Redefining life – a new minimal genome

By Rebecca Hall
Friday 29 April 2016

Scientists have created a synthetic bacterium with the smallest genome ever, containing a tiny 473 genes. This effort nudges us one step closer to a complete understanding of the function of every gene in our cells, but the procedures involved have the potential to raise objections.

Technological advances in the last few decades have propelled biology and genetics into the spotlight, epitomised in 2003 when the first human genome, the entire set of genetic information, was published by the National Human Genome Research Institute. Since then, countless genes and genomes have been sequenced, providing seemingly limitless data that can be used to understand how we function.

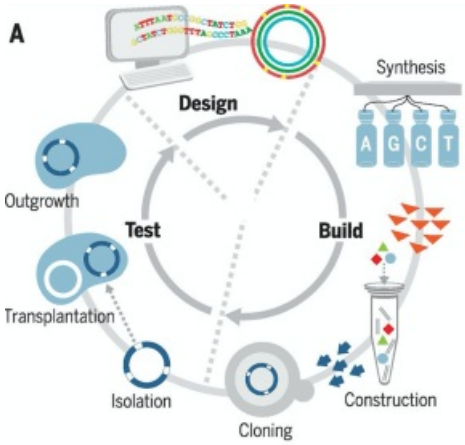

Image: Hutchison et al.

Bacteria with small genomes are useful entities as they contain fewer *non-essential* genes. Identifying *core* genes that are conserved between species is key to figuring out which are required for life. Researchers led by Craig Venter, perhaps best known for his contribution to the Human Genome Project, have taken a novel, synthetic biology approach to addressing this question. Rather than relying on what nature has provided, they decided to build their own tiny genome from scratch.

The scientists designed a 531 kilobase (kb) genome and introduced it into a synthetic bacterium, a huge reduction on the efforts in 2010 that produced a 1079 kb genome. Dubbed JCV-syn3.0, this organism has 473 genes, 149 of reportedly unknown function. By way of comparison, the gene content of *E. coli* is over 4000. Despite the scientific achievements, techniques such as this are not always welcomed warmly.

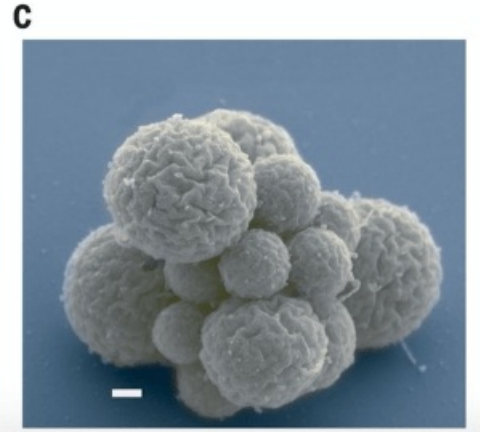

Image: Hutchison et al.

A key concern is that Venter's work might be *playing God*. That remains to be seen, but the line between life as we know it, between living and non-living, is becoming increasingly blurred. This work has real potential to advance our understanding of the role of our genes, many of which are still unknown. Their goal is to reduce this genome size even further, possibly by removing some of the genes of unknown function, to a point at which they can state with certainty that the only genes remaining are ones essential for life. However you view the principle, the science is undoubtedly brilliant and its potential cannot be ignored.

Hutchinson *et al.*, *Science,*

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