

BIOGRAPHICAL SKETCH

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NAME: Wesalo, Joshua Scott

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

POSITION TITLE: Ophthalmology Resident

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
Franklin & Marshall College, Lancaster, PA	BA	08/2009	05/2013	Chemistry, Economics (Minor: Applied Mathematics)
University of Pittsburgh School of Medicine, Pittsburgh, PA Residency in Ophthalmology, McGaw Medical Center of Northwestern University	MD, PhD	06/2014 06/2023	06/2023	Medicine, Chemistry

A. Personal Statement

I am a third-year resident physician in ophthalmology at Northwestern University. My goal is to become a translational physician-scientist in ophthalmology. Ultimately, I want to run a basic science laboratory focused on vision restoration, maintain a medical and surgical ophthalmology practice as a uveitis specialist, and teach at an academic medical center. My clinical, research, and volunteer work has prepared me for this career. During my thesis work under the direction of Dr. Alexander Deiters, I developed methods for turning on proteins' function using designer small molecules or light as triggers. I created several novel amino acids and refined methods for installing them into proteins at specific sites using a "genetic code expansion" technique. These tools have potential for developmental biology research as well as developing novel therapeutics in ophthalmology. I additionally pursued a mini-postdoctoral fellowship in Dr. Susana da Silva's lab to apply these tools in chick and retinal organoid models to study retinal development, where I was the first to perform genetic code expansion in chickens (manuscript in preparation). In residency, I performed research in Dr. Brenda Bohnsack's laboratory to apply genetic code expansion to study eye development in zebrafish.

During graduate and medical school, I developed my clinical interest in ophthalmology through volunteer and clinical experiences. I shadowed Dr. Andrew Eller, a vitreoretinal surgeon, the summer before starting medical school (2014), and became with fascinated the field. I later completed a longitudinal clinical clerkship with him with honors in 2017-18, and another with Dr. S. Tonya Stefko, an oculoplastic surgeon, with honors in 2019-20. Starting in 2015, I started volunteering for Guerrilla Eye Service, a mobile free eye clinic for underserved patients in the Pittsburgh area. I have volunteered at 32 clinics, serving as the student leader at 12, and co-leader at 7. I served as the organization's scheduling coordinator and equipment coordinator from 2018–2021. When back in medical school, I completed an ophthalmology rotation with honors with uveitis specialist Dr. Marie-Hélène Errera and performed research about applications of OCT-angiography imaging for uveitis. During residency, I continued to develop my clinical and research acumen through work and research on unusual cases such as Rosai-Dorfman Disease affecting the cavernous sinus (resulting in a presentation at *American Academy of Ophthalmology*), necrotizing retinitis associated with Chagas disease, and uveal effusion syndrome (resulting in a presentation at the *Yannuzzi Rounds*). My clinical interests include uveitis and retina and I plan to pursue fellowship training to gain deeper knowledge in these areas.

Overall, my team of clinical and research mentors in chemical biology and ophthalmology and my continued plans for research in vision restoration will prepare me for a career applying chemical biology techniques to vision restoration.

B. Positions and Honors

ACTIVITY/ OCCUPATION	START DATE (mm/yy)	ENDING DATE (mm/yy)	FIELD	INSTITUTION/ COMPANY	SUPERVISOR/ EMPLOYER
Resident Physician	6/23	6/27	Ophthalmology	Northwestern University	Dmitry Pyatetsky, MD
Postdoctoral Fellow	1/23	6/23	Ophthalmology	University of Pittsburgh	Susana da Silva, PhD
Medical Student	08/21	12/23	Medicine	University of Pittsburgh	N/A
Graduate Student Researcher	09/16	08/21	Chemistry	University of Pittsburgh	Alexander Deiters, PhD
Graduate Rotation 3	09/15	09/16	Chemistry	University of Pittsburgh	Alexander Deiters, PhD
Graduate Rotation 2	06/15	08/15	Chemistry	University of Pittsburgh	Alexander Deiters, PhD
Medical Student	08/14	12/22	Medicine	University of Pittsburgh School of Medicine	N/A
Graduate Rotation 1	06/14	08/14	Pharmacology	University of Pittsburgh	Patrick Pagano, PhD
Research Assistant	05/13	05/14	Chemistry	Franklin & Marshall College	Ken Hess, PhD
Research Fellow	05/13	05/14	Chemistry	Clinic for Special Children	Kevin Strauss, MD
Calculus Tutor	08/10	05/13	Mathematics	Franklin & Marshall College	Robert Gethner, PhD
Summer Undergraduate Researcher	06/12	08/12	Pharmacology	University of Pennsylvania	Vladimir Muzykantov, MD, PhD
Undergraduate Researcher	01/12	05/13	Chemistry	Franklin & Marshall College	Ken Hess, PhD
Undergraduate Researcher	06/11	08/11	Chemistry	Franklin & Marshall College	Ryan Mehl, PhD and Ken Hess, PhD
Undergraduate Researcher	06/10	08/10	Chemistry	Franklin & Marshall College	Ryan Mehl, PhD and Ken Hess, PhD
Volunteer Research	06/09	08/09	Neuroscience	Kennedy Krieger Institute	Mary E. Blue, PhD
Volunteer Research	06/08	08/08	Bioinformatics	Kennedy Krieger Institute	Jonathan Pevsner, PhD

Other Experience and Professional Memberships

2023– American Academy of Ophthalmology
 2014– Allegheny County Medical Society
 2014–2016 American Medical Association
 2015– American Chemical Society
 2017–2019 American Heart Association

Selected Honors

2025	Consultant of the Year Award, Northwestern Medicine Emergency Department
2023	University of Pittsburgh-Carnegie Mellon University MSTP Mini Post-Doctoral Fellowship
2021	University of Pittsburgh Degree Completion Fellowship Award
2019	Pitt-CMU MSTP Carol and S. Sutton MD Outstanding Service Award — to the student who has stood out in the past year for extraordinary work in leading, planning, and/or performing activities that have strengthened the program as a whole and benefited the student body.
2019	University of Pittsburgh School of Medicine Community Service Certificate
2013–2014	Eyler Fellowship — awarded by Clinic for Special Children to conduct research for a year prior to entering medical school.
2013–	Phi Beta Kappa Society
2013	Theodore Alexander Saulnier, Jr. Prize in Chemistry — to chemistry major who demonstrates an especially searching mind in probing the frontiers of the unknown.
2013	Theodore E. Woodward, MD Healing Arts Prize — to the outstanding senior who will be pursuing post-graduate study in a health professions field.
2013	Isaac E. Roberts Prize in Biology — student with the highest grades in biology.
2010	Eric C. Rackow, MD Endowed Achievement Scholarship for the Pre-Healing Arts
2009–2013	Honor's List, Franklin & Marshall College
2009–2013	National Merit Scholarship
2009–2013	John Marshall Scholarship, Franklin & Marshall College
2005 and 2006	Carson Scholars Fund Scholarship

C. Contributions to Science

- Optical control of protein function.** Genetically encoded regulation of protein function with light has led to "optogenetics" as an emerging research area. I have developed genetic code expansion methods to site-specifically install photocaged amino acids into proteins in living cells. I have leveraged these methods to control protein translocation, enzyme activity, fluorescence, and nanobody-epitope binding. While developing novel light-responsive amino acids, my collaborators and I discovered a new method based on ribosomal skipping to apply genetic code expansion to challenging protein targets, validated a prodrug concept for improved amino acid delivery, and worked out design rules for plasmid systems to deliver the machinery for genetic code expansion with optimized efficiency. These methods place light-removable protecting groups at precisely-defined positions in proteins, allowing for spatial and temporal control over many functions using light.
 - Wesalo, J. S.;** Liu, Q.; Luo, J.; Shade, O.; Deiters, A. "Genetically Encoded Lysine Analogues with Differential Light Sensitivity for Activation of Protein Function." *ChemPhotoChem* **2024**, *8*, e202300312. DOI: [10.1002/cptc.202300312](https://doi.org/10.1002/cptc.202300312).
 - Joest EF, Winter C, **Wesalo JS**, Deiters A, Tampé R. Light-guided intrabodies for on-demand *in situ* target recognition in human cells. *Chem Sci*. 2021 Apr 8;12(16):5787-5795. doi: [10.1039/d1sc01331a](https://doi.org/10.1039/d1sc01331a). PMID: [35342543](https://pubmed.ncbi.nlm.nih.gov/35342543/); PMCID: [PMC8872839](https://pubmed.ncbi.nlm.nih.gov/PMC8872839/).
 - Joest EF, Winter C, **Wesalo JS**, Deiters A, Tampé R. Efficient Amber Suppression *via* Ribosomal Skipping for *In Situ* Synthesis of Photoconditional Nanobodies. *ACS Synth Biol*. 2022 Apr 15;11(4):1466-1476. doi: [10.1021/acssynbio.1c00471](https://doi.org/10.1021/acssynbio.1c00471). Epub 2022 Jan 21. PMID: [35060375](https://pubmed.ncbi.nlm.nih.gov/35060375/); PMCID: [PMC9157392](https://pubmed.ncbi.nlm.nih.gov/PMC9157392/).
 - Zhou W, **Wesalo JS**, Liu J, Deiters A. Genetic code expansion in mammalian cells: A plasmid system comparison. *Bioorg Med Chem*. 2020 Dec 15;28(24):115772. doi: [10.1016/j.bmc.2020.115772](https://doi.org/10.1016/j.bmc.2020.115772). Epub 2020 Sep 19. PMID: [33069552](https://pubmed.ncbi.nlm.nih.gov/33069552/); PMCID: [PMC7961839](https://pubmed.ncbi.nlm.nih.gov/PMC7961839/).
- Small-molecule control of protein function.** Conditional control over protein function empowers us to dissect the role that proteins play in the dynamic environment of living cells. Amino acids that are activated using designer small molecules as triggers complement optically-triggered photocaged amino acids. Small molecule-triggered amino acids can be triggered alongside photocaged amino acids for sequential activation

in the same sample (manuscript in preparation). Further, designer small molecules can be used to trigger protein activation in many cells or zebrafish embryos at once and in opaque tissues where light cannot penetrate, and no optical equipment is required. Existing biocompatible triggers, however, often lack the speed of optical methods. I developed novel amino acids that I designed to turn on much faster than previous generations in response to a highly biocompatible designer small molecule. I leveraged this next-generation genetic code expansion approach to control post-translational modifications, protein translocation, and gene recombination. I have also developed complementary tools for small molecule-triggered gene knockdown with oligonucleotides in live zebrafish.

- a. **Wesalo JS**, Luo J, Morihiro K, Liu J, Deiters A. Phosphine-Activated Lysine Analogues for Fast Chemical Control of Protein Subcellular Localization and Protein SUMOylation. *Chembiochem*. 2020 Jan 15;21(1-2):141-148. doi: [10.1002/cbic.201900464](https://doi.org/10.1002/cbic.201900464). Epub 2019 Oct 30. PMID: [31664790](https://pubmed.ncbi.nlm.nih.gov/31664790/); PMCID: [PMC6980333](https://pubmed.ncbi.nlm.nih.gov/PMC6980333/).
- b. **Wesalo JS**, Deiters A. Fast phosphine-activated control of protein function using unnatural lysine analogues. *Methods Enzymol*. 2020;638:191-217. doi: [10.1016/bs.mie.2020.02.020](https://doi.org/10.1016/bs.mie.2020.02.020). Epub 2020 Apr 6. PMID: [32416913](https://pubmed.ncbi.nlm.nih.gov/32416913/).
- c. Darrah K, **Wesalo J**, Lukask B, Tsang M, Chen JK, Deiters A. Small Molecule Control of Morpholino Antisense Oligonucleotide Function through Staudinger Reduction. *J Am Chem Soc*. 2021 Nov 10;143(44):18665-18671. doi: [10.1021/jacs.1c08723](https://doi.org/10.1021/jacs.1c08723). Epub 2021 Oct 27. PMID: [34705461](https://pubmed.ncbi.nlm.nih.gov/34705461/); PMCID: [PMC9014490](https://pubmed.ncbi.nlm.nih.gov/PMC9014490/).
- d. **Wesalo JS**, Deiters A. Conditional control of protein function through Staudinger reduction. *Tetrahedron Symposium*, Virtual, June 23, 2021.

3. **Development of methods for ganglioside GM3 production and analysis for the treatment of GM3 Synthase Deficiency.** One in one-hundred Amish individuals carry a loss-of-function mutation in GM3 synthase (*Siat9*) that can cause GM3 Synthase Deficiency in their children. Affected children lose control of their movements, lose their vision and hearing, and suffer from profound developmental delay, typically dying before adolescence. No treatment approaches to date have been successful. I worked with a team of clinicians and scientists based at the Clinic for Special Children and Franklin & Marshall College to develop a new approach: ganglioside replacement therapy.

I developed an assay for quantifying serum gangliosides. Gangliosides are challenging analytes, and this required enzymatic digestion followed by conjugation to a fluorophore and detection with HPLC, so I learned molecular biology, organic synthesis, and analytical chemistry techniques as I developed the assay. Next, I worked on methods to obtain ganglioside GM3 for the therapy. At first, I developed an arduous protocol for extracting milligram quantities of GM3 from buttermilk. Next, I switched my efforts to synthesis of multigram quantities of this complex natural product. Researchers I trained have completed my work and are planning clinical trials through the Clinic for Special Children. Further work is underway at Pittsburgh Children's Hospital to determine how ganglioside replacement therapy will fit in with hematopoietic stem cell or liver transplantation and to optimize the treatment in a mouse model.

- a. **Wesalo, J. S.** Oral presentation. "Laboratory Synthesis of GM3: A Bridge to the Cure." *GM3 Synthase Deficiency Research Summit*. 11 Oct 2016. Children's Hospital of Pittsburgh, Pittsburgh, PA.
- b. **Wesalo, J. S.** Oral presentation. "GM3 Synthase Deficiency." *Genomic Medicine and the Plain Populations of North America*. 17 Jul 2013. Franklin & Marshall College, Lancaster, PA.
- c. **Wesalo, J. S.**; Mehl, R. A.; Hess, K. R. Poster presentation. "From Making Pancakes to Saving Lives: The Quest for a Cure for GM3 Synthase Deficiency in Buttermilk." *Franklin & Marshall College Autumn Research Fair*. 23 Sept 2011. Franklin & Marshall College, Lancaster, PA.
- d. **Wesalo, J. S.**; Mehl, R. A.; Hess, K. R. Poster presentation. "Hot on the Ganglioside Trail: Towards a Practical and Reproducible Assay for Serum Ganglioside Levels in GM3 Synthase Deficiency Patients." *Franklin & Marshall College Autumn Research Fair*. 24 Sept 2010. Franklin & Marshall College, Lancaster, PA.

4. **New applications of ocular coherence tomography.** Ocular coherence tomography (OCT) uses near-infrared light to image the eye with near-cellular level resolution. Its applications continue to grow as the

technology evolves and it is validated for more medical conditions, allied clinical fields, and model systems for research. My work has focused on studying OCT as it applies to neurologic diagnosis and treatment monitoring, to imaging of retinal organoids for use in research, and to applications of OCT angiography (OCTA) in uveitis.

- a. **[Invited review; article in preparation] Wesalo, J.;** Brown, J. C.; Baim, A.; Simon, S. "Optical Coherence Tomography for the Neurologist." *Curr Treat Options Neurol.*, 2026.
- b. Wang, B.; Ganjee, R.; Khandaker, I.; Flohr, K.; He, Y.; Li, G.; **Wesalo, J.;** Sahel, J.-A.; da Silva, S.; Pi, S. "Deep learning based characterization of human organoids using optical coherence tomography." *Biomed. Opt. Express*, **2024**, *15*, 3112–3127. PMID: [38855657](#).
- c. Melachuri, S.; Dansingani, K. K.; **Wesalo, J.;** Paez-Escamilla M.; Gagrani, M.; Atta, S.; Indermill, C.; Sahel, J.-A.; Nischal, K. K.; Chhablani, J.; Errera, M.-H. "OCT Angiography in Noninfectious Uveitis: A Description of Five Cases and Clinical Applications." *Diagnositics (Basel)* 2023, *13*, 1296. PMID: [37046514](#); PMCID: [10092962](#).

5. Selected Other presentations:

- a. **Wesalo, J. S.** Oral presentation. "Controlling proteins with small molecule triggers." *Pitt-CMU MSTP Annual Scientific Retreat*. 2 Aug 2019. University of Pittsburgh, Pittsburgh, PA.
- b. **Wesalo, J. S.** Oral Presentation. "Speeding up control of biomolecular function through the Staudinger reduction." *Biological Chemistry Student Seminar Series*. 25 Apr 2017. University of Pittsburgh, Pittsburgh, PA.
- c. **Wesalo, J. S.;** Simon, S. S.; Russell, E. J.; Bautista, M. M.; Jaffe, E. S. Oral Presentation. "Really Doubling Down", Grand Rounds Symposium, *American Academy of Ophthalmology Annual Meeting*, Orlando, FL, October 20, **2025**.
- d. **Wesalo, J. S.;** Jampol, L. M.; Bowen, R. C. Oral Presentation. "More than meets the eyes", *Yannuzzi Rounds*, Chicago, IL, March 9, **2026**.

A. Additional Information: Scholastic Performance

YEAR	SCIENCE COURSE TITLE	GRADE	YEAR	OTHER COURSE TITLE	GRADE
Franklin & Marshall College			Franklin & Marshall College		
2009	General Chemistry 1	A	2009	Microeconomics (AP Credit)	S
2009	Calculus 3	A	2009	Macroeconomics (AP Credit)	S
2010	Evolution, Ecology, and Heredity	A	2009	English Language/Composition (AP Credit)	S
2010	General Chemistry 2	A	2009	English Literature/Composition (AP Credit)	S
2010	Linear Algebra and Differential Equations	A	2009	US Government and Politics (AP Credit)	S
2010	Principles of Physiology and Development	A	2009	US History (AP Credit)	S
2010	Organic Chemistry 1	A	2009	World History (AP Credit)	S
2010	Probability and Statistics 1	A-	2009	Calculus 2 (AP Credit)	S
2011	Organic Chemistry 2	A-	2009	Mortality & Meaning	A
2011	Probability and Statistics 2	B+	2009	Mathematics of Art	A
2011	Cell Biology	A	2009	Low Brass	A-
2011	Fundamental Physics 1	A-	2009	Orchestra	NC
2011	Chemical Analysis	A	2010	Intro to Economic Perspectives	A
2011	Thermodynamics and Kinetics	B+	2010	Altered States	A
2012	Introduction to Biochemistry	A	2010	Low Brass	A

YEAR	SCIENCE COURSE TITLE	GRADE	YEAR	OTHER COURSE TITLE	GRADE
2012	Directed Study–Chemistry	A	2010	Orchestra	NC
2012	Fundamental Physics 2	A	2010	Value and Distribution	B
2012	Independent Study–Chemistry	A	2010	Music Theory 1	A
2013	Inorganic Chemistry	B+	2011	Intermediate Microeconomics	A
2013	Medicinal Chemistry	P	2011	Low Brass	A
2013	Chemistry of Solar Energy Conversion	P	2011	Orchestra	A
2013	Advanced Biochemistry	A	2011	Game Theory	A-
2013	Independent Study–Chemistry	A	2011	Elementary Chinese 1	A
			2012	Intermediate Macroeconomics	A
			2012	Low Brass	A
			2012	Orchestra	A
			2012	Musicianship 1	A
			2012	Environmental History	A
			2012	Money and Banking	A
			2012	History of Economic Thought	A
			2013	Political Economy of Health	A
			2013	Low Brass	A
			2013	Orchestra	A

YEAR	SCIENCE COURSE TITLE	GRADE	YEAR	OTHER COURSE TITLE	GRADE
	University of Pittsburgh School of Medicine			University of Pittsburgh School of Medicine	
2014	Human Anatomy	P	2014	Ethics, Law, & Professionalism	P
2014	Biochemistry	P	2014	Medical Decisionmaking	P
2014	Genetics	P	2014	Medical Interviewing	P
2014	Cellular Pathology 1	P	2014	Introduction to Physical Examination	P
2015	Cellular Pathology 2	P	2015	Advanced Physical Examination	P
2015	Immunology	P	2015	Behavioral Health	P
2015	Medical Microbiology	P	2015	Population Health	P
2015	Neuroscience	P		MSTP Coursework	
2015	Psychiatry	P	2014-2016	Professional Development 1, 2, and 3 (Molecular Medicine, Methods & Analysis, and Grantwriting)	P
2015	Cardiology	P	2014-2016	Research Basis of Medical Knowledge 1 and 2	P
2015	Nephrology	P	2017	Ethics for Medical Scientists	P
2015	Pulmonology	P	2017	Longitudinal Clinical Course	H
2015	Digestion & Nutrition	P		Graduate School Coursework	
2015	Skin & Musculoskeletal System	P	2016	Basics of Personalized Medicine	A
2016	Hematology and Oncology	P	2016	Molecular Biology	A+
2016	Endocrinology	P	2017	Biological Chemistry 2	A+

YEAR	SCIENCE COURSE TITLE	GRADE	YEAR	OTHER COURSE TITLE	GRADE
2016	Reproduction & Developmental Biology	P	2017	Imaging Cell Biology in Living Systems	A
2016	Clinical Psychiatry Core Clerkship	HS	2017	Doctoral Preliminary Evaluation	P
2016	Neurology Core Clerkship	H	2018	Comprehensive Exam	P
2017-2018	Longitudinal Clinical Clerkship (Retina)	H	2021	Final Exam (Thesis Defense)	P
2019-2020	Longitudinal Clinical Clerkship (Oculoplastics)	H			
2021	Obstetrics and Gynecology	HS			
2021	Pediatrics	HS			
2022	Adult Inpatient Medicine	H			
2022	Surgery	H			
2022	Anesthesia	H			
2022	Intensive Ophthalmology Elective	H			
2022	Adult Outpatient Medicine	HS			
2022	Family Medicine	H			
2022	Medicine Acting Internship	H			
2022	Medical Toxicology	H			

Grade Legend:

“P” – Pass

1. F&M College: Letter grades of “A” to “C-” are converted to Pass for courses that are taken as Pass/Fail.
2. University of Pittsburgh School of Medicine and MSTP: All preclinical courses are graded Pass/Fail.

“S” – Satisfactory

Franklin & Marshall College awards an “S” for AP credits if a student earns a 4 or 5 on the AP exam.

“HS” – High Satisfactory (medical school clerkships only).

“H” – Honors (medical school clerkships only).

MCAT: 37S (98%ile)

USMLE Step 1: 257

Undergraduate GPA: 3.88

Graduate GPA: 4.0