

Modeling the Malaria parasite-Mosquito midgut cell interactions

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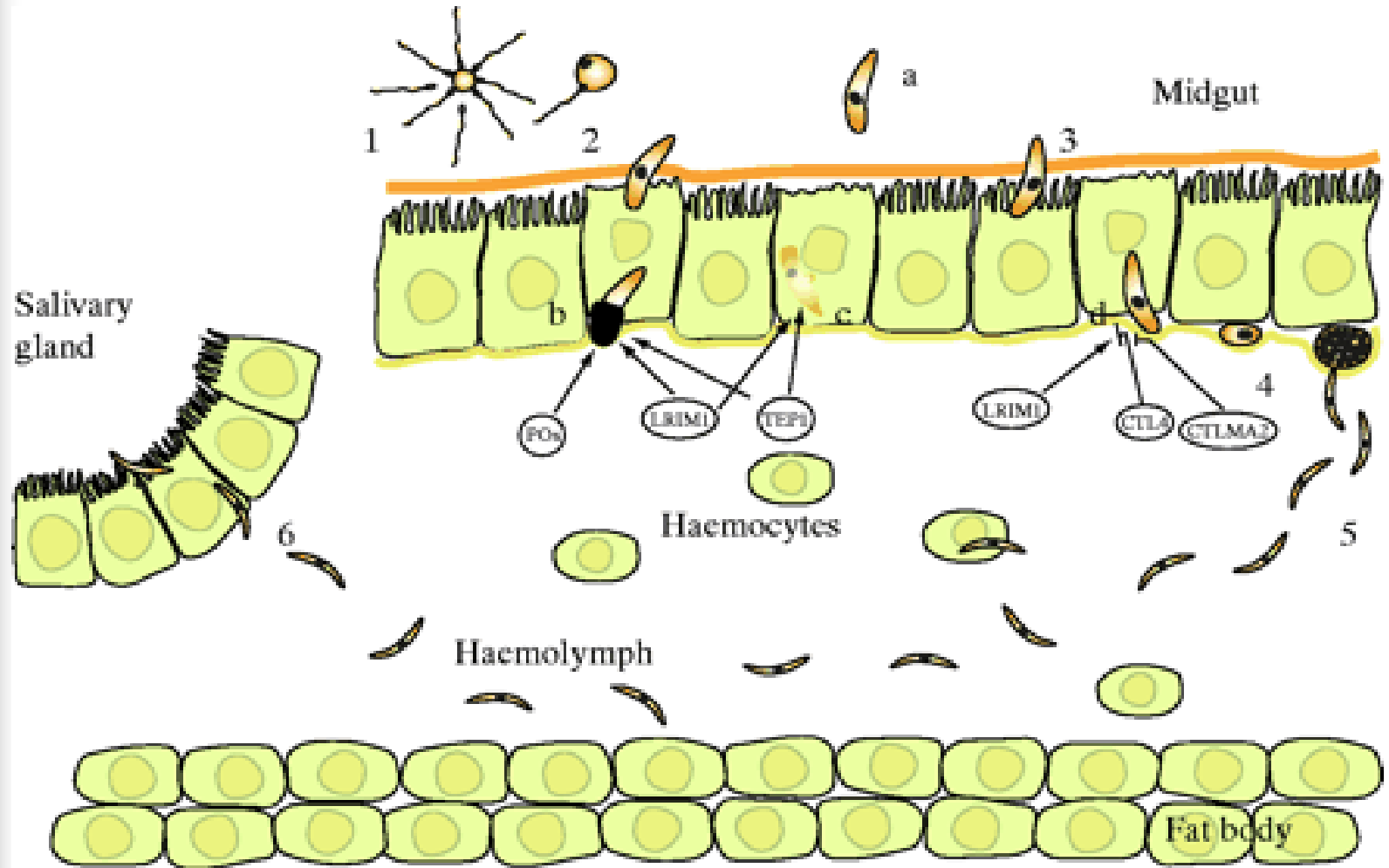
Introduction

- **Motivation: Transmission blocking of the malaria parasite in/at the midgut of the mosquito. The mosquito here is the vector.**
- **Background:**
 - **A number of questions exist (like vector competence) as regards the know how of blocking the transmission of the malaria parasite at these regions.**
- **Aim: Simulate the computational existent of blocking the parasite transmission process in/at the midgut of the mosquito.**
- **Main modeling tool used: Agent Based Model (ABM)**

ABM and Biological Interactions Modeling

- **Cancer is a Complex Adaptive System – Schwab and Pienta, Medical Hypotheses, 1996**
- **ABM built for the Brain tumor cell invasion, what it delivered?**
 - An imaging tool to detect the spread and progression of micro-tumor foci in cancer patients – Zhang *et al.*, Journal of Theoretical Biology, 2007
- **First question we answered: Is Malaria in/at the midgut a Complex Adaptive System?**
 - Consists of relatively independent parts that are interconnected and interactive
 - Capable of forming and changing strategies
 - Change how strongly interactions occurred in a way to maximizes the average fitness of the system

Schematic view of Plasmodium sporogonic (sexual) cycle and mosquito defence reactions during midgut invasion –
Osta et al., Journal of Exp Biol., 2004



Our resulting ABM and Future Work

- **Design a two-phase ABM that simulate the malaria parasite cell invasion actions**
 - **In the midgut (migration and death)**
 - **At the wall of the midgut (migration, proliferation and death)**
- **Implementation of this design is on-going using Java programming on Netbeans Integrated development environment version 6.0**
- **We look forward to using our model to predict answers to questions that will elucidate the know how of blocking the transmission of the malaria parasite**

Conclusion and Acknowledgement

- **Conclusion**

- **Show that the interactions of the malaria parasite with the mosquito in and at the wall of its midgut are complex adaptive system**
- **Design a novel agent based model to simulate these interactions**
- **Ultimately aimed to use our results to model a DDT analog, which can be tagged, the DDT++**

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