

*Resisting the Western Scientist Inside and Outside
of the Collegiate Biology Classroom*

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Abstract

In this thesis, I explore how conceptions of western science and scientists invade the Swarthmore Biology department and how it impacts BIPOC students inside and outside the classroom. The findings indicate that BIPOC students are routinely harmed by many ideas conceived from colonialism. However, both students and faculty demonstrate resistance inside and outside the classroom. Inside the classroom, faculty members build strong relationships with students in small communities and negate Western science's claim of objectivity. Outside of the classroom, programs like the Biology Big Sibling-Little Sibling program are recentering BIPOC students and their lived experiences, effectively creating a community where BIPOC students can safely exist.

Dedication

First and foremost, this thesis is dedicated to my parents, siblings, friends and mentors. Without their unending support, my own path in biology would have been much more difficult and challenging. Their guidance navigated me through the toughest moments and led me to find a true calling in life. It goes without saying that I would not have pursued a biology major and even a college diploma without them.

This thesis is also dedicated to all the students of color that have walked through any Natural Sciences and Engineering departments since their conceptions. Their rightful presence has created the space for individuals like myself and many others to call out injustices, and to fight towards a department that values and treasures all of our beings.

Finally, I dedicate this paper to all of the members of the Biology Diversity Student Group. Your critical care for the department and your desire to improve the department for future students gave space for this paper to develop. Your work laid the groundwork for student-department accountability that allowed the Big Sibling-Little Sibling Program to form.

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I would like to express my sincere gratitude to all of those who allowed me to listen to their stories from the formal to the informal ones, the lengthy to the short, and the happy to the sad. All of these stories of resistance have allowed students like myself to navigate through unwelcoming and harmful spaces towards our own paths of resistance. It cannot be understated that the power of a story is what has allowed this thesis to come to fruition.

Secondly, I want to thank my two wonderful advisors, Liz and Edwin.

Edwin, your unrelenting criticality and resistance to the institution and these systemic problems has truly inspired much of this thesis. I can only hope that one day, I will be an educator much like you who inspires students to reimagine our world and what it could be. Thank you for all the wonderful conversations and for being a true model of educators fighting for decolonization.

To Liz, there are not enough words to describe the immense gratitude I have for you. It goes without saying that you are one of the best mentors I have ever had. My experience in the Biology department and even at Swarthmore would have been so much more difficult without your constant support. Your authentic care reminds me that the Biology department has so much love in it and that students like myself do belong within that space.

Lastly, I thank my parents. Their sacrifice, their resilience, and their creation of community in a foreign country taught me the importance of standing up for yourself and your communities. I would not be the person I am today without their love and support. *Les agradezco todo lo que han hecho para ayudarme llegar a este día y espero siempre ser su orgullo.*

Introduction

In this thesis, I will explore the ways that societal constructions of western scientists are either resisted or perpetuated in the field of science, and its impacts on Black, Indigenous, and People of Color (BIPOC) students. To conduct this research, I will utilize Bronfenbrenner's Ecological Systems Theory (2005) to understand how the Biology department at Swarthmore College can be a looking glass into this social reproduction. Bronfenbrenner's framework describes a series of interacting concentric circles surrounding the individual with each circle representing different systems: Microsystem, Mesosystem, Exosystem, Macrosystem and Chronosystem. I propose that the Biology department operates at the Microsystem and the Mesosystem, while the societal constructions of western science and scientists reside in the Macrosystem. These systems are in constant interaction with each other, and as such exert influence onto one another. Thereby, Microsystems and Mesosystems are environments where the Macrosystem can reproduce itself, meaning we can understand how societal ideas can reproduce themselves in classrooms or departments.

To investigate the reproduction of western science and its implications for BIPOC students in the Biology department, I will examine the question: What is the status of the application of internal and external practices to divest from the ascription of a western scientist in the context of the Biology Department? For this research, I will categorize a western scientist as a person who is indoctrinated into the field of western-European-science. The western scientist views science as an objective subject that maintains a position of neutrality. Moreover, the "objectivity" of science allows scientists to deem their knowledge production as a rational project, thereby viewing all other knowledge as irrational (Reiss & Sprenger, 2020).

This investigation will take place in two Microsystems spaces within the Mesosystem that is the Biology department: the Biology Big Sibling-Little Sibling Program, a mentorship program, and one Biology classroom. Initially, the exploration's sole focus was the mentorship program, but there was a missing component to the thesis. Given that the thesis is exploring ideas of social reproduction, it is necessary to also investigate the social reproduction of western science in the classroom. Moreover, mentorship programs are often posed as the solutions to retention problems as they support students during transitional periods (Posa, 2011). However, mentorship programs cannot solve institutional or societal issues; they can at most create safe spaces for students and communities of support (Rawana et al, 2015). The scope and perspective of the thesis would be greatly limited if the only space investigated was the mentorship program. Therefore, my thesis needed to attempt to explore the classroom setting from a fuller perspective.

This work builds on the efforts and experiences of many students of color that have walked through the biology department, including myself and primarily the Biology Diversity Student Group (BDSG). A group of students formed the BDSG after the events of George Floyd following during the summer of 2020. This group of biology and former biology students from the class of 2021 and 2022 decided to form to address specific problems in the department related to the experiences of BIPOC students. In its mission statement, the BDSG demonstrates its intent to voice marginalized students' experiences in the department to bring about systemic change.

The purpose of this student group is to take concrete actions to better support underrepresented students, especially Black and Indigenous students, in the Biology Department. The group will be guided by the conviction that supporting these students should be a main goal of the department as opposed to an add-on or side project, and that

this will require systemic changes and long-term commitment to this goal. Students in the group are dedicated to synthesizing experiences from many students as well as research on successful initiatives at other institutions to create and advocate for changes in the Swarthmore College Biology department, Natural Sciences Division, and the broader college community (BDSG, 2020).

In many ways, this thesis continues their work of bringing to light the voices of marginalized students through semi-structured interviews with current Biology students and faculty. I conducted six interviews with three Biology Big Siblings, two Biology Little Siblings, and one faculty member. The interviews were conducted to understand the current state of the Biology Big Sibling-Little Sibling program, to evaluate the impacts and practices currently happening in the program and the classroom, and most importantly, to listen to the voices of those that are often pushed to the periphery.

This thesis presents itself in the following manner: Introduction, Literature Review, Background, Methodology, Results, Discussion, and Conclusions. The Literature Review was conducted to understand how western science represents and validates itself to society, and to explore whether mentorship programs have successfully created refuge spaces for BIPOC students (Mamdani, 2019; Elshakry, 2010). The literature points to colonial roots of western science and its usage of knowledge and objectivity as validation mechanisms that further entrench western science into a necessary and dominant component of society (Wane et al., 2004). The literature review also determines that mentorship programs can create safe spaces for BIPOC students and points to the potential benefits of that space.

In the second section, the Background, I contextualize the problems that the Biology department faces and introduce the initial solution proposed, the Big Sibling-Little Sibling

program. The Methodology section notes and justifies all of the methods regarding data collection and data analysis for the literature review and the thesis. In the Results section, I introduce the Biology Big Sibling-Little Sibling Program and discuss the themes present in their interviews of the Big Sibling, Little Siblings, and faculty. In the Discussion portion, I will evaluate whether there is divestment from the western scientists in either, both, or none of the two spaces. And finally, the Conclusions section will synthesize the findings of this paper and situate them within the larger field.

This thesis is not ethnographical, but I would like to highlight, at least once this thesis, that just as much as this thesis serves as a tool to spread the voices of marginalized students, it is also a way to spread my own. I am a first-generation, low-income, Mexican-American student who borders the Education and Biology Department. My personal view of belonging in the Biology Department mirrors the experiences of other mentors and mentees. It was emotionally challenging to reflect on my own experiences throughout the formation of the thesis. However, it reminds me of my original intention: to start the seeds of change to make the Biology Department a welcoming and safe space for all students such that no other marginalized student leaves harmed again.

Literature Review

Our entire understanding of our world is situated in the colonial context. That is the world we know today is colonized: our minds, our spirits, and the lands on which we reside. The colonial structure impacts and influences all aspects of our lives, and education is not exempt from this truth. In fact, higher education is a system that reinforces colonialism and is a mechanism by which colonialism sustains its grasp on us.

Therefore, the primary purpose of this literature review is to understand how colonialism invades higher education, specifically the sciences and who we deem is a scientist. The literature review will define the context of the Swarthmore Biology Department, and set up a framework and structure by which to evaluate the Biology Big Sibling-Little Sibling Program, a mentorship program developed to primarily support BIPOC biology students. Additionally, a portion of this literature will serve to learn about decolonial frameworks and decolonialism, as much of my paper deals with colonial impacts. In my opinion, it is necessary to understand and learn about decolonialism as just as colonialism exists, so does decolonialism. This literature review will be used to answer the following research questions: how do higher education institutions support the colonial structure and perpetuate the notion of a western scientist and scholar? The second question, what is the role of mentorship programs in creating safe spaces for BIPOC students within institutions, and how can we evaluate their success?

Defining Decolonialism

At different points in time, decolonization was used differently and till this day it is constantly evolving. There are definitions in regard to decolonizing the curriculum, “the liberation of thought from the fetters of cartesian duality,” political decolonization, political independence from colonial nation, or as stated above, “long-term process involving the

bureaucratic, cultural, linguistic, and psychological divesting of colonial power” (Le Grange, 2016, p. 8; Smith, 1999, p. 98). Furthermore, since colonialism is a global issue, the literature on decolonization is global as well. Thus, it goes without saying that the global perspectives on colonialism will be nuanced.

To begin this section, we will start with the history of anti-colonialism and decolonization. Betts (2012) states that historians believe the first act of decolonization, defined as political independence, was initiated in Haiti through the Haitian revolution. This revolution “freed” Haiti from the French colonial rule in 1791, not without leaving lasting effects. Haiti’s current economic situation, due to being forced by France to pay reparations for the emancipation of slaves, is a clear example of the long term effects of colonial violence even after “decolonization.” Then, around two hundred years later, the second wave of decolonization began in the 20th century. The aftermath of the World Wars left many colonial powers weakened. Along with increased resistance to colonial rule and the UN’s *1945 Declaration on Decolonization of Granting Independence to Colonial Countries and People*, the “end” of colonialism began (Betts, 2012).

This so-called decolonization was criticized by many including Fanon (1965). Fanon agreed that with decolonization came a new nation, but that it was more than that. He posited that decolonization was a violent process where “the replacing of a certain ‘species’ of men by another ‘species’ of men” (p.33). Fanon means that a new social order would replace the social order imposed by colonial rule, where the once colonized people would dominate the social hierarchy. He remarks that this would be “complete disorder” (p. 36). This decolonization would be chaotic because it enacts the complete opposite of what has been normalized, essentially flipping the normalized social hierarchy on its head. Following these initial critiques of

decolonization, as a practice of political independence, came economic and cultural critiques (Betts, 2012).

Thiong'o (1984) follows Fanon in creating more critical definitions of decolonization. He views a struggle within our reality between imperialism and defiance or resistance, and that the greatest weapon held by imperialism is what Thiong'o calls the *cultural bomb*.

The effect of a cultural bomb is to annihilate a people's belief in their names, in their languages, in their environment, in their heritage of struggle, in their unity, in their capacities and ultimately in themselves (p. 3).

With this term, Thiong'o demonstrates that decolonization requires more than just political independence, it requires decolonizing and relocating the cultural identity of the indigenous world. Additionally, this *cultural bomb* has now affected who we are today. The *cultural bomb*, "annihilated" people themselves, and in its stead placed the Eurocentric one. Therefore, Thiong'o states that "we have to coldly and consciously look at -- what imperialism has been doing to us to and to our view of ourselves in the universe" (p. 88). In other words, decolonize ourselves. This marked the transition to more modern definitions of decolonization and anti-colonialism.

Modern decolonization and anti-colonialism discourse moves past the politics of nation-states and into discourses on the Euro-centric and the "other". It also begins to create spaces for a focus on social inequalities such as racism, classism, and so forth, and their interrelatedness resulting from colonial violence. For example, an anti-colonial discursive framework aims to realize the interlocking nature of various systems of oppression and rejects the privileging of any one single site over and above others.

Such a realization comes from acknowledging that our social lives are profoundly affected by the relations of power and domination, which are oppressive and colonial by nature (Dei, 2001, p. 311).

Similar to Dei's anti-colonial discursive framework, Wynter (2003) speaks about decolonization as a method to dismantle systems of oppression like race because race is one of the causal effects of coloniality, and to decolonize is to unsettle what was once colonized. These modern definitions and frameworks are posed as possible solutions to societal issues, but one begins to wonder if these are the right intentions to decolonization.

In response to an increase in educators that demand a need to decolonize education, schools, or curriculum, Tuck & Yang (2012) warn of the dangers of using decolonization as a metaphor. If this term is appropriated, it can lead to the opposite of decolonization, where the western is recentered, resettled. Without an understanding of the operations of settler colonialism, decolonization becomes what Tuck & Yang describe as a *settler moves to innocence*:

strategies or positionings that attempt to relieve the settler of feelings of guilt or responsibility without giving up land or power or privilege, without having to change much at all (p.10).

They emphasize that the implications of decolonization include unsettling settlers, that is, for most educators, ourselves. In contrast, to other literature, Tuck & Yang tell us what decolonization *isn't*. They critique those who seek *only* to decolonize the mind and those that use "colonization as a metaphor for oppression," describing those actions as *settler moves to innocence* (p. 20). Those actions ignore the fact that there is still stolen land and that colonialism continues to exist. Hence, Tuck and Yang push for more radical and incommensurable

decolonization that can be difficult to imagine because it requires the settlers to return Indigenous land and life. What this will look like, is a question that is left unanswered by decolonization because it requires us to reimagine.

Based on the literature so far, it seems that decolonization will have different definitions, but there are common ideas throughout them all, including the idea that is pushing against the conceptualization of an “other” and the need to unsettle the settled. The push to recognize that colonialism is endemic to all of our world in multiple manners is another central idea in decolonization. However, what is true is that European ideologies and values were centralized, so for the purpose of this paper, we will understand decolonism to be the unsettling of the hegemonic European/Western thought and power.

Colonialism in Higher Academia & Its Self Preservation

Higher academia and its institutions are centers of western knowledge and as such are vehicles for the continuation of modern colonialism. Modern colonialism is thought of as the second generation or second wave of colonialism where the mind is colonized through different disciplines (La Grange, 2016). Others like Nkrumah (1966) describes modern colonialism or neocolonialism as the final most dangerous stage of imperialism, where the economic and political systems are controlled from the outside, resulting in “foreign capital [that] is used for the exploitation rather than for the development of the less developed parts of the world” (Nkrumah, 1966, p. 3).

The very institutional form of western universities that are characterized by compartmentalization originates from the colonial world. This is highlighted by the start of the notion as the “other” and viewing it as lesser than. When the west renamed itself as the rational man, anyone other than the settlers were forcefully placed in the “other” category and named the

“irrational/subrational Human other” (Wynter, 2003, p. 266). This idea is similar to the concept of the center and its periphery. Not only did the west become the rational man, it also named itself as the center of the “modern” world, displacing all else into the periphery (Dussel, 2011). This centering is not just political, it is cultural and economic, meaning that many, if not all, structures were centered around the western, including knowledge. As Jansen (2019) writes “knowledge is not neutral,” knowledge cannot be isolated from power structures (p. 2). Who controls what is deemed as knowledge are those in positions of authority who in our case are the settlers. Additionally, the power dynamics of knowledge can be thought of as a cyclical process where “knowledge draws its authority from power, which in turn legitimates itself through the authority of knowledge” (p. 2). Therefore, these academic institutions that we value, benefit from colonial rule because it legitimates their own authority, position as the center and their ideas of rationality. Furthermore, the preservation of this form of authority-legitimization in institutions is done in what La Grange (2016) states as “under the guise of academic freedom and institutional autonomy” (p. 5).

Higher education institutions justify their power through knowledge and with that power comes the decision on what content is taught and valued (Mamdani, 2019). It is also from this knowledge as a power framework that the western knowledge has become the only acceptable form. Alongside the erasure and ignorance of Indigenous knowledge and Indigenous ways of knowing, it has become inconceivable for western institutions to think of other knowledge systems as valid (Smith, 1999). Santos (2014) even goes as far as to call this erasure of Indigenous knowledge an *epistemicide*. Meda (2020) highlights this invalidation of Indigenous knowledge by colonial institutional administrators, “[they] viewed IK (indigenous knowledge) as unscientific, illogical, anti-developmental and useless” (p. 91). It is obvious that these

administrators will bring these colonial views into the institution and sequentially, into the curriculum. Therefore, higher education institutions serve as vehicles for colonialism because they continue to indoctrinate students into this system that partake in the *epistemicide* and invalidation of Indigenous knowledge.

Since the very foundation of the knowledge taught at these institutions is settled, Stein (2019) posited that one it would be difficult to even imagine a transformed higher education. Our current epistemological and ontological frameworks constrain us from creating solutions because they are rooted in the colonial. That is why Stein gestures for possibilities “that might exceed what is currently enabled by the organizing pillars of colonial modernity” (p. 144). This is a similar radical notion to that which Tuck & Yang (2012) were proposing. There is a challenge to learn to step out of our epistemological norms and imagine something that may be so different from what we have now. In a similar vein, Wane et al. (2004) speak about reimagining our higher education, but critique that these institutions do not have a space that allows for this action because of the narrow Western perspective.

Both Stein (2019) and Wane et al. (2004) go on to recognize that the productivist and positivist nature of knowledge in relation to power, is a constraint on higher academia. In modern day academia, this relation is portrayed by how power is determined, for instance, “how much money you can bring in, or how much you publish, and so on” (Wane et al., 2004, p. 8). The viewing of knowledge as just a system for production, and production is tied to power because of capitalist ideologies continuing the traditions of colonial knowledge-power structures. The difficulty is that the structure of power creation is entirely normalized, hence disrupting this might be impossible to imagine, bringing us back to the first point Stein makes.

Colonialism also has a built-in buffer because in any attempt to decolonize, many types of actions will arise from those within the institutions due to their own personal views, self-contradictions and positions of power. Andreotti et al. (2015) outlines four different articulations of decolonization that people may take: “the everything is awesome”, soft-reform, radical-reform, and beyond-reform space. The first space, “everything is awesome”, assumes that nothing is wrong such that there is no need for any decolonization practices. The following space, soft-reform, critiques the access to education or inclusion but does not acknowledge the need for decolonization. This is a “tokenistic” practice that is not a substantive decolonization action. The third space, radical-reform, critique the soft-reform space and shift the need to the decolonization of higher education as a commitment to center and empower marginalized groups, address epistemological dominance (i.e Eurocentrism), and redistribute re-appropriate material resources (p. 33).

The limitation of this stage is that there is little change to the normalized ontologies because the decolonizing actions are imagined and practiced in the existing system, where the colonial pillars still remain. The final space is the beyond-reform space where the focus is on normalized ontologies. It is in this space where the meaning of decolonization is equated to destroying modern colonialism’s systematic violences i.e capitalism, racism, etc. Many in this space are skeptical about the possibilities of decolonizing higher education or completely doubt the ability to repair it. People can inhabit any of these four spaces in response to modern colonial violence, and it will be difficult to come to a consensus on a plan for decolonization action if people are in different spaces.

As a society, we value post-secondary institutions for broadening the perspectives and knowledge of students. Nonetheless, higher education positions itself in the center of colonialism

due to its perpetuation of a colonial knowledge system. Ignoring this dichotomy is harmful to not only indigenous peoples, but all people engaged at these institutions as well. By disregarding how colonialism impacts knowledge in these spaces, we disregard who decides what knowledge is or isn't, who this knowledge is for, and what knowledge is shared.

The Western Scientist

Before determining what a western scientist is, we must first understand what western science is and how it came about. Western science is the science that developed in a handful of European countries in the 16th and 17th century (Basalla, 1967). It is now known today as modern science due to the influence of European colonization. As many European countries' imperialism expanded throughout the world, thanks to their technological advancements, they proved the "supremacy" of European science to the countries in which they colonized. Afterward, as the Europeans invaded colonized countries, so did their culture including cultural norms around academics and science. With the addition of missionaries, European science was now globalized and recognized as the only valid definition (Elshakry, 2010).

One of the major reasons that the European definition of science was accepted was because of its philosophy and preference for the "abstract" and the "objective." Objectivity and neutrality are words that are thrown around everywhere in the scientific community, and it is still widely valued. There stands the notion that objectivity is what frees scientists from dealing with personal biases (Reiss & Sprenger, 2020). It is how scientists are able to say that something is a fact or a truth. However, we question whether objectivity and neutrality should be the standard. When we center objectivity and neutrality, we decenter and delegitimized subjective and spiritual knowledges, reinforcing the colonial systems. Wane et al. (2004) describe this phenomena,

Western academic ontology (and epistemology) is based on assumptions about objective, materialistic, and subjective individual and social realities, therefore non-physical spiritual realities are generally not accepted to be universally, objectively ‘true’ phenomena” (p. 505).

This categorization as objectiveness as truth and spirituality, another knowledge form, as not true is the subjugation/colonization of the “other” once again. Decolonizing this aspect of higher education would be difficult because of the institutional culture and pressure “to silence any discussion of spirituality within the halls of academe.” (Shahjahan et al., 2009, p. 65).

To put it simply, western science is European science, and it is not just the practice and notions of objectivity and neutrality, but it also includes the culture of science as well. There is a scientific culture that was created in Europe as well, and we should include it within our broad definition of western sciences.

As for a western scientists, we can point to Basalla’s (2015) definition of a colonial scientist,

If formally trained, the colonial scientist will have received some or all of his scientific education in a European institution, if informally trained, he will have studied the works of European scientists, and will have purchased his books, laboratory equipment and scientific instruments from European suppliers. This training will direct the colonial scientist’s interest to the scientific fields and problems delineated by European scientists [...] Therefore, the colonial scientist seeks the membership and honors of European scientific societies (p. 614).

In this long description of a colonial scientist, we see continuous references to European science, even the interest of a scientist must be in line with that of the European. This description

perfectly represents what western scientists are, they are scientists indoctrinated into a school of thought that centers only the western, otherwise known as the European.

Mentorship Programs as Refuges

Mentorship programs have proven beneficial for a multitude of reasons including improving retention rates, academic success and feelings of belonging (Posa, 2011). However, BIPOC students are a special group of students, whose experiences can greatly contrast those of white students. With that being said, many programs have identified this same idea and have begun to specifically target BIPOC students in the mentoring programs. In particular, a study completed on a mentorship program for Aboriginal university students in Canada, highlights a mentorship program for BIPOC students. Rawana et al. (2015) quote a student who recounted that the mentorship program allowed them to feel as if “[she] were not in a canoe all on [her] own” (p. 21). Her canoe is a representation of a shared space created through mentorship, and alludes to a potential space for refuge.

But why is it that BIPOC students need a refuge space? Many times the desire for spaces of refuge come from the need of BIPOC communities to share stories of harm and to have someone “bear witness to the violent realities that more privileged colleagues may not understand” (Garcia et al., 2021, p. 54). Garcia et al. describe the dangers that BIPOC communities face when they share their stories in the wrong space, and how it leads to even more harm.

In fact, mentorships can create spaces of refuge. Browdy et al. (2021) do not employ a complete mentorship program, yet they still touch on mentorship. They speak about the importance of a space and what it allowed them to do through mentorship,

This space was important because it allowed us to speak freely without judgment, but

also to be able to listen to each other—to hear each other’s different perspectives and ways of coping, navigating, and negotiating the daily obstacles and expectations of graduate school (p. 16).

Browdy et al. perfectly describe what a true refuge would be for BIPOC students, however it is directly related to the strength of connection. These refuges are called “hearts-to-hearts,” and require deep and authentic relationships. In order for peer mentorship programs to successfully evolve refuge spaces would require genuine care and time put into forming and developing mentor-mentee relationships.

Mentorship Program Evaluation Methods

Many mentoring programs use very similar methods to evaluate the benefits of a mentorship program. The majority either use pre and post-surveys to determine causal relationships. This is primarily for academic or retention information. In regards to evaluation of feelings and motivations, studies use a mix of qualitative methods—interviews. The use of interviews allows them to explore the experiences of students and follow up on topics or ideas of interest (Rawana et al, 2015; Miller, 2019). I conclude that it would be best to use a qualitative methods approach to evaluate the benefits and motivations of the Biology Big Sibling-Little Sibling Program at Swarthmore College.

Background

Current Problems in the Biology Department

I want to preface that none of the problems posed exist only in the Swarthmore Biology Department. Instead, many of the issues I will pose are systemic. So, I believe that many of the other departments at Swarthmore also face these same issues. Moreover, the root of the problem also lies in societal constructions of science; therefore, it is a problem within the entire field. However, for this thesis, I will focus on the Biology Department because that is one of the departments that I genuinely care about and desire to improve.

The primary problem that the department faces is that the majority of BIPOC students have experienced harm in the department, including students who have left the department. One of the original goals of the BDSG was to summarize the experiences of BIPOC students who stayed and those who left; we saw that many students described having at least one harmful experience within the department.

The second and potentially related problem is that the Biology department has seen a drop in the retention rate of majors, especially in terms of BIPOC majors. This problem is not within the scope of my thesis, but some of the themes discussed in the paper may serve as possible rationales.

The third problem is that BIPOC students feel that they are not centered in the department. This problem arose from informal conversations with BIPOC students about their feelings related to their identity and the department.

The Potential Solution: The Big Sibling–Little Sibling Program

The Biology Big Sibling-Little Sibling program was founded and created by two members of the BDSG after other BDSG initiatives fell through, in the summer of 2021. The

program was developed in conjunction with the Diversity, Equity, and Inclusion committee (DEI committee) that was formed by the Biology Department to address issues brought up by the BDSG. Two faculty members of the DEI committee volunteered to act as the supporting faculty members of the program. It was decided that the mentorship program is a part of the Biology department rather than applying for a charter as a campus club in order to have more freedom for choices and to create more connections between the program and the department.

The Biology Big Sibling-Little Sibling was first active as a mentorship program in the fall of 2021. Either juniors or seniors in the department that were either Biology, Neuroscience, Biochemistry or Special Biology Majors were recruited as Big Siblings during the summer. In the beginning of the fall semester, sophomores and freshmen were invited to apply for a mentor, and 40 mentor-mentee pairings were created.

The primary intent of the mentorship program was to create a greater sense of community within the department. The secondary goal was to combat feelings of isolation and unpreparedness that many students, particularly minoritized students, have that made them feel as if they did not belong in the department. The reasoning behind these goals was that the program would create a new system of support that could help resist feelings of unbelonging in the department through relationships.

Methodology

For the intent of this thesis, I conducted a literature review and qualitative methods such as semi-structured interviews.

Literature Review

Multiple databases served as sources of collection for the literature review: Education Resources Information Center (ERIC), Google Scholar, and ProQuest Education Database. Google Scholar was used to define decolonialism and initial exploration of the topic for the basic background research. Afterward, several more refined search terms were developed for the investigation into the question of how western science and scientists are validated and constructed in higher institutions. The terms consisted of the following: *Decolonialism, Higher Education, Higher Academia, Western Knowledge, Sciences, Biology*. The same databases were utilized to find sources to answer the second question of the literature review regarding mentorship programs. For that section of the literature review, the search terms included: *Mentorship Programs, Mentoring, College, Higher Academia, Peer Mentorship Programs, and Evaluation*. Many of these terms were combined with "AND" commands, allowing the searches to pull up more related sources.

As for source criteria, there were no such criteria regarding the publication date because understanding the impacts of colonialism requires a historical perspective. Therefore, all relevant and primary sources were chosen based on their relevance to the research question. In addition, there was a research preference for journals specifically related to the themes of decolonialism, such as the journal, *Decolonization: Indigeneity, Education & Society*. The criteria for mentorship programs' sources, mentorship papers centering on BIPOC students were preferred, and documents that had methods to evaluate mentorship programs.

Semi-Structured Interviews

Six semi-structured interviews were conducted and analyzed using an interpretative phenomenological analysis. This analytical method allows the researcher to explore each participants' lived experiences (Smith, 2004). Students were selected for participation in this study if they were either a Big Sibling or Little Sibling in the Biology Big Sibling-Little Sibling Program. There was a preference for BIPOC mentor and mentee participants and for mentor and mentees that often met (often is defined as at least 3-4 times a semester), but it was not a requirement for interviewing. Moreover, sampling for the student participants was not random, and each participant was personally invited to participate. The faculty participants were selected if they had tenure within the department and based on availability. Again, there was no random selection; it was also a personal invitation for participation.

Three of the six participants were Big Siblings. They were either juniors or seniors majoring in Biology or an interdisciplinary major such as Neuroscience, Biochemistry, or Education and Biology Special Major. Two participants were identified as Little Siblings and were both freshmen. Given that they are in their first year, neither of the students declared a Biology major, but both indicated an interest in Biology. Initially, there was going to be an additional Little Sibling, but a replacement could not be found in time due to unforeseen circumstances. As a result, there were only two Little Siblings interviewed. In addition, only one faculty member was interviewed for the thesis.

All of the interviews were semi-structured, and I was the interviewer. The interviews took place either on Zoom or in person. The conversations typically took 30-45 minutes, and they were audio recorded on a cellular device, and audio was also recorded on Zoom for transcription purposes (no video recording was utilized). All participants gave written and verbal consent for

audio recordings. To protect the anonymity of each of the participants, they will be called pseudonyms throughout the paper.

Each of the three groups of participants had different questions to best investigate their perspectives and experiences at different stages in their journey within the Biology Department. However, the mentors and mentees had similar questions for research into the evaluation of the mentorship program.

The six interviews were fully transcribed for a thematic analysis using a coding structure. After reading all interviews for initial broad topics, a basic thematic coding schema was developed. Next, the basic code was utilized to generate broader themes, and sub-themes were created (see Table. 1).

Table 1. Semi-structured interview thematic and sub theme coding with examples.

Themes	Sub Themes	Sample of Coded Text
<i>Existence of Pocket communities</i>		<i>I'm more like interacting with a smaller group of people...</i>
<i>Challenges with cultivating belonging</i>	Participants comment on their academic scores in biology	<i>You know, I got a C in Bio 001.</i>
	Participants state experiencing imposter syndrome	<i>If you already have doubts that are related to like who you are, and every time you get the question wrong or do something wrong.</i>
	Participant highlights authentic science experience	<i>I was really excited. I think at first, for like an opportunity to have my own projects like in the lab component, and to get to ask real biologist questions and stuff.</i>
<i>Institutional supports are required for change</i>	Participants comment on positive impacts of institutional changes	<i>SP [Scholars Program], I really like the way it's formatted. It's just like a really chill environment where you know, we just get together and then you just study. So, I really liked the idea that it's not like an actual class where we sit down, and people just lecture at you.</i>
	Participants mention that there are not enough supports	<i>Or have infrastructure in place where we are paying people to do it. I have all these ideas for Bio but I don't have the time or person power to even organize changes.</i>

Results

Three main themes were identified in all six of the interviews, and this section will discuss how those themes appear in each of the three groups.

Existence of Pocket Communities

A common thread throughout all the interviews was that students found it hard to point at a large community in the Biology department, which was true within the Big Sibling–Little Sibling program. They routinely mentioned that they did believe that community existed, but that it was a smaller community that did not include all students, or as one Big Sibling described it, "but it is a community divided." Big Siblings specifically describe the existence of smaller communities, such as research labs, relationships with professors, and groups composed of friends within the department.

Big Siblings, who had research experience, felt that research labs were spaces where they could develop relationships with other students, professors, and other researchers. Peer or professor connections made in labs were sustained even after the conclusion of their time in the labs. Nevertheless, professor-student communities can still exist regardless of research experience. Riley, a Big Sibling, mentions that talking to some professors, particularly their advisor, about topics beyond academics allowed her to feel comfortable with her advisor.

Like the Big Siblings, the Little Siblings' interviews indicated similar notions of missing a large community while acknowledging that a community exists in the Biology department. This theme appeared when students described being familiar with few people in the department apart from the handful of introductory Biology students and faculty, primarily due to their short time being part of the department. The trend of pocket communities continued in the Big Sibling–Little Sibling program. Students felt deeply connected to either their Big or Little, but

those connections did not extend to other pairs in the program. As Riley puts it, "I know my mentee [Little Sibling], but I do not know any others, but like I wish I did." Other student participants echoed the same sentiment, recommending that the program hold larger events so that they could meet more of the pairs.

The Little Siblings described a different pocket community: the Scholars Program (SP). SP is an attached course to both introductory courses in Biology with a faculty to student ratio of 12 to 1. The class is meant to be additional support for students in the large introductory course, and with that, it is marketed towards underrepresented students. Both Little Siblings continuously made positive comments along the lines of "I enjoy it" or "it is fun." They felt supported within the space, and Cam, one Little-Sibling, remarked that the strongest point about the course was that it felt as if "there is no judgment, it is very much we are all in this together." Another community built by SP was the connection between professors and students. Jaime, the other Little Sibling, discussed how their strongest connections with faculty came from SP, "the people I have the most connection to [the two professors who taught in Bio SP] because of SP, the little class size, so they actually know who you are."

A final classroom-related pocket community was the labs attached to Biology courses. Again, both students and faculty mentioned the existence of these spaces as places where connections could be made. Specifically, the faculty member—Professor Smith—spoke about the lab being a space where they could work on building community and connect with students on a more personal level. Likewise, the Little Siblings also talked about the lab being a fun space that allowed them to introduce themselves to the Biology faculty.

Challenges with Cultivating Belonging in the Biology Department

Belonging in any space at Swarthmore seemed to be a larger issue in conversation with students; however, they all agreed that belonging in the Biology department was difficult for a multitude of reasons. All three Big Siblings primarily attributed the challenge to academic success or the need to succeed in introductory Biology courses. There was a degree of shock that came with their academics in the introductory courses. All of them had noted that they either liked Biology or did well in Biology prior to attending Swarthmore, so doing "badly" in their first course in Biology deeply impacted their perception of their ability to succeed later in intermediate courses or in general as biology students. Riley, who had lab experience in high school, got a C in their intro biology course and talked about how they grappled with the notion that if one "was struggling with this class [introductory biology course], that [they] shouldn't be a biology major at all." Riley went on to explain that experience was her motivation for being a Big Sibling in the mentorship program, as they wanted to demonstrate to future Biology majors that grades were not a marker of one's potential as a biologist.

Academic success was more than just a grade to the Big Siblings and Little Siblings; it also represented how well they could think like biologists. They continuously mentioned that the introductory courses required more than just learning the content and relearning "how to even study," which are already challenging aspects of collegiate biology courses. However, an additional piece was understanding "how to think [as a biologist]." So, bad grades reflected their inability to demonstrate their knowledge or study and reflected that they were unable to think like biologists. Professor Smith described this same issue that they grapple with as an educator, "if you say this is what a biologist does and then a student fails at that activity, I think that that could be feedback [to] them [telling a student] that they are not a biologist."

One Big Sibling, Kris, discussed how making mistakes in conjunction with imposter syndrome had larger implications than self-image; it carried messages about their ethnic community as well.

If you already have doubts that are related to like who you are, and every time you get the question wrong or like, do something wrong, it's not just because of a mistake you made. It's like, oh, somebody could tie this back to my identity. –Kris

Furthermore, when students discussed feeling incompetent in Biology with others, their responses would be to give up or change majors. Kris mentions in their retelling that when they asked their white friends if they could relate to his story, the friends would say that "they never had anything like that."

Aside from the introductory courses generating feelings of exclusion, students also had strict definitions of biologists. Jaime succinctly stated that a biologist "would just have to be a person who does research and studies biology." But the only type of research that students deemed acceptable was research conducted at institutions. When prompted if they saw themselves as biologists, all the Little Siblings and one Big Sibling said no or at least "not yet." Jordan, the Big Sibling, felt that they were not qualified to be a Biologist because "I just go to my classes and I do my work, but I'm not like doing anything of my own." True belonging in the field was deeply connected to researching and exploring their own scientific ideas. For the Big Siblings who had conducted research, research was a way to prove to themselves that they could be biologists. Kris recalled their positive research experience, "I did research that was really helpful. It made me realize that, like okay, I'm good at this [biology]."

Professor Smith also corroborated the positive influence of research on students of color. They quoted one of their prior students of color telling them that research was a life-changing

opportunity. This extended beyond summer research to in-class projects. For a lab project, Professor Smith found that "getting feedback from peers and seeing peer's work has been empowering for students."

However, not everyone held the same definitions of a biologist. Kris posed similar definitions when reflecting on their ideas of a biologist in their first year at Swarthmore but noted that their current definition is quite different:

Anybody who thinks biologically, whether that's like the Western definition of biology or like other non-western definitions. But anybody who uses, like those principles of thinking to think about the world around them.

In many ways, Kris' definition holds more commonalities with that of Professor Smith than the other students. Professor Smith defined biologists as those who have "a curiosity of what is going on in living systems coupled [...] with some level of training on how to uncover the truth about the living world."

Jordan perfectly sums up the sentiments of many of the students, "I've had a lot of questioning about, in general, whether I feel a part of it. To be honest, I've thought about leaving. But I still kind of hope to be a part of it [Biology], but right now, it's tough." The hope to belong remains within them, but it is not easy to achieve.

Change Requires Institutional Supports

The Biology department has made several institutional changes that have induced positive changes for students. One example is the creation of the SP program. As previously mentioned, the Little Siblings quite enjoyed the course and were surrounded by supportive faculty and peers. They mentioned that the small size allowed SP to feel more personal than Bio 002, one of the introductory Biology courses, but SP was more than just a small class. For Cam,

SP permitted them to be in community with other BIPOC students, "I really like that it's for, you know, people of color, like I never really had like that sort of affinity group in high school like one that is stem-based." Even some Big Siblings remarked on the empowerment that SP gave them to believe in their ability to succeed in Biology.

Even smaller changes in introductory courses like adding groups to incorporate more group work have helped students form connections. Both of the Little Siblings mentioned making sustained relationships with their group mates created in Bio 001, another introductory course. Cam recounts that he actually became very close friends with them, and they became part of his support group in Biology. Similarly, Jaime felt connected with their group mates and stated that they were some of the only connections he felt in Bio 002 aside from SP and the introductory lab section.

Another smaller change in the introductory courses was the introduction of culturally relevant materials around race and justice which both had success in engaging students. Professor Smith expressed seeing much success engaging students of color when discussing the racist histories of science. Even the simple act of acknowledging racism in the Biology classroom was like an act of reassurance for students that racism and race were something that they could talk about in Biology. The impacts were so great that students even came up to Professor Smith and said, "it showed me that you think that someone like me could do biology by just admitting the racist histories." The Little Siblings also mentioned that the lectures on culturally relevant content in Bio 001 were some of the most memorable lectures.

However, institutional changes do not have to be course-related to make positive changes. Examples of institutional changes are the amendment of requirements for graduation and the introduction of the Biology Big Sibling–Little Sibling program. In conversation with

Professor Smith, they brought up the department's decision to remove Organic Chemistry as a major requirement. Many majors were stressed by the course because of its difficulty, and it stood in the way of student success, so the department modified its graduation requirements.

The Biology Big Sibling-Little Sibling was another non-course change formed in collaboration with departmental support (institutional support). Both Big Siblings and Little Siblings described having, in general, very positive experiences within the program, and both Big Sib and Little Sib felt that they benefited from the program. For example, Cam describes their relationship with their Big Sibling as a close one. In addition, having a Big Sibling that they could identify with on-campus allowed them to see more possibilities.

He [Cam's Big Sibling] was a lab TA [...], so it was cool to just to be like, oh hey, and it was cool to see him thriving. It made things easier, in that, uh if you see people leading by example that you identify with, you have that like inherent kind of support [...] like oh I can do this too, I want to do this. –Cam

The relational aspect of the program was strongly felt by both Big Siblings and Little Siblings. Kris stated that the program allowed for friendships and mentorships to form, "it became a place where people are going to be there for you [...] where at least one person cares."

Aside from promoting friendships and community, the Big Sibling–Little Sibling program had professional and emotional benefits for Little Siblings. Both Jordan and Riley talked about helping their Little Siblings with course selections. Riley also discussed helping their Little Sibling with anxieties related to career aspirations and helping with supporting their Little Sibling's interest in clinical research.

Further, the program created a space where Big Siblings could discuss their own good and bad experiences. The sharing of their stories helped students feel heard and made them feel

important. Jordan felt that taking on the role of a mentor in the department made them "more valuable in the department."

Regardless of all of these positive institutional changes, the faculty indicated wanting to make more changes but that there is a lack of support for those changes. This lack of support comes from the absence of institutional pathways or the presence of institutional barriers. Throughout the interview, Professor Smith explored many potential changes to support BIPOC students better, like completely revamping a course and collaborating with professors in other departments. However, there were many limitations, the biggest one being that there is never enough time. Even when there is time, such as during a sabbatical, it is difficult because they feel pressure to publish research.

Moreover, many imagined changes require staff support that is currently unavailable, "I don't have the time or person power to even organize changes." The importance of having more staff support cannot be understated; as Professor Smith describes, hiring a staff member that could handle logistical concerns allowed them to concentrate on research with students. Lastly, the absence of institutional supports to preserve modifications in introductory courses means that any changes can disappear at any time. This is especially a concern that Professor Smith holds, "all the changes I make in an intro course could evaporate in the next iteration."

Discussion

Their Stories Highlight...

Communities dispersed but not gone completely.

Community holds many meanings, but within this paper, community is defined by the benefits and relationships "that accrue from building on the synergies of individuals in common locations or with common interests as they work towards sharing understandings, skills or knowledge for shared purposes" (Kilpatrick et al., 2003, p. 2). The presence of connections throughout the Biology department demonstrated that there is community; without connections, there would be no community, as a community is defined by members having relationships with each other. All of the participants indicated relationships and associations with others in the department, thereby validating the presence of communities.

Moreover, the spaces where community was achieved are not surprising: individual relationships, small classrooms, or labs. Previous literature has demonstrated how smaller spaces like classrooms are more likely to have more positive interpersonal interactions between student-teacher or peer-peer interactions, which may explain why all the identified communities were small. (Fowler, 1995). However, it was clear that the communities were not cohesive, and there was no unification of the communities; there was no association between the different communities. That is where the theme—pockets of community—emerges. The Big Siblings, Little Siblings, and faculty all note specific examples of spaces where they felt in community, but there was no overlap between separate spaces even when there were obvious opportunities for integration across communities. For example, the Biology Big Sibling—Little Sibling was an example of this missed opportunity. The students had built small pair communities, but the community remained within a group of two when it could have been a community for a group of

80. The communities alive in the Biology department emulate what are known as silos in that they coexist without acknowledging the presence of the other.

The presence of communities for students, especially BIPOC students, is tremendous. Community creates spaces where not only students are centered, but so are their stories and histories in a safe environment that values them. Therefore, the stories of these five participants demonstrate that the Big Sibling-Little Sibling program is building communities for them in the department. The Big Siblings and the Little Siblings describe having relationships that allow them to be authentic and demonstrate care—small pockets of community between two people—where both the Little Sibling and the Big Sibling belong. The same thing is happening in some of the other spaces like SP. Students have a space where they can develop interpersonal relationships with faculty that will counteract negative pressures related to belonging and societal expectations. Research has proven that caring relationships with professors who "do more than teaching" effectively demonstrate that students matter (Guzzardo, 2021). In other words, authentic relationships with professors are centering practices. This is the strength of communities that develop relationships of care. However, these communities are dispersed, resulting in students' viewing the Biology department as having a fragmented community.

Belonging is conception and identity-based, but it is not a fixed state.

Clearly, for these five BIPOC students, a sense of belonging in the Biology department took time to develop and was challenged by many experiences in their first years. The Big Sibs and the Little Sibs held the idea that academic success was a marker of belonging and self-efficacy. This extremely pervasive notion is pushed throughout society. Society has established academic achievement typically measured by test scores or grades as an indicator of success and thereby an indicator of worth (Nyström et al., 2018). So, when students face

"failures" or obtain bad results, their self-efficacy—their own belief in their ability to perform—lowers. Therefore, the influence that both the definitions of biologist and academic success directly alters the student's sense of belonging within the department.

This phenomenon is amplified when students hold marginalized identities. For students who seemed to already struggle with imposter syndrome—a student's self-perception as a fraud—any mistakes made amplified their questioning of whether to continue or not (Kolligian Jr. & Sternberg, 1991). Moreover, BIPOC students are often placed in positions where they feel they represent their entire identity group when they are made the token minority student. Tokenization brings about additional pressure as the student is now burdened with representing an entire group, bringing about heightened visibility (Flores-Niemann, 1999; Wingfield & Wingfield, 2014). One of the mentors demonstrated feeling that their mistakes had impacts on their whole community, which was a heavy burden to carry. Moreover, the heightened visibility of being a token minority student means that both the successes and failures are more visible. Hence, belonging in the Biology department is no easy task; for some BIPOC students, it requires overcoming both imposter syndrome and tokenization.

Additionally, conceptions of what biologists and whom biologists are negatively impacted a student's sense of belonging. The *biologists* characterized by students from different years point to the social influence students have experienced. Their idea that Biological research can only be conducted at institutions ignores the science and research performed in non-institutional but still equally valid spaces. Their ideas of a biologist fall in line with many conceptions of a Western scientist as objective and exclusionary. In actuality, their definitions harm their own sense of belonging because it serves to invalidate their own knowledge and skills they possess. It causes the students to think that they are not "enough" or that they are not

biologists "yet," although by other definitions—those of older students and faculty—students would be "qualified enough."

As seen above, research is strongly intertwined with a student's idea of being a biologist or belonging within the department. Experiencing a positive and authentic research experience seems to grow a student's sense of belonging by allowing them to produce work of their own and to become more confident in their abilities. This is supported by the literature that shows that undergraduate research can support minority students in career pathways and support students to think like biologists and feel like biologists (Lopatto, 2017; Seymour et al., 2004). Therefore, research is a tool to change students' self-perceptions in Biology so that they can believe that they belong in the department.

Changes are possible with the right supports in place.

The third theme demonstrated that institutional changes are occurring in the Biology department and that the changes are acting as buffers for the first two themes. Both students and faculty speak about prime examples of those buffers like Biology SP, the Big Sibling-Little Sibling Program, and the teaching of culturally relevant material and topics. In Biology SP, the pocket-community is recentering students and creating spaces of identity-based belonging. In that space, BIPOC students are surrounded by other BIPOC students doing science. This allows students to reconstruct perceptions of who can do Biology. The Biology Big Sibling-Little Sibling Program's creation of community and highlighting of BIPOC excellence in the department act as buffers for imposter syndrome and feelings that they are not enough. Specifically, the caring relationships prioritized the goals and the well-being of the Little Siblings such that they became the center of those communities. In addition, the Big Siblings opened doors for Little Siblings, meaning that the presence of Big Siblings gave the Little Siblings

access to spaces that were priorly perceived as unattainable. It also centered the Big Siblings in a valued position in the department. In other words, it gave Big Siblings a role within the department, allowing them to see themselves as a valued member of the department.

Lastly, introducing culturally relevant material and topics within Biology allows students to feel that their issues and histories are valued and seen in the department. Students can authentically belong because all their political struggles relating to identity are being acknowledged (Barton & Tan, 2020). Nevertheless, these changes would not be possible without institutional support, and more institutional support is needed to create pathways for future and sustainable change.

Divestment from Ascription of a Western Scientist

The stories shared by Big Siblings, Little Siblings, and faculty demonstrate an initial divestment from the ascription of a western scientist both inside and outside of the classroom. Specifically, this divestment is in the form of resistance. The acts of resistance strip the power away from the concept of a western scientist. By stripping the power from this colonial system, we begin to give power back to the process, practices, ideas, and oppressed people. There are multiple acts of resistance visible throughout each of the three themes and across the three different groups of participants.

In the classroom, there is resistance demonstrated by the faculty in what they choose to teach. The inclusion of conversations surrounding examples of scientific racism in the classroom directly contradicts the idea that western science is objective and neutral. It proves to students that they are allowed to speak of the existence of race within the space, but more than that, they are allowed to exist as BIPOC students. In addition, the inclusion of culturally-relevant material disrupts what western science poses as relevant scientific interests. Since western science centers research on "scientific fields and problems delineated by European scientists," the inclusion of

non-European science and issues will inform students that their issues and topics of interest are also relevant and thereby important (Basalla, 1967, p. 614).

Classrooms also create spaces that recenter BIPOC students through pocket communities and relations. Recentring BIPOC students is an act of resistance from the ascription to a western scientist because centering gives students power. Moreso, giving power to students, who are pushed to the margins by a system of colonialism, will also disrupt colonial practices like western science.

The Big Sibling-Little Sibling program, a space outside of the classroom, is also generating resistance. Both Big Siblings and Little Siblings are being recentered in their pair communities. In addition, these spaces are evolving to become spaces of refuge where Big Siblings and Little Siblings can share vulnerabilities and stories related to their experiences. Colonialism and western science seek to make scientific spaces neutral where personal relations and community are excluded as that does not belong in science. Yet, these communities of care and refuges are including ideas of well-being and care into scientific communities once again.

However, the most important act of resistance is the presence of these BIPOC Biology students in the department. As we have seen, all of the students indicated that they did not feel that they belonged in biology at one point or another. They received a message from society, the classroom practices, historical ideas, or academics that they were missing something that led to imposter syndrome or feelings of inadequacy. However, their persistence to stay within the department despite these harmful experiences that impacted their self-image demonstrates that they resisted these messages. Moreover, their presence alone asserts the idea of rightful presence: a process that reauthorizes the knowledges, the inequities, and the historical stories of the othered

(Barton & Tan, 2020). Students are disrupting the system of western science through their natural resistance by rightfully belonging.

Conclusion

In this looking glass into society, we begin to see that the Biology department at Swarthmore College is starting to divest away from definitions and conceptions of western science. In these Microsystems and Mesosystems, the students and faculty resist these messages from the Macrosystem. Moreover, all of the institutional changes they have launched are impacting more than just the Microsystem and the Mesosystem in which they occur. But they are also influencing the larger society through its interactions with the Macrosystem. As Professor Smith put it, “You gotta work on the systems of which you have power over,” and then that work will start to spill over into the next system, and so forth. Therefore, this is our chance.

However, there are still many challenges that the Biology department faces before we can say all is good. As a department, we have the duty to be a space for *all* students to feel safe, comfortable, and supported. Yet, that is not the case for many BIPOC students. BIPOC students are still not centered. BIPOC students are still being harmed and deciding to leave. Their voices are still being discredited and ignored. And their ideas, vulnerabilities, and selves are still being questioned. This thesis and the presentation of the thesis demonstrated that these harmful practices are still ongoing in the department. Until they stop, the problems posed previously will continue to persist.

I want to end this thesis with a quote from Jordan that emphasizes the importance of recentering BIPOC students and pushing back against these western definitions and these harmful practices. “We all had some relations to those identifiers [of marginalized communities], [but] we still have a lot to offer the bio department. We still have a lot to contribute.”

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Appendix A

Future Steps - Building a Path Forward

A series of recommendations given to the Swarthmore Biology Department and the Big Sibling–Little Sibling program informed by the thesis. Recommendations include rationales for the suggestions and examples or sources.

Recommendations for the Big Sibling-Little Sibling Program

1. **Hold large Big Sibling-Little Siblings events, where Big Sib-Little Sib pairs can meet other pairs more often to build a more extensive community.**
 - a. **Rationale:** The current program is developing and sustaining pockets of community between the one pair of Big Sib and Little Sib to grow the departmental community there.
 - b. **Example:** Hold Big Sib-Little Sib Program beginning and end of the semester meet up.
2. **Hold events where Biology faculty are present.**
 - a. **Rationale:** A departmental-wide community will also include more robust relationships with faculty members. The Big Sib-Little Sib program can help create a non-intimidating space where younger students can comfortably enter.
 - b. **Example:** Host lunches with Faculty members and Big Sib-Little Sib pairs.
3. **Become an institutionalized program within the Biology department.**
 - a. **Rationale:** The current program is student-led, and that has caused significant structural issues that point towards a need for a greater support system. Additionally, the program has successfully developed relationships and smaller-scale communities. So, there are benefits to sustaining the program which would require more institutional support.
 - b. **Example:** Collaborative leadership between at least one full-time faculty member and the student leadership board.

Recommendations for the Biology Department

Classroom Level Recommendations

1. Include more authentic group research opportunities in class.

- a. **Rationale:** The literature and this thesis demonstrate that research is directly tied to a person's self-image as a scientist. Moreover, research labs are pockets of community within the Biology Department, so if those were modeled within the classroom, we could build more communities.
- b. **Example:** Course-Based Undergraduate Lab Experiences (CURE)
- c. **Potential Resource:**
 - i. Article: [Course-Based Undergraduate Research Experiences Can Make Scientific Research More Inclusive](#)

2. Have conversations about the lack of neutrality in science.

- a. **Rationale:** This is already happening inside the faculty's classroom, and it has seen great success in engaging students. Additionally, we resist Western science by disproving the notion that science is neutral.
- b. **Example:** Discuss the connections between science and society, and initiate conversation surrounding the racist legacies of biology.
- c. **Potential Resources:**
 - i. Book: Superior the Return of Race Science by Angela Saini
 - ii. [Northeastern University Library Resource – Biology: Diversity and Anti-Racism in Biology](#)

- 1. Library resource page that includes books, podcasts, and articles.

3. Include more skills-based lessons, especially in the introductory Biology courses.

- a. **Rationale:** There are students in introductory Biology courses who learn the topics for the first time and how to think like a biologist. We, as educators, may incorrectly assume that students come in with that knowledge; however, that is not true, and it results in students feeling like they can't belong in the department because they were unprepared.

Departmental Level Recommendations

1. Hold more whole Biology Department events throughout the year.

- a. **Rationale:** Will help support and build a whole department-wide community. Will introduce faculty to more students and first-year students to upper-level students in the department.
 - b. **Example:** Hold end-of-the-semester events in the fall and spring or field trips open to students of all years.
- 2. Agree to a departmental antiracist framework.**
- a. **Rationale:** An antiracist framework would lay the groundwork for the department to create further changes in the future. Moreover, it would serve as a commitment from the department to its students and its faculty members to work towards dismantling racist practices and policies.
 - b. **Potential Resources:**
 - i. [PULSE: Anti Racism Resources for Biology Departments](#)
 1. It is currently not complete, but they link many other resources.
 - ii. Article: [Ten simple rules for building an antiracist lab](#)
- 3. Center BIPOC students throughout the department.**
- a. **Rationale:** Drawing from a DisCrit Framework (Disability and Critical Race Theory), if the department centers those who have historically been in the margins, that will make the department more accessible to them, and then the department will become more accessible to everyone as well.