.

In this course we will look at the microbiology, etiology, management, and social impact of six infectious diseases (influenza, HIV/AIDS, cholera, tuberculosis, malaria and the tineas). Necessary biological background will be provided where appropriate, e.g. the anatomy/physiology of the human respiratory, digestive, circulatory, integumentary and immunological systems. We will also look at antibiotic discovery and mode-of-action, and explore why bacterial resistance to antibiotics arose so rapidly. Around Ghana, we will find time to discuss yellow fever and schistosomiasis.

COURSE OBJECTIVES

1. To make students aware that infectious disease has been, and will continue to be, a major threat to the life of humankind;
2. To appraise students of the form of the major human infectious pathogens: viruses, bacteria, fungi and protozoa, and to provide them the basic biology of these types of entities;
3. To review with students the anatomy and physiology of the human respiratory, circulatory, digestive, integumentary, lymphatic and immune systems;
4. To inform students about the etiology, signs/symptoms, management and prevention of influenza, HIV/AIDS, cholera, tuberculosis, malaria and the tineas;
5. In somewhat lesser detail, to cover yellow fever and schistosomiasis;
6. To illustrate how drugs control pathogen growth and to describe how pathogens can become drug-resistant.
7. To review for students the historical, logistical and ethical implications of managing major pandemic infectious disease.

REQUIRED TEXTBOOKS

AUTHOR: Steve Parker.
TITLE: The Human Body.
PUBLISHER: DK Publishing, London.
ISBN #: 1465402136
DATE/EDITION: 2013.

COST: US$ 40 (US$ 22.13 and less from Amazon.com).

Note: I will also supply at the course's beginning, copies of my *LectureNotes* (full-text, not *PowerPoint* summaries) for sale ($9.00) on the ship. This practice has proved an enormous success in five previous voyages.

TOPICAL OUTLINE OF COURSE

A1.	U*	Jan. 12	Introduction to the course and the Lab. programme. Review of basic biochemistry; the 'biochemical quartet'.
A2.	T	Jan. 14	Basic cell biology (prokaryote/eukaryote distinction; sub-cellular structure, etc.). An overview of basic evolutionary theory.
A3.	H*	Jan. 16	Types of human disease — infectious/functional. Definition of basic disease vocabulary. Types of human pathogen. The signs/symptoms distinction.
			Hawaii
A4.	U*	Jan. 19	Methods of infectious disease transmission. Basic molecular biology; information flow in cells from nucleic acid to protein to effect. Basic virology.
A5.	W	Jan. 22	The human non-specific defense system and its operation. The human respiratory system. Influenza from the patient's perspective.
A6.	S	Jan. 25	The influenza virus and how it makes you sick. Antigenic shift and drift. Antiviral drug Therapy.
A7.	M	Jan. 27	1st class test.
			Japan
A8.	T	Feb. 4	Operation of the human immune system. Vaccines. Specific methods for managing a 'flu epidemic. A quick look at yellow fever.
			China
A9.	W	Feb. 12	Structure and function of the human circulatory and lymphatic systems. Blood pressure/EKG traces and what they mean.
			Vietnam
A10.	H*	Feb. 20	The humoural and cellular immune systems. HIV/AIDS signs and symptoms.
			Singapore
A11.	M	Feb. 24	How the HIV/AIDS virus makes one sick. HIV/AIDS prevention. HIV/AIDS in South Africa.
			Myanmar
A12.	W	Mar. 5	Structure and function of the human digestive system.
A13.	F	Mar. 7	Basic bacteriology. Koch's Postulates. How the cholera vibrio makes one sick. Cholera management. Prevention of Traveller's Diarrhea.
			India
A14.	S	Mar. 15	John Snow, cholera and the beginning of the discipline of epidemiology. Public Health and the WHO/CDC.
A15.	T	Mar. 18	Tuberculosis: history, etiology and management. The sanatorium story. The discovery of streptomycin, the 'second great antibiotic'.
A16.	H*	Mar. 20	2nd class test.
			Mauritius
A17.	S	Mar. 23	PBS' DVD *The People's Plague* — part II. Of DOTS and Mantaux tests.

A18.	W	Mar. 26	The biology of protozoa. Liver function in the human. Cell division in eukaryotes.
			South Africa
A19.	H*	Apr. 3	The life cycle of mosquitoes. Malaria: types, etiology.
A20.	S	Apr. 5	Malaria: management, and prophylaxis. The Panama Canal story
A21.	T	Apr. 8	A quick look at yellow fever and schistosomiasis
			Ghana
A22.	T	Apr. 15	The structure and function of human skin. Basic mycology. Dermatophytes and the tineas.
A23	H*	Apr. 17	How drugs are found. How drugs control pathogens — the penicillin story.
A24	U*	Apr. 20	The origin of drug resistance in pathogens. The tension between the drug needs of humanity and animal husbandry.
			Morocco
A25	M	Apr. 28	3rd and final class test.

* Note: 'H' = Thursday; 'U' = Sunday.

Additionally, a set of 10-15 *QuizQuestions* will be posted on the Ship's internal website each class day. These questions will focus on the material covered that day in class and will provide students a simple 'active' mechanism of self-assessing their mastery of the day's material. I have used such *QuizQestions* in all my undergraduate teaching for the last four decades, with great effect according to student evaluations. I will not post answers to *QuizQuestions* –s the answers are readily obtained from the *LectureNotes*/PowerPoint lecture slides (available on the ship's intranet). However, I will make myself available in the Ship's Union for 30+ minutes every other early evening while we are at sea, to help students with any *QuizQuestion* with which they have difficulty. I will also encourage students to use *QuizQuestions* in small group review of material for tests.

FIELD ASSIGNMENTS/LABS

The class will visit the Tygerberg Children's Hospital, home of the 'HOPE Cape Town' Association. 'HOPE Cape Town' is a nonprofit organization that offers community outreach, education and counseling focusing on HIV/AIDS and TB in the Western Cape Province of South Africa. Tygerberg Children's Hospital provides specialty pediatric care for infants with HIV/AIDS, TB and various cancers. Tygerberg Hospital serves predominantly the township population of Cape Town. The visit will feature a presentation by one of the staff. Through this experience participants will gain insight into the incidence and management of HIV/AIDS and TB in South Africa and the implications of these two diseases on township families and society.

We will have lunch in the Langa Township to allow students to appreciate more fully what township life in the RSA is about. Local musicians will play during lunch and thereafter they will answer student's questions about township health care.

In the afternoon, we will visit the Groote Schuur Hospital. This hospital serves predominantly the 'white' community of Cape Town and its comparison with Tygerburg is telling. It was in this hospital that Dr. Christiaan Bernhard performed the world's first human-to-human heart transplant. A section of this hospital has been set aside as a museum. We will see the surgical theatres wherein the trial procedures were accomplished first on dogs, then on humans. Most of the original equipment has been recovered and life-sized wax models of surgical staff and patients lend immediacy to each exhibit. There are several excellent models of the human

circulatory system, together with dissections of healthy and diseased human hearts. There is also coverage of Bernhardt's life and his motivation to perform the world's first successful cardiac transplant, so putting South African (Afrikaner) medicine in the front line of international medicine.

Following these two disparate encounters, students will prepare an approximately 1000-word report on health care delivery issues in the RSA.

METHODS OF EVALUATION

There will be three class tests in the course. Each test will be a mix of multiple choice, true/false and short essay questions and each will contribute 27.3% to the student's final score. The 3rd test, although given in the 'final period' will not be cumulative. The report described above will contribute 18% to the student's final score. Final grades will be computed according to the following protocol:

Calculating the class mean for the composite of all three tests and two papers, scaling the composite mean to be 75%, and assigning grades from the following table:

A+	(4.0 quality points)	100 - 97.6%
A	(4.0 quality points)	97.5 - 92.6%
A-	(3.75 quality points)	92.5 - 90.0%
B+	(3.25 quality points)	89.9 - 87.6%
B	(3.0 quality points)	87.5 - 82.6%
B-	(2.75 quality points)	82.5 - 80.0%
C+	(2.25 quality points)	79.5 - 77.6%
C	(2.0 quality points)	72.6 - 77.5% (class mean)
C-	(1.75 quality points)	72.5 - 70.0%
D+	(1.25 quality points)	69.9 - 67.6%
D	(1.0 quality points)	67.5 - 62.6%
D-	(0.75 quality points)	62.5 - 60.0%
F	(0.0 quality points)	59.9% and below.

RESERVE LIBRARY LIST

AUTHOR: Steven Johnson
TITLE: *The Ghost Map.*
PUBLISHER: Penguin Publishing
ISBN #: ISBN-1-59448-925-4
DATE/EDITION: 2006
COST: US$ 17.99 at Amazon.com.

I will also bring three DVDs with me to the ship: the movie *Outbreak*, and the two-part PBS documentary: *Tuberculosis: The People's Plague*. These will run on the ship's continuous loop TV system.

ELECTRONIC COURSE MATERIALS
None.

ADDITIONAL RESOURCES
None

Honour Code Statement:

On Semester at Sea the University of Virginia's honour code prohibits all acts of lying, cheating, and stealing in an academic context. Please consult the Voyager's Handbook for further explanation of what constitutes an honor offense.

As an affirmation of commitment to this community of trust, each written assignment for this course must be pledged by the student as follows: "On my honor as a student, I pledge that I have neither given nor received aid on this assignment." The pledge must be signed, or, in the case of an electronic file, signed".