

Project Specification: Animation of Protein Interaction with Lipid Bilayers

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Abstract

This document aims to address the goals, methodology and requirements of the project. The project is based around animating interactions between proteins and lipid bilayers.

1 Problem

Almost all living creatures have cell membranes made up of lipid bilayers. They are only nanometers in width, and are made up of several smaller molecules called phospholipids. The phospholipids have a hydrophilic head and two hydrophobic tails, and form the membrane by themselves. Several proteins interact with lipid bilayers. However, the small size of the bilayer means it is very difficult to observe.

My project aims to create animations to show the interactions between lipid bilayers and proteins. These will be well suited for educating people about these reactions. While some animations for these reactions exist, they are not of sufficient quality and detail. I believe that the project will create better animations that will be of more use.

2 Objectives

There are several goals of the project that must be met to complete the project.

- The first step is to acquire, install and set up the software the project will be using. Two pieces of software are needed for the project. The first is Autodesk Maya. This is a piece of animation software in which the animation will be created. The second piece of software is Molecular Maya, a toolkit built to assist users in creating and animating molecular structures. Autodesk Maya is available for free for students on the Autodesk website, and Molecular Maya is available for download from their

website. I have obtained and installed both pieces of software, fulfilling these requirements. I am using the 2012 version of Autodesk Maya, as that is the latest version that Molecular Maya supports.

- An in-depth understanding of the reactions between the bilayer and proteins will be required in order to accurately represent the reactions. This will be attained through a combination of academic reading and learning from people knowledgeable in the topic.
- A working knowledge of both Autodesk Maya and Molecular Maya will be required for productive work on the project. This will be achieved through a combination of practice and tutorials (both text and video based).

3 Methodology

The project can be divided into two sections. The first section is research. This will be done through a combination of reading literature on the subject, gathering information from the internet and hands-on practice with the software. The information gained and thoughts on the software will be published regularly on a blog I will maintain for the project duration. This allows information to be stored and easily referred back to.

The second stage of the project is the application of the knowledge to create the animations. I will be running Autodesk Maya on Microsoft Windows on my laptop. Save files will be backed up via git to a private repository, as well as to Dropbox. This allows for recovery of the project if the laptop is somehow made unavailable. Each animation will be planned out before starting, with scope for change in case of positive emergent behaviour. To show progress in the research stage of Maya and Molecular Maya, I will be making screencasts using Open Broadcasting Software. These will allow me to document the learning process, and document my workflow and methodology.

4 Timetable

	2	4	6	8	10	Break	2	4	6	8	10	Break
Research	█	█	█	█								
Progress Report				█	█							
Animation One					█	█	█					
Further Animation							█	█	█			
Project Presentation										█		
Final Report								█	█	█	█	█

The first seven weeks of term one will be spent researching both the biology of the interactions between the proteins and lipid bilayers, and the usage of Autodesk Maya (specifically the Molecular Maya toolkit). My starting point for the biological research is Lehninger's 'Principles of Biochemistry'.

The next two weeks of term one will be spent preparing the progress report due in week nine. This will be the conclusion of the research stage of the project, and will result in the presentation of all my research.

The tenth week and Christmas holidays will be spent working on the first animation of the project, which will be the formation of a lipid bilayer from many phospholipids. The workrate will be lowered due to the holidays, so this first animation may extend into the first or second week of term two. The blog will be updated with experiences and observations of the animation process. This will help with the final report.

The first six weeks of term two will be spent on further animations, this time involving protein interactions with the lipid bilayer. Information about this animation will be made available after further research into the protein interactions. During this time, work will begin on the final report of the project. The writing during this time will focus mainly on the research, as the animation will still be ongoing.

The next two weeks of term two (weeks seven and eight) will be spent preparing the project presentation. This will involve collecting information from the blog for use in the slides, as well as any tweaking of the animations for the presentation format.

The remainder of term two and the Easter holidays will be spent completing the final report. The report will be written in LaTeX, and include a full bibliography of all research sources.