BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Fera, Daniela

eRA COMMONS USER NAME (credential, e.g., agency login): D_FERA

POSITION TITLE: Assistant Professor of Biochemistry

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
New York University	B.A.	05/2005	Chemistry (honors), Mathematics
University of Pennsylvania	Ph.D.	08/2012	Biological Chemistry
Boston Children's Hospital (postdoc)	n/a	07/2017	Structural Biology

A. Personal Statement

Throughout my research career, I learned a variety of techniques in biochemistry, cell biology, and bioinformatics (e.g. biolayer interferometry, isothermal titration calorimetry, cell viability assays, etc.). During my postdoctoral training I developed expertise in X-ray crystallography and negative stain electron microscopy while determining and analyzing three-dimensional structures of antibodies and their complexes with the HIV envelope (Env), a target for vaccine development. I also trained in preparing cryo-electron microscopy (cryo-EM) grids and performing data collection. Through my investigations, I was able to show the importance of studying structures throughout the virus-antibody co-evolutionary process that occurs in HIV-1 infected individuals who produce broadly neutralizing antibodies (bnAbs) that can target >50% HIV variants: key structural or mutational changes were identified from all the structures I had determined. I also analyzed structures of antibodies produced from immunization studies in complex with HIV Env to highlight improvements that could be incorporated into future immunogens.

My current research builds on my prior work, which had focused on later members of bnAb lineages, as well as unliganded antibody structures. Specifically, current research focuses on early members of antibody lineages that interact with HIV Env, to identify what properties of the virus Env triggered a lineage that eventually led to the development of bnAbs. This work will identify key features of HIV Envs to incorporate into immunogens to elicit similar lineages in uninfected individuals by vaccination. We are also analyzing antibodies from influenza immunization studies and their interactions with hemagglutinin to guide universal flu vaccine design strategies. I am equipped to oversee these projects because of my unique combination of expertise in the approaches necessary to carry out this work, instrumentation available including the support of facilities and collaborators, the motivation of undergraduate students, and the preliminary data we have already obtained.

As an Adjunct Professor of Biochemistry and Biophysics at the University of Pennsylvania, I have local connections that benefit my research group at Swarthmore College. For example, we have access to the staff and equipment at the Electron Microscopy (EM) facilities at the University of Pennsylvania, making the EM work in this proposal feasible. Moreover, our work is of wide interest to the field. As an independent PI, I have already successfully attained grants from amfAR, the Foundation for AIDS Research, and the NIH.

Three recent publications and a poster presentation related to this proposal are listed below. In addition to the two papers listed below, we have two manuscripts under review and another in preparation describing crystal structures and EM data determined in my laboratory.

1. Morriss, J.W., Zhou, J.O., Fera, D. (2019). Structural Analysis of an Early Intermediate of the DH270 Broadly Neutralizing B-cell Lineage. (Poster Presentation). HIV Vaccines (X7) Keystone Symposia, Whistler, British Columbia Canada
2. Zhou, J.O., Ton, T., Morriss, J.W., Nguyen, D., Fera, D. (2018) Structural Insights from HIV-Antibody Co-Evolution and Related Immunization Studies. *AIDS Research and Human Retroviruses*. 34(9):760-768.
3. Fera, D., Lee, M.S., Wiehe, K., Meyerhoff, R.R., Piai, A., Bonsignori, M., Aussedat, B.,Walkowicz, W.E., Ton, T., Zhou, J.O., Danishefsky, S., Haynes, B.F., and Harrison, S.C. (2018) HIV Envelope V3 Region Mimic Embodies Key Features of a Broadly Neutralizing Antibody Lineage Epitope. *Nature Communications*. 9(1111).
4. Bonsignori*, M., Kreider*, E.F., Fera*, D., Meyerhoff*, R.R., Bradley*, T., Wiehe, K., Alam, S. A., Aussedat, B., Walkowicz, W.E., Hwang, K.K., Saunders, K.O., Zhang, R., Gladden, M.A., Monroe, A., Kumar, A., Xia, S.M., Cooper, M., Louder, M.K., McKee, K., Bailer, R.T., Pier, B.W., Jette, C.A., Kelsoe, G., Williams, W.B., Morris, L., Kappes, J., Wagh, K., Kamanga, G., Cohen, M.S., Hraber, P.T., Montefiori, D.C., Trama, A., Liao, H.X., Kepler, T.B., Moody, M.A., Gao, F., Danishefsky, S.J., Mascola, J.R., Shaw, G.M., Hahn, B.H., Harrison, S.C., Korber, B.T., Haynes, B.F. (2017) Staged induction of HIV-1 glycan-dependent broadly neutralizing antibodies. *Science Translational Medicine.*9(381).

*(*equal contribution) Swarthmore College undergraduate coauthors are underlined.*

Including undergraduates in research is central to the educational mission of Swarthmore College. I have constructed realistic research plans and timelines for undergraduate research and maintained effective and productive relationships with old collaborators. Each semester I have had at least four undergraduate students working in the laboratory (the last year I had ten, in anticipation of fulfilling the roles of the four graduating seniors). Three of the students worked on honors theses in my laboratory. Four students have graduated and all of them have taken positions as research assistants at other institutions, with plans to go on to graduate or medical school after. One has even joined a laboratory at the University of Pennsylvania focusing on HIV work.

Undergraduate students have been involved in all aspects of my research program: carrying out experiments, analyzing data, visiting other laboratories and facilities, initiating new research directions and writing up work for submission to peer-reviewed journals. All students have presented posters describing their research at meetings ranging from local Swarthmore College events to national and international conferences. Most recently, these have included poster presentations at the 2019 HIV Vaccines Keystone Symposium (Whistler, BC), where I was invited to serve as a session chair, and the 2018 FCBIS meeting (Philadelphia, PA).

I have mentored a diverse group of undergraduate students who will go on to advanced work in science or medicine. Some of the students who have worked in my laboratory in the past 10 years and have gone on to graduate or medical school include:

During Ph.D.:

Student	Career Path
Sarah Johnson (undergraduate '10)	Ph.D. program, Princeton University
Stephanie Barros (graduate, '15)	Postdoctoral Fellow, New York University

During Postdoctoral Fellowship:

Student	Career Path
Claudia Jette (undergraduate '15)	Ph.D. program, California Institute of Technology
Brendan Pier (technician '14-'15)	M.D. program, University of Connecticut Medical School
Matthew Lee (technician, '16-'17)	M.D. program, Carle Illinois College of Medicine

As PI:

Student	Career Path
Julia Morriss '19	Lab Technician, Broad Institute
Diep Nguyen '19	Lab Technician, University of Pittsburgh
Therese Ton '19	Lab Technician, Broad Institute
Jeffrey Zhou '19	Lab Technician, University of Pennsylvania

B. Positions and Honors

Employment and Experience

09/02 – 05/05	Teaching Assistant, New York University Department of Chemistry
09/05 – 06/06	Math Teacher, Frederick Douglass Academy VI High School
11/05 – 05/06	Math Teacher (after-school program), York College/Far Rockaway HS
07/06 – 08/06	Teaching Assistant, New York University Department of Chemistry
05/07 – 05/08	CTL Graduate Fellow, Center for Teaching and Learning, University of Pennsylvania
09/14 – 12/14	Adjunct Faculty, Department of the Sciences, Wentworth Institute of Technology
09/14 – 05/15	Adjunct Faculty, Department of Chemistry and Physics, Emmanuel College
09/15 – 12/15, and 09/16 – 12/16	Adjunct Professor of Chemistry, School of Arts and Sciences, Massachusetts College of Pharmacy and Health Sciences
11/12 – 07/17	Postdoctoral Researcher, Boston Children's Hospital / Harvard Medical School
08/17 – present	Assistant Professor of Biochemistry Department of Chemistry and Biochemistry, Swarthmore College
08/18 – present	Adjunct Assistant Professor of Biochemistry and Biophysics, University of Pennsylvania

Other Experience and Professional Memberships

03/08 – 04/08	Selection Committee for Penn Prize for Excellence in Teaching by Graduate Students
09/08 – 05/09	Graduate & Professional Student Assembly Recreation Advisory Board
09/08 – 05/09	Graduate & Professional Student Assembly Student Life Policy Council
07/09, 07/10	Organizing Committee, Chemistry-Biology Interface Scientific Retreat
11/09, 05/11	Organizing Committee, Chemical Biophysics Mini-Symposium
06/15 – 07/17	Mentoring Committee, Boston Children's Hospital Postdoctoral Association
06/16 – 07/17	Mentoring Committee Chair, Boston Children's Hospital Postdoctoral Association
03/15 – 07/17	Member, HMS Biological Chemistry and Molecular Pharmacology Training Committee
10/17 – present	Ad Hoc Reviewer for Scientific Journals
09/18 – present	Scientific Advisory Committee member, amfAR, The Foundation for AIDS Research
11/18 – present	Member, Sigma Xi
04/19 – present	Richard Rubin Scholar Mentor, Swarthmore College
03/20 – present	American Chemical Society, member

Honors and Awards

01/03 – 05/03	Dean's Undergraduate Research Fund Recipient, New York University
06/03 – 08/03	Department of Chemistry Research Fellowship, New York University
09/02 – 05/05	College of Arts and Science Presidential Scholar, New York University
04/05	Merck & Company Award, New York University
04/05	Founder's Day Award, New York University
04/07	Chemistry Department Teaching Award, University of Pennsylvania
04/07	Penn Prize for Excellence in Teaching by Graduate Students, University of Pennsylvania
05/07 – 05/08	Center for Teaching and Learning Fellowship, University of Pennsylvania
09/07 – 08/09	NIH Chemistry-Biology Interface Pre-doctoral Training Grant (GM071339)
09/09 – 08/10	BMB Structural Biology Training Grant, University of Pennsylvania
05/12	Second Place Prize for Poster Presentation, Wistar Institute Cancer Retreat
12/14 – 10/16	NRSA NIH Ruth L. Kirschtein National Research Service Award, F32
09/15	Postdoctoral Award, CHAVI-ID Annual Retreat
09/15	Poster Prize, CHAVI-ID Annual Retreat
11/16 – present	Mathilde Krim Fellowship in Basic Biomedical Research
02/17	Travel Award, Boston Children's Hospital Postdoctoral Association
08/17	Kiehl's LifeRide for amfAR Grant Recipient

C. Contributions to Science (undergraduate authors underlined in publications)

1. **Structural Analysis of Antibody Affinity Maturation and Interactions with HIV Env.** My current laboratory is continuing work that I began as a postdoctoral fellow. My research focused, and continues to focus, on developing an understanding of the antibody response to the rapidly co-evolving pathogen, HIV, to provide insights for vaccine design. Two of my projects involved understanding antibody affinity maturation in HIV-infected patients who developed antibodies of significant breadth. One of these was the first patient studied from the onset of infection through the development of broadly neutralizing antibodies against the receptor binding site, making it an important case study for understanding immunogen design. I used X-ray crystallography and biochemical approaches to characterize the antibody lineage from this patient. My structural analysis revealed that sites outside the antigen-binding surface may be critical during affinity maturation and thus should be considered in addition to the commonly mutated antibody complementarity determining regions. I have extended my structural toolkit in analyzing antibody affinity maturation against a glycan site on the HIV envelope from a second donor. I used negative-stained electron microscopy, together with kinetic analyses, to analyze the binding epitope of the glycan-dependent antibodies and showed that this antibody binds differently compared to others of the same class. Crystal structures with a synthetic glycopeptide further revealed that improbable mutations were critical in the development of breadth in the donor that produced glycan-dependent antibodies. This latter donor is a focus of some of our current research.
   a. **Fera, D.**, Schmidt, A.G, Haynes, B.F., Gao, F., Liao, H.X., Kepler, T.B., and Harrison, S.C. (2014) Affinity Maturation in an HIV Broadly Neutralizing B-cell Lineage Through Reorientation of Variable Domains. *PNAS,* 111; 10275-10280
   b. Bonsignori*, M., Kreider*, E.F., **Fera*, D.**, Meyerhoff*, R.R., Bradley*, T., Wiehe, K., Alam, S. A., Aussedat, B., Walkowicz, W.E., Hwang, K.K., Saunders, K.O., Zhang, R., Gladden, M.A., Monroe, A., Kumar, A., Xia, S.M., Cooper, M., Louder, M.K., McKee, K., Bailer, R.T., Pier, B.W., Jette, C.A., Kelsoe, G., Williams, W.B., Morris, L., Kappes, J., Wagh, K., Kamanga, G., Cohen, M.S., Hraber, P.T., Montefiori, D.C., Trama, A., Liao, H.X., Kepler, T.B., Moody, M.A., Gao, F., Danishefsky, S.J., Mascola, J.R., Shaw, G.M., Hahn, B.H., Harrison, S.C., Korber, B.T., Haynes, B.F. (2017) Staged induction of HIV-1 glycan-dependent broadly neutralizing antibodies. *Science Translational Medicine.* 9(381). (*equal contribution)
   c. **Fera, D.**, Lee, M.S., Wiehe, K., Meyerhoff, R.R., Piai, A., Bonsignori, M., Aussedat, B., Walkowicz, W.E., Ton, T., Zhou, J.O., Danishefsky, S., Haynes, B.F., and Harrison, S.C. (2018) HIV Envelope V3 Region Mimic Embodies Key Features of a Broadly Neutralizing Antibody Lineage Epitope. *Nat Commun.* 16;9(1):1111

2. **Structural Analysis of HIV Envelope – Antibody Complexes from Immunization Trials.** In addition to the contributions described above, I worked with other collaborators at the Duke Human Vaccine Institute (DHVI) to identify the binding modes of anti-HIV antibodies elicited from rhesus macaque immunizations and human vaccination trials. I used X-ray crystallography and negative stain electron microscopy in these studies, which revealed that the elicited antibodies could only bind open envelope trimers and thus could not develop the breadth one would desire to eradicate this rapidly evolving pathogen. These results suggested that immunizations should be performed with HIV envelope trimers that are stable in a closed conformation, which mask non-neutralizing antibody epitopes.
   a. Bradley*, T., **Fera*, D.**, Bhiman, J., Eslamizar, L., Lu, X., Anasti, K., Zhang, R., Sutherland, L.L., Scearce, R.M., Stolarchuk, C., Lloyd, K.E., Parks, R., Martelli, A., Foulger, A., Abdool-Karim, S.S., Barnett, S., Kepler, T.B., Alam, S.M., Montefiori, D.C., Moody, M.A., Liao, H.X., Morris, L., Santra, S., Harrison, S.C., and Haynes, B.F. (2016) Structural Constraints of Vaccine-Induced Tier-2 Autologous HIV Neutralizing Antibodies Targeting the Receptor Binding Site. *Cell Reports,* 14; 1-12. (*equal contribution)
   b. Easterhoff, R., Moody, M. A., **Fera, D.,** Cheng, H., Ackerman, M., Wiehe, K., Saunders, K.O., Vandergrift, N., Parks, R., Kim, J., Michael, N.L., O'Connell, R.J., Excler, J.L., Robb, M.L., Vasan, S., Rerks-Ngarm, S., Kaewkungwal, J., Pitisuttithum, P., Nitayaphan, S., Sinangil, F., Tartaglia, J., Phogat, S., Kepler, T.B., Alam, S.M., Liao, H.X., Ferrari, G., Seaman, M.S., Montefiori, D.C., Tomaras, G.D., Harrison, S.C. and Haynes, B.F. (2017) HIV envelope CD4 binding site antibodies

with long variable heavy third complementarity determining region boosted with a HIV vaccine. *PLoS Pathogens.* 13(2).

c. Williams*, W.B., Zhang*, J., Jiang*, C., Nicely*, N.I., **Fera*, D.**, Luo, K., Moody, M.A., Liao, H.X., Alam, S.M., Kepler, T.B., Ramesh, A., Wiehe, K., Holland, J.A., Bradley, T., Vandergrift, N., Saunders, K.O., Parks, R., Foulger, A., Xia, S.M., Bonsignori, M., Montefiori, D.C., Louder, M., Eaton, A., Santra, S., Scearce, R., Sutherland, L., Newman, A., Bouton-Verville, H., Bowman, C., Bomze, H., Gao, F., Marshall, D.J., Whitesides, J.F., Nie, X., Kelsoe, G., Reed, S.G., Fox, C.B., Clary, K., Koutsoukos, M., Franco, D., Mascola, J.R., Harrison, S.C., Haynes, B.F., Verkoczy, L. (2017) Initiation of HIV neutralizing B cell lineages with sequential envelope immunizations. *Nat Commun.* 23;8(1):1732 (*equal contribution)

Complete List of Published Work in MyBibliography:
https://www.ncbi.nlm.nih.gov/sites/myncbi/daniela.fera.1/collections/58357840/public/

D. Additional Information: Research Support and/or Scholastic Performance

Research Support (within the last three years)

Ongoing Research Support

NIH/NIAID Research Enhancement Award (R15) 04/01/2020 – 03/31/2023
1R15AI150484 - 01A1 Fera (PI)
Analysis of the Initiation of an HIV Broadly Neutralizing Antibody Lineage in a Single Host
The major goal of the proposed research is to analyze, structurally, the initiation of a virus-antibody "arms race" in a donor who developed antibodies of significant breadth, which would be informative for immunogen design.

Swarthmore College Faculty Research Fund Fera (PI) 11/01/2017 – 8/31/2019
Structural analyses of antibody-virus co-evolution to guide immunogen design.
Determine structures and analyze mutants of an earlier member of the DH270 broadly neutralizing N332-glycan dependent antibody lineage in complex with the HIV envelope to determine features of the HIV envelope that triggered this lineage, and contribute to vaccine design strategies.

Swarthmore College Start-Up Fund Fera (PI) 08/1/2017 – 07/31/2022
Determine how antibodies develop and bind to a variety of antigens.
This fund supports a variety of biochemical and structural investigations of antibody-antigen complexes.

Completed Research Support

Mathilde Krim Fellowship in Basic Biomedical Research – Phase II 8/01/2017 – 07/31/2018
109502–61–RKVA Fera (PI)
Structural analyses of antibody-virus co-evolution to guide immunogen design.
Determine structures and analyze mutants of an earlier member of the DH270 broadly neutralizing glycan dependent antibody lineage in complex with the HIV envelope to determine features of the HIV envelope that triggered this lineage, and contribute to vaccine design strategies.

Mathilde Krim Fellowship in Basic Biomedical Research 11/01/2016 – 07/31/2017
109502–61–RKVA Fera (PI)
Structural analyses of antibody-virus co-evolution to guide immunogen design.
The major goal was to biochemically and structurally investigate how late members of a glycan-dependent broadly neutralizing antibody lineage penetrate the HIV envelope glycan shield and bind to the envelope's protein regions.