

About Simon Brooks

Grand Challenges Scholars Program

2021 Scholar - Intersectional Sustainability

Made by Simon Brooks

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1 - Simon is pursuing a Bachelor of Science in Chemical Engineering, with minors in Engineering Entrepreneurship and Theology. Outside of engineering and sustainability, Simon starts on the Men's Club Volleyball team at Villanova, plays classical piano, and has performed and taught breakdancing!

When most people think about sustainability, they think of climate change and pollution, and label them as environmental issues. Today, I present to you that sustainability is much more intersectional. A truly sustainable society operates by putting the needs of the most vulnerable first, as we cannot all prosper until we each prosper. Mental and physical healthcare, education, diversity equity and inclusion: these are all systemic issues that have intrinsic roles in defining a society's ability to live sustainably.

Holistic Sustainability starts with education. With my homeschooling background, my life has always revolved around nature, learning, and creating. The first focus of my homeschooling was to learn by doing, and I developed a sincere love for learning. At a young age, homeschooling taught me about life beyond the traditional "academic" subjects.

Holistic sustainability requires a healthy amount of self-awareness and reflection. I realized that I learn best through conversation in diverse and inclusive groups. I learned the importance of self-pacing, and that no educational journey should feel like a race in comparison to others. There is room for us all to succeed, and our setbacks and imperfections are valuable parts of that path to success. When homeschooling, I felt that I belonged; I was able to think creatively and be valued. I learned aside people who were younger and older, and developed friendships with the adult teachers using first names only, as a sign of mutual respect. Homeschooling is not just a different location for school; it is learning as a way of life. I am an engineer now, not to assume I have the answers to solve problems, but to constantly learn and help improve society.

Holistic sustainability means pursuing your passions within your work, and seeking out ways to improve the world from multiple angles. My love for math and chemistry stems from its ability to connect the world of unknowns to the properties of particles and their interactions. Pursuing the Grand Challenge

Scholars Program with a Bachelor of Science in chemical engineering at Villanova combined the mathematics and science approach to learning that I love with the supportive community and team-focused environment that I longed for. I am passionate about sustainability in all its forms—from redesigning chemical processes, to mental health, diversity and inclusion, and activism. I brought this passion with me when helping to organize the Villanova University 2030 Sustainability Plan with the Student Sustainability Committee, when founding the Engineering Wellness Committee, and when representing the college of engineering on the university-wide Community First Committee which is devoted to keeping the Villanova community safe and healthy during COVID-19.

Intersectional sustainability is action-oriented and team driven. According to the World Health Organization, air pollution kills an estimated seven million people worldwide per year. With a holistic mindset, technical innovations to remove carbon dioxide emissions not only advances the technological field of study to slow global climate change, but also addresses the health and equity of the pollution. The American Lung Association notes that poorer areas and predominately Black communities suffer greater harm and are more likely than other communities in the United States to suffer in health from air pollution.

My technical work is where I most directly address climate change, the heart of actions that need to be taken to have the most sustainable impact. I began performing undergraduate catalysis research in the spring of 2018 under the guidance of Drs. Charles Coe and Michael A. Smith. Our team synthesizes materials to absorb the carbon dioxide produced in the water-gas shift reaction, enabling rapid sorption-enhanced production of hydrogen. My research team focuses on innovative approaches to develop and implement materials that remove carbon dioxide and increase the sustainability and efficiency of producing hydrogen. The Grand Challenge Scholars Program at Villanova University is the perfect fit for me to unify my studies of innovative technologies, advances in my research of sustainable materials, and development of the skills to become a leading educator, researcher, and consultant in sustainable engineering.

Building on my research, leadership, and organizational experience at Villanova, intersectional sustainability and empathy will be the heart of my future research and community work as an environmental engineering consultant. I am currently a senior chemical engineering major with minors in engineering entrepreneurship and theology, and I am taking on the Grand Challenge theme of Intersectional Human and Climate Sustainability.

Research/Creativity



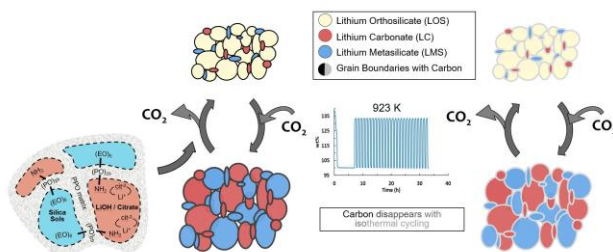
As an undergraduate researcher working with chemical engineering professors Drs. Charles Coe and Michael A. Smith, I synthesize and analyze high-temperature CO₂ capture materials. In the United States, pollution is frequently discussed as a transportation issue. But the EPA shows that electricity production and industrial processes together generated 49% of the United States' 2018 greenhouse gas emissions. Since the spring of 2018, I have worked to improve the efficacy of my team's material of focus, lithium orthosilicate (LOS). LOS reacts with CO₂ at high temperatures to form lithium carbonate and lithium metasilicate, effectively removing the CO₂ from the gas phase. Also at high temperatures is the industrial process where methane is reformed in steam followed by the water-gas-shift reaction, which produces hydrogen and CO₂. If this carbon dioxide can be captured, not only would it decrease emissions, but it would also chemically drive for faster production of hydrogen. The application of my team's research addresses climate sustainability with its emissions removal, while simultaneously advancing the ability for blue and/or green hydrogen production, an energy project that is essential for us to reach our global sustainable energy goals outlined by the United Nations.

With the nature of my team's research being discovery-driven, creative solutions are needed every day to approach proper characterization, modeling, and synthesis of our materials. I have contributed greatly to the synthesis method and modeling of our best sample, as seen in our summer 2020 publication, and the pending acceptance of our spring 2021 publication. I am second author on both publications; the summer 2020 publication can be found here:

<https://pubs.acs.org/doi/10.1021/acs.jpcc.0c04230>.

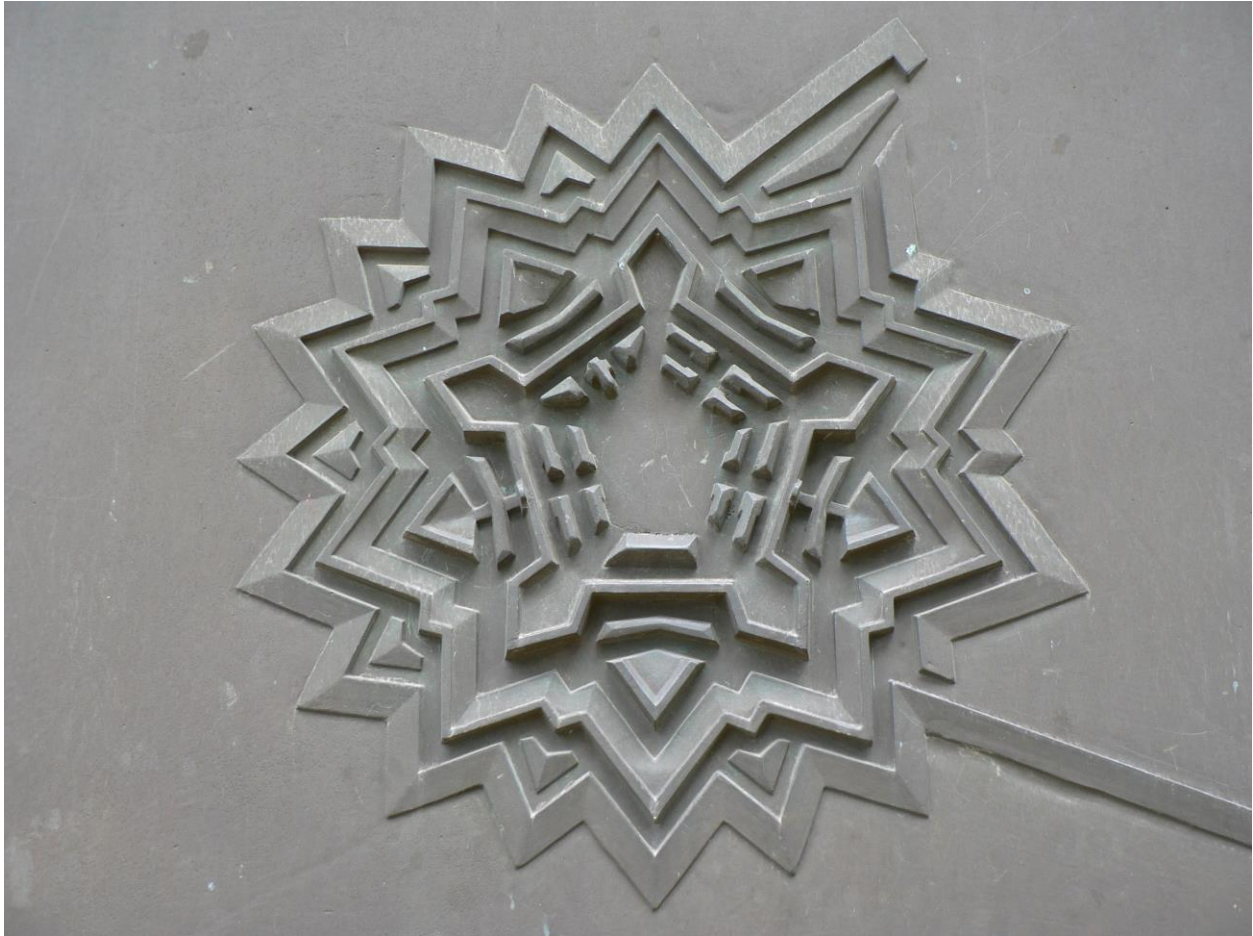
Our synthesis method is simple and feasible for scale-up, as it takes place in one pot with common materials and a straightforward apparatus. This is key to actually getting the sorbent (LOS) out and working in industry, as many innovations seem practical but might not be practical on a design or economic scale. Sustainable solutions are those that are not just theoretical solutions, but are practical for implementation.

Intersectional sustainability requires active leadership that continues the momentum of the team's progress. My actions and contributions have made sustainability a focus of the research team itself, too. I have consistently pushed for bringing in underclassmen and bringing them up to speed with trainings and lab shadow days to promote teamwork. This helps the sustainability of the research team beyond the efforts of those who will leave the project. I also renovated our data management system, created a Standard Operating Procedure (SOP) for data management, am working on renovating our instrument SOPs, and have consistently pushed for sustainable language in our publications, not just highlighting the technical innovation, but its potential impact on the world. All of these other research initiatives focus on securing the human sustainability of the research project, as success needs to continue after I graduate and after our PhD candidate graduates.



2 - Graphical abstract of 2021 publication: *Surfactant-Mediated Lithium Orthosilicate Composite Enables Rapid High-Temperature CO₂ Absorption*

Multidisciplinary Solutions



Multidisciplinary sustainability has been the focus of my technical, academic, and public engagement activities at Villanova. For my technical research team, I coordinated a cross-department connection with Dr. Feeman of the Department of Mathematics at Villanova. From spring 2019 through summer of 2020, I would coordinate times for Dr. Feeman to meet with my team to discuss important mathematical theories that advanced our novel model, describing the behavior of our carbon capture materials. While engineering and mathematics overlap quite a bit, the expertise can vary greatly, and I was the catalyst to find the link between these quite different focuses--linear algebra and core-shell reaction kinetics--and further the team's collaboration to develop a model that is the first published solution of its kind within our research field.

Outside of research, I view sustainability in a holistic manner, and have led many service site trips to help our greater Philadelphia community prosper in a more sustainable way. I have also organized a first-ever Villanova Sustainability Plan Town Hall, connecting the public / Villanova to all facets of sustainability on and off campus: from academics and well-being to energy use and social justice. Sustainable solutions are much more than just technical solutions, they look like frameworks and structure that are organized to continue for generations of Villanovans after I graduate.

Academically, multidisciplinary teamwork was the heart of my entrepreneurship minor program. In the summer of 2018, I worked on a team for the Engineering Entrepreneurship Summer Institute (E2SI). On my team was myself (chemical engineering), a chemist, a psychologist, and a finance analyst. The four of us focused our energy on not just a novel product, but the business model for that product if it were to launch. This multidisciplinary team brought in different lived experiences, different strengths and passions, and I was the leader of this team to bring everyone together on the project. Inclusion plays a key role in teamwork and success, as the value of individuals contributing to their strengths creates a sustainable work culture, and a more innovative solution to the worlds' sustainable needs.

In this program, while I was able to focus on the engineering and leadership side of the project, our psychology major was able to bring in the perspective of the end-user of our project and really helped in our strategic marketing of our product to bring more of an emotional appeal. The finances were held by the financial analyst major, but all decisions need economic input. The chemistry major had a passion for CAD drawings, and while I could have also done CAD drawings as an engineer, it was important on my leadership end to have each team member play to their strengths. The result was a cohesive team, innovating together and putting our hearts into our work successfully. For example, I pushed for the use of biodegradable pulp paper in our product design to add environmental sustainability, but it was a collaborative effort to find an economical vendor, develop an ergonomic design, and frame strategic marketing program to bring about the best multidisciplinary decision for our product's materials.



3 - Engineering Entrepreneurship Summer Institute (E2SI) 2018: The Grab N' Go innovation team report video.

Business/Entrepreneurship



In my first semester at Villanova, I led a team of engineering classmates to first place in the Innovation, Creativity, and Entrepreneurship (ICE) Challenge for our idea: The Crumb Collector, a miniature vacuum to use on-the-go. I enjoyed every second of collaboration, as we developed a creative video for our marketing and business angle. In the end, the pitch is what won us our first place prize. Technical innovations are only as good as their pitch, and it was a business and entrepreneurial effort as much as it was creative and technical. My team took to heart the words of Simon Sinek, in that people will not buy into what you are doing unless they buy into why you are doing it.

As I mentioned before, I was on an interdisciplinary team during my time in the E2SI program. After much teamwork, we got a provisional patent on our novel food-and-drink carrier with locking handles that form a lid for insulation—a solution that could revolutionize how we take food to-go. Although we did not launch a business after this program, we were set up with success with the entrepreneurial mindset, and had verbal interest from Campus Corner, Villanova Dining Services, and the Philadelphia Phillies organization to implement our product. Sustainability was at the heart of this product, as it would reduce plastic waste and reuse pulp fiber from recycled paper. I have since represented this program for many promotional videos for Villanova University, serve as the Mentorship Chair for the E2SI Alumni Mentorship Network, and have presented on behalf of the program to the Dean of Engineering and the Villanova Parent Executive Committee.

The business and entrepreneurial skills I learned have allowed me to progress many organizations and clubs I have led while at Villanova—such as being co-president of TEDxVillanovaU, providing a new structure of leadership for the organization, and successfully running a full TEDx conference on a college campus during a pandemic. Sustainability in its business, leadership, and entrepreneurship ways has been at the forefront of many activities and initiatives I have led while at Villanova.

Another example of entrepreneurship is in this viewpoint of sustainability as a whole. I intend on eventually starting my own side business of consulting on non-technical and non-engineering projects that relate to sustainability. Committee formation and leadership structures that focus on the most vulnerable are essential to intersectional sustainability. For example, engineering solutions mean nothing if policy does not support its implementation. I aim to take my engineering perspective and bring that perspective into independent work. I have begun to do this for mental health and well-being at Villanova, which is a critical part of an organization's success in their business and leadership models.



4 - First-year ICE Challenge winning product idea: The Crumb Collector



5 - Co-hosting the 2021 conference TEDxVillanovaU: Solve for Why.

Global/Multicultural Experience



Taking a global technical perspective, energy demand is plaguing global sustainability efforts as energy is used everywhere. As my research hopes to improve energy production while decreasing emissions on the technical front, cultural quality of life on a global level presents even more complicated problems. With an intersectional sustainability approach, solutions to these climate and human sustainability problems would not just decrease these emissions but do so by focusing on in the most efficient and impactful ways that improve the lives of the vulnerable.

Nigeria currently has the 5th lowest life expectancy of any country at 54 years of age, and a population that is expected to reach over 700 million people by 2100. Yes, transportation is an important sector in the United States that needs to decrease emissions. However, securing adequate health care, food, water, and education in developing vulnerable Nigerian communities is a more urgent and important matter in sustainability, especially considering the massive amounts of emissions that will come from Nigeria's unprecedented demands for electricity and industrial products. We cannot separate the global intersectionality that is at the heart of true sustainability and sustainable environmental policies.

While COVID-19 has limited the amount of travel and global service opportunities for me to take advantage of while at Villanova, after I graduate I will be working in environmental engineering consulting at Ramboll. As a consultant, I will work on projects that directly increase our health and well-being by performing superfund site clean-up project management duties and exploring technical innovations for treatment of contaminated ground water. Once travel restrictions are lifted from the pandemic, I plan on engaging with the global projects at Ramboll, and live out the service to the more

vulnerable through my work. I am not sure exactly the timeline on these projects, but I do know that all employees are eligible to do global work, and Ramboll has offices all over the world. My hope is to be directly engaged in work that improves green energy production in more vulnerable communities in developing and growing nations, such as Nigeria.

Multicultural experiences can also be just as impactful in a local setting, and grassroots improvements combine together to collectively improve the grand challenge of human and climate sustainability. It is important for me to have a positive impact within my community as an anti-racist activist and ally for issues that disproportionately affect minoritized communities, such as gun violence. My first year at Villanova, there was a tragic shooting at Stoneman Douglas Highschool in Parkland, FL. It shocked the world, but Villanova seemed too quiet on the matter. I took it upon myself to go to every Villanova leader I knew from the Center for Peace and Justice to the Office of the President, Student Life, and Public Safety, and I expressed my intention to organize a walk-out against gun violence in solidarity with those hurting in Parkland, FL. It was a successful event, impactful, and even led to policy changes that Villanova University President Fr. Peter Donohue put in place largely from my efforts and the efforts of my co-organizer and dear friend. Sustainability isn't just environmental progress, it's connecting those in whatever capacity you can to grow movements of change together. The Villanova community grew that day, but so did our place in the larger movement for non-violence and gun control in America, and in becoming a more anti-racist institution of higher education.

I have continued these efforts through senior year, co-leading a Freedom School session in honor of Rev. Martin Luther King Jr., titled, *The Misremembering of American History: The Story of America's Moral Decay*. This session promoted the need for a sustainable change in our education system, pointing out a few of the key ways that American education has led us into a decay morally. This is a global and a multicultural problem. We all have a role to play in improving our flawed past, and it can start with education. It can also start with prosecutorial reform, and I have written a self-published op-ed on the matter addressing its intersectionality with race and racism via the platform Medium.



<https://sway.office.com/ivRxKXqNBxvh4fEa#content=69D3hm8TYcYHaK>

6 - Video: Villanova University Walk-out Against Gun Violence, part of a nation-wide walk-out in solidarity with those in Parkland, FL. March 14th, 2018. Read the [Villanovan article on the walk-out event here.](#)

The Misremembering
of American History:
The Story of America's
Moral Decay

Simon Brooks
Undergraduate Student
Villanova University

7 - Video: [The Misremembering of American History: The Story of America's Moral Decay](#)



8 - Image: Lady Justice; note the blindfold for impartiality.

Full Op-Ed: [A Plea for Justice: We Urgently Need Prosecutor Reform](#)

Social Consciousness



Health and Well-Being is a crucial aspect of sustainability. If we all burnout, these systems of progress will cease to progress further. The modern day engineer needs to be a healthy engineer; the modern day student deserves to not have to choose between their education and their health. That's why I co-founded Villanova's College of Engineering Well-Being Committee, and created its novel structure. Our mission is to foster a mutually supportive environment of wellness for students, faculty, and staff. And our vision is for students, faculty, and staff, to feel a sense of belonging to an inclusive and healthy engineering community.

The Engineering Well-Being Committee (EWC) is a college-wide committee with departmental subcommittees. At the college level, we collaborate with the college's Diversity Equity and Inclusion (DEI) committee, promote college- and university-wide initiatives and resources on health and well-being, and engage with student groups and organizations within engineering to execute events focused on mental health and well-being.

At the department level, subcommittees collaborate with other departments and with the college to lead initiatives for students, faculty, and staff of their department to engage in dialogue about mental health and well-being. These subcommittees focus more on how to implement our mission and vision within their department through academic and non-academic improvements that affect the day-to-day lives of students. The general committee focuses more on how to implement our mission and vision through more structural college-wide initiatives and collaborations.

Most recently, in collaboration with the Engineering Student Council, the EWC successfully created approximately 200 free wellness kits for Well-Being Wednesday, a new tradition as part of Engineers' Week at Villanova.

This committee is not only responsible for its successful well-being promotional events, but also for a structure of leadership that puts well-being and mental health at the forefront of decision making in each department. Long term, I am a founding member of the Mental Health and Well-Being Committee, a leading university committee for whom I have created the structure so that these efforts continue past my graduation. Social consciousness is a key part of sustainability, as focusing on only technical solutions will lead to disconnect, burnout, and slow change. I hope that future generations will be able to continue this committee work, truly transforming Villanova into a more adaptable and sustainable community.

Additionally, I have continuously brought my well-being focus to expand my sphere of influence within other Villanova programs. As a three-year Orientation Counselor, I have made mental health and sustainability focal points of my group and individual conversations with first-year and prospective students, who are truly the next generation of Villanovans. As a three-year volunteer in the Villanova Engineering, Science, Technology, Enrichment, and Development (VESTED) program, I am proud that our team of volunteers always brings up the importance of Mental Health in STEM-related fields to the high school aged cohort of VESTED students. I believe the success of our next generation of engineers relies heavily on how sustainable we can be with ourselves, not just the world around us.



9 - Engineering Well-Being Committee de-stressor event for first-year students. This was an event organized and run by myself on behalf of the EWC, with support and messaging by the College of Engineering. This event served two purposes: to provide healthy de-stressing activities for first-year engineering students, and to provide a safe space for students to socialize during COVID-19.



10 - I mentored the drone project group at VESTED during the spring of 2020, helping each group to build, code, and present on their findings. I had the privilege to engage in dialogue with the students about the importance of sustainability, health, and well-being in an engineer's career.