37 HiHA Seminar

Hiroshima Research Center for Healthy Aging (HiHA)

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HIROSHIMA UNIVERSITY

Synthetic Biology Approach towards Creation of an Organism with a New Genetic Code

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Summary

Recoding—the repurposing of genetic codons—is a powerful strategy for enhancing genomes with functions not commonly found in nature. I will discuss the computational design, synthesis, and experimental progress toward assembly of a 3.97-megabase, 57-codon Escherichia coli genome in which all 62,214 instances of seven codons are being replaced with synonymous codons across all protein-coding genes. Our testing of 55 segments of about 50-kilobases showed that 63% of the recoded genes have been validated. We found 91% of the tested essential genes retained functionality with a limited fitness effect. We demonstrate identification and correction of lethal design exceptions, only 13 of which were found in 2229 genes. This work underscores the feasibility of rewriting genomes and establishes a framework for large-scale design, assembly, troubleshooting, and phenotypic analysis of synthetic organisms.

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