

# 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](mailto:wilson7@illinois.edu), URL: <http://mcb.illinois.edu/faculty/profile/wilson7>

**Office hours:** By appointment – setup via email request

**Course TA:** Mr. Shahbaz M. Khan ([shahbaz3@illinois.edu](mailto:shahbaz3@illinois.edu)) will be assisting with grading and course logistics and will be available for office hours on Wednesdays at 9:30 am via Zoom, or by appointment – setup via email request.

**Class Time and Location:** This term, class will meet virtually on Mondays 4:00-4:50 pm. Because not all students in the class are in the same time zone, lectures will be either (1) prerecorded with recorded Q&A/discussion via Zoom during regular class time or (2) live-streamed recorded during class time and posted, depending on the presenter for that class period. All lectures will have a lecture-specific activity associated with it. Details and expectations for each lecture will be posted ahead of time on the Moodle site under the lecture tab.

## 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 23 – Brenda Wilson** – first day of class, course logistics and “Introduction to Global Biosecurity”

**Aug 30 – Brenda Wilson** – “Global Biosecurity in a Complex, Dynamic World: Emerging & Escalating Issues”

**Sept 6 – Labor Day - no class**

**Sept 13 – Brenda Wilson** – “Global Biosecurity and Science Literacy and Making Informed Decisions”

**Sept 20 – Will Sander** – “Surveillance and the Risk to Biosecurity”

**Sept 27 – Gay Miller & Brenda Wilson** – “Preventing Pandemics: Three Areas for Action”

**Oct 4 – Gay Miller** – “Keeping the United States Biosecure from Foreign Animal Diseases”

**Oct 11 – Carl Gunter** – “Genome Security”

**Oct 18 – Collin Kieffer** – “Viruses and Vaccines”

**Oct 25 – Margarita Teran-Garcia** – “Global Biosecurity and Social Determinants of Health and Health Equity”

**Nov 1 – Steven Blanke** – “Synthetic Biology: The Promise and Perils of Reprogramming Biology within the Sandbox of Life”

**Nov 8 – Brenda Wilson** – “Genetically Modified Organisms (GMOs) – Impact on Food Security”

**Nov 15 – James Slauch** – “Food Safety and Biosecurity” – any time after Nov 1

Nov 22 – Thanksgiving break - no class

Nov 29 – **Brenda Wilson** – “Food Safety: the Case for Food Irradiation – Science Meets Law”

Dec 6 – **Mallory Stites and Matthew Windsor** – “National Labs and biosecurity”

Dec 13 – **Final** – all presentations, assignments, peer-evaluations, and papers due

### Course Learning Objectives:

After taking this course, students will be able to:

1. Understand the components of scientific literacy and the process of scientific inquiry.
2. Communicate complex scientific information.
3. Apply simple predictive models to biology-related phenomena in the context of biosecurity.
4. Understand 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. Possess 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 – 14 class periods

260 pts – 20 pts for each lecture-specific quiz and/or activity assignment (top 13 scores are used)

20 pts – 2-member team assignment #1 – news article #1

20 pts – 2-member team assignment #2 – news article #2

80 pts – 4-member team assignment #3 – travel advisory poster/pamphlet project

- 20 pts – Part A – 2-page travel advisory executive summary – graded by TA and instructor
- 20 pts – Part B – team-designed travel advisory poster/pamphlet – 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 – 4-member team assignment #4 – public service announcement media project

- 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  
A – 475  
A- – 450  
B+ – 425  
B – 400  
B- – 375  
C+ – 350

C – 325  
C- – 300  
D+ – 275  
D – 250  
D- – 225  
F – <225

## Overview of Course Assignments:

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

**NOTE:** Normally, this course is designed to have in-class discussions and in-person group interactions. However, due to the COVID-19 pandemic situation and biosafety restrictions for large enrollment courses, we will be holding lectures in this course remotely via Zoom (the link will be posted on the course Moodle page), and we will be completing assignments via the course Moodle site. Some lectures (depending on the lecturer) will be prerecorded, and students will be expected to view them ahead of time and participate in the discussions during the live session on Mondays at 4:00 pm, which will also be recorded for those students unable to attend. Other lectures will be recorded during the live session, and the live recording will be posted afterwards. Students who miss the live session are expected to view the recording. All students are expected to participate in the lecture-specific activities. Students attending can submit their responses to questions posed by the speakers during the lecture into the Chat box. I will be moderating the sessions. Students who are unable to attend will need to submit to Moodle their written responses to the questions that are posed during the discussions by next class period.

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 those papers 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.

There will be a lecture-specific online quiz, activity worksheet, or assignment (individual or 2-membered team) that is associated with each lecture. All quizzes, assignments, and expectations for each lecture will be posted online in the Moodle site.

Throughout the semester there will also be four homework assignments: two 2-membered team assignments (#1 and #2) and two 4-membered team-based assignment (#3 and #4). These will count as your midterm and final projects (there is no final exam). All assignments should be submitted via the course Moodle site.

For Assignments #1 and #2, you will be grouped into teams of 2 persons. You may select your team partner, with whom you will work for these assignments. Once you are paired with a partner, you will remain with that person for the remainder of the course. If a team partner drops the course, then you may partner with another student who is also not partnered – this is indicated on the left-hand-side of the website page under the “Participants” tab. If you need help with finding a partner, please let the TA or me know, and we will help assign you a partner.

For Assignments #3 and #4, you will be grouped into teams of 4 persons, where the 2-membered teams formed for Assignments #1 and #2 will now be combined into 4-membered teams. This team grouping will be chosen by each 2-membered team based on which pathogen/disease they would like to work on (the list of choices is provided under the assignment instructions – **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 of the projects. There will be a self-assessment component to the grade regarding teamwork in each case.

## **Assignment #1 (2-membered team) – News Article #1, due by 4 pm on Monday, September 20**

### **20 points**

**Scenario:** For this assignment, you will work as a two-membered team to identify a **recent news article** from a reputable and well-recognized magazine or news outlet source (such as the *News Gazette*, *Chicago Tribune*, *New York Times*, *Times Magazine*, *The Washington Post*, or *USA Today*) that **covers a topic of relevance to *biosecurity***. Your team will then research the scientific facts of the article, finding relevant primary literature sources that support or dispute the facts, and in a short critique article (~500 words) summarize your findings. You should include a concluding statement regarding your assessment of the news report and whether or not it is scientifically sound, citing the sources that support your conclusions. You should include a statement making the connection to biosecurity.

**Format:** Submit a pdf of your critique article of ~500 words, including a catchy title, your names & team number, date & assignment #, and a pdf copy of the chosen news article (combine them into one pdf file with your critique article in front). The news article should be recently published (from 2020-2021) and on a topic related to biosecurity.

**Grading Rubric:** 5 points for appropriate choice of news article, 5 pts for appropriate choice of literature sources, 5 pts for rational assessment of the soundness of the news report, 5 pts for appropriate connection to biosecurity

## **Assignment #2 (2-membered team) – News Article #2, due by 4:00 pm on Monday, September 27**

### **20 points**

**Scenario:** For this assignment, your team will identify a key **scientific article from the primary literature**, i.e., from a premier research scientific journal (such as *Science*, *Nature*, *Cell*, *Neuron*, or the *New England Medical Journal*), and write a news article (in a style for a news outlet such as the *News Gazette* or the *Daily Illini*). The short article (~500 words) should highlight the findings of that key paper and relate it to scientific issues that might be of interest or benefit to the general public. You can assume that the audience has at least a high school education, but not necessarily a college education in science. Your article should place the importance of the paper's findings in a context that is understandable, but still accurate, to the audience. You may need to do a little research on your own to build the background context around the topic area.

**Format:** Post a pdf of your news article of ~500 words, including a catchy title, your names & team number, date & assignment #, and a pdf copy of the key article (combine them into one file with your news article in front). The key article should be a primary literature article that was published in 2020 or 2021 and should be on a topic related to biology and biosecurity (in the broad sense). If you are not sure about the suitability of the article, you may ask your TA or instructor.

**Grading Rubric:** 5 points for appropriate choice of key primary literature article, 5 pts for appropriate level for the audience, 5 pts for appropriate scientific detail of information conveyed to the public, 5 pts for appropriate connection to biology and biosecurity

## Assignment #3 (4-membered team) – Travel Advisory Poster/Pamphlet Project

– Part A due by 4:00 pm on Monday, October 11

– Part B due by 4:00 pm on Monday, October 18

– Submit Parts A and B (revised if needed) to Part C by 4:00 pm on Monday, October 25

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

– Part C due by 4:00 pm on Monday, November 1

***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 2-membered team will join with another 2-membered team to become a 4-membered team, and 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, you will work as a four-membered team to generate the travel advisory summary and poster. In the last part, you will participate as an individual in peer-evaluation of the team-generated travel advisories.

**Scenario:** Your team is called in as infectious disease expert consultants for a large, multi-million-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 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 US, 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

**Part A: (20 points) – due by 4:00 pm on Monday, October 12**

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** (~500 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 PMID, website URL, etc.)!

**For your report 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 in regard to possible side effects or problems associated with taking the available 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 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)

**Part B: (20 points) – due by 4:00 pm on Monday, October 19**

Your team is asked to compile the information gathered in Part A to design a travel advisory poster (or infograph) 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 or an infograph 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

**Part C: (40 points)**

– submit Parts A and B to Part C by 4:00 pm on Monday, October 26

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

– complete Part C by 4:00 pm on Monday, November 1

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

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).

## **Assignment #4 (4-membered team) – Public Service Announcement Media Project**

– Part A due by 4:00 pm on Monday, November 15

– Part B due by 4:00 pm on Monday, November 29

– Submit Parts A and B (revised if needed) to Part C by 4:00 pm on Monday, December 6

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

– Complete Part C by 5:00 pm on Monday, December 13

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

### **100 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 attached) 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 the NGO.

**How To Prepare:** For tips on how to prepare a Public Service Announcement for the Ad Council (<https://www.adcouncil.org>), 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 15**

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 will 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

**Part B: (25 points) – (also Part A and B submitted to Part C) due by 4:00 pm on Monday, November 29**

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 of the presentation may be in the form of a film, documentary, panel debate with talking heads, short play/skit/enactment illustrating a key topic, an animated movie, or a 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. 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

**Part C: (70 points)**

– submit Parts A and B to Part C by 4:00 pm on Monday, December 6

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

– complete Part C by 5:00 pm on Monday, December 13

***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 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).

**Potential Topics for Assignment #4 Project: (select a specific topic from these choices)**

**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 example

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

**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?

**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, please first send me the title, topic, and short description for approval.***

## **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 seminar or up to 1 point for any biology-related 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! In order to earn credit for a particular seminar, you must submit by the last day of classes (**5 pm on December 8, 2021**) 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 material 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 submissions = 5**