Undergraduate Research Bio-Tech Summer Bridge Program

Summer 2012

Project ASCENCION
Oxnard College’s Title V STEM grant

Evaluation Report – 9/10/12

Submitted to
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Project “ASCENSION” is targeted at increasing the percentage of students who pursue educational and career pathways in STEM. Under the project, a 6-week Undergraduate Research Bio-Tech summer bridge program took place in the biology laboratory at Oxnard College (OC).

Two generations of Oxnard College students—those who are currently enrolled in OC (n=3), and OC transfers who are currently CSU/UC students (n=3)—were brought together to initiate and execute three research projects. The program enabled students to gain hands-on experience conducting research in a lab setting while fostering an educational community and capitalizing on its strengths.

Concentrating on both outcomes and implementation of the program, and considering students’ personal narratives, the program was evaluated using pre and post personal interviews. These interviews allowed both to capture the individual perspectives and to find common themes. Data indicated that the program successfully reached its goals: to have students develop their technical, academic, personal, and social skills as researchers, to increase their interest and motivation in STEM education and careers, and to enhance their market value as laboratory workers. It is worthwhile noting that the program was very meaningful to all student participants—the OC students who were still deliberating on which pathway to chose and the CSU/UC students who had already transferred, committed to a path and made investments on it. This may be attributed to the inherited flexibility maintained in the program which provided each individual with opportunities to explore, learn and develop according to one’s needs. It further demonstrated that even after transferring to a four-year institution, students may greatly benefit from guidance and growth opportunities to support their chosen path.

Overall, the students felt strongly about the program, its implementation and operation. They declared much appreciation and could very easily count their benefits. These benefits, in turn,
suggest potential impacts of the program far beyond the program’s stated goals. Students navigating their educational path with confidence and based on making informed decisions, is one example. The unique attributes of the program and their advantages were recognized; this knowledge may serve other education institutions and agencies in creating new programs.
Under Oxnard College’s Title V STEM grant (“Project ASCENCION”), a six-week summer bridge program focused on developing laboratory and academic skills was offered to three Oxnard College (OC) students and three CSU/UC students.

**STUDENTS’ CHARACTERISTICS**

Students were greatly diverse in their characteristics. In fact, the program was structured to adjust for, and capitalize on, their diversity. Here is a short summary of students’ backgrounds:

- All students were either enrolled students at Oxnard College or CSU/UC students who transferred from Oxnard College.
- Students came from different familial backgrounds: Two students, for example, had their first career in the army prior to going back to school and are now parents; some students entered Oxnard College directly out of high school, but others did not originally plan to further their education and entered the college after a couple of years working outside.
- Students greatly varied in their previous research experience. While all of them had some experience working with the program’s professor (i.e., Dr. James Harber) in the biology lab in one setting or another (e.g. being a student in his class or doing directed study with him) prior to the initiation of the summer bridge program, some students had much more extensive experience doing laboratory work, including in other settings.
- Students also varied in their plans for their future. These included the following:
  - transferring to CSUCI and majoring in biology.
  - obtaining a B.S. in biology with an emphasis in clinical laboratory from CSUCI.
  - working in the health field, perhaps as a lab technician.
  - obtaining a certificate as a clinical laboratory scientist.
  - applying to a M.D.-Ph.D. program and becoming a medical researcher.
  - graduating from UCLA with a B.S. in cellular-molecular-developmental biology.
CURRICULUM

During the course of the six-week program, students worked collaboratively on promoting three research projects. Each project was led by one of the three CSU/UC students and was at a different developmental stage, as the work on the projects was originated prior to the beginning of the summer bridge program. Thus, it was a structured framework for learning and experiencing. At the same time, much flexibility was promoted and kept by the professor and the students as the work on the projects was distributed among students depending on projects’ needs, as well as students’ interests and learning objectives. In fact, each work day began with a team meeting where the progress and needs on each project were shared among all. It was through these meetings that all students were kept on board with the progress made on each project—as well as challenges encountered by the researchers and new discoveries made by them, and were able to show their interest and offer their support. Even within the somewhat structured work plan for each day, all students contributed wherever and whenever possible.

In addition, a didactic emphasis was placed by the professor on discussing current events in research, discussing emerging technologies, reviewing general skills, and acknowledging the importance of grounding one’s research work in the literature.

PROGRAM GOALS

Centered in the biology laboratory at Oxnard College and facilitated by professor Dr. Harber, the program objectives were as follows:

1. Students develop technical skills needed from research lab workers (e.g., following safety procedures, learning how to operate and use certain tools and machines).
2. Students develop academic skills needed from research lab workers (e.g., reading manuscripts, conducting literature reviews).
3. Students develop personal skills needed from research lab workers (e.g., perseverance, self-discipline).
4. Students develop social skills needed from research lab workers (e.g., collaboration, asking for guidance, providing mentoring).
5. Increase students’ interest and motivation in STEM education and careers.
6. Students are more marketable as laboratory employees and research assistants.

These were defined as overarching goals for all students regardless of their academic advancement, research experience and aspirations. Yet, the manifestation of these at the individual level may vary depending on the student’s developmental stage and current needs.

Appendix A presents the program’s resources, activities and outputs as they relate to the program’s outcomes.

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**PROTOCOL**

The evaluation of the summer bridge program concentrated on two domains:

1. Mapping the implementation and operation of the program in order to:
   a. suggest points for improvement.
   b. recognize critical elements for program success and replication.
   c. better understand program’s strengths and outcomes.

2. Examining program outcomes at the individual level.
3. Recognizing and explaining unintended results.

Accordingly, data for the evaluation was collected via personal interviews with program participants on the first week of the program (i.e., pre-interviews) and the last week of the program (i.e., post-interview). Four different versions of protocol were created to accommodate the academic advancement of the student (i.e., OC vs. CSU/UC students) and the point in time when the interview took place (i.e., pre/post program). The interview protocols are presented in Appendix B through Appendix E.

Appendix F presents an overview of the evaluation plan.
PROGRAM OUTCOMES

DEVELOPING TECHNICAL AND ACADEMIC SKILLS

Through participation in the program students developed their technical and academic skills. This was made possible by the very nature of the program (i.e., researching in a lab) and the curriculum, and was greatly fostered by the empowering environment led by professor Dr. Harber and maintained by the students.

Students learned various technical skills: some general skills applicable to a work in a biology research lab (e.g., safety procedures, ordering and organizing supply), and others more specific to the projects they were involved with (e.g., stem culture). One of the CSU/UC students mentioned that even reviewing the more basic skills, mainly for the benefit of the Oxnard College students, was good refresher for all. All students were very excited (and appreciative) of these learning experiences: The OC students, by the variety of their learning; and the CSU/UC students by the depth of it. Specifically, students’ development of their technical and academic skills was aligned with their proficiency levels such that the OC students were exposed to, and had hands-on experiences in a variety of tools and techniques (as they were involved in each of the projects), while the CSU/UC students went deeply into orchestrating their project and establishing their expertise. One of the fundamental examples was the distinct impact the program had on students’ thought processes. While the OC students learned how to approach a research project from its beginning and plan their daily work; the CSU/UC students learned to make decisions and navigate their study forward. Here are some examples:

- Planning the work and being resourceful were two major lessons for one student: “...Different ways of organizing yourself, prepare yourself in general, like researching a topic before you go into research... You learn to manage with what you have to make it work”. (OC student)

- The dynamic in the lab was “surprising” to another student, particularly the discovery of the amount of work and time that goes into planning and preparing for an experiment. The student further explained that in a regular college class all the materials and equipment are ready for use by the students. But through this program, the student
realized how things operate and look at the beginning of the work when researchers have to prepare and execute their study. (OC student)

- One student learned “How to really choose the battles, where will we make the biggest impact, where will we have success, and where our limitations are.” Adding: “Before, I was so overwhelmed just doing the experiment, it all seemed so complicated... I feel like I just got to another level of understanding in science or my skills of researching”. And also, “Just being able to deal with the technical challenges each day is a huge skill.” (CSU/UC student)

- Another student learned that a good research design, and, accordingly, appropriate analysis of the results, are rooted in a well developed understanding of the relevant research prior to taking any operational steps. (CSU/UC student)

One specific academic skill that the program aimed to address was the preparation of summative posters to be presented by the students in a professional conference in November 2012. Such posters usually present the research question (and its theoretical foundation), procedures and results. The importance of this learning for the students was evident in both interview sessions (pre and post) with the students. As it turned out, none of the students had a prior experience producing a poster; yet, it was recognized by the students as a desired experience. It is interesting to note the different perspectives students held:

- For one, the importance of producing a poster lied in the opportunity to tell people about the work accomplished by the students and be a role model to others: “to show people – this is what I do, this is what you can do”. (CSU/UC student)

- Another student had a similar thought but more from an institutional perspective: “we do all this stuff here, we really want to take it somewhere and show, like, OC is doing this science experiments; we are capable here”. (CSU/UC student). This vision was shared by another student who reflected on the poster by saying: “throwing OC’s name out there”. (OC student)

- A student was also interested in having this as practice before fulfilling a departmental poster presentation requirement: “this is a really great way to get comfortable with that
before I go and do that... anything to help ease the anxiety of learning next year will really help me”. (CSU/UC student)

- And, “making an accomplishment” was also mentioned as a reason for wanting to prepare a poster (OC student)

Evidence for the empowering environment in the laboratory and its positive impact may be found in some of the students’ reflections. For example, one student talked about the difficulties encountered in the mastering of a certain lab technique and Dr. Harber’s encouragement: “I liked how he pushed me by saying – Don’t worry, if it’s bad we can do it again”. Another student gave as example of Dr. Harber’s encouragement after a long day of work in the lab at a somewhat isolated area: “He would say - What you are doing is a really important part... don’t feel like you are not part of the team because you are”. Students also mentioned the relationship among them as a source of empowerment: the OC students felt comfortable approaching the CSU/UC students with questions and requests for guidance, and they found the mentoring provided to them to be sound; the CSU/UC students felt empowered by taking a head lead over their project (more on this in the next section). Perhaps, the strongest evidence for the empowering environment might be the unanimous indication by all students that the work flow and work distribution in the lab went very well as they all worked as a team and helped each other. Students’ reflections on their collaborative work are listed in the next section.

DEVELOPING PERSONAL AND SOCIAL SKILLS

Central to the work of a laboratory researcher, beyond the technical skills, are the researcher’s personal attributes and his/her ability to work as part of a team. In the post-interview sessions, students identified developing both sets of skills.

The CSU/UC students took the main responsibility over their projects. All three students were satisfied with the progress made on their projects - an indication to their successful management of their project’s resources and endeavors. The students further experienced the opportunity to provide mentoring to the OC students. Differences in their approach to
mentoring were evident, thus serving as an indication that each student had the opportunity to develop this capacity as they wished. Mentor 1 mainly supported the students when approached by them with questions. Mentor 2 focused on distributing the work and teaching the students the skills and techniques required for the work to be completed. The mentoring was sufficient to enable the student to perform and continue the work also in the absence of the mentor. Mentor 3 was more concerned with creating a supportive environment for the team by encouraging students to ask questions, keep face in the presence of failures and share their thoughts. The mentoring experience was most meaningful to Mentor 3 who discussed adding this “managerial skills” to the resume and could now envision taking a managerial position in a laboratory in the future (“it is not scary anymore”). Mentor 2 mentioned having the opportunity to experience mentoring as one of the values of the program.

Another social dimension in the program was the collaboration among students. Students had only good remarks regarding their mutual work in the lab:

- “Everyone contributed somehow to each other... no one was left behind”. (CSU/UC student)
- “Everyone knew what to do”. (OC student)
- “Students were exchanging ideas and coming up with more research questions. Projects started in one place and evolved”. (CSU/UC student)
- “Everyone has something they can learn from another person no matter what your position or experience is... In a collaborative setting we definitely share a lot”. (CSU/UC student)

Moreover, a sense of a “scholarly community” was built among group members to such extent that students perceived the continuity of their joint work and established relationships to extend beyond the completion of the program. Specifically, students were engaged in thinking about mechanisms that would enable them to continue the work on the projects during the course of the year. The OC students talked about the possibility of continuing their involvement in the projects through “directed study” with professor Dr. Harber and by returning to the program next summer. The CSU/UC students presented their hopes that the
OC students would be able to continue and progress some of the research work after the summer and were planning on getting updates from the OC students and coming back to the lab sporadically throughout the year, depending on their availability.

The OC students noted the advice for their futures provided to them by the CSU/UC students (such as how to apply to different academic institutions and which courses to take) and said that they felt comfortable enough to contact the students in the future for further guidance.

Students’ technical, academic and social experiences in the lab had an impact on their personal growth. They indicated the following learning outcomes:

- Being resourceful: Working under constraints (e.g., materials and equipment); planning and managing resources.
- Staying flexible and being creative: Revising one’s work plan to adjust for changes, constraints and new discoveries.
- Problem solving.
- Working independently.
- Time management.
- Maintaining high motivation and managing frustration.
- Initiating.
- Taking responsibility.

**INCREASED INTEREST AND MOTIVATION IN STEM EDUCATION AND CAREERS**

All student participants noted their interest in STEM, specifically biology and lab work at the beginning of the program. Thus, the impact of the program on students’ interest and motivation in STEM education and careers may be best described as “reinforcing” or “assuring”. Surprisingly, similar effect was also noted by the CSU/UC students who had more research experience and had advanced their educational (and occupational) paths prior to the initiation of the summer bridge program. One OC student, who planned to pursue a B.S. degree in biology looked at the CSU/OC students as role models and thus gained confidence in meeting this academic goal. Another OC student was more certain at the end of the program in his/her
interest in becoming a lab technician; following the program, he/she was more aware of the different opportunities available to them and felt that due to experience gained by participation in the program they have one less barrier to overcome. The program helped a third OC student, originally interested in pursuing a B.S. in biology, to find a more specific niche of interest (i.e. bioinformatics). This student further recognized, though participation in the program, that he/she was falling short in their mathematic skills, that are so critical to successful functioning in the lab, and therefore plans to take more courses in math in the upcoming academic year. One CSU/UC student set as a goal to be admitted into a M.D.-Ph.D. program and become a medical researcher. This goal was not refined but the student felt the experiences gained throughout the program (e.g., leading a research project, managing others, preparing and presenting a poster) would provide a competitive edge. Another CSU/UC student, interested in pursuing a certificate in clinical laboratory scientist, mentioned still being interested in this as well as a new or more formed desire to look for a job in a lab. Finally, a third CSU/UC student, currently studying toward a B.S. degree and working in an entry level position in a laboratory, indicated that as a result of participation in the program, he/she has a clearer vision of becoming a true researcher in a lab (i.e., initiating research and leading others and not merely assisting others on their projects).

**STUDENTS ARE MORE MARKETABLE**

Students felt strongly that this experience has boosted their resumes and increased their competitiveness in the field. They further believed that this experience, in turn, would assist them in finding paid jobs or internships in laboratories both in academia and the industry.

Time will tell whether or not the summer bridge program helped the students in securing jobs or internships. And still, many forces (e.g., the labor market, student’s availability, being able to secure work-grant money) and the interplay among them will determine the end result. Nevertheless, at this point in time, it is safe to claim that having students: a) gain confidence in their abilities; b) develop substantial motivation and targeted interest; c) enhance their resume
with concrete skills and knowledge; d) foster their professional networks\(^1\); and, e) have the ability to mentor others, would most definitely increase their competitiveness in the labor market and provide them with the tools to go about searching, applying for, and securing positions.

As an example, here is a narrative telling the story of Trish (for privacy reasons, the true name of the student will be kept confidential). Trish had just completed her first year at a UC campus, majoring in cellular-molecular-developmental-biology after transferring from Oxnard College with an A.A. in natural sciences. Prior to transferring, she spent almost four years at OC. During these years she worked with professor Dr. Harber as a lab assistant for two years and participated in the same summer bridge program last year, just before she transferred. Upon her arrival to the UC campus, Trish was able to secure work-study funds and found a job in a lab as an assistant. Later, as funds ran out, she was hired as an employee. Trish was told by her employer that her being comfortable in the lab played in her favor. She further mentioned that professor Dr. Harber assisted her in writing her resume (“He is always willing to help people especially if they put in the first effort and bring in the resume”). Even after having gained all this experience and securing a job, she came back into the program this summer as she saw the great value it held for the students, she among them, and at the end-of-the-program she noted that she had learned more than what she thought she would. Some of the outcomes and quotes provided in this report are based on the interviews with Trish. Here is another quote: “This (i.e., the program) must be the most hands on that we can get. In internships at the UC, in the labs that I have taken, there were hardly any hands on.” Trish also told me that if all goes well she should be graduating in a year. Her laboratory already discussed with her the option of hiring her as a full-time employee upon her graduation. She chose to give the credit to professor Dr. Harber and the summer bridge program. But perhaps a more suitable example to illustrate the impact of the program would be her talking about the poster, saying that she will share the final product of the poster with her lab, thinking it might help her get the job offer.

\(^1\) These four outcomes were reviewed in previous sections of this report.
PROGRAM OPERATION AND IMPLEMENTATION

STUDENTS’ OVERALL SATISFACTION WITH THE PROGRAM

All students were highly satisfied with the program and were all in agreement that they would recommend other students to participate in the program in the future. Furthermore, all students indicated they would like to join again next summer, if still in the area.

Students came into the program with various expectations including, but not limited to:

- Get hands-on laboratory experience; develop new skills and get exposure to new techniques; develop new skills.
- Explore educational and professional paths; explore interests.
- Learn from CSU/UC students about their institutions and different programs.
- Develop overall breadth and depth of knowledge.
- Obtain experience working independently in a lab.
- Get the experience in creating a poster and presenting their work to others.
- Continue their pre-initiated research/ sustain research experience.
- Function as a role model and provide guidance and advice to other students.

In the post-interviews, students were reminded of their initial expectations and were presented with the following questions: “were your expectations met?” All students indicated their expectations were fully met. Only one CSU/UC student felt that her secondary expectation of thinking about potential pathways was not met. Also, one CSU/UC student hoped to fully complete the project by the end-of-the-program and this was not attained. Nevertheless, in a research setting it is often the case that things take unexpected turns and take more time than planned. The student showed awareness to this nature of research evolution and was very satisfied with what they were able to attain.

PROGRAM’S GOALS

At the beginning of the program, students were asked to reflect on the pre-defined goals for the program. They all agreed that the six pre-defined goals were appropriate and important. At the end of the program, students were asked to reflect on the pre-defined goals once again; they were all in agreement that all goals were met.
The program ran three times a week (in the afternoon hours), for six weeks. As previously mentioned, the students worked collaboratively with the aim of promoting all three projects. Flexibility was maintained by the professor and the students, and individuals’ learning greatly depended on the specific project and the motivation of the student. In addition, knowledge content was infused by the professor, in a constructive way, by providing students with reading materials and facilitating discussions around certain topics.

The flexibility maintained in the program was acknowledged by all students as beneficial. It helped build the relationships and team spirit, capitalized on students’ strengths and promoted the learning of the individuals. Its benefits may be further demonstrated using the following narrative: While working on one of the projects, the students came across an unexpected result. With the support of the professor, the OC students began working on a small research as a side project, investigating this unforeseen event. This had an immense effect on the students as it demonstrated to them the beauty and meaning of researching (i.e., making new discoveries) and allowed them to take responsibility over, and nourish, their own study.

Several students chose to reflect on the program by contrasting it to their classroom experiences. They indicated the program being something completely different than learning in a classroom setting. They further indicated that this setting enabled them to build meaningful and constructive professional relationships with one another, as well as to greatly extend their learning.

Students also provided only positive feedback about professor Dr. Harber (none of them could come up with any tip on how the professor may improve his functioning). Here are some of the things they mentioned about him: “Professor Dr. Harber really made a point to have the lab meetings. He slowed down and found ways to involve everybody in all projects” (CSU/UC student); Professor Dr. Harber did a pretty good job running the program... He made himself available; he communicated with all of us pretty well on a personal level and as a group in general... The project planning was also well, I mean, he guided us on how much time things will
take” (OC student); “He knows what he is doing... I think he is doing a really good job” (OC student).

The CSU/UC students, for whom this was a second experience with the program, reflected on this year’s experience and noted its improvement compared to the previous year. One student felt that this year they were able to make much more progress. The following potential explanations were provided: a) students worked on projects that were initiated prior to the beginning of the summer bridge program (hence, no time was wasted on the initiation of projects); b) the clear responsibilities of the project leaders and the OC students; c) projects were interrelated to some extent.

It was not easy for students to come up with ideas on how this summer bridge program may be improved for next year. It is interesting to note, though, that all students indicated the challenge associated with working under equipment constraints, including the need to make do with limited supply, the work with old tools (e.g. slowly spinning centrifuge; old computer that often freezes), and the need to share equipment (e.g., one computer). In addition, one student would have liked to see an improvement in the administrative support provided to the program. The student felt they were rushed to fill in the hiring paperwork and pointed to the need in having better communication with the filming crew as it was not clear to the students if they would be able to get a copy of the footage to be used in their posters. In addition, one CSU/UC student mentioned that the OC students were not showing sufficient involvement in producing the poster. One reason for this might be the limited time students had left for this purpose. Another reason may be that since the CSU/UC students were uncertain on how to approach this assignment they were unable to provide guidance and direct the work of the OC students, who were probably even less confident. It may be that more time should be devoted to this task and more guidance should be offered by the professor. Finally, two of the CSU/UC students suggested the addition of high school students as a third tier in the program for next year. They thought it would not substantially hold back the progress on the projects (by having to spend some more time thought focusing on the more basic training); while, at the same time, it would greatly serve the community and the purpose of the program.
UNINTENDED RESULTS

Every program has the potential of producing unintended results. These may be short- or long-term results and either positive or negative in nature. Unintended results are unexpected outcomes. The summer bridge program had several unintended results, all are positive. Students showed continuous commitment to the project. At the end-of-the-program all students showed interest, to varying degrees, in continuing the work of the projects. OC students were thinking about doing “directed study” with professor Dr. Harber during the academic year, and CSU/UC students wanted to come back into the lab whenever they would find the time and join the program again next year. This commitment has impacts that extend much beyond the mere completion of the research projects. It means that students have built and will continue to build their identity as researchers and their professional networks. It further means, that the OC students will be even more connected to the academic setting and their learning objectives and that the CSU/UC students will continue to spread OC’s name throughout. We can also indicate side benefits to students’ developing connections and building their professional network. These connections, in turn, will assist the OC students navigating their educational and career paths, increasing the likelihood that they will take more “right” turns and taking direct paths, rather than wasting valuable time wondering around. In addition, it increases their chances for securing employment in the future as in today’s job market it is a lot about having someone opening the door for you.

Conclusions and Recommendations

The Undergraduate Research Bio-Tech summer bridge program serviced three OC and three CSU/UC students. The six-week program enabled students to fully integrate into a research laboratory setting and develop a broad range of skills that will later serve them in their academic learning and employment in the STEM field. The program was unique as it exposed students to research as it unfolds in a real context and, thus, it enabled students to develop technical, academic, personal, and social skills.
Data collected through personal interviews with the participants indicated that students’ learning was meaningful as well as personal and tailored to the needs and interests of the students. This was attainable thanks to the work flexibility promoted and maintained by Dr. Harber and the students, as well as the professor’s commitment to his students’ developmental needs and learning objectives.

These outcomes, in turn, have much impact at the individual and institutional levels. At the individual level, students developed many skills that directly affected their levels of confidence, interest and commitment to research, their education, and their community, and may indirectly affect their educational and career pathways. It is important to note that the program had a major effect not only on the OC students, who may have made fewer steps in determining their paths, but also on the CSU/UC students, all of which are OC transfers, who had already made great investments committing to their chosen path. These students were able to further establish their identity as researchers and brought their skills to a next level—Increasing their competitiveness in the playing fields they are currently attending. At the institutional level, the program provided OC with more committed students and created opportunities for spreading and strengthening the institution’s name and its capacity among its affiliates. For example, via the poster presentation in a conference (scheduled to take place in November), students will share personal narratives. Furthermore, students’ sustained research may feed back into OC’s biology classrooms through their involvement in a directed study setting. And, OC as an institution will transfer highly qualified students into 4-year institutions.

Considering the successful implementation and most favorable outcomes of the program, it is recommended that the program run again each summer. It is further advised to consider the integration of high school students into the program as OC is committed to promoting high school students’ participation in higher education in the STEM fields and in light of the program’s success impeccably serving the developmental and educational needs of a diverse body of students. Furthermore, the program demonstrated the superb importance of creating educational communities that promote mentors and leaders. It is worthwhile taking this
component into consideration in the development and implementation of educational programs.
## Appendix A: Theory of Action

### ASCENSION – Theory of Action for the Undergrad Research Bio-tech Summer Bridge

<table>
<thead>
<tr>
<th>Resources</th>
<th>Activities</th>
<th>Outputs</th>
<th>Short-term Outcomes</th>
<th>Medium-term Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant money</td>
<td>6-week curriculum on red tide and antibiotic resistant organisms in seawater, cardiac stem cell culture and immunofluorescence, and genetic detection of bacteria using a G+/G- strategy</td>
<td>OC Students engage in activities that promote familiarity with working and researching in a lab setting</td>
<td>OC Students develop technical, academic, personal, and social skills required by those working in labs</td>
<td>Increase the likelihood for the OC students to attend 4-year institution</td>
</tr>
<tr>
<td>OC biology lab and equipment</td>
<td>Principle investigator and CSU/UC students provides mentoring and guidance to support the research work of OC students</td>
<td>OC Students Engage in activities that promote the acquisition of skills needed by a lab worker</td>
<td>Increased OC students’ confidence in their ability to perform well in a lab setting</td>
<td>Increase the likelihood for the students to major in STEM</td>
</tr>
<tr>
<td>1 OC faculty (Principle investigator)</td>
<td>Students prepare poster presentations summarizing their research</td>
<td>OC Students get hands-on exposure to the STEM fields</td>
<td>Increased confidence in their ability to independently learn STEM subjects, and understand research manuscripts</td>
<td>Increase the likelihood for students to intern / work in a lab during their studies and later in their careers</td>
</tr>
<tr>
<td>Grant administrators</td>
<td></td>
<td>Students experience working independently and in teams, and receiving mentoring from faculty and colleagues</td>
<td>Increased interest in STEM and working in a research lab</td>
<td>Increased likelihood of success in a 4-year institute</td>
</tr>
<tr>
<td>UC and CSU students</td>
<td></td>
<td>OC students present their research posters in a conference</td>
<td>OC Students are more committed to their education</td>
<td></td>
</tr>
<tr>
<td>OC students</td>
<td></td>
<td>Students are more marketable</td>
<td>OC students are more committed to their education</td>
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Appendix B

Research Bio-tech Summer Bridge – Pre-program Interview Protocol (OC students)

**Interview questions**

1. Please tell me a little bit about yourself as a student here, at OC?
   a. Study objective?
   b. Major? (if declared)
   c. Year in the program? (have you been taking any semester off?)

2. List all your experiences with Prof. Harber so far? (e.g., course taking, working with the Prof. in the lab)

3. List all your experiences in conducting research so far.

4. What were the reasons you decided to join this research summer bridge program?

5. What are your expectations from the program?

6. Do you have any worries or concerns about your participation in the program? What might they be?

7. To the best of your knowledge, what is this program all about? What are the goals of the program?

8. To the best of your knowledge, what will you be doing in the next six weeks of the program? How will the work on the project be organized? What will you be doing each week?

9. I will read to you a list of program goals, and would like for you to tell me for each goal whether this goal is important to you, somewhat important to you, or not important at all:

<table>
<thead>
<tr>
<th>Students develop technical skills needed from research lab workers</th>
<th>Important</th>
<th>Somewhat important</th>
<th>Not important</th>
</tr>
</thead>
</table>

| Students develop academic skills needed from research lab workers |
|---|---|---|

| Students develop personal skills needed from research lab workers |
|---|---|---|

21
Students develop **social** skills needed from research lab workers

Increased students’ interest and motivation in STEM education and careers

Students are more marketable

10. Have you met any of the other participants in the program prior to joining the program? If yes – how well do you know them?

11. What do you expect the relationships between OC students and CSU/UC students to be?

12. How do you see yourself in the near future (say, next year to three years from today)?

13. When you think about your future, what may be some of the barriers or challenges along the way?

14. When you think about your future, what are the things that would help you get there (i.e., achieve your goals)? More specifically, is there any thing that we, at Oxnard College, or administrators at the CSU or UC can do to assist you? Were should we put our efforts in supporting you?

15. Is there anything you wish to clarify or add?
Appendix C

Research Bio-tech Summer Bridge – Pre-program Interview Protocol (CSU, UC students)

Interview questions

16. Please tell me a little bit about yourself as a student?
   a. Educational path?
   b. Current institute?
   c. Study objective?
   d. Major?
   e. Year in the program? (have you been taking any time off?)
17. List all your experiences with Prof. Harber so far (e.g., course taking, working with the Prof. in the lab)
18. List all your experiences in conducting research so far (including job for pay or internships).
19. What were the reasons you decided to join this research summer bridge program?
20. What are your expectations from the program?
21. Do you have any worries or concerns about your participation in the program? What might they be?
22. To the best of your knowledge, what is this program all about? What are the goals of the program?
23. To the best of your knowledge, what will you be doing in the next six weeks of the program?
   How will the work on the project be organized? What will you be doing each week?
24. Have you met any of the other participants in the program prior to joining the program? If yes – how well do you know them?
25. What do you expect the relationships between OC students and CSU/UC students to be?
26. One of the expectations we have from the more advanced students, like you, is to provide mentoring / guidance to OC students. Do you feel that you can be an effective mentor? Have you thought what your mentoring style may look like?
27. When you think about your educational path so far, what may be some of the barriers or challenges that you have encountered along the way?
28. When you think about your educational path so far, what were the things or factors that helped you get to where you are at right now (i.e., achieve your goals)? If previously participated in the
Research Bio-tech summer bridge program – What do you think was the contribution of the program to your path?

29. Do you feel that your learning of science (including math, biology, technology, engineering) is affected by your English language comprehension? In what ways? Do you have any idea how your learning challenges in these subjects may be relieved through working on the language channel (e.g., tutoring in English comprehension, programs?)

30. Is there anything you wish to clarify or add?
Appendix D

**Research Bio-tech Summer Bridge – Post-program Interview Protocol (OC students)**

**Interview questions**

1. How would you summarize your experience with the program?
2. Could you please describe the program to me? What were you doing in the past six weeks? How was the work organized? What were you doing each week? What was Prof. Harber’s contribution to the project? What was the distribution of responsibility among the students?
3. Was the program valuable to you? In what ways? (In other words, did you benefit from participating in the program?)
4. Would you recommend students who are similar to you to participate in the program? What may be the reasons for and against?
5. Do you think you might want to participate in the program next year as well? What may be the reasons for and against?
6. Six weeks ago, you mentioned the following expectation from participating in the program:

   ________________________________________________________________________

   Were these expectation met? To what extent? Did you have expectations that were not met and you still wish the program would have fulfilled these expectations?

7. What were some of the difficulties or challenges you encountered in the program? When I interviewed you 6 weeks ago, you mentioned some concerns related the program __________. Have these concerns materialize? In your opinion, were you able to successfully cope with these challenges?

8. I will read to you a list of program goals, and would like for you to tell me for each goal whether this goal was met:

<table>
<thead>
<tr>
<th>Goal</th>
<th>Goal met</th>
<th>Somewhat met</th>
<th>Goal was not met</th>
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<tbody>
<tr>
<td>Students develop <strong>technical</strong> skills needed from research lab workers</td>
<td></td>
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<tr>
<td>Students develop <strong>academic</strong> skills needed from research lab workers</td>
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</tbody>
</table>
Students develop **personal** skills needed from research lab workers

Students develop **social** skills needed from research lab workers

Increased students’ interest and motivation in STEM education and careers

Students are more marketable

9. If you could give one tip to Prof. Harber for next year, what would it be?
10. If you could give one tip to next year’s more advanced student participants (i.e., CSU/UC students), what would it be?
11. If you could give one tip to next year’s OC student participants, what would it be?
12. Have you developed any relationships with the CSU / UC students? How would you describe these relationships?
13. Did you expect any mentoring or guidance from Prof. Harber and your CSU / OC teammate? What were their style? Did you feel their mentoring was effective to you? Was there anything missing?
14. How do you see yourself in the near future (say, next year to three years from today)? Have your vision of your future changed in any way as a result of your participation in the program? In what way?
15. When you think about your future, what may be some of the barriers or challenges along the way?
16. When you think about your future, what are the things that would help you get there (i.e., achieve your goals)? More specifically, is there any thing that we, at Oxnard College, or administrators at the CSU or UC can do to assist you? Were should we put our efforts in supporting you?
17. What have you learned from the program (or perhaps what do you understand now that you did not understand 3 weeks ago) that you think will help you in the future?
18. Do you feel that your learning of science (including math, biology, technology, engineering) is affected by your English language comprehension? In what ways? Do you have any idea how
your learning challenges in these subjects may be relieved through working on the language channel (e.g., tutoring in English comprehension, programs?)

19. Is there anything you wish to clarify or add?
Appendix E

Research Bio-tech Summer Bridge – Post-program Interview Protocol (CSU, UC students)

Interview questions

20. How would you summarize your experience with the program?

21. Could you please describe the program to me? What were you doing in the past six weeks? How was the work organized? What were you doing each week? What was Prof. Harber’s contribution to the project? What was the distribution of responsibility among the students?

22. Was the program valuable to you? In what ways? (In other words, did you benefit from participating in the program?)

23. Would you recommend students who are similar to you to participate in the program? What may be the reasons for and against?

24. Do you think you might want to participate in the program next year as well? What may be the reasons for and against?

25. Six weeks ago, you mentioned the following expectation from participating in the program: ________________________________________________________________________.
   Were these expectation met? To what extent? Did you have expectations that were not met and you still wish the program would have fulfilled these expectations?

26. What were some of the difficulties or challenges you encountered in the program? When I interviewed you 6 weeks ago, you mentioned some concerns related the program___________. Have these concerns materialize? In your opinion, were you able to successfully cope with these challenges?

27. Have you developed any relationships with the OC students? How would you describe these relationships?

28. How would you summarize the joint work you and the OC student experienced? What was the distribution of responsibility between the two of you? What was your mentoring style and how effective do you think you were in your mentoring?

29. If you could give one tip to Prof. Harber for next year, what would it be?

30. If you could give one tip to next year’s more advanced student participants (i.e., CSU/UC students), what would it be?

31. If you could give one tip to next year’s OC student participants, what would it be?
32. How do you see yourself in the near future (say, next year to three years from today)? Have your vision of your future changed in any way as a result of your participation in the program? In what way?
33. What have you learned from the program (or perhaps what do you understand now that you did not understand 3 weeks ago) that you think will help you in the future?
34. Is there anything you wish to clarify or add?
Appendix F

Undergrad Research Bio-tech Summer Bridge – Evaluation Plan

Program Goals:

1. Students develop technical skills needed from research lab works (e.g., following safety procedures, learning how to operate and use certain tools and machines).
2. Students develop academic skills needed from research lab works (e.g., reading manuscripts, conducting literature reviews).
3. Students develop personal skills needed from research lab works (e.g., perseverance, self-discipline).
4. Students develop social skills needed from research lab works (e.g., collaboration, asking for guidance, providing mentoring).
5. Increased students’ interest and motivation in STEM education and careers.
6. Students are more marketable as laboratory employees and research assistants.

<table>
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<th>Measures</th>
<th>Instrument</th>
<th>Administration time</th>
<th>Comments</th>
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<tr>
<td>OC students’ acquire lab related technical, academic, personal, and social skills</td>
<td>Pre-interview (OC students)</td>
<td>6/11 (early afternoon)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post-interview (OC students)</td>
<td>7/23 (late afternoon)</td>
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<tr>
<td>OC students’ STEM interest and motivation</td>
<td>Pre-interview (OC students)</td>
<td>6/11 (early afternoon)</td>
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<td></td>
<td>Post-interview (OC students)</td>
<td>7/23 (late afternoon)</td>
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<td>OC students’ job market competitiveness</td>
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<td>CSU/ UC students’ developmental/educational paths and the contribution of the research bio-tech to their development</td>
<td>Pre interview (CSU / UC students)</td>
<td>6/11 (early afternoon)</td>
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<td></td>
<td>Post interview (CSU / UC students)</td>
<td>7/23 (late afternoon)</td>
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<td>Program’s operation overall</td>
<td>1. Post-interview (OC students)</td>
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</tr>
<tr>
<td></td>
<td>2. Post interview (CSU / UC students)</td>
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