

Global Biosecurity Course Syllabus and Schedule

Course rubric: MCB 436 (1 credit hour, CRN#60483)

Course Director: Dr. Brenda A. Wilson, Professor of Microbiology, B209 Chemical & Life Sciences Laboratory, email: wilson7@illinois.edu, URL: <http://mcb.illinois.edu/faculty/profile/wilson7>

Office hours: By appointment via Zoom or in person – setup via email request

Course TA: Pallob Barai (pbarai2@illinois.edu), a graduate student in Cell & Developmental Biology, will be assisting with grading and course logistics and will be available for office hours on **TBA** at the MCB Learning Center (101 Burrill Hall), or via Zoom by appointment – setup via email request.

Class Time and Location: Mondays at 4:00 pm, 213 Gregory Hall

Course Description:

Seminar-based course designed to provide students with broad coverage of key areas of scientific, legal, social, ethical, and political aspects of biosecurity, emphasizing current problems and research in the areas of biodefense, emerging infectious diseases, synthetic biology, global health, food security and other topics. Through a combination of related reading assignments, quizzes and activities, individual and team-based assignments, and weekly special topics seminars, students will learn to integrate knowledge of modern biomedical research, advances in biotechnology, and natural and manmade biological threats and how they relate to global biosecurity. Students will gain the skills to seek out and analyze information related to biosecurity and then develop and communicate public policies, engagement and strategies for enhancing global biosecurity.

Course Schedule:

Aug 21 – Lecture 1: Brenda Wilson – first day of class, course logistics and “Introduction to Global Biosecurity”

Aug 28 – Lecture 2: Brenda Wilson – “Global Biosecurity in a Complex, Dynamic World”

Sept 4 – Labor Day - no class

Sept 11 – Lecture 3: Brenda Wilson – “Global Biosecurity and Science Literacy and Making Informed Decisions”

Sept 18 – Lecture 4: Collin Kieffer – “Viruses and Vaccines”

Sept 25 – Lecture 5: Will Sander – “Surveillance and the Risk to Biosecurity”

Oct 2 – Lecture 6: Gay Miller – “Keeping the United States Biosecure from Foreign Animal Diseases”

Oct 9 – Lecture 7: Carl Gunter – “Genome Security”

Oct 16 – Lecture 8: Holly Rosencranz – “Health Impact of Climate Change through a Biosecurity Lens”

Oct 23 – Lecture 9: Steven Blanke – “Synthetic Biology: The Promise and Perils of Reprogramming Biology within the Sandbox of Life”

Oct 30 – Lecture 10: Brenda Wilson – “Genetically Modified Organisms (GMOs) – Impact on Food Security”

Nov 6 – Lecture 11: James Slauch – “Food Safety and Biosecurity”

Nov 13 – Lecture 12: Brenda Wilson – “Food Safety: The Case for Food Irradiation – Science Meets Law”

Nov 20 – Thanksgiving break - no class

Nov 27 – Lecture 13: Brenda Wilson – “Global Biosecurity and the Antibiotic Resistance Crisis”

Dec 4 – Lecture 14: Margarita Teran-Garcia – “Global Biosecurity and Social Determinants of Health and Health Equity”

Dec 14 (Thursday) – Final – all assignments and papers due by 10:00 pm (hard cutoff!)

Course Learning Objectives:

After taking this course, students will be able to:

1. Describe the components of scientific literacy and the process of scientific inquiry.
2. Summarize and explain complex scientific information.
3. Apply simple predictive models to biology-related phenomena in the context of biosecurity.
4. Demonstrate how paradigms of biosecurity relate to society and policy and their own lives.
5. Critically evaluate science-related news and information for their credibility and validity.
6. Apply critical thinking and reasoning skills to solve problems related to biosecurity.
7. Synthesize a general working knowledge of fundamental biological concepts relevant to biosecurity.
8. Recognize that biosecurity is a dynamic, collaborative, and inter-disciplinary field.

Grading

500 points total

300 pts – Lecture-specific Assignments – 14 class periods

- 240 pts – 20 pts for each lecture-specific activity or assignment (top 12 scores are used)
- 60 pts – 5 pts for each in-class iClicker or other activity (top 12 scores are used)

80 pts – Midterm Project: 4-member team assignment #1– travel advisory poster

- 20 pts – Part A – 2-page travel advisory executive summary – graded by TA and instructor
- 20 pts – Part B – team-designed travel advisory poster – graded by TA and instructor
- 40 pts – Part C – peer-evaluation of executive summary and poster
 - 15 pts – score based on evaluations from other students
 - 15 pts – score based on your evaluation of other teams' travel advisories
 - 10 pts for self-evaluation of team

120 pts – Final Project: 4-member team assignment #2 – public service announcement ad proposal

- 25 pts – Part A – 2-page executive summary of the PSA pitch – graded by TA and instructor
- 25 pts – Part B – team-designed PSA media presentation – graded by TA and instructor
- 70 pts – Part C – peer-evaluation of executive summary and PSA
 - 30 pts – score based on evaluations from other students
 - 30 pts – scored based on your evaluation of other teams' PSAs
 - 10 pts for self-evaluation of team

Grade Cutoffs: (out of 500 total points)

A+ – 495	C – 325
A – 475	C- – 300
A- – 450	D+ – 275
B+ – 425	D – 250
B – 400	D- – 225
B- – 375	F – <225
C+ – 350	

Overview of Course Assignments:

Each class will meet for ~1 hour, once a week on Mondays at 4:00 pm.

NOTE: This course is designed to have in-class discussions and in-person group interactions. Participation in these in-class exchanges and team-based activities and projects is an important component of the learning experience in the course (see Learning Objectives listed above).

Some lectures (depending on the lecturer) will be prerecorded or have prerecorded components, and students will be expected to view them ahead of time and participate in the talking-point discussions during the in-person class session on Mondays at 4:00 pm. All students are expected to attend and participate in the lecture-specific activities. The TA and I will be moderating the sessions.

For each lecture, one or a few key papers that are relevant to the material covered in the corresponding lecture will be assigned (citations will be posted on the course website). Downloadable pdf copies of the lecture notes will be available for each of the lectures on the course website (*Note: these materials are for your educational benefit and are not for sale, transfer, or public posting of any kind*). All students in the class are expected to have read the assigned reading before the class for full benefit of the lecture content. Each student should come to class prepared to ask questions, discuss the topics covered by each speaker, and respond to questions posed in class.

In-class iClicker Quizzes (Individual through iClicker Mobile App):

For each lecture, students are expected to use their iClicker mobile apps to respond to in-class questions (5 pts total each lecture) that will be posted in class. Depending on the instructor, questions will be in the form of a quiz based on the lecture material or an opinion poll. Responding to questions is mandatory for full credit, partial credit is given for quizzes if there is a response even if not correct. Register and download the app onto your mobile phone or laptop – instructions are posted under the tab on the Moodle site. You can register directly by going through this link: <https://join.iclicker.com/ZEBR>

Lecture-specific Activities or Assignments:

For each lecture, there will be a lecture-specific online quiz, activity worksheet, or assignment that is associated with the lecture material (20 pts total each lecture). All quizzes, assignments, and expectations for each lecture will be posted online in the Moodle site under the associated tab for each lecture. Students will have at least 1 week to complete these assignments, which will be due by 4:00 pm on the next scheduled lecture day.

4-Membered Team Project Assignments (Assignment #1 Midterm and Assignment #2 Final):

There will be two 4-membered team projects for the mid-term Assignment #1 and the final Assignment #2 – there is no final exam, but this will serve as your final project. This team grouping will be chosen based on which pathogen/disease each person would like to work on – the list of choices is provided under the assignment instructions in the syllabus and under the Assignments tab on the Moodle site – **NOTE: your group number should match your pathogen/disease number.** It is expected that all members of the team will work with each other to complete both projects. Failure to work professionally with your team will impact your grade.

Academic Integrity:

As UIUC students, everyone in this course is expected to be completely familiar with the [UIUC Student Code, Article 1. Part 4. Academic Integrity \(sections 401-406\)](#). Cheating will NOT be tolerated in this course. Any student found cheating could face receiving a failing "F" grade for the course and recommendation for suspension or dismissal from the University.

Extra Credit Opportunities – Biosecurity-related Seminars:

10 points maximum

To encourage students to broaden their scope of knowledge in issues of biosecurity and to enhance students' learning experience by gaining a "flavor" of relevant current research topics and trends, I will allow students to earn extra credit toward their *individual* final grade: up to 2 points for every clear biosecurity-related 1-hour seminar or up to 1 point for any biology-related 1-hour seminar that could have a connection (you will need to justify this) with a biosecurity issue (sorry, other types of seminars will *NOT* count) that they attend during the course of the semester.

RULES to receive full credit: The seminar must be a full-length (~1-hr) seminar given by a professor; only half-credit will be given for 30-min seminars. Student seminars do *NOT* count! For Zoom talks or seminars, you must provide the URL. In order to earn credit for a particular seminar, you must submit by the last day of classes (**5:00 pm on December 6, 2023**) a 600-word, type-written summary of that seminar, including the title of the seminar, the speaker's name and affiliation with URL to their website, the date, time and location of the seminar, the main points communicated in the seminar, and *IMPORTANTLY* ~150 words about any connections to topics covered in our class, pointing out how the seminar topic connects to biosecurity and including what the impact the seminar topic has with regard to biosecurity.

In some cases, you may find the material covered difficult to understand. In such cases, it may be necessary for you to look up information that was not clear during the seminar (perhaps by reading some recent papers by the speaker). This is acceptable, so long as you provide a citation of the sources you used to write the summary.

Submit your summaries in order of date of seminar attended.

Maximum number of submissions = 5

DRES Accommodations:

If you require special accommodations, please contact Disability Resources and Educational Services (DRES) as soon as possible at [disability@illinois](mailto:disability@illinois.edu) or call 217.333.4603.

Please email your current DRES letter to me (wilson7@illinois.edu) within the first 10 days of classes.

We are committed to providing a learning environment where our students can succeed. We will try to meet your accommodation needs once the process has started. Note that accommodations are not retroactive to the beginning of the semester but begin the day you contact your professor with a current letter of accommodation from DRES.

Please note that since students have at least 1 week (often more) to complete each assignment, students should work closely with their DRES advisor/counselor to help meet those deadlines. NOTE: students are obligated to communicate well in advance with their instructors, team members, and DRES advisor regarding any issues in meeting their assignment deadlines.

Midterm Project: Assignment #1 (4-membered team) – Travel Advisory Poster

– Select 4-Membered Team by 4:00 pm on Monday, September 11

– Part A due by 4:00 pm on Monday, September 18

– Part B due by 4:00 pm on Monday, September 25

– Submit Parts A and B (revised if needed) to Part C by 4:00 pm on Monday, October 2

NOTE: This is a HARD deadline! If you do not submit by this deadline, you will receive a score of 0!

– Part C self-assessment due by 4:00 pm on Monday, October 9

– Part C peer-assessment due by 4:00 pm on Monday, October 9

NOTE: This is a HARD deadline! If you do not submit by this deadline, you will receive a score of 0!

80 points

For this team assignment, your 4-membered team will propose and design a travel advisory poster. There will be three parts to this assignment. For the first two parts A and B, you will work as a four-membered team to generate the travel advisory summary and poster. In the last part C, you will participate as an individual in self-assessment and peer-evaluation of the team-generated travel advisories.

Scenario: Your team is called in as infectious disease expert consultants for a large, multi-billion-dollar corporation that sends representatives to all parts of the world to gather information and statistics about potential markets. You have been assigned the responsibility of updating the corporation's leadership on what should be done for its representatives who will be sent to these regions so as to protect them from potential health hazards. The CDC regularly posts travel notices to inform travelers and clinicians about current health situations related to specific destinations. These issues may arise from disease outbreaks that may affect travelers' health. The CDC has issued several Travel Alerts for the following destinations:

- (1) Polio in many countries in Central Africa
- (2) Measles (Note: not Rubella) in Germany, Belgium, Italy, France, and Romania
- (3) Cholera in Cuba, Dominican Republic, Haiti, Mexico, and Yemen
- (4) Chikungunya in the Caribbean, Federated States of Micronesia, Mexico and Brazil, Ethiopia
- (5) Rubella (Note: not measles) in Japan
- (6) Dengue in South and Central America, Mexico, and the Caribbean
- (7) Plague in Madagascar
- (8) Yellow fever in Uganda, Democratic Republic of Congo, Angola, and Brazil
- (9) Ebola in Democratic Republic of Congo
- (10) Zika in Brazil and Columbia
- (11) Malaria in Burundi
- (12) Monkeypox in Nigeria, Democratic Republic of Congo
- (13) Extensively drug-resistant (XDR) Typhoid Fever in Pakistan
- (14) Meningococcal disease in Benin
- (15) Buruli ulcer disease in Central and South Africa
- (16) Chagas disease in Mexico, Central America and South America
- (17) Elephantiasis tropic (lymphatic filariasis) in the tropical and sub-tropical countries
- (18) Schistosomiasis in tropical countries
- (19) Q fever in California, Iowa, and Texas
- (20) Leishmaniasis in Brazil, Ethiopia, Sudan, South Sudan, India, and Bangladesh

- (21) Rat-bite fever (*Streptobacillus moniliformis*) in Washington and Florida
- (22) Histoplasmosis in the Midwest USA
- (23) Leptospirosis in parts of Asia, Oceania, the Caribbean, Latin America and Africa
- (24) Rocky Mountain spotted fever in the USA, Western Canada, and South and Central America
- (25) Hand, foot and mouth disease in Southern California
- (26) African trypanosomiasis (African sleeping sickness) in Central Africa
- (27) Lyme disease in New England of USA
- (28) Diphtheria in many of the members of the Commonwealth of Independent States
- (29) Respiratory syncytial virus in USA
- (30) *Vibrio vulnificus* in coastal areas of USA

Part A: (20 points) – due by 4:00 pm on Monday, September 18

Your team is asked to **choose one of the situations above (your group number should match the number of the disease above) and to prepare a 1-page executive summary report** (~600 words) that you will submit to the corporation's leadership. To assist in preparing the report, you may use the Internet to research current healthcare industry data on current trends, treatments, and protocols for the travel alert you have chosen for your report, as well as scientific journal articles (but not a textbook or lecture notes). Be sure to cite your sources (journal article with its PMID, website URL, etc.) – for websites include the URL link!

Grading Rubric:

For your report, you should address the following points:

- (1) Identify the microbe or virus responsible for the disease, how it causes disease, its mode of transmission, and symptoms of the disease. (4 pts)
- (2) Based on your research, describe briefly how individuals from the corporation who are traveling to those regions can protect themselves. Provide any preventive measures and/or treatments that are currently available and their recommended use. (4 pts)
- (3) Develop **three** questions or concerns (and your answers to them) that you anticipate that the leadership in the corporation will ask you regarding possible side effects or problems associated with taking the available precautions or treatments for the diseases. Provide the rationale behind each of your questions. (6 pts)
- (4) Propose **three** lessons that have been learned from past outbreaks of that disease or a similar disease (state which one) that will underscore the importance of preparing for any upcoming trip that a member of the corporation may take to that region and why these lessons will be beneficial in keeping the traveler safe. (6 pts)

NOTE: Working as a team is an important skillset for resolving issues in Global Biosecurity, so Teamwork is an important component of this assignment. Not working as a team will impact your grade by 5 points!

Part B: (20 points) – due by 4:00 pm on Monday, September 25

Your team is asked to compile the information gathered in Part A to design an informative travel advisory poster (or infographic) that could be used to caution travelers to the region where the travel advisory is in effect. For example, you may choose to use a powerpoint application to generate a poster (ask your TA or me during office hours, if you do not know how to do this) or an infographic application, such as that available at URL: <https://piktochart.com>.

Grading Rubric: 6 pts for completeness, accuracy, and quality of content, 6 pts for creativity, effort, and quality of visual appearance, 8 pts for effectiveness to inform and educate the public about the situation.

NOTE: You will be deducted 5 points for not working as a team!

Part C: (40 points)

– submit revised Parts A and B to Part C by 4:00 pm on Monday, October 2

NOTE: This is a HARD deadline! If you do not submit by this deadline, you will receive a score of 0!

– Part C peer-assessment due by 4:00 pm on Monday, October 9

NOTE: This is a HARD deadline! If you do not submit by this deadline, you will receive a score of 0!

– Part C self-assessment due by 4:00 pm on Monday, October 9

In this part, you will participate in peer-evaluating the travel advisory executive summaries and posters that were generated by each of the teams. For this exercise you will evaluate the travel advisories of other teams (15 points) and they will evaluate your team's travel advisory (15 points). You will also provide a self-assessment of your own team (10 points).

NOTE: You will be deducted up to 10 points for the self-assessment part for not working as a team.

Final Media Project: Assignment #2 (4-membered team) – Public Service Announcement

- Select 4-Membered Team by 4:00 pm on Monday, October 16
- Part A due by 4:00 pm on Monday, November 6
- Part B due by 4:00 pm on Monday, November 13
- Submit revised Parts A and B to Part C by 4:00 pm on Monday, November 27

NOTE: This is a HARD deadline! If you do not submit by this deadline, you will receive a score of 0!

- Part C peer-assessment due by 10:00 pm on Thursday, December 14
- Part C self-assessment due by 10:00 pm on Thursday, December 14

NOTE: This is a HARD deadline! If you do not submit by this deadline, you will receive a score of 0!

120 points

For this final team assignment, your 4-membered team will research and develop a media-based project in the form of a public service announcement. There will be three parts to this assignment. For the first two parts, you will work as a 4-membered team to generate the executive summary (Part A) and media presentation (Part B). In the last part, you will participate as an individual in peer-evaluation of the team-generated public service announcements from other teams.

Scenario: Your team is hired as infectious disease expert consultants for a large nongovernmental organization (NGO) that as part of its public awareness campaign to educate or inform the public about biosecurity matters of concern wants your team to propose and develop a public service announcement for the US Advertising Council. The Ad Council accepts requests from sponsor institutions for advertising campaigns that focus on particular social issues and distributes the advertisements to a large network of media outlets, including TV ads and internet videos. The NGO has a list (see below) of topics that they are interested in making the public more aware of regarding biosecurity. Your team's task is to research the topic and come up with an executive summary and video that will convince the Ad Council to partner with your NGO.

How To Prepare: For tips on how to prepare a Public Service Announcement for the Ad Council, go to URL: <https://www.adcouncil.org>. Also check out:

<http://www.govtech.com/education/news/How-to-Create-the-Perfect-Public-Service-Announcement.html>

Part A: (25 points) – due by 4:00 pm on Monday, November 6

For this part, your team will select a topic from the list provided by the NGO (see attached) and will research the topic to generate an **executive summary (1000 words)** that provides a justification for the choice of biosecurity topic (i.e., answers the question: What's the pitch for the ad?). For the chosen topic, the team should cover these critical points, which should also be brought out in the video ad presentation:

- (1) Introduction of the topic, including significance of topic, scientific background, scientific and societal issues, legal and policy background, and global biosecurity impact of the topic. (4 pts)
- (2) Significance, pros & cons, advantages & disadvantages, benefits & risks, controversial aspects of the topic. (4 pts)

- (3) Who the stakeholders are and why they should be concerned or involved with the topic. (4 pts)
- (4) What policies, laws, rules, agreements, regulatory mechanisms, monitoring systems, containment measures, and enforcement mechanisms are currently in place to ensure biosecurity. (4 pts)
- (5) Recommendations about what policies, educational or public awareness strategies, regulatory or control mechanisms, or other policies or practices that should be explored or implemented to address the topic in terms of biosecurity. (4 pts)

Format: Post your executive summary (1000 words), which should include a catchy title, your names & team number, date & assignment #, and on a separate page (not part of the word count maximum) a list of 6 citations of sources used to generate your executive summary (at least 1 should be from a research article from the primary scientific literature and 1 should be from a review article from a scientific journal).

Grading Rubric: In addition to inclusion of the points mentioned above (20 pts total), 5 pts for overall completeness and quality of content and sources and adherence to recommended Ad Council guidelines.

NOTE: You will be deducted up to 10 points for not working as a team.

Part B: (25 points) – due by 4:00 pm on Monday, November 13

Your team is asked to compile the information you gathered in Part A to design and execute a 5-minute media **video** as a public service announcement pertaining to the biosecurity topic of interest that brings out all the issues mentioned in the executive summary.

Format: The presentation may be in the form of a film, documentary, or webinar panel debate with talking heads, video of a short play/skit/enactment illustrating a key topic, an animated movie, or video message (lots of options but must stay within the 5-min timeframe). All members of the team must indicate the role that they played in the presentation in the acknowledgements. Students should use Illinois Media to generate and submit their video presentations (see instructions within the URL provided on the website).

Grading Rubric: 7 pts for completeness and quality of content and sources, 8 pts for creativity, quality, effort of visual appearance, 10 pts for overall effectiveness to inform and educate the public.

NOTE: You will be deducted up to 10 points for not working as a team.

Part C: (70 points)

– submit revised Parts A and B to Part C by 4:00 pm on Monday, November 27

NOTE: This is a HARD deadline! If you do not submit by this deadline, you will receive a score of 0!

– Part C peer-assessment due by 10:00 pm on Thursday, December 14

– Part C self-assessment due by 10:00 pm on Thursday, December 14

NOTE: This is a HARD deadline! If you do not submit by this deadline, you will receive a score of 0!

You as an individual will now participate as a member of the Ad Council in peer-evaluating the executive summaries and videos that were generated by the other teams. For this exercise, you will evaluate the ad proposals of other teams (30 points), and they will evaluate your team's ad proposal (30 points). You will also provide a self-assessment of your own team (10 points).

NOTE: You will be deducted up to 10 points in the self-assessment part for not working as a team.

Potential Topics for Assignment #4 Project: (select a topic from these choices – BUT NOT COVID-19!)

Biosecurity regarding new, persistent, or re-emerging infectious diseases: (focus on one example)

- Preparing for a natural catastrophic disaster emergency – lessons learned from a recent event
- Global challenge of antibiotic resistance – pick one antibiotic-resistance or disease to focus on
- Zoonotic diseases – minimizing risk in a global society
- Lessons learned from recent events with regard to prevention/preparedness/response?
- Impact of lack of adequate education and scientific literacy on marginalized and underdeveloped regions of the world

Biosecurity regarding introduction of foreign biological agents: (focus on one example)

- Risk, prevention, and management of introduction of alien plant, insect or animal species for use in agriculture, conservation or ornamental (focus on one example)
- Exotic pets – introduction of alien microbes and pests through transport/import of exotic pets
- Impact of federal legislation: Noxious Weed Control Act (2004), National Aquatic Invasive Species Act (2005), Public Land Protection and Conservation Act (2005) or other related legislation
- Impact of insect control by host-plant resistance - genetically modified plants

Biosecurity regarding environmental and anthropogenic factors: (focus on one example)

- Impact of agricultural practices (such as slash-burn, monocultures, large-scale production, biopesticides) on spread of infectious diseases
- Emergence and control of tropical infectious diseases, invasive species spread – focus on one
- Impact of climate change and protecting biological diversity – impact on endangered species
- Impact of man-made catastrophes (e.g., oil spills) on spread of infection, global ecology
- Application of regenerative agricultural practices on food production

Biosecurity regarding emerging biotechnologies:

- Use of biosensors and genetic molecular markers
- Feed additives (hormones, antibiotics) and other agricultural practices
- Biofuels from genetically modified microbes, plants, or animals
- Bioremediation – introduction of recombinant or genetically modified microbes for bioremediation
- Nanoparticles for drug and reagent delivery – do nanoparticles pose a health risk?
- Use of microbiomes as indicators of responsiveness or non-responsiveness to drug treatment regimens or cancer therapies
- Use of microbiomes as treatments for current *Clostridioides difficile* infections, bacterial vaginosis, or preterm birth prevention

Biosecurity regarding synthetic biology: (focus on one or very few related examples)

- Impact of SYNBIOSAFE, Industry Association Synthetic Biology (IASB), OpenWetWare, iGEM, Do-It-Yourself Biology (DIYbio), Biopunk, Biohack, and/or similar initiatives/programs
- Human genome sequencing and intellectual property rights – who has rights to my DNA?
- Genetically modified organisms – plants, animals, insects, microbes, or humans (focus on one)

NOTE: If your team members have another related topic that is not on this list and not COVID-19, please first send me the title, topic, short description, and justification for choice for approval.