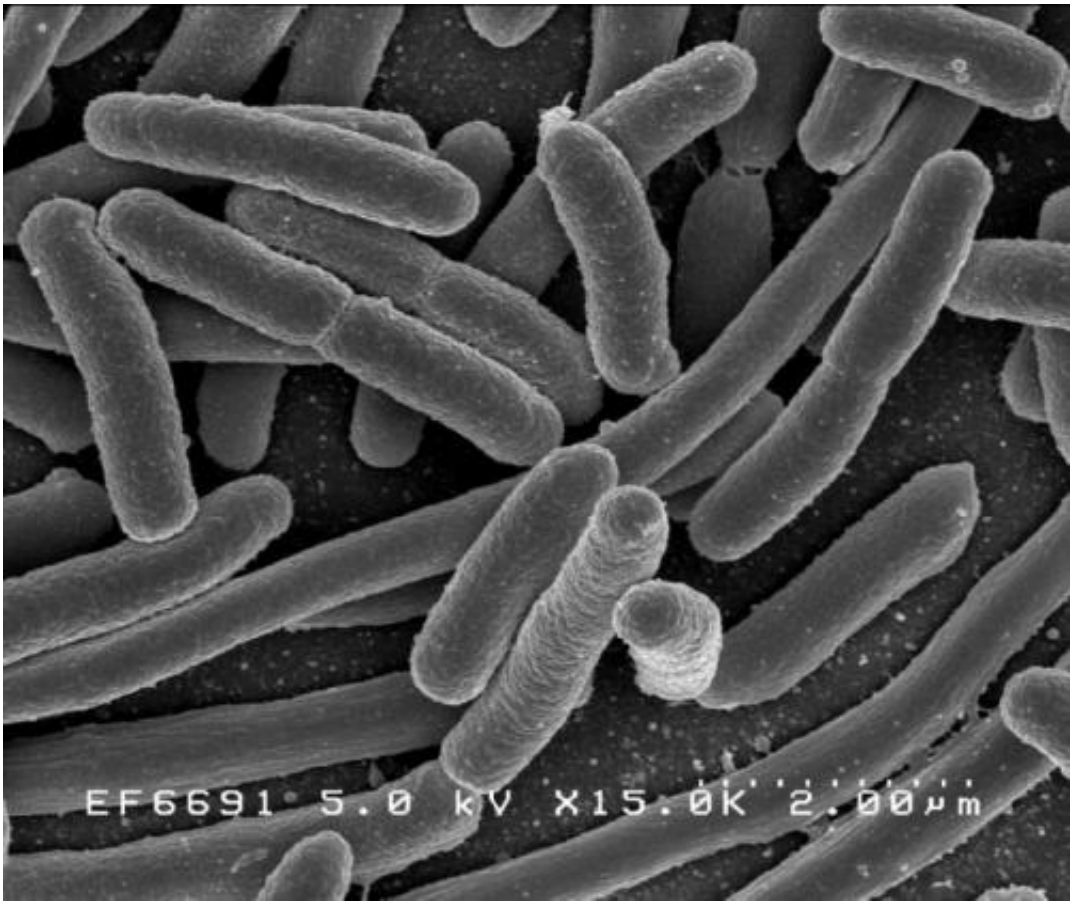
Researchers replace the genes of E. coli bacteria with synthesized genome

May 16 2019, by Bob Yirka



Escherichia coli. Credit: Rocky Mountain Laboratories, NIAID, NIH

A team of researchers at Cambridge University has replaced the genes of *E. coli* bacteria with genomes they synthesized in the lab. In their paper published in the journal *Nature*, the group describes replacing the

genome and removing redundant genetic codes.

The genetic code is the program of life—its arrangement leads to protein creation that controls the functions inside cells. The genome of any given organism is quite complex, yet it is based on just three sets of DNA bases. Each of the three can hold just one of four bases, which means there are just 64 possible combinations. But there are only 20 amino acids, which means there must be some codes in a given genome that are not needed. Prior research has shown that at least some of those codes are used as backups (redundancies) while some are used for other purposes, and many are not yet understood. In this new effort, the researchers had two goals: The first was to synthesize the genome of an *E. coli* bacterium in their lab—all four million letters of it. The second was to find out what would happen to such a specimen if some of its DNA redundancies were removed.

The researchers report that they achieved both objectives by recoding the *E. coli* DNA on a computer with multiple redundancies removed. Once the desired genome was redesigned, it was split up and sent to a DNA synthesizer. The output from the DNA still needed tweaking, however, which meant the team had to stitch together smaller pieces into longer ones before it could be put into a living *E. coli* bacterium—they named it Syn61 because only 61 of the 64 possible codes were used.

The researchers report that it took longer for the special bacterial specimen to grow, but other than that, it behaved just like unedited specimens. They suggest that in future efforts, it might be possible to replace the redundancies they removed with other sequences to create bacteria with special abilities, such as making new types of biopolymers not found in nature.

More information: Julius Fredens et al. Total synthesis of Escherichia coli with a recoded genome, *Nature* (2019). DOI:

10.1038/s41586-019-1192-5