Technology takes a step forward in genetic research

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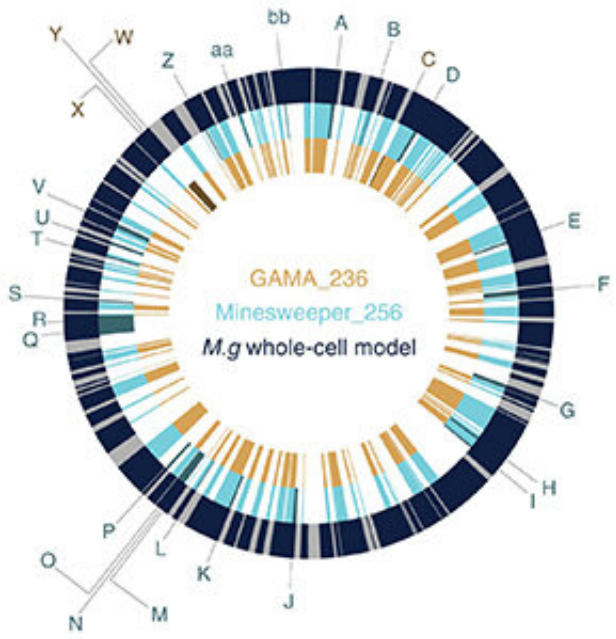

Comparing the initial genome (outer ring) to two smaller versions produced using supercomputers. Credit: University of Bristol

New research brings combined computational and laboratory genome engineering a step closer following the design of smaller and smaller genomes, to advance genetic manipulation, using supercomputers by researchers at the University of Bristol.

Genomes are the complete set of genes or genetic material within a cell or organism. These building blocks of DNA are quantified by counting their number of base pairs. The size of genomes can be vast and vary across different types of organisms, from a bacterium with 160,000 base pairs (Carsonella ruddi) to humans, with three billion base pairs (Homo sapiens). Genetic variety is still being explored and gene functions understood within biology.

By minimizing genomes, researchers can understand better what each gene does within a cell. Previous genetic research has created smaller genomes which can be chemically grown within the lab (Hutchison III et al.). However, the research published in *Nature Communications* has found a way to design a smaller genome, using a computer to do it.

Computational methods for designing genomes are scarce. However, algorithms run on Bristol's supercomputers have allowed the researchers to design a genome which is smaller, simpler, and can be easily manipulated. The research team tested designs within a computerized cell model to see if the cells are able to grow and divide. The researchers plan to apply designs like these within real cells in the future. This will allow them to discover how advanced this technology really is.

Making smaller genomes with a computer can contribute to researchers understanding of their properties and using computational methods to manipulate genetics is a technological step forward.

Professor Claire Grierson, Head of the School of Biological Sciences and senior author of the paper, said: "The work has implications beyond making smaller genomes. If we can use supercomputers to design a smaller genome, then we can get them to design cells to do anything we like.

"Perhaps we can design cells that turn cheap waste material into

feedstock or make a specific medicine. This is exciting for the future of cell design."

The research highlights the powerful potential of computer designing genomes, which can be manipulated for varying purposes. However, as with other genetic technological advancements, there is need for ethical oversight. With new technological power comes new responsibilities.

More information: Joshua Rees-Garbutt et al. Designing minimal genomes using whole-cell models, *Nature Communications* (2020). DOI: 10.1038/s41467-020-14545-0

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