

SCIENCE AND SUBJECTIVITY

VOL. 5 2022-2023



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SCIENCE AND SUBJECTIVITY
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TABLE OF CONTENTS

MISSION

I

MEET THE RCSS

II

A LETTER FROM OUR DIRECTOR

Bob Pollack

III

READING EQUITY AND DIVERSITY IN SCIENCE PROJECT (READS PROJECT)

Liana Dawson

1

BRINGING BACK THE "AT YOUR SERVICE" VOLUNTEERING PROGRAM

Dennis Zhang

4

INTERGENERATIONAL NARRATIVE MEDICINE WORKSHOPS

Phalaen Chang and Lina Huang

8

GLASS HALF FULL OR EMPTY: ILLUMINATING THE HUMAN TRANSCRIPTOME

Theo Nelson

10



PROMOTING ORAL HEALTH IN UNDERSERVED PEDIATRIC POPULATIONS
Priscilla Castro
14

INDEPENDENT PRACTICE - BREAKING THE HIERARCHY
Tess E.K. Cersonsky, M.D.
18

REFLECTIONS ON THE TRICENTENNIAL PROJECT AND RHETORIC OF SCIENCE
Ellie Hansen
19

POST-GRADUATE REFLECTIONS
Kimia Heydari
20

ANOTHER SENIOR
Amy Pollack
22

Mission

The mission of the Research Cluster for Science and Subjectivity (RCSS) is to provide undergraduates with the experience of taking responsibility for their own work as future scientists and physicians who will practice with a more complete understanding of their fields and of whom they care for.

We do this by providing stipends for students who will propose and carry out their own projects involving aspects of science, subjectivity and service. We envision future generations of scientists, physicians and other science-grounded professionals building their careers in realization of a more complete human experience.

Together, RCSS undergraduate interns currently explore:

Spirituality and the arts in end of life care

The role of race in how people experience healthcare

Ethics and implications of genetics in healthcare

The first and only program of its kind at Columbia University, RCSS is led entirely by undergraduate students under the direction of Cluster Leader Dr. Robert Pollack. The experience of leading a project or developing a class has allowed students to investigate academic issues while developing real-world skills and providing the chance to impact their communities.

To learn more about who we are, visit

<https://rcss.scienceandsociety.columbia.edu/content/about-us>

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A LETTER FROM OUR DIRECTOR

Dear friends and colleagues,

Let me begin with the first of two important pieces of news. First, Spring 2023 was my last semester as Professor of Biological Sciences; after 45 years in the position, I have retired to Emeritus Professor effective July 1 2023. Second, thanks to the generous responses received from members of the RCSS Advisory Board, this has been a big change for me, but not at all a big change for the RCSS.

Four members of the RCSS advisory Board - Professor of Music Magdalena Baczewska, Professor of Biology Lili Yamasaki, Villanova University Professor of Philosophy of Science Lisa Dolling, and CSS Administrator Melinda Miller – worked with me as co-directors of the RCSS through the end of June, sharing responsibility for this transition.

On July 1 Professor Yamasaki will become my successor as Director of the RCSS, as I become a member of the RCSS Advisory Board. The Admin-Intern-scholars for this academic year and next have been working with us both to assure that the RCSS principle of helping our Intern-scholars while never grading them or giving them orders, will be stably in place for Academic Year 2023-24.

Thereafter we expect that RCSS will be fully ensconced in its original home, the Center for the Study of Science and Society. The CSS Director, Professor Pamela Smith, has been working with me to assure that the many

administrative changes necessary will all take place smoothly, so that there will be no disruption in the project plans our current Intern-Scholars have for Academic years 2023–24 and thereafter.

I am proud of the many accomplishments of the RCSS since its inception; perhaps none is more impressive - though also less visible - than the fact that this transition in leadership is taking place without any break in our agreement that the RCSS's work must always be the work created by its intern-scholars.

Thank you all, and please, stay in touch with Amy and me.

Bob Pollack
Emeritus Professor of Biology and Founding
Director of RCSS

Bob Pollack





SCHOLAR REFLECTIONS

READING EQUITY AND DIVERSITY IN SCIENCE PROJECT (READS PROJECT)

BY LIANA DAWSON

OVERVIEW

The Reading Equity and Diversity in Science Project (READS Project) seeks to create diverse, developmentally appropriate children's books that inspire a love of reading in children, encourage book ownership, and empower children to write their own stories. The READS Project is composed of members from Chribble, a club at Columbia University dedicated to creating books for children in need.

BACKGROUND

Early literacy is critical to children's development, and can put students at risk of failing to graduate high school. In low-income neighborhoods, 1 developmentally appropriate book is available for every 300 children. The recent COVID-19 pandemic magnified existing inequities, and early literacy is no exception. Less than half of third-grade students are reading proficient according to the New York City Department of education, and 45% of New York State schools lack libraries. There is less than one librarian for every 3,400 students in New York. In the Bronx, 70% of students read below grade level.

START LIGHTHOUSE

One Bronx-based intervention to the problem, Start Lighthouse, partners with public schools in hosting "Literary Adventures" to help build home libraries and instill a sense of book ownership. Moreover, Start Lighthouse empowers family members and caregivers by hosting community workshops.

PROJECT GOALS

By contributing to Start Lighthouse and addressing the book desert in the Bronx, we hope to decrease disparities in early reading and learning and contribute to the pipeline of future scientists. Reading and literacy is an essential first

step in a child's journey to pursuing science. To support and foster more diversity in science, early support is needed to help students to join the scientific community—support that increases their likelihood of graduating high school and going to college. Furthermore, by creating age-appropriate books, we hope to spark young children's interest in reading which can eventually lead to a scientific career through books based on topics ranging from science to humanity.

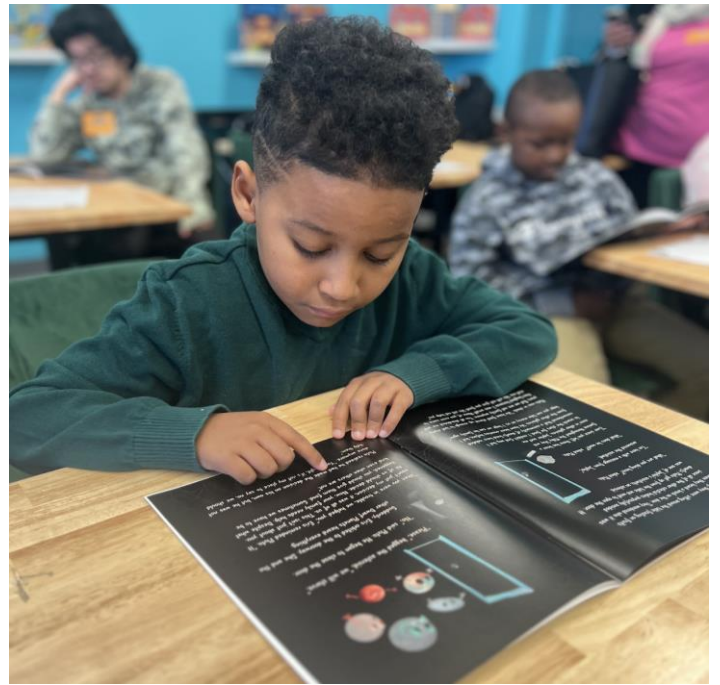
OUR FIRST BOOK

With teams of student illustrators and writers from Chribble, we created an original children's book to donate to Start Lighthouse titled *Pluto and the Milky Way Council*. In the book for children grades 2-5, Pluto is no longer considered a full planet due to new requirements. Instead he is categorized as a Dwarf planet. In this coming-of-age story, Pluto finds friendship and the ability to forgive as he moves beyond the Milky Way Council.

We visited Start Lighthouse in the Bronx and distributed the books to a third grade classroom at Port Morris School of Community Leadership PS/MS 5X. We read the story aloud in front of the classroom with three children and a teacher reading aloud the parts of some of the characters in the story. After reading, children asked questions ranging from "how long did it take you to write?" To "who made all the details in the pictures?" We finished up the day with a writing and drawing activity that we created to help the children reflect on forgiveness and imagine what kind of planet they would be. The children were very engaged and excited to meet us and have us sign their books. The characters even resonated with the third graders, with some of the children saying things like: "I'm Pluto" or "I would be Jupiter because I'm big."



Kathryn and I (both volunteers from Chribble) standing with students as we hold the books.



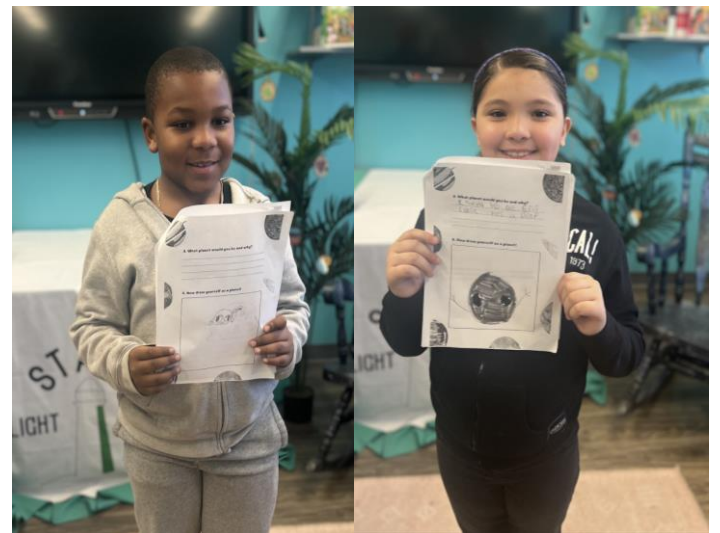
A student reading along with us.



Us reading the book aloud with the students and one of their teachers.



Me (Liana Dawson) signing one of the student's books.



Students sharing their writing/drawing activity of what type of planet they would be with the class.

FUTURE STEPS

Moving forward, we are excited to continue our relationship with Start Lighthouse. We are hoping to follow up with the same group of students, and read with them again. This time we will donate our second book, which is about a fox that feels sad and the friends that visit him. It is our intention that the books will provide ideas for how children might process difficult emotions like sadness, increase their love of reading, and empower them to take control of their mental health.

REFLECTION

Learning more about Start Lighthouse's mission and seeing the walls full of the stories of BIPOC authors and illustrators made me realize how important it is for children to see people that look like them writing stories they can relate to. My favorite part about the whole process was being able to interact with the students and see their eyes light up. They asked for our autographs and repeated over and over to us how much they liked the book. I felt honored to have created something specifically for a group of children that they really enjoyed and appreciated. I hope to continue helping children and inspiring them to write their own stories through art, and literature and science.



Liana Dawson (CC'23) studied Medical Humanities before matriculating into NYU Long Island School of Medicine ('26) this summer. She loves practicing Spanish by watching telenovelas and movies like *Violetta* and being around children and their parents. She also loves baking cookies—her favorite type are S'mores cookies!

BRINGING BACK THE "AT YOUR SERVICE" VOLUNTEERING PROGRAM

REINVIGORATING A DECADE-OLD PARTNERSHIP BETWEEN COLUMBIA AND A NEW YORK CITY HOSPICE/PALLIATIVE CARE CENTER

BY DENNIS ZHANG

MY MOTIVATIONS: AN EYE-OPENING SUMMER AT TERENCE CARDINAL COOKE (TCC)

Ex-military. Ex-intelligence spy. Ex-rocket scientist. June (name changed to protect anonymity), adorned in her signature pair of hickory-tinted aviators, now assumed the position of "The Thinker." She rested her head on one arm, knuckles curled flat against her chin, as she gazed intently upon the massive white board before her. The board housed a giant crossword puzzle, already half filled in. Wheelchair-bound, she subtly rocked back and forth.

Next to June, lined up in a semi-circle around the board, were tens of other residents of the hospice center in wheelchairs of varying shapes and sizes. Some stared with equal vigor; others simply dozed off in the soothing sunlight of the outdoor patio space where the game took place. Ex-pediatricians, ex-body building fanatics, ex-Broadway child guardians. What united these remarkable men and women was repeating sequences of three letters, "CAG," in their genetic code that communicated a rare neurological condition: Huntington's disease.

"Six letter word for the capital of Colorado?" I prompted. June, a Colorado native, immediately shot back, "Denver." I grinned and gave her a fist bump.

This was a typical day in my life as a volunteer in the Recreation department of the Terence Cardinal Cooke Health Care Center, or TCC for short. During the summer of 2022, I spent half of my time working in a Columbia research lab working on gene editing technologies that could

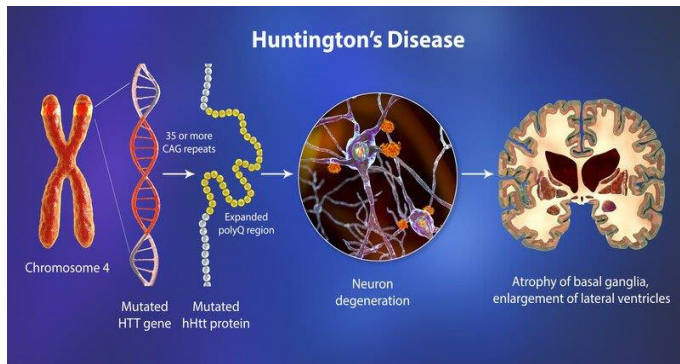
potentially cure genetic diseases, like Huntington's, and the rest of my time at the TCC. In brief, the TCC provides both short- and long-term forms of health care, ranging from sub-acute rehabilitation programs to hospice/palliative care. Of special note, the center houses specialized care programs, and the one that I spent my summer with was the Huntington's disease unit, which happens to be one of the largest (and few) of its kind in America.



The Terence Cardinal Cooke Health Care Center is located just steps from Central Park on 1249 Fifth Avenue, New York, NY. (Source: [TCC website](#))

Huntington's disease is a rare, inherited neurological disorder that causes brains to degenerate over time, causing patients to experience declines in cognitive function, mood swings and/or depression, and even loss of motor control (ability to move, eat, talk, etc.). It's a devastating disease, and my supervisor Eileen, an absolutely incredible recreational therapist

who has worked with the unit for decades, has witnessed multiple generations of some families enter the center's care.



Huntington's disease is currently cureless, with symptoms mostly developing between the ages of 30-50 and each child of an affected parent generally having a 50% chance of inheriting the disease-causing gene. (Source: [First Choice Neurology](#))

In spite of this grim reality, I've found Huntington's residents at the TCC, like June, to be wonderfully kind and even eager to share their stories. Over the course of summer 2022, I befriended many Huntington's residents over facilitating recreational activities that ranged from music therapy (where I was the designated DJ who had to figure out everyone's music tastes) to word games (featuring the crowd-favorite crossword puzzles). I loved the experience, and Eileen and the TCC Recreation department emphasized how they'd really appreciated a set of extra hands.

For context, I started my experience right when the TCC re-opened its doors to volunteers as COVID-19 restrictions loosened. The pandemic hit the center (like many others of its kind) hard, not only in terms of lost lives but also in terms of lost staff that made caring for residents all the more arduous. Eileen once had a whole team of speech therapists, masseurs, and even other volunteers helping her out in the past. Because of COVID-19, she was effectively on her own with a growing number of residents.



Recreational therapist Eileen Fogarty with a resident in the Huntington's unit. (Source: [TCC website](#))

Learning how short-staffed the center was, coupled with my own enriching experience, motivated me to pursue my RCSS project: to bring back the "At Your Service" volunteering program. "At Your Service," or AYS for short, was a program started in 2011 by a fellow RCSS intern, Ashley Shaw CC'13, that brought Columbia students to the TCC as volunteers and ensured that these students were helping out where they were most needed. Later, the program further evolved to offer "reflection sessions," which were dedicated programming for volunteers to reflect on their experiences and collectively learn more (e.g. about end-of-life/palliative care, nursing homes, advanced directives, dealing with grief, bioethical issues, etc.). However, like many other volunteering programs during the pandemic, AYS was left memberless and inoperational for 2 years. When I pitched my idea to revive the program to RCSS director, Dr. Robert Pollack, and my fabulous RCSS advisors, Dr. Anthony Lechich and Dr. Christina Staudt, they all eagerly hopped on board. I was ready to hit the ground running.

FROM IDEA TO ACTION: HOW I BROUGHT BACK "AT YOUR SERVICE"

My vision for the [restored AYS](#) and how I carried out this vision can be split into four main branches that I will detail below: (1) recruiting volunteers, (2) handling club logistics, (3) facilitating reflection sessions, and (4) designing a

meaningful service project.

Recruiting volunteers went smoother than expected. After onboarding an executive board, we opened up our figurative 'club doors' to the Columbia student body and, without much of a concerted effort, achieved a pool of ~20 interested volunteers across varying grade levels and backgrounds. Of these interested candidates, as of writing, roughly half were able to start volunteering after successfully finishing the multi-month onboarding process at the TCC, which involves procuring the required medical forms and tests, receiving medical clearance, and completing online e-trainings and an in-person orientation. We also partnered with the "Life At the End of Life" course, specifically with instructor Dr. Craig Blinderman and TA Jocelyn Chen SEAS'23, to get another ~20 students fully onboarded and volunteering at the TCC — yet another tradition that had been derailed for two years by the pandemic.

On the logistical side of things, we were able to navigate the hurdles of both being a Columbia student group and a partner of the TCC without much issue. On the Columbia side, thanks to an experienced executive board filled with members that had leadership experiences in other student organizations, we were able to successfully apply for over \$1000 in funding for reflection session food expenses (more on this below), write up a new organizational constitution, and gain access to the Columbia space reservation portal. On the TCC side, my summer spent at the center came in use as I had already familiarized myself with the onboarding process, as well as health and safety regulations, and had built a good rapport with the volunteering coordinator and others in the Recreation department that our volunteers would be based out of.

"Reflection sessions," as described earlier, are dedicated times for volunteers to congregate, reflect on their experiences, and/or learn more about a topic related to their experience at the TCC. While my summer at the center was enriching, it was also somewhat isolating in that I

had no one to turn to who could relate to the things I was seeing, hearing, and feeling as I went about my day. That feeling of isolation personally underscored why reflection sessions existed in the past and why I had to bring them back in the renewed AYS program. As volunteers, we navigate the TCC thinking about how we can better serve center residents and staff - but that doesn't leave much room for processing our own emotions when we see unsettling things and/or reflecting on how the experience is shaping our own understanding of health care. Thus, being able to offer these reflection spaces to new volunteers and/or share knowledge I'd acquired from my own experience (e.g. 'all about Huntington's disease,' 'how to navigate the TCC,' etc.) was immensely gratifying to me and hopefully helpful to others. As a not-to-be-understated plus, we were very diligent in putting our Columbia budget to good use - ensuring that everyone happily left meetings with their stomachs full!

Outside of restoring the infrastructure and operations of AYS, my final major goal was to design a meaningful service project that would leave a lasting impact on the TCC beyond our own time as Columbia students. As mentioned earlier, speech therapists used to frequent the Huntington's unit prior to the pandemic. There, these therapists would often make personalized binders that housed residents' life stories, important people and memories, and miscellaneous other items that helped residents prolong their ability to communicate in the face of a disease that threatened to strip away that capability. As a volunteer, I vividly remember how reading these books, particularly for residents that were in the late-stages of their disease and completely non-communicative, inspired ways of trying to relate and/or reach them. Did he have a son working in construction out in North Carolina? Was she a lover of cats? I can only imagine how these personal treasures, captured in a tangible visual medium, were invaluable not only to past volunteers, but also to residents themselves and loved ones visiting them. It's true that my fellow volunteers and I don't have formal

training in speech therapy, but the practice of documenting the life stories of residents is something that just requires a willing ear and a dedicated spirit. As such, after getting permission from TCC staff, I'm proud to say that we've already kickstarted the process of making these 'life story books' (kept confidential and safe in resident rooms at the TCC) and are hopefully laying the foundation for a future track record of AYS volunteers making lasting impacts at the TCC. (Spoiler alert: Stay tuned for potential musician-TCC partnerships in the near future!)

THE FUTURE: WHAT LIES AHEAD?

As we enter a 'post-pandemic' world, my paramount priority is to ensure the longevity of AYS. Towards this end, I'm excited to continue expanding our campus presence as we make a more concerted effort to recruit volunteers and build up our budget to accommodate this influx.

As I reflect on my journey from the first day I stepped foot in the TCC, I'm struck by how much my own experience at the center has shaped my understanding of health care. The need for more hands on deck helping nurses and recreational therapists out in centers like the TCC has become clearer. The urgent need for next-generation therapeutics to treat devastating genetic conditions like Huntington's has become more salient. And the necessity of compassionate care throughout and, in particular, at the end of life - when medicine can no longer 'cure' - simply cannot be overstated.

Ultimately, I think this experience has not only opened my eyes, but also provided me with a platform to make a tangible difference by bringing back AYS. As new generations of AYS leaders take the reins and build out the program's future, I encourage them to not only seek to preserve the foundation that we've laid, but also invite our growing community of volunteers to thoughtfully navigate their experiences at the TCC and readily harness their own talents to devise new forms of service.



'At Your Service' volunteers from the 2022-23 academic year (some not pictured).



Dennis Zhang CC'24 is a biology major who is passionate about exploring genetics and precision medicine from interdisciplinary lenses. As an RCSS intern, he has revived the AYS volunteering program and co-designed/taught two year-long classes at the Double Discovery Center. Outside of the RCSS, he is an avid podcast listener, plays the guitar, and can either be found deep in Dodge gym or running along the Hudson.

INTERGENERATIONAL NARRATIVE MEDICINE WORKSHOPS

BY PHALAEEN CHANG &
LINA HUANG

This spring, we hosted the third semester of Intergenerational Narrative Medicine Workshops, which was attended by a total of 12 participants. The project started as an effort to foster connections between generations, as intergenerational networks have become increasingly rare with age segregation, ageism, and urbanism. In this iteration of the project, we continued under the same mission, but this time through a pop-up workshop meant to address the same themes in a shorter span of time.

Our facilitators Juliana Nociari and Ruth Conboy, current student and alum of the Columbia University Program in Narrative Medicine, started the session with the poem "I Have a Time Machine," by Brenda Shaughnessy. Describing a time machine that only moves forward in the future one second at a time, the poem prompted thoughts about the strangeness of time. Some older participants described feeling more drawn to the past as they aged, connecting with how the poem described the past as a "rearview mirror." They also discussed how the poem deals with the past and future, but not the present, perhaps reflecting an outlook that is too caught up in thinking back or ahead. One participant commented that the poem was "meaningful" and "so rich." Another said they had "never thought as intensely about time before."

Afterwards, the participants responded to a writing prompt about the next moment. They shared a variety of responses - some talked about mundane, everyday tasks, while others focused on the immediate next moment. When filling out a post-workshop survey, one participant still remembered two beautiful lines that someone had written.

In a post-survey we conducted after the

workshop, it seemed that most of the older participants had a lot of experience with narrative medicine and most of the participants had either a lot or some experience interacting with people of the other generation. After the experience, most participants also expressed hopes for more chances to interact with other generations through narrative medicine.

LINA'S REFLECTIONS

In the weeks leading up to the session, we met with the facilitators, recruited participants, and thought about how to make the workshop a space for meaningful conversations. When we held the workshop at last, I was surprised and gratified at how quickly the participants connected with the poem and each other. It seemed that, even with our different experiences and thoughts on aging, we shared a common curiosity and enthusiasm to explore the topic together.

When one of the participants pointed out that line about the past being like a "rearview mirror," I remembered a time my mom and I visited a museum in Prague. One section was filled with exhibits of domestic items from the late 1900s. My mom had told me that some of the items were like the ones from her childhood - radios, indoor steam pipes, and even the setup of the room evoked her childhood home. It made me think about how the past can hold so much meaning, a difficult thing for me to remember in college, where I focus so much on the future. And, like the scenery behind a moving car, the past is always accumulating. That line, and the participant reflections on it, were a thought-provoking reminder to step away from too much fixation on the future and to take time to keep the past in mind.

PHALAEEN'S REFLECTIONS

Last year, it was possible to have a series of workshops that allowed for relationships to develop and for me to see how people opened up over time. This year, however, it was interesting to see how people would engage with each other in a one-time pop-up workshop. It took some flexibility and last-minute planning, but with the support of Ms. Stephanie Adler-Yuan and our lovely facilitators Ruth and Juliana, we were able to put together an experience we felt were reflective of the mission we had set out for ourselves.

Stories have always been a driving motivator for me in the work I do, and I am thankful, always, to be entrusted with the heart that the participants brought to the workshops. In the hour we spent in the workshop, I was given the chance to reflect on my lived time. Whereas for me, something that happened a week ago often feels like a different lifetime ago in distance, one older participant said that they could remember moments from their past as if it were yesterday. While I envisioned aging, especially out of school systems and particularly so in retirement, as something that means gaining freedom from deadlines, one older participant remarked that

they still often felt like they were forever chasing and being chased by deadlines or the increasingly real reality of their mortality. Conversations from the workshops over my last two years here gave me the space to reflect how I was viewing myself relative to the time I've had and the time to come. I left with a newfound appreciation for what it means to engage with the pasts people bring with them in their stories, and also how to understand myself relative to the time I've had and will have. Graduating and "moving into the real world" gave me a lot of grief about time, purpose, identity, and meaning, but the older members' reflections throughout the workshops last year and this year gave me a lot of perspective and comfort; I can only hope to be as wise and grounded when I am older.

In looking towards the future of this project, many possibilities were brought up—potential more extensive partnerships with EPIC, expanding to include more people from the local community, introducing these workshops to local nursing homes, etc. Though I am graduating this year, I'm excited to see where this project might go in the future and endlessly thankful for the support we've received for this project despite the hurdles!



Phalaen Chang (CC '23) is a senior majoring in Neuroscience and Public Health. Her favorite color is purple-ish blue. People have told her that she is curious, compassionate, and resilient. Her hobbies include binge reading Webtoons and watching film analyses and opdocs on YouTube.



Lina Huang (CC '26) is a freshman intending to major in Biology and Medical Humanities. She grew up in Los Angeles, and enjoys reading, exploring new places, and playing the guzheng. Her favorite color is light blue.

GLASS HALF FULL OR EMPTY: ILLUMINATING THE HUMAN TRANSCRIPTOME

BY THEO NELSON

THE SIGNIFICANCE OF OUTREACH

Compared to peer governmental institutions, the National Aeronautics and Space Administration (NASA) has one of the strongest outreach programs. The cosmos, and our relationship to it, seems an effective motivator of innate curiosity. For me, this manifested as a research question exploring the impacts of microgravity on biological systems. Throughout the first two years of my Columbia Journey, I participated in the NASA Student Payload Opportunity with Citizen Science competition, a one-time opportunity to design and fly a biological payload to the International Space Station. Our team, led by Swati Ravi and Kal Ganeshan, proposed, built and flew a payload studying antibiotic resistance of mixed-species biofilms.

From NASA's perspective, outreach to local communities is just as significant as technical biology. As the outreach lead for our team, I produced, distributed and co-taught a citizen science introductory series, in partnership with a NYC foundation, Sophie Gersen Healthy Youth and the Columbia Engineering Outreach Office, preparing students to judge antibiotic effectiveness based on Kirby-Bauer Disk Diffusion image data, instilling a healthy respect for space science along the way. One of NASA's greatest strengths is significant public buy-in for their projects, bolstered by these kinds of strong citizen science efforts.

This experience continues to inspire me when performing community outreach.

THE ORIGIN OF THE COURSE

Last June, Dennis Zhang (CC'24) and I were sitting on the high shelf in front of Low Library, enjoying a shared meal. He was relating his experiences as an RCSS intern-scholar the previous year, writing and



MS126 students design their own fish tanks to account for microgravity, supported by Columbia SPOCS Outreach Lead Theo Nelson.

teaching a virtual course on Genetics and Ethics at the Roger Lehecka Double Discovery Center. What arose from this conversation was a vague idea of an in-person biology lab course for the same students, providing exposure to research in the life sciences. Emerging from a COVID-world, lacking with regard to these opportunities, we felt that our efforts were all the more significant.

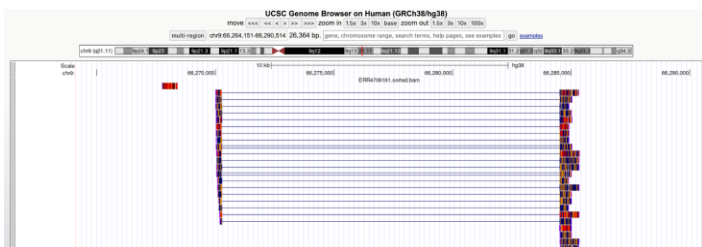
A PERSONAL RESEARCH STORY

The course follows the outline of a traditional research experience: theory development, hypothesis generation, experimentation, result interpretation and poster presentation. Yet, we faced that challenge of providing a genuine research experience within the compressed format of a one-day per week semesterly class.

Inspired by NASA's approach, Dennis and I conceived of a project where a large number of hypotheses can be analyzed utilizing a standardized "one-method-fits-all" approach, in the same manner in which similar analysis is performed on the nearly endless amount of stars

and galaxy clusters in our universe.

These hypotheses are drawn from my personal research output; namely, the production of a free, publicly accessible long-read RNA sequencing analysis pipeline, known as L-RAPiT. As a part of preparing this course, I selected five random samples sourced from human HEK293T cells, ran the pipeline and found many uncharacterized but expressed RNA transcripts within this popular cancer cell line.



Aligned long-read RNA-sequencing data from sample [ERR4706161](#), providing evidence for a novel transcript variant on chromosome 9 of the human genome.

Illuminating the hidden part of the human transcriptome and finding cell-type specific transcript variants continues to be a major application of long-read RNA sequencing technologies. Gold-standard validation of these transcripts involves conventional polymerase chain reaction amplification from source cDNA. When I first published L-RAPiT [[10.3390/ijms232415851](#)], my main use case involved this exact pipeline. The course introduces students to these predictions and verifies them with the same established methods.

Reproducibility is a core tenet of science; the student's experience therefore is an exercise in this very principle, in that they are reproducing the pipeline discovery model. Additionally, the students are reproducing the work of their fellow classmates, since each transcript variant is assigned to multiple students.

Although the design exemplifies reproducibility, each transcript is a novel undiscovered RNA strand when compared to established human transcript reference databases. As a result, the

students have the opportunity to be the first to explore these transcripts. Although follow-up and functional characterization would require an additional PhD worth of work, the students can contribute to the first step along this path.

THE COURSE OUTLINE

In terms of implementation, the course is organized into eight one-and-a-half-hour sessions:

- 1) Lecture: Introduction to DNA; Introduction to the Central Dogma
- 2) Dry Lab: Selecting DNA to Amplify; Primer Design
- 3) Lecture: Environmental Health and Safety; Lab Safety
- 4) Wet Lab: Preparing Polymerase Chain Reactions to Amplify DNA
- 5) Wet Lab: Visualizing DNA Bands with Gel Electrophoresis
- 6) Wet Lab: Extracting DNA from Solid Gel Blocks
- 7) Dry Lab: Analyzing DNA Sequencing Results
- 8) Presentation: Students present their results!

Each lab has an associated pre-lab and protocol.

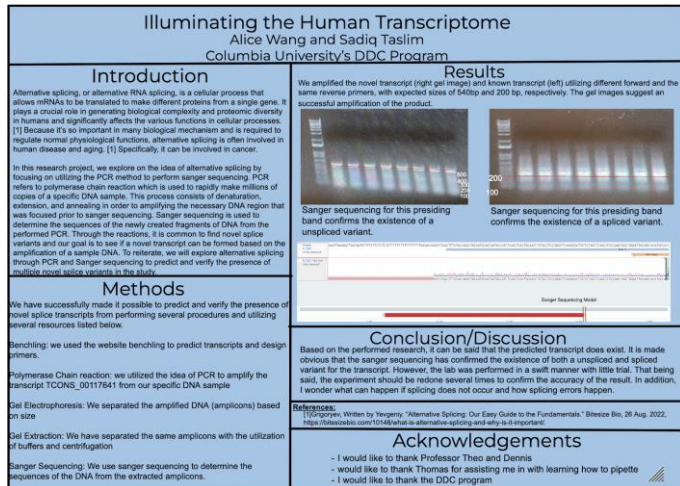


Students perform gel extraction based on the QiaQuick Gel Extraction protocol.

REFLECTIONS ON STUDENT EXPERIENCES

In the two semesters we have taught the course, Dennis and I have found a high correlation between student attendance and performance.

Combined with consistent submission of our pre-laboratory assignments, students are successfully prepared for more independent laboratory research experiences. As an example, we provide the following poster produced by students in the Spring, 2023 semester.

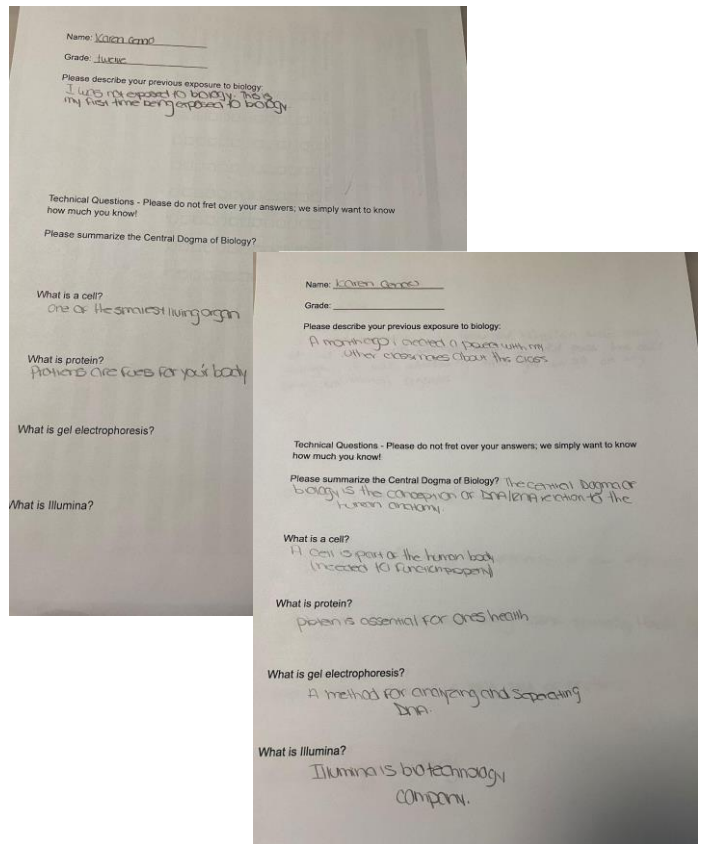


Student-produced poster, presenting gel electrophoresis and sanger sequencing results for the novel transcript variant on chromosome 9 of the human genome, shown in a previous figure.

Many students struggled with the course material, mainly due to a lack of previous exposure to biological sciences. We had a unique opportunity to monitor one such student's - Karen's - progress through two iterations of our course. During the fall semester, she attended seven of eight sessions. Based on her pre-class surveys, we conclude that she successfully learned and retained the material from the first iteration of course. Her spring, 2023 pre-class survey demonstrated an equivalence between her understanding of biology and our course content. As a result, the questions emphasizing course material were answered in a more technical manner than those unrelated to course content.

To further contextualize her experience taking the course twice, we asked Karen to contribute a reflection to this journal, provided below, lightly edited:

Hello!! My name is Karen Angelina Genao, I am interested in prioritizing academics and



Karen's pre-class surveys, Fall, 2022 & Spring, 2023.

becoming the best version of myself. My current hobbies are volleyball, reading, journaling and evolving my mindset. I chose to take this class course the first time around because I've always been interested in biology. The high school I go to does not give me the advantage to take biology related courses however, DDC did!! This subject has always intrigued me and I am glad to have been given the opportunity to be involved.

I chose to take it the second time because I genuinely enjoyed the first class. Between both classes, I have learned many new things. The first time I took this class; it felt like an introduction to biology, as well as some hands-on experience. For example, understanding what DNA, RNA, blue bands [unspliced transcript variant], red bands [spliced transcript variant], are and how it all corresponds to the subject.

The second time was more hands on, exploring the different machines used to create a gel, as well as creating your own. The course has changed between the two semesters by

expanding the learning experience. Also, learning it from the perspective of other Columbia students/teachers. This class fits into the student's experience within the Double discovery center by giving the students an opportunity to learn beyond their classrooms. DDC grants education in a knowledgeable, hands on, exciting way.

This class has impacted my future planning. As a senior in high school I am still unsure about what I would like to major in. Though, after learning more about biology, I'd definitely be interested in joining clubs that correspond with the subject in college, I've even considered majoring in biology!!

In summary, we provide these representative examples to demonstrate that the course provides valuable experience. The course successfully promotes student development, both as researchers and scientists.

ACKNOWLEDGMENTS

The [Double Discovery Center](#), especially Rabiyya Smith and Sasha Wells, for providing funding, pedagogical support and students for this program. The [Columbia Department of Biomedical Engineering](#), especially Lauren Heckelman and Joe Viola, for providing lab space and supervision. The [Research Cluster on the Subject and Subjectivity](#), especially Lili Yamasaki and Robert Pollack, for providing advice.

The project was founded by Theo Nelson (CC '24) (DDC Instructor ; Fall 2022-Spring, 2023). Dennis Zhang (CC '24) is credited as a co-founder (DDC Instructor ; Fall 2022-Spring, 2023). We are fortunate to be joined by six undergraduate volunteers for the Spring, 2023 semester: Sophia Sorid, Julia Rocha, Albert Grass, Neil Bajaj, Madisyn Pilla, Nicholas Djedjos; and one graduate student volunteer: Timothy Chang.



Theo Nelson (CC '24) is a junior, majoring in computer science and pursuing a premedical track. With a closet full of orange clothes, he pursues his academic and extracurricular activities with discipline, humility and kindness. Outside of these spheres, he is an avid skier and more amateur tennis player.

PROMOTING ORAL HEALTH IN UNDERSERVED PEDIATRIC POPULATIONS

BY PRISCILLA CASTRO

Have you considered the impact of oral health on your overall well-being? For many of us, oral hygiene is just a small part of our daily routines. This consists of brushing and flossing twice a day to prevent the development of tooth decay and gum disease. For children, however, establishing this routine can be challenging and may require guidance to develop healthy habits. Underserved pediatric populations face significant barriers in accessing preventive dental practices, which can lead to even bigger consequences in the future.

I have been working at my local dental office located in the San Francisco Bay Area since high school. The dental office treats a diverse demographic consisting of a large population of minorities that rise in low-income neighborhoods. I assist in a variety of routine and surgical dental procedures ranging from cleanings, to root canals and extractions. My experiences at the office have allowed me to witness the negative consequences that arise from inadequate preventative dental care in pediatric populations. Unfortunately, children from low-income families are twice as likely to experience these detrimental effects. Due to the lack of dental insurance or parents' inability to take time off from work, many underserved children are unable to schedule routine 6-month cleanings to prevent plaque and tartar build-up. As a result, minor and preventable dental issues escalate into bigger and more costly dental treatments. On a local level, the biggest impact can be made by targeting the vulnerable individuals within your community.

Therefore, the dental office allocates time to visit local elementary schools to teach an interactive lesson on dental hygiene and healthy eating habits to prevent dental disease. We simulate a human-sized demonstration of brushing and flossing marked by pink and white t-shirts with

the occasional "sugar bug" (cavity). This leaves a humorous yet memorable impression of circular brushing and bidirectional flossing. In the end, we gift each student with a dental kit and a step-by-step pamphlet to maintain these habits at home. We aim to influence the children's day-to-day dental routines and encourage them to tackle oral prevention when family circumstances don't permit them to see a dentist.

My experiences at my local dental office have inspired me to continue my efforts to promote oral health in underserved pediatric populations. I specifically target the challenges that disproportionately impact overlooked populations in Upper Manhattan who struggle to access adequate dental care. I have decided to participate in the ongoing initiatives at the Columbia University College of Dental Medicine (CDM). Dr. Letty Moss-Salentijn, the Vice Dean for Curricular Innovation and Interprofessional Education, has kindly connected me with like-minded dental students who share my dedication to this cause. I have interacted with the coordinators of the Mobile Dental Center who relocate their van to accommodate nearby patients at their convenience to receive care. Additionally, I am in contact with Jonathan Katz, a 3rd-year dental student, and the Pediatrics Club to organize local events that cater to pediatric patients in need of dental care. With the support of CDM, I am excited to continue participating in community outreach efforts such as Give Kids a Smile Day.

I have also taken part in the Columbia ASDA Advocacy Fellowship hosted by the American Student Dental Association. As a fellow, I've had the opportunity to work with CDM's advocacy and legislative committee to raise awareness on public health and dental advocacy topics ranging from student debt, the opioid crisis, and the

impact of COVID-19 on dental care. I have the responsibility to create infographics and participate in brainstorming events that aim to improve current legislation around dental care, working alongside dental students. I hope to utilize this role to advocate beyond the local level by promoting changes in dental policy and working towards a future of accessible dental care for everyone, regardless of socioeconomic status.

As an extension of my project, I brought this initiative overseas. During my break, I traveled to three cities in Cuba: Havana, Viñales, and Varadero. I visited local dental clinics and spoke with dentists to gain a better understanding of their challenges. Many local clinics have a shortage of dental supplies from the lack of imported resources and technology. I was truly shocked by their ability to operate under such scarce conditions. As a result, preventative dental treatments have become a luxury as clinics allocate most of their efforts to emergency cases. Therefore, I brought a suitcase full of toothbrushes, floss, and informational pamphlets. I handed them out to local individuals, including children and families, who expressed immense gratitude for the resources. I was struck by the dedication of the local dental providers who continue to work tirelessly to provide the best care to their patients despite these obstacles. My experience abroad has solidified my commitment to advocate for increased access to dental care and resources both, locally and globally.

I am incredibly thankful for the opportunity to be a part of the RCSS community during my time at Columbia. The unconditional support of the intern scholars and advisory board members has not only encouraged me to develop my project but has also given me the confidence to aim higher than I ever thought possible. I especially want to thank Dr. Bob Pollack, who first introduced me to RCSS before I even transferred to Columbia in 2021. I know that the RCSS community will truly miss his guidance, but I am confident that his legacy will continue to inspire

future scholars beyond his retirement.



Toothbrushes and toothpastes that were distributed to locals.



An informational pamphlet in Spanish with suggestions for maintaining healthy teeth.



Priscilla Castro (CC '23) is a senior studying biology. She is originally from the San Francisco Bay Area. During her free time, she loves to explore the city and play volleyball on a sunny day. She hopes to continue her initiative beyond graduation!



ALUMNI AND ADVISORY BOARD
REFLECTIONS

INDEPENDENT PRACTICE - BREAKING THE HIERARCHY

BY TESS E.K. CERSONSKY, M.D.

Medicine is all about hierarchies, including attendings, fellows, residents, medical students, undergraduates, and everything in between. Even among those at the top, there exist full professors, associate professors, and assistant professors. We rely on these hierarchies to help train and support upcoming physicians. Without the hierarchy, we would not be able to pass on knowledge from one generation of doctors to the next.

However, a strict hierarchy prevents new ways of thinking from being disseminated to those in more senior positions. The opposite forms the foundation of the RCSS, and it is indeed rare. In my medical education, I have come across a plethora of mentors and teachers. Most are excellent - providing me with the confidence and experience to grow into the doctor I hope to be. A rare few go beyond this and recognize not just the skills that they think I need to grow, but also the skills I have that they can encourage and support.

Take this as an example: I'm a young machine learning researcher, learning to develop ideas and questions of my own. I have an idea for an abstract and need a mentor, someone who can help me navigate the bureaucracy and give me feedback. I approach a mentor with whom I

haven't worked before, and he provides me support for my own project. Over the course of working together, he teaches me about my field of interest, maternal-fetal medicine, and I teach him about machine learning techniques.

Sound familiar? I recently had the opportunity to reflect on what RCSS has done for my career and aspirations, and I don't think that I would be able to conduct these independent projects on my own without doing this work with Dr. Pollack and RCSS. By inspiring me to take on my own project, rather than instructing me to complete one of his (as is often the norm for young, aspiring researchers), Bob taught me to navigate roadblocks on my own, create my own protocols, and, most importantly, to be proud of my own ideas. He did that while providing me support and guidance, so I was able to learn management skills and life skills while growing even more.

As I start my residency in OB/GYN, I can only hope to pay it forward - I've been mentoring medical students and asking them to think about their interests. I am not here to push my own ideas on them, but rather to help them develop their own research and clinical skills. I can only thank RCSS and Bob for this mentality, which is the ideal when it comes to creating independent thinkers!

REFLECTIONS ON THE TRICENTENNIAL PROJECT AND RHETORIC OF SCIENCE

BY ELLIE HANSEN

Hi everyone! My name is Ellie and I graduated from Columbia last year with a major in Psychology. I first found out about RCSS my sophomore year when fellow alum Mariel Sander approached me about taking over her idea for the Tricentennial Project, a new student climate group. I had been brainstorming a student group that would have intellectual discussions on climate change, while Mariel had just proposed a similar project that would combine faculty and students to Dr. Pollack. After Mariel graduated, I took up the project, and found a wonderful group of driven fellow students that would host four student/faculty events centered on bringing both together for organic discussion on climate issues like extreme heat, climate modeling and prediction, and adaptation to wildfires. The project culminated in an event that brought together student climate groups with the administration of the new Columbia Climate School, including Dean Sir Alex Halliday, for conversation on students' desired relationship with the school.

The following year, fellow RCSS alum Kimia Heydari and I created a course focused on the Rhetoric of Science, interested in exploring relationships between our language and scientific research and communication. Partnering with RCSS board member Prof. Lisa Dolling, we developed an undergraduate course that would explore classical rhetoric, use of metaphor in

science, gender in science concepts, and the modern rhetoric of science. We hosted the course in Spring 2022, and our students created amazing projects exploring rhetoric of science in their own issues of choice, including medical ethics, genetic testing, and science and entrepreneurship.

Throughout my time at RCSS, I always felt like my ideas were fully supported and my creativity pushed more than anywhere else in the University. The entire RCSS board and student body contributes to this, but no one models this better than Dr. Robert Pollack. I remember early Zoom conversations about the Tricentennial Project and asking Dr. Pollack if he thought the project was ready to begin. Each time, he would tell me that only I could answer that question. After a while, I finally understood what he meant. Dr. Pollack gives his students the confidence (and sometimes the push) to launch their own ideas. His extensive mentorship is evident in his exploration of students' ideas, and commitment to obtaining financial and institutional support for our projects. His commitment is echoed by the knowledgeable and diverse Advisory Board he created to bring as many perspectives and student/faculty collaborations as possible. As Dr. Pollack looks to retirement, I want to thank him, and everyone else at the RCSS, for their efforts to make the group truly special.

POST-GRADUATE REFLECTIONS

BY KIMIA HEYDARI

Reflecting upon my education at Columbia University, I find that my experiences within the RCSS emerge as some of the most formative: these experiences instilled in me self-trust and an eye for justice when enlivening proposals into projects with social responsibility.

I joined the RCSS a week after lockdowns began in 2020: I was concerned about what role artifacts of humanity (i.e., the arts and literature) could play in the midst of pestilence. I sent Dr. Pollack a writing sample and a few broad-ranging questions, and after a few email exchanges, we shared a zoom call with other members of the RCSS. During that call, he asked me to write up a proposal and gave me total freedom to start work in whichever I saw fit. The ear-to-the-ground approach that the RCSS instilled in me helped me position myself as an active member of my community—online and in Washington DC. That summer, as part of the RCSS, I organized a series of online conversations about a few pieces of modern and contemporary art. Working within the inspiring crucible of RCSS was a motivation for me to collaborate alongside museum docents from the Hirshhorn museum and the National Gallery of Art in Washington DC and found a program called Dial-a-Docent during the first few months of the pandemic.

Later, my most important leadership role emerged out of the RCSS, which was creating and teaching “Rhetoric of Science,” a graduate-level class at Columbia College. This role strengthened my ability to find gaps in college curricula and support my students in their scholarly endeavors. This project was also a

collaboration with my dear colleague and friend, Ellie Hansen. In 2021, while we were both engaged in research, we both found ourselves reflecting on the responsibility science researchers have to society—and how emboldening this responsibility might help younger researchers become more inspired and gain ownership of their intellectual contributions. In designing the syllabus, my strategy was to seek out the advice of leaders whom I wanted to emulate and to run trials to get feedback from those whom I wanted to lead. After creating an initial syllabus alongside philosopher of science Professor Lisa Drolling, I met with professors in the departments of Biology, Psychology and English whose input helped refine the syllabus to better meet the needs of student-researchers at Columbia. Before the launch of our course in Spring 2022, I hosted student seminars with science writers like Carlo Rovelli and Sherry Turkle in November and December of 2021. The majority of my engagement with the RCSS was online until, during pockets of 2022, I got to share lunches with other scholars, alumni, and members of the advisory board at faculty house. Whether it was on zoom or in-person, I always felt inspired by ways in which my peers were working on projects that aligned with their core values as responsible intellectuals and citizens. This spring, when I shared with Dr. Pollack that I was going to medical school, he reminded me to have the same approach to learning that I had learned from the RCSS: to lead with intellectual integrity and curiosity, write to learn, and never underestimate the importance of collaboration in bringing proposals alive.

ABOUT THE ALUMNI



Dr. Tess Cersonsky is a 1st-year resident in Obstetrics and Gynecology at the Icahn School of Medicine at Mount Sinai Hospital. She graduated from Columbia in 2017. She was a member of the RCSS from 2015-2017, creating the “Life at the End of Life” course. As an OB/GYN, she pursues research utilizing machine learning to understand and predict adverse pregnancy outcomes. She loves to teach and learn, participating in mentorship programs and teaching high school classes. She intends to eventually practice in an academic setting.

Ellie Hansen (CC '22) graduated from Columbia College last year with a major in Psychology. She created the Tricentennial Project and Rhetoric of Science course at RCSS, and currently works at the National Institute of Mental Health in Washington, D.C. Her favorite color is blue and she loves reading and exploring new cities with her friends.



Kimia is a recent alumna who studied English and Biology. After graduating, she conducted research within the Critical Care Department of the National Institutes of Health and collaborated part-time alongside a healthcare startup as a care coordinator for patients seeking treatment for Opioid Use Disorder. This summer, she will matriculate at Harvard Medical School. She loves writing poetry and has an ever-expanding book/art list she'd like to experience.

ANOTHER SENIOR

BY AMY POLLACK

For RCSS Intern-Scholars interested in my help and advice, my expertise is in the fine arts and graphic design. I have a large collage in the permanent collection of Columbia University. You can see it on display on the second floor of Faculty House. This work of mine is personal, and deals with the ravages of, and responses to, eugenics.

In the past I have designed props for LaMama Theater, and a T-shirt for Cold Spring Harbor Laboratory. I have also done the frontispiece for many of Bob Pollack's books; we are in addition co-authors of "The Course of Nature," where my illustrations enlarge his commentary based on current scientific ideas. Dennis Zhang and Theo Nelson have used this book in their DDC Course for High School students.

The Intern-Scholars I have been in touch with about their projects include those of the Chribble Club whose project includes writing a series of science books for children: Liana Dawson, Kathryn Whitten and Chichi Oknokwo. Melody Gomez and Keylin Escobar have also shared their

proposal with me, that will study different ways to show the interesting connections that exist between science and art, on our RCSS website.

I am looking forward to learning more about these and other RCSS projects, and to helping when I can.



Advisory Board member Amy Pollack, with her artwork "Primary Geography" which remains on exhibit on the second floor of Faculty House.



Amy Pollack is a senior growing vegetables and flowers in her gardening upstate New York. In New York City her windowsill has one tomato plant and one squash plant. It is no wonder that her favorite color is green.

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SCIENCE AND SUBJECTIVITY