特別講演（講義）のお知らせ

20230721 (Fri) 11:00-12:10 大阪公立大，杉本キャンパス，田中記念会館ホール

Design, Construction, and Analysis of a Semi-Synthetic Minimal Bacterial Cell

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The minimal cell is the hydrogen atom of cellular biology. Such a cell, because of its simplicity and absence of redundancy, would be a platform for investigating just what biological components are required for life, and how those parts work together to make a living cell. Since the late 1990s, our team at the Venter Institute has been developing a suite of synthetic biology tools that enabled us to build what previously has only been imagined, a minimal cell. Specifically, a bacterial cell with a genome that expresses only the minimum set of genes needed for the cell to divide every two hours that can be grown in pure culture. That minimal cell has about half of the genes that are in the bacterium on which it was based, *Mycoplasma mycoides* JCVI syn1.0, the so-called synthetic bacteria we reported on in 2010. We used transposon bombardment to identify non-essential genes, and genes needed to maintain rapid growth in *M. mycoides*. Those findings required re-design and re-synthesis of some reduced genome segments. Three cycles of design, synthesis, and testing, with retention of quasi-essential genes, produced synthetic bacterium JCVI-Syn3.0 (531 kb, 474 genes), which has a genome smaller than that of any autonomously replicating cell found in nature. Synthetic bacterium JCVI-Syn3.0 retains almost all genes involved in synthesis and processing of macromolecules. Surprisingly, it also contained 149 genes with unknown biological functions, suggesting the presence of undiscovered functions essential for life. This minimal cell is a versatile platform for investigating the core functions of life, and for exploring whole-genome design. Since it was initially reported in 2016, we have identified functions for about 65 of the original 149 genes of unknown function. These findings have been used to create flux balance analysis and kinetic whole cell computational models of our minimal cell that replicate laboratory observations about our minimal cell. Additionally, we have used JCVI-syn3.0, which has an abnormal cell division and cell morphology phenotype, and a JCVI-syn3.0 mutant containing an additional seven non-essential genes that has divides normally and looks like wild type *M. mycoides* to investigate how modern cell division and cell size control might have evolved.

ヒトゲノムで知られる米国クレイグベンター研究所では，生命の理解を目指して，ゲノム DNA の化学合成，入れ替え，コンピューターデザイン，など合成生物学の分野でも際立った成果をあげて来ました．特に 2016 年に発表したミニマル合成細菌 syn3.0 は世界に大きな衝撃を与えました．今回，合成生物学チームリーダーの Glass 教授が研究の経緯と今後について，広範な視聴者を対象に講演します．この機会をお見逃しなく．（世話人：宮田真人 miyata@omu.ac.jp）