



# History's Greatest Arms Race: How infectious diseases have changed human evolution



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## ***Introduction:***

There's no question that infectious diseases have a huge impact on our lives and our societies. But did you know that these infections have also shaped our very biology? In this talk, we will explore the influence that infectious diseases have had on human evolution. In part one, we will provide an overview of both historical and contemporary disease outbreaks. We will also talk about two of the most deadly diseases—malaria and HIV/AIDS—delving into the history of these infections in humans. In part two, we will discuss the details of how human evolution occurs and how infectious diseases can impact this process. In part three, we will examine these concepts in depth through specific examples—again focusing on malaria and HIV/AIDS. We will end with a discussion of how infectious diseases will continue to impact human evolution in the future.

## ***Speakers***



**Lola Fagbami** is a fourth-year graduate student PhD in the Chemical Biology Program at the Harvard Graduate School of Arts Sciences. She is interested in studying metabolism in infectious diseases for therapeutic utility. Lola was born and raised in Lagos, Nigeria and relocated to the east coast of the United States with her family in her teens. She graduated from Emory University with BS in Chemistry, and further studied Biomedical Science and Public Health at Rutgers University. Lola is passionate about expanding scientific literacy through outreach and mentoring and refuting chemophobia wherever it may be found. In her free time, she enjoys the footballing skills of Manchester United, all sorts of performance art, and science fiction and fantasy stories.



**Wesley Wong** is a fifth-year PhD student at the Harvard T.H. Chan School of Public Health. He is currently mentored by Dr. Dyann Wirth, Dr. Daniel Neafsey, and Dr. Daniel Hartl. Prior to graduate school, he majored in Microbial Sciences at the University of California, Berkeley. He is interested in understanding the evolution of infectious diseases through the use of computational genomics and mathematical models. When not in lab, he can be found roaming the streets for good food or at home playing video games.



**Rebecca Mandt** is a third-year graduate student at the Harvard T.H. Chan School of Public Health. She is currently pursuing her Ph.D. in the laboratory of Dr. Dyann Wirth. She is interested in understanding how drug resistance develops in the malaria parasite, and is looking at the mechanisms of resistance for novel antimalarial drugs. Rebecca is originally from St. Paul, MN and graduated from Grinnell College with a B.A. in biology. When she is not in the lab she enjoys swing dancing, conversations with friends, and exploring the city. After graduate school she hopes to pursue a career at the interface of basic biology and public health.

## ***Glossary of Important Terms***

**Epidemic:** Describes a situation where an infection rapidly increases and becomes widespread

**Pathogen:** An organism which can cause disease. Can include bacteria, viruses, parasites and fungi.

**Natural selection:** The concept of “survival of the fittest” --the major underlying mechanism of **evolution**. Natural selection requires genetic differences (differences in the DNA) between individuals in a population. This variation leads to physical differences known as **traits**, that allow some individuals to survive and reproduce better than others. These traits are passed down to the offspring of the next generation, and over time become more common in the population.

**DNA:** A molecule that acts as the instruction manual for an organism..

**Genotype:** The set of DNA that is found in an organism. In humans, everyone’s genome is unique, and determines their **phenotype**

**Phenotypes/Traits:** Observable characteristics of an organism. These characteristics are ultimately determined by the **genotype**

**Proteins:** Diverse molecules molecules which make up the structure of our cells and perform various functions. Proteins are what ultimately make up our traits or phenotypes

**Mutations:** Random mistakes or “typos” in the DNA which can lead to subsequent changes proteins.

**Fitness:** The relative ability of an organism to survive and reproduce, thus passing their genetic material (DNA) to the next generation

**Selective pressure:** Any reason for an individual with a given trait to have a fitness advantage or disadvantage. We will focus on infectious diseases as a selective pressure favoring humans with traits protecting them against infection

## ***Resources to learn more***

(1) “Human Resistance to Infectious Diseases” by Sara Little

<https://biogeekery.wordpress.com/2013/02/25/human-resistance-to-infectious-diseases/> -- a reader-friendly blog post by a Ph.D. student in Pathobiology

(2) “An Introduction to Infectious Disease” by Tiffany Hsu.

<http://sitn.hms.harvard.edu/flash/special-edition-on-infectious-disease/2014/an-introduction-to-infectious-disease> -- a SITN article that provides an excellent primer to what infections are and how we fight them off.

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