

General Policies: Nemergut

- Email is the best way to get in touch. Emails sent less than 24 hours prior to an exam will not be answered.
- PowerPoint files will not be posted, I will post notes, vocabulary words, important figures #s, and “common misconceptions” to CU Learn. Study guides will be posted 1 week prior to exams.
- Chapters from the text are recommended as reference, but will be more detailed than lectures. You will not be tested on this additional detail.
- Clicker participation will continue to be worth extra credit points. Two exams remaining: Nov 26th, Dec 17th. Lowest grade will be dropped, grades from all sections will be adjusted.
- Ask questions during lecture, Poor classroom behavior will not be tolerated, Turn off your cell, Arrive on time and don't leave early

Genetics & Evolution Overview: Concepts: Variation, Inheritance, selection

Malaria & Sickle Cell Disease & MRSA Vocabulary & Figures

- Malaria, Sickle cell disease, Hemoglobin
- Staphylococcus aureus*, methicillin, MRSA, antibiotics, sensitive, resistant
- Genes, dominant, recessive, heterozygote, homozygote, heterozygote advantage
- Figs 23.13, 28.11
- Wikipedia entries on sickle cell and malaria and MRSA are useful resources

Part 1: Sickle Cell Disease is caused by a mutation in hemoglobin genes

- Results in sickle-shaped red blood cells
- Cells get stuck in blood vessels, causes oxygen deprivation, organ damage
- Shortened life expectancy

Genetics of sickle cell disease

- Caused by a mutation in hemoglobin (protein that binds oxygen in red blood cells) gene
- This is a recessive genetic disorder (not dominant)
- For full expression of disorder, require two defective genes (one from mom, one from dad)

Part 2: Malaria is caused by *Plasmodium falciparum*, *Plasmodium vivax*, etc.

- Parasite that can live in humans and mosquitoes
- Widespread in tropical and subtropical regions: Americas, Asia, Africa
- Kills between 1 and 3 million people a year- 180 deaths in this lecture time.
- Whole genome of this organism is sequenced: http://www.sanger.ac.uk/Projects/P_falciparum/

Malaria and other diseases

- Before antibiotics, patients with Syphilis were intentionally inoculated with malaria, which caused a fever and the effects of the two diseases could be minimized to some degree.
- Malaria increases HIV patients viral load, AND HIV increases the spread of malaria.

Malaria symptoms

- Fever, shivering, joint pain, vomiting, anemia
- Can be cyclical
- Can be chronic

Malaria treatments and preventatives

- No vaccine
- Chloroquine, quinine, cheap, many resistant strains
- DDT, Mosquito nets, sanitation, poverty, treatment of infected individuals

Part 3: Evolution: Malaria and Sickle Cell Disease

- Sickle cell trait (Rr) appears to increase immunity to malaria
- Thus, in areas where malaria is endemic, heterozygotes have an advantage over homozygotes (RR and rr)

Heterozygote advantage

- Acts to maintain recessive genes in the population
- 8-10 % of African- Americans have sickle cell trait, although the average is decreasing
- This is unusually high for a trait which has such detrimental effects

Part 4: Staphylococcus aureus

- Can be found on healthy human skin and in healthy nasal cavities
- In hospital settings, can cause septicemia, pneumonia, meningitis
- Community associated- occurs in healthy people: can cause skin infections, toxic shock

- Antibiotics were discovered by chance when old *S. aureus* cultures were left on the lab bench
- Sensitive bacteria are killed by antibiotics, resistant bacteria are not
- Bacteria can exchange genes, including antibiotic resistance genes, leading to genetic variation
- Methicillin resistance can be exchanged
- Use of antibiotics selection against sensitive bacteria, leaving behind resistant strains, which can exchange genes!