

Research Interests

Eukaryotic Genome Evolution (Genetic Interactions Between Cytoplasmic Organelles and the Nucleus)

Honours Projects

The projects will aim to provide a broad experimental and scientific education and experience in molecular genetics. The laboratory is concerned to provide Honours students with strong practical and intellectual support. Many previous participants have used this experience to continue very successfully in many diverse areas of research.

Possible Honours projects: Endosymbiotic evolution

Mitochondria and chloroplasts contain genomes which encode only a small fraction of the proteins required for their biogenesis and function. Most of the genes that were present in the prokaryotic ancestors of these organelles have been transferred to the nucleus during endosymbiotic evolution.

Genes that relocated and became functional in the nucleus were deleted from the organelle genomes, reducing organelle genome size. Early experiments, confirmed by genome sequencing revealed many large contiguous segments of mitochondrial and chloroplast DNA sequences, sometimes even complete organelle genomes that are integrated into the nuclear DNA of many organisms.

The process of organellar DNA transfer and integration – that underlies endosymbiotic gene transfer - is a ubiquitous, ongoing, and natural mechanism that pervades nuclear DNA dynamics (Timmis et al., 2004). As a result of functional gene transfer to the nucleus, cytoplasmic organelle autonomy has been abolished and nuclear complexity and heterogeneity have increased.

Real time experiments in tobacco show that chloroplast DNA transposes to the nucleus at an astonishingly high frequency, suggesting that the process is capable of generating a high level of nuclear and cytoplasmic genetic novelty that must have been a major driver of eukaryote-specific evolution.

The Timmis laboratory has gained international recognition for its contribution in this area.

Possible projects should be discussed in general terms in the first instance.

References

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