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# Hao Derek Cheng

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## Objective

Highly self-motivated and innovative scientist with specialization in immunology and programming (R). Proficient laboratory and computational skills. Analyzed large clinical dataset using supervised and unsupervised machine learning methods.

Passionate about learning new skills and eager to develop a career in the field of biotechnology

## Skills

### • Data science skills:

- Machine learning algorithms: random forest, regularized random forest, logistic regression, support vector machine, partial least square discriminant analysis, lasso and elastic-net regularized generalized linear models, cox proportional hazards models, hierarchical clustering, K-means clustering, principal component analysis, independent component analysis.

- Proficient in R

### • Computer software: ImageJ, FlowJo, Geneious, Cytoscape, Microsoft office suite, Illustrator, and Graphpad Prism

- **Laboratory skills:** yeast cell and mammalian cell culture, flow cytometry, molecular cloning, recombinant protein expression and purification, HPLC, FPLC, western blot, ELISA, SPR, Luminex assay, single B cell sorting, antibody cloning

## Education

09/2012 – Present

**Dartmouth College**, Hanover, NH

*Ph.D in Microbiology and Immunology*

09/2007 – 07/2011

**Wuhan University**, Wuhan, China

*Bachelor of Science*

## Graduate Research

September 2013 – Present

**Thayer School of Engineering, Dartmouth College**, Hanover, NH

*PhD Candidate*

*Advisor: Margaret.E.Ackerman*

### **Identify signatures of antibody neutralization breadth at HIV-1 CD4bs**

- Expressed gp120 library on yeast cell surface and characterized HIV mAbs and polyclonal serum.
- Identified three amino acid mutations critical for neutralization through machine learning methods.
- Constructed novel gp120 probes and performed the single B cell sorting, and antibody cloning.

### **Investigate age-dependent functional impact of IgG glycan in childhood**

- Simulated IgG glycan/IgG binding to age relationships through statistical and computational methods.
- Classified IgA deficient, wiskott-aldrich syndrome, and recurrent respiratory infections subjects from healthy control with elastic net algorithms.

### **Characterize functional impact of IgG Fc glycan in juvenile idiopathic arthritis**

- Characterized IgG function and glycan profile from healthy children and juvenile idiopathic arthritis (JIA) patients.
- Built predictive models classifying JIA from healthy controls with random forest algorithms.
- Identified critical biological features and performed *in vitro* test.

### **Predict diverse antiviral effector functions with unique IgG biophysical features**

- Performed classification on HIV vaccine recipient, placebo recipient, elite controllers, chronic treated subjects, chronic untreated subjects, and HIV serum negative subjects.
- Predicted IgG ANTI-HIV effector functions using regularized random forest, identified unique biological features associated with different effector functions

January 2017 – January 2017

**Walter Reed Army Institute of Research**, Springfield, MD

*Visiting Student*

*Visiting Lab: Shelly Krebs*

- Performed singled B cell cloning from HIV donor PBMC, analyzed antibody sequences

July 2016 – July 2016

**VISC, Fred Hutchinson Cancer Research Center**, Seattle, WA

*Visiting Student*

*Visiting Lab: Raphael Gottardo*

- Evaluated high-dimensional immune responses data collected from rhesus macaque SHIV vaccine study.

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- Built predictive models of vaccine induced immune responses using machine learning.

### Work Experiences

June 2011 – July 2012

Department of Biomedical Engineering, Tsinghua University, Beijing, China

Research Assistant

Advisor: Yanan Du

- Optimized aptamer design for lymphoma cancer cells, and functionalized PEG-hydrogel with aptamers
- Performed chip-surface polymerization of aptamers, characterized aptamer functionalized chip with TEM, captured and released lymphoma cells on chip surface.
- Cultured stem cells in 3D micro-fabricated hydrogel

### Teaching Experiences

- Spring term 2013, Teaching Assistant Bio13 Gene Expression and Inheritance, **Dartmouth College**
- Winter & Spring term 2010, Teaching Assistant Molecular Cellular Biology, **Wuhan University**

### Academic Conferences

1. Antibody Engineering & Therapeutics 2015, San Diego, CA. (Poster Presentation)
2. Annual Meeting of Society for Glycobiology 2015, San Francisco, CA. (Oral Presentation)
3. International Conference on Intelligent Systems for Molecular Biology (ISMB), Orlando, July 2016. (Poster Presentation)
4. 7<sup>th</sup> International conference on Bioengineering and Nanotechnology, 2017, Chicago, IL. (Oral Presentation)

### Activities and Honors

- 2017 Dartmouth Graduate School Academic Conference Travel Award
- 2016 Neukom Travel Award for 2016 ISMB
- 2015 Travel Award for 2015 Annual Meeting of Society for Glycobiology
- 2015 Travel Award for 2015 Antibody Engineering & Therapeutics
- 2013-2014 Vice president of Dartmouth Chinese student and scholar association
- 2007-2011 Scholarship and “Distinguished Individual” Prize in all academic year, Wuhan University
- 2009-2010 Project leader of college research team, funded by the National Innovative Experimental Projects.
- 2007-2009 Chairperson of Life Sciences Department debating team, won championship twice in WHU league.

### Publications

1. **Hao D.Cheng**, Henning Stöckmann, et al, High-throughput characterization of the functional impact of IgG Fc glycan aberrancy in juvenile idiopathic arthritis. (Submitted)
2. **Hao D.Cheng**, Sebastian K.Grimm, et al, Fine epitope signature of antibody neutralization breadth at the HIV-1 envelope CD4 binding site. (Submitted)
3. **Hao D.Cheng**, Noortje de Haan, et al, Age-dependent functional impact of IgG glycan variation in childhood. (In preparation)
4. **Hao D.Cheng**, Guido Ferrari, et al, Diverse antiviral effector functions predicted by unique IgG biophysical features. (In preparation)
5. Easterhoff D, Moody MA, Fera D, **Cheng H**, et al. (2017) Boosting of HIV envelope CD4 binding site antibodies with long variable heavy third complementarity determining region in the randomized double blind RV305 HIV-1 vaccine trial. *PLoS Pathog.*2017 Feb 24;13(2) :e1006182
6. Huang Y, Ferrari G, Alter G, Forthal DN, Kappes JC, Lewis GK, Love JC, Borate B, Harris L, Greene K, Gao H, Phan TB, Landucci G, Goods BA, Dowell KG, **Cheng HD**, et al. (2016) Diversity of Antiviral IgG Effector Activities Observed in HIV-infected and Vaccinated Subjects. *J Immunol.*2016.Dec ;197(12):4603-4612
7. Liping Xie, **Hao Cheng**, et al. (2015) Nanostructural morphology master-regulated the cell capture efficiency of multivalent aptamers. *RSC Advances*, 2015.5.39791
8. Mahan AE, Tedesco J, Dionne K, Baruah K, **Cheng HD**, et al. (2014) A method for high- throughput, sensitive analysis of IgG Fc and Fab glycosylation by capillary electrophoresis. *J Immunol Methods.*2014 Dec 15
9. Boesch AW, Brown EP, **Cheng HD**, et al. (2014) Highly parallel characterization of IgG Fc binding interaction. *MAbs*, 2014 Jul 1;6(4):915-27