



CDE international seminar #06

(ERATO Evolving Symbiosis Project International Seminar Series #03)

June 11th (Fri), 9:00am~ (Japan time) [Lang: English]

Prof. John Glass

(J. Craig Venter Institute, USA)

Website of Prof. Glass: <https://www.jcvi.org/about/john-glass>

Design, construction, and analysis of a synthetic minimal bacterial cell

Click this URL for registration (free event)

<https://bit.ly/3op8RMs>

(Zoom URL will be sent to you based on the registered information)

- Abstract -

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 50 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 *Mycoplasma mycoides* to investigate how modern cell division and cell size control might have evolved. This work was supported by Synthetic Genomics, Inc., DARPA Living Foundries contract HR0011-12-C-0063, and the J. Craig Venter Institute.

[領域代表より、抜粋] (原文はHPをご覧ください)

過去半世紀の間、生物の進化についての私たちの理解はどれほど深まったのだろうか。いま目の前にいるちっぽけな虫のかたちすら満足に説明してくれない。進化に関する私の理解はあの頃とあまり変わってはいない。さりとて、このままでよいとも思わない。いよいよ謎を解くべく、何かを始めなければならない。動植物のかたちがなぜこのようなものでなければならないのか、そしてそれが洗練されて行く過程にどのように合目的性が入り込むのか、自然選択説や中立説を包含するのみならず、それらが扱うことのできなかった本質的要素を統合することを通じ、本領域は進生物学の新たな理論体系の構築を目標とする。この試み自体、進生物学領域における梁山泊であり、自ら新たな潮流となり、進化研究を変える第一歩ならんと欲するものである。
<http://constrained-evo.org/greeting.html>

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- ERATO NOMURA Microbial Community Control Project
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- Grant-in-Aid for Scientific Research on Innovative Areas "Constrained & Directional Evolution"

For all of you who are interested in Evolutionary Biology

We are happy to announce open, online international seminar provided by the research project "Constrained and Directional Evolution" (led by Dr. Shigeru Kuratani).

The aim of this open seminar is to share and discuss over the challenging topics in evolutionary biology, such as Evolvability, Constraints, Directionality in phenotypic evolution etc., and to boost interactions between scientists interested in these topics. It's an open seminar with participation free of charge, and we welcome your participation (Students, Postdocs, Pls etc.)

[Greeting from the chair of this project]

How much has our understanding of biological evolution improved in the past half century? Not even the shape of the tiny insect in front of us now can be satisfactorily explained. My understanding of evolution has not changed much since then. I do not think it's the way it should be. It's good enough. At last, it's time we start doing something to solve the mystery.

Why should the shapes of plants and animals be the way they are? How does purposefulness explain the process of these refinement of shapes? This project aims to construct a new theoretical system of evolutionary biology by not only encompassing natural selection and neutral theories but also integrating essential elements that previous theories failed to address. We hope that this attempt will provide a place for gathering bold challengers, and further leads to a new trend in the field of evolutionary biology.
<http://constrained-evo.org/greeting.html>

進化にご興味のある全ての皆様へ

新学術領域「進化制約方向性(倉谷代表)」公開オンラインセミナーのお知らせです。表現型進化の方向性、拘束、進化可能性といった概念や問題について、考え、議論したり新たな考えや人の相互作用をもたらすための不定期で行う国際オンラインセミナーです(公開。参加費無料)。フランクなオンラインミーティングです。大学院生の方々も広くご参加いただけましたら幸いです。近くに興味を持たれそうな方がおられましたらお声がけいただけると幸いです。