# Supplemental Material

***CBE—Life Sciences Education***

**Thompson *et al.***

**Biology Research Network Student Interviews, 2015-2016**

*A. Background:*

1. Can you tell me a little bit about yourself, where did you grow up and what was your childhood like?
2. What did/do your parents do?
3. Were you interested in science as like a little kid?
    a. What was interesting to you?
4. At what point did you know you wanted to do science in college?
5. Were your parents supportive of you studying science?

*B. Research Background:*

1. How you got involved with undergraduate research?
2. What do you do in your research?
3. What has your experience been like?
    a. Did you have any particular successes? What about failures?
    b. What were you hoping to get out of your research experience?
    c. Has your research experience given you opportunities you might not have had otherwise?
    d. Has engaging in undergraduate research influenced your idea of like being successful in science?
4. How do you think you rank among like the other people that you work with?
    a. Do other people see you as a scientist? How would they identify you? How do you identify yourself?

*C. Dénouement:*

1. What do you want to do in the future?
2. If you could talk to a freshman, what advice would you give about doing research and just college in general?

**Biology Research Network Faculty Interview Questions, Fall 2016**

*A. Lab Questions:*

1. How many students do you have in your lab?
2. What is your lab's makeup (i.e., undergrad, grad, post-doc, etc.)?
3. How much of what goes on in your lab is related to the Biology Research Network [BRN]?
4. Practically speaking, how do students learn what to do in your lab?
    a. What's been particularly successful (strategies/training)?
    b. What barriers have you faced?
5. How long do students typically work in the lab (meaning semesters, not hours)?
6. Does their role/position change over time?

*B. Faculty: Student Relationships and Student "Success:"*

1. When do you consider your students "successful" in the BRN?
2. *Card Sort.* Provide them with notecards with each student name on a card. (Skype/phone interviews will use a list of students.)
    a. Can you group the students for whom you've written letters of recommendation?
    b. Can you group the students who went onto graduate school?
    c. Can you group the students who went into fields of science?
    d. Can you group any students you developed strong relationships. Why these students?
        i. Have those relationships helped students have opportunities they may not have had otherwise? Can you give me an example?
    e. Do any of these students really stand out as particularly successful? Tell me about one.
        i. How, if at all, did their experience with the BRN contribute to this success?
    f. Do any of these students really stand out as leaders/strongest in the lab?
    g. Did any of these students have a particularly difficult time in the lab/work in the BRN? What happened?
3. Are there students that brought unique life experiences that contributed to the BRN in unexpected ways?
4. Whether there were students that made you think of things in a different way? Made you think about the BRN differently?
5. Have students brought innovation to the BRN (culturally or scientifically?) How?
6. *Diversity:* Have you had students from underrepresented groups [minority or first generation] working in the BRN?
    a. What do you think their experience was like in the BRN?
    b. Were there particular supports that these students needed -- or you noticed they needed? Were you able to provide them with these supports? (If not, what were you able to direct them elsewhere?)
    c. Did you go out of your way to recruit underrepresented students?

**Biology Research Network Student and Faculty Code Table**[1]

| Code Category | Code Name | Brief Code Description | Student and/or Faculty |
|---|---|---|---|
| **Science Identity** | SREC-Scientist[2] | Self-Recognition as scientist or "science person" | S/F |
| | SREC-SciLove | Self-Recognition through "love of science" | S/F |
| | OREC-Non-science | Recognition by non-science others | S/F |
| | OREC-Science | Recognition by meaningful science others (teachers, faculty, influential others, etc.) | S/F |
| | OREC-Peer | Recognition by peers | S/F |
| | OREC-Grades | Recognition through grades | S/F |
| | REC-Positive | Positive recognition | S/F |
| | REC-Negative | Negative recognition | S/F |
| | REC-Little | Little/no recognition | S/F |
| **Other Identities** | IDEN-Gender | Identified gender | S/F |
| | IDEN-Ethnicity | Identified race/ethnicity | S/F |
| | IDEN-Religious | Identified religion | S/F |
| | IDEN-FinancialSoc | Identified financial position | S/F |
| | IDEN-Academic | Identity as academic | S/F |
| | IDEN-Political | Identified political status | S/F |
| | IDEN-Underrepresented | Identified as underrepresented student | S/F |
| | IDEN-Sexual | Identified sexual orientation | S/F |
| **Science-Related Cultural Capital** | CAP-Passive[3] | Exposure to science capital through household and social world (i.e., development of the "taste" for science | S/F |
| | CAP-Active[4] | Participation in scientific activities (i.e., development of the "practice" of science) | S/F |
| **Project** | PROJR-CURE | Participation in Course-based | S/F |

[1] Codes based on the following resources: Bourdieu (1997[1986]), Holland et al. 1998; Wenger 1998; Lareau and Horvati 1999; Rugget 2002; Carter 2003; Lareau 2003; Bourdieu 2004; Yosso 2005; Tonso 2006; Carolone and Johnson 2007; Johnson 2007; Hunter et al. 2007; Laursen et al. 2010; Thiry et al. 2011; Chang et al. 2011; Chemers et al. 2011; Johson et al. 2011; Carlone and Johnson 2012; Carlone et al. 2014; Hazari 2013; Gazley et al. 2014; Archer et al. 2015; Thompson et al. 2015, among others.

[2]**SREC-Scientist** included coding for both student *and* faculty discussion of how they perceived themselves and their students as scientists.

[3] **Sub-codes for CAP-Passive included:** Family science habitus (science education/career), family and community attitudes toward science, access to formative individuals, exposure to scientific activities, inclusion in scientific activities (including institutional opportunities), and exclusion from scientific activities (including institutional barriers).

[4] **Sub-codes for CAP-Active included:** Doing research; participating in scientific discourse (including technical description of work on the project); creating professional products (reports, posters, manuscripts and articles, and presentations); participating in extra-curricular science; engaging with non-scientists about science; consuming science-related media; and providing leadership in scientific activities.

| | | | |
|---|---|---|---|
| **Participation** | | Undergraduate Research Experience (CURE) | |
| | PROJR-Access | Students' recruitment or access to the BRN | S/F |
| | PROJR-Compensation | Project Compensation | S/F |
| | PROJR-MEN-Instrumental | Instrumental mentorship (e.g., academic; career; training) | S/F |
| | PROJR-MEN-SocEm | Socioemotional mentorship (e.g., emotional and social support) | S/F |
| | PROJR-PeerTrainee | Received training from a peer | S/F |
| | PROJR-PeerTrainer | Served as a peer trainer | S/F |
| | PROJR-Collaboration | Collaborated with peers or faculty | S/F |
| | PROJR-Culture | Discussion of lab and/or CURE culture | S/F |
| | PROJR-Competence[5] | Described competence with science | S/F |
| | PROJR-Leader | Described student as leader | F |
| | PROJ-Learn | Description of how students learned | F |
| | PROJR-Recruitment | Description of student recruitment | F |
| | PROJ-Successful | Student successes | F |
| | PROJ-Challenge | Student challenges | F |
| | PROJ-InnovationStudent | Student innovation | F |
| | PROJ-InnovationFaculty | Faculty innovation | F |
| | PROJ-Background | How faculty began involvement with BRN | F |
| | PROJ-Advice | Advice for faculty BRN newcomers | F |
| | PROJ-Role | Description of role in BRN | F |
| | PROJ-Future | Future projections for BRN | F |
| **Motivations** | MOT-ScienceValue | Participation in science for science value (i.e., its own sake; knowledge) | S/F |
| | MOT-SocValue | Participation in science for social value (i.e., chance of doing good) | S/F |
| | MOT-EconValue | Participation in science for economic value (i.e., value to themselves or the market) | S/F |
| | MOT-Career | Participation in science for career aspirations (i.e., gaining degree, graduate school, and/or career) | S/F |
| | MOT-CareerScience | Student pursuing career in science | F |
| | MOT-Career Other | Student pursuing career in non-science | F |
| **Capital** | CAP-Strategy | Capital strategy | S/F |
| | CAP-CapEx | Capital execution | S/F |
| | CAP-Social | Social capital | S/F |

[5] **Sub-codes for PROJR-Competence included:** Science ownership (e.g., independent project); science practice (e.g., developing skills); project success; project failures; and project contribution and innovation.

| | | | |
|---|---|---|---|
| | CAP-Institutional | Institutional capital | S/F |
| | CAP-Alternative | Alternative capital | S/F |
| **Other** | CC-Personal | Discussion of personal interactions with peers or faculty | S/F |
| | CC-Paradox | Paradox | S/F |
| | CC-Counterex | Counter-example of any codes | S/F |
| | CC-Quote | Great quote | S/F |
| | CC-[Student Name] | Name of student indexed | S/F |

## Cultural Capital Domain Rubric

| DOMAIN | LOW CAPITAL | MID-LEVEL CAPITAL | HIGH CAPITAL |
|---|---|---|---|
| **INTEREST IN SCIENCE**<br>Student's description of their interest in science | ***Not interested in science***<br><br>"I wasn't really *in* to anything in high school. I didn't really enjoy it at all and didn't want to go to college" (Sean). | ***Interest in science comes from inspirational teacher***<br><br>"And then I really, really liked my biology teacher in high school. The AP biology course and I loved her. She was excited about *science and biology* and made it so fun that that's how – why I wanted to major in biology" (Sabrina). | ***Interest in science coming from curiosity about the natural world***<br><br>"I've always just loved science classes, it's always just interested me. But I think part of the reason why is…there's a big creative side of me and I just like to explore it and see where something goes…I kind of like the mechanical part of it and then that kind of transferred over into like science…But the idea of just like discovering something has always been there if that makes sense" (Shelby). |
| **EDUCATION & CAREER ASPIRATIONS**<br>Student's aspirations for further education and career in science; desire to translate science experience into a research career | ***Aspiration to non-science career; Unaware of careers in science***<br><br>"Honestly, I think what I didn't realize coming into this, that was kind of eye-opening, was the fact, 'How many awesome job opportunities are out there?' Working in a lab, even if it's just as a lab technician, I didn't realize that lab manager was a thing and could be a thing" (Simone). | ***Aspiration to professional training and/or health science careers***<br><br>"I was originally pre-med and just last semester I switched it to pre-pharm… so I'm applying to pharmacy schools now" (Sophia). | ***Aspiration to graduate education and/or research career in science***<br><br>"I really want to be a doctor but like starting work with unPAK, like I realized I really like research. So I kind of want to do some type of medical research with infectious disease" (Sarah). |
| **FAMILY SCIENCE EXPOSURE**<br>Household attitudes and exposure to science, and family members with science-related careers | ***No or little science exposure; non-science careers; familial obligations***<br><br>"I don't know if I had any like experience with science outside of the classroom. […] Neither of my parents are scientists... my mother is a cashier at Kroger and my dad is a retail owner, so he owns like a gas station" (Sophia). | ***Mid-level science exposure; science technician careers***<br><br>"My dad's a radiologist tech, my mom, she's a nurse. So you know, they kind of know a little bit about science and you know, I was in that sort of environment, you know, growing up" (Sheldon). | ***Strong exposure to science; research or advanced science careers***<br><br>"Both my dad and my brother are in computer science [PhD]" (Sadie). |
| **RESEARCH ACCESS**<br>Student's access to the biology research network | ***Did not seek research experience; was invited or encouraged to join***<br><br>"The – actually the only reason I got involved with [the network] is because [Dr. Fatima] who had previously had for my [biology] lecture teacher, she actually sought me out to get me to join it" (Sierra). | ***Institutional programs motivate or broker research experience***<br><br>"I really love [biology] classes, so that's why I get into the [bridge] … exchange program. And then I took classes at [Northeastern College]. And then I came back … during the summer for internship with Professor [Florence]" (Selena). | ***Individually sought out research experience***<br><br>"I read through all the biology professors in the … biology department to see what research they were doing because I knew I wanted to do some kind of research and hers seemed interesting. And then I approached her and then I guess it worked out in the sense that like she had positions available and I was interested in what she was doing" (Serichai). |
| **PRACTICING SCIENCE**<br>Student's development of a practical sense of day-to-day work of science | ***Bored with the mundane aspects of research***<br><br>"I guess I was just a little turned off by all the lab work and the tediousness of all that was probably the biggest thing" (Sean). | ***Recognizing the importance of day-to-day practice; slow build up of knowledge***<br><br>"But I think now science is more about like let's, you know, observe this. Maybe it'll have an interesting effect, maybe not. And it's being skeptical about things and realizing that you have | ***Excited about the prospect (and work) of "figuring it out" and importance to larger scientific goal***<br><br>I think a lot of people think that like oh, if I want to make my mark on the scientific community, I have to do this grand big thing. That's not |

| | | | |
|---|---|---|---|
| | | to replicate, even though people don't necessarily want to replicate. And how eureka moments don't really happen … science isn't a big moment, it's a stepping stone in the right direction that [sometimes] ends up being wrong" (Shawna). | necessarily true. Even though I'm part of this – like I'm a very, very small part (laughs) of this big thing, you know, it still could make a difference, you know? So it doesn't have to be really large, it's kind of like the little things I guess that count" (Shelby). |
| **SCIENTIFIC OWNERSHIP**<br>Student's ownership or agency over their research, including innovating project protocols, and making a contribution to science | ***Workhand***<br>"Like [I] try to do my best…harvesting in a way that we can have amazing results, we can have real results that can be put into a graph. Like kind of doing my best to make this project grow and be successful" (Selena). | ***Sense of contribution to the broader scientific goals***<br><br>"…it is a process and it's not just an end goal, … It's not just I gathered this information, now we're going to write the paper, now the paper's published, so now we're done. It's constantly like we're doing something with this information" (Sophia). | ***Development and pursuit of independent research***<br><br>"They [faculty] wanted us all to do individual research projects…So I had to find out a project that would work for my 20 hours a week that was still doable, manageable and let me still work on the normal [network] stuff along with my side project. So Dr. Frank told me about a couple different options and I worked with one of them… I wanted to try to sow out some seeds that had issues with germinating…So I wanted to try that. I had like five out of 30 grow (laughs), so that's not the highest success rate but the protocols that I started for the auger itself have now been used by [other students] and we even did one for the normal [network] farm" (Sage). |
| **LEADERSHIP IN THE LAB**<br>Student's leadership role in the lab and among other students | ***Little leadership; content to contribute***<br><br>"…working on one project doesn't make me like – like suave in the field of research and knowing everything I'm doing. … I only know what I'm doing because [Dr. F] tells me what to do, so (laughs) you know, I don't think I could ever like – after this be like, 'Oh okay, I can totally do this completely by myself,' so" (Shea). | ***"Showing" or teaching others***<br><br>"I didn't realize how much I had learned until I had to go back and teach him. So it was like– I really do understand this concept, I really do understand how to do this. … Because if you can't explain it to someone else, then you don't know it as well as you think you do" (Shreya). | ***Leader in the lab; takes initiative***<br><br>"I was the leader over them in regards to like my project. So basically whenever I needed someone – something done or whatever, if someone was looking for, you know, work to do, they would basically come to me and I would, you know, tell them what needed to be done, how they were to do it, you know, give protocol, things like that. And so yeah, I was the leader of my own project. Not necessarily on other people's projects that were going on in the lab. But yeah, I did have a degree of leadership" (Sheldon). |
| **SCIENTIFIC COLLABORATION**<br>Student's collaboration with peers and faculty | ***No or little collaboration with others***<br><br>"I don't like doing repetitive things by myself. Well, I wasn't really by myself but like you're the only one working on it. There's other people like there but they're working on their own things" (Stephanie). | ***Reciprocity with other students***<br><br>"I think that the collaborative effort is actually what's the most helpful because if someone doesn't know something, someone else might. And if that person knows it, they can teach me and then the repetition of always using, because we're doing so much data, it really drills it in…it's really, really great to have someone there to ask and work around and workshop an idea" (Sage). | ***Collaboration with faculty***<br><br>"Like I'm helping – I'm doing research with [Dr. F] and this is like her work and this is like her job and her passion and I just want to be able to support her in the best way that I can do that and I think the best way I can do that is to make sure that I do what she asks of me, that I do it the best that I can do it, and as like precisely as possible" (Serichai). |

| | | | |
|---|---|---|---|
| **PERFORMING SCIENCE**<br>Student's interaction with others about science | ***Engaging with friends and family about science***<br><br>"Yeah, they're both supportive of me studying science. My dad actually…he'll ask what classes I'm in at the beginning of the semester (laughs) and then he tries to like learn organic chemistry from Wikipedia (laughs) to talk to me about it… and so it's very cute" (Suri). | ***Outreach and class presentations; within-network performance***<br><br>"We all give our own presentation at lab meeting, everyone gives you feedback (laughs). Yeah. Everyone's very involved with everyone else's projects" (Sabrina). | **Professional publications or presentations to the broader field of science**<br><br>"I wanted to kind of know what it was like to do a project, you know, collect the data and then where would you go with that data, because going in, [Dr. Faye] wanted me to be part of the summer undergraduate research thing and at the end of that, you have to make a poster, which I'd never made a poster before. So that was sort of an event in itself because you have to – it's harder than it looks to condense –Everything you've done over four months onto a small PowerPoint thing that gets turned into a poster" (Shawna). |
| **USING SOCIAL CAPITAL**<br>Student's capitalization on faculty connections to other science professionals outside the network | ***No relationships brokered***<br><br>"There's a lot of professors that I've talked to and they're all really helpful but it's just like none of them do exactly what like I'm really interested in and they're just like you should like email like people from other universities so they can help you but it's like – I don't know. No, I don't have like a mentor but also I – I don't know. I just think it's like really weird to be like – they're so much older than me and it's just like really weird for me to have like a closer relationship to people that are like older than my parents" (Stephanie). | ***Accessing connections to other faculty/labs within the network, and non-professional/educational***<br><br>"I've definitely developed a relationship with several of my professors, particularly [Fiona]. She's my independent study advisor and so we spend a lot of time together … And two of the other researchers who are – well, PIs who are on the grant, Dr. [Fred] and Dr. [Frank]. I took a class with Dr. Frank and so I talk to both of them a lot but not as much as [Fiona.] And there is a couple grad students who are in the lab that I hang out with and talk to about random things but also like the work I'm doing and their projects and stuff like that, so yes, I have developed those relationships." (Sarah). | ***Accessing professional or educational connections beyond the research network***<br><br>"[Dr. Florence] basically was like, 'You know, it's good for you to get experience in more than one lab, so here's this program. You'd probably be a good candidate. Why don't you see if there's someone you want to work with?' She gave me a list of names of people in [another state] that she thought I might be interested in.<br>… So she found the program and pointed me towards the P.I.s" (Samantha). |
| **EMBEDDEDNESS IN LAB & FIELD**<br>Student's connection to the lab and beyond to the broader field of science | ***Detached***<br><br>"I've been doing summer research and [Dr. Flynn] said, 'Hey, you did this project, will you come to [this project meeting]?' And I said yeah. I'm not really-- I feel bad because I don't do constant research on this like y'all do. I'm just here to sort of represent the school" (Santiago). | ***Lab as a home-base***<br><br>"…another thing that [the biology research network] has done for me is being an older transfer student, meeting people, meeting–making friends through the school has been really, really difficult and now I feel like I don't have that issue because I have a good network of people to work here. I've had people in every single class – like almost since I've started working here, I've had someone from [the biology research network] in every – in one of my classes, if that makes any sense, because it's a small school. It's not like a massive school. So we all see each other…So it's – it's helped me feel weirdly less alone in this college" (Sage). | ***Building professional relationships beyond the lab***<br><br>"[The project manager] was a saint and I emailed her constantly --figuring that out. And then I went to [Southern College]…I went down there for a couple days and spent time in their lab, … figured out kind of what the project was about. Because before, we didn't really have an understanding really… so that's why I went to [Southern College] to figure out more about the project. And they really got me like acclimated to everything. So I did everything. I did all the measurements all by myself, so it was long days in my lab" (Sabrina). |