The Foundation now receives around 125 applications per year. On average, they run 30 pages long and include two essays, four recommendation letters, and one institutional letter of support. That’s almost 4,000 pages of dense, academic text. How can we cope with this workload? This seems like a good time to pull back the curtain and give a little glimpse into how the Foundation makes its selections.

Things used to be easier. When the Churchill Scholarship started in 1963, the first director, Roger Fenn contacted a select number of universities to see if they had outstanding students interested in attending a new Cambridge college. He sent just three Scholars that year. In the early years, the Scholars were selected with assistance from the National Science Foundation. Starting in the 1970s, Harold Epstein established a formal list of Participating Institutions, each of which could nominate up to two students annually for the Churchill Scholarship. That list now stands at 125, and we receive an average of around one nominee per institution. Harold also started the practice, which continues to this day, of former Churchill Scholars selecting each new cohort.

This year, a record 20 former Churchill Scholars participated in the selection of 17 students. How do we divide up their work? It starts with the applicants themselves. On their applications, students must choose from a list of four broad categories, stating which best describes their area of study: Mathematics (Part III of the Tripos), Physical Sciences,
Letter from the Executive Director

Last summer, the current cohort of Churchill Scholars faced an impossible decision. The British Embassy had been closed for months and was not yet issuing visas. It was unclear if Cambridge would welcome students in October. Meanwhile, if the Scholars decided to stay in the US, most had PhD or MD programs waiting for them, and their housing deposits were coming due.

I was not sure we would have any Churchill Scholars this year. The last time the Scholarship faced a situation like this was during the Vietnam War, when the draft prevented many students from accepting the Scholarship. I should never have worried! In the end, 12 of the 16 Scholars chose to matriculate during this academic year. (We made an exception to our usual no-deferrals policy, and two students deferred to 2021, one deferred to 2022, and one declined the Scholarship.)

We even managed to bring the cohort to the Churchill War Rooms in between UK lockdowns. You can follow the cohort’s experience through their blog, which is linked on the homepage of our website (www.churchillscholarship.org) or you can visit their site directly (churchillscholars2021.wordpress.com). With each of their posts, I am amazed at how they are thriving and making the most of a difficult year.

Speaking of being amazed, we are in the middle of one of the worst economic downturns in generations, and yet our Trustees and alumni have risen to the occasion and made 2020 the best fundraising year in our history. We received a record 151 gifts from former Churchill Scholars. Some of our Trustees stepped up with larger gifts than usual this year, to make sure we would make it through ok. And then we received the largest gift ever from a former Churchill Scholar. I was saddened in March to have to say goodbye to Jerry Simpson, a Scholar from the second year of this program in 1964, and a friend and frequent lunch companion. Thanks to Jerry, we increased our cohort this selection round from 16 to 17 students, as he left us what amounted to around $850,000 already, in addition to further funds that are residing in a charitable trust that he set up to benefit this Foundation and other charities close to his heart.

I now look forward to 2021. We received a near-record 125 applications for the current round. In addition to the cohort of 17, we have two deferred students, which means we will be sending 19 Churchill Scholars to the College in the fall. In the meantime, I hope you enjoy reading the bios of the current students.

“Speaking of being amazed, we are in the middle of one of the worst economic downturns in generations, and yet our Trustees and alumni have risen to the occasion and made 2020 the best fundraising year in our history.” Mike Morse
The Zoom Where It Happened continues

Life Sciences, and Engineering or Computer Science. For these four areas, we put together four “teams” of specialists. Each team is comprised of two former Scholars, who score applications on a scale from 1.0 to 5.0. (Given current trends, we may need to split the Life Sciences group in two and add even more former Scholars to the Committee.) Round One is essentially the group stage of our selection process, where eight former Scholars each read between 25 and 45 applications, depending on how many applicants there are for their group.

The top candidates from each group then make it to Round Two, where we aim to have between 30 and 35 finalists, proportionate to the numbers of candidates from the four areas. In Round Two, we have a new set of eight former Scholars, spread out across the same four areas, to read and score all the remaining applications.

The scores are not the final word, but the start of a discussion in the selection meeting. Before the meeting, we analyze the scores using three different methods (all suggested by former committee members): raw averages, z-scores (where the averages are weighted by the standard deviation of each reader’s set of scores), and Borda scores (where we convert scores into a simple ranking). This year, for the first time, we held the meeting virtually using Zoom. It took over five hours.

There was one additional former Scholar in the Zoom, which proved to be critically important. While the Executive Director normally chairs the meeting as a non-voting member, this year we had a Deputy Chair of the Committee, Suzanne Carter Squires (Applied Mathematics and Theoretical Physics, 2012–13) who herself had served on the Committee recently. We did this to ensure continuity in a pandemic year in case Michael Morse was unable to attend. In the end, Michael did attend the Zoom, but was not at full strength (he is now!), and Suzanne led the discussion. She also put together the pre-meeting analyses.

The Committee aims to reach consensus on 16 Churchill Scholars and three alternates. Some years, however, we end up with more finalist candidates than there are remaining slots, and further agreement is hard to obtain. In these difficult cases, we use approval voting (suggested by a mathematician). In approval voting, the committee members can make a positive vote for as many remaining candidates as they like. Some members really favor one candidate and will only vote for that person, even if there is more than one slot available. Others would be happy if a number of them win, and they vote for several. The chair then tallies the results. Whenever we have used this system, everyone has been happy with the outcome.

In addition to the 16 Churchill Scholars selected at the meeting, we have one additional member of the cohort: the Kanders Churchill Scholar in Science Policy. Because there is only one award for that scholarship, we have a separate system. The directors of the Cambridge Master’s in Public Policy nominate a handful of students out of a dozen or so applications they receive each year. A separate committee of three former Churchill Scholars with professional experience in science policy then selects a winner using the same criteria as the Churchill Scholarship in science, math, and engineering. There is no separate application for that competition.

Former Scholars should contact the Foundation if they are interested in volunteering.
Harold Epstein was synonymous with the Winston Churchill Foundation. He joined at a precarious time. The founding Chair, Carl Gilbert, had recently stepped down, along with Roger Fenn, the first director. In 1970, an interim director was struggling to find recipients for the Scholarship when so many graduating students were being drafted. That is when Ambassador Lewis Douglas, the second Chair of the Foundation discovered Harold through their mutual friend, Edward Warburg. It is hard to imagine the Churchill Scholarship surviving into the 1970s, let alone to today, without Harold’s innovations as Executive Director.

After graduating the City College of New York, Harold enlisted in the Army Air Corps and served in China during the Second World War. On return, he studied for a PhD in American History at Columbia. His career included teaching at Hunter College and work as an Army historian. Before joining the Churchill Foundation he had been working as chief aide to Bernard Baruch, whose memoirs Harold had a hand in writing. Harold was also vice president of the Institute for International Education, vice president for development at Hofstra University, and assistant to the president of Hebrew Union College.

Harold was married for 66 years before his beloved wife Lillian passed away in 2015. He once said that he always wanted there to be a baby in his house, and to that end he was proud to have four children and nine grandchildren.

In his final years, Harold’s short-term memory had begun to fade, but he never forgot a Churchill Scholar selected during his 36 years of running the Foundation. He followed their careers with great enthusiasm. When he retired in early 2007, the Board of Trustees established an Epstein Churchill Scholar each year, to remember his many contributions.
Professor Paul E. Rapp: I have many warm memories of Mr. Epstein. One year, schedules aligned, and I was able to serve on the committee that selected Churchill Scholars. We met at the Faculty Club at Harvard, and as can be imagined were faced with superb applications from all of the applicants. Reaching final decisions was extraordinarily difficult, and as the selection process advanced it became increasingly more difficult. At about 4 PM there was a quiet knock at the meeting room’s door, and a young gentleman in a white jacket brought in a tray with a bottle of sherry and sherry glasses. Mr. Epstein went to each of us presenting a glass of sherry, and final decisions were made expeditiously. Mr. Epstein certainly knew how to advance an administrative process. I wish that I could utilize this method in the US government! Once convergence had been reached, members of the committee with one voice declared “Thank heavens I wasn’t a candidate this year. I would never have been selected!” Mr. Epstein then deeply impressed me with his generosity of spirit. He reached into his jacket pocket and pulled out his notes. He reminded each member of the committee about the contents of their application for a Churchill Scholarship. “You did this,” he would say to one. “You did that,” he said to another. He had reviewed all of our applications and had something positive to say about each of us.

The last time I saw Mr. Epstein (I could never refer to him any other way) was in Washington, DC. An exhibit of Churchill’s papers was to open at the Library of Congress and former Churchill Scholars were invited to a preview conducted by one of the Curators. I met Mr. Epstein at Union Station and we then visited the exhibit. We then spent the afternoon together before going to a reception at the British Ambassador’s residence. During our afternoon together, Mr. Epstein and I discussed his work in Europe after World War II. Our meeting was in 2004 and 9/11 was still very much in our minds. We discussed my frustration with the US response. He provided valuable counsel and gentle wisdom.

He was a gentleman from another time and culture. He will be greatly missed.

Dr. Jared Silvia: I was fortunate enough to be in his last cohort. I remember fondly how, in my interview, Harold was quite interested in my role as captain of the College Bowl Team. We spent half the time talking about the team and our run at the national competition. I feel that was indicative of Harold and his style, wanting to know the person behind the resume. I had lunch with Harold in the summer of 2005 before I left for Cambridge. We met at a restaurant on the Upper West Side of Manhattan. Harold’s passion for the Foundation and its mission was inspiring. He made it clear that he saw the role of the Foundation as being critical to Churchill’s legacy. It’s hard to estimate the impact that he has had shepherding the Foundation and the Scholars through the years. I feel like he is one of life’s unsung heroes, working diligently to make a difference even though it is mostly behind the scenes. I know I would not be the same person I am today without the Churchill Foundation and Harold.

Dr. Malisa Dorn: I served on the Churchill Scholarship Selection Committee several times during the 2000s. We were all astonished when Harold announced his retirement during one of our meetings; it was difficult to conceive that we would enter an era in which the scholarship existed without him. I am still extremely grateful for my time at Churchill College, and for Harold’s making it possible through his devotion to managing the scholarship for so many years.
Professor Ronald J. Adrian: Harold Epstein was a good man dedicated to the Churchill Scholars. He was always a welcome and reassuring presence during his visits with the scholars in Cambridge.

Professor Jeffrey M. Marcus: In 1675, Sir Isaac Newton, when speaking of his scientific accomplishments, said, “If I have seen further it is by standing on the shoulders of Giants.” For me, like so many other Churchill Scholars, Harold Epstein, was one of the Giants who lifted us to a place where we have been able to make so many important scientific contributions. At the same time, what Harold would consistently remember me for in the years after I graduated from Cambridge was not my scientific work as a Churchill Scholar, but rather the cookbook that I wrote, collecting the recipes of the many friends that I made while in College. I still use that cookbook frequently. Harold Epstein was a Giant in his impact on so many of us. I will remember him always for his dedication, kindness, and generosity.

Mitch Bradley: As a Churchill Scholar from 1980, I am saddened by Harold’s passing, but also encouraged by the long and productive life he lived. The year I spent at Cambridge broadened my perspective immensely, so I am very grateful for the opportunity that the Churchill Scholarship afforded, and for Harold’s role in making it possible. My best wishes to his surviving family members as they mourn the loss and simultaneously celebrate a life well-lived.

John L. Loeb Jr.: Reflections, Memoirs and Confessions: By the time I joined the Board, in 1975, Harold was already the heart and soul of the foundation…. In the early days, there weren’t many applications for scholarships. Few in the American academic world had even heard of the Winston Churchill Foundation. Harold deserves credit for changing all that. He visited colleges and universities all over the country and mined them for their best and brightest…. When it came to fundraising, the partnership between Harold and me was a perfect fit: I had the contacts and Harold had the administrative skills. He did the lion’s share of the work and deserved a large portion of the accolades. After Father [John L. Loeb Sr.] asked me to take on the job of raising money for the foundation, I gave it a great deal of thought, concluding that an effective way to raise money would be to give out an award with special meaning to the recipient…. We decided to go all out for the event [to honor Ross Perot with the Winston Churchill Foundation Award in February 1986]…. I contacted Prince Charles, who agreed to make the presentation to Perot on behalf of the Winston Churchill Foundation. Harold and I designed a medal with a silver ribbon with Churchill’s profile on it in honor of the occasion…. I’ve never experienced anything like that dinner before or since.

The next morning there was a meeting of those members of the Churchill board of directors who were in Dallas, including my father, Harold and me. Father, who completely dominated these meetings, went through a few managerial items and then said, “I guess that’s it,” and got up to leave. Before Father could go, Harold interjected. “Don’t you think we should talk first about our tremendous success?” he asked.

Father clearly couldn’t find it in himself to congratulate Harold or me on what was not only a great success, but also one that surpassed Father’s goals. Over the years, Harold’s carefully balanced diplomacy and editing of my contentious letters muted our frequent father-son skirmishes. If Harold hadn’t brought it up at the meeting, no mention would have been made that we had just netted $1.5 million dollars, $500,000 more than the campaign goal Father had set for me.
Our dad was first and foremost an educator and a mentor. His long-time role as executive director of the Winston Churchill Foundation gave him a wonderful opportunity to live the values he cherished—curiosity and lifelong learning, promoting cross-cultural understanding through travel and communication, and nurturing and developing talented young people who were motivated and engaged in their communities.

Just as most Churchill Scholars describe their year in Cambridge as one of the highlights of their lives, our dad regarded his career at the Churchill Foundation as an enormous adventure and blessing. Although he was not especially fluent in science and technology, he reveled in his visits to the college, in attending seminars on science policy or tours of the Churchill War Rooms and getting to know the scholars who were studying machine learning or plant science. We can still see him poring over candidates’ applications from scores of universities, or carefully reading scholars’ narratives at the conclusion of their experience and marveling at their achievements and especially their growth and reflections.

Most of all, our dad was gratified and proud of the thoughtful, versatile, successful and fulfilled individuals the Churchill Scholars became. He was greatly enriched by his work through the years and inspired by the lives he touched.
IN MEMORIAM

CHARLES ELLINGTON (1952–2019)
The much-beloved Bee Movie (2007), written by Jerry Seinfeld and others and featuring the voices of many Hollywood stars, begins with the famous words, “According to all known laws of aviation, there is no way a bee should be able to fly.” This was, in fact, true before Charles Ellington (Zoology, 1973–76) remodeled our understanding of aerodynamics to account for the flight and hovering of bumblebees. For these advances, he was named a Fellow of the Royal Society.

Charlie was one of the rare Churchill Scholars who never left Cambridge. A graduate of Duke University, he won the Churchill at a time when it would support an average of one PhD student per year. He eventually finished his PhD at Cambridge and worked his way up to Professor of Zoology. He was a member of Downing College.

Among his many accolades was the 2007 Pilkington Prize for teaching at Cambridge, which he won for developing Cambridge’s introductory course in Quantitative Biology. Charlie had suffered from diabetes since childhood. It was this condition that led to his early retirement in 2010 and premature death. He is survived by his loving wife Stephanie and sons Matt and Nic.

JOHN SIMPSON (1939–2020)
Known as Jerry to his friends, John Simpson (Physiology, 1964–65) arrived in Cambridge with the second class of Churchill Scholars. A graduate of RPI in Mechanical Engineering, he was already enrolled at MIT when he took the Scholarship. At Cambridge, he studied neuroscience before there was a word for the discipline. This set him on a career of researching the cerebellum and to work with international collaborators in Japan and the Netherlands.

His research centered around single cell neurophysiology of cerebellar neurons and their relation to the control of eye movements. One of his major contributions was the discovery that retinal image slip modulates activity of climbing fibers of compartmentalized zones in the vestibulo-cerebellum, such that this modulation is optimal when the visual field rotates around one of the three virtual axes of the semicircular canal pairs.

Jerry finished his PhD at MIT and held a faculty position at the University of Iowa before becoming Professor of Neuroscience and Physiology at NYU Langone Health. He passed away in March last year following a long period of hospitalization. His wife of 51 years, Diane Simpson, passed away in January, 2021. She had been a professor of psychology, artist, calligrapher, and playwright. Jerry was a generous supporter of the Winston Churchill Foundation, and we have recognized that by naming a Simpson Churchill Scholar each year.
VINAY AYYAPPAN

As cancer cells metabolize nutrients, they leave behind information that can be used to facilitate cancer diagnosis and treatment. Conventional imaging techniques cannot capture the speed at which these processes occur. Dr. Ferdia Gallagher in the Department of Radiology has been at the forefront of driving clinical applications using a new technique called hyperpolarized $^{13}$C magnetic resonance imaging (MRI). This could allow the viewing in real-time of the breakdown of a metabolite injected into the body with 10,000 times the sensitivity of traditional techniques. Vinay will perform human trials of hyperpolarized $^{13}$C MRI on chemotherapy patients. The goal is to integrate this new imaging technique alongside other methods like tissue sampling and tumor genomics to create individually tailored treatments for each patient.

Upon his arrival at JHU, Vinay studied the mechanisms by which breast cancer cells obtain energy and nutrients. He investigated the altered metabolism of a compound called creatine and the role of the CKMT1 gene in the metastasis of breast cancer. These efforts resulted in a second-author publication in NMR in Biomedicine, a first-author manuscript under review, and multiple poster presentations as well as the opportunity to present his abstract at the annual International Society of Magnetic Resonance meeting in Paris. In the summer of 2019, he interned at UCSF where he combined biological studies of metabolism and advanced imaging methods with state-of-the-art computational methods for data analysis in investigating telomere maintenance. In the field of bioinformatics he maintained the world’s largest open source database on ADP ribosylation. During the fall of his senior year, he began a collaboration with a group that investigates the use of aspirin as a contrast agent for a new MRI technique called “Chemical Exchange Saturation Transfer.”

Vinay has been integral to three undergraduate bioengineering design teams focusing on translational research with end products ranging from low-cost reusable biopsy needles to deep learning methods allowing for cancer analysis in resource poor settings. In the fall of 2019, he was nominated as a head teaching assistant. Vinay is a Goldwater Scholar, two-time Astronaut Scholar, and the recipient of two JHU awards for undergraduate research. He had 15 A+ grades with no grades below A. Vinay has elected to begin medical school at the University of Pennsylvania and defer his Churchill Scholarship by two years.

ANNA BIGGS

Anna is preparing for a career in theoretical physics research. Her academic interests lie at the intersection of mathematical physics, quantum field theory, string theory, and quantum information theory. At Cambridge, she proposes a course of study that will strengthen her understanding of supersymmetric gauge theories and address a burgeoning interest in quantum information and the black hole information paradox. Anna has been thinking about using string theory approaches to study the mysteries of black hole physics, where the principles of general relativity and quantum mechanics appear at first to contradict one another.

By the spring of her sophomore year, Anna was eager for an opportunity to apply her coursework in complex analysis and algebraic geometry to research questions. As a Weissman Research Fellow, she worked with Professor Murad Alim’s geometric field theory and string theory group at the University of Hamburg. Her contribution was a novel calculation of certain particle states in the string theory she and Professor Alim were studying, a result that had only been previously sketched in literature. She presented her work at a poster session in 2019 at the National Collegiate Research Conference and is currently in collaboration with Professor Alim on a manuscript for publication. Building on her interest in using differential geometry to answer questions from string theory, she secured a Herchel Smith Fellowship for research with Stanford Professor Shamit Kachru. Her work on computing approximations of Ricci-flat metrics on K3 manifolds was ongoing during her senior year under the supervision of a postdoctorate fellow at Harvard’s Black Holes Initiative. Anna also has worked on graphene properties in the experimental physics lab of Professor Amir Yacoby as a PRISE Fellow recipient.

She is a Goldwater Scholar, a member of Phi Beta Kappa, recipient of Harvard’s Detur Book Prize and a John Harvard Scholar. She was the national winner of the 2016 Cum Laude Paper Prize and a Presidential Scholar. A single A- was all that stood between her and a perfect 4.0 GPA. She worked for the Harvard College Office of BGLTQ Student Life.

Jonathan Bagger (Applied Mathematics and Theoretical Physics, 1977–78) was named CEO of the American Physical Society.
AZIM DHARANI  
Gerschel Churchill Scholar

Azim’s research focuses on the biophysical characteristics of metals for improved anti-cancer metallo-drugs and the development of metal-catalyzed solar fuels. Cambridge Professor Erwin Reisner’s lab is pioneering semi-artificial photosynthesis research and under his supervision, Azim will explore materials engineering approaches to developing solar fuel cells and the use of transition metal co-factors in simulating enzyme activity.

Azim has worked on the design of copper-binding drugs to inhibit the growth of metastatic prostate cancer (MPC). Despite their cancer inhibiting properties, these drugs target both healthy and cancer cells. Azim designed a strategy using prochelators to selectively target MPC cells, thereby reducing the side-effects of these heavy-metal drugs to healthy cells. His contribution to the project resulted in a co-authored publication in a leading chemistry journal. He also did large-scale synthesis of those prochelators and evaluated their anti-cancer properties in mice. He applied his finding to the study of Wilson’s disease (a disease of excess copper build-up) and has synthesized another copper prochelator drug to potentially combat this disease. Azim’s computational projects include modeling amino acid mutations and simulating how these changes alter the folding stability of Griffithsin, a protein with the ability to inhibit HIV by binding to sugars on its viral envelope. At Memorial Sloan Kettering, he worked on the development of a model system to evaluate the accuracy of free energy calculations in order to understand the current state of atomistic computational modeling of small metal-containing molecules. He also completed an internship at DE Shaw Research where he utilized supercomputers specializing in molecular dynamics to investigate an emerging class of proteins called RNA chaperones, and this is expected to be published with Azim as a first-author.

Azim is an Angier B. Duke Scholar, Goldwater Scholar, and Phi Beta Kappa inductee. He has received several research fellowships, including the American Association for Cancer Research Undergraduate Fellowship, American Chemical Society Inorganic Division Award for Undergraduate Research, and an award for best poster and oral presentation from Sloan-Kettering Cancer Center. Azim was a member of the Duke Classics Collegium and published an article on biochemistry and the archaeological record on tumors.

THOMAS FREITAG  
Kanders Churchill Scholar

Thomas’s undergraduate research focused on epidemiology and health disparities, primarily on the spread of HIV and on substance abuse. At Cambridge, Thomas plans to explore the science policy challenges in stemming the transmission of HIV. By comparing the success in various countries of pre-exposure prophylaxis (PrEP), which can vastly reduce the spread of HIV, Thomas hopes to make best-practice recommendations for global health organizations.

At the University of Pittsburgh, Thomas worked alongside Dr. Mackey Friedman on the Pitt Men’s Study, which is part of the longest-running HIV cohort study of gay and bisexual men in the US. Bringing experience as a neuroscience major to epidemiology, Thomas also collaborated with Dr. James Becker to examine the relationship between chronic HIV infection and neurocognitive decline. Thomas was an AMGEN Scholar in the summer of 2019 and worked at the NIH, looking at how interactions between race, ethnicity, and sexuality may explain disparities in drug and alcohol abuse. Thomas presented their findings at the NIH Summer Poster Day, and this research was subsequently selected for a national conference and publication. Thomas additionally won the David C. Frederick Public Service Internship Award, given to six Pitt students to carry out public service internships. Thomas used their award to work as a Policy Fellow at the City of Philadelphia’s Office of LGBT Affairs.

Thomas spent the 2019–20 academic year as one of two Pitt students to win a highly competitive spot in a year-abroad program at Jesus College, Cambridge. While finishing the Natural Sciences trips, Thomas has become involved in various Cambridge science policy activities, such as Students for Global Health.

Thomas had a 4.0 average with 22 A+ grades and no grade lower than A. In the challenging organic chemistry sequence, Thomas was one of only three students out of 215 total who earned an A+ in both semesters. Thomas was also a member of the nationally renowned Pitt Men’s Glee Club, which represented the United States at the centennial anniversary of the Battle of Flanders Field in Waregem, Belgium in October 2017. Thomas’s goal is to obtain an MD/PhD, focusing on epidemiology and public policy, with the ultimate aim to help eliminate global health disparities in at-risk populations.

Michael Rosen (Chemistry, 1987–88) shared the 2020 Wiley Prize and was elected to the U.S. National Academy of Sciences.
ELISEANNE KOSKELO

Elise will join Professor Siân Dutton’s Group in the Cavendish Lab where she will conduct experiments focusing on exotic phases and frustrated magnetism in Ising garnets and other crystals. She will then attempt to understand which theoretical models of quantum behavior best explain experimental observations.

Elise’s first research position began in high school at Los Alamos National Lab, where she researched nondestructive methods to identify hidden defects in metal parts and composites using scanning laser ultrasound techniques. She has applied for a US patent based on this technology to inspect 3D printed parts, in situ, and developed a number of algorithms to analyze 3D datasets, now essential to evaluation technology. For her senior thesis research at Pomona, she investigated the role of “stochastic resonance” in thermoreflectance imaging, in which she developed a complete, experimentally-validated computational and analytical model of how noise can be used to stochastically enhance the resolution of the thermal imaging technique. Elise also received funding for summer research at Leibniz University in Germany where she worked on molecular spectroscopy. In the summer of 2020, she researched structural phase transitions in 2D materials using density functional theory for the Los Alamos National Lab Computational Physics Summer Workshop.

Elise is a Goldwater Scholar, Phi Beta Kappa, and member of Sigma Xi. She has received awards for scholarship and science research including the SPIE D J Lovell Scholarship. She was a teaching assistant and leader of two campus special interest organizations including one dedicated to women in physics and astronomy. She is an avid runner and a small business owner selling fiber art. After Cambridge, she will pursue a PhD in experimental condensed matter physics at Harvard University with an NSF Graduate Research Fellowship.

JAMIE LEE

Dyer Churchill Scholar

Cyber intrusions from hostile entities are a growing threat in both the civilian and military spheres. At Cambridge, Jamie will be taking Machine Learning and Machine Intelligence. Because Cambridge currently has some of the leading cybersecurity researchers in the world, she is eager to investigate their ongoing efforts involving real-time human and object tracking. She has a particular interest in the development of efficient visual tracking algorithms for Unmanned Aerial Vehicles (UAVs) and other aircraft systems which can track and classify humans, ground vehicles, weapons, and other objects of interest. Jamie will serve as an officer in the US Navy’s Information Warfare community after her year at Cambridge.

As a Trident Scholar, Jamie worked on mitigating data leakage through access patterns made by map application users (e.g., Google Maps, Strava). The cloud storage servers that are integrated with the map platforms can still attempt to obtain confidential information about the user during the search query process. She has worked to develop a novel remote-storage data structure that enhances user security at comparable performance levels. Her findings were presented at the 2019 Jean Bartik Computing Symposium and the 2019 Secure and Trustworthy Cyberspace PI Meeting. As an intern at the National Reconnaissance Office, she developed algorithms that derived more predictive kinematic features to help classify aircraft for better threat assessment. Her work resulted in a paper at the 2019 Military Sensing Symposium. She worked at Lawrence Livermore National Labs where she developed a program that helped to improve the accuracy and precision of nuclear energy yield estimates without the need for time-consuming manual measurements. She also worked on the problem of collapsing bee populations caused by a class of neuro-active insecticides called neonicotinoids at the George Mason University Shared Research Instrumentation Facility.

Jamie was a student ambassador representing the US Naval Academy at the Japanese Maritime Officer Candidate School. She was a senior member of the Navy judo team and volunteered for the Women in Cyber and Computing Club.
HARRISON (WEI TSE) LI

Modern sequencing and molecular profiling technologies have generated large amounts of datasets that have yet to be analyzed for biological insights. Harrison is interested in computationally simulating biological gene-gene interaction networks and developing new algorithms to analyze and integrate large-scale bioinformatics datasets, with the goal of teasing out undiscovered patterns and observations. Harrison likes to connect ideas from math, computer science, genetics, biotechnology, and medicine to develop methods that will lead to therapeutic targets at the individual patient level. At Cambridge, he will work with Dr. Florian Markowetz to explore how patterns of aberrations in the copy number of genes may provide insights into their importance in cancer initiation and development.

Harrison has contributed to more than 20 projects that explore key features of tumors, including non-coding RNA dysregulation, dysfunctional immune signaling processes, and the tumor-resident microbiome. Through correlation testing and interrogation of multiple data types, Harrison sought to elucidate the mechanisms by which these features affect tumor aggressiveness. Harrison taught himself deep learning techniques in order to stratify cancer patients according to immunologic phenotype, which he inferred from integrating different data sets. His facility with large data sets has enabled him to analyze the immune phenotype, non-coding RNA landscape, and microbiome composition of multiple cancers, including head and neck, prostate, kidney, liver, lung, and bladder cancer. He is the author of eleven papers and is a co-first author in eight of them, with five other manuscripts in preparation or under review.

Harrison is a Goldwater Scholar and Regents Scholar. He has a 3.99 GPA and received 21 A+ grades. He was captain of UCSD’s 2019 iGEM (International Genetically Engineered Machine) team. He enjoys traveling, reading, cooking, poetry writing, running, and hiking. Harrison has deferred his Scholarship by one year and will remain in his undergraduate lab. During the pandemic, he has published two papers on COVID-19’s relationship with tobacco and E-cigarette use and submitted three additional papers for publication, which looked at co-morbidities in COVID-19 patients and applied machine learning to COVID-19 patient data.

ALICE LIN

Alice will pursue a career in research mathematics concentrating on number theory and arithmetic geometry. In the Part III course, she will study differential geometry that will go beyond her undergraduate-level classic theory as well as algebraic topology which is indispensable for future work in modern number theory and arithmetic geometry. She will take advantage of the depth of the graduate level classes in algebra and algebraic geometry available to her, such as the courses on representation theory and algebraic surfaces. She is also excited about the opportunity to learn new techniques on the modularity of elliptic curves.

Evolutionary game theory seeks mathematical models for the evolution of biological systems such as cooperation among insects. Under the supervision of Professor Simon Levin and his group at Princeton, Alice’s first research project analyzed numerical simulations to understand how players would behave along the continuum between public and private property. In addition to continued studies on theoretical ecology, she also became enchanted with a sequence of courses on algebra and the foundations of number theory. In the summer of 2018, she completed an REU at Boise State where she was part of a number theory team, helping to uncover properties of elliptic pseudoprimes and Carmichael numbers. The poster on this work was awarded the “Outstanding Poster Award” for undergraduates at the annual joint meeting of the American Mathematical Society and the Mathematical Association of America. She continued her study of elliptic curves through her junior year and wrote an expository paper on the Modularity Theorem and Eichler-Shimura theory. In the summer of 2019 she studied number theory with Professor Ken Ono at Emory University where she and her collaborators produced a paper in the area of modular forms and harmonic Maass forms. She has expanded her work on modular forms for her senior thesis and applied algebraic techniques to study analytic properties of Hilbert modular forms.

In her junior year she received the Peter A. Greenberg ’77 Prize from Princeton’s Math Department for “outstanding accomplishments in mathematics” and the Shapiro Prize for academic excellence. She held several mentoring roles on campus, including the Mentoring Möbius group to help initiate undergraduates into the world of math research. She is an accomplished violinist and has toured with the Princeton University Orchestra. She revived the Princeton Bee Club and was its president.
DANIEL MALAWSKY
Gabelle Churchill Scholar

Using data from the East London Genes & Health study, Daniel will work with Dr. Hilary Martin at the Wellcome Sanger Institute to analyze data from this study of a consanguineous population to identify individuals with rare inactivating mutations and to study how they impact the met abolomic and phenotypic profiles of individuals. He hopes to elucidate the effect of these mutations on health. Daniel hopes to pursue a research career in population and medical genetics.

During his first research experience in neurobiology, Daniel studied neural circuits related to stress responses in mice. It became clear that he would need to rely heavily on computational and statistical methodologies in order to effectively analyze the complex data produced. He co-developed a semiautomated image analysis pipeline to extract the data needed from the collected images of the brain regions in question. With his interdisciplinary background in chemistry and programming, he contributed to a project in the rising field of Systems Chemistry at Oxford University; the project he worked on was motivated by the unsolved “Origins of Life on Earth” problem and the autocatalytic potential of chemical reaction networks. He also has experience in the field of high-throughput single cell-gene expression analysis where he focused on a type of therapy-resistant brain tumor called medulloblastomas. His contributions to the project earned him co-authorship on a paper published in Nature Communications and an upcoming co-first authorship on a paper expected to be published in Communications Biology.

He is a recipient of the Morehead-Cain Scholarship as well as several other grant and merit awards including Phi Beta Kappa. He is an accomplished cellist and volunteer community gardener. He has worked in a refugee clinic setting in Tel Aviv, Israel, and enjoys discussing philosophy.

SRINIVAS MANDYAM
Russo Churchill Scholar

Professor Jeffrey Baumbarg’s lab is pioneering the use of three-atom-thick semiconductors called Transition Metal Dichalcogenides (TMDs) in devices called nanocavities. This research could allow for the development of so called “room temperature exciton devices” with the potential to slash energy consumption in large computational systems. However, high quality TMDs are difficult to synthesize reliably. Srinivas co-first authored a paper in ACS Nano reporting the first known method of selectively producing large quantities of the bilayer TMD WSe2 (W=Tungsten, Se=Selenium). At Cambridge, he will fabricate bilayer WSe2 and ensonce the material in nanocavities to observe the effect of electrical tuning on the optical responses of these structures.

Srinivas has extensive undergraduate experience with TMDs. He came up with a clever way to use “growth promoter” chemicals to grow large area bilayer flakes of 2 specific types of TMD. His improved growth methods produced such high quality TMD that it allowed collaborators from another lab to precisely pattern atomic-scale holes in the material to modify its quantum properties. He also worked on biosensors based on graphene field effect transistors (GFETs). He helped to improve his lab’s nucleic acid detection to achieve attomolar (10^-18) sensitivity. The following summer he worked on a project aimed at developing GFET sensors for the rapid detection of anti-cancer drugs. Srinivas also conceived of an improved method for capturing and detecting methylated DNA, which is a biomarker for cancer. These projects resulted in five publications, with another in review.

Srinivas has been a teaching assistant for five different courses in physics and statistics including a graduate course. In addition, he created and taught a weekly elective class at a Philadelphia public middle school on effective public speaking and persuasion skills. He received a grant to study public speaking anxiety remediation in young students. He is a Goldwater Scholar, a Dean’s Scholar, and was elected to Phi Beta Kappa as a junior. He is also a NASA PSCG scholar, a Hertz Finalist, and an NSF Graduate Research Fellow. He was the only sophomore winner of the Vagelos Challenge Award in his year. He has 10 A+ grades and is a chorale singer and award-winning metrical poet, among other interests.
Sal is excited about a branch of theoretical physics that describes the behavior of “zillions and zillions” of particles, known as quantum many-body theory. These systems of particles exhibit exotic emergent quantum phenomena when their constituents are strongly interacting with each other. Sal is currently exploring whether the general laws of quantum electrodynamics (QED), which describes how light and matter interact, can emerge from the collective behavior of particles in a physical material. He is continuing this research interest by pursuing his MPhil with Dr. Claudio Castelnovo in the Cavendish Laboratory’s theory of condensed matter group.

As a first-year student, Sal helped to build an experiment to study the chemical stability of the liquid scintillator used by the SNO+ detector. Toward the end of his sophomore year, Sal was introduced to the Fermi-Pasta-Ulam-Tsingou (FPUT) paradox in the field of condensed matter theory. During the summer before his junior year, he essentially resolved a 60-year-old problem of non-linear statistical mechanics. He was the lead author on the paper for this research, which was published as an “Editor’s Pick” in the February 2019 issue of Chaos. Sal has since completed a second paper published in the November 2019 issue of Chaos, of which he is the lead author, expanding on his findings. He presented his FPUT paradox findings at the 2019 and 2020 APS March meetings and has given numerous poster and oral presentations. Sal worked on his senior honors thesis researching emergent QED in a theoretical model of a class of materials called quantum spin ice. He is the lead author of a paper on his findings, which is currently under peer-review.

Sal graduated with a BA and MA with a perfect 4.0 GPA and has already completed the first two years of the physics Ph.D. curriculum at Boston University. He was awarded “Learning Assistant of the Year” at BU. He is a Goldwater Scholar, a member of Sigma Xi, a recipient of an NSF Graduate Research Fellowship, and is currently a finalist for the LeRoy Apker Award. Outside of theoretical physics, he enjoys listening to and attending punk rock shows, playing video games, reading political theory, and everything espresso- and coffee-related.

Mehtaab chases after those elusive and unexpected moments of mathematical insight which can occur after long periods of struggle with seemingly intractable problems. As a high school participant in the MIT-Primes-USA program, Mehtaab came under the thrall of a branch of mathematics called combinatorics. According to Mehtaab, open problems in combinatorics are often elementary to state and they offer exciting possibilities for high school students because there is a low barrier to entry. Since this initial experience, his main interests have stayed within combinatorics. Mehtaab has deferred his Churchill experience by a year and will be a visiting scholar, collaborating with Professor Tim Gowers.

In 2017 Mehtaab participated in the University of Minnesota-Duluth REU where he and his co-collaborators produced results for publication in: Electronic Journal of Combinatorics, European Journal of Combinatorics, SIAM Journal of Discrete Mathematics and Journal of Combinatorics. As a sophomore, Mehtaab teamed up with two fellow undergrads and solved a conjecture first posed in 2001 regarding the maximum number of independent sets in a graph of given degree distribution. Their work was published in the Journal of Combinatorial Theory Series B. This was then extended by the same team to more general situations including graph coloring in a paper titled “A Reverse Sidorenko Inequality,” which was published in Inventiones Mathematicae. Subsequently, he finished two more papers with this team, one solving a problem in additive combinatorics which was published in Mathematical Proceedings of the Cambridge Philosophical Society and another paper which improves on an 80-year-old result in high dimensional discrete geometry, which was published in Advances in Mathematics. He also published results in Discrete Mathematics and Annals of Combinatorics.

Mehtaab also takes particular delight in creating math problems for competitions like AMC and AIME so that young enthusiasts can discover the joy of stumbling upon “flashes of insight.” He has worked for quantitative trading firms over winter and summer breaks. He has earned 27 A+ grades over the course of his undergraduate career with no grade below an A.
**Jasmine Stone**  
*Simpson Churchill Scholar*

Jasmine’s love of swimming spurred a fascination with learning, decision-making and motor control. As a synchronized swimmer, she often wondered how choreography instructions, which are often ambiguous but crucial for synchronization, were interpreted by her teammates. At Cambridge, she will work in the lab of Dr. Guillaume Hennequin, who is a leading theorist in the area of motor control. She will attempt to augment Dr. Hennequin’s control theory model of movements with her own quantitative model of how the brain prepares for movements using a new machine learning tool called “latent factor analysis via dynamical systems.” She plans to pursue a career in computational and theoretical neuroscience.

As a high school student, she joined a neuroscience lab at the University of Texas-Austin and conducted research on perception. She presented that work at two research conferences. At Yale, she worked with a graduate student on a project at the junction of computational neuroscience and artificial intelligence, using trained recurrent neural networks (RNN’s) to study how cortical circuits perform cognitive tasks. She was instrumental in the development of the lab’s RNN-training code base, and her work has resulted in a publicly released software package, a conference presentation, and a paper in preparation as co-first author. In addition, she has interned at the Howard Hughes Medical Institute’s Janelia research campus where she comparatively evaluated algorithms for distinguishing different neurons in calcium-ion images of neural activity.

Jasmine is a Phi Beta Kappa inductee and Goldwater Scholar as well as the recipient of multiple research grants and academic merit awards at Yale, including the Benjamin F. Barge Prize, awarded for excellence in mathematics. She was a nationally ranked high school synchronized swimmer and founded the synchronized swimming club at Yale. She was a first violinist for the Yale Symphony Orchestra and holds two patents pertaining to neuromuscular control. In her summers, she also interned at Google and at CTRL-Labs, a brain-machine interface startup recently acquired by Facebook.

**Macy Vollbrecht**  
*Epstein Churchill Scholar*

Macy’s research of mammary gland development during pregnancy and also plant genome engineering spurred her interest in plant developmental biology. She is interested in the genetic control of shoot branching and how plant architecture traits hold important implications for agriculture. At Cambridge, Macy will work with Dr. Ottoline Leyser to study how changes in cytokinin homeostasis and how cytokinin-mediated regulation of another key hormone (auxin) may affect shoot branching. Using the model plant Arabidopsis thaliana, she will investigate mutants in a large gene family called Arabidopsis Response Regulators, which regulate cytokinin signaling.

While in high school, she worked on a gene editing project in zebrafish. She investigated the role of the SOCS3 gene as a potential tumor suppressor by using CRISPR/Cas9 gene editing to create mutant zebrafish with loss-of-function alleles in SOCS3. At the University of Minnesota’s Center for Precision Plant Genomics, she engaged in projects ranging from bioinformatics to molecular biology to biochemistry. In one of these projects, she and her collaborators worked on a novel method to create gene edited plants, which led to a paper in *Nature Biotechnology* and the opportunity to present her findings in a seminar normally reserved for faculty and grad students. She and her group also worked on a directed evolution project to engineer an enzyme that conferred herbicidal tolerance in a few plant species. Macy held a summer internship at a local biotech company where she independently utilized novel genome-engineering strategies to help develop disease and agricultural models in large animals. Her contribution to these data involving site-specific transgene integration in pig cells was later used for an NIH grant submission in the Somatic Cell Gene Editing program. The following summer, she participated in a research program at Cold Spring Harbor Lab where she investigated how the immune system controls the proliferation and gene expression of mouse mammary epithelial cells. She received the “Best Undergraduate Poster” award at the University of Minnesota’s Developmental Biology symposium.

Macy received an Astronaut Scholarship. She was an active leader for campus engagement activities, worked as a teaching assistant, and is an ultimate frisbee player, playing competitively on the national-level college women’s team.
Tanay Wakhare

Artificial General Intelligence (AGI) is still only a theoretical possibility. Tanay would like to use his mathematical background to research topics involving theoretical computer science and deep learning, to pursue the possibility of AGI in his lifetime. At Cambridge, he is most excited about engaging with the AI group and Programming, Logic and Semantics group in order to delve into the mathematical formalism of artificial reasoning.

Tanay spent the summer of 2020 implementing and training recent innovative reinforcement learning algorithms, allowing agents to learn intelligent strategies to solve problems based on only feedback about their performance. In mathematics, he formed a lasting working relationship with Dr. Christophe Vignat from the University of Paris Sud. Together, they co-authored multiple papers about exotic zeta functions, continuous binomial coefficients, automatic sequences, elliptic functions, and the discrete normal distribution. Tanay secured a research position at the National Institutes of Standards and Technology, where he authored two papers with Dr. Howard Cohl on generating functions for basic hypergeometric series. He also collaborated with Dr. Karl Dilcher from Dalhousie University to study the Witten zeta function. He also wrote a solo paper solving an open conjecture on the Jacobitheta function, the building block of elliptic functions. His work has been published in a variety of leading journals.

Tanay is a Goldwater Scholar and the recipient of multiple honors from the University of Maryland, including the University Medal, the highest honor the university bestows on an undergraduate. He has developed and taught three courses at Maryland and has been a teaching assistant seven times. Tanay has hiked through 21 national parks, and has spent time backpacking across Europe and Asia. He minored in archaeology. On account of the uncertainties surrounding the pandemic, Tanay has decided to go straight to his PhD program at MIT.

Michael Xiao

In middle school, Michael began experimenting in his parents' basement using a UV lamp and watching YouTube videos on how to extract DNA. In high school, his work demonstrating mutagenesis induced by particulate matter and UV light resulted in a first-author published paper (Mutation Research), and he was the first-ever high school student to present his work at the Annual Meeting of the American Association for Cancer Research (AACR). At Cambridge, he will join Dr. Christian Frezza’s lab where he will build on his previous work investigating intracellular interactions in the context of tumor initiation by combining cell signaling, metabolism, and epigenetics.

As a college sophomore, he researched the role of auto-inhibition in a protein kinase called PASK, which is crucial for adult stem cell function. His first-author work detailing the PASK auto-inhibited state is in submission, and the data that he generated for the project was used to help secure a $1.8M R01 research grant from the National Institutes of Health. He has also worked on the role of a special tyrosine kinase [JAK2] in the blood disorder called hypereosinophilia, and his discovery of a novel patient derived variant of JAK2 resulted in a publication in the journal Blood as a contributing author. In addition, he explored the role of SIRT5, an enzyme involved in acute myeloid leukemia and its role as a tumor promoter. His results have been submitted to Cancer Cell with Michael as co-author. In addition, he has worked on potential applications for cancer diagnostics and immunotherapy involving thymidine kinase 1 which is expressed on some breast and prostate cancer cells; he has presented this work to the AACR while still in high school on three separate occasions.

Michael is a Goldwater Scholar and received the University of Utah’s flagship merit scholarship award. He graduated magna cum laude. He is a competitive pianist with a wide classical repertoire and won an opportunity to play at Carnegie Hall.
The Churchill Adviser Award: Two West Coast Labs Honored

In recent years, two labs have produced a combined eight Churchill Scholars. The professors running those labs—Pomona College’s Malkiat Johal and UC-San Diego’s Weg Ongkeko—share the second annual Churchill Adviser Award. The Award is given annually to Campus Representatives, Churchill nominating committee members, or recommendation writers who have consistently distinguished themselves through their sustained efforts to recognize, recommend, or nominate exceptional STEM students.

Johal is Chair of Chemistry at Pomona College. Over the past 10 years, Michael Gormally, Will Fletcher, Gabriella Heller, and Hannah Wayment-Steele were undergraduates in his lab before winning the Scholarship. He also taught the 2020–21 winner, EliseAnn Koskelo, in the highly challenging course, Chemistry 51. In all, he has been a mentor or professor for five of the six Pomona students who have won the Churchill Scholarship.

Ongkeko is Associate Professor of Head and Neck Surgery at UC-San Diego and also the Churchill Campus Representative. He has had the rare privilege of having three future Churchill Scholars working in his lab at the same time. Students from his lab have won the Churchill Scholarship in three of the preceding four years, and four times in all. Four of the five UC-San Diego Churchill Scholarship winners (Vikram Juneja, Angela Zou, Aswini Krishnan, and Harrison Li) worked in his lab.

Travis Sawyer (Physics, 2016–17) went straight from a PhD to a tenure track position at the University of Arizona, where he continues to collaborate with his Cambridge lab in medical imaging.
Members of the 2020–21 Churchill Scholars cohort visiting the Churchill War Rooms in December.