Evolutionary Theory for
CONSTRAINED & DIRECTIONAL EVOLUTION
Grant-in-Aid for Scientific Research on Innovative Areas
新学術領域　進化の制約と方向性

http://constrained-evo.org

13th CDE international seminar (Fukatsu ERATO #07; online)

September 28th (Tue), 9:00-10:00 (Japan time) [Lang: English]

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Mechanisms of reproductive parasitism: How CI operons function, evolve, jump, and die

Click this URL for registration (free event)
https://www.jst.go.jp/erato/fukatsu/news/2021/210928.html
(Zoom URL will be sent to you based on the registered information)

- Abstract -

Wolbachia are obligate intracellular bacteria. They are the most common known insect endosymbiont. One cause of their abundance is reproductive manipulation. Wolbachia cause cytoplasmic incompatibility (CI). The CI phenotype was first observed in the 1930?s and characterized in the 1960?s. Recent discoveries have identified two gene operons that induce CI. The operons behave as a toxin antidote (TA) systems. The toxin has either deubiquitylating or nuclease enzymatic domains that induce the CI phenotype; in some cases both enzyme domains are present. Recent proteomic studies have identified nuclear import factors (karyopherins) and protamine histone exchange chaperones (P32) as target substrates. The operons that induce CI have also been found in close sister bacteria Rickettsia and Orientia. In Rickettsia the operons appear on plasmids which suggests that CI evolved from a simple plasmid TA system. Furthermore, the operons are capable of horizontal gene transfer and have recently “jumped” into pathogenic Orientia tsutsugamushi. The Orientia operon is active when tested in transgenic Drosophila models. Notably, Trombiculid mite vectors exhibit Orientia dependent parthenogenesis. This observation suggests a new hypothesis that parthenogenesis induction and CI might share a common mechanistic foundation, built upon these operons. Finally, evolutionary theory predicts that selection does not maintain these operons, once fixed in a population. However, they persist in nature by “jumping” to new organisms. Operons that do not jump eventually psuedogenize by N-terminal deletions in the toxin gene and/or mutations reducing toxin enzymatic efficiency.

[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、本領域は進化生物学の新たな理論体系の構築を目論む。この試み自体、進化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。
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- ERATO FUKATSU Evolving Symbiosis Project
  https://www.jst.go.jp/erato/fukatsu/

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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, PIs 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.
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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。