



Gates Summer Internship Program

Reflections on the Summer of 2021



Gates Center for Regenerative Medicine
UNIVERSITY OF COLORADO **ANSCHUTZ MEDICAL CAMPUS**

The Gates Summer Internship Program (GSIP) encourages outstanding undergraduates to consider careers in biomedical research and regenerative medicine. State-of-the-art training opportunities are provided in the Gates Center for Regenerative Medicine members' laboratories.

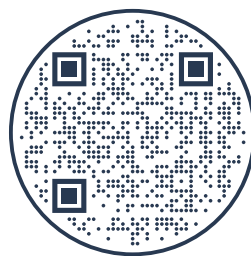


Last summer the Gates Center delighted in welcoming the Gates Center Internship Program (GSIP) Class of 2021 to the University of Colorado Anschutz Medical Campus!

This group of extraordinary college undergraduates was selected from a talented pool of applicants and joined us from Colorado, all over the United States, as well as Toronto, Canada, and Ghana, West Africa. Impressively, over half of our class of 25 returned as participants from the virtual program we hosted during the summer of 2020 due to the pandemic. Though it was hard to see behind their masks on our first day, these interns were elated at the prospect of trading in their wearisome Zoom seats for actual assignments working in Gates Center members' laboratories across campus.



The challenges and joys of conducting and participating in the summer of 2021's on-campus program are reflected in the messages included in this booklet. They are also documented in a video (scan QR code) that shows the impressive role GSIP has played – not just in inspiring students, but also in supporting our interns' mentors and their staff as they work together to advance medical research.



As we approach the eighth year of the program and select the Class of 2022, the Gates Center wants to thank all those who make this program possible. In a world that often seems full of discord and uncertainty, we consider these aspiring scientists and doctors to be a beacon of hope and deserving recipients of our collective support.

2021 GSIP TEAM



“ I want to thank all of the people that support the Gates Summer Internship Program. Your support allows me to host fabulous undergraduate students in my laboratory each summer. These students push the science forward and are a joy to mentor and watch grow after they leave the lab. Thanks again for your support - we can't do it without you. ”

Joseph Brzezinski, Ph.D.
Co - Director



“ I am inordinately proud to be a part of GSIP, which is playing a profound role in exposing exceptional students to the rich and intriguing world of biomedical research and regenerative medicine. I can't think of anything more thrilling and heartening than helping ignite and advance the hopes and dreams of such bright, diligent, and thoughtful young people. This Class of 2021 - and those who have preceded them - truly aspire to make the world a better place, and they clearly cherish having had this opportunity in preparation to do so. ”

Jill Cowperthwaite
Co - Director

“ I love working with the faculty, staff, and students in GSIP. Everyone involved in the program takes exceptional care to ensure a challenging, engaging, and supportive experience. Our interns are talented, earnest, and contagiously enthusiastic! Their curiosity and excitement fueled by opportunities on the Anschutz Medical Campus provide them the best possible launch pad. I look forward to seeing where they go from here and am grateful to be part of their journeys.

Jane Rech, Ph.D.
Program Associate



“ Working with GSIP continues to fulfill my passion of staying involved with students and higher education. It is so rewarding to serve a program that not only provides a foundation for future scientists and clinicians, but also builds their confidence and hope about the future along the way. While science wasn't my forte as an undergrad, I am learning and gaining just as much as the interns and am thankful to all of those who have made this impactful program possible.

Jessica Heard
Program Coordinator



2021 GSIP MENTORS

Kristin Artinger, Ph.D.	Professor	School of Dental Medicine Department of Craniofacial Biology
Linda Barlow, Ph.D.	Professor	Department of Cell and Developmental Biology
Gana (Dash) Batt, Ph.D.	Associate Director of Protein Development and Manufacturing	Gates Biomanufacturing Facility
Ganna Bilousova, Ph.D.	Associate Professor	Department of Dermatology
Stanca Birlea, M.D., Ph.D.	Associate Professor	Department of Dermatology
Joseph Brzezinski, Ph.D., M.S.	Associate Professor	Department of Ophthalmology
Peter Dempsey, Ph.D.	Associate Professor	Department of Pediatrics
Patricia Ernst, Ph.D.	Professor	Department of Pediatrics
Santos Franco, Ph.D.	Assistant Professor	Department of Pediatrics/ Developmental Biology
Curt Freed, M.D.	Professor Leopold Korn and Michael Korn Chair in Parkinson's Disease	Department of Medicine Division of Clinical Pharmacology and Toxicology
Jeffrey Jacot, Ph.D.	Associate Professor	Department of Bioengineering
Traci Lyons, Ph.D.	Associate Professor	Department of Medicine/ Medical Oncology
Russell Marions, Ph.D.	Senior Scientist	Gates Biomanufacturing Facility
Karin Payne, Ph.D.	Associate Professor	Department of Orthopedics

Eric Pietras, Ph.D.	Associate Professor Cleo Meador and George Ryland Scott Endowed Chair in Hematology	Department of Medicine/ Hematology
Nidia Quillinan, Ph.D.	Associate Professor	Department of Anesthesiology
Mary Reyland, Ph.D.	Professor	Department of Craniofacial Biology
Jennifer Richer, Ph.D., M.S.	Professor	Department of Pathology
Holger Russ, Ph.D.	Assistant Professor	Barbara Davis Center for Diabetes Basic Research
Yiqun Shellman, Ph.D.	Associate Professor	Department of Dermatology
Kunhua Song, Ph.D.	Associate Professor	Department of Medicine Division of Cardiology
Ronald Vagnozzi, Ph.D.	Assistant Professor	Department of Medicine Division of Cardiology
Maria Natalia Vergara, Ph.D.	Assistant Professor	Department of Ophthalmology
Michael Verneris, M.D.	Professor The Barton Endowed Chair of Pediatric Bone Marrow Transplant	Department of Pediatrics/ Hematology Oncology and Bone Marrow Transplantation
Lori Walker, Ph.D.	Associate Professor	Department of Medicine Division of Cardiology

“One of the great joys of my life is
to mentor...”

Karin Payne, Ph.D.

“ It may have been because we could not host an on-campus program in 2020 due to the pandemic, but the Class of 2021 will always stand out in my memory as having been a real favorite. This group of students was extraordinarily engaged and so grateful to be able to participate in the GSIP program on campus and in person. Betty and I were very pleased to once again be able to host the end-of-program celebration at our home, and we were delighted that so many students took the time to thank us for their experience as they were leaving the party. For us, this was truly one of the highlights of 2021! ”

**Dennis Roop, Ph.D.
Director, Gates Center**



End-of-Program Celebration: Gates Center Director Dennis Roop, Ph.D. on left with Missy and John Warner and Gates Center Associate Director and GSIP donor Mark Petrash, Ph.D. Missy is a trustee of the Glendorn Foundation, which has generously supported both Gates Center research and GSIP.

CLASS OF 2021 REFLECTIONS

Thank you for giving me a once-in-a-lifetime opportunity to learn and decide on the career path to pursue. This past summer internship experience will always be treasured by me.

Joseph Adjei

Rochester Institute of Technology

Mentor: Ronald Vagnozzi, Ph.D.

Research Poster Title: The Effect of TLR7-Mediated Viral RNA Stress on Macrophages and Fibroblasts



Thank you so much for the time, resources, and support to make this program possible. Research is certainly not an inexpensive enterprise, and this experience has been huge in influencing future career moves for me. I am so grateful to have been part of the Gates Program this year. Thank you for all you've done to make it happen!

Gabriella "Ella" Annest

University of California, Berkeley

Mentor: Mary Reyland, Ph.D.

Research Poster Title: Conditioned Media from PKC δ Knock Down Cells is Sufficient to Transfer Radioprotection



(left to right) Interns Lizzie Belcher and Ella Annest enjoy the end-of-program celebration.

To everyone involved in GSIP for the 2020 and 2021 cycles:

Thank you so much for your kind support and guidance as we navigated the COVID-19 pandemic and everything that came along with it. Despite some setbacks, the two summers I spent as a GSIP Intern were invaluable as I was provided an outlet for my scientific passions, allowed to grow as a scientist, and able to pursue cutting-edge research projects. I am honored to have been selected to participate in this wonderful, door-opening program, and hope that this opportunity is available to young students for years to come.

Sincerely,

Aleezah Balolia

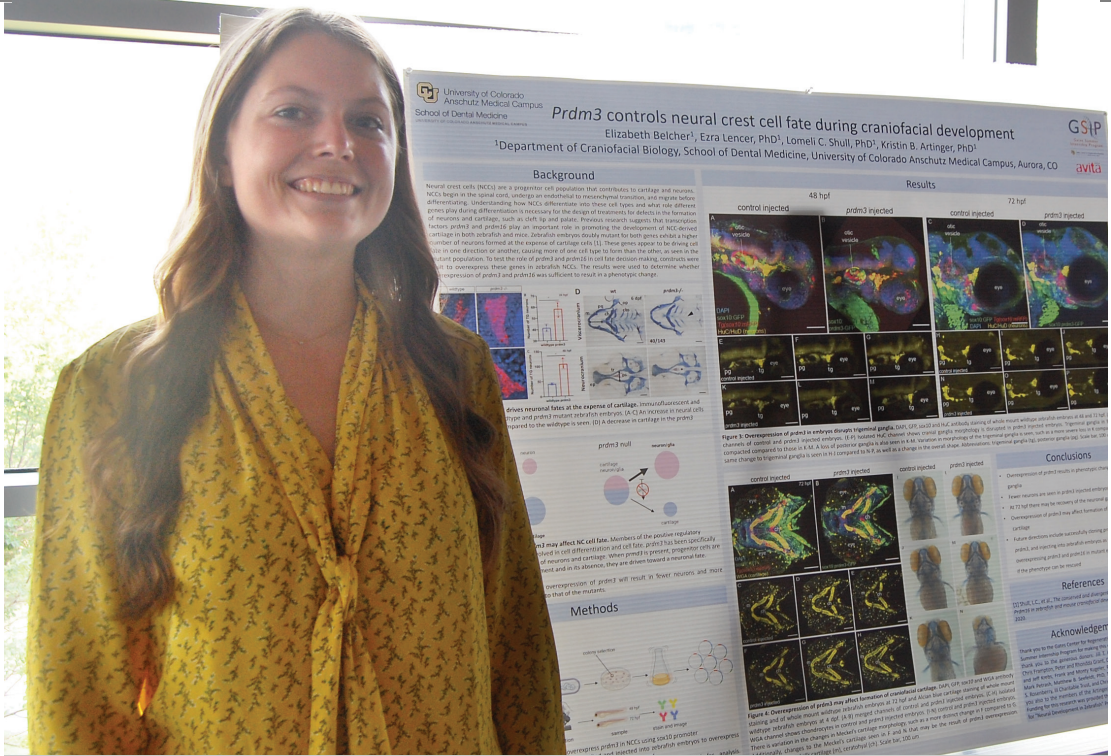
The University of Colorado Denver

Mentor: Santos Franco, Ph.D.

Research Poster Title: Ascl1 Cooperates with Shh to Promote Oligodendrocyte Fate



Aleezah (center) describes her research to fellow intern Joseph Adjei and his interpreter.



Dear Grant family and GSIP donors,

Thank you so much for making this program possible! I am so thankful for the opportunity to do research at the Gates Center this summer and to gain experience in a new area. It was a privilege to be a part of such an impactful mission. I was able to learn not only from the lab I was in, but also from the other interns, seminar speakers, and graduate panels. I will be taking all that I have learned back to school for my senior year and hopefully into my post-graduation career!

Thank you again,

Elizabeth "Lizzie" Belcher

North Carolina State University

Mentor: Kristin Artinger, Ph.D.

Research Poster Title: Prdm3 Controls Neural Crest Cell Fate During Craniofacial Development



Thank you, donors, for supporting the Gates Center and budding scientists. Your contributions are greatly appreciated!

Chiara Dart

The University of Colorado, Boulder

Mentor: Yiqun Shellman, Ph.D.

Research Poster Title: A Novel Regimen for Treating Melanoma: MCL1 Inhibitors and Azacitidine



Thank you so much for helping to provide this opportunity for growth, networking, and fun! Being a part of GSIP this summer has re-instilled a lot of the confidence I lost during school due to COVID and has reminded me of why I love research science.

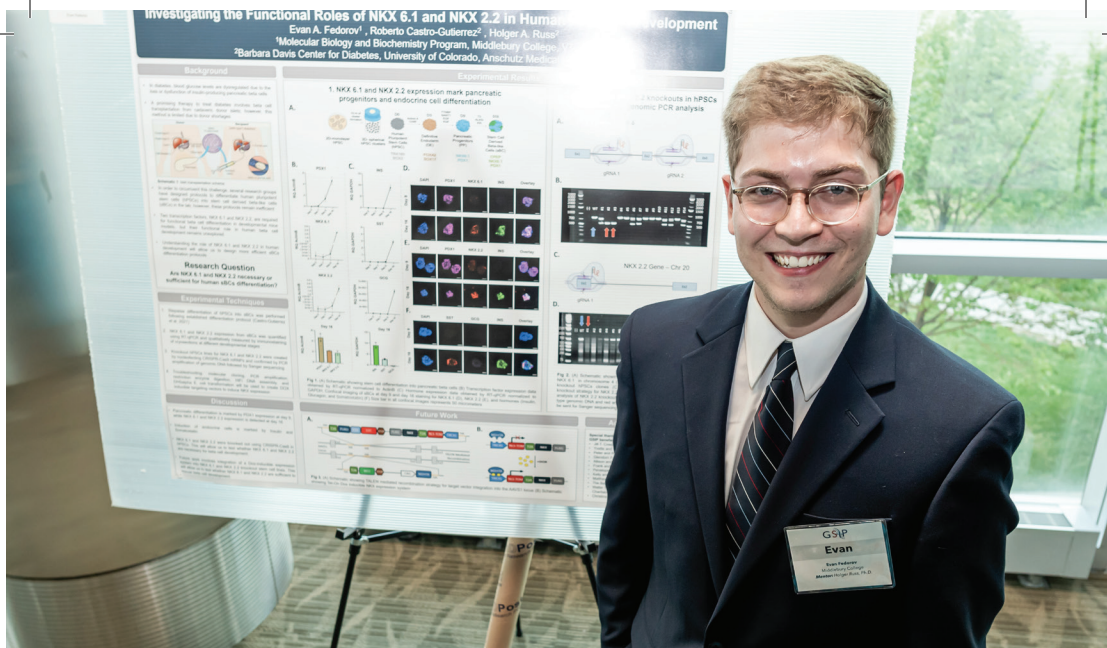
Phoebe Dillon

Colorado Seminary

Mentor: Kunhua Song, Ph.D.

Research Poster Title: Investigation into Alternative Modeling and Treatment of Hypertrophic Cardiomyopathy





Dear Grant family and GSIP benefactors,

Thank you very much for your continued support and involvement in the Gates Summer Internship Program. This was truly an unforgettable experience and an incredible introduction to the world of regenerative medicine.

During this summer, I learned many laboratory techniques, established valuable professional connections, and gained insightful career advice. I am truly grateful for GSIP for not only reinforcing my career interests in stem cell biology but for also endowing me with the skills necessary to succeed in graduate school and as a researcher.

To conclude, I would like to reiterate my gratitude towards all the GSIP benefactors, as this program would not be possible without your support and generosity.

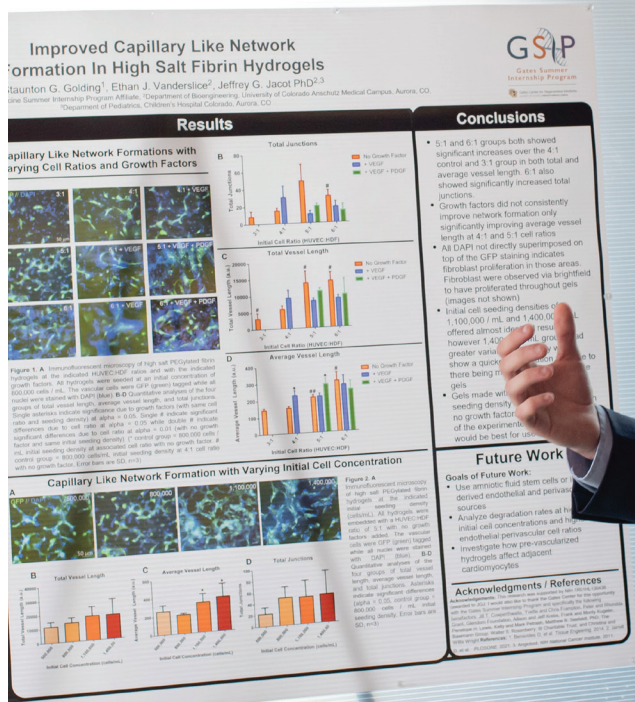
Sincerely,

Evan Fedorov

Middlebury College

Mentor: Holger Russ, Ph.D.

Research Poster Title: Investigating the Functional Roles of NKX 6.1 and NKX 2.2 in Human Beta Cell Development



Thank you to all the mentors, donors, foundations, and organizations involved in making GSIP happen this last summer. In particular, thank you to Dr. Jacot for supporting my project and helping me to grow as a scientist and engineer during my summer in his lab. Thank you also to Ethan Vanderslice for teaching me how to conduct bench research and the necessary techniques needed in a wet lab. I know that often it was a slow process - teaching me, so thank you for the endless patience you showed. Lastly a special thank you to Rhondra Grant.

Staunton Golding
Vanderbilt University

Mentor: Jeffrey Jacot, Ph.D.

Research Poster Title: Improved Capillary Like Network Formation in High Salt Fibrin Hydrogels

Thank you so much for the opportunity to be a part of the GSIP program. I can confidently say I grew enormously this summer due to the program's unwavering support. I'm so grateful for the opportunity I got to work in the Walker lab, and I especially enjoyed working day to day with Dr. Hadi Ali—I can't wait to see where our work this summer takes us!

As a result of this experience, I'm more excited than ever to pursue a career in science.

I wish you all the best!

Warmly,
Dustin Grossman
Georgia State University
Mentor: Lori Walker, Ph.D.
Research Poster Title: The Molecular Basis of Cardiomyocyte Dedifferentiation

Thank you so much for an excellent summer program, with support from numerous sources as well as fantastic mentors. :)

Sabrina Hafeez
The University of Colorado Boulder
Mentor: Jennifer Richer, Ph.D. M.S.
Research Poster Title: Modulation of Heme Oxygenase-1 by Androgen Receptor to Enhance Survival and Stemness Properties During Breast Cancer Metastasis



Dear Donors, Mentors, and Lab Staff,

I can honestly say that the Gates Summer Internship Program has given me my favorite research experience yet. I have met so many great people, learned so many new things, and seen more of the beautiful state of Colorado than ever before. I would sincerely like to say thank you for all of the support that you have provided to the program. Without it, I would not have had the experience I did this summer.

After graduating from Clemson University, I will be applying to medical school. Doing research this summer has inspired me to do a research fellowship after becoming a doctor so I can continue to be on the cutting edge of science and provide the most up-to-date care.

Thank you again for your support of the GSIP program. It will continue to inspire young scientists in their journey of changing the world.

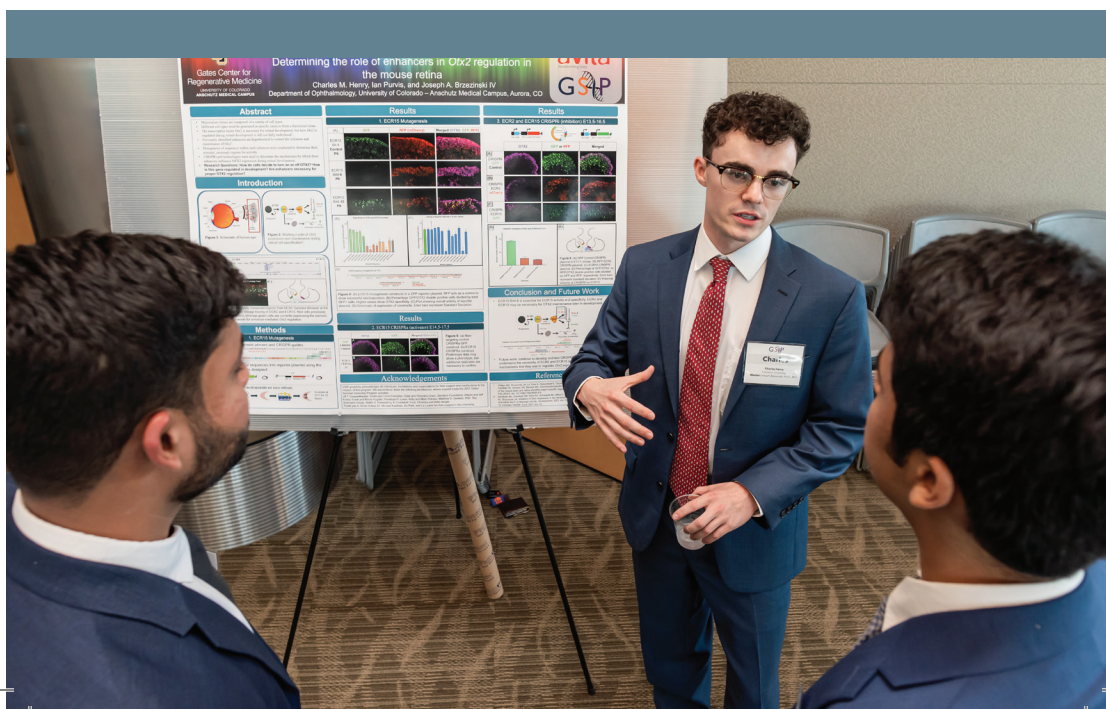
All the best,

Charles Henry

Clemson University

Mentor: Joseph Brzezinski, Ph.D., M.S.

Research Poster Title: Determining the Role of Enhancers in Otx2 Regulation in the Mouse Retina



Thank you so much for your help and support this summer, I am eternally grateful for what I have had the privilege of learning this summer & have truly had one of the best summers of my life!

Helen Li

Cornell University

Mentor: Maria Natalia Vergara, Ph.D.

Research Poster Title: Development of a Novel Stem-Cell Derived Organoid Model of Retinal Alzheimer's Histopathology



Thank you SO MUCH for your support this summer! Being an intern with the Gates Center helped me develop my skills as a scientist, from designing my own project to presenting my work and every step in between. I am so grateful for the opportunities that I had this summer. This internship was so valuable for my career. I appreciate your generosity and passion for this program. Without your support, I would not be the aspiring scientist that I am now.

Dayle Matheny

Ball State University

Mentor: Eric Pietras, Ph.D.

Research Poster Title: Itaconate and IL-1 Increase the Clonogenic Activity of Hematopoietic Stem Cells





Dear GSIP Donors,

Thank you very much for your generosity in making GSIP possible. This summer was a great opportunity to do cutting-edge research in my field of interest while developing basic lab skills. I thoroughly enjoyed working in Dr. Freed's Lab where I was able to learn so much about neuroscience and pharmacology and contribute to Parkinson's Disease research. The seminars also allowed me to gain exposure to stem cell research in a variety of fields and provided me with useful information for informing my future career path decisions. Thank you again for enabling students like me to have this incredible experience.

Best,

Parth Mody

The University of Pennsylvania

Mentor: Curt Freed, M.D.

Research Poster Title: Screening Drugs for Neuroprotective Effects in a Novel Parkinson's Disease Cell Model

Thank you for providing this opportunity for me to explore research in regenerative medicine. I have continued onto a Ph.D. program in Chicago, and I really appreciate the opportunities and experiences afforded to me through the Gates Summer Internship Program.

Nupur Pandya

Virginia Commonwealth University

Mentor: Linda Barlow, Ph.D.

Research Poster Title: An Examination of Retinoic Acid Signaling in Taste Cell Differentiation



Dear Generous Donors,

I can't thank you enough for supporting the Gates Summer Internship Program. You all have made this program possible. Your generosity allowed me and my new friends to explore our passion in scientific fields while developing techniques and strategies that will be necessary for us to succeed.

In addition to the amazing learning experience provided by the Gates internship, I also was able to explore different aspects of Colorado through the program's social outings. Not only that but the internship exposed me to many career and graduate school exploration events that were invaluable in helping to determine my career trajectory.

Without this program and your generosity, this would not have been possible. I sincerely thank you all.

Meet Patel

University of North Alabama

Mentor: Stanca Birlea, M.D., Ph.D.

Research Poster Title: Understanding Cellular and Molecular Changes in Vitiligo Lesions That Do Not Respond to Treatment



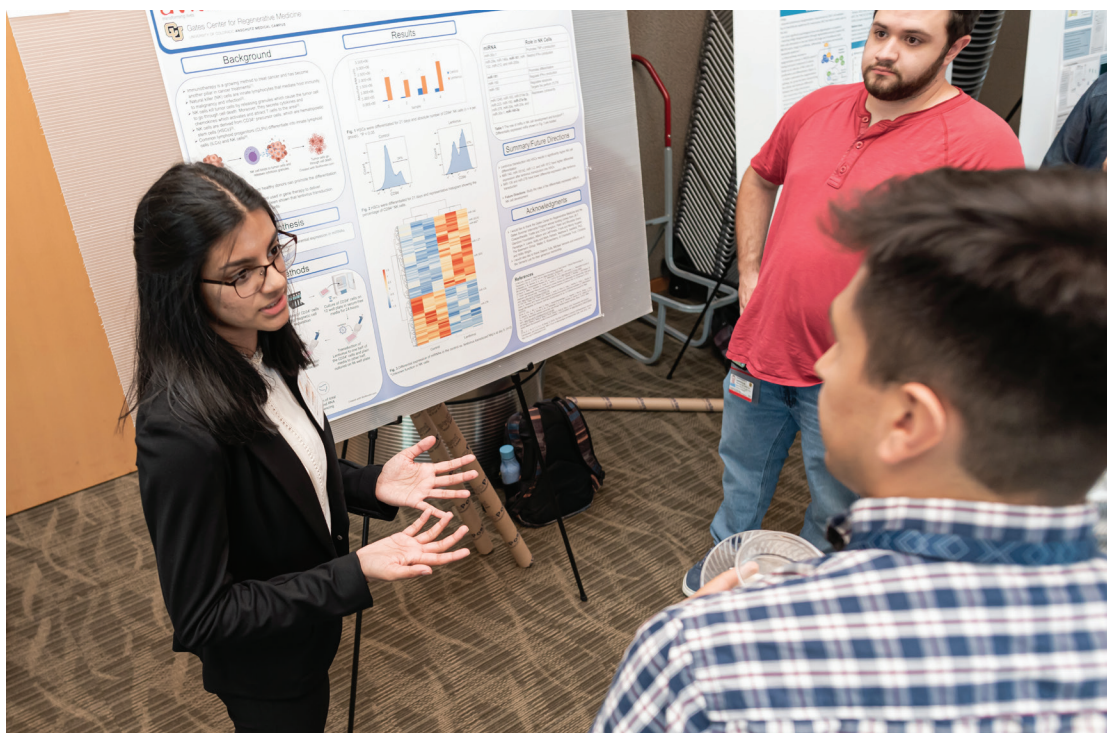
I would like to thank the Grant family and the generous donors who made GSIP possible. The exposure to cancer research that I had this summer was extremely valuable and impacted my perspective on medicine. I learned so much about stem cell science and immunology and met many amazing scientists in the process. Not only was this program important for my future in medicine, but it was so much fun. I will never forget the exciting trips that the interns got to go on. I would also like to thank Dr. Verneris and everyone in the Verneris Lab. Each member of the lab helped me with my project this summer and I couldn't have done it without them.

Amrita Purkayastha

University of Colorado Boulder

Mentor: Michael Verneris, M.D.

Research Poster Title: Lentivirus Transduction into HSCs Results in Increased NK Cell Differentiation



Thank you to everyone in this program. I am blown away by all that I learned and did. My mentors were some of the most fantastic people I ever got to meet. This made me really excited for my future, I walked out of this internship with direction and optimism. That's all thanks to everyone I met and made it possible for me to be here. This internship gave me the motivation to push through my last years at Mines and I (and my parents) greatly appreciate that!

Thank you!

Noah Marie Rainer

Colorado School of Mines

Mentor: Russell Marians, Ph.D.

Research Poster Title: Development of Potency Assay for CAR T Cell Therapy by Monitoring Cytokine Production



Thank you so much to everyone involved with the Gates Summer Internship Program, the Gates Center for Regenerative Medicine, and Dr. Traci Lyons's lab for allowing me the opportunity to engage in fascinating research and to make many new friends and memories.

Arteen Rasti

Purdue University

Mentor: Traci Lyons, Ph.D.

Research Poster Title: Semaphorin 7A Influences Survival Factors in Macrophages and Human Dermal Lymphatic Endothelial Cells





Thank you from the bottom of my heart for your incredible generosity in supporting the Gates Summer Internship Program. This experience was incredibly valuable to me and without your contribution, it would not have been possible. As an intern, I gained vital experience doing various important lab procedures that I will be able to bring to future

research jobs and medical school. Again, thank you so very much. I wish you all the best.

Sincerely,

Karina Sharma

Middlebury College

Mentor: Peter Dempsey, Ph.D.

Research Poster Title: Generating SOX2 and E-Cadherin Fluorescent Reporters in iPSC's



To all who contributed to the Gates Summer Internship Program Class of 2021, I would like to truly thank you for making this program possible. I will forever value the experiences I gained in a field I have loved since I was a young girl. I have had the immense privilege of working with some of the brightest young scientists in this field, and I am so

eager to continue our friendships as we enter into our next phases. To my phenomenal mentor and lab staff, thank you for welcoming me into your close-knit family and teaching me as much as one can possibly learn in a short eleven weeks. I will forever remember this summer and I cannot emphasize enough the integral impact this program has made on my passion to leave this world better than I found it.

Natalie Shelden

The University of Colorado Boulder

Mentor: Ganna Bilousova, Ph.D.

Research Poster Title: Developing an In Vitro 3D Model of Ehlers-Danlos Syndrome

I give a heartfelt thank you to the donors, the staff, and the mentors for all their hard work in making this phenomenal summer experience possible. I learned so much about research in academia and the potential in the field of regenerative medicine, and this opportunity has given me more confidence in choosing my future career path.

Cathy Shi

Carnegie Mellon University

Mentor: Karin Payne, Ph.D.

Research Poster Title: Differentiation Potential of Implanted Mesenchymal Stromal Cells in a Cartilage-Mimetic Hydrogel for Growth Plate Injuries

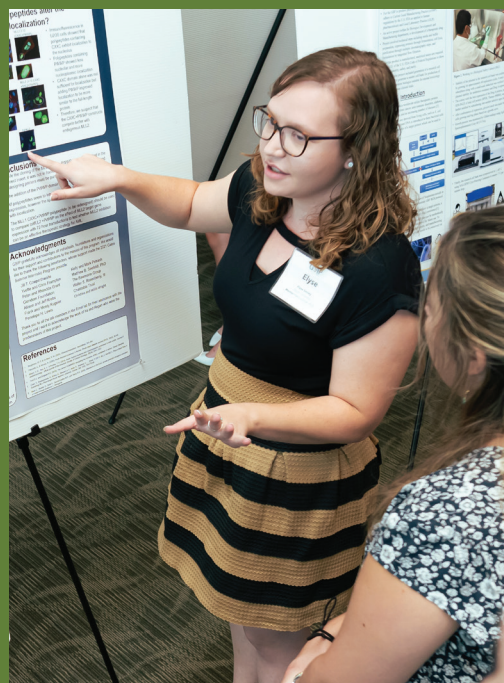
I would like to sincerely thank the individuals who made this year's Gates Summer Internship Program an incredible experience that allowed me to learn what it was like to be a full-time researcher and to confirm my path towards medical school. Thank you to the generous donors for providing the means for this educational and social experience and meeting an amazing group of fellow interns. Also, a special thank you to Dr. Ernst and the other members in her lab for their guidance and expertise during my time in the lab.

Elyse Smiley

Regis University

Mentor: Patricia Ernst, Ph.D.

Research Poster Title: Pre-Clinical Development of MLL2 Specific Inhibitors for Leukemia





The Gates Summer Internship Program (GSIP) on the Anschutz Medical Campus was an incredible experience that allowed me to grow appreciably as a professional and aspiring scientist. As one of two interns at the Gates Biomufacturing Facility (GBF), I was able to gain significant knowledge, crucial skills, and vital techniques all in a fast-paced three-month span. Working in the Biologics team at the GBF allowed me to support the process development of protein biologics at an FDA-approved current Good Manufacturing Practice (cGMP) site directly facilitating Phase I clinical trials of investigational new drugs. Specifically, I assisted in formulation studies and the generation of a research cell bank utilized to generate a master cell bank for the production of cGMP grade protein biologics suitable for animal toxicology studies

and human clinical trials. Additionally, I actively participated in 14 weekly seminars, various networking events, and presented a scientific poster on research cell banking. I also attended fun social activities with our class, such as bowling, white-water rafting, and cheering on the Colorado

Rockies at a baseball game. There were memorable moments abundant throughout the summer, and I know that all of which I have gained during this time will positively shape me to have a bigger impact in the world. Ultimately, this internship has furthered my desire to continue in a STEM research career moving forward. I am extremely grateful to have been in the 2020 & 2021 GSIP cohort of scholars.

Thank you to the GSIP team for your outstanding support of the 25 students in the GSIP class of 2021, and for making this summer a most memorable one for all of us!

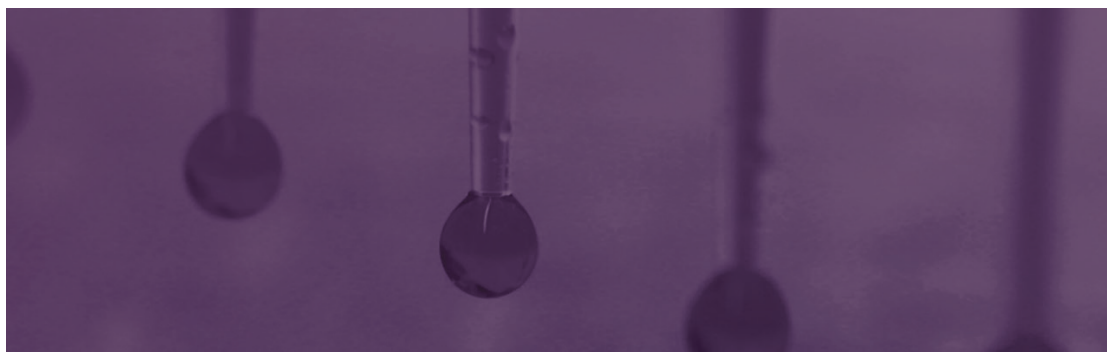
Thank you to the benefactors of GSIP for supporting our education and making this amazing experiential learning opportunity possible for all of us through your generous funding.

Thank you to Dash Batt, Ph.D. and Arden Doerner Barbour, Ph.D. for your phenomenal leadership and mentorship during my time with the Gates Biomanufacturing Facility. I really appreciate the GBF team for treating me like family and warmly welcoming me into the workplace this summer.

Jimmy Tangchittsumran
University of Colorado Denver

Mentor: Gana Batt, Ph.D.

Research Poster Title: Biologics Development and Manufacturing:
Research Cell Bank





To all those who have helped make the Gates Summer Internship Program possible,

Thank you so much for making this experience a reality! Because of the support of donors and mentors and program directors, my entire cohort has been given this amazing opportunity to learn and gain hands-on experience in translational research. The connections we have made through this program, along with the knowledge gained through our research experiences, seminars on current research, and hearing the paths mentors have taken to accomplish their goals have all been invaluable for guiding us on a path to future success. I've learned that there is no single way to achieve a goal and that through creativity and hard work anything is possible.

I am so grateful to have had this opportunity. The support and encouragement I received from my mentor and everyone in the GSIP program have been overwhelming. I was pushed to grow as a scientist and challenged to apply everything I have been taught in novel ways. The skills and knowledge I gained in just a few short weeks are priceless as I launch into my career.

Thank you for giving us this opportunity!

Sincerely,

Raechel Tittor

Missouri Western State University

Mentor: Nidia Quillinan, Ph.D.

Research Poster Title: Cerebellar Stroke Causes Increased Activation of the Deep Cerebellar Nuclei

ACKNOWLEDGMENTS

Since its inception in 2015, the Gates Summer Internship Program has been made possible by generous philanthropic support and in-kind contributions from the following individuals, foundations and organizations:

Avita Medical

Jill T. Cowperthwaite and Charles P. Jones

Davidson College

Yvette and Chris Frampton

Deborah Froeb and Tim Gardner

The Glendorn Foundation

Rhondda and the late Peter Grant

Joyce and Wayne Hutchens

Illumina Inc.

Allison and Jeff Krebs

Monty and Frank Kugeler

Penelope H. Lewis

Middlebury College

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Jane Rech, Ph.D. and Chris Toll

Ann and Kevin Reidy

Betty and Dennis Roop, Ph.D.

Matthew B. Seefeldt, Ph.D.

The Bawmann Group Inc.

A. Sheffield Tulp

Walter S. Rosenberry, III Charitable Trust

Christina and Willis Wright

As always, we hope our ongoing efforts will honor the vision of our founding donors Rhondda and the late Peter Grant who so treasured being a part of the development and growth of this program.



(left to right) Longtime supporter Rhondda Grant with Glenny and Michelle Buquet (intern Staunton Golding's grandmother and mother) at the Closing Day Ceremony



The GSIP Class of 2021's passion helped advance science, and they left few pins standing!



Gates Center for
Regenerative Medicine

UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

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See our **GSIP website** (scan QR code)
or contact Jill Cowperthwaite at **303-724-6143**
or jill.cowperthwaite@cuanschutz.edu
with any questions.

