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Interviewing Neuroscientists for an Undergraduate Honors Project

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Honors projects that supplement standard coursework are a widely used practice in undergraduate curricula. These projects can take many forms, ranging from laboratory research projects to performing service learning to literature analyses. Here we discuss an honors project focused on interviewing neuroscientists to learn about individual scientific practice and career paths, and synthesizing the resulting information into a personal reflection essay. We detail step-by-step instructions for performing this type of project, including how to develop interview questions, a sample project timeline, deliverables, learning objectives and outcomes, and

address potential pitfalls. We provide sample interview questions, an interview solicitation email, and in the supplemental materials an example student reflection essay, assessment rubrics, and the transcription of a student-conducted interview of Drs. John Godwin and Santosh Mishra of North Carolina State University. This type of project is a promising method to enable student-researcher communication, and potentially useful to a broad spectrum of both honors and non-honors neuroscience coursework.

Key words: interviews, neuroscientists, honors project, undergraduate, reflection essay, rubrics

Honors programs are intended to enrich, challenge, or in some way accentuate the normal undergraduate experience to allow high-achieving students to fully reach their academic potential and pursue signature passions (Hebert and McBee, 2007; Seifert et al., 2007). From the perspective of neuroscience education these honors programs often enhance one of the five goals recommended for most undergraduate and even aspects of graduate curricula: 1) initiating students in experimental methodology, design and analysis, 2) increasing awareness of specific branches of neuroscience, 3) development of critical thinking skills, 4) enhancing professional communication skills, and 5) understanding scientific ethics (Ramirez, 2005; Wiertelak and Ramirez, 2008; Akil et al., 2016). The specific goals, formats, and activities of undergraduate honors programs are diverse (Austin, 1985; Pflaum et al., 1985; Reed, 1988; Sederberg, 2005; Hebert and McBee, 2007; Seifert et al., 2007; Rice, 2015. This diversity ranges from entire honors undergraduate colleges or majors (for example, the Plan II Honors Program at the University of Texas at Austin; http://liberalarts.utexas.edu/plan2/), to designated honors classes, an honors thesis based upon either laboratory research or a literature review, or specific honors projects that supplement a non-honors course.

Here we concentrate on the use of specific honors projects that supplement a non-honors course. In this format, students participating in a university- or departmental-wide honors program can perform an honors project that extends a specific course that is not offered in an honors format. This supplemental honors project is typically required in addition to the regular deliverables associated with the course. These projects can take many forms, ranging from finite experiments (distinguished from the sustained research effort required for an undergraduate

thesis), the creation of activities for public outreach, to a variety of essays. In this manuscript, we describe an honors project supplementing an introductory upper division neuroscience course. In this project, the student interviewed practicing neuroscientists using personally created questions, and synthesized the information gained with the student's own perspective to create a reflection essay.

This project builds upon previously documented uses of interviews in neuroscience classrooms. The most common use is printed and/or prerecorded interviews of patients and/or medical practitioners in the context of neurological case studies (Meil, 2007; Mickley and Hoyt, 2010; Kennedy, 2013; Been et al., 2016). An interesting extension of this practice was described by Mickley and Hoyt, who first guided undergraduates through published case studies, and then organized student interviews of a patient with a neurological disorder (Mickley and Hoyt, 2010). Other authors have briefly referenced incorporating interviews of neuroscience professionals undergraduate coursework, but few details and no methodology were presented (Dickinson, 2009; Adams, 2011; Lom, 2012). Building on this collective experience, here we extend the use of interviews to incorporate multiple learning goals across Bloom's Taxonomy while concomitantly allowing students to meaningfully explore individual scientific practice and neuroscience career paths. We extensively document step-by-step instructions for conducting interviews, including potential pitfalls, writing interview questions, timelines, and how to incorporate a final reflection essay. We provide examples of actual student work, including interview questions, solicitation emails, and in the Supplementary Materials, rubrics, a student reflection essay written by Catalina Montiel, and interviews of Drs. John Godwin and Santosh Mishra. We

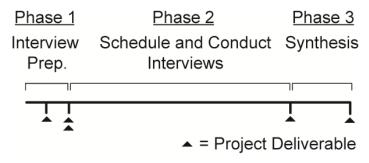


Figure 1. The interview project was formatted into three distinct phases. The first phase focused on interview preparation, and produced three specific deliverables spread across two weeks: a draft list of interview questions generated by the student, a final list of interview questions, and then a practice interview with the supervising professor. The second phase consisted of scheduling, conducting, and transcribing the two interviews. This was the longest phase, lasting 10 weeks, and concluded with one deliverable: the written transcript of the interviews. The final 4-week phase was the synthesis phase, during which the student analyzed the information gained from the interviews into a meaningful final essay. The project ended with the delivery of that essay. Triangles indicate project deliverables.

believe this information will be useful as a successful model for how to integrate student conducted interviews into both honors and non-honors neuroscience curriculum.

PROJECT METHODS AND TIMELINE

Student Admission Level

At NC State, undergraduate studies in neuroscience are provided via the B.S. in Biological Sciences with a Concentration in Integrative Physiology and Neurobiology. Like most universities, a variety of honors programs exist at NC State to supplement this major. Some programs are campus-wide, such as the University Scholars Program. department specific, are such Undergraduate Honors Program in Biological Sciences. What these programs have in common is that they allow high achieving students to design a challenging and individualized program of advanced study. Both programs have strict overall GPA requirements for both program entrance and tenure, ranging from 3.50 to 3.75 on a 4.00 scale. Both campus-wide and department-specific programs also require multiple credit hours of honorsdesignated upper-division coursework. This coursework may either be classes officially designated as an honors course, or a regular course that includes an "Honors Contract." NC State's upper division neurobiology course is not an officially honors-designated course, so the student must personally initiate an Honors Contract with the instructor of the course. The course instructor may then decide whether to proceed with an honors contract with that student. If an Honors Contract is initiated, it must include some sort of supplemental project or learning activity in addition to the regular coursework. In the neurobiology class at NC State, these projects have taken many forms, ranging from posters describing laboratory research projects to creating and performing public engagement activities, to several versions of the project described here, namely interviewing neuroscientists and synthesizing the resulting transcripts into a reflection essay. The Undergraduate Honors Program in Biological Sciences also requires mentored research and/or teaching experience and an undergraduate thesis. These fairly rigorous requirements result in multiple levels of student preselection, producing a limited but high achieving number of students (typically 2-3 in a class size of about 70 students).

Learning Objectives

We elucidated the following learning objectives for this project:

- Learn to create and conduct professional interviews that gather predefined and specific knowledge relevant to the student, both in terms of neuroscience factual knowledge, and conceptual knowledge of neuroscience career paths.
- Integrate and evaluate the information obtained via the interviews to create a personal reflection essay that analyzes common and/or divergent information and themes, incorporates neuroscience knowledge and/or skills acquired via current or pervious coursework, and also how the professional path experienced by the interviewed scientists influences the student's perspective on his or her own future.

These learning objectives fall into the following skills articulated using Bloom's Taxonomy (revised): Knowledge domain, Procedural Knowledge; Cognitive domain, Analyze, evaluate and creation/synthesis (Krathwohl, 2002).

Project Deliverables

This project incorporated five deliverables. The first three deliverables centered on interview preparation – the draft list of interview questions, the final list of interview questions, and then the practice interview. The last two deliverables were the final reflection essay and interview transcripts. Below we describe in detail each deliverable. These deliverables could be easily modified to meet local requirements.

Project Structure and Timeline

The project was organized into three distinct phases, distributed unequally across NC State's 16-week academic semester (Figure 1). The project was intentionally frontand end-loaded, leaving the bulk of the semester relatively free for the student to focus on essential coursework. Each phase ended with at least one project deliverable. The first phase focused on interview preparation. This phase lasted 2 weeks. During this time, the student drafted an initial list of interview questions, which was the first deliverable of the project. This set of questions was critiqued during a meeting between the student and the supervising professor. The student then revised this draft question list into a final version over the course of a week, at the end of which the student either emailed the final question list to the supervising professor or met with the professor in person. The third deliverable of this phase was performing a mock interview with the professor. We

combined this practice interview with delivery of the final interview questions. However, this could be a distinct phase if necessary. After conducting a mock interview, the student was permitted to schedule, conduct and transcribe interviews. This phase lasted about 10 weeks. This was the longest phase, primarily because of the necessity of being flexible with student coursework, interviewee's schedules, proactively planning for potential difficulty in scheduling interviews, and the considerable time required to transcribe the interview. At the end of this phase interview transcripts were due, although alternatively transcripts could be due alongside the final essay. The project then entered its synthesis phase. This final phase lasted 4 weeks. During this time, the student analyzed the information gained from the interviews and wrote a meaningful final essay synthesizing the information. The project ended with the delivery of that essay, which was due at the end of the semester.

Drafting the Interview Questions

Students began by writing a list of questions centered on four broad themes. The themes were provided to the student but specific questions were not. These themes were: "Your path into neuroscience," "Current research," "The field of neuroscience compared to other disciplines," and "The brain and its future." These categories proved useful for the student to generate a set of about 15 draft questions. There are a plethora of published interviews with neuroscientists (Paul, 2004; Paul, 2005; Paul, 2006), and students may be encouraged to investigate these to help write their own questions. This set of questions were then refined by the student with input from the supervising professor to a shorter list of about 10 final questions, which proved more suitable for a 30-minute interview. If shorter interviews are desired, perhaps in the 15-minute range, the number of questions could be reduced. Some questions were multipart, allowing the student flexibility depending on the interview. Here is an example of a set of final questions generated by a student:

- What was your undergraduate degree in? What triggered your passion for neuroscience?
- Who influenced you the most throughout your career and how did he/she lead you to pursue your current work?
- 3. What is an average day like? What types of activities do you do? How has that changed overtime as your career advances?
- 4. Which disciplines do you use more often in your investigations and why?
- 5. Why do you think neuroscience was not considered a field until the 20th century?
- 6. What has been the advantage of neuroscience becoming a field of study instead of a branch of biology or any other discipline?
- 7. How would you rank the importance of neuroscience in learning about the human body compared to other disciplines and why?
- 8. What has been your most important contribution to neuroscience?

- . What are your dreams for the field of neuroscience?
- 10. What aspect of the brain or nervous system amazes you the most? Why?

Students were encouraged to use the questions as a basic framework, with the freedom to substitute other questions during the interview if they proved more interesting. Students were also not required to ask all questions, as long as the interview was substantive. The point was to conduct an excellent interview, not necessarily conform to a predetermined question list.

Mock Interview

After generating the final list of questions, a practice interview was then held between the student and supervising professor. Students could also potentially perform mock interviews with peers or teaching assistants. Mock interviews were helpful for time management, to eliminate redundant questions and refine existing ones, and rehearse professional interview etiquette and conduct. After successfully completing the mock interview, as assessed using the rubric provided in the Supplementary Materials, the student began contacting neuroscientists to arrange interviews.

An alternative to conducting the mock interview with the supervising professor would be for the students to conduct peer interviews with each other. This would be done before the "real" interviews, allowing for practice and also to gain insight on how to best run the interview based upon their own experience. Students could also potentially perform peer interviews near the end of the project, after interviewing the working neuroscientists. This would be a mechanism to push students to self-reflect on their undergraduate neuroscience studies and its application in the professional sphere.

Arranging the Interviews

The student in consultation with the supervising professor first generated a list of 6-8 potential candidates at NC State for interviews. Students investigated laboratory websites, publications, and departmental materials to investigate In our version of this project, potential candidates. interviews were limited to Principal Investigators at our home institution, NC State University. However, there is value in expanding the interview pool to individuals outside of the home institution. These interviews could be performed either in person or remotely, using programs such as Skype. This project could also be expanded beyond principal investigators. Loosening the interview restrictions may allow students to follow their own interests to acquire information most relevant to their career and academic goals, encouraging both inquiry-based learning and self-efficacy. For example, if a student is interested in studying with a professor for graduate school, then this project may be a useful mechanism to learn more about that individual scientist. Students could also potentially interview graduate students and post-doctoral fellows to gain insight into earlier career stages. This project could also be expanded to include non-academic neuroscientists, as many PhD-level neuroscientists do not work in

academia (Akil et al., 2016). For example, students could contact two PhDs working in different capacities in industry and compare/contrast their findings in the reflection essay.

Alternatively, instead of individual students arranging their own interviews, a single neuroscientist could be brought into a group setting. This alternative method would change the nature of the project, but it may be more feasible if this project were conducted for an entire course of students rather than as a supplemental honors project for select students. Another alternative would be to use the available pre-recorded interviews with neuroscientists, archived on both neuroscience-oriented and more general digital libraries and websites (Paul, 2004; Paul, 2005; Paul, 2006; Korey, 2009; Olivo et al., 2015). This approach would require revision of the learning objectives.

Regarding the version of this project described here, interview candidates were contacted by the student either via email or verbally and invited to interview within a 10week time frame. We found this to be a reasonable amount of time to schedule an interview. Two candidates were initially and individually contacted. If the candidate was unable to commit to an interview or was unresponsive to email, then another single candidate was contacted until two interviews were scheduled. The student did not arrange more than two interviews because of the lengthy time needed for transcription. Emails were individually sent to each potential candidate. Emails were not mass mailed to multiple candidates, and we highly recommend that mass email invitations be avoided. We now provide a sample email invitation written by a participating student:

Dear Dr. ___,

Would you be willing to be interviewed for a neuroscience honors project?

I am an NC State Student in Biological Sciences and I am currently taking a class in Neurobiology. To obtain a broader learning experience I decided to do an Honors Project that requires interviewing two neuroscientists from the area. From the project I am expecting to learn about the life of a neuroscientist and how their career has evolved throughout the years. I would like to learn how neuroscientists perceive the brain, and how different it might be from my perspective. I have found your field of study very interesting and I would like to interview you if you have time.

The interview is set up to be only half an hour and we could arrange some time to meet during the next weeks; I would like to have the interviews done by the end of [Insert Month Here].

I appreciate your time and consideration. Have a great week.

Best Regards,

[Student Name and Affiliation]

Conducting and Transcribing the Interviews

Before the interview, the student ensured that she/he knew how to find the researcher's office and building at NC State. The student arrived on time. Before starting the interview, the student politely requested whether the interview could be digitally recorded. The interview lasted no more than 30 minutes, and could potentially be shorter. As soon as possible, the student transcribed the interview. This took considerable time, between 3-7 hours per interview depending on length. Thus, it was important from the perspective of time management to limit the number of interviews and the length of the interview. Speech-to-text software may also be useful for this phase of the project, in order to shorten transcription time. The transcription was returned to the supervising professor as a project deliverable. Example interview transcriptions are included in the supplemental materials.

Final Reflection Essay

After conducting and transcribing the interviews, the student began work on the final deliverable of the project, the reflection essay. In our version of the project, this essay analyzed the interviews for broader themes and allowed the student to think deeply about what she/he learned from the project, either scientifically, professionally, or personally. Given that for us this was a supplemental honors project for an upper-division course, we provided few restrictions on essay format and context in order to allow the student to pursue individual interests. However, depending on the student and learning objectives, the essay requirements could be easily altered. An example student reflection essay is included in the supplemental materials.

Grading the Project

Each deliverable was graded pass/fail with equal weight, given that this was a supplemental honors project. Written and verbal comments/critiques were provided. To assist with assessment, rubrics were developed from previous work (Felder and Brent, 2010; Meitzen, 2015), and are available as Supplemental Material. In our experience it was necessary to include all five deliverables with firm due dates in order to keep the project on track, manageable, and enable multiple instances of formal feedback from the supervising professor. An extension of this project would be to provide quantitative evaluations. To help enable this, rubrics incorporate both qualitative and quantitative evaluation, with a separate category for letter grade.

OUTCOMES

Learning objectives were met for this activity, as assessed by rubric-assisted evaluation of student work, and email-solicited qualitative feedback from the participating students and neuroscientists. The first learning objective was to "learn to create and conduct professional interviews that gather...neuroscience factual knowledge and conceptual knowledge of neuroscience career paths." Student deliverables related to this objective included the draft and final question lists, the mock interview, and the interview transcripts, all of which were assessed using

rubrics (supplemental material). Qualitative feedback relevant to this objective includes the following quotations. "I believe that every student and scientist have a different perception of the field and what it takes to succeed in it. However, in my specific case the interviews allowed me to understand how a career in science is driven by different opportunities and what the researchers are able to learn from them, to then be able to further contribute to the knowledge of the field. This also applies to life and how people decide to accept new challenges and experiences and learn from them." Scheduling interviews was found to be challenging. "Choosing the people to interview, contacting them and actually getting an answer was one main obstacle. I was able to interview only two at the end. Even though interviewing two neuroscientists was the initial goal of the project I believe that having interviewed maybe four, where two focused on one similar area and the other two in another similar area would have given further insight on how different paths in the career give different ways of thinking even though their current interests are the same." Thus, it may be advantageous to perform shorter interviews of more scientists, although the magnitude of the project has to be managed. Transcribing recorded interviews was also surprisingly challenging. "Understanding the correct way in which to transcribe an interview was a must. I was able to guide myself with articles posted online but maybe attending a workshop on campus on how to transcribe interviews or maybe talking to an English professor with knowledge on the subject would have helped." Thus, students may benefit from targeted training in transcription or by employing voice-to-text transcription software.

The second learning objective was to: "integrate and evaluate the information obtained via the interviews to create a personal reflection essay that analyzes common and/or divergent information and themes, incorporates neuroscience knowledge and/or skills acquired via current or pervious coursework, and also how the professional path experienced by the interviewed scientists influences the student's perspective on his or her own future." The student deliverable related to this objective was the final reflection essay, which was assessed via a rubric (supplemental material). Qualitative feedback relevant to this objective was highly positive. For example, "As I was expecting, I was able to see how the approach to neuroscience varied from one scientist to another depending on their specific area of work." "The project and its interviews definitely allowed me to understand in a better way how a career in science is driven and what it takes to succeed in the field, but most importantly in life. As mentioned in the reflection essay, this project allowed me to understand why becoming a neuroscientist is not my desire in life, but medical school is, instead. Even though I work in a neurobiology lab and my major concentration is also neurobiology, this is only a stepping stone in my career, one that has allowed me to discover the scientific world and how science contributes to medicine, my true passion. Therefore, my greatest learning has been understanding that every experience in life has the ability to shape and define who we are. They will change throughout our career and life, but accepting the challenges and learning from each experience is what will allow us to succeed."

Interviewed neuroscientists also found the experience positive. In particular, they appreciated that the interview questions emphasized career paths. "I thought it was...nicely focused on the 'how did I get myself into this?' question - might make things more accessible for students who might have interest, but find the whole endeavor shrouded in mystery still (even I do to some extent!)." A different participating neuroscientist wrote that "[The student's] questions are good but I have two suggestions, and I feel that would help to some extent for choosing a right career path as a student. Questions: As a scientist how does one balance their work and personal life? How is the life of a scientist different from the life of any other professional (either medical or non-medical)?"

POTENTIAL PITFALLS

Three broad pitfalls were encountered in executing this project: elucidating the questions, procuring and conducting interviews, and time management. It was necessary for the student to review interview questions with the supervising professor before contacting candidates. Redundant questions were either eliminated or edited. This was especially important considering that the target interview time was no more than thirty minutes. A second pitfall was procuring the interviews. To mitigate this, the student generated an initial list of 6-8 potential individuals to interview. Working from this list, individually contacting potential candidates was found to be more productive than mass emailing groups of candidates. It was important to give each candidate several days or even over a week to respond, and that the candidate had a significant length of time in weeks during which to schedule the interview. In our case we budgeted 10 weeks, which gave great flexibility for scheduling. Regarding time management, a potential pitfall is exceeding the allotted time for the interview. To address this pitfall, both the number and quality of interview questions were evaluated as project deliverables, and mock interviews were conducted. The student also paid strict attention to time and ended the interview at 30 minutes, even if all the questions were not asked. Attention to time management extended to the overall project as well. Deadlines for the various components of the project were set at the beginning of the semester. These interim deadlines proved useful for keeping the overall project on track.

CONCLUSIONS

Here we describe how to perform interviews of neuroscientists as part of a supplemental honors project. We hope that the detailed methods presented here will prove useful for a variety of course subjects, formats, and levels. Besides being employed as a supplemental honors project, this activity may be useful for senior capstone courses or perhaps freshman seminars. Overall, we feel that interviews generate a meaningful learning opportunity that is easily tailored to fit individual student interest.

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