

PMI 214 Notes

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- Malaria no longer in US because of policies and culture in the 1950s (window screens, new deal stuff, A/C and TV)
- Malaria is mostly (> 90%) a problem in sub-Saharan Africa. In the New World, mostly in Brazil
- Malaria is mainly transmitted by Anopheles mosquitoes - many different types - many different biologies
- Makes Malaria control through mosquito control very difficult
- > 200,000,000 clinical cases per year
- > 600,000 deaths per year (> 90% in Africa)
- increasing problem
 - evolution of resistance of Malaria parasites
 - mosquito resistance to insecticides
 - no economic incentive to produce treatments
- 4 human Malaria parasites
 - Plasmodium _____
- antibodies do NOT provide immunity like they do with Dengue
- origins of Malaria traced back to the age of dinosaurs (someone found a bloodfeeding fly in amber just this year)
- every group of vertebrates has its own set of malaria parasites
- Humans have had Malaria since the beginning of homo-sapiens
- Hippocrates wrote about symptoms of Malaria
- contemporary knowledge began in 1880 when Laveran found malaria in the parasite - Ross in 1897 found it was transmitted by mosquitoes
- three stages of the malaria parasite life cycle
 - liver stage (site of initial infection)
 - blood stage (produces pathology)
 - mosquito stage
- Liver stage
 - invade hepatocytes in the liver
 - asexual reproduction
 - highly virulent
 - no overt pathology
 - 6-15 days
 - sometimes Malaria parasites hibernate in the liver (record in 75 years) (just happens with *P. vivax* and *P. ovale*)
- Blood stage

- enter the red blood cell
- ingest contents
- replicate
- rupture and releases merozoite
- develop anemia
- infected cells stick to vessel walls - then bursts
- symptoms
 - * headache
 - * fever
 - * fatigue
 - * pain
 - * very general symptoms
- general symptoms can lead to deadly situations within 24 hours
- clinical features:
 - * periodic episodes of fever (red blood cells all rupture around the same time - very regular - can be diagnostic)
- infected cells produce adhesive knobs - sticks to the lining of the blood vessels - can clump and cause clogs
- infected cells release toxins (ex: nitric oxide, which is extremely damaging to brain cells) ← this is the main killer of humans
- Mosquito Stages
 - Malaria reproduces sexually in the mosquito
 - Mosquito will simply ingest human malaria parasites
 - Parasites become gametocytes, which, within *hours* after ingestion by mosquito turn in to gametes and form zygotes
 - The mosquito is, in fact, infected
 - This cycle takes 2 weeks
 - Macrogamete(female) are inseminated by microgametes(male)
 - ookinete is the only diploid stage - exits the stomach by penetrating stomach cells and produces cysts which release parasites, which migrate and penetrate into the salivary gland
- Malaria puts a huge economic burden on developing countries - sick people can't come into work
- Malaria has driven human evolution in some cases
 - Homozygotes for anemia have big problems
- Malaria pills damage liver if taken more than 6 months to a year.. but in the short term, can prevent Malaria spread in the human body
- Management
 - insecticide-treated bed nets
 - indoor residual spraying (DDT indoors... yuck... stays for more than a year)
 - * environmental impacts are fairly minimal if this is restricted to indoors?
 - * relatively nontoxic to humans
 - * people accept is
 - * water soluble (don't have to mix it with oil)
 - * kills cockroaches, ants, mosquitoes, and other stuff
 - Bed nets and drugs work well (Gates foundation, George Bush was good for Malaria (President's Malaria Initiative)) - have saved hundreds of thousands of lives
 - Genetically Modified Mosquitoes (November 8 lecture)
- Problems:
 - Mosquitoes are evolving evolution to BOTH bed nets and DDT
- Poverty \iff Malaria in a lot of places
 - Farmers get sick right when their crops are ready