Infectious diseases
Global Health Sciences BIOS27815
Paris, France

Course Instructor:
Cara Brook, PhD (cbrook@uchicago.edu)
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Course Location:
U. Chicago Paris Center, Paris, France
January 6 – January 23, 2025
9:30am – 11:45am Monday-Thursday, with 2x full day Friday field trips

Office Hours:
Dr. Brook will be available daily from 12:00-1:00pm for office hours during the first week (Jan 6-9).
Dr. Beavis will be available daily from 11:45 – 12:15 during the second and third weeks as well as by appointment.

Overview & Format:
This course is designed for students interested in pursuing careers in public health, global health, infectious disease diagnostics, modeling, or related disciplines. The aim of the course is to introduce students to the taxonomy of parasites and pathogens and the key infectious diseases of importance in the field of global health.

The course will take place during the Winter Quarter Study Abroad track at the University of Chicago Paris Center, which has a focus on the Global Health Sciences. Class attendance (100%) is mandatory. Class will meet in the morning, Monday-Thursday, and two mandatory, full day field trips will be held on Friday, January 10 and Friday, January 17. During the January 10 field trip, we will travel to Amsterdam, the Netherlands to visit and learn from the Amsterdam Institute for Global Health and Development (aighd.org) and their partner organization, PharmAccess (pharmaccess.org). We will also tour the Museum Vrolik (museumvrolik.nl/en/), dedicated to depictions of the human body. During the January 17th field trip, we will travel to a town near Lyon to visit BioMerieux, one of the largest diagnostic companies in the world.

Outside of field trips, class time will be split between lecture and activities/tutorials and student-led oral presentations and discussions of readings on focal infectious diseases that will be provided by the faculty. All students will be required to present twice throughout the three-week course period.

Students will complete one problem set in week two to ensure that they are familiar with terminology related to epidemiology and public health and to help prepare them for the final exam.

The final exam will take place on the last day of class (Thursday, January 23, 2025) and will involve free-response answers to questions related to course material and readings.

Late Policy: Late work (e.g. for problem set or presentations) will not be accepted, unless under extreme circumstances (e.g. serious illness, injury, family trauma). If these circumstances apply, please notify Dr. Brook and Dr. Beavis immediately to establish a make-up plan. Otherwise, late assignments will be given a score of 0.

AI Policy: Artificial Intelligence (AI) tools (e.g. ChatGPT) are not permitted for use in any capacity related to the preparation of any written assignments for this course (e.g. problem set). Any student caught using these tools in this context will receive a score of 0 on the corresponding assignment, and all previously submitted written work will undergo re-evaluation under scrutiny for evidence of AI support.

Grading Breakdown:
Attendance (Including Field Trips): 10%
In-Class Participation (Including Field Trips): 15%
Homework (One Problem Set): 15%
In-Class Presentations (x2): 30%
Final Exam: 30%

Course Texts: There is no single text for this course. All readings (mostly scientific articles but also a few book chapters) will be posted as pdfs to Canvas.

Objectives:
By the end of the course, students will be able to:

- Understand and describe fundamental principles in epidemiology and public health science.
- Describe the diversity of parasites and other pathogens that are responsible for infectious diseases.
- Describe and discuss important diseases of global health concern.
- Describe and discuss available interventions to combat infectious disease in a global health context.

Schedule:

- *A typical class will open with a lecture and/or activity from 9:30-10:30am or 11am, followed by a 5-minute biobreak, then close with student-led presentations and group discussion.*
- *Some lectures may be longer or shorter, and the activity/tutorial time will be expanded or contracted accordingly to make up the difference.*
- *Lectures will be interactive, and students will be called upon or asked to participate throughout.*
- *Readings should be done prior to the date on which they are listed. Readings are required for all students, though the student assigned to each presentation slot will need to read the most deeply to facilitate group discussion on the topic.*

Date	Lecture	Activities/Tutorials	Readings and Homework
Week One:			
Monday, January 6	*Introduction to epidemiology and public health terminology* • what is global health? • major diseases of global health concern • identifying an infectious agent - bacteria, viruses, protozoa, and helminths - infectious disease diagnostics in global health settings • understanding infectious diseases - principles of epidemiology and disease dynamics	*Activity*: Dynamical Fever (group exercise and discussion)	*No readings or homework required prior to day one.*

	- R0, RE, force of infection (λ) - Herd immunity, critical vaccination threshold		
Tuesday, January 7	*Identifying infectious diseases* • Reading recap and discussion	*Activity:* Investigating novel viruses from Next Generation Sequencing data	*Readings:* Yek et al. 2022 *Please read prior to class and come prepared to discuss*
Wednesday, January 8	*Introduction to vector-borne viruses* • what is a vector? • taxonomy of vector-borne viruses • deep dive: biology of dengue and challenges to control • impacts of climate change on dengue transmission	*Two students present disease of focus and lead group discussion*	*Readings:* Student 1: Zika *Katzelnick et al. 2020* Student 2: Chikungunya *Xavier et al. 2023*
Thursday, January 9	*SARS-CoV-2 in the context of global health* • SARS-CoV-2 in the context of other coronaviruses • Nextstrain and GISAID • global expansion of pathogen genomic sequencing in response to COVID-19 • vaccine equity and access	*Two students present disease of focus and lead group discussion*	*Readings:* Student 3: MERS *Cho et al. 2016* Student 4: SARS-CoV-2 *Worobey et al. 2022*
Friday, January 10	11am – 12pm: Visit to Museum Vrolik: http://www.museumvrolik.nl/en/ 12pm-2pm: Visit to Amsterdam Institute for Global Health and Development; 3 short presentations: • vaccine hesitancy • vaccine manufacturing in Africa • Effects of diarrheal disease on antibiotic use. 3pm-5pm: Visit to PharmAccess. – Vaccine Development in LMICS		*Readings – **All students will read all three papers for AIGHD and one paper each for PharmAccess.*** **For AIGHD (x3):** Blog- Scaling up Vaccine Manufacturing in Africa: https://healthgovernance.ideasoneurope.eu/2024/09/27/scaling-up-vaccine-manufacturing-in-africa-the-team-europe-initiative/ Vaccine Hesitancy - *MacDonald 2015* Childhood vaccines in LMICs – *Lewnard et al. 2020*

			<u>For PharmAcces (x5) – each student reads one</u> **Paige & Trinity:** Digital health exchange in Kenya (*Dohmen et al 2022*) **Katie & Yolanda:** Connected diagnostics for malaria treatment in Kenya (v*an Duijn et al. 2021*) **Sadie:** Digital mobile health platform for LMICS (*Husiman et al 2022*) **Naomi:** Preparing SSA for future outbreaks – Insights from COVID-19 (*Gomez-Perez et al. 2024*) **Obi:** COVID-19 response in Kenya (v*an Duijn et al. 2023)*
<u>Week Two:</u>			
Monday, January 13	An Introduction to Pathology and Laboratory Testing	*Two students present papers and lead group discussion*	Background: For discussion: Student 5: Angell, ethics Student 6: Hopkins, Disease eradication
Tuesday, January 14	HIV Infections and AIDS	*Two students present papers and lead group discussion*	Background: For discussion: Student 7: Nachega, PEPFAR Student 8: Shai, HIV-1 LMIC
Wednesday, January 15	Tuberculosis	*Two students present papers and lead group discussion*	Background: For discussion: Drug resistant tb Student 9: Global TB Student 10: Meintjes, HIV-TB
Thursday, January 16	Helminth Infections	*Two students present papers and lead group discussion*	Background: For discussion by all: BioMerieux 2023 annual report
Friday, January 17	Course field trip to Marcy l'Étoile, headquarters of BioMerieux, near Lyon, France.		*Readings: TBA*

Week Three:			
Monday, January 20	Bloodborne Parasites	*Two students present papers and lead group discussion*	Background: For discussion: Student 11: Gaudinski, malaria monoclonal Student 12: Bell, Malaria dx
Tuesday, January 21	Syndromes: Diarrhea and Meningitis	*Discussion: Two students present papers and lead group discussion*	Background: For discussion: Student 13: DeVries, Vaccine derived polio Student 14: Stafford, Syphilis
Wednesday, January 22	Sexually Transmitted Infections	*Questions and Lessons Learned*	Background: What surprised you? For discussion: Review session – Questions?
Thursday, January 23	*Last day of class – final exam.*		

Readings:

January 7

Yek, Christina, et al. "Metagenomic pathogen sequencing in resource-scarce settings: lessons learned and the road ahead." Frontiers in epidemiology 2 (2022): 926695.

January 8

Student 1:

Katzelnick, Leah C., et al. "Zika virus infection enhances future risk of severe dengue disease." *Science* 369.6507 (2020): 1123-1128.

Student 2:

Xavier, Joilson, et al. "Increased interregional virus exchange and nucleotide diversity outline the expansion of chikungunya virus in Brazil." *Nature Communications* 14.1 (2023): 4413.

January 9

Student 3:

Cho, Sun Young, et al. "MERS-CoV outbreak following a single patient exposure in an emergency room in South Korea: an epidemiological outbreak study." *The Lancet* 388.10048 (2016): 994-1001.

Student 4:

Worobey, Michael, et al. "The Huanan Seafood Wholesale Market in Wuhan was the early epicenter of the COVID-19 pandemic." Science 377.6609 (2022): 951-959.

January 10
AIGHD – All students please read all three articles

Blog- Scaling up Vaccine Manufacturing in Africa:
https://healthgovernance.ideasoneurope.eu/ 2024/09/27/scaling-up-vaccine-manufacturing-in-africa-the-team-europe-initiative/

MacDonald, Noni E. "Vaccine hesitancy: Definition, scope and determinants." *Vaccine* 33, no. 34 (2015): 4161-4164.

Lewnard, Joseph A., Nathan C. Lo, Nimalan Arinaminpathy, Isabel Frost, and Ramanan Laxminarayan. "Childhood vaccines and antibiotic use in low-and middle-income countries." *Nature* 581, no. 7806 (2020): 94-99.

PharmAccess – Please read the one article you are assigned – see calendar above.

Dohmen, Peter, Teresa De Sanctis, Emma Waiyaiya, Wendy Janssens, Tobias Rinke de Wit, Nicole Spieker, Mark Van der Graaf, and Erik M. Van Raaij. "Implementing value-based healthcare using a digital health exchange platform to improve pregnancy and childbirth outcomes in urban and rural Kenya." *Frontiers in public health* 10 (2022): 1040094.

van Duijn, Shannen MC, Angela K. Siteyi, Sherzel Smith, Emmanuel Milimo, Leon Stijvers, Monica Oguttu, Michael O. Amollo et al. "Connected diagnostics to improve accurate diagnosis, treatment, and conditional payment of malaria services in Kenya." *BMC Medical Informatics and Decision Making* 21 (2021): 1-12.

Huisman, Liesbeth, Shannen MC van Duijn, Nuno Silva, Rianne van Doeveren, Jacinta Michuki, Moses Kuria, David Otieno Okeyo et al. "A digital mobile health platform increasing efficiency and transparency towards universal health coverage in low-and middle-income countries." *Digital health* 8 (2022): 20552076221092213.

Gómez-Pérez, Gloria P., Aafke E. de Graaff, John T. Dekker, Bonifacia B. Agyei, Ibironke Dada, Emmanuel Milimo, Marilyn S. Ommeh, Peter Risha, Tobias F. Rinke de Wit, and Nicole Spieker. "Preparing healthcare facilities in sub-Saharan Africa for future outbreaks: insights from a multi-country digital self-assessment of COVID-19 preparedness." *BMC Health Services Research* 24, no. 1 (2024): 254.

Van Duijn, Shannen, Hellen C. Barsosio, Mevis Omollo, Emmanuel Milimo, Isdorah Akoth, Robert Aroka, Teresa De Sanctis et al. "Public-private partnership to rapidly strengthen and scale COVID-19 response in Western Kenya." *Frontiers in public health* 10 (2023): 837215.

January 13
Background:
For discussion:
Student 5: Angell M. The ethics of clinical research in the Third World. N Engl J Med. 1997 Sep 18;337(12):847-9. doi: 10.1056/NEJM199709183371209. PMID: 9295243.
Student 6: Hopkins DR. Disease eradication. N Engl J Med. 2013 Jan 3;368(1):54-63. doi: 10.1056/NEJMra1200391. PMID: 23281976.

January 14
Background:

For discussion:

Student 7: Nachega JB, Serwadda D, Abimiku A, Sikazwe I, Abdool Karim Q. PEPFAR at 20 - A Game-Changing Impact on HIV in Africa. N Engl J Med. 2023 Jul 6;389(1):1-4. doi: 10.1056/NEJMp2304600. Epub 2023 Jul 1. PMID: 37395552.

Student 8: Shao Y, Williamson C. The HIV-1 epidemic: low- to middle-income countries. Cold Spring Harb Perspect Med. 2012 Mar;2(3):a007187. doi: 10.1101/cshperspect.a007187. PMID: 22393534; PMCID: PMC3282497.

January 15

Background:

Farhat, M., Cox, H., Ghanem, M. *et al.* Drug-resistant tuberculosis: a persistent global health concern. *Nat Rev Microbiol* **22**, 617–635 (2024). https://doi.org/10.1038/s41579-024-01025-1

For discussion:

Student 9: Global tuberculosis control: lessons learnt and future prospects. Nat Rev Microbiol. 2012 May 14;10(6):407-16. doi: 10.1038/nrmicro2797. PMID: 22580364.

Student 10: Meintjes G, Maartens G. HIV-associated tuberculosis. *N Engl J Med* 2024;391:343-355

January 16

Background:

For discussion: BioMerieux 2023 annual report

January 20

Background:

For discussion:

Student 11: Gaudinski MR, Berkowitz NM, Idris AH, Coates EE, Holman LA, Mendoza F, Gordon IJ, Plummer SH, Trofymenko O, Hu Z, Campos Chagas A, O'Connell S, Basappa M, Douek N, Narpala SR, Barry CR, Widge AT, Hicks R, Awan SF, Wu RL, Hickman S, Wycuff D, Stein JA, Case C, Evans BP, Carlton K, Gall JG, Vazquez S, Flach B, Chen GL, Francica JR, Flynn BJ, Kisalu NK, Capparelli EV, McDermott A, Mascola JR, Ledgerwood JE, Seder RA; VRC 612 Study Team. A Monoclonal Antibody for Malaria Prevention. N Engl J Med. 2021 Aug 26;385(9):803-814. doi: 10.1056/NEJMoa2034031. Epub 2021 Aug 11. PMID: 34379916; PMCID: PMC8579034.

Student 12: Bell D, Wongsrichanalai C, Barnwell JW. Ensuring quality and access for malaria diagnosis: how can it be achieved? Nat Rev Microbiol. 2006 Sep;4(9):682-95. doi: 10.1038/nrmicro1474. PMID: 16912713.

January 21

Background: Melnick JL. 1996. Current status of poliovirus infections. Clin Microbiol Rev 9:. https://doi.org/10.1128/cmr.9.3.293

For discussion:

Student 13: DeVries, AS, Harper, J, Murray, A, et al. Vaccine-derived poliomyelitis 12 years after infection in Minnesota. *N Engl J Med* 2011;364:2316-2323

Student 14: Stafford IA, Workowski KA, Bachmann LH. Syphilis Complicating Pregnancy and Congenital Syphilis. N Engl J Med. 2024 Jan 18;390(3):242-253. doi: 10.1056/NEJMra2202762. PMID: 38231625.