ENS – Physics – Project Blurb at UNSW Sydney

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Only very recently has technology been developed to accurately estimate the protein sequence of ancient proteins and then **genetically engineer ancient proteins into bacteria in the present day**.

This knowledge can be used to understand how simple residue changes in one component affect the overall function of a large biological complex. When we understand how mutations between distant parts of a protein are linked, and investigate the order in which those changes occurred, we can draw up a set of *'blueprints'* for directing the evolution of existing molecular machinery into **new machinery with novel function**.

Our focus is on one of nature's oldest rotating parts: the bacterial flagellar motor (BFM). A remarkable piece of bionanotechnology – the BFM is a rotary motor 40 nm in diameter, powered by ion transit across the cell membrane, that operates at an energy efficiency close to 99% and senses concentration gradients in its local environment to navigate bacteria to food.

This project will quantify the key structural and functional changes that occurred during the evolution of the BFM and use this to initialise directed evolution experiments. These experiments will evolve multiple types of molecular motors each with different specificity for their ionic environments. This library of motors will then be used for microfluidic applications where separate motors drive local microfluidic flows in response to their environment.

Timeframe: Feb – June 2019