Yongsen Ruan

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Biography & Research Interests

I obtained my BSc in biotechnology from the Sun Yat-sen University in 2015. And in 2020, I completed my PhD in biochemistry and molecular biology (advisor: Prof. Chung-I Wu) at the Sun Yat-sun University. During my PhD studies, I became much interested in the theoretical population genetics and specialized in computational biology and mathematical modelling. My PhD's work is focused on the integration of theoretical population genetics and computation models with genomic data of cancer and normal tissues. I'm interested in exploring how mutation, selection, migration and other evolutionary driving forces to affect tumorigenesis, cancer metastasis, tumor heterogeneity and aging.

In addition to somatic evolution, I'm interested in theoretical aspects of traditional evolutionary processes, including the evolution of sex, how recombination and beneficial mutations affect the fitness dynamics of a population, rigorous characterization of Hill-Robertson effect. Recently, I'm studying the origin and early evolution of COVID-19, the founder effect in COVID-19 outbreaks.

Education

09/2015 – 08/2020
Doctor of Science
School of Life Sciences, Sun Yat-sen University
Major: Biochemistry and Molecular Biology
Thesis: "Theoretical Study on Evolution of Mutation Rate in Soma and Germline Cell"
Advisor: Prof. Chung-I Wu

09/2011 – 07/2015
Bachelor of Science
School of Life Sciences, Sun Yat-sen University
Major: Biotechnology
Thesis: "Heat shock impact on the development of *dcr-1*^{RNAi} *Drosophila Melanogaster*"
Thesis Supervisor: Prof. Chung-I Wu

Scholarships and Awards

12/2017 Third prize of the 14th China Post-Graduate Mathematical Contest in Modeling
08/2012 Outstanding student scholarship, Sun Yat-sen University

Publications

Ruan Y, Wang H, Chen B, Wen H, Wu CI. 2020. Mutations Beget More Mutations-Rapid Evolution of Mutation Rate in Response to the Risk of Runaway Accumulation. *Mol. Biol. Evol.*, 37: 1007-1019. (Published)

Ruan Y, Luo Z, Tang X, Li G, Wen H, He X, Lu X, Lu J, Wu CI. On the founder effect in COVID-19 outbreaks - How many infected travelers may have started them all? *Natl. Sci. Rev.* (in press)

Ruan Y, Wen H, He X and Wu CI. A theoretical exploration of the origin and early evolution of a pandemic. (Under Review)

Ruan Y, Wang H, Zhang L, Wen H, Wu CI. Sex, fitness decline and recombination – Muller' ratchet vs. Ohta's ratchet. (Under Review)

Wang H, **Ruan Y**, Zhang L, Lu X, Wen H, Wu CI. Muller's ratchet – Does it really operate in nature? (Under Review)

Ma F, Lu G, Chen Q, **Ruan Y**, Li X, Lu X, Li C. Dynamic global analysis of transcription reveals the role of miRNAs in synergistic stabilization of gene expression. *Sci. Bull.* (in press)

Chen B, **Ruan Y**, Wen H, Wu CI. On single vs. multiple origins of tumors – Numerous incipient tumors in the early stage of tumorigenesis. (In preparation)

Chen B, **Ruan Y**, Zhang Y, Wen H, Wu CI. From the warring states rises the empire – the many tiny clones engulfed in a dominant tumor. (In preparation)

Academic Presentations

Yongsen Ruan, Chung-I Wu (2019). *Mutations beget more mutations – The evolution of mutation rate and the runaway accumulation*. Oral presentation (OR-051) at the Annual Meeting of the Society for Molecular Biology and Evolution in 2019, Manchester, England.

Yongsen Ruan, Ao Lan, Chung-I Wu (2018). *Different types of cell migration during tumor growing process lead to spatial patterns of genetic variation*. Poster (POB-086) presented at the Annual Meeting of the Society for Molecular Biology and Evolution in 2018, Pacifico Yokohama, Yokohama, Japan.