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Stochastic Modelling of Evolutions of Small Populations

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The aim of my project was to modify and run an already existing MATLAB based program which models a biological population. Since the investigated populations were small (around 100 or less), random events were considered important, and therefore the implemented model had to be stochastic. This model differs from many others in that it simulates two loci (genes) rather than only one, making it much more realistic.

My role in the project was mainly to investigate the effects that different scenarios have on the extinction of a given population. For example, a typical scenario was the following: in a population of 40 individuals, a sudden environmental change (e.g. warmer climate) makes all but a few less fit (e.g. reproduce at a lower rate). How will the population change in the following 50 generations? What is the probability of extinction?

Another major point was to investigate how recombination (the exchange of chromosomes) affects the probability of extinction of the given population. No recombination should be equivalent to commonly used one-locus models. Somewhat surprisingly, in most cases it was found that recombination increases risk of extinction. To explain this, it needs to be understood that recombination is a random process, and as such is undesirable because randomness is what produces extinction. A fully deterministic model would not give any extinctions at all.

Participating in this project taught me many things. I learnt a little bit about genetics and conservational biology. I also saw how mathematics can be applied in other branches of science, and how the diversity in knowledge amongst scientists can be useful when dealing with real world problems.

This vacation scholarship was certainly very interesting, and although different from my honours thesis topic, I hope that I will find the experience very useful when studying for honours.

Ognjen received an ICE-EM Vacation Scholarship in December 2006.
See http://www.ice-em.org.au/students.html#scholarships2007