



Catherine Blish

Associate Professor of Medicine (Infectious Diseases)

Medicine - Infectious Diseases

CLINICAL OFFICES

- **Infectious Disease Clinic**

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Bio

CLINICAL FOCUS

- Infectious Disease

ACADEMIC APPOINTMENTS

- Associate Professor, Medicine - Infectious Diseases
- Member, Bio-X
- Member, Child Health Research Institute

ADMINISTRATIVE APPOINTMENTS

- Fellow, Stanford Center for Innovation in Global Health (CIGH), (2015- present)
- Associate Director, Stanford Medical Scientist Training Program (MSTP), (2014- present)

HONORS AND AWARDS

- Chan Zuckerberg Investigator, Chan Zuckerberg Biohub (2017)
- Fellow, Infectious Diseases Society of America (2017)
- Investigator in the Pathogenesis of Infectious Diseases, Burroughs Wellcome Foundation (2017)
- Outstanding Investigator Award, Western Society for Clinical Investigation (2017)
- Elected Member, American Society for Clinical Investigation (2016)
- Tashia and John Morgridge Faculty Scholar in Pediatric Translational Medicine, Stanford Child Health Research Institute (2015)
- Clinical Scientist Development Award, Doris Duke Charitable Foundation (2013)
- Faculty Scholar, Donald E. and Delia B. Baxter Foundation (2013)
- NIH Director's New Innovator Award, NIH (2013)
- McCormick Faculty Award, Stanford University School of Medicine, Office of Diversity and Leadership (2012)
- Outstanding Faculty Mentor Award, Stanford Immunology (2012)

- Young Investigator Award, Arnold and Mabel Beckman Foundation (2012)
- ICAAC Young Investigator Award, American Society for Microbiology (2010)
- Young and Early Career Investigator, Enterprise-OCTAVE Workshop on Correlates of Vaccine Protection to HIV (2010)
- New Investigator Award, University of Washington Center for AIDS Research (2009)
- Young Investigator Award, AIDS Vaccine, Seattle, WA (2007)
- Outstanding Consultant, Infectious Diseases, MedCon (2003)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, Infectious Diseases Society of America (2013 - present)
- Member, American Association of Immunologists (2012 - present)
- Member, American Society for Microbiology (2009 - present)

PROFESSIONAL EDUCATION

- PhD Training: University of Washington School of Medicine (1999) WA
- Residency: University of Washington Medical Center Dept of Medicine (2003) WA
- Medical Education: University of Washington School of Medicine (2001) WA
- Fellowship: University of Washington Infectious Disease Program (2007) WA
- Board Certification: Infectious Disease, American Board of Internal Medicine (2006)
- PhD, University of Washington , Immunology (1999)
- BS, University of California, Davis , Biochemistry (1993)

LINKS

- <https://sites.stanford.edu/blishlab/>; <https://sites.stanford.edu/blishlab/>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Our goal is to develop new methods to prevent and control infectious diseases through better understanding of human immunology. We have several major areas of ongoing investigation.

Understanding the diversity and biology of human natural killer (NK) cells.

Our interest in NK cells stems from their ability to directly lyse infected and tumor cells and to mediate antibody-dependent cellular cytotoxicity, acting as a bridge between innate and adaptive immune responses. Our recent study demonstrated that human NK cells are much more diverse than previously appreciated, with both genetic and environmental determinants. We are currently examining how this diversity is regulated and its implications for viral immunity in both healthy and diseased states.

Defining the role of NK cells in viral immunity.

Vaccination is one of the most effective methods to prevent morbidity and mortality related to infectious diseases, yet there are many viral infections for which durable, broadly cross-protective vaccines remain desperately needed. Recent data indicating that NK cells may be capable of immunologic memory raises the possibility that we could harness NK cells to fight viruses. Current projects in the laboratory are focused on better understanding how human NK cells recognize and control infection with HIV-1, influenza, West Nile Virus, and Epstein Barr Virus.

Immune signatures of human pregnancy.

Pregnant women are at increased risk of contracting viruses including HIV and influenza, and are more susceptible to severe complications once infected. A major focus of the laboratory is to define the immune mechanisms that contribute to viral susceptibility in pregnant women. These investigations focus broadly on T cell, antibody, and NK cell responses to viruses during pregnancy, and use infection and vaccination as models. In addition, we are also studying the role of immunity in preterm birth.

CLINICAL TRIALS

- Genetic and Environmental Factors in the Response to Influenza Vaccination, Recruiting

Teaching

COURSES

2018-19

- Advanced Immunology II: IMMUNOL 202 (Spr)
- Physician Scientist Hour: INDE 217 (Aut, Win, Spr)

2017-18

- Advanced Immunology II: IMMUNOL 202, MCP 202 (Spr)
- Physician Scientist Hour: INDE 217 (Aut, Win, Spr)

2016-17

- Advanced Immunology II: IMMUNOL 202, MCP 202 (Spr)
- Physician Scientist Hour: INDE 217 (Aut, Win, Spr)

2015-16

- Advanced Immunology II: IMMUNOL 202, MCP 202 (Spr)
- The Immune Response to Infectious Diseases: BIOS 245 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Nora Vivanco Gonzalez

Postdoctoral Faculty Sponsor

Lisa Kronstad, Giovanni Martinez-Colon

Doctoral (Program)

Shannon Choi, Shamik Mascharak

Postdoctoral Research Mentor

Lisa Kronstad, Giovanni Martinez-Colon, Elena Vendrame

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biomedical Informatics (Phd Program)
- Cancer Biology (Phd Program)
- Immunology (Phd Program)
- Infectious Diseases (Fellowship Program)
- Microbiology and Immunology (Phd Program)

Publications

PUBLICATIONS

- **Differential Induction of IFN-alpha and Modulation of CD112 and CD54 Expression Govern the Magnitude of NK Cell IFN-gamma Response to Influenza A Viruses.** *Journal of immunology (Baltimore, Md. : 1950)*
Kronstad, L. M., Seiler, C., Vergara, R., Holmes, S. P., Blish, C. A.
2018
- **Zika Virus Infection Induces Cranial Neural Crest Cells to Produce Cytokines at Levels Detrimental for Neurogenesis.** *Cell host & microbe*
Bayless, N. L., Greenberg, R. S., Swigut, T., Wysocka, J., Blish, C. A.
2016; 20 (4): 423-428
- **Human NK cell repertoire diversity reflects immune experience and correlates with viral susceptibility.** *Science translational medicine*
Strauss-Albee, D. M., Fukuyama, J., Liang, E. C., Yao, Y., Jarrell, J. A., Drake, A. L., Kinuthia, J., Montgomery, R. R., John-Stewart, G., Holmes, S., Blish, C. A.
2015; 7 (297): 297ra115-?
- **Enhanced natural killer-cell and T-cell responses to influenza A virus during pregnancy.** *Proceedings of the National Academy of Sciences of the United States of America*
Kay, A. W., Fukuyama, J., Aziz, N., Dekker, C. L., Mackey, S., Swan, G. E., Davis, M. M., Holmes, S., Blish, C. A.
2014; 111 (40): 14506-14511
- **Genetic and environmental determinants of human NK cell diversity revealed by mass cytometry.** *Science translational medicine*
Horowitz, A., Strauss-Albee, D. M., Leipold, M., Kubo, J., Nemat-Gorgani, N., Dogan, O. C., Dekker, C. L., Mackey, S., Maecker, H., Swan, G. E., Davis, M. M., Norman, P. J., Guethlein, et al
2013; 5 (208): 208ra145-?
- **Maintaining a Robust Pipeline of Future Physician-Scientists** *JOURNAL OF INFECTIOUS DISEASES*
Blish, C. A.
2018; 218: S40-S43
- **Diversification of human NK cells: Lessons from deep profiling.** *Journal of leukocyte biology*
Wilk, A. J., Blish, C. A.
2018
- **Humanized mouse model supports development, function, and tissue residency of human natural killer cells** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Herndler-Brandstetter, D., Shan, L., Yao, Y., Stecher, C., Plajer, V., Lietzenmayer, M., Strowig, T., de Zoete, M. R., Palm, N. W., Chen, J., Blish, C. A., Frleta, D., Gurer, et al
2017; 114 (45): E9626-E9634
- **Redefining Memory: Building the Case for Adaptive NK Cells** *JOURNAL OF VIROLOGY*
Paust, S., Blish, C. A., Reeves, R.
2017; 91 (20)
- **Zika virus infection induces cranial neural crest cells to produce cytokines at levels detrimental for neurogenesis**
Blish, C.
SPRINGER.2017: S9-S10
- **Mass Cytometry Analytical Approaches Reveal Cytokine-Induced Changes in Natural Killer Cells.** *Cytometry. Part B, Clinical cytometry*
Vendrame, E., Fukuyama, J., Strauss-Albee, D. M., Holmes, S., Blish, C. A.
2017; 92 (1): 57-67
- **The newborn human NK cell repertoire is phenotypically formed but functionally reduced** *CYTOMETRY PART B-CLINICAL CYTOMETRY*
Strauss-Albee, D. M., Liang, E. C., Ranganath, T., Aziz, N., Blish, C. A.
2017; 92 (1): 33-41
- **The natural killer cell response to West Nile virus in young and old individuals with or without a prior history of infection.** *PloS one*
Yao, Y., Strauss-Albee, D. M., Zhou, J. Q., Malawista, A., Garcia, M. N., Murray, K. O., Blish, C. A., Montgomery, R. R.
2017; 12 (2)

- **NKG2A-Expressing Natural Killer Cells Dominate the Response to Autologous Lymphoblastoid Cells Infected with Epstein-Barr Virus** *FRONTIERS IN IMMUNOLOGY*
Hatton, O., Strauss-Albee, D. M., Zhao, N. Q., Haggadone, M. D., Pelpola, J. S., Krams, S. M., Martinez, O. M., Blish, C. A.
2016; 7
- **Increased Proinflammatory Responses of Monocytes and Plasmacytoid Dendritic Cells to Influenza A Virus Infection During Pregnancy** *JOURNAL OF INFECTIOUS DISEASES*
Le Gars, M., Kay, A. W., Bayless, N. L., Aziz, N., Dekker, C. L., Swan, G. E., Davis, M. M., Blish, C. A.
2016; 214 (11): 1666-1671
- **The newborn human NK cell repertoire is phenotypically formed but functionally reduced.** *Cytometry. Part B, Clinical cytometry*
Strauss-Albee, D. M., Liang, E. C., Ranganath, T., Aziz, N., Blish, C. A.
2016
- **Natural Killer Cells Display Functional and Receptor Diversity in Response to Alloantigen.**
Hatton, O., Shawler, T., Blish, C., Martinez, O., Krams, S.
WILEY-BLACKWELL.2016: 721
- **NKG2A-Expressing Natural Killer Cells Dominate the Response to Latent Epstein-Barr Virus Infection.**
Hatton, O., Strauss-Albee, D., Krams, S., Blish, C., Martinez, O.
WILEY-BLACKWELL.2016: 720-21
- **Natural Killer Cell Diversity in Viral Infection: Why and How Much?** *Pathogens & immunity*
Blish, C. A.
2016; 1 (1): 165-192
- **Human NK Cell Diversity in viral infection: Ramifications of Ramification** *FRONTIERS IN IMMUNOLOGY*
Strauss-Albee, D. M., Blish, C. A.
2016; 7
- **Application of Mass Cytometry (CyTOF) for Functional and Phenotypic Analysis of Natural Killer Cells.** *Methods in molecular biology (Clifton, N.J.)*
Kay, A. W., Strauss-Albee, D. M., Blish, C. A.
2016; 1441: 13-26
- **Pregnancy Does Not Attenuate the Antibody or Plasmablast Response to Inactivated Influenza Vaccine.** *journal of infectious diseases*
Kay, A. W., Bayless, N. L., Fukuyama, J., Aziz, N., Dekker, C. L., Mackey, S., Swan, G. E., Davis, M. M., Blish, C. A.
2015; 212 (6): 861-870
- **Intrinsic retroviral reactivation in human preimplantation embryos and pluripotent cells.** *Nature*
Grow, E. J., Flynn, R. A., Chavez, S. L., Bayless, N. L., Wossido, M., Wesche, D. J., Martin, L., Ware, C. B., Blish, C. A., Chang, H. Y., Pera, R. A., Wysocka, J.
2015; 522 (7555): 221-225
- **Immunogenicity and clinical efficacy of influenza vaccination in pregnancy** *FRONTIERS IN IMMUNOLOGY*
Kay, A. W., Blish, C. A.
2015; 6: 1-9
- **IL-2 DEPENDENT NATURAL KILLER CELL RESPONSES TO ALLOGENEIC AND AUTOLOGOUS EPSTEIN-BARR VIRUS (EBV) plus B CELL LYMPHOMAS**
Hatton, O., Hadad, U., Blish, C., Esquivel, C., Krams, S., Martinez, O.
WILEY-BLACKWELL.2015: 93
- **IL-2-Dependent Natural Killer Cell Responses to Epstein-Barr Virus B Cell Lymphomas Involve the NKG2A/NKG2C Axis**
Hatton, O., Strauss-Albee, D., Blish, C., Esquivel, C., Krams, S., Martines, O.
WILEY-BLACKWELL.2015
- **Delayed BCG vaccination--time to take a shot.** *journal of infectious diseases*
Kay, A. W., Blish, C. A.
2015; 211 (3): 335-337
- **Immunogenicity and Clinical Efficacy of Influenza Vaccination in Pregnancy.** *Frontiers in immunology*

- Kay, A. W., Blish, C. A.
2015; 6: 289-?
- **Coordinated Regulation of NK Receptor Expression in the Maturing Human Immune System** *JOURNAL OF IMMUNOLOGY*
Strauss-Albee, D. M., Horowitz, A., Parham, P., Blish, C. A.
2014; 193 (10): 4871-4879
 - **Association between Latent Proviral Characteristics and Immune Activation in Antiretrovirus-Treated Human Immunodeficiency Virus Type 1-Infected Adults.** *Journal of virology*
Liang, E. C., Sceats, L., Bayless, N. L., Strauss-Albee, D. M., Kubo, J., Grant, P. M., Furman, D., Desai, M., Katzenstein, D. A., Davis, M. M., Zolopa, A. R., Blish, C. A.
2014; 88 (15): 8629-8639
 - **Natural Killer Cell Responses to Autologous and Allogeneic Epstein-Barr Virus (EBV)(+) B Cell Lymphomas**
Hatton, O., Hadad, U., Strauss-Albee, D., Blish, C., Esquivel, C., Krams, S., Martinez, O.
LIPPINCOTT WILLIAMS & WILKINS.2014: 245-46
 - **Systemic Cytokine Levels Show Limited Correlation With Risk of HIV-1 Acquisition.** *Journal of acquired immune deficiency syndromes*
Lehman, D. A., Ronen, K., Blish, C. A., Baeten, J. M., Jalalian-Lechak, Z., Jaoko, W., Mandaliya, K., Richardson, B. A., McClelland, R. S., Overbaugh, J.
2014; 66 (2): 135-139
 - **Natural Killer Cell Responses to Autologous and Allogeneic Epstein-Barr Virus (EBV)(+) B Cell Lymphomas**
Hatton, O., Hadad, U., Strauss-Albee, D., Blish, C., Esquivel, C., Krams, S., Martinez, O.
WILEY-BLACKWELL.2014: 245-46
 - **Association between Cellular Immune Activation, Target Cell Frequency, and Risk of Human Immunodeficiency Virus Type 1 Superinfection** *JOURNAL OF VIROLOGY*
Blish, C. A., Dogan, O. C., Jaoko, W., McClelland, R. S., Mandaliya, K., Odem-Davis, K., Richardson, B. A., Overbaugh, J.
2014; 88 (10): 5894-5899
 - **Antibody-dependent cell-mediated virus inhibition antibody activity does not correlate with risk of HIV-1 superinfection.** *Journal of acquired immune deficiency syndromes*
Forthal, D. N., Landucci, G., Chohan, B., Richardson, B. A., McClelland, R. S., Jaoko, W., Blish, C., Overbaugh, J.
2013; 63 (1): 31-33
 - **Genital Inflammation Predicts HIV-1 Shedding Independent of Plasma Viral Load and Systemic Inflammation** *JAIDS-JOURNAL OF ACQUIRED IMMUNE DEFICIENCY SYNDROMES*
Blish, C. A., McClelland, R. S., Richardson, B. A., Jaoko, W., Mandaliya, K., Baeten, J. M., Overbaugh, J.
2012; 61 (4): 436-440
 - **HIV-1 Transmission Goes Retro (Steps Back)** *JOURNAL OF INFECTIOUS DISEASES*
Blish, C. A.
2012; 206 (9): 1336-1338
 - **Measurements of Immune Responses for Establishing Correlates of Vaccine Protection Against HIV** *AIDS RESEARCH AND HUMAN RETROVIRUSES*
Burgers, W. A., Manrique, A., Masopust, D., McKinnon, L. R., Reynolds, M. R., Rolland, M., Blish, C., Chege, G. K., Curran, R., Fischer, W., Herrera, C., Sather, D. N.
2012; 28 (7): 641-648
 - **Cellular immune responses and susceptibility to HIV-1 superinfection: a case-control study** *AIDS*
Blish, C. A., Dogan, O. C., Jaoko, W., McClelland, R. S., Mandaliya, K., Odem-Davis, K. S., Richardson, B. A., Overbaugh, J.
2012; 26 (5): 643-646
 - **The impact of HIV-1 infection and exposure on natural killer (NK) cell phenotype in Kenyan infants during the first year of life.** *Frontiers in immunology*
Slyker, J. A., Lohman-Payne, B., John-Stewart, G. C., Dong, T., Mbori-Ngacha, D., Tapia, K., Atzberger, A., Taylor, S., Rowland-Jones, S. L., Blish, C. A.
2012; 3: 399-?
 - **The impact of HIV-1 infection and exposure on natural killer (NK) cell phenotype in Kenyan infants during the first year of life** *FRONTIERS IN IMMUNOLOGY*
Slyker, J. A., Lohman-Payne, B., John-Stewart, G. C., Dong, T., Mbori-Ngacha, D., Tapia, K., Atzberger, A., Taylor, S., Rowland-Jones, S. L., Blish, C. A.
2012; 3

- **The role of amino acid changes in the human immunodeficiency virus type 1 transmembrane domain in antibody binding and neutralization** *VIROLOGY*
Lovelace, E., Xu, H., Blish, C. A., Strong, R., Overbaugh, J.
2011; 421 (2): 235-244
- **The Breadth and Potency of Passively Acquired Human Immunodeficiency Virus Type 1-Specific Neutralizing Antibodies Do Not Correlate with the Risk of Infant Infection** *JOURNAL OF VIROLOGY*
Lynch, J. B., Nduati, R., Blish, C. A., Richardson, B. A., Mabuka, J. M., Jalalian-Lechak, Z., John-Stewart, G., Overbaugh, J.
2011; 85 (11): 5252-5261
- **Hormonal Contraception and HIV-1 Transmission** *AMERICAN JOURNAL OF REPRODUCTIVE IMMUNOLOGY*
Blish, C. A., Baeten, J. M.
2011; 65 (3): 302-307
- **Changes in Plasma Cytokines after Treatment of *Ascaris lumbricoides* Infection in Individuals with HIV-1 Infection** *JOURNAL OF INFECTIOUS DISEASES*
Blish, C. A., Sangare, L., Herrin, B. R., Richardson, B. A., John-Stewart, G., Walson, J. L.
2010; 201 (12): 1816-1821
- **Comparative Immunogenicity of Subtype A Human Immunodeficiency Virus Type 1 Envelope Exhibiting Differential Exposure of Conserved Neutralization Epitopes** *JOURNAL OF VIROLOGY*
Blish, C. A., Sather, D. N., Sellhorn, G., Stamatas, L., Sun, Y., Srivastava, I., Barnett, S. W., Cleveland, B., Overbaugh, J., Hu, S.
2010; 84 (5): 2573-2584
- **Breadth of Neutralizing Antibody Response to Human Immunodeficiency Virus Type 1 Is Affected by Factors Early in Infection but Does Not Influence Disease Progression** *JOURNAL OF VIROLOGY*
Piantadosi, A., Panteleeff, D., Blish, C. A., Baeten, J. M., Jaoko, W., McClelland, R. S., Overbaugh, J.
2009; 83 (19): 10269-10274
- **Cross-Subtype Neutralization Sensitivity despite Monoclonal Antibody Resistance among Early Subtype A, C, and D Envelope Variants of Human Immunodeficiency Virus Type 1** *JOURNAL OF VIROLOGY*
Blish, C. A., Jalalian-Lechak, Z., Rainwater, S., Nguyen, M., Dogan, O. C., Overbaugh, J.
2009; 83 (15): 7783-7788
- **Human Immunodeficiency Virus Type 1 Superinfection Occurs despite Relatively Robust Neutralizing Antibody Responses** *JOURNAL OF VIROLOGY*
Blish, C. A., Dogan, O. C., Derby, N. R., Nguyen, M., Chohan, B., Richardson, B. A., Overbaugh, J.
2008; 82 (24): 12094-12103
- **Enhancing exposure of HIV-1 neutralization epitopes through mutations in gp41** *PLOS MEDICINE*
Blish, C. A., Nguyen, M., Overbaugh, J.
2008; 5 (1): 90-103
- **Transmission of HIV-1 in the face of neutralizing antibodies** *CURRENT HIV RESEARCH*
Blish, C. A., Blay, W. A., Haigwood, N. L., Overbaugh, J.
2007; 5 (6): 578-587
- **HIV-1 subtype A envelope variants from early in infection have variable sensitivity to neutralization and to inhibitors of viral entry** *AIDS*
Blish, C. A., Nedellec, R., Mandaliya, K., Mosier, D. E., Overbaugh, J.
2007; 21 (6): 693-702
- **Anergic CD8(+) T cells can persist and function in vivo** *JOURNAL OF IMMUNOLOGY*
Blish, C. A., Dillon, S. R., Farr, A. G., Fink, P. J.
1999; 163 (1): 155-164
- **Chronic modulation of the TCR repertoire in the lymphoid periphery** *JOURNAL OF IMMUNOLOGY*
Blish, C. A., Gallay, B. J., Turk, G. L., Kline, K. V., Wheat, W., Fink, P. J.
1999; 162 (6): 3131-3140
- **LOSS OF CELL-CYCLE CONTROLS IN APOPTOTIC LYMPHOBLASTS OF THE BURSA OF FABRICIUS** *MOLECULAR BIOLOGY OF THE CELL*
Neiman, P. E., BLISH, C., HEYDT, C., Loring, G., THOMAS, S. J.
1994; 5 (7): 763-772