CURRICULUM VITAE

Yongsen Ruan, Ph.D.

Postdoctoral Research Fellow
Research Associate
School of Life Sciences, Sun Yat-sen University
Guangzhou, 510275, P.R. China

Email: rnygsn@163.com; ruanyongsen@gmail.com
Homepage: https://www.yongsen-ruan.com/

Research Interests

My research focuses on understanding many interesting evolutionary processes by integrating approaches from evolutionary genomics, mathematical statistics, and computational biology. I'm most interested in the relative contributions of stochastic and deterministic forces to a variety of evolutionary phenomena. There are three major research directions: (1) ***Adaptive evolution of SARS-CoV-2***, including the origin, cross-species transmission, intra- and inter-host evolution, and spread dynamics of variants of concerns (VOCs). Using branching process theory, and genomic approaches, we describe the spatiotemporal distribution of new SARS-CoV-2 variants and track the evolutionary dynamics of these variants at three levels: intra-host, inter-host, and globally. These will help us generalize the adaptive evolutionary patterns and theory of SARS-CoV-2 at different levels. (2) ***Cancer evolutionary dynamics***, including tumorigenesis, heterogeneity, and metastasis. We are applying the theory of population genetics to understand how mutation, selection, genetic drift, and migration drive tumor evolution with the help of cancer genomics. (3) ***Theoretical aspects of traditional evolutionary processes***. Combine the evolutionary approaches with mathematical modeling and computational simulation, we analyze publicly available data to understand evolution of mutation rate, epistasis, fitness landscapes, and Hill-Robertson effect. In particular, characterize and understand how mutation rate, genetic recombination and beneficial mutations change the fitness dynamics of populations.

Education

Year/Period	Degree	Thesis	Institution
09/2015 – 08/2020	Ph.D. in Biochemistry and Molecular Biology	Theoretical Study on Evolution of Mutation Rate in Soma and Germline Cell	School of Life Sciences, Sun Yat-sen University Mentor: Prof. Chung-I Wu
09/2011 – 07/2015	B.S. in Biotechnology	Heat shock impact on the development of *dcr-1*^{RNAi} *Drosophila Melanogaster*	School of Life Sciences, Sun Yat-sen University

Professional History

Year/Period	Position	Institution

10/2020 – date	Postdoctoral Research Fellow	School of Life Science, Sun Yat-sen University
12/2021 – date	Research Associate	School of Life Science, Sun Yat-sen University

Honors and Awards

05/2021	National Postdoctoral Innovative Talents Supporting Program (博士后创新人才支持计划)
12/2017	Third prize of the 14th China Post-Graduate Mathematical Contest in Modeling
08/2012	Outstanding student scholarship, Sun Yat-sen University

Research Grants

Year/Period	**Project title, Grant number, Funding agency, Award amount, Role**
07/2021 – 06/2023	The origin tracing of SARS-CoV-2 and evaluation of epidemic prevention and control strategies based on adaptive evolution theory, BX2021395, National Postdoctoral Innovative Talents Supporting Program (博士后创新人才支持计划), 630,000 RMB, PI
01/2022 – 12/2024	Domestication of mammalian cells and evolution between unicellular and multicellular organisms, 32150006, National Natural Science Foundation of China, 2,980,000 RMB, Participant

Publications (# co-first authors, * corresponding authors)

***Published*:**

(1) **Ruan Y**#, Hou M#, Tang X#, He X, Lu X, Lu J*, Wu C I* & Wen H*. The Runaway Evolution of SARS-CoV-2 Leading to the Highly Evolved Delta Strain. ***Molecular Biology and Evolution*** 39, msac046, doi:10.1093/molbev/msac046 (2022).

(2) **Ruan Y**, Wen H, Hou M, He Z, Lu X, Xue Y, He X, Zhang Y P* & Wu C I*. The twin-beginnings of COVID-19 in Asia and Europe-one prevails quickly. ***National Science Review*** 9, nwab223, doi:10.1093/nsr/nwab223 (2022).

(3) **Ruan Y**, Luo Z, Tang X, Li G, Wen H, He X, Lu X, Lu J* & Wu C I*. On the founder effect in COVID-19 outbreaks: how many infected travelers may have started them all? ***National Science Review*** 8, nwaa246, doi:10.1093/nsr/nwaa246 (2021).

(4) **Ruan Y**, Wen H, He X & Wu C I*. A theoretical exploration of the origin and early evolution of a pandemic. ***Science Bulletin*** 66, 1022-1029, doi:10.1016/j.scib.2020.12.020 (2021).

(5) Wu C I*, Wen H, Lu J, Su X D, Hughes A C, Zhai W, Chen C, Chen H, Li M, Song S, Qian Z, Wang Q, Chen B, Guo Z, **Ruan Y**, Lu X, Wei F, Jin L, Kang L, Xue Y, Zhao G & Zhang Y P. On the origin of SARS-CoV-2-The blind watchmaker argument. ***Science China Life Sciences*** 64, 1560-1563, doi:10.1007/s11427-021-1972-1 (2021).

(6) Zhang L#, Qin Z#, Huang T, Tam B, **Ruan Y**, Guo M, Wu X, Li J, Zhao B, Chian J S, Wang X, Wang L & Wang S M*. Prevalence and spectrum of DNA mismatch repair gene variation in the general Chinese population. ***Journal of Medical Genetics***, jmedgenet-2021-107886, doi:10.1136/jmedgenet-2021-107886 (2021).

(7) Ma F#, Lu G-A#, 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. ***Science Bulletin*** 65, 2130-2140, doi:10.1016/j.scib.2020.08.011 (2020).

(8) **Ruan Y**, Wang H, Chen B, Wen H* & Wu C I*. Mutations Beget More Mutations-Rapid Evolution of Mutation Rate in Response to the Risk of Runaway Accumulation. ***Molecular Biology and Evolution*** 37, 1007-1019, doi:10.1093/molbev/msz283 (2020).

***Submitted*:**

(1) **Ruan Y**[#], Hou M[#], Li J[#], Song Y[#], Wang H-Y I, He X, Zeng H, Lu J, Wen H*, Chen C* & Wu C-I*. One viral sequence for each host? – The neglected within-host diversity as the main stage of SARS-CoV-2 evolution. ***bioRxiv***, 2021.2006.2021.449205, doi:10.1101/2021.06.21.449205 (2021).

(2) **Ruan Y**, Wang H, Zhang L, Wen H* & Wu C-I*. Sex, fitness decline and recombination – Muller's ratchet vs. Ohta's ratchet. ***bioRxiv***, 2020.2008.2006.240713, doi:10.1101/2020.08.06.240713 (2020).

(3) Chen B, Wu X, **Ruan Y**, Zhang Y, Wen H J*, Lan P* & Wu C-I*. Many are called but few are chosen – Multiple clonal origins greatly elevate the functional heterogeneity of tumors. ***bioRxiv***, 2020.2009.2001.277848, doi:10.1101/2020.09.01.277848 (2020).

Academic Presentations

07/2019	**Yongsen Ruan**, Chung-I Wu. "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, Manchester, England.
07/2018	**Yongsen Ruan**, Ao Lan, Chung-I Wu. "Different types of cell migration during tumor growing process lead to spatial patterns of genetic variation". Poster presentation (POB-086) at the Annual Meeting of the Society for Molecular Biology and Evolution, Pacifico Yokohama, Yokohama, Japan.

Professional Memberships

Society for Molecular Biology and Evolution

Professional Services

Ad-hoc Reviewers for journals:

National Science Review