DNA clues to reproductive behaviour

Different modes of reproduction leave 'signatures' in an organism's DNA sequence.

A species of wild yeast goes through a cycle of sexual reproduction once in every 1,000 asexual generations, according to new research by Imperial biologists published in the *PNAS* journal in April.

The study focused on the wild yeast Saccharomyces paradoxus, which is able to reproduce both sexually and asexually. The scientific team used this yeast to examine how sexual and asexual reproduction cause different types of variations in an organism's DNA sequence. A DNA sequence is like an organism's 'blueprint' - a complete set of chemical instructions needed for it to grow and function.

The researchers analysed the DNA sequences of wild yeast and discovered how infrequently the yeast reproduces sexually by noting the unique 'signatures' sexual and asexual reproduction leave in the yeast's DNA sequence.

When the yeast reproduces asexually a mother cell generates a bud, which becomes detached, creating a new daughter cell, identical to the mother cell. During the budding process, the original DNA of the mother cell is copied, and occasionally mistakes are made, known as mutations. As these mutations occur in every generation, they can be used to distinguish asexual lineages and their total number can be used to estimate the number of asexual generations in a population.

On the other hand, if the yeast reproduces sexually, the mother cell's genetic material undergoes a process of division and recombination to create a new living organism. As a result of this recombining process new combinations of genes can be found in the offspring's DNA sequence, which indicate that the new organism was created by sexual, as opposed to asexual, reproduction.

Isheng Jason Tsai, a postgraduate student in Imperial's Department of Life Sciences, one of the authors of the paper, explains why being able to identify when different reproductive methods have occurred is important:

"Finding the unique signatures left by different types of reproduction on the yeast's DNA gives us valuable insights into the life cycle of this species, which is otherwise very difficult to study. This research has shed new light on the study of microbes, and their patterns of reproduction."

Jason and his colleagues analysed variations in the DNA sequence of one particular chromosome in two populations of the wild yeast Saccharomyces paradoxus.

By analysing the yeast's DNA sequences, the researchers were able to estimate rates of DNA variation caused by asexual reproduction, and rates of DNA variation caused by sexual reproduction. Both these two rates increase with the number of individuals in the population and can be used to estimate population size.

Comparing the estimates from these two different types of DNA variation enabled them to conclude that S. paradoxus goes through a sexual cycle approximately once every thousand asexual generations.

The paper, "Population genomics of the wild yeast Saccharomyces paradoxus: Quantifying the life cycle" was published online on 14 March. It can be downloaded here: http://www.pnas.org/cgi/content/abstract/105/12/4957 .

Source: Imperial College London