

Evolution & Behaviour

Human gut parasite has a sinister use for its stolen genes

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This Break was edited by Carlos Javier Rivera-Rivera, Scientific Editor- TheScienceBreaker

It is well established knowledge that bacteria routinely [exchange genes](#) between unrelated species, creating an extensive network of information flow independent of sexual reproduction. By acquiring new genes, each being a blueprint for a single protein, the bacteria gain also the functions the proteins perform within the cell. This phenomenon is forcing itself on our attention especially with the spread of antibiotic resistance among bacteria, which is threatening our ability to fight infections. But is swapping of genes important also in more complex organisms like animals, plants, or single-celled [protists](#)? Their DNA might be better protected against change as it is enwrapped in membranes of the nucleus, but it is unclear if this barrier plays a significant role. Answers to this puzzle will have far-reaching implications both for evolutionary theories and practical understanding of diseases. The jury is still out, but new data from a human gut parasite add to the growing pile of evidence that free movement of genes is indeed happening across the whole tree of life.

Roughly one billion people worldwide have their guts infected with a microscopic sphere-shaped protist called [Blastocystis](#) which is distantly related to [kelp](#) and [water molds](#). The parasite often goes unnoticed, but in some individuals, it manifests with severe digestive malfunctions reminiscent of the [irritable bowel syndrome](#). A collaboration of Canadian scientists has now thoroughly sequenced and assembled the complete genetic information of *Blastocystis* and searched it for genes potentially stolen from other organisms, and identified 167 genes which clearly represent recent gains. Most of these genes came from bacteria, often from groups coinhabiting guts of

humans and other animals together with *Blastocystis*, and about 20 originated from more advanced organisms, possibly past hosts of the parasite.

Blastocystis did not gain and retain the genes randomly. The researchers say that most of the genes they identified may provide a direct advantage for the parasitic lifestyle of *Blastocystis*. Some of them are likely involved in scavenging and utilizing nutrients which the parasite finds in the gut environment. Others may serve in evading recognition by the immune system or surviving its attacks. The newly identified genes may therefore be important for the parasite's pathogenesis, in other words, the mechanisms leading to disease. Still a lot of work has to be done before we can talk about practical utilization of this knowledge, but now we know the path. The genes which *Blastocystis* stole and incorporated into its own arsenal may one day provide targets for newly developed drugs, becoming an Achilles' heel of the parasite. The most promising targets are the genes which are also shared with other, unrelated, parasitic protists, since these are evidently crucial for parasitism. By targeting them, the drugs can damage the parasite's interactions with host cells and dampen its ability to invade. These genes may also be safer targets because they came from organisms even more evolutionary distant from humans than the parasite itself, which means a lower risk of side effects for the patient.

Regardless of the future therapeutic applications, the study of *Blastocystis* and its stolen genes has already provided decisive insights into the mechanisms of biological evolution. It is becoming more and more difficult to ignore the importance of gene transfer into,

and between, complex organisms endowed with a nucleus. Stolen genes clearly can benefit the recipients and help them to colonize new environments, including the environments inside a host in the case of parasites.