BI-CO MATHEMATICS COLLOQUIUM

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"Using Mathematics to Unravel the Complexities Associated to Malaria Transmission Success, following a Human-Parasite-Mosquito Interaction in a Built Environment"

Monday, November 27, 2023
Talk at 4:30 PM – Park 338
Reception at 4:15 PM – Park 361, Math Lounge

Abstract:
Plasmodium falciparum parasites are the causative agents of human malaria disease, while female Anopheles mosquitoes are the transmitting agents of the parasites. Part of the parasite's life cycle resides in humans and the other part in female mosquitoes. Transmission of the parasite from an infectious human to a susceptible feeding mosquito is plausible when the mosquito successfully draws blood from the infectious human, with success if the drawn blood meal contains the transmissible parasite forms (gametocytes) from humans to mosquitoes. On the other hand, transmission from an infectious mosquito to a susceptible human is plausible following a successful feeding encounter between the mosquito and the human, with success if the feeding encounter results in the injection of the transmissible parasite forms (sporozoites) from mosquitoes to humans. Notably, the process is not always successful; the quest to draw blood is costly and may fail resulting in the mosquito's demise. Moreover, even when blood is successfully drawn from a human, parasite transmission may fail. In fact, a successful parasite transmission, and hence malaria transmission, requires two sequentially distinct successful feeding episodes by a susceptible feeding mosquito, the first from an infected human with the transmissible parasite forms followed by one from a susceptible human, with the parasite being in its transmissible state in the feeding mosquito at the latter feeding. Thus humans, parasites and female mosquitoes must interact synergistically in order for the transmission cycle to be successfully completed. The bottlenecks involved illuminate how the human-mosquito interaction enhances the parasites' exploitation of the evolutionary and reproductive needs of mosquitoes to ensure the parasites success and survivability. Therefore, understanding this complex process, viewed from the lens of transmitting mosquitoes, also driven by their evolutionary need to survive, is essential. This is situated in a built environment that showcases fluctuations in temperature which affects various aspects in the malaria problem. In this talk, I will illustrate the role of mathematics in aiding our understanding of the malaria problem.

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