

## Evolution of genes and genomes: an emerging paradigm in life science

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Traditional molecular biology, defined in a broad sense to include most of life science research that focuses on single or a few genes to understand their functions and application values to medicine and agriculture, has generated interesting and important accomplishments. Meanwhile, in recent years, a new paradigm is emerging in biological research that further adds new approaches and new dimension of scientific problems to the well developed areas based on molecular research. In this emerging paradigm, the dimension of evolution with its fundamental scientific problems and analysis means, the large scale of data from genomic research and sophisticated computational techniques were introduced and combined to solve biological problems. Emergence of the new paradigm is changing the ways biologists view the world of life and the ways to organize research of life sciences. It would be hardly possible to find an advanced research institute or advanced fields that do not contain the new paradigm or at least its components.

We are editing this special issue, entitled “Evolution of genes and genomes”, to further disseminate, advocate and promote the research of life science by introducing the new paradigm. We invited 14 research groups from major research universities and institutes to report their original research reports, elaborate on their opinions and perspectives on the various issues regarding evolution of genes and gen-

omes. These articles cover major fields, including molecular evolution, genome evolution, human population genetics, medical genomics and genetics, plant biology and evolution, genomic evolution of fishes, evolution of gene functions, and networks of gene interactions. The time scale of evolution includes both macro- and micro-scales of time, i.e. the long time scale for divergence of species and the population genetic time scale within species such as human populations.

We expect that the paradigm as implicated in these papers would further encourage the exploration for conceptual progress and mechanistic understanding of increasing magnitude of picture underlying interesting scientific problems. We hope that publication of these papers can provide an opportunity to further stimulate the development of new paradigm and to combine their research components with conventional molecular and applied research. We also anticipate that the presented studies from cross-disciplinary efforts that cover several major fields in life sciences as shown in this issue would promote collaboration and interaction among researchers from diverse expertise to find and solve challenging scientific problems that are not easy to solve in a single approach.

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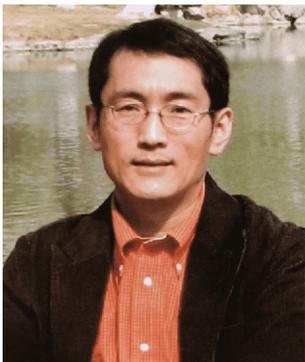
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**Compliance and ethics** *The author(s) declare that they have no conflict of interest.*

### Biographical sketch



Dr. Manyuan Long is the Edna K Papazian Distinguished Service Professor at the University of Chicago in its Department of Ecology and Evolution and the College. He is interested in origination and evolution of new genes and related problems in molecular and functional evolution. He started his research of new genes in the graduate school at University of California at Davis in the early 1990s and joined the Chicago faculty in 1997 after four years of postdoctoral research in Departments of Molecular and Cellular Biology and Organismic and Evolutionary Biology at Harvard University in the laboratories of Walter Gilbert and Richard Lewontin. Currently, he is fascinated in molecular mechanisms, evolutionary processes and adaptive and non-adaptive evolutionary forces underlying rapid origination of new functions and phenotypes in human and *Drosophila*, using experimental, computational and theoretical approaches.



Dr. Bairong Shen is the professor of medical informatics and systems biology in the West China School of Medicine and the West China Hospital, Sichuan University, in its Institutes of Systems Genetics. Trained as a scientist initially in surface chemistry at Fudan University in the early 1990s, he eventually marched to emerging new fields of bioinformatics and systems biology by teaching and self-teaching at Tampere University in Finland as an assistant professor. He started and headed the Center for Systems Biology at Soochow University from 2008 to 2018 when he moved to Chengdu to join the West China School of Medicine and West China Hospital. His scientific interests include characterization of molecular networks and disease markers, development of new bioinformatics tools and exploration of medical informatics.