Seventeen Minutes: The Time of Host Blood Protein Remaining in Anopheles Mosquitoes

Zhu, Liyuan (School: Shanghai Foreign Language School Affiliated to SISU)

Malaria can be transmitted by Anopheles. Anopheles similarly ingest a variety of bioactive factors during host feeding. Theoretically, therapeutic proteins in ingested blood, such as antibodies, could be functional to prevent plasmodium zygogenesis. However, it's unknown how long the protein will remain in the Anopheles midgut. To this end, my research began by introducing Gaussian luciferase (GLuc), a reporter protein, into Anopheles to determine the half-life of the exogenous protein. After selecting a single E. coli colony and preparing a large quantity of GLuc plasmids, the plasmids were transferred into the mouse liver via hydrodynamic tail vein injection. I collected blood from the mouse's cheek at different times to explore the expression of secreted GLuc, finding its activity peaking at 48 hours. The GLuc-containing mouse was then fed to Anopheles. Following that, the Anopheles were ground in different buffer solutions and at various times. With different grams of plasmids injected, I discovered a positive correlation between GLuc activity in Anopheles and that in mouse blood. I calculated that the half-life time of GLuc in Anopheles was 17.88 minutes, and this highly coincides with the critical period of Plasmodium reproductive development. By performing intestinal lumen separation in Anopheles after blood feeding, I noticed the non-intestinal lumen segment still expressed about 1/10 of the GLuc activity compared to the intestinal segment, and exogenous proteins can be absorbed into other tissues in Anopheles before degradation. My model, which mimics the natural process of blood-feeding, could be used for large-scale screening of exogenous proteins. These findings will aid future research on host blood proteins in bloodborne disease transmission like malaria.

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