**BACKGROUND AND GOALS FOR FELLOWSHIP TRAINING**

1. **Doctoral Dissertation and Research Experience**

**Post-Baccalaureate Research (Johns Hopkins University).** In my senior year of undergraduate studies, I acquired a 30hr/wk internship at the Johns Hopkins Behavioral Pharmacology Research Unit (BPRU), which I became a full-time position following graduation. During my four-year tenure, I assisted or coordinated 11 studies, the most notable being a series of NIMH/NIDA Center Grant studies investigating the effect that cigarettes with strategically manipulated nicotine content had on smoking reduction/regulatory behavior in an average- to heavy-smoking sample with the goal of improving public health on a national scale. Tangential projects focused on nicotine reduction in vulnerable populations, including opioid-maintained populations and women of child-bearing potential. Coordinating these projects meant training and managing a small team of researchers to recruit hundreds of participants over a two-year period. Participants would return to lab on a weekly or biweekly basis for six months to receive a battery of cognitive tests, clinical tests, provide biospecimens, answer questionnaires, and exchange experimental product, all while also completing daily experiential sampling surveys. Our site specifically excelled in recruitment and participant retention under my coordination relative to other participating sites. This experience is where I first became interested in ecological validity in research. In overseeing these large-scale, heavily regimented and highly critiqued projects, I saw firsthand how crucial piloting and protocols were for study success. I also discovered that I excelled in the organization and attention to detail that this planning required.

**Post-Baccalaureate Research (Drug & Alcohol Dependence).** Due to my meticulousness and writing proficiencies, I was also offered the position of Editorial Office Manager for the Elsevier journal Drug and Alcohol Dependence. Over two years, I managed routine operations for the journal, coordinating across a team of editors and reviewers to evaluate the quality of manuscripts for publication. This meant greater exposure to self-regulatory models and neural research than I otherwise would have encountered and was where I first developed my interest in neuroimaging methods. To sustain our journal’s publishing rate of over 500 articles per year, I developed skills to quickly understand and review manuscripts that contained novel techniques and analyses in an efficient manner. I held this position simultaneously with my other roles at the BPRU.

**Post-Baccalaureate Research (Children’s Hospital of Philadelphia).** In 2017, I accepted a position as a Clinical Research Coordinator in the Gastroenterology, Hepatology, and Nutrition Department at the Children’s Hospital of Philadelphia to acquire clinical experience and explore my interest in early developmental populations. I acclimated quickly to the new environment and began overseeing two projects, one of which was a survey of the gut microbiota composition in patients who had gastrointestinal tract portions resected, resulting in short bowel syndrome (SBS), which typically results in greater variance in microbiome composition, making traditional antibiotic treatments ineffective and negatively impacting developmental cognition and health trajectories. The latter project resulted in a *Gut Microbe*s manuscript, on which I was an author, summarizing our microbiome survey and recommended treatment courses for patients suffering from these conditions. The second demanded collection, processing, and storage of live human tissue and other biospecimens during endoscopy procedures and organ resections. These samples yielded a biobank of 150 enteroids, or replicable patient cells from diseased or non-diseased GI tract tissue, which can be used to test experimental treatments without harming vulnerable patients. This was a major advancement for treatment development. I developed an appreciation for research stewardship, as helping to build research infrastructure for others with this repository directly motivated my interest in open-source programming and data-sharing practices. In working with these unique vulnerable populations, I also developed a greater appreciation for how pivotal the intersection of development is to my interests in affect, self-regulation, and neuroscience.

**Predoctoral Research (Temple University).** As a doctoral student under the mentorship of Dr. Chelsea Helion, I became interested in understanding neural and behavioral representations of contextually-dependent social affective information across early development. To model this context-dependency, my research incorporates naturalistic stimuli and paradigms pursuing high ecological validity to yield models as close to real-world common experiences as current technical limitations will allow. For example, while the emotion regulation field has demonstrated associations between low-intensity affective experiences and subsequent self-regulatory choices, high-intensity affective experiences have been elusive, especially outside of the lab. Yet, self-regulation in high-intensity situations is precisely when successful regulation may be of the utmost importance, especially for anxiety and traumatic stress disorders. As such, we leveraged a quasi-naturalistic, controlled environment (i.e., a Haunted Haunted) across two studies (N1 = 57, N2 = 118) to explore associations between high intensity affective experiences and self-regulation, memory, and physiology. We found that affective intensity strongly predicted effort to regulate but did not predict which strategies untrained and undirected participants chose in the field. However, participants who had not experienced the haunted house directly but were presented with information about those same events from the haunted house in the context of a lab did demonstrate an association between affective intensity and strategy choice. These results extend well-established relationships to new contexts and highlight how real-world situations can complicate what otherwise might appear to be clear effects. Results from the project were presented at the 2021 and 2022 Society for Personality and Social Psychology Conferences, the latter of which resulted in winning an SPSP travel award. The manuscript is also currently available as a preprint and under review at *the Journal of Experimental Psychology: General.*

Much of my research has specifically focused on extending similar ecological validity to fMRI studies. In my second year I published my first first-author publication in *Social Cognitive & Affective Neuroscience* which used video stimuli and representational similarity analysis (RSA) to highlight differences in neural representations of affective information between adults (ages 20 - 44) and children (ages 4 - 10). We hypothesized, based on extant literature, that neural development between prefrontal and subcortical affective structures during adolescence should influence representations of affective information in those regions. We found evidence that representations of affective information in the ventromedial prefrontal cortex (vmPFC) grow more dissimilar with age relative to subcortical structures (i.e., amygdala and nucleus accumbens), as well as evidence for greater representational pattern similarity for negative relative to neutral and positive stimuli, which collectively may reflect a maturation towards more evaluative affective processes. Data from the project won poster awards at the 2021 Society for Personality and Social Psychology Emotion Pre-Conference as well as 2021 Social Affective Neuroscience Society Conference, and was presented at a symposium I organized for the 2022 American Psychological Association conference on the importance of context in affective research.

My interests in ecologically-valid neuroimaging and social affective phenomena have culminated in a project Dr. Helion and I launched in my third year and which aims to document behavioral and neural representations of how social uncertainty judgments form using study designs that mirror important features of a social world. While many well-established trial-by-trial paradigms capture economic and perceptual uncertainty, the uncertainty a person might feel when determining trust or honesty is based upon information: a.) revealed across a continuous time course rather than in neatly defined trials, b.) that may be mixed with and need to be sorted from irrelevant information, and c.) that features both unknown possible outcomes and probabilities. While much of the literature highlights how aversive uncertainty can be, people seek uncertainty in media offering an avenue through which to explore this phenomena in the lab. By providing participants with a basic context, presenting a video stimulus with varying uncertainty (e.g., competitions, crime mysteries), and continuously recording how uncertain participants are of a given outcome, we can explore neural responses to social uncertainty, domain-specificity from perceptual uncertainty, and how that neural activity predicts subjective assessments of uncertainty. I intend to continue pursuing my interest in developmental phenomena by adapting this paradigm for adolescents in my postdoctoral phase. Though existing studies of social uncertainty in development are relatively limited, an increase interest in social feedback during adolescence suggests social ambiguity should be highly aversive. Understanding how certainty judgments form during this period would be highly relevant to treatment of anxiety disorders, depression, and related psychopathologies.

By merit of the statistical and programming skills I have developed pursuing these projects, I was also invited to contribute to and co-direct in my second and third years of graduate school, respectively, a new student-run organization, the Coding Outreach Group (COG). We host semi-annual coding bootcamps for beginners in R, Python and Bash; hands-on skill workshops for intermediate to advanced coders, on topics such as using fMRIPrep, Github, and Linux machines, or conduction data visualizations and RSA; and regular office hours for people of all skill levels, from undergraduates through faculty, to find solutions to coding problems. We plan to introduce new programming in Summer 2023, wherein contributors work together to produce a novel functional programming tool or library to be used in data collection, analysis, or visualization. Our educational materials are self-generated, free, open-source, and hosted on our webpage as tutorials so learners can progress at their own pace. COG has extended beyond the Temple community through outreach events with *Girls Who Code* but is currently resource limited. In October 2023, we are seeking NIH funding via a METER (NOT-NS-23-011) grant to increase our ability to serve local communities. As a first-generation college attendee from a low SES, single-parent background, I would not have the education or skills that I do if not for exceptional mentorship. As such, I dedicate much of my effort towards mentorship. I received a Mentor of the Year award from the Temple Psychology Department for my work with Honors students because of these efforts and I plan to continue in that vein for the rest of my time as a graduate student, post-doctoral fellow, and PI.

**Doctoral Dissertation (Temple University):** The project proposed under Specific Aim 1 in this application is intended to be my doctoral dissertation.

1. **Training Goals and Objectives**

My long-term goal is to pursue a career in academia, developing my own independent research program as the principal investigator of a social developmental neuroscience laboratory focused on studying neural and behavioral representations of social affective phenomena using novel computational techniques and naturalistic study paradigms. I hope to study the relationship between uncertainty cognition and behavior across development in my future work. The F99/K00 award would be an extraordinary step forward towards meeting this long-term goal. Completing this project and its associated training plan will provide me with experience that I would not otherwise have available to me within my program, and which is necessary to achieve my ultimate career goals. Award funding would eliminate my need for internal funding and redirect over 20hrs per week of my time from non-research activities to learning computational statistical techniques, the social developmental neuroscience literature, and the skills I need to become a successful independent researcher at an R1 institution. With this in mind, my goals for this award have been carefully considered with my mentorship team. Namely, my training plan will allow me to: 1) learn computational neuroscience methods and analyses; 2) Develop expertise in the social adolescent neuroscience literature; and 3) gain theoretical and professional skills necessary for a career as an independent investigator. These training activities make use of an integrative approach spanning various research aptitudes which would not be possible without the support of this fellowship.

**Training Goal 1: Computational Neuroscience Methods.** *F99 Phase* Studying social and affective topics using naturalistic stimuli during fMRI demands the application of analytic techniques sensitive to the subtle variations in voxel-by-voxel patterns that represent them. As such, multivariate pattern analyses (MVPA) and computational neuroscience techniques are absolutely essential to my broader goals and complement my pre-existing experience of implementing naturalistic designs and stimuli into my studies. While I have some experience with intrasubject MVPA analyses, like representational similarity analysis, my proposed project requires the use of intersubject MVPA approaches, like intersubject correlations (ISC), and complementary computational techniques, such as functional hyperalignment and generalized estimating equations. Additionally, applying ISC approaches to continuous neuroimaging data requires the use of advanced pre-processing techniques to address temporal dependencies among our data, like voxel-wise detrending or temporal smoothing. Temple has state-of-the-art imaging facilities in Weiss Hall where my lab and office are located. This access will be essential to performing this project. My mentorship team includes two experts in statistical and computational approaches to analyze data.

My specific training goals include learning the theory behind previously noted pre-processing and analytic techniques, how to apply them to data in Python, R, FSL or similar programming languages. I will follow directed readings/tutorials with my mentor and consultant dedicated to computational neuroscience methods and statistical methods. I will complete one-on-one meetings with members of my advising team to receive hands on training and critical feedback on my application of these new methods, including forecasting potential issues that I might run into and what the solutions to those issues might be. I will carefully document my pre-processing and analysis for replication and data-sharing practices. Furthermore, I will adapt the tools and functions I develop for these purposes into open-access data analysis tools for other researchers interested in using video stimuli or applying these analytic techniques to continuous video stimuli to use. This will likely require the creation of separate packages being developed in R and Python, which will be hosted on my personal Github as they are developed. These skills will complement the statistical, programming, and neuroimage analysis skills that I have already developed with tools including fMRIPrep, FSL, Fresurfer, Bash, Python, R, MRICron, hierarchical linear modeling, data visualization, and representational similarity analyses as a graduate researcher at Temple University. I have already completed all of the advanced statistical and neuroscience coursework Temple has to offer in pursuit of my concentration in quantitative methods. However, I will supplement my training with intensive summer workshops in computational neuroscience techniques. I have previously attended Neurohackademy, had been accepted but could not attend Neuromatch, and will attend the Summer Institute for Social and Personality Psychology program this summer, which all offer some relevant coursework in this regard. I will ideally attend Neuromatch or the Dartmouth MiNDs summer program, which are both very well-suited to my training goal. In my second year, I intend to volunteer as a teaching assistant at one of these summer programs, as this will allow me to not only develop mentorship skills but also critically engage with the skills and approaches, I am learning from a novel perspective, thus deepening my understanding of their utility and application. Calls to volunteer as a teaching assistant for summer programs are common and so this training goal would not require any special accommodations. Beyond one-on-one meetings with my mentorship team, I will also attend an fMRI journal club for the Temple University Brain Research & Imaging Center (TUBRIC) which is attended by many other professors and researchers at Temple who will be available for personal instruction and consultation as needed. TUBRIC offers a community of researchers at Temple and attending meetings will increase training with access to highly-productive researchers. Finally, I will also supplement my education by regularly attending the conference for Computational Cognitive Neuroscience, which is a premier gathering for cutting-edge computational neuroscience techniques. By attending this conference, I will immerse myself among field-leading methodological experts and develop fruitful working relationships and collaborations to guide my personal development as a neuroscientist employing computational techniques.

*K00 Phase*. During my postdoctoral phase, I hope to extend my computational neuroscience skills and apply them to adolescent populations. The developmental neuroscience field has been slow to adapt some of the more established computational techniques, including RSA, ISC, Hyperalignment, and Hidden Markov Modeling. Yet the precision and nuance that they can offer when studying much of the phenomena developmental researchers are interested in cannot be ignored. As such, I intend to offer my existent statistical proficiencies to an established developmental neuroscience lab to help bridge the methodological gap by testing the validity of and adapting computational techniques to adolescent samples. During this phase of my training, I plan on continuing to attend relevant conferences (e.g., CCN) and identifying additional workshops that I can attend to learn how computational techniques are developed and to explore the work that has already been completed by computational developmental neuroscientists. I intend on helping to develop naturalistic designs sensitive to and engaging for adolescents that can be employed within MRI machines. I will continue to improve and maintain the open-source packages I developed in the F99 phase with the goal of submitting them for acceptance to the official package repositories of R and Python.

**Training Goal 2:Social Adolescent Neuroscience Literature Expertise.** *F99 Phase.* Although my interests in developmental neuroscience emerged early within my graduate research career circumstantial limitations prevented me from developing experience with directly collecting data from adolescent samples. The onset of COVID-19 interrupted my first year of graduate school and delayed my neuroimaging skill-building timeline by over two years. Although I was able to learn a lot of neuroimaging theory and to develop analytic skills by applying them to pre-existing datasets, being the first graduate student of a social affective neuroscience lab that started during the pandemic limited the neuroimaging experience that I was able to develop to that of adults, and thus a sizeable proportion of my theoretical study of the literature had to be directed to adults as well. However, this grant offers me an immensely consequential opportunity to make up for or supplement these lost experiences by providing access to information and resources I could not otherwise reasonably access. As such, my training plan includes one-on-one instruction from my advising team, which includes field-leading experts like Dr. Laurence Steinberg, on social adolescent neuroscience development. Much of the twenty or more hours that I currently spend per week teaching can be redirected to the guided literature review that my mentors and I will engage in to ensure that I develop expertise in this field. My advisors will identify a selection of ground-breaking and precedent setting empirical studies and reviews from the adolescent neuroscience literature for me to critical engage with and discuss during regularly scheduled meeting. This literature review will grow more specific and self-directed in my second year as I prepare to produce a theoretical review of the current work in the field on adolescent responses to and representations of social ambiguity. These one-on-one meetings will be complemented by group meetings as I attend regular events hosted by the developmental psychology area at Temple. This includes talks, discussions, and trainings relevant to developmental psychologists and is well-attended by highly-regard and productive developmental researchers who can offer supplemental guidance and training as needed. Lastly, I will attend the highly regarded developmental neuroscience Flux conference yearly to keep up-to-date with the field and network with potential postdoctoral advisors. I have attended Flux in the past and have greatly enjoyed the content and culture, thus I anticipate that my future postdoctoral advisor might likely attend conferences like this. I will discuss my career goal and options with my advising team as they pertain to research on social adolescent neuroscience to solicit their opinions and help guide my decision.   
  
 *K00 Phase.* During the postdoctoral phase of this grant, I intend to supplement the theoretical knowledge that I had gained during my predoctoral studies with hands-on fMRI experience as I adapt my quasi-naturalistic uncertainty paradigm for application with adolescent samples. I will continue my attendance at relevant conferences such as Flux and attempt to contribute to the field by regularly publishing novel developmental research.

**Training Goal 3: Future Principal Investigator Training.** *F99 Phase.* This training grant will not only improve my conceptual knowledge and skillset, but will also help me develop the auxiliary competencies that are less-often discussed, but just as crucial to a researcher’s success, such as lab management skills, mentorship, networking, grant-writing, and research communication. My mentorship team has devised an exhaustive plan to help me develop in each of these areas and advance my standing towards being a professional scientist Interaction with mentors: Drs. Helion and Chein will closely assess my training goals and milestones and provide immediate feedback on my research and training progress. I have been working with both my mentor and co-mentor and interact with them on a regular basis. Under this award, I will have weekly one-on-one meetings with both mentors, in addition to weekly group meetings as we meet for both independent and joint lab meetings on a weekly and biweekly basis, respectively. This schedule will continue for the duration of my training and will increase with this award. These meetings will be significant as a primary source of training and project feedback. I will additionally meet with Drs. Smith and Steinberg one-on-one once per month to seek their expertise for this project. However, I regularly interact with both, as their physical office locations proximal to my lab and can contact them as needed beyond regularly scheduled meetings. Mentoring opportunities: As a first-generation higher-education researcher from a low-income background, I would not be completing this application as a doctoral student without excellent mentoring. As such, I have a strong desire and moral obligation to continue mentoring others. I already have an extensive mentorship history, having mentored undergraduate and graduate students alike and winning an award from Temple for my efforts. Furthermore, as the director of the Coding Outreach Group (COG), a Bridge Scholar mentor, and mentor for Temple Honors students, I have had ample opportunities to mentor promising early-stage researchers and I intend to continue in their vein throughout my graduate studies. Teaching: I have taught three undergraduate courses as an instructor of record (Intro. to Stat.; Developmental Psychology, twice) and served as an instructor of record for Intro. to Statistical and three Neuroscience courses. Additionally, I develop and lead programming courses and workshops for coders of all levels as director of the COG. Although my teaching duties will cease with this award, my COG commitment will not. Seminars: Temple University holds a neuroscience speaker series of I am the current Chair. Researchers from other institutions spend the day at Temple and I coordinate one-on-one meetings between them and faculty/graduate students with overlapping interests. This allows students to build relationships with experts in the field and grow my network. I will continue these duties. Grant writing and publishing: Academic research converts grant money into scientific discoveries that are communicated through conference presentations and journal articles. Though I have experience with generating and submitting grants, having taken a grant writing class with Dr. Lauren Alloy, I could greatly improve my skills further. My mentor and co-mentor will help me learn how to write effective grants and impactful journal articles which will be a significant requirement that will be met with this training opportunity. Talks: I will present my project proposals and findings at both local and national conferences and meetings, ensuring that I am exposed to feedback on science communication and research methods from a diverse cross section of the scientific community. Local meetings: There are several meetings and seminars which I will attend and offer the opportunity to present my ongoing research at Temple. This includes monthly for the TUBRIC journal club, the Social Psychology journal club, and the Cognition and Neuroscience program area (‘Brown Bag Series’). I will present at SAN and CAB lab meetings one to two times per year and other local Temple meetings, such as the Philadelphia Decision Neuroscience Symposium. Temple and lab PIs have close connections to universities in Philadelphia and surrounding areas which will also give me the opportunity to present at lab meetings of similar research interest. National meetings: I will attend and present my research at national meetings for Computational Cognitive Neuroscience, Flux, and the Social Affective Neuroscience Society. Interactions at these meetings will allow me to disseminate my work to a larger scientific audience and receive invaluable feedback from field experts. Applying for a postdoc: As my PhD training progresses, I will meet with my advisors to strategize on applying for postdoctoral positions, and to learn how to and practice delivering successful job talks. This proposal would be incredibly beneficial as I move towards the end of my graduate training and opening future opportunities.

*K00 Phase.* I will aim to pursue many of the same research activities during my K00 and listed within the F99. I will increase my focus towards grant writing and publishing as well as networking at local and national meetings in order to expand my professional network and the reach of my scientific audience. I will identify labs with shared interests in which I could build collaborations and potentially give talks on my research. I will also attempt to further establish myself as a recognized expert in my particular niche by contributing to relevant journal editorial boards and conference organizing boards to increase my prospects of matching with my ideal R1 institution when creating my own personal social developmental neuroscience lab.

1. **Activities Planned Under This Award**

During the award period, I plan to split my time between research, coursework and workshops, and meetings. I plan to spend 80% of my time on research, 10% of my time on training through coursework and workshops, and 10% of my time on meetings. Below is a table to outline all Training Goals per year and mentorship team applicable to stated goals during the F99 phase.

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| --- | --- | --- | --- |
| **Training** | **F99 Year 1** | **F99 Year 2** | **Mentor(s)** |
| **Goal 1: Learn Computational Neuroscience Methods and Analyses** | 1. Data collection 2. Learn autoregression pre-processing via nltools 3. Learn application of ISC approach via nltools 4. Learn how to model time series data via GEEs in R 5. Attend CCN Conference 6. Apply to computational neuroscience bootcamp (e.g., Neuromatch, MiNDS) | 1. Pre-processing and data analysis 2. Examine neural synchrony of social/ non-social uncertainty and it’s downstream effects on behavior 3. Create open-source library of functions to collect, clean, and analyze video data 4. Present at CCN Conference 5. Learn open-science and data sharing for naturalistic video stimuli data 6. Teach at computational neuroscience bootcamp (e.g., Neuromatch, Neurohack) | Dr. Helion  Dr. Chein  Dr. Smith |
| **Goal 2:**  **Develop Expertise in the Social Adolescent Neuroscience Literature** | 1. Attend FLUX conference 2. Regular one-on-one meetings with Dr. Steinberg (1 hr/month); Guided review of the literature 3. Identifying possible postdoc mentors 4. Attend Developmental Area Meeting (2 hrs/month) | 1. Attend FLUX conference 2. Regular one-on-one meetings with Dr. Steinberg (at least 1hr/month) 3. Interpreting results in the context of developmental literature for future adolescent adaptation 4. Contacting and selecting postdoc mentor 5. Attend Developmental Area Meeting (2 hrs/month) | Dr. Helion  Dr. Chein  Dr. Steinberg |
| **Goal 3:**  **Future**  **Principal**  **Investigator**  **Training** | 1. Regular one-on-one meetings with Dr. Helion (2+hrs/week), Dr. Chein (1hr/week), and Drs. Smith and Steinberg (1hr/month) 2. Attend Neuroscience Seminar Series (2hrs/month), TUBRIC Journal Club (2hrs/month), Social Psychology Seminar (2hrs/month), Cognition & Neuroscience Brown Bag Series (2hrs/month) and enroll in Ethics and Ethical Conflicts in Psychological Science 3. Present for SAN/CAB Lab Meeting (1-2 times/year), Philadelphia Decision Neuroscience Symposium) (1 times/year) 4. Prepare and submit manuscripts for peer-review (1-2/year) 5. Mentor undergraduate students and research assistants in the SAN Lab, researcher through COG 6. Attend and present for local and national conferences (2/year) including SANS, SPSP, and others as possible during funding 7. Regularly discuss career opportunities, applications and the transition to independent research with advisors and experts in the field | | Dr. Helion  Dr. Chein  Dr. Smith  Dr. Steinberg |

Throughout the K00 phase, I plan to spend approximately 70% of my time on research (Pursuing my outlined K00 proposal, publishing my dissertation research), 10% of my time on training through coursework and workshops (Organizing conference symposiums, receiving training from mentees), 10% of my time on meetings (mentorship, journal clubs, project planning), and an additional 10% devoted specifically to professional development, including seeking networking events, interviews, and job talks in anticipation of creating my own lab with the skills and experience I will have acquired from my training. By the end of the K00 Phase, I will have acquired the skills and experience I require to launch my own independent line of developmental research due to the support of this award.