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: Ronen Marmorstein

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

POSITION TITLE: Professor and Vice Chair

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
University of California, Davis, CA	B.S.	1984	Chemistry and Genetics
University of Chicago, Chicago, IL	M.S.	1989	Physical Chemistry
University of Chicago, Chicago, IL	Ph.D.	1989	Chemistry

A. Personal Statement

My laboratory studies the molecular mechanisms of (1) protein post- and co-translational protein acetylation and acetyl-CoA metabolism (2) gene expression and epigenetic regulation, and (3) MAPK signaling. The laboratory uses a broad range of biochemical, biophysical and structural research tools (X-ray crystallography and cryo-EM) to determine macromolecular structure and mechanism of action. The laboratory also uses high-throughput small molecule screening and structure-based design strategies to develop protein-specific small-molecule probes to interrogate protein function and for preclinical studies.

Ongoing projects that I would like to highlight include:

NIH P01 AG 031862 (Dr. S. Berger)
07/01/2008-6/31/2023
Epigenetics of Aging and Age-Associated Diseases
Project 1: Molecular basis for epigenome homeostasis by histone chaperone and acetyltransferase complexes (Dr. R. Marmorstein, Project Leader)
Project 1 covers our work on studying the structure/function of the HUCA histone chaperone complex and molecular events associated with H4K16 acetylation

NIH R35 GM118090 (Dr. R. Marmorstein)
07/01/2016-06/31/2021
Molecular Mechanisms and inhibition of Protein Acetyltransferases
The overall goal of this proposal is to understand the molecular mechanisms of protein acetylation by HATs, non-histone KATs and NATs.
The renewal application received a priority score of 20 and is expected to be funded

NIH R01 CA226888 (Drs. R. Marmorstein and J. Winkler)
12/03/2018-11/30/2023
Development of BRAF Dimer Inhibitors to Treat Drug Resistant Melanoma
The overall goal of this proposal is to use the RAS-RAF-MEK-ERK (MAPK/ERK) signaling pathway as a model to develop small molecule inhibitors that specifically target kinase dimers as lead compounds for therapeutic development

I am extremely dedicated to training the next generation of scientist. Over the 27 years of my faculty tenure, 31 graduate students have obtained Ph.D. degrees from my laboratory and 18 postdoctoral fellows have previously worked in my laboratory. In addition, 6 research technicians and 40 undergraduate students have

previously worked in my laboratory. Overall, my trainees have either stayed in academics, or taken on leadership positions in universities or industry, including 7 faculty positions, 11 post-doctoral fellowships and 13 industrial positions. My laboratory currently has a highly interactive group of individuals, which includes 3 postdoctoral fellows, 8 predoctoral students, 1 lab manager and 2 undergraduate students. I have also been involved in the recruitment and training of scientists outside my laboratory, including being the PI of training programs in Basic Cancer Research (2007-2013) and Chemistry-Biology Interface (2005-present, founding member), serving as chair or member of 11 faculty recruitment committees and 9 faculty-mentoring committees. My graduate training activities also extends to serving on student thesis committees (75); directing the Candidacy Exam Prep Course (2013-present) and X-ray crystallography course (2005-present) and teaching in numerous other courses; interviewing graduate student candidates; providing course advice to students, and participating in student recruitment and the recruitment of underrepresented populations. Part of my role as Vice-Chair of the Department of Biochemistry and Biophysics is to help mentor all of our Junior faculty members (currently 4) and to promote recognition of our Department faculty by nominating them for local and national awards (~ 4 per year).

B. Positions, Scientific Appointments and Honors

Positions and Employment:

2017 - present	George W. Raiziss Professor and Vice-Chair, Department of Biochemistry and Biophysics, Investigator, Abramson Family Cancer Research Institute, Perelman School of Medicine at the University of Pennsylvania
2016 - 2018	Interim Faculty Director, Electron Microscopy Research Laboratory, Perelman School of Medicine at the University of Pennsylvania
2013-2017	Professor, Department of Biochemistry & Biophysics, Investigator, Abramson Family Cancer Research Institute, Perelman School of Medicine at the University of Pennsylvania
2010-2013	Hilary Koprowski, M.D. Professor, The Wistar Institute
2008-2013	Program Leader, Gene Expression and Regulation Program, The Wistar Institute
2003-2013	Wistar Institute Professor of Chemistry, the Department of Chemistry, University of Pennsylvania
2002-2013	Professor, The Wistar Institute, Philadelphia, PA
1999-2003	Wistar Institute Associate Professor of Chemistry, the Department of Chemistry, University of Pennsylvania
1999-2002	Associate Professor, The Wistar Institute, Philadelphia, PA
1995-present	Member, Graduate Group in Biophysics and Molecular Biophysics, the University of Pennsylvania School of Medicine
1994-1998	Wistar Institute Assistant Professor of Chemistry, the Department of Chemistry, University of Pennsylvania
1994-1998	Assistant Professor, The Wistar Institute, Philadelphia, PA

Other Experience and Professional Memberships:

Intramural Activities (chaired or directed only):

2018	Chairman, Faculty Search Committee, Department of Biochemistry and Biophysics, University of Pennsylvania
2017	Co-Chairman, Faculty Search Committee, Department of Biochemistry and Biophysics, University of Pennsylvania
2017-present	Vice-Chair, Department of Biochemistry and Biophysics
2016-2018	Interim Faculty Director, Electron Microscopy Research Laboratory
2010-2012	Chairman, Faculty Search Committee, Wistar Institute
2007-2013	Director and PI, T32 Wistar Basic Cancer Research Training Program
2005-present	Director and PI, T32 Wistar/UPenn Chemistry-Biology Interface Training Program
2005	Chairman, Wistar Institute Structural Biology Search Committee
2005-2009	Chairman, Wistar Institute Training Committee
2004-2006	Chairman, Graduate Admissions, Biochemistry and Molecular Biophysics Graduate Group, the University of Pennsylvania School of Medicine
2002-2004	Director, Wistar Institute Summer Undergraduate Research Fellowship Program
1996-2001	Chairman, Wistar Institute Seminar Committee

Extramural Activities:

2019, 20, 21	Ad Hoc Member, NIH CSR DP5 NIH Director's Early Independence Award Panel
2019	Ad Hoc Member, NIH NCI Special Emphasis Panel, Provocative Questions Workshop
2018	Mail-in Reviewer for The Wellcome Trust
2018	Ad Hoc Member, NIH NIGMS MIRA Special Emphasis Study Section Review Panel
2017	Ad Hoc Member, NIH NIGMS MIRA Special Emphasis Study Section Review Panel
2017	Call-in Reviewer, NIH NCI Special Emphasis P01 Study Section Review Panel
2017	Ad Hoc Member, NIH MIGMS P30 Synch. Res. Special Emphasis Study Section Panel
2016	Ad Hoc Chair, NIH NCI Special Emphasis Study Section Panel
2016	Ad Hoc Chair, NIH NCI Special Emphasis Study Section Panel
2016	Ad Hoc Member, NIH NCI P30 Cancer Center Review/Site Visit
2016	Member, Innovative Research Grants Committee, Stand Up to Cancer
2016	Ad Hoc Member, NIH Study Section (MSFC)
2015	Ad Hoc Member, NIH Study Section (GGG-A(80) AREA)
2015	Mail-in Reviewer for NIH Center for Scientific Review Pilot Study
2015	Mail-in Reviewer for Research Foundation Flanders
2015	Ad Hoc Member, NIH Study Section (NCI Omnibus review, ZCA SRB-2)
2014	Mail-in Reviewer for The Human Frontier Science Program
2014	Mail-in Reviewer for The Medical Research Council
2014	Mail-n Reviewer for The Wellcome Trust
2014	Mail-in Reviewer for NSF, Molecular Biophysics Study Section
2014	Ad Hoc Reviewer for Cancer Research UK
2014	Ad Hoc Member, NIH Study Section (NCI Omnibus review, ZCA SRB-2)
2014	Ad Hoc Member, NIH S10 Study Section (ZRG1 IMST-G)
2014-present	Member, Editorial Board of the Journal of Biological Chemistry
2012	Mail-in Reviewer for NIH
2011	Mail-in Reviewer for NSF, Molecular Biophysics Study Section
2011-present	Member, STARR Cancer Consortium Scientific Review Board
2011	Site Visit Member, NCI Laboratory of Cell Biology
2011-present	American Federation for Aging Research National Scientific Advisory Council
2008-2009	Member, Search Committee for the Chair of the Department of Biochemistry and Biophysics, University of Pennsylvania School of Medicine
2008-2009	Chair, Internal Committee to Review the Genomics and Computational Graduate Group, University of Pennsylvania School of Medicine
2008-2010	Chair, NIH Study Section (MSFC)
2006-2010	Member, NIH Study Section - MSFC
2005	Ad Hoc Member, NIIH P01 Review (GM)
2005	Ad Hoc Member, NIH Study Section (MSFB)
2004	Chair, NIH P01 review (GM)
2004	Ad Hoc Member, NIH P01review (GM)
2004	Chair, ACS Study Section (Genetic Mechanism in Cancer)
2003	Vice-Chair, ACA Study Section (Genetic Mechanism in Cancer)
2002	Ad Hoc Member, NIH P01review (NCI)
2002	Ad Hoc Member, NIH Study Section (BBCA)
2000-2004	Member, ACA Study Section (Genetic Mechanism in Cancer)
1999-2000	Ad Hoc Member, ACA Study Section (Genetic Mechanism in Cancer)
1999	Ad Hoc Member, NIH Study Sections (ZRG1-AARR3-01; ZRG1-AARR1-03)
1998	Member, NIH Shared Instrumentation Program (NCRR), Special Study Section

1995-present Manuscript reviews for *Acta Crystallog., Analytical Biochemistry, Biochemistry, Biochemisty Biophysics Acta. Cell, Cell Reports, Cell Chemical Biology, Chembiochem, Chemistry & Biology, Drug Discovery Today, EMBO J., EMBO Reports, Genes & Develop., J. Biol. Chem., J. Leukocyte Biol.*, *J. Med. Chem.*, *J. Mol. Biol., J. Med. Chem. Comm., Mol. Cell, Mol. Cell. Biol., Nature, Nature Communications, Nature Struc. Mol. Biol., PLoS Biology, PLoS ONE, Proc. Natl. Acad. Sci. USA, Proteins, Science, Structure, Traffic, Trends in Biochemical Sciences*

C. Contributions to Science

1. My laboratory has pioneered the structure-function analysis of histone acetyltransferases (HATs) and continues to make seminal contributions in this area. Specifically, my laboratory determined the first crystal structure of a type A HAT and characterized its mechanism of catalysis, and the first to describe the mode of histone substrate binding by a HAT. My laboratory has extended our studies to the broader family of N-acetyltransferases including the non-histone lysine acetyltransferases (KATs) and the N-amino acetyltransferases (NATs). We have uncovered important molecular signatures that distinguish HATs, KATs and NATs. My laboratory has also contributed to the development of acetyltransferase inhibitors. The vast majority of the human proteome is acetylated in a functionally important manner and alterations occur in human diseases. This suggests that protein acetylation may rival protein phosphorylation as a biologically important protein modification and that KATs and NATs represent important therapeutic targets.

a. Lasko, L.M., Jakob, C.G., Edalji, R.P., Qiu W., Montgomery D., Digiammarino .EL., Hansen T.M., Risi R.M., Frey R., Manaves V., Shaw B., Algire M., Hessler P., Lam L.T., Uziel T., Faivre E., Ferguson D., Buchanan F.G., Martin R.L., Torrent M., Chiang G.G., Karukurichi K., Langston J.W., Weinert B.T., Choudhary C., de Vries P., Van Drie J.H., McElligott D., Kesicki E., Marmorstein R., Sun C., Cole P.A., Rosenberg SH, Michaelides M.R., Lai A., Bromberg K.D. Discovery of a selective catalytic p300/CBP inhibitor that targets lineage-specific tumours. (2017) *Nature*, 550:128-132. PMID:28953875; PMCID:PMC6050590
b. Gottlieb, L. and Marmorstein, R. Structure of human NatA and its regulation by the Huntingtin interacting protein HYPK. (2018) Structure 26:925-935. PMID: 29754825: PMCID: PMC6031454
c. Deng, S., McTiernan, N., Wei, X., Arnesen, T. and Marmorstein, R. Molecular basis for N-terminal acetylation by human NatE and its modulation by HYPK, (2020) *Nature Comm.,* 11: 14584-14587. PMID32042062: PMCID: PMC7010799
d. Deng, S., Pan, B., Gottlieb, L. and Marmorstein, R. Molecular basis for N-terminal alpha-synuclein acetylation by human NatB. (2020) *eLife.,* 9: e57491. PMID32885784

2. My laboratory is studying the molecular basis for how chromatin is assembled and maintain by histone chaperone complexes. We have focused on the binding and histone deposition of H3/H4 complexes by the ASF1 and VPS75 proteins and the multi-subunit HIRA complex, which specifically deposits the histone H3 variant, H3.3, in a replication independent manner. Histone H3.3 is deposited at active genes, after DNA repair and in certain forms of heterochromatin in non-proliferating senescent cells, and recurrent H3.3 mutations are found in pediatric glioblastoma and dysregulation of H3.3-specific activities in tumor growth and leukemia exemplifies the necessity for proper regulation of H3.3-specific deposition pathways. Together with the Peter Adams laboratory we have pioneered a molecular understanding of the HIRA complex highlighting the particular importance of the HIRA and Ubn1 subunits of H3.3-specific activities.

a. Ricketts, M.D., Frederick, B., Hoff. H., Tang, Y., Schultz, D.C. Rai, T.S., Vizioli, M.G. Adams, P.D. and Marmorstein, R. Ubinuclein-1 confers histone H3.3-specific binding specificity by the HIRA histone chaperone complex. (2015) *Nature Communications*. 6:7711-. PMID: 26159857: PMCID: PMC4509171
b. Haigney, A., Ricketts, M. D. and Marmorstein, R. Dissecting the Molecular Roles of Histone Chaperones in Histone Acetylation by Type B Histone Acetyltransferases (HAT-B), (2015) *J. Biol. Chem*., 290:30648-30657. PMID: 26522166: PMCID: PMC4683284
c. Ray-Gallet, D., Ricketts, M.D., Sato, Y., Gupta, K., Boyarchuk, E., Senda, T., Marmorstein, R., and Almouzni, G. Functional activity of the H3.3 histone chaperone complex HIRA requires trimerization of the HIRA subunit. (2018) *Nat. Commun*. 9:3103. PMID:30082790: PMCID: PMC6078998
d. Ricketts, M.D., Dasgupta, N., Fan, J., Han, J., Gerace, M., Tang, Y., Black, B.E., Adams, P.D. and Marmorstein, R. The HIRA histone chaperone complex subunit UBN1 harbors H3/H4 and DNA binding activity. (2019) *J. Biol. Chem.*, 294: 9239-9259. PMID:31040182; PMCID: PMC6556585

3. My laboratory has leveraged our expertise in biochemistry and X-ray crystallography with small molecule screening for structure-based Inhibitor development for therapy of melanoma and other cancers. There is a particular interest in melanoma and the laboratory had developed inhibitors to several important oncogenic kinases in melanoma including BRAF, PI3K, PAK1 and S6K1. The laboratory has also targeted the oncoproteins E7 and E6 from human papillomavirus (HPV), the causative agent of a number of epithelial cancers, and a significant portion of head and neck cancers. These studies have important implications for therapy.

a. Qin, J., Rajaratnam, R., Feng, L., Salami, J., Barber-Rotenberg, J.S., Domsic, J., Reyes-Uribe, P., Liu, H., Dang, W., Berger, S.L., Villanueva, J., Meggers, E. and Marmorstein, R. Development of organometallic S6K1 inhibitors. (2015) *J. Med. Chem*. 58:305-314. PMID: 25356520; PMCID: PMC4289024
b. Grasso, M., Estrada, M.A., Ventocilla, C., Samanta, M., Maksimoska, J., Villanueva, J., Winkler, J.D. and Marmorstein, R. Chemically linked vemurafenib inhibitors promote an inactive BRAFV600E conformation. (2016) *ACS Chem. Biol.* 11: 2876-2888. PMID: 27571413: PMCID: PMC5108658
c. Emtage, R.P., Schoeberger, M.J. Fergusion, K.M., and Marmorstein, R. Intramolecular autoinhibition of Checkpoint Kinase 1 is mediated by conserved basic motifs of the C-terminal Kinase Associated-1 domain. (2017) *J. Biol. Chem*. 292:19024-19033. PMID:28972186: PMCID: PMC5704483
d. Grasso, M., Estrada, M.A., Berrios, K.N., Winkler, J.D. and Marmorstein, R. N-(7-Cyano-6-(4-fluro-3-(2-(3-(trifluoromethyl)phenyl)acetamido)phenoxy)benzo[d]thiazol-2-yl)cyclopropanecarboxamide (TAK632) promotes inhibition of BRAF through the induction of inhibited dimers. (2018) *J. Med. Chem.* 61:5034-5046. PMID: 29727562: PMCID: PMC6540792

4. My laboratory has more recently studied the connection between metabolism with cancer signaling and chromatin regulation, with a particular focus on the acetyl-CoA metabolism and metabolite acylation enzymes such as ATP citrate lyase (ACLY). Our studies uncovered the molecular mechanism of ACLY and provided a molecular scaffold for the structure-based development of ACLY inhibitors for therapy of cancer and metabolic and cardiovascular disorders.
a. Bazilevsky, G.A., Affronti, H.C., Wei, X., Campbell, S.L., Wellen, K.E. and Marmorstein. R. ATP-citrate lyase multimerization is required for coenzyme-A substrate binding and catalysis, (2019) *J. Biol. Chem.* 294:7529-7268. PMID: 30877197; PMCID: PMC6509486
b. Wei, X., Schultz, K., Bazilevsky, G.A., Vogt, A. and Marmorstein R. Molecular basis of acetyl-CoA production by ATP-citrate lyase. (2020) *Nature Structural & Molecular Biology* 27:33-41. PMID: 31873304

Complete bibliography is available at: http://www.ncbi.nlm.nih.gov/pubmed/?term=Marmorstein+R
(>200 manuscripts; Scopus H-index=69; Google Scholars H-index=82)

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: Schultz, Kollin

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

POSITION TITLE: Ph.D. Student

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)*	Start Date MM/YYYY	Completion Date MM/YYYY	FIELD OF STUDY
Utica College	BA	08/2014	05/2018	Biochemistry
University of Pennsylvania	PHD	06/2018		Biochemistry & Molecular Biophysics

A. Personal Statement

My goals for my Ph.D., are to develop a strong skillset of biochemical, biophysical, and structural biology techniques, and use them to further the understanding of acetyl-CoA metabolism. As an undergraduate student at Utica College, I completed a diverse set of coursework in biology, chemistry, math, and physics that has uniquely prepared me to join a lab like Dr. Ronen Marmorstein's that uses a wide array of techniques to answer complex biological questions. When I first arrived at the University of Pennsylvania, I completed a lab rotation in Dr. Kathryn Wellen's lab where I was involved in investigating the role of acetyl-CoA metabolism in the development of pancreatic cancer, and the potential of targeting it as a novel therapy. My work there contributed to Dr. Wellen's publication in *Cancer Discovery*. Following my time in Dr. Wellen's lab, I completed a second lab rotation in Dr. Marmorstein's lab where I worked on the protein ATP-citrate lyase (ACLY) which is the main acetyl-CoA producing enzyme in the cytoplasm. We were able to resolve the structure of recombinantly expressed ACLY with single particle analysis cryo-EM and validate the structure and catalytic mechanism with site-directed mutagenesis and complementary biochemical and biophysical techniques. This work resulted in a recent publication in *Nature Structural and Molecular Biology*. My third and final lab rotation was in Dr. Ben Garcia's laboratory where I learned about liquid chromatography-mass spectrometry (LC-MS) analysis of proteins. For my thesis work, I plan to apply the various techniques that I have learned to understand the structural dynamics of fatty acid synthase (FASN), which is an acetyl-CoA consuming lipid metabolism enzyme. I believe that I am particularly qualified to take on this project because of my background and experiences in Dr. Wellen's, Dr. Garcia's, and Dr. Marmorstein's labs.

1. Alessandro Carrer, Sophie Trefely, Steven Zhao, Sydney Campbell, Robert J Norgard, **Kollin C Schultz**, Simone Sidoli, Joshua L.D. Parris, Hayley C Affronti, Sharanya Sivanand, Shaun Egolf, Yogev Sela, Marco Trizzino, Alessandro Gardini, Benjamin A Garcia, Nathaniel W Snyder, Ben Z. Stanger and Kathryn Wellen. Acetyl-CoA metabolism supports multi-step pancreatic tumorigenesis. *Cancer Discov* (2019) DOI: 10.1158/2159-8290.CD-18-0567
2. Xuepeng Wei, **Kollin Schultz**, Gleb Bazilevsky, Austin Vogt, and Ronen Marmorstein. Molecular Basis for Acetyl-CoA Production by ATP-Citrate Lyase. *Nature Structural and Molecular Biology* (2019), DOI: 10.1038/s41594-019-0351-6

B. Positions and Honors

Positions and Employment

2017	NSF Genomes to Phenomes REU – Neuroscience
2018-	Graduate Student- University of Pennsylvania

Other Experience and Professional Memberships

2014-2018	Member, American Chemical Society
2018-2020	Member, New York Academy of Science

Honors

2015	CRC Freshman Chemistry Achievement Award
2016	ACS Undergraduate award in Analytical Chemistry
2017	ACS Undergraduate award in Physical Chemistry
2020	NIH T32- Chemistry-Biology Interface Training Grant

C. Contributions to Science

1. **Graduate Research**: My first lab rotation project as a graduate student focused on the role of acetyl-CoA metabolism in the development of pancreatic cancer, and the potential of targeting downstream fates of acetyl-CoA as a novel treatment method. My work contributed to a publication in *Cancer Discovery*. As a rotation student and member of my thesis lab, I worked with a postdoc on elucidating the structure and molecular mechanism of ATP-citrate lyase (ACLY). Our work was published in *Nature Structural and Molecular Biology*. For my thesis work I will be focusing on the structural dynamics of the acetyl-CoA consuming enzyme, fatty acid synthase (FASN), to increase our molecular understanding of its mechanism and regulation.
    a. Alessandro Carrer, Sophie Trefely, Steven Zhao, Sydney Campbell, Robert J Norgard, **Kollin C Schultz**, Simone Sidoli, Joshua L.D. Parris, Hayley C Affronti, Sharanya Sivanand, Shaun Egolf, Yogev Sela, Marco Trizzino, Alessandro Gardini, Benjamin A Garcia, Nathaniel W Snyder, Ben Z. Stanger and Kathryn Wellen. Acetyl-CoA metabolism supports multi-step pancreatic tumorigenesis. *Cancer Discov* (2019) DOI: 10.1158/2159-8290.CD-18-0567
    b. Xuepeng Wei, **Kollin Schultz**, Gleb Bazilevsky, Austin Vogt, and Ronen Marmorstein. Molecular Basis for Acetyl-CoA Production by ATP-Citrate Lyase. *Nature Structural and Molecular Biology* (2019), DOI: 10.1038/s41594-019-0351-6

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

YEAR	COURSE TITLE	GRADE
	UTICA COLLEGE	
2014	General Biology I	A
2014	General Chemistry I	A
2014	Written Communication I	A
2014	Advanced Fitness	A
2014	Beginning Spanish II	A
2014	First Year Seminar	A
2015	General Biology II	B+
2015	General Chemistry II	A
2015	Intro to Chem Research Methods	A
2015	Written Communication II	A
2015	Calculus II	A
2015	Genetics	A

YEAR	COURSE TITLE	GRADE
2015	Organic Chemistry I	A
2015	Intro to Public Speaking	A
2015	Critical Thinking	A
2015	General Physics I	A-
2016	Cell Biology	A
2016	Organic Chemistry II	A
2016	History of Art I	A
2016	General Physics II	A
2016	Statistics in the Behavior Sci	A
2016	Quantitative Analysis	A
2016	Phys Chem I: Therm & Kinetics	A
2016	Biochemistry	A
2016	Biochemistry Lab	A
2016	Introduction to Psychology	A
2017	Molecular Biology	A
2017	Physical Chemistry II: Struct	A
2017	Physical Chemistry Lab	A
2017	Res Methods: Nanomaterials I	A
2017	Adv Organic Chem Lab	A
2017	Biochemistry II	A
2017	Senior Seminar	A
2017	Native American Culture & Hist	A
2017	Inorganic Chemistry	A
2017	Calculus III	A
2017	Ordinary Differential Equation	B
2017	Physics III	A
2018	Immunology	A
2018	Res: Explore Mech/Chem Reaction	A
2018	Instrumental Methods	A
2018	Senior Seminar	A
2018	DC and AC Electronics	A
2018	Special Topics in Physics	A
	UNIVERSITY OF PENNSYLVANIA	
2018	Cell Biology	B+
2018	Macromolecular Biophysics: Principles and Methods	A+
2018	Macromolecular Crystallography: Methods and Application	A
2018	Lab Rotation	A
2019	Structural & Mechanistic Biochemistry	A
2019	Data Analysis and Scientific Inference	A+
2019	Lab Rotation	A
2019	Chemical Biology	A-
2019	Structural Biology TG	A
2019	Pre-Dissertation Lab	A
2019	Stress Responses and Metabolism in Cancer	A
2020	Pre-Dissertation Lab	A
2020	Current Biochemical Topics	A+
2020	Candidacy Exam Course	A