Frontiers in Science – a luncheon seminar supported by HFSP
ヒューマン・フロンティア・サイエンス・プログラムへの招待：
HFSP が拓く生命科学の最前線

Chair: Prof. Nobutaka Hirokawa, President of HFSPO
廣川信隆（HFSPO 会長／東京大学）

Organizer: HFSPO

Symposium moderator: Tadashi Uemura (Kyoto University)
上村匡（京都大学）
Gohta Goshima (Nagoya University)
五島剛太（名古屋大学）

11. December 2012; 11:40 – 13:00

Abstract:

The Human Frontier Science Program (HFSP) is an international funding program that supports collaborative research among scientists in different countries, and provides postdoctoral fellowships. It also supports the postdoc-young investigator transition as HFSP Fellows seek scientific independence in setting up their first laboratories. The aim of HFSP is to support frontier research in biology with topics ranging from biomolecular studies to higher cognitive functions. Funding is available for basic research in the life sciences and emphasizes participation of applicants who employ mutidisciplinary approaches. In this Symposium, HFSP awardees will present their current research and discuss the importance of international collaborations.

This symposium is supported by MEXT (Ministry of Education, Culture, Sports, Science and Technology - Japan) to invite Dr. Tobias Walther and Dr. Kentaro K. Shimizu.

ヒューマン・フロンティア・サイエンス・プログラム（HFSP）は、基礎生命科学の世界的発展を願い、1987 年に我が国が提唱して設立された国際研究支援財団です。これまでに、数多くの日本人ポスドクや PI の研究活動を支援してきました。世界に先駆けて設立当初より、物理や工学など他の学問分野との連携や、国際共同研究の発展を推進しており、世界各国から極めて高い評価を受けています。世界的に厳しい財政状況が続く中、HFSP は基礎研究に勤しむ研究者の希望の光として、現在も燦然と輝いています。本シンポジウムでは、まず HFSP をご紹介してぜひ一人でも多くの大学院生、ポスドク、そして PI の皆さんにご応募して頂くと共に、HFSP の支援を受けユニークな研究を展開された２名の気鋭の研究者に講演をお願いしました。好奇心から始まって科学的に重要な発見に至るという純粋基礎研究の醍醐味を、お弁当片手に堪能していただければと思います。

Tobias Walther 氏と清水健太郎氏を招聘するに当たって、文部科学省の支援を頂いています。

Program:

11:40 – 11:50	**Welcome remark** Nobutaka Hirokawa, president of HFSPO/University of Tokyo 廣川信隆（HFSPO 会長／東京大学）
11:50 – 12:00	**Introduction: HFSP funding for frontier research in the life sciences** 廣川信隆（HFSPO 会長／東京大学）
12:00 – 12:25	**The Many Phases of Fat: Cell Biology of Lipid Droplets** **脂肪百面相：脂質滴の細胞生物学** Tobias Walther, Yale University
12:25 – 12:50	**Polyploid speciation and adaptive evolution studied by next-generation sequencing** **次世代シークエンサーを活用した倍数体種分化と適応進化の研究** Kentaro K. Shimizu, University of Zürich 清水健太郎（チューリッヒ大学）
12:50 – 13:00	**Discussion**

The Many Phases of Fat: Cell Biology of Lipid Droplets
脂肪百面相：脂質滴の細胞生物学
Tobias Walther
Department of Cell Biology, Yale School of Medicine, New Haven, CT, USA

Most cells store excess metabolic energy in the form of fat that is stored in cytosolic *Lipid Droplets* (LDs). LDs function at critical points of cellular physiology: Not surprisingly therefore, LDs are involved in many common diseases, such as metabolic syndrome, fatty liver disease, atherosclerosis and obesity. Despite their almost universal presence and links to common human pathologies, many basic questions about LDs are unclear. LDs thus provide both great challenges and opportunities for cell biology. Within this field, we specifically address how lipid droplets are built, how they grow, how they contribute to the organization of biochemical pathways and how lipids get stored and utilized there. Building on cell biological discoveries, we connect mechanistic studies of LDs with their important functions in disease.

Polyploid speciation and adaptive evolution studied by next-generation sequencing
次世代シークエンサーを活用した倍数体種分化と適応進化の研究
Kentaro K. Shimizu[1], Reiko Akiyama[1], Rie Shimizu-Inatsugi[1], Jun Sese[2], Aika Terada[2], Satoru Akama[2], Angela Hay[3], Hugo Hofhuis[3]
[1]University of Zurich, Switzerland, [2]Tokyo Institute of Technology, Japan, [3]Oxford University, UK

With the support of HFSP, we are studying network merge of duplicate genome function in recently hybridized species, through interdisciplinary collaboration integrating evolutionary genomics, informatics and developmental genetics. Although origin of species has been a central topic in biology since Darwin (1859), little is known about the molecular basis how a new species exploit a new environmental niche. Polyploidization, or genome duplication

with hybridization, is a major mode of speciation in animals, fungi and plants. We have shown that polyploidization occurred recurrently in *Arabidopsis* and its related genus *Cardamine*, and that polyploid species appeared repeatedly by the genomic fusion of species from different habitats. Notably, during the 20th century, a new polyploid *Cardamine insueta* emerged in the Swiss village of Urnerboden, providing a unique opportunity to study speciation *in situ*. A major obstacle to study polyploid species has been the difficulty to distinguish the expression of duplicated genes (or homeologs) due to high sequence similarity. By exploiting next-generation sequencers and new algorithms, the expression levels of homeologs were quantified separately. The data suggested that gene networks for stress responses unique to each parent are safeguarded in the polyploid species enabling them to exploit fluctuating or intermediate habitats.