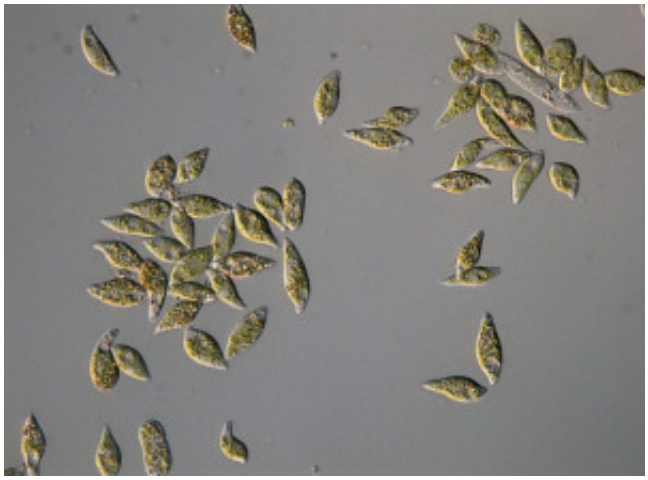
The potential in your pond

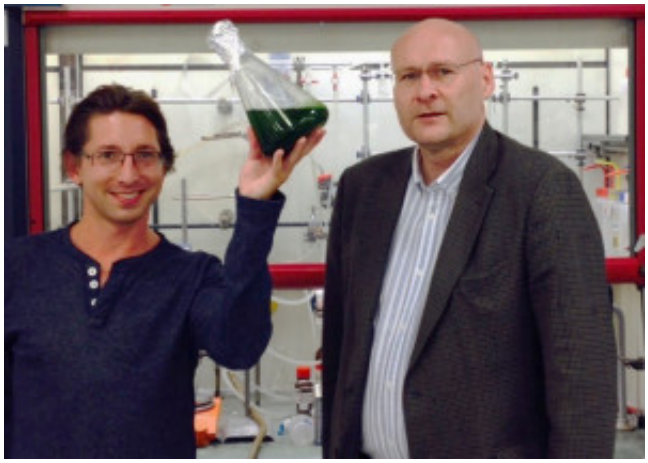
First described over 300 years ago, *Euglena gracilis*, is a single celled algae found in puddles and ponds around the world. This little organism is finding uses from foods to fuels and is even scheduled to be sent into space as part of the Eu:CROPIS mission into sustainable living on Mars and the Moon.



Euglena gracilis – a talented algae

The key to Euglena's survival is its ability to make a wide range of vitamins and minerals and its ability to both photosynthesise and eat other microbes, but the genetic basis of these talents has remained a mystery. Their closest well studied relatives, from which they diverged at least 1.2 billion years ago, are the parasites that cause African Sleeping Sickness in humans, and these live a very different lifestyle.

In order to understand what makes *Euglena gracilis* so special Dr Ellis O'Neill and Professor Rob Field from the John Innes Centre in Norwich have sequenced genetic material from Euglena, in orderto provide information about all of the genes that the organism is actively using. From this analysis, Professor Field and his team projected that Euglena has at least 32,000 active, protein-encoding genes, significantly more than humans who have approximately 21,000. Only a third of these genes were constantly active, while the rest changed depending on the growth conditions. "Around 10,000 genes are switched on when the lights are on and 10,000 switched off, so it's almost as if *Euglena* is two different organisms living in the same chassis," explains Prof. Field. Nearly 60% of the active genes don't match those found in any other organism studied to date, meaning we simply don't know what they do.



Dr. Ellis O’Neill and Prof. Rob Field in the lab with a culture of Euglena

Euglena creates many well-known, valuable natural products including vitamins, essential amino acids and heart-healthy beta-glucans, which are also reported to have anti-HIV and anti-cancer effects. Unexpectedly, there are pathways for the production of complex drug-like molecules, which are completely unknown from this type of organism. Given the usefulness of the compounds we know about, these findings have the potential, with further research, to lead to the discovery of new products including advanced biofuels and new medicines such as antibiotics.

With this many genes to investigate Prof. Field “hopes this landmark research will encourage other scientists to build on our findings with *Euglena*, and other algae, to work out exactly what compounds they make and how we can use them.” In the meantime, Field and his team are now working on the algae that are found of the Norfolk broads. It makes you wonder what other secrets are hidden in your pond.

Publication

The transcriptome of Euglena gracilis reveals unexpected metabolic capabilities for carbohydrate and natural product biochemistry.
O'Neill EC, Trick M, Hill L, Rejzek M, Dusi RG, Hamilton CJ, Zimba PV, Henrissat B, Field RA
Mol Biosyst. 2015 Sep 15