Albert Wu Cheng

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Education

Massachusetts Institute of Technology (MIT) – Cambridge, MA

PhD Candidate in Computational and Systems Biology 2013 (Expected)

- Supervisors: Prof. Chris Burge, Prof. Rudolf Jaenisch
- Concentrations: Molecular Systems Biology (Gene Regulation: Epigenetics, Transcriptional, mRNA processing), Bioinformatics, Cancer and Metastasis, Stem Cell and Development, Somatic Cell Reprogramming, Non-coding RNAs, Synthetic Biology, Genome Engineering
- Thesis: Post-transcriptional gene regulation in pluripotent stem cells, somatic cell reprogramming and cancer metastasis

Hong Kong University of Science and Technology (HKUST) – Hong Kong

MPhil in Biology 2005-2007

- Supervisor: Prof. King L. Chow
- Concentrations: Developmental Genetics, RNAi screen
- Thesis: Characterization of *irx-1* in *C. elegans* sensory ray development

BSc in Biochemistry 2002-2005

- GPA 3.9/4.0 First Class Honors with Academic Achievement Medal. Ranked 3rd in class
- Supervisors: Prof. Nancy Ip, Prof. Hong Xue, Prof. Robert Ko
- Final Year Project Thesis: SLAM-associated protein (SAP) as a potential negative regulator in Trk signaling. Second Year Research Project: Computational design of primers for genotyping

Research Experience

Massachusetts Institute of Technology (MIT) – Cambridge, MA

- Conducted research through computational analysis and experimental biology
- Constructed CRISPR-on, an RNA-programmable transcriptional activator based on CRISPR/Cas, that allows multiplexed activation of endogenous genes. See http://crispr-on.org
- Dissected the RNA transcriptome of epithelial-mesenchymal transition and cancer cell lines leading to the identification of a panel of splicing markers for metastatic cancers. Patent application submitted outlining the detection of metastatic cancer using splicing molecular signature.
- Contributed to pioneering studies of pluripotency states in mouse and human embryonic stem cells
- Studied enhancer epigenetics leading to the discovery of H3K27ac as an histone mark for active enhancers
- Contributed to the study of the application of genome editing and iPSC technology for disease modeling and regenerative medicine
- Research published in 22 papers in peer-reviewed journals.

- Collaborators: Prof Frank Gertler, Prof Harvey Lodish, Prof Richard Young, Prof Phil Sharp, Prof Alexander van Oudenaarden, Prof Laurie Boyer

Hong Kong University of Science and Technology (HKUST) – Hong Kong

- Involved in a genome-wide RNAi screen for genes required for proper specification and morphogenesis of *C. elegans* male sensory rays.
- Developed an integrative computational and experimental approach to study gene functions in *C. elegans* sensory ray formation. Dissected the functions of *irx-1 (Iroquois)* gene.
- Involved in a study of a regulator of receptor tyrosine kinase Trk-mediated signaling
- Developed a software kit for the design of primers for genotyping (Finalist in President's Cup competition)

Publications

(*These authors contributed equally)

Pubmed

First-authored

- **Cheng, A.W. *,** Wang, H.*, Yang, H, Shi, L., Katz, Y., Theunissen, T.W., Rangarajan, S., Shivalila, C.S., Dadon, D.B., Jaenisch, R. (2013) Multiplexed activation of endogenous genes by CRISPR-on, an RNA-guided transcriptional activator system. ***Cell Res.*** 23(10):1163-71 PMID: 23979020
- Shapiro, I.M. *****, **Cheng, A.W. ***, Flytzanis, N.C., Balsamo, M., Condeelis, J.S., Oktay, M.H., Burge, C.B., Gertler, F.B. (2011) An EMT-driven alternative splicing program occurs in human breast cancer and modulates cellular phenotype. ***PLoS Genet.*** 7(8):e1002218 PMID: 21876675
- Creyghton, M.P.*****, **Cheng A.W.***, Welstead, G.G., Kooistra, T., Carey, B.W., Steine, E.J., Hanna, J., Lodato, M.A., Frampton, G.M., Sharp, P.A., Boyer, L.A., Young, R.A., Jaenisch, R. (2010) Histone H3K27ac separates active from poised enhancers and predicts developmental state. ***Proc. Natl. Acad. Sci. U.S.A.*** 107(50):21931-6 PMID: 21106759

Other

- Li, Y., Wang, H., Muffat, J., **Cheng, A.W.**, Orlando, D.A., Loven, J., Kwok, S., Feldman, D.A., Bateup, H.S., Gao Q., Hockemeyer, D., Mitalipova, M., Lewis, C.A., Heiden, W.G.V., Sur, M., Young, R.A., Jaenisch, R. (2013) Global transcriptional and translational repression in human-embryonic-stem-cell-derived Rett Syndrome neurons.***Cell Stem Cell*** 13(4):446-58 PMID: 24094325
- Rudenko, A., Dawlaty, M.M., Seo, J., **Cheng, A.W.**, Meng, J., Le, T., Faull, K.F., Jaenisch, R., Tsai, L.H. (2013) Tet1 is critical for neuronal activity-regulated gene expression and memory extinction. ***Neuron*** 79(6):1109-22 PMID: 24050401
- Yang, H.*, Wang, H.*, Shivalila, C.S.*, **Cheng, A.W.,** Shi, L., Jaenisch, R. (2013). One-step generation of mice carrying reporter and conditional alleles by CRISPR/Cas-mediated genome engineering. ***Cell*** 154(6):1370-9 PMID: 23992847

- Faddah, D.A., Wang, H., **Cheng, A.W.,** Katz, Y., Buganim, Y., Jaenisch, R (2013). Single-cell analysis reveals that expression of nanog is biallelic and equally variable as that of other pluripotency factors in mouse ESCs. ***Cell Stem Cell*** 13(1):23-9 PMID: 23827708
- Wang, H.*, Hu, Y.C.*, Markoulaki, S., Welstead, C.G., **Cheng, A.W.,** Shivalila, C.S., Pyntikova, T., Dadon, D.B., Voytas, D.F., Bogdanove, A.J., Page, D.C., Jaenisch, R (2013). TALEN-mediated editing of the mouse Y chromosome. ***Nat. Biotechnol.*** 31(6):530-2 PMID: 23666012
- Wang, H.*, Yang, H.*, Shivalila, C.S.*, Dawlaty, M.M., **Cheng, A.W.,** Zhang, F., Jaenisch, R (2013). One-step generation of mice carrying mutations in multiple genes by CRISPR/Cas-mediated genome engineering. ***Cell*** 153(4):910-8 PMID: 23643243
- Lodato, M.A., Ng, C.W.*, Wamstad, J.A.*, **Cheng, A.W.**, Thai, K.K., Faenkel, E., Jaenisch, R., Boyer, L.A. (2013) SOX2 Co-occupies Distal Enhancer Elements with Distinct POU Factors in ESCs and NPCs to Specify Cell State. ***PLoS Genet.*** 9(2):e1003288 PMID: 23437007
- Dawlaty, M.M., Breiling, A., Le, T., Raddatz, G., Barrasa, M.I., **Cheng, A.W.**, Gao, Q., Powell, B.E., Li, Z., Xu, M., Faull, K.F., Lyko, F., Jaenisch R. (2013) Combined Deficiency of Tet1 and Tet2 Causes Epigenetic Abnormalities but Is Compatible with Postnatal Development. ***Dev. Cell*** 24(3):310-23 PMID: 23352810
- Buganim, Y.*, Faddah D.A.*, **Cheng, A.W.,** Itskovich, E., Markoulaki, S., Gantz, K., Klemm S.L., van Oudenaarden A., Jaenisch, R. (2012) Single-Cell Expression Analyses during Cellular Reprogramming Reveal an Early Stochastic and a Late Hierarchic Phase. ***Cell*** 150(6):1209-22 PMID: 22980981
- Buganim, Y., Itskovich, E., Hu, Y.-C., **Cheng, A.W.**, Ganz, K., Sarkar, S., Fu, D.D., Welstead, G., Page, D.C., Jaenisch, R. (2012) Direct Reprogramming of Fibroblasts into Embryonic Sertoli-like Cells by Defined Factors. ***Cell Stem Cell*** 11(3):373-86 PMID: 22958931
- Welstead, G.G., Creyghton, M.P., Bilodeau, S., **Cheng, A.W.**, Markoulaki, S., Young, R.A., Jaenisch R. X-linked H3K27me3 demethylase Utx is required for embryonic development in a sex-specific manner. ***Proc. Natl. Acad. Sci. U.S.A.*** 109(32):13004-9 PMID: 22826230
- Kim, J., Su, S.C., Wang, H., **Cheng, A.W.**, Cassady, J.P., Lodato, M.A., Lengner, C.J., Chung, C.Y., Dawlaty, M.M., Tsai, L.H., Jaenisch R. (2011) Functional integration of dopaminergic neurons directly converted from mouse fibroblasts. ***Cell Stem Cell*** 9(5):413-9 PMID: 22019014
- Wong, P., Hattangadi, S.M., **Cheng, A.W.**, Frampton, G.M., Young, R.A., Lodish, H.F. (2011) Gene induction and repression during terminal erythropoiesis are mediated by distinct epigenetic changes. ***Blood*** 118(16):e128-38 PMID: 21860024
- Dawlaty, M.M., Ganz, K., Powell, B.E., Hu, Y.C., Markoulaki, S., **Cheng, A.W.**, Gao, Q., Kim, J., Choi, S.W., Page, D.C., Jaenisch, R. (2011) Tet1 is dispensable for maintaining pluripotency and its loss is compatible with embryonic and postnatal development. ***Cell Stem Cell*** 5;9(2):166-75 PMID: 21816367
- Soldner, F., Laganière, J., **Cheng, A.W.**, Hockemeyer, D., Gao, Q., Alagappan, R., Khurana, V., Golbe, L.I., Myers, R.H., Lindquist, S., Zhang, L., Guschin, D., Fong, L.K., Vu, B.J., Meng, X., Urnov, F.D., Rebar, E.J., Gregory, P.D., Zhang, H.S., Jaenisch, R. (2011) Generation of isogenic pluripotent stem cells differing exclusively at two early onset Parkinson point mutations. ***Cell*** 146(2):318-31 PMID: 21757228
- Lengner C.J., Erwin, J.A.*, Gimelbrant A.A.*, **Cheng A.W.**, Guenther M.G., Welstead G.G., Alagappan R.,

Frampton M.F., Xu P., Powers D., Barrett C.B., Young R.A., Lee J.T., Jaenisch R., Mitalipova, M. (2010) Derivation of pre-X inactivation human embryonic stem cells under physiological oxygen concentrations. ***Cell*** 141(5):872-83 PMID: 20471072

- Hanna J., **Cheng, A.W.**, Saha K., Kim J.P., Lengner, C.J., Soldner, F., Cassady, J.P., Muffat, J., Carey, B.W., Jaenisch R. (2010) Human embryonic stem cells with biological and epigenetic characteristics similar to those of mouse ESCs. ***Proc. Natl. Acad. Sci. U.S.A.***107(20):9222-7 PMID: 20442331
- Hanna, J.*, Markoulaki, S.*, Mitalipova, M., **Cheng, A.W.**, Cassady, J.P., Staerk, J., Carey, B.W., Lengner, C.J., Foreman, R., Love, J., Gao, Q., Kim, J., Jaenisch, R. (2009) Metastable Pluripotent States in NOD-Mouse-Derived ESCs. ***Cell Stem Cell*** 4(6):513-24 PMID: 19427283
- Markoulaki, S.*, Hanna, J.*, Beard, C., Carey, B.W., **Cheng, A.W.**, Lengner, C.J., Dausman, J.A., Fu, D., Gao, Q., Wu, S., Cassady, J.P. and Jaenisch, R. (2008) Transgenic mice with defined combinations of drug-inducible reprogramming factors. ***Nat Biotechnol*** 27(2):169-71 PMID: 19151700
- Lo, K.Y., Chin, W. H., Ng, Y. P., **Cheng, A. W.**, Cheung, Z. H and Ip, N. Y. (2005) SLAM-associated protein (SAP) as a potential negative regulator in Trk signaling. ***J Biol Chem*** 280(50):41744-52 PMID: 16223723

Patent Applications

- Alternatively Spliced mRNA Isoforms as Prognostic and Therapeutic Tools for Metastatic Breast Cancer and Other Invasive/Metastatic Cancers.
- Methods Of Mutating, Modifying Or Modulating Nucleic Acid In A Cell Or Nonhuman Mammal

Conference Poster Presentations

- **Cheng, A.W.** and Chow, K.L. (2007) Transcription factors *en route* gene regulatory networks of organogenesis. Poster submitted for the 16th International *C. elegans* Meeting
- Yip, S. Y., **Cheng, A.W.** and Chow, K. L. (2006). *Distal-less* homolog *ceh-43* and *Iroquois* homolog *irx-1* control peripheral sensory organ assembly in *C. elegans.* Poster presented at the East Asia Worm Meeting 2006
- Chan, W.H., Yip, S.Y., **Cheng, A.W.**, Wong, Y.F., Chow, K.L. (2006). A transcriptional network controlling male sensory organ development in *C. elegans.* Poster presented at the The Society of Developmental Biology 65th Annual Meeting
- **Cheng, A.W.** and Chan, Y.W. [supervised by Prof. Hong Xue] (2004) A Software Kit *SEP* for Designing Primer for SNP Genotyping and Other Purposes. Presented at HKUST President's Cup Exhibition

Awards and Scholarships

Ludwig Graduate Fellowship (Koch Institute, MIT) 2010

- Awarded for a period of one year to cover tuition and stipend to study the mechanisms of metastasis using integrative approaches

Croucher Scholarship (Hong Kong) 2007-2010

- Awarded for a period of three years to cover tuition and stipend for the PhD study at MIT

HKUST Academic Achievement Medal 2005

- Awarded for top 1 percentile students

CMA & Donors Scholarship 2005

HKUST President's Cup 2004 Finalists 2004

The George K Lee Foundation Scholarship 2004

Dean's List 2002-03, 2003-04 Spring, 2004-05

HKUST Programming Contest 1st Runner-up 2002

Teaching and Work Experience

- Teaching Assistant, 7.91, Foundations of Computational & Systems Biology, MIT 2008
- Teaching Assistant, BIOL 124, Cell Biology Laboratory, HKUST 2006
- Private Piano Teacher 2005

Leadership and Teamwork Experience

STeLA (Science and Technology Leadership Association) Conference

Chief Technology Officer 2009-2011

- STeLA is an international student-run non-profit organization that holds an annual conference with workshops and courses in leadership with an emphasis on leadership in science and technology. Around 20 participants from each of USA, China, Japan and France attend the conference each year
- Coordinated with technology officers from different branches (countries)
- Managed website and created online application system for recruitment of participants
- Managed Google app, mailing lists, wiki knowledgebase for staff
- Acted as secretary for some of the conference call meetings

Science Student Association (SSA), HKUST Student Union

Information System Secretary 2004-2005

- SSA serves students in the School of Science and provides a networking platform, organizes orientation camp to welcome new students. It also organizes academic talks and social events
- Managed website and provided IT support for the team
- Created an online system for all students in the university to plan and print class schedules as time table cards
- Led the organization of the annual Science Students Festival that consisted of a series of events including a singing competition, pub night, BBQ gathering, academic talk, etc.
- Negotiated with the university to open new sites for student activities.

Extra-curricular Activities

MIT 100k Accelerate Contest 2013 *Semi-finalists* **Jan-Feb 2013**

- Our team (QuantumSpec) was one of the 36 semi-finalists selected from more than 200 entries.
- Worked on developing business model for our portable spectrometer

NCIIA E-Teams Stage I Grant Winner (Team) **Jan 2013**

MIT vs Harvard Case Competition 2012 *Finalists* **August 2012**

- Our team was one of the five finalists from the 20 MIT and Harvard teams
- Evaluated and selected new market entry points for a client company specialized in data analytics for biopharma business development
- Recommended strategies for market entry and positioning of offerings to maximize revenue

Volunteer Consulting Group (VCG) at Consulting Club of MIT **July-August 2012**

- Participated in a summer volunteering consulting project with an MIT start-up company
- Conducted research on market segmentation and identified revenue streams
- Recommended market targeting and scaling strategies as well as strategies to secure revenue streams

Skills, Qualifications and Interests

- Computational: Programming and web technology (C++, Objective-C, iPhone SDK, Java, Python, PHP, Javascript, Actionscript, AJAX, Flash, SQL), R, MATLAB, bioinformatics (high-throughput sequencing analysis, SNP and expression microarray, biostatistics)
- Experimental biology: RNAi screen, molecular cloning, protein detection, high-throughput sequencing, mouse embryonic stem cells techniques, gene targeting, somatic cell reprogramming, *C. elegans* genetics.
- LCCI Book-keeping - First Level, passed w/ Distinction
- ABRSM Grade 8 Piano and Grade 8 Musical Theory
- Bartending Certificate, DrinkMaster Bartending School, Boston, MA
- Music composition/improvisation, photography, DIY electronics, mixology.