# **Predicting movement patterns of Plasmodium sporozoites in the skin of mice**

Our collaborators performed the following experiments. They injected sporozoites, parasites that cause malaria, into skin of mice and imaged movements of these parasites over time with a microscope. The data from these experiments are provided. These experiments were performed several times; different “movies” are for different experiments in which different numbers of parasites were imaged. In the data data, there **(x,y)** positions of each parasite (with a given Parasite ID) over time (in sec). We would like to understand movement patterns of these parasites in the skin. Using a programming language of your choice (R, python, or similar but preferably using open-source languages), write a program and a short report addressing the following tasks/questions:

1. Import these data and plot trajectories for a selected list of parasites.
2. Calculate distribution of average and instantaneous speeds for all parasites, mean squared displacement change with time for all parasites and generate plots of these characteristics.
3. Using machine learning (or other techniques), what movement patterns of the parasites can you detect? How many groups of parasites are there?
4. Can you propose a machine learning-based method to predict movement pattern from a given trajectory data? What is the precision/AUC of your method?

Following these analyses, write a short (up to 2 pages) report that should include figures with informative captions addressing the questions posted. Also submit the code (annotated, so analyses can be repeated) that was used to address these questions (not included in the 2-page limit).