Evolutionary Theory for
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新学術領域　進化の制約と方向性

CDE international seminar (online)

7th: June 11th (Fri), 17:00-18:00 (Japan time) [Lang: English]

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https://www.embl.de/research/units/dev_biology/arendt/index.html

Building bilaterian brains: The evolution of associative and motor centers

Click this URL for registration (free event)
https://forms.gle/7fR6Kxx4Y9fstnR99
(Zoom URL will be sent to you based on the registered information)

- Abstract -

The emergence of the bilaterian brain is one of the remaining mysteries in animal evolution. In recent years, single-cell transcriptomics have allowed to elucidate the identities of neuron types in the brains of several bilaterians, sort them into major families, and compare them across bilaterians. While most of these studies so far focused on the neuron types and neuron type families of the mammalian brain and more recently also of the fly brain, we have now characterized all neurons in the brain of the 6-days-old young worm of the nereid, the marine annelid Platynereis dumerilii. For this, we align a cellular gene expression atlas to the segmented cells of a whole-body volume electron microscopy dataset covering an entire young worm, and trace randomly selected neurons for all brain ganglia (Vergara et al., Cell in press, 2021).

Capitalizing on this unique multimodal atlas, we identify several components of the nereid brain that are also present in other animals and thus allow reconstructing the basic composition of the bilaterian brain. First, we characterize the neurons that innervate the sensory appendages of the annelid head; that is, antennae, palpae and peristomial cirri. We show that the antennal, palpal and cirral ganglia are serially homologous to the peripheral sensory ganglia of the trunk and thus form part of a sensory-motor girdle that forms the core of the central nervous system. Second, the nereid brain harbors a huge unpaired dorso-posterior ganglion with sensory cells directly innervating the neurosecretory plexus in the dorsal brain (see also Tessmar-Raible et al, 2007; Williams et al 2017). Third, we reveal the cellular composition and molecular anatomy of the mushroom bodies, the presumed associative centers of the nereid brain. Unexpectedly, we find that all three pairs of mushroom body calyces harbor bipolar sensory neurons that innervate the neurosecretory plexus. Furthermore, proliferative mushroom body cells uniquely co-express lhx6, arx, dlx, and nkx2.1, reminiscent of GABAergic inhibitory cells of the vertebrate telencephalon and hypothalamus. We propose that similar cells existed in bilaterian ancestors, and that the integration of neurons forming part of the sensory-motor girdle, the neurosecretory centre, and of lhx6+, arx+, dlx+ (LAD) interneurons was key to the emergence of the associative and motor centers in the bilaterian brain.

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。

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.
http://constrained-evo.org/greeting.html

[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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