

Yongsen Ruan

School of Life Sciences, Sun Yat-sen University

No. 135, Xingang Xi Road, Haizhu District, Guangzhou, 510275, P.R. China

Email: ruanyongsen@gmail.com; mygsn@163.com

Personal Website: <https://www.yongsen-ruan.com/>

Research Interests

My work focuses on evolutionary processes. I am especially interested in the theoretical aspects of these evolutionary processes and how these theories combined with experimental/clinical data allow a better understanding. We also work on the population genetics of fitness dynamics, e.g. Hill-Robertson effect, Muller's ratchet.

Most recently, I propose a runaway model, in which the accumulation of mutators forms a positive-feedback loop to let mutations beget more mutations. This model can apply to both soma and germline. In somatic tissues, many weak effect mutators can explain the mutation load difference between normal tissues and cancers. In germline, a small increase in the baseline mutation rate could trigger the runaway accumulation, leading to an unbearable fitness effect for longer living species. We hence suggest that the baseline mutation rate in mammals with long generation time may seem unnecessarily low due to the need to minimize the risk of the runaway accumulation.

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 *dcx-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? (Accepted)

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's ratchet vs. Ohta's ratchet. (Submitted)

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

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. (Accepted)

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.