ARTICLE
Neuroscience Ambassadors: Creating a Network of Academia-Community Partnerships

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The field of neuroscience offers exciting, yet complex, insights into the human mind. In recent years, the need to improve the dialogue between neuroscientists and the public has been recognized, and an emphasis has been placed on the generation of public-based educational programs which reach outside the academic environment and into the community. One promising avenue includes the generation of mutually beneficial academia-community partnerships. These have the potential to allow faculty and students to acquire the necessary skills to become effective "neuroscience ambassadors", while delivering attractive, fun, informative and educational opportunities to the general public. The Department of Psychology/Interdisciplinary Neuroscience Minor at Saint Francis University (SFU) created a public-oriented, neuroscience-based network of educational programs with local public libraries, Girl and Cub scout troops, elementary schools, high schools, children museums and nursing homes, in rural Pennsylvania. We envisioned that the programs will serve to improve academia-community conversations and benefit students, faculty, community partners and the public alike. In this paper, the design, implementation, implications, limitations, and future directions of the project are discussed.

Key words: neuroscience-education; community-engaged pedagogy, academia-community partnership, testimonies, reflection

The field of neuroscience offers fascinating insights into human development, cognition, motivation, emotion, communication, and behavior. Utilizing some of the greatest technological advancements of the last few decades, research within the field has dramatically improved our ability to understand, treat and prevent many diseases and disorders. Groundbreaking neuroscientific discoveries fascinate undergraduate and graduate students alike, compel them to integrate a neuroscience-focused minor/concentration into their majors, and drive them to explore their future as neuroscientists. In the college classroom, these students receive a comprehensive introduction to the structure and function of the nervous system, a thorough coverage of the methods and practices utilized within the field, and opportunities to discuss the medical applications and ethical implications of neuroscientific findings. The educational context is thus designed to provide them with the skills necessary to venture into controversial topics such as brain-computer interface (Batista, 2020) or gene-delivery/gene-editing therapies (Arjmand et al., 2020). It is also devised to provide them with the tools that are necessary for the comprehension of rare, intriguing yet devastating conditions such as Prosopagnosia (Cohen et al., 2019), Capgras Syndrome (Jedidi et al., 2015), Phantom Limb Syndrome (Andoh et al., 2018), Alien Limb Syndrome (Gallant et al., 2015), Locked-in Syndrome (Lesenfants et al., 2018) and Cotard's Syndrome (Sahoo and Josephs, 2018).

The complexity of both methodology and terminology may hinder the dissemination of neuroscientific knowledge to the general public. While traditional peer-reviewed articles are not always accessible to the non-scientific community, the conversion of neuroscientific information to featured articles in current and widespread media has the potential to misrepresent data, lead to misleading conclusions, (Gonon et al., 2011; O'Connor et al., 2012), or enable the creation of unsubstantiated myths, such as the "Mozart effect", suggesting that classical music enhances children's intelligence (Pietschnig et al., 2010), the idea that we only use 10% of our brains, or the postulation that humans can be divided into left vs. right "brain thinkers", (Centre for Educational Neuroscience, 2016). The proliferation of predatory, sham scientific journals, which lack proper peer-review process or editorial supervision, adds to this problem, by enabling the publication of invalid, questionable, and potentially fabricated data (Klyce and Feller, 2017). On top of these issues, many sectors of the general public, including elementary, middle and high school students, receive minimal exposure to neuroscientific-focused instruction, as the field may not be included in their K-12 curriculum or neuroscientific-based educational programs may not be available at their region (e.g., rural areas).

The lack of accurate presentation of neuroscientific data to the general community can generate confusion and decrease confidence in scientific investigation. For instance, the scientific ability to comprehend, and manipulate learning and memory at the molecular level (Liu et al., 2014; Ramirez et al., 2013) can be a frightening idea if translated to the deletion of "true" memories and creation of "fake" memories. The use of MRI and fMRI technology to track brain activity in health and disease (Huth et al., 2016) can be alarming if interpreted in the context of "mind reading" or even "mind controlling" methodologies. The ability to edit the genome and track epigenetic modifications (Arjmand et al., 2020;

Heidenreich and Zhang, 2016; Pardo et al., 2014) can be downright terrifying in the context of reproductive genetic engineering (e.g., “designer babies;” Ledford, 2019).

The acknowledgment of the need to improve the communication of neuroscientific research to the public (Illes et al., 2010; Robillard and Illes, 2011) has propelled the generation of informational databases/websites (Karikari, 2015; Chudler, 2022) instructional materials, available for public distribution (Dana Foundation, 2022a; Society for Neuroscience [SfN], 2022a) and some funding opportunities (Dana Foundation, 2022b; PAR-17-339: Science Education Partnership Award (SEPA) (R25), NIH, n.d.). In this context, the Society for Neuroscience operates a “Find a Neuroscientist” program which allows educators to arrange the visit of a neuroscientist in their classrooms (SfN 2022b).

In the quest to bridge the gap between neuroscientists and the public, academic institutions take an active part, utilizing social media (Valentine and Kurczek, 2016), creating outreach programs, and integrating volunteerism, service learning, community-engaged pedagogy and community-based experiential learning pedagogy (Bazzett et al., 2018; de Lacalle and Petruso, 2012; Fox, 2015; Yu et al., 2013) into the curriculum. These programs have been recognized to yield multidimensional benefits to all involved allies. Enhancing public knowledge, generating interest and enthusiasm (Bazzett et al., 2018) and strengthening local communities, these programs are also leveraged to enhance the students’ learning experience, facilitate personal growth, teach civic responsibility (Fox, 2015), enable skill acquisition and professional development (Brownell et al., 2013; de Lacalle and Petruso, 2012), and promote a deep understanding of neuroscience (Yu et al., 2013).

Inspired by these findings and aiming to deliver fun and educational neuroscience-based educational programs to various sectors of the community, a network of academia-community partnerships was generated, linking the Department of Psychology and the Interdisciplinary Neuroscience Minor at Saint Francis University (SFU) with a variety of community partners in rural Pennsylvania. The generation of the program, its expansion and modifications, preliminary evaluation of its benefits, an assessment of its limitations and future directions are discussed below.

BACKGROUND

SFU is a private Catholic liberal arts university, founded in 1847. With undergraduate enrollment of approximately 1600 students, SFU is located amidst the forests and farmland of Loretto, PA, about 20 miles from Altoona, PA. Although the Department of Psychology has a long history of activity at SFU, the Interdisciplinary Neuroscience Minor (integrating psychology, biology, chemistry, physical and occupational therapy faculty and curricula) is relatively new. Since its generation in 2013, the number of students graduating with a neuroscience minor has tripled, the number of students involved in neuroscience-based research has grown 10-fold, and new interest in the development of a neuroscience major has been recognized. In 2019, SFU was approved to host a local chapter of Nu Rho Psi, the National Honor Society for Neuroscience, and 7 faculty and students have since been inducted into the society. The growth of the minor has spawned an interest in the establishment of neuroscience-centered educational partnerships between SFU and its local community.

THE FIRST COMMUNITY PARTNER – PUBLIC LIBRARIES

Public libraries offer a reliable, educational, and social atmosphere to the general public. The Hollidaysburg Area Public Library, a 501(c)3 organization serving the Hollidaysburg area community (approximately 24,000 people) was established as the first community partner. Beginning in 2016, a series of presentations was implemented into the Hollidaysburg Area Public Library calendar. These included presentations focused on learning and memory, human senses, brain/nervous system anatomy, and psychopharmacology (content described below). Importantly, as the partnership between SFU and the Hollidaysburg Area Public Library evolved, so did the nature of the collaboration. First, library coordinators indicated that presentations scheduled to the summer months are greatly needed, as these months are marked by low public attendance to the library. This request led to the generation of a summer-specific, family-oriented workshop, which enabled kids, youth, and families to dissect sheep brains within the library, while learning about brain function, structure, health and disease. A second adaptation to the program was made during the pandemic, as libraries closed their doors to visitors yet struggled to maintain contact with the public. During the summer of 2020, the Hollidaysburg Area Public Library switched from face-to-face meetings to a free online summer reading program, provided through a virtual platform (Beanstack). The program allowed the library to offer virtual badges, prize drawings, virtual story times, activity challenges, and craft activities. Communication between SFU and library personnel yielded that this online reading program is yet another venue for academia-community partnership. Integrated into the program were **short videos**, prepared by SFU instructors and students. These 6-10 minute videos combined active learning and neuroscience content. Side by side with the videos (delivered online through the reading program), **activity kits** were generated by SFU faculty and made available for **curbside pickup** at the library (content described below).

BRANCHING OUT: ADDING PARTNERS

The integration of our neuroscience-educational program into the Hollidaysburg Area Public Library summer reading program yielded unexpected and exciting results. The accessibility of the educational videos, disseminated by the Hollidaysburg Area Public Library, and the availability of the complementary activity kits attracted the attention of additional local libraries (the Altoona Public Library and Roaring Springs Public Library), which also integrated these into their summer reading programs, thus extending the reach of this partnership. In addition, much interest was generated in families who homeschool their children,

Public Testimonies:
Ms. Melissa Garrity (Parent, Ebensburg Cub Scouts): "We loved the interaction with the college students. They were all extremely knowledgeable, outgoing, and interesting. There were many different stations, but my boys were most intrigued by the brain illusions and tuning forks. I couldn't get them away from that station, they were having so much fun trying to decipher what each illusion card meant! Wonderful program put on by a great group of students and their professor".
Jennifer and Dave Wagner (Parents, Hollidaysburg Area Public Library): "My family has attended two of the Brain Awareness events hosted by Dr. Flaisher-Grinberg and her students. It's truly hard to summarize the great benefits of this program for my family. My children, Ben, age 10, and Chloe, age 11, have been so inspired by the program that both have decided to pursue science fields in their future education. For our children, who attend a small school, this hands-on experience with goggles, scalpels, and dissections may not otherwise occur until college. Our school system simply can't afford these opportunities. The partnership between the SFU and the Hollidaysburg Area Public Library offers such a benefit to our rather oppressed socioeconomic community. I wholeheartedly thank SFU for this amazing and educational opportunity for my family."
Community Partners' Testimonies:
Janet Eldred, Director of the Hollidaysburg Area Public Library: "We are proud to offer free neuroscience programs at our library through this partnership. Our library patrons of all ages have attended the programs with great interest, and have especially enjoyed the hands-on aspect, which provides a learning opportunity that could not be possible without a professional partnership of this kind. Some families have attended multiple events, realizing an interest in the topic which cannot be covered in only one or two sessions. There is much scope for future programs! This partnership would not be possible without the hard work and initiative of the SFU Psychology Department."
Ms. Melanie Ramsey, Director of Youth & Children's Services at the Hollidaysburg Area Public Library: "We were immediately interested in a partnership to bring neuroscience to our library users and were eager to participate in planning and designing a public program with Dr. Flaisher-Grinberg. The programs were successful and well-attended from the very first, and different concepts were explored based on public interest and input. Together, we considered the audience, and the possible ways learning could be organized in a library setting. In a public library, the approach must be a little more flexible since the presenter has no way of knowing how many people, and of what ages, will attend. The activities were appropriate, interesting, informational, and entertaining, and allowed individuals of all ages to meet and talk personally with students and scientists. Some of our participants have shared that they are now interested in learning more about neuroscience, considering neuroscience as a possible career, or starting a new neuroscience-based hobby due to this partnership. We are very proud to partner with Dr. Flaisher-Grinberg and SFU."
Students' testimonies:
Amber Rogers (2020 graduate, Psychology & Education Major): "I really enjoyed the Brain Awareness event. Watching young kids enjoy the brain activities and learn about the brain was awesome. I thought teaching young children about the brain was a wonderful experience to be a part of."
Christine Geiger (2018 graduate, Psychology & Biology Major): "I thought the event was great because it was bringing kids closer to science. Watching them get excited to hold a brain or a rat is simply wonderful!"
Cecilia Garza (2019 graduate, Psychology Major): "The event allowed me to break out of my comfort zone and learn how to help young kids get excited about learning. This event not only made me like my field of study more, but it allowed kids to learn more about something they probably did not know much about".
Faculty Testimonies:
Dr. Flaisher-Grinberg (SFU program coordinator): "This partnership spans all 3 pillars of academic duties. The opportunity to teach students how to become "neuroscience ambassadors" who deliver educational content to our local community has enhanced my teaching pedagogy, and the evaluation of the effects of the program on neuroscience-focused knowledge and interest has enhanced my scholarship. In addition, this partnership has enabled me to connect with my local non-academic community, better understand the needs of my community, and make meaningful relationships with individuals who share my passion for neuroscience. As such, the program has promoted both my personal and professional development, not to mention the attainment of my ultimate goal – celebrating the fun of neuroscience with our general public!".

Table 1. Testimonies provided by the community, community partners representatives, college students and SFU faculty.

indicating that such activities can easily be integrated into homeschooling curriculum. We intend to explore both these avenues in the future.

In addition, working with the Hollidaysburg Area Public Library enabled a reach into a specific audience, which in turn acted to increase the reach of the program. Specifically, the Hollidaysburg Area Girl Scout Troop conduct their weekly meetings at the library. The overlap between their meeting times and some of our sessions initially enabled the girl scouts to attend these events, and later led to the generation of troop-specific events. This factor enabled the generation of educational opportunities, delivered to scouts and tailored to their specific badges and awards (even during the pandemic). Importantly, the connection with one scout troop led to the connections with additional scout troops, to include the Martinsburg Area and the Ebensburg Area Cub Troop. As these troops target a younger audience, the program was adapted to enhance a certain theme: Halloween. Specifically, annually offered around Halloween, we tie neuroscience themes with zombies, Frankenstein, brains, rats, etc.

In 2017 we began to partner with local elementary schools. Targeting the month of May, when teachers are exhausted and students are looking forward to their break, faculty and student-led neuroscience sessions delivered within the classroom offered an exciting and refreshing outreach opportunity. Starting with the CW Longer Elementary and expanding to include Foot of Ten Elementary, and Penn Mont Academy, classroom visitations were scheduled to introduce neuroscientific concepts in a

Figure 1. Exploring and dissecting sheep brain specimens

fun, active, and attention-captivating fashion (content described below). Importantly, the connection to the elementary schools enabled communication with the teachers supervising and supporting the Hollidaysburg Area Elementary Gifted Program. A conversation between SFU and the program's supervisors (including a 3rd school, Frankstown Elementary), indicated that there is much interest in field trips, venturing outside the classroom and into academia. Hence, "Gifted Day" was created, to include a day of neuroscience-based activities delivered to elementary students in the program by SFU students and faculty. With the collaboration of the chemistry department (providing chemistry-focused activities) and the education department (allowing supervision and direction by students training towards their education degree), 50 elementary students and teachers within the gifted program traveled to SFU in November of 2019 for a special day (content described below). Although, due to the pandemic and traveling restrictions, both programs were paused during the 2020 and 2021 school years,elementary classroom visitations are scheduled to resume on May 2022, and the "Gifted Day" program in scheduled for November 2022. Also, recognizing that opportunities such as this one should be made available to all students, we plan to extend our reach to try and include the general population of students enrolled in the Hollidaysburg Area Elementary School District.

Early in 2018, we developed two new partnerships. First, given the high level of public interest in the program (specifically, the "festival-like" brain-awareness events described below), the "Quaint Corner Children's Museum & Discovery Center", in Altoona, PA, reached out to the SFU's Psychology Department, with the request to integrate similar events into the curriculum. The Quaint Corner museum is an interactive, hands-on center housed within the local community. Each room in this beautiful Victorian mansion is dedicated to a different theme (from science to music and art). Since the museum is open mostly on the weekends, the implementation of the program required the recruitment of students and faculty who are available during these times. Also, since the museum can be attended by very young children (3-4 years old), the program was adjusted to assure the safety of all involved participants. Second, late in 2018, the partnership between SFU and our local elementary schools enabled the incorporation of local high schools into the network. In the past decade, SFU has been offering one-week Summer STEM Academies to high school students in grades 10 and 11. These academies enable high school students to live in campus dorms, attend college classes, and experience the lives of a college student. Acceptance is highly selective, and attendance is rewarded with college credits and tuition scholarship. Although the STEM academies traditionally included topics such as chemistry, biology, pre-medicine and exercise physiology, the rising interest in neuroscience, building on library presentations, elementary school visitations, and personal connections, marked the summer of 2018 with the first "Psychology and Neuroscience" STEM Academy. Withhigh enrollment during the summers of 2018 and 2019 (30 students total), the academy was among the only four academies approved to take place during the summer of 2021.

In 2019, the previously described connections yielded a new and surprising partnership with a local nursing home, the "Garvey Manor Nursing Home" in Hollidaysburg, PA. Upon preliminary conversations with staff and management, it was discovered that the residents show much interest in neuroscience-specific themes, and that interactive sessions can greatly reduce a boring day-to-day routine and create

Figure 2. Exploring sensation & perception, as well as drug effects on *Daphnia magna*.

excitement and engagement. Given the variety of interests, capabilities (e.g., sight or hearing deficiencies, memory deficits, delicate skin), and special needs (e.g., wheelchairs), the program was again adjusted to assure safety to all involved. Although similar connections were made with additional nursing homes in our area (e.g., "**John Paul II Manor**" in Cresson, PA), access to these locations has been disabled since March 2020. We hope to resume these collaborations in the near future.

FINDINGS

The informal assessment of the efficacy of the program (testimonies) yielded that there is much public interest in neuroscience-specific, fun and active, educational programs, and that all events were well-attended. Both the community and SFU partners are highly satisfied by the collaboration and are interested in its continuation and further development. The public, community partners, SFU instructors and students find the program to be valuable, believe that it contributes to their knowledge, skills, and personal development, and feel that it facilitates the attainment of their future goals. Some testimonies are provided in Table 1.

Outreach Content: Neuroscience-Focused Lectures, Workshops, and Classroom Visitations

Various neuroscience-related topics have been included in the lectures, workshops and classroom visitations delivered thus far. Specific themes and related activities are described below.

The Neuroscience of our Brain in Health and Disease

During these sessions, the structure, function, organization and development of the brain and nervous system are discussed. Complementary activities are directed at the inspection of preserved (mice, rats and sheep) and plastic (human) brain specimens. Attendees receive the opportunity to hold, examine, and at times, dissect these specimens. This also allows for the comparison between the brains of various species (e.g., complexity, relative size) or discussion of various conditions which may damage the brain and adversely affect normal behavior. This concept can be expanded to discuss the importance of the cerebrospinal fluid (CSF), demonstrated when raw eggs (e.g., brains) are dropped to the floor after they have been placed in a box (e.g., skull) with or without water (e.g., CSF). This program can also include a discussion of the importance of neuronal synchronization (and the corpus callosum), demonstrated when the participants are asked to draw a circle and a square, using both hands, at the same time. While the described activities are found to engage various ages, the content (e.g., brain structure and function) can be adjusted to children, youth, adults, and elderly individuals. Converting this session into a "brain dissection workshop" enables entire families to dissect sheep brains at the public library or at a children's museum, under direction, supervision and strict safety regulations. Although this program requires much planning, preparation, caution and hygiene, it attracts a high number of attendees is attained (about 70-80 participants, see Figure 1).

The Neuroscience of Sensation and Perception

During these sessions, the structure, function, organization, and development of the human senses are described, and their organization into our perceptual world is demonstrated. Complementary activities include the inspection of preserved (cow) and plastic (human) eye specimens. Since preserved cow eye specimens are relatively cheap, small, and easy to clean, these sessions commonly include preserved specimen dissection. Given the capturing nature of perceptual illusions, various visual, auditory, olfactory, gustatory, and tactile illusions can be explained and demonstrated via active attendees' participation. These sessions can be made incredibly active when normal and abnormal sensory and perceptual processes are demonstrated, and the physiology behind them explained. For instance, the "blind spot", "homunculus organization", "bone conduction" (using tuning forks), "sensory adaptation" (to color or smell), genetic and individual variance in taste perception [using Phenylthiourea (PTC) paper strips or via

Figure 3. Training live rats to jump through hoops.

the creation of "taste maps"] are all fun and interactive activities (see Figure 2).

The Neuroscience of Drug Use and Abuse

These sessions are dedicated to the discussion of the beneficial and harmful effects of drugs on brain and behavior. To complement the scientific explanations with fun and active demonstrations, 60x phone scope magnifiers, various drugs, and the "*Daphnia magna*" (small planktonic crustaceans) live system are used. Applying different drugs to the *Daphnia magna*, inspecting their activity and heartbeat using microscopes, detecting strange behaviors (e.g., live birth) or even unfortunate Daphnia's death allows for the exploration of psychopharmacological agents such as alcohol and caffeine (observable effect on activity and heartbeat are easily demonstrated), additional agents such as nicotine and adrenaline, and a discussion of their relevance to human behavior. This is also an opportunity to discuss pollution, contamination, and environmental safety (as Daphnia live in ponds and lakes). When interactive sessions include young children, the 60x magnifiers can be applied towards the investigation of anatomy and physiology (e.g., skin and hair), or to the investigation of the natural environment around us (flowers, grass, rocks, etc.) (see Figure 2).

The Neuroscience of Learning and Memory

During these sessions, the biological and psychological processes implicated in learning and memory are explained, demonstrated, and applied towards controversial topics such as memory manipulation. These sessions are supplemented with hands-on activities which focus on the training of live rats (to choose the "correct" arm in a maze or jump through a hoop using operant conditioning). While the topic itself attracts the attention of the audience, the ability to learn about rats, interact with them, and train them, generated much excitement and engagement in audiences of various ages. Importantly, since the student presenters have much experience with the training of rats (and take a liking to the rats), the enthusiasm is mutual (see Figure 3).

At SFU, we offer a special "Canine Learning and Behavior" course, which allows students to foster shelter dogs for an entire semester, bring them to class, train them according to 'learning' methodologies, and facilitate their future adoption. Thus, active presentations of learning concepts can be adapted to replace the training of live rats with live dogs. The integration of live dog-training sessions into the educational program facilitates conversation regarding the neurobiology of learning and memory, learning methodologies (e.g., classical and operant conditioning), neuroplasticity, comparative cognition, and evolution (brain relative size and complexity). Again, student ambassadors who are familiar with the dogs deliver the sessions and have the opportunity to convey their love and care of the dogs to the general audience. Since this activity can be conducted both indoors and outdoors, we were able to maintain this program throughout the pandemic (see Figure 4).

Talks, Workshops, Festivals, Summer Academies and Online Delivery

While some educational programs maximize engagement and excitement by focusing on a single topic (e.g., learning and memory, sensation and perception), others benefit from the exposure of the audience to a variety of topics. For example, when invited into elementary classrooms, nursing-homes, or in certain library-based programs, the content of the interaction, and supporting fun activities are all tailored to a single topic. Other programs, especially those delivered at the public library, museum, "Gifted Day" or the high-school oriented STEM academy (see Figure 5), allow the audience to actively interact with much of the content described above, organized into an "academy", or a "festival" form (commonly centered around "Brain Awareness"). Delivered as a part of Brain Awareness Week (Dana Foundation, 2022a) but also throughout the year, SFU students deliver various "stations", in which participants have the opportunity to watch brain/eye dissection/dissect them themselves, create a taste map, inspect Daphnias' behavior under drugs' application through a 60x magnifiers,

Figure 4. Talk attendees, presenters, and canines.

or train a rat/dog for a trick. When organized into festivals, these programs commonly include two additional "stations": a station were neuroscience-focused puzzles, coloring or drawing activities can be completed (designated for younger participants), and a prize "station", delivering stickers, pens, rulers, brain-shaped erasers, etc., courtesy of the Dana Foundation, (Dana Foundation, 2022b) and of the SFU Department of Psychology.

As mentioned above, during the pandemic, it was discovered that some of these materials can be easily converted to 6-10 min. recorded video, which can be distributed alongside activity kits, and "curbside" distributed. Hence, videos were created by faculty and students to include the following: Brain structure explanations aided with a kit containing a shower cap and a marker (to draw brain areas on top of the cortex), neuron structure information supplemented by colorful pipe cleaners (which can be assembled to create a neuron), depth illusion explanation (supplemented by colorful crayons), and an explanation of the cerebrospinal fluid (this activity can be easily completed with everyday materials found in every home; uncooked eggs, water, and plastic containers).

LESSONS LEARNED

While the current program can be conceptualized as outreach or service activity, delivered by academia to the general community, we attempted to construct it according to the guidelines of 'community-engagement' practices. Community-engagement is defined as the "collaboration between institutions of higher education and their larger communities" (whether local, regional, national, or global), aiming to create a "mutually beneficial exchange of knowledge and resources in a context of partnership and create meaningful collaborations which jointly target civic issues, needs and disparities" (Welch and Plaxton-Moore, 2019). Embracing these guidelines, the generation of the academia-community partnerships described above was guided by a conscious effort to comprehend, and meet the culture, goals, values, demographics, and specific needs of both the academic and the community partner. With time and resource limitations in mind, we found that maintaining a flexible structure to the program, with everchanging content, location, set of ambassador students, and delivery method, enabled us to accommodate to different audiences' backgrounds, capabilities, and interests. In addition, the establishment of a long-term commitment between the academic and the community partner, and the allocation of roles and responsibilities among both partners enabled the generation of trust, open lines of communication, and equal distribution of efforts (e.g., the marketing of the events was mostly handled by the community partners). The goals of all partners were aligned, and the constraints unique to each partner considered (e.g., the academic partner seeks to assure safety during brain dissection workshops, while the community partner seeks to maintain hygiene procedures). Validating the suggestion that programs such as the one described above offer exciting opportunities for public and students' learning, we also found that the program tends to branch, expand, and transform.

Specifically, while positive students' testimonies were leveraged to attract and guarantee the participation of additional college students in the delivery of the program (even during the weekends, summer months or during the pandemic), positive testimonies spread by word of mouth among community partners, facilitated connections with new sectors of the community, and generated new educational opportunities.

CONCLUSIONS, LIMITATIONS AND FUTURE DIRECTIONS

The above-mentioned information indicates that the program improved the communication of neuroscientific data to the general community, involved faculty and students in community-engagement activities, and enriched the educational programs offered by public libraries, children's museums, scout troops, nursing homes and school-based elementary/high school/gifted programs. This interactive experience with the field of neuroscience was found to attract public interest and was well-attended. It was also found to positively enhance students' ability to act as "Neuroscience Ambassadors," promoting their capacity to

Figure 5. High school students attending the "Psychology & Neuroscience" Summer STEM Academy.

communicate science and enhancing their organizational skills, material comprehension, and active citizenship. Testimonies provided by all involved partners suggest that the program is perceived as a mutually beneficial educational opportunity, and that all who are involved are interested in its continuation and further development.

There are a few limitations to the creation of a program such as the one described above. First, the gathering of funds and materials is required, to support the purchase of specimens (e.g., preserved sheep brains and cow eyes), materials (e.g., dissection kits, goggles, gloves, and cleaning supplies) and to provide students' transportation into the community. In addition, lesson plans and educational activities must be generated. In this context, the Dana foundation is an essential resource, working relentlessly to distribute educational supplies such as booklets, fact sheets, and puzzles, and to support neuroscience-focused public education with grants and awards (Dana Foundation, 2022b). Additional recommended resources include "Neuroscience for Kids," (Chudler, 2022) and "Public Education Programs," (SfN, 2022c), as well as institutional-specific funds (e.g., faculty development grants) or community-based funds.

Second, an educational program such as the one described above requires the recruitment and training of motivated and devoted student ambassadors. The fact that participation in the program is completely voluntary, as none of the activities is tied to a specific class or is directly compensated (e.g., class or extra credit), can hinder student recruitment. This factor is exacerbated by the fact that some sessions (e.g., museum-based events and festivals) can take place during the evenings, weekends or summer breaks, and by the requirement that student ambassadors undergo training sessions prior to their engagement with the community. These training sessions aim to assure students' grasp on the materials, and prepare them to handle various age groups, avoid unwanted scenarios (e.g., young children's access to dissection tools) or manage unpredicted occurrences (e.g., animal phobias). Although these training sessions are time consuming for both students and faculty, they critically reduce the amount of supervision needed throughout the events and allow student ambassadors to adjust their interactions to the interests, background, and constraints of their audience. For instance, working with a preserved brain/eye specimen, students may choose to dissect it, help a child dissect it, or just talk about it. Using 60x phone magnifiers to observe the effects of alcohol on *Daphnia's* heartbeat and activity, students may choose to develop a conversation about drugs in general, animal behavior, or help the child explore their skin, hair, or the environment. Despite these hurdles, we have found that some students are eager to participate in the program, are inspired by the opportunity to interact with their communities and are aware of the benefits of the program to the public, their institution, as well as to their own professional and personal development. The generation of a wide pool of trained ambassadors allows the program to stay active even when some ambassadors are not available to participate (e.g., exam season, weekend, or summer break), or as some ambassadors graduate and move on to the next stage of their lives.

Third, it must be acknowledged that the generation of a public-oriented educational program requires the devotion of much time, effort, and commitment on behalf of a dedicated faculty member. Although the program described above is not currently associated with a specific class and extends beyond the faculty's regular teaching load, it is advised that if possible, organizing faculty tie the program with a course or are otherwise compensated for their hard work (e.g., course reduction). One may also consider the fact that while the generation of such a program may be a 'labor of love', it does contribute towards one's personal and professional development, acting to improve teaching effectiveness, generate new avenues for scholarship, and epitomize service, which reach beyond the immediate academic institution or professional field, and into the general

community.

Fourth, the utilization of live animals as a part of the program may be subjected to various constraints. While the maintenance of animal colonies in small undergraduate institutions may not always be feasible due to financial restrictions and federal regulations (Elcoro and Trundle, 2013), or access to dogs may not be achievable, the use of the *Daphnia magna* system is highly recommended. Daphnia are inexpensive, require very little space, and are easy to transport. In addition, they are active, interesting and quite entertaining. Moreover, in some academic institutions, the use of *Daphnia magna* for educational purposes may not require IACUC (Institutional Animal Care and Use Committee) protocol approval. The inclusion of rats and/or dogs, on the other hand, does require the submission and approval of a relevant IACUC protocol. In this context, it is important to mention that the integration of live animals into the program requires the dedication of care and attention to specific constraints of the community partner. For instance, while some public libraries are excited to welcome a dog into their premises, many may only allow public engagement with an "American Kennel Club – Canine Good Citizen" (AKC-CGC) certified dog (American Kennel Club, n.d.). In this respect, they may prefer the engagement with a rat or a mouse. On the other hand, nursing home personnel may choose to protect the residents' delicate skin while interacting with live rats, providing gloves and soft blankets.

Fifth, a program such as the one described above requires much flexibility on the side of the academic partner. The procedures required to support brain specimen dissections at a local library may be different than the ones required to support a similar activity when performed on campus. The interaction with live rats can require different precautions when involving young children, young adults or the elderly population. Moreover, the program described above may include incidents in which last minute adjustments have to be made to accommodate the specific needs of the community partner. For instance, we have experienced incidences in which we had to restrict dog-visits to public libraries (to only include AKC-CGC-certified dogs), add student ambassadors to library-visits (to accommodate an unexpectedly high number of visitors), and to unfortunately cancel events at the request of the community partner (e.g., the pandemic). Although these unexpected events can become hurdles, learning to overcome such obstacles has been found to yield an indirect, yet valuable, benefit to both students and faculty.

Finally, it is important to mention that currently, no comprehensive assessment of the program's direct benefits to ambassadors or participants has been conducted. We plan for future implementations of the program to include direct assessments of students' content comprehension, skill acquisition (e.g., science communication, public speaking), and interest in neuroscience. We also plan to directly assess the effects of the program on the general public, measuring comprehension, engagement, and interest in the development of future careers in neuroscience. It is our hope to keep and extend the program, generate new academia-community partnerships, and share the love of neuroscience with our community.

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