RACHEL HIN YING NG

Phone: (408) 510-1239
Email: rachelng@uw.edu
Github: https://github.com/racng

EDUCATION

Ph.D. University of Washington, Bioengineering — Anticipated June 2025
B.S. California Institute of Technology (Caltech), Bioengineering — June 2018
Graduated *summa cum laude*, GPA: 3.9/4.0

RESEARCH INTERESTS

Develop computational and bioinformatics tools to deepen understanding of immune response, cancer, and chronic disease.

RESEARCH EXPERIENCE

Heath Lab, Institute for Systems Biology, Seattle, WA — 2020 –Present
Graduate Student Research Assistant
Mentors: Dr. James Heath, Dr. Yapeng Su, Dr. Priyanka Baloni

- Developing computational tool for systems-level immune cell metabolic flux analysis that integrates single cell transcriptome, metabolome, and genome data.
- Developing analysis of interactions between single cell receptor and serum protein.
- Performed T cell receptor analysis integrating single cell sequencing data and TCR databases to understand phenotypes of antigen specific T cells.

T cell Therapeutics Research Laboratory, City of Hope, Duarte, CA — 2018 – 2020
Research Associate I, Computational and Systems Immunology Group
Mentors: Dr. Vanessa Jonsson, Dr. Christine Brown, Dr. Stephen Forman

- Developed bioinformatics pipeline for single cell RNA-seq data from CAR T clinical trials for glioblastoma, lymphomas, prostate cancer, and breast-to-brain metastasis
- Wrote Python packages and shell scripts integrating single cell RNA-seq sub-analyses (TCR analysis, variational inference, doublet detection, SNP calling, CNV inference, RNA velocity)
- Wrote R software to automate analysis of longitudinal flow cytometry data

Heath Group, California Institute of Technology, Pasadena, CA 2015 – 2018
Undergraduate Researcher
Mentors: Dr. James Heath, Dr. Yapeng Su, Dr. Ryan Henning

- Analyzed single cell and bulk RNA-Seq of melanoma resistance using statistical and machine learning methods (sample progression discovery, self-organizing map, single-cell topological data analysis)
- Performed mathematical modeling of cell state transition dynamics
- Synthesized and characterized peptides targeting KRAS (G12D) oncoprotein

Quartz Therapeutics, BridgeBio, San Francisco, CA 2017
Intern
Mentors: Dr. Brad Heller, Dr. Ryan Henning

- Studied cancer drug potency in treating RAS dependent cancer

Kao Lab, University of California, San Francisco 2012 – 2013
Summer Student Researcher
Mentors: Dr. Aimee Kao, Helen McCurdy

- Studied neurodegenerative disease-associated proteins in *C. elegans*

TEACHING EXPERIENCE

Institute for Systems Biology, Seattle, WA 2021
Research Mentor, Heath Lab

- Mentored undergraduate student on data analysis of cancer clinical trial survey data

California Institute of Technology, Pasadena, CA 2017 – 2018
Teaching Assistant, Division of Biology and Biological Engineering

- Undergraduate teaching assistant for introductory biology course in core curriculum
- Designed problems for exams, homework, and recitations
- Graded exams and homework
- Taught at recitations and office hours

California Institute of Technology, Pasadena, CA 2017 – 2018
Course Tutor, Undergraduate Deans Office

- Tutored Caltech students in bioengineering courses

PUBLICATIONS

1. Xu AM, Chour W, DeLucia DC, Su Y, Pavlovitch-Bedzyk AJ, **Ng R**, Davis M, Lee JK, Heath JR. SPAN-TCR: A CDR3 Length-Agnostic Method to Characterize Antigen-Specific TCR Diversity. *Manuscript in preparation*.

2. Su Y, Yuan D, Chen D, **Ng R**, Wang K, Choi J, Li S, Hong S, Zhang R, Xie J, Kornilov S, Scherler K, Pavlovitch-Bedzyk AJ, Dong S, Lausted C, Lee I, Fallen S, Dai C, Baloni P, Smith B, Duvvuri V, Anderson K, Li J, Yang F, Duncombe C, McCulloch D, Rostomily C, Troisch P, Zhou J, Mackay S, DeGottardi Q, May D, Taniguchi R, Gittelman R, Klinger M, Snyder T, Roper R, Wojciechowska G, Murray K, Edmark R, Jones L, Zhou Y, Rowen L, Liu R, Chour W, Algren H, Berrington W, Wallick J, Cochran R, Micikas M, Unit the I-SCB, Wrin T, Petropoulos C, Cole H, Fischer T, Wei W, Hoon D, Price N, Subramanian N, Hill J, Hadlock J, Magis A, Ribas A, Lanier L, Boyd S, Bluestone J, Chu H, Hood L, Gottardo R, Greenberg P, Davis M, Goldman J, Heath JR. Systems Biological Assessment Reveals Multiple Risk Factors and Immune-Endotypes for Post-Acute COVID-19 Sequelae. *Submitted to Cell*.

3. Witte O, Nesterenko PA, McLaughlin J, Tsai BL, Sojo GB, Cheng D, Zhao D, Mao Z, Bangayan NJ, Obusan MB, Su Y, **Ng RH**, Chour W, Xie J, Li Y-R, Lee D, Noguchi M, Carmona C, Phillips JW, Kim JT, Yang L, Heath JR, Boutros PC. HLA-A*02:01 restricted T cell receptors against the highly conserved SARS-CoV-2 polymerase cross-react with human coronaviruses. *Submitted to Cell*.

4. Jonsson VD, **Ng RH**, Dullerud N, Wong RA, Hibbard J, Wang D, Aguilar B, Starr R, Weng L, Alizadeh D, Forman SJ, Badie B, Brown CE. CAR T cell therapy drives endogenous locoregional T cell dynamics in a responding patient with glioblastoma. *Manuscript in revision at Nature Medicine*.

5. Lee JW, Su Y, Baloni P, Chen D, Pavlovitch-Bedzyk AJ, Yuan D, Duvvuri VR, **Ng RH**, Choi J, Xie J, Zhang R, Murray K, Kornilov S, Smith B, Magis AT, Hoon DSB, Hadlock JJ, Goldman JD, Price ND, Gottardo R, Davis MM, Hood L, Greenberg PD, Heath JR. Integrated analysis of plasma and single immune cells uncovers metabolic changes in individuals with COVID-19. *Nat Biotechnol*. Published online September 6, 2021:1-11. doi:10.1038/s41587-021-01020-4

6. Su Y, Lu X, Li G, Liu C, Kong Y, Lee JW, **Ng R**, Wong S, Robert L, Warden C, Liu V, Chen J, Wang Z, Yang Y, Cheng H, Ng AHC, Qin G, Peng S, Xue M, Johnson D, Xu Y, Wang J, Wu X, Shmulevich I, Shi Q, Levine R, Ribas A, Baltimore D, Guo J, Heath JR, Wei W. Kinetic Inference Resolves Epigenetic Mechanism of Drug Resistance in Melanoma. *bioRxiv* [preprint]. Published online August 5, 2019:724740. doi:10.1101/724740

7. Su Y, Wei W, Robert L, Xue M, Tsoi J, Garcia-Diaz A, Moreno BH, Kim J, **Ng RH**, Lee JW, Koya RC, Comin-Anduix B, Graeber TG, Ribas A, Heath JR. Single-cell analysis resolves the cell state transition and signaling dynamics associated with melanoma drug-induced resistance. *PNAS*. 2017;114(52):13679-13684. doi:10.1073/pnas.1712064115

8. Salazar DA, Butler VJ, Argouarch AR, Hsu T-Y, Mason A, Nakamura A, McCurdy H, Cox D, **Ng R**, Pan G, Seeley WW, Miller BL, Kao AW. The Progranulin Cleavage Products, Granulins, Exacerbate TDP-43 Toxicity and Increase TDP-43 Levels. *J Neurosci*. 2015;35(25):9315-9328. doi:10.1523/JNEUROSCI.4808-14.2015

PRESENTATIONS

1. **Ng RH**, Starr R, Alizadeh D, Forman SJ, Banovich NE, Brown CE, Jonsson VD. Single cell RNA sequencing analysis of CAR T therapy for glioblastoma identifies T cell composition and clonality as predictors of clinical response. Poster presented at: 2019 City of Hope Annual Poster Session; 2019 Oct 29; Duarte, CA.

2. Jonsson VD, **Ng R**, Dullerud N, Wong R, Brown CE. Uncovering T cell dynamics over course of chimeric antigen receptor (CAR) T cell therapy. Oral Presentation at: 2019 Cold Spring Harbor Single Cell Analyses Meeting; 2019 Nov 13–16; Cold Spring Harbor, NY.

3. **Ng RH**, Starr R, Alizadeh D, Forman SJ, Banovich NE, Brown CE, Jonsson VD. Single cell RNA sequencing analysis of CAR T therapy for glioblastoma. Poster presented at: Engineering Immunity and Parker Institute for Cancer Immunotherapy Retreat; 2019 Sept 6; Lake Arrowhead, CA.

4. McCarthy AM, Kim J, Henning RK, Mishra A, **Ng R**, Museth AK, Heath JE, Winson E, Oh J, Heath JR. Development of a High-Throughput Immunofluorescence Assay Platform Using a DNA-Encoded Streptavidin Library for the Rapid Evaluation of Protein-Catalyzed Capture Agents. Poster presented at: 253rd ACS National Meeting; 2017 Apr 2-6; San Francisco, CA.

5. **Ng R**, Su Y, Heath JR. Transcriptomic analysis of drug-induced de-differentiation of melanoma cells. Oral Presentation at: Caltech Summer Undergraduate Research Fellowship Seminar Day; 2016 Oct 15; Pasadena, CA.

6. **Ng R**, Henning R, Heath JR. Optimizing synthetic capture agent targeting G12D epitope of oncoprotein KRAS. Oral Presentation at: Caltech Summer Undergraduate Research Fellowship Seminar Day; 2015 Oct 15; Pasadena, CA.

HONORS AND AWARDS

Tau Beta Pi 2018
Engineering Honor Society, top 1/5th among Caltech seniors in engineering

SCIAC All-Academic Team 2015-2017
NCAA Division-III student-athlete recognized by the Southern California Intercollegiate Athletic Conference (SCIAC)

Summer Undergraduate Research Fellowship 2016
Hugh F. and Andy Lou Colbin Named Fellow
Fellowship awarded by Caltech for undergraduate research in the Heath Group

Summer Undergraduate Research Fellowship 2015
Fellowship awarded by Caltech for undergraduate research in the Heath Group

Valedictorian 2014
Mills High School, Millbrae, CA

PROFESSIONAL AFFILIATIONS

Society of Women Engineers, 2014 – 2017
Tau Beta Pi, 2018 – Present

COMMUNITY SERVICE

Engineers Without Borders, California Institute of Technology 2014 – 2018
Vice President (2017), Webmaster (2016)
Designed and fundraised for a spring source protection system in Ilam, Nepal

Society of Women Engineers, California Institute of Technology 2014 – 2018
Vice President (2017), Secretary (2016)
Organized mentoring program, community outreach, and participation in national conference

Health Advocate, California Institute of Technology 2015 – 2018
Certified Emergency Medical Responder
Provided emergency first aid, medical assistance, and counseling in student dormitory

Innoworks, California Institute of Technology 2014 – 2016
Director (2016), Mentor (2015)
Conducted summer science camp for underserved middle school students

TECHNICAL SKILLS

Platforms: Linux, macOS, Windows
Programming Languages: Python, R, Bash, Matlab, LaTeX, Mathematica
Application/Packages: GitHub, Jupyter Notebook, Cytoscape**,** Cellranger, kallisto, Scanpy, scVI, Scrublet, scVelo, velocyto, cellSNP, vireo, inferCNV, openCyto, Samtools, Bcftools, GATK4, cobrapy, COBRAToolbox
Computational and Theoretical: Stochastic/deterministic simulations, machine learning (clustering, decision trees, regression SVM, Gaussian process), dimension reduction, image segmentation, Bayesian parameter estimation, model selection, MCMC, longitudinal analysis
Experimental: Cell culture, molecular cloning, mass spectrometry, flow cytometry, ELISA, HPLC

REFERENCES

Dr. James R. Heath, President and Professor
Institute for Systems Biology
401 Terry Ave N, Seattle, WA 98109
Email: jim.heath@isbscience.org

Dr. Vanessa D. Jonsson, Assistant Professor
Applied Mathematics
University of California, Santa Cruz
1156 High St, Santa Cruz, CA 95064
Email: vjonsson@ucsc.edu

Dr. Justin S. Bois, Teaching Professor in Biology and Biological Engineering
Biology and Biological Engineering
California Institute of Technology
1200 E California Blvd, Pasadena, CA 91125, MSC 114-96
Email: bois@caltech.edu