

INTRODUCING A CENTER

The Center for Quantitative Biology at Peking University

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Received January 30, 2014

OVERVIEW

In the 21st century, scientific research is becoming more and more interdisciplinary. New discoveries are often made at the boundaries of different disciplines. Biology is entering a new era in which quantitative measurements and mathematical modeling play increasingly important roles in understanding and predicting biological behavior. Facing this challenge and opportunity, the Center for Quantitative Biology (CQB, formally the Center for Theoretical Biology) was established in 2001, with the support of the Nobel Laureate Prof. T. D. Lee and the leadership of Peking University. As part of PKU's strategic initiative in enhancing interdisciplinary research, CQB is dedicated to research and education at the interface between the traditional more quantitative disciplines (such as mathematics, physical sciences, engineering, computer science) and the biological sciences. CQB has a proficient teaching and research team, comprising of prominent members with outstanding achievements in various fields of physics, chemistry, life sciences, biotechnology and mathematics. Up to 2015, CQB has 16 principal investigators, including one member of the Chinese Academy of Sciences, one recipient of the "Thousand Talent Plan", two "Cheung Kong Scholar" Chair Professors, three "Cheung Kong Scholar" Visiting Professors and three recipients of the "Thousand Young Talent Plan". More than 50 graduate students and 4 postdoctoral fellows are currently enrolled in CQB.

RESEARCH

Current research areas of CQB include: (i) systems

biology; (ii) synthetic biology; (iii) computational biology and bioinformatics; (iv) disease mechanism and drug design from a system biology perspective. The goal of CQB is to become a leading research center in the field of system biology and to promote the development of quantitative life sciences. In recent years, CQB received a number of major funding supports from the Ministry of Science and Technology of China and the National Natural Science Foundation of China. Exciting and cutting-edge researches are being carried out at CQB, some of which have been published in prestigious journals such as *Cell*, *Science*, *Nature Chemistry*, *PNAS*, *PRL*, *JACS*, *Angew Chem*.

EDUCATION

Education has always been a priority of CQB. We made notable progress in quantitative biology course development for both graduate and undergraduate students. CQB not only provides basic courses, but also develops innovative training programs with new concepts and models. For example, in the course "Selected Papers in Quantitative Biology", the lecturer presents background materials and spends most of the time stimulating and steering the discussion on chosen classic papers. In this course, the students are encouraged to take over and lead the discussion. To face the challenge of interdisciplinary research, before joining a research group, each graduate student needs to rotate in three laboratories of different disciplines. The prescribed coursework along with the laboratory experience ensures that the students obtain solid knowledge required for their future research. The CQB has established a stimulating scientific culture of open discussion, idea exchange and collaboration for

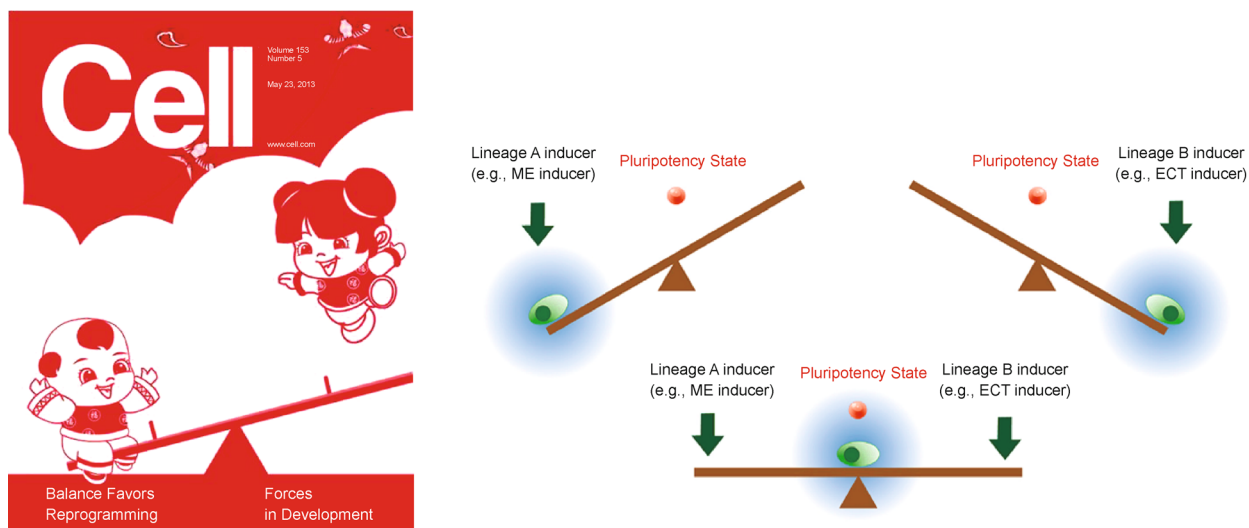


Figure 1. The “Seesaw Model” of maintain and change of cell fate (Reprinted from *Cell*, Shu et al. Induction of pluripotency in mouse somatic cells with lineage specifiers, 2013, 153(5), 963–975, with permission from Elsevier; Cited 55 times).

faculties and graduate students. Together with the Center for Systems and Synthetic Biology at the University of California at San Francisco (UCSF), CQB organized the first brainstorming workshop in 2012, which aims in stimulating students’ independent scientific thinking. In 2013, Prof. Q. Ouyang, deputy director of CQB, hosted the second brainstorm event of Peking University. And in 2014, the third brainstorming workshop, “IIAS-PKU Workshop on ‘Strategies & Design Principles in Cellular Complex Systems’”, was jointly organized with the Israel Institute for Advanced Studies (IIAS) and was held in Jerusalem, Israel.

Up to now, more than 50 students in CQB successfully graduated and obtained PhD degree. Many of them continued research activities in world-class universities and institutions, and achieved exciting scientific progress. After finishing their postdoc training, some of them already started their independent position in China with the support of “Thousand Young Talent Plan”.

For the undergraduate training, the CQB hosts the integrated science program (ISP), which is a revolutionary new science curriculum for undergraduate training in Peking University. Different from traditional programs, ISP breaks boundaries between disciplines and designs a series of new courses. The best teachers at Peking University from different departments are invited to design new courses integrating two or more disciplines and to teach the students in ISP. Faculties at CQB routinely host undergraduate students for their research activities. Since 2007 CQB has been the home for the PKU International Genetically Engineered Machine (iGEM) team. GEM competition is an international program that aims at encouraging undergraduate students to think and perform research activities independently. Many of Peking iGEM’s award-winning projects have been published in *Molecular System Biology* (2012), *ACS Synthetic Biology* (2012), *Quantitative Biology* (2013), and *Nature Communication* (2014).



Figure 2. The “IIAS-PKU Workshop” in Jerusalem.



Figure 3. Peking iGEM club.

ACTIVITIES

The CQB has been very active in international collaborations. Besides the CQB Annual Symposium, CQB has organized 1–2 international conferences each year since 2001. For example, in 2013, CQB hosted the conference “Microfluidics and Quantitative Biology”. In 2014, CQB hosted the conference “Breaking Barriers, from Physics to Biology (II)” and organized “The First International Young Scholars Systems and Synthetic Biology Symposium”. With the symposium of young scientists, CQB hopes to build a bridge for young scientists who are interested in research opportunities in China, especially in CQB at PKU. Furthermore CQB has several joint centers and regularly hosts short and long term international visitors.

PERSPECTIVE

In the past decade, CQB has accumulated much



Figure 4. 2014 CQB Annual Symposium.

experience on the research and education at interdisciplinary science. CQB’s mission is to promote research, education, international exchange and collaboration at the interface of physical and biological sciences and to become a leading international center for the emerging interdisciplinary field of Quantitative Biology.