

# Arthur S. Kim, Ph.D.

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## **EDUCATION**

August 2016 – August 2020      Doctor of Philosophy, Molecular Microbiology and Microbial Pathogenesis  
Department of Medicine, Division of Infectious Diseases  
Department of Pathology and Immunology  
Washington University School of Medicine  
Advisors: Michael S. Diamond, M.D., Ph.D. and Daved H. Fremont, Ph.D.

September 2007 – December 2011      Bachelor of Science, Microbiology  
Minor, Economics  
University of California, San Diego

## **PROFESSIONAL EXPERIENCE**

January 2021 – Present      Postdoctoral Fellow  
Department of Chemistry  
Department of Immunology and Microbiology  
The Scripps Research Institute  
Advisors: Benjamin F. Cravatt, Ph.D. and John R. Teijaro, Ph.D.

August 2016 – November 2016      Predoctoral Student (Rotation)  
Department of Pathology and Immunology  
Washington University School of Medicine  
Advisor: Herbert "Skip" W. Virgin, M.D., Ph.D.

May 2016 – August 2016      Visiting Scientist  
Department of Chemical Physiology  
The Skaggs Institute for Chemical Biology  
The Scripps Research Institute  
Advisor: Enrique Saez, Ph.D.

August 2012 – August 2016      Research Laboratory Manager  
Department of Immunology and Microbial Science  
The Scripps Research Institute  
Advisor: Michael B. Zwick, Ph.D.

September 2011 – August 2012      Research Technician  
Department of Immunology and Microbial Science  
The Scripps Research Institute  
Advisor: Michael B. Zwick, Ph.D.

May 2009 – September 2011      Research Intern  
Department of Immunology and Microbial Science  
The Scripps Research Institute  
Advisors: Mansun Law, Ph.D., Dennis R. Burton, Ph.D.

## **REVIEWED PUBLICATIONS**

1. **Kim AS**, Leaman DP, Zwick MB. (2014) Antibody to HIV-1 gp41 MPER alters ligand recognition properties and stability of functional Env spikes without complete neutralization. ***PLOS Pathog.*** 10(7):e1004271. PMID: [25058619](#)
2. Lee JH, Leaman DP, **Kim AS**, de La Peña AT, Sliepen K, Yasmeen A, Derking R, Ramos A, de Taeye SW, Ozorowski G, Klein F, Burton DR, Nussenzweig MC, Poignard P, Moore JP, Klasse PJ, Sanders RW, Zwick MB, Wilson IA, Ward AB. (2015) Antibodies to conformational epitopes on gp41 neutralize HIV-1 by destabilizing the Env spike prior to receptor binding. ***Nat Commun.*** 6:8167. PMID: [26404402](#)
3. Parker CG, Galmozzi A, Wang Y, Correia BE, Sasaki K, Joslyn CM, **Kim AS**, Cavallaro C, Lawrence M, Johnson S, Thompson L, Shi J, Narvaiza I, Saez E, Cravatt BF. (2017) Ligand and target discovery by fragment-based screening in human cells. ***Cell.*** 168(3):527-541. PMID: [28111073](#)
4. Stano A, Leaman DP, **Kim AS**, Zhang L, Autin L, Ingale J, Gift SK, Truong J, Wyatt RT, Olson AJ, Zwick MB. (2017) Dense array of spikes on HIV-1 virion particles. ***J Virol.*** 91(14). PMID: [28446665](#)
5. Nasamu AS, Glushakova S, Russo I, Vaupel B, Oksman A, **Kim AS**, Fremont DH, Tolia N, Beck JR, Meyers MJ, Niles JC, Zimmerberg J, Goldberg DE. (2017) Plasmepsins IX and X are essential and druggable mediators of malaria parasite egress and invasion. ***Science.*** 358(6362):518-522. PMID: [29074774](#)
6. Gift SK, Leaman DP, Zhang L, **Kim AS**, Zwick MB. (2017) Functional stability of HIV-1 envelope trimer affects accessibility to broadly neutralizing antibodies at its apex. ***J Virol.*** 91(24). PMID: [28978711](#)
7. Zhang R, **Kim AS**, Fox JM, Nair S, Basore K, Klimstra WB, Rimkunas R, Fong RH, Lin H, Poddar S, Crowe JE Jr, Doranz BJ, Fremont DH, Diamond MS. (2018) Mxra8 is a receptor for multiple arthritogenic alphaviruses. ***Nature.*** 557(7706):570-574. PMID: [29769725](#)
8. Nelson CA, Wilen CB, Dai Y, Orchard RC, **Kim AS**, Stegeman RA, Hsieh LL, Smith TJ, Virgin HW, Fremont DH. (2018) Structural basis for murine norovirus engagement of bile acids and the CD300lf receptor. ***Proc Natl Acad Sci.*** 115(39):9201-9210. PMID: [30194229](#)
9. **Kim AS**, Austin SK, Gardner CL, Zuiani A, Reed DS, Trobaugh DW, Sun C, Basore K, Williamson LE, Crowe JE Jr, Slifka MK, Fremont DH, Klimstra WB, Diamond MS. (2018) Protective antibodies against Eastern equine encephalitis virus bind to epitopes in domains A and B of the E2 glycoprotein. ***Nat Microbiol.*** 4(1):187-197. PMID: [30455470](#)
10. Hasan SS, Sun C, **Kim AS**, Watanabe Y, Chen C, Klose T, Buda G, Crispin M, Diamond MS, Klimstra WB, Rossmann MG. (2018) Cryo-EM Structures of Eastern Equine Encephalitis Virus Reveal Mechanisms of Virus Disassembly and Antibody Neutralization. ***Cell Rep.*** 25(11):3136-3147. PMID: [30540945](#)
11. Basore K, **Kim AS**, Nelson CA, Zhang R, Smith BK, Uranga C, Vang L, Cheng M, Gross ML, Smith J, Diamond MS, Fremont DH. (2019) Cryo-EM structure of Chikungunya virus in complex with the Mxra8 receptor. ***Cell.*** 177(7):1725-1737. PMID: [31080061](#)
12. Zhang R, Earnest JT, **Kim AS**, Winkler ES, Desai P, Adams LJ, Hu G, Bullock C, Gold B, Cherry S, Diamond MS. (2019) Expression of the Mxra8 receptor promotes alphavirus infection and pathogenesis in mice and Drosophila. ***Cell Rep.*** 28(10):2647-2658. PMID [31484075](#)
13. Galmozzi A, Kok BP, **Kim AS**, Montenegro-Burke JR, Lee JY, Spreafico R, Mosure S, Albert V, Cintron-Colon R, Godio C, Webb WR, Conti B, Solt LA, Kojetin D, Parker CG, Peluso JJ, Pru JK, Siuzdak G, Cravatt BF, Saez E. (2019) PGRMC2 is an intracellular haem chaperone critical for adipocyte function. ***Nature.*** 576(7785):138-142. PMID [31748741](#)
14. Zhang L, Irimia A, He L, Landais E, Rantalainen K, Leaman DP, Vollbrecht T, Stano A, Sands D, **Kim AS**, IAVI Protocol G Investigators, Poignard P, Burton DR, Murrell B, Ward AB, Zhu J, Wilson IA, Zwick MB.

(2019) An MPER antibody neutralizes HIV-1 using germline features shared among donors. *Nat Commun.* 10(1):5389. PMID [31772165](#)

15. Kim AS\*, Zimmerman O\*, Fox JM, Nelson CA, Basore K, Zhang R, Durnell L, Desai C, Bullock C, Deem SL, Oppenheimer J, Shapiro B, Wang T, Cherry S, Coyne CB, Handley SA, Landis MJ, Fremont DH, Diamond MS. (2020) An evolutionary insertion in the Mxra8 receptor-binding site confers resistance to alphavirus infection and pathogenesis. *Cell Host Microbe.* 27(3):428-440. PMID [32075743](#) (\*Equal contribution)
16. Graziano VR, Walker FC, Kennedy EA, Wei J, Ettayebi K, Strine MS, Filler RB, Hassan E, Hsieh LL, Kim AS, Kolawole AO, Wobus CE, Lindesmith LC, Baric RS, Estes MK, Orchard RC, Baldrige MT, Wilen CB. (2020) CD300lf is the primary physiologic receptor of murine norovirus but not human norovirus. *PLOS Pathog.* 16(4):e1008242. PMID [32251490](#)
17. Powell LA, Fox JM, Kose N, Kim AS, Mahedi M, Bombardi R, Carnahan RH, Slaughter JC, Morrison TE, Diamond MS, Crowe JE Jr. (2020) Human monoclonal antibodies against Ross River virus target epitopes within the E2 protein and protect against disease. *PLOS Pathog.* 16(5):e1008517. PMID [32365139](#)
18. Case JB, Rothlauf PW, Chen RE, Liu Z, Zhao H, Kim AS, Bloyet L, Zeng Q, Tahan S, Droit L, Ilagan M, Tartell MA, Amarasinghe GK, Henderson JP, Miersch S, Ustav M, Sidhu S, Virgin HW, Wang D, Ding S, Corti D, Theel ES, Fremont DH, Diamond MS, Whelan SPJ. (2020) Neutralizing antibody and soluble receptor inhibition of a replication competition VSV-SARS-CoV-2 and a clinical isolate of SARS-CoV-2. *Cell Host Microbe.* 28(3):475-485. PMID [32735849](#)
19. Powell LA, Miller A, Fox JM, Kose N, Klose T, Kim AS, Bombardi R, Tennekoon RN, de Silva D, Carnahan RH, Morrison TM, Diamond MS, Rossmann MG, Kuhn RJ, Crowe JE Jr. (2020) Human mAbs broadly protect against infection of arthritogenic alphavirus by recognizing conserved elements of the Mxra8 receptor binding domain. *Cell Host Microbe.* 28(5):699-711. PMID [32783883](#)
20. Case JB, Bailey AL, Kim AS, Chen RE, Diamond MS. (2020) Growth, detection, quantification, and inactivation of SARS-CoV-2. *Virology.* 548:39-48. PMID [32838945](#)
21. Hassan AO, Kafai NM, Dmitriev IP, Fox JM, Smith BK, Harvey IB, Chen RE, Winkler ES, Wessel AW, Case JB, Kashentseva E, McCune BT, Bailey AL, Zhao H, VanBlargan LA, Dai Y, Ma M, Adam LJ, Shrihari S, Danis JE, Galinski LE, Hou YJ, Schafer A, Kim AS, Keeler SP, Weiskopf D, Baric RS, Holtzman MJ, Fremont DH, Curiel DT, Diamond MS. (2020) A single-dose intranasal ChAd vaccine protects upper and lower respiratory tracts against SARS-CoV-2. *Cell.* 183(1):169-184. PMID [32931734](#)
22. Zhou QF, Fox JM, Earnest JT, Ng TS, Kim AS, Fibriansah G, Kostyuchenko VA, Shi J, Shu B, Diamond MS, Lok SM. (2020) Structural basis of Chikungunya virus inhibition by monoclonal antibodies. *Proc Natl Acad Sci.* 117(44):27637-27645. PMID [33087569](#)
23. Ma H\*, Kim AS\*, Kafai NM, Earnest JT, Shah AP, Case JB, Basore K, Gilliland TC, Sun C, Nelson CA, Thackray LB, Klimstra WB, Fremont DH, Diamond MS. (2020) LDLRAD3 is a receptor for Venezuelan equine encephalitis virus. *Nature.* 588(7837):308-314. PMID [33208938](#) (\*Equal contribution)
24. Williamson LE, Gilliland T Jr., Yadav PK, Binshtein E, Bombardi R, Kose N, Nargi RS, Sutton RM, Durie CL, Armstrong E, Carnahan RH, Walker LM, Kim AS, Fox JM, Diamond MS, Ohi MD, Klimstra WB, Crowe JE Jr. (2020) Human antibodies protect against aerosolized Eastern equine encephalitis virus. *Cell.* 183(7):1884-1900. PMID [33301709](#)
25. McLellan LK, McAllaster MR, Kim AS, Tothova L, Olson PD, Pinkner JS, Daugherty AL, Hreha TN, Janetka JW, Fremont DH, Hultgren SJ, Virgin HW, Hunstad DA. (2021) Type 1 pilus-mediated binding of *Escherichia coli* to renal tubular epithelium in ascending pyelonephritis. *PLOS Pathog.* 17(1):e1009314. PMID [33513212](#)
26. Williamson LE, Reeder KM, Bailey K, Tran MH, Roy V, Fouch ME, Kose N, Trivette A, Nargi RS, Winkler ES, Kim AS, Gainza C, Rodriguez J, Armstrong E, Sutton RE, Reidy J, Carnahan RH, McDonald WH, Schoeder

CT, Klimstra WK, Davidson E, Doranz BJ, Alter G, Meiler J, Schey KL, Julander JG, Diamond MS, Crowe JR Jr. (2021) Therapeutic alphavirus cross-reactive E1 human antibodies inhibit viral egress. *Cell*. 184(17):4430-4446. PMID [34416147](#)

27. **Kim AS\***, Kafai NM\*, Winkler ES, Gilliland TC Jr., Cottle EL, Earnest JT, Jethva PN, Kaplonek P, Shah AP, Fong RH, Davidson E, Malonis RJ, Quiroz JA, Williamson LE, Vang L, Mack M, Crowe JE Jr., Doranz BJ, Lai JR, Alter G, Gross ML, Klimstra WB, Fremont DH, Diamond MS. (2021) Pan-protective anti-alphavirus human antibodies target a conserved E1 protein epitope. *Cell*. 184(17):4414-4429. PMID [34416146](#) (**\*Equal contribution**)
28. Malonis RJ, Earnest JT, **Kim AS**, Holtsberg FW, Aman MJ, Daily JP, Diamond MS, Kielian MC, Lai JR. (2021) Near-germline human monoclonal antibodies neutralize and protect against multiple arthritogenic alphaviruses. *Proc Natl Acad Sci*. 118(37):e2100104118. PMID [34507983](#)
29. Basore K, Ma H, Kafai NM, Mackin S, **Kim AS**, Nelson CA, Diamond MS, Fremont DH. (2021) Structure of Venezuelan equine encephalitis in complex with its LDLRAD3 receptor. *Nature*. 598(7882):672-676. PMID [34646020](#)
30. Kafai NM, Williamson LE, Binshtein E, Sukupolvi-Petty S, Gardner CL, Ryckman ZJ, Liu J, Mackin S, **Kim AS**, Kose N, Carnahan RH, Jung A, Droit L, Handley SA, Klimstra WB, Crowe JE Jr., Diamond MS. (2022) Neutralizing monoclonal antibodies protect against Venezuelan equine encephalitis virus aerosol challenge. *J. Exp. Med*. 219(4):e20212532. PMID [35297953](#)
31. **Kim AS**, Diamond MS. (2022) A molecular understanding of alphavirus entry and antibody protection. *Nature Reviews Microbiology*. Submitted.

#### **SELECTED ABSTRACTS AND INVITED TALKS**

1. **Kim AS**, Leaman DP, Zwick, MB. Neutralizing antibody to HIV-1 gp41 MPER alters recognition properties of functional Env spikes. AIDS Vaccine, Barcelona, Spain. October 7-10, 2013.
2. **Kim AS**, Leaman DP, Zwick MB. Changes in glycosylation and variable residues of Env arbitrate completeness of HIV-1 neutralization by a potent gp41 antibody. Keystone Symposia: HIV Vaccines, Banff, Alberta, Canada. March 22-27, 2015.
3. **Kim AS. (Invited Talk)** Variable residues and glycosylation modulate the level of incomplete neutralization by an HIV-1 gp41 antibody. Twenty-Second West Coast Retrovirus Meeting, Palm Springs, California, USA. October 1-3, 2015.
4. **Kim AS. (Invited Talk & Scholarship Recipient)** Identification of protective antibody epitopes on the Eastern Equine Encephalitis virus envelope protein. Keystone Symposia: Antibodies as Drugs. Whistler, British Columbia, Canada. February 25-March 1, 2018.
5. **Kim AS**, Zimmerman O, Nelson CA, Basore K, Zhang R, Desai C, Cheng M, Bullock C, Durnell L, Deem SL, Oppenheimer J, Shapiro B, Wang T, Coyne CB, Handley SA, Landis MJ, Fremont DH, Diamond MS. (2019) An evolutionarily ancient sequence insertion in the Mxra8 receptor confers resistance to alphavirus infection. Viruses and Cells Gordon Research Conference. Lucca, Italy. May 26-31, 2019.

#### **PATENT APPLICATIONS**

1. Compositions and Methods for Mitigating Norovirus Infection. US Patent Application No. 62/698,735. Filed July 16, 2018.
2. Compositions and Methods for Inhibition of Alphavirus Infection. International Patent Application No. WO/2019/136316. Filed April 1, 2019.
3. Compositions and Methods for Inhibiting Viral Recognition Sites. US Patent Application No. 63/017,399. Filed April 29, 2020.

## **AWARDS AND SCHOLARSHIPS**

1. Keystone Symposia Future of Science Fund Scholarship, 2018
2. Molecular Basis of Viral Pathogenesis Training Program Fellow (T32 AI007354), 2021-2022
3. Open Philanthropy Fellow of the Life Sciences Research Foundation, 2022-2025

## **PROFESSIONAL ACTIVITIES**

1. Member, American Society of Microbiology
2. Ad hoc reviewer for *PLOS One*, 2020
3. Ad hoc reviewer for *Journal of Immunology*, 2020
4. Ad hoc reviewer for *Cell Reports Medicine*, 2020

## **MENTORING**

<u>Trainee</u>	<u>Current Position</u>
1. Marisa Lue	Associate Scientist, Illumina
2. Judy Jun	MD, Sackler School of Medicine, Tel Aviv University
3. Steven Leung	DDS, Arthur A. Dugoni School of Dentistry, University of the Pacific
4. Daniel Wen	Test Engineer, Ginkgo Bioworks
5. Andrew Trinh	PA, University of Nevada, Las Vegas
6. Edward Pak	Development Associate, BioLegend
7. Sally Cello	Laboratory Solutions Specialist, Mettler-Toledo International, Inc
8. Woojoo Kim	Associate, Charles River Associates
9. Aadit Shah	MD Candidate, Stanford University School of Medicine
10. Drason Zhang	Summer Undergraduate Research Fellow (SURF), Scripps Research