



# Evaluation Report

## Research Experiences for Undergraduates

### June 10-August 2, 2013

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# REU Evaluation Report

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## Background

### Introduction

Nineteen undergraduates participated in the 2013 NIMBioS Research Experiences for Undergraduates (REU), which took place June 10-August 2, 2013. During the eight-week program, participants lived on campus at the University of Tennessee, Knoxville (UT), and worked in teams with NIMBioS postdocs and UT faculty to conduct research at the interface of mathematics and biology. The award included a stipend, housing and some funding to support travel.

The six research projects for the 2013 program included:

- Mathematical modeling of fetal electrocardiograms
- Modeling animal disease from coronavirus
- Automatic detection of rare birds from audio recordings
- Modeling the environmental transmission of infectious diseases: *Escherichia coli* transmission in cattle
- Modeling protein translation and genome evolution
- Modeling animal social network dynamics

Program organizers were Suzanne Lenhart (Dept. Mathematics/NIMBioS), and Kelly Sturner (NIMBioS). Mentors in the program included Arik Kershenbaum (Biology), David Buehler (Wildlife Science), Cristina Lanzas (Veterinary Medicine), Shi Chen (Veterinary Medicine), Suzanne Lenhart (Mathematics), Shigetoshi Eda (Wildlife Health), Melissa Kennedy (Veterinary Medicine), Xiaopeng Zhao (Computational Biology, Disease Modeling), Heather Finotti (Mathematics), Mike Gilchrist (Evolutionary Bioinformatics), Tuoc Phan (Mathematics), Amiyaal Ilany (Animal Social Networks), and Jiang Jiang (Biology).

### Project Backgrounds

Descriptions of the projects have been provided by program mentors:

*Title: Mathematical Modeling of Fetal Electrocardiograms*

*Mentors: Dr. Xiaopeng Zhao, Dr. Heather Finotti*

Fetal electrocardiograms (ECG) may be a useful tool to detect birth defects and prevent birth-defect related deaths. Currently, noninvasive fetal ECG cannot be accurately estimated due to artifacts as well as various bioelectrical activities from both the mother and the fetus. In this project, previous human ECG models will be adopted and extended to simulate electrocardiograms (ECG) generated by a fetus as measured using electrodes placed on the mother's abdomen. Numerical simulations will be carried out to investigate effective methods in estimating fetal ECG parameters.

*Title: Modeling Animal Disease from Coronavirus*

*Mentors: Dr. Suzanne Lenhart, Dr. Shigetoshi Eda, Dr. Melissa Kennedy*

Coronaviruses are responsible for a variety of diseases in humans and other animals. This project will investigate modeling of coronavirus infections from an epidemiological viewpoint. Methods to control the transmission of the virus in animal populations will be considered. The species to be studied may include cats (including big cats such as cheetahs), pigs and/or birds.

*Title: Automatic detection of rare birds from audio recordings*

*Mentors: Dr. Arik Kershenbaum, Dr. David Buehler*

The Great Smoky Mountains National Park is home to a large number of rare bird species, but assessing the distribution and population sizes of these species is problematic and time-consuming, precisely because of their rarity. Automated equipment that can detect and identify the calls and songs of rare birds would allow park staff to quantify and localize their presence, and plan management accordingly. In this project, students will develop signal processing algorithms to detect and identify the calls of rare species automatically, and then test these algorithms on unattended 24 hour recordings from the Park itself.

*Title: Modeling the environmental transmission of infectious diseases: Escherichia coli transmission in cattle*

*Mentors: Dr. Cristina Lanzas, Dr. Shi Chen*

Infectious diseases (e.g. influenza, enteric, foodborne and waterborne pathogens) can have environmental reservoirs and be transmitted by contact among individuals and between individuals and their associated environments. For diseases with environmental reservoirs, little is known about how the contact patterns between hosts and environment influence disease transmission. This REU project will study the spread of a zoonotic environmental-transmitted pathogen, Shiga-toxicogenic *Escherichia coli*, in beef cattle populations. We will use animal movement datasets, data on pathogen survival in the environment, and mathematical models to study the role of the environment in transmission.

*Title: Modeling protein translation and genome evolution*

*Mentors: Dr. Mike Gilchrist, Dr. Tuoc Phan*

Protein translation, an important step in gene expression that assembles the proteins used throughout the cell, is one of the most fundamental and conserved biological processes. Yet like all biological processes translation has intrinsic costs and processing errors. Due to redundancy inherent in the genetic code (e.g. codons GAA and GAG both code for glutamic acid), the evolution of coding sequences will be influenced by these costs and errors. The goal of this summer's research be to use mathematical models of the intra-ribosomal processes responsible for the costs

and errors during protein translation in order to study the patterns found within the genomes of different organisms. The outcome of this work will be a better understanding of how the ribosome works and, in turn, our ability to extract information from genomic sequences.

*Title: Modeling animal social network dynamics*

*Mentors: Dr. Amiyaal Ilany, Dr. Jiang Jiang*

The growing interest in social networks has led to many advances in the study of networks across different fields, from physics to sociology. Until recently, most research was focused on static networks, representing only snapshots of the data. To understand the evolution of social networks and their effect on individuals, we need to analyze how they change in time. In this project, students will model social network dynamics in different species using cutting-edge methods, to study the role of individual attributes and network-inherent rules in shaping social structure.

## Evaluation Design

### Evaluation Questions

This evaluation consisted of two parts: a participant evaluation and a mentor evaluation. The evaluation of the program was both formative and summative in nature, in that the data collected was intended to both gain feedback from participants and mentors about the quality of the current program and also to inform next year's program. A pre/post evaluation design was used to measure self-reported changes in participant skills and knowledge as a result of taking part in the program.

The participant evaluation framework was guided by Kirkpatrick's Four Levels of Evaluation model for training and learning program (Kirkpatrick, 1994<sup>1</sup>). Several questions constituted the foundation for the evaluation:

- How satisfied were participants with the program overall?
- Did the research experience meet participant expectations?
- Did the research experience impact participant plans to go to graduate school?
- To what extent did participants increase their research skills during the program?
- To what extent do participants feel they gained knowledge about the research process?
- How satisfied were participants with their mentors?
- How satisfied were participants with the accommodations offered by NIMBioS?
- What changes do participants feel NIMBioS should make in the program for next year?

The mentor evaluation was guided by the following questions:

- How satisfied were mentors with the program overall?
- Were the training and supports for their participants adequate?
- How satisfied were mentors with the training they received?
- What changes do mentors feel NIMBioS should make in the program for next year?

### Evaluation Procedures

Electronic surveys aligned to the evaluation questions were designed by the NIMBioS Evaluation Coordinator with input from the NIMBioS Associate Director for Education, Outreach, and Diversity, and the Education and Outreach Coordinator. The final instruments were hosted online via the University of Tennessee's online survey host Qualtrics.

Links to the participant pre-survey were emailed to the 19 REU participants on May 30, 2013. A reminder email was sent to non-responding participants on June 3 and June 5, 2013. By June 11, 2013, 19 participants had given their feedback, for a response rate of 100%.

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<sup>1</sup> From Kirkpatrick, D.L. (1994). *Evaluating Training programs: The Four Levels*. San Francisco, CA: Berrett-Koehler.

Links to the participant post-survey were sent to the 18 REU participants on August 12, 2013. Reminder emails were sent to non-responding participants on August 19 and 22, 2013. By August 29, 2013, 17 participants had given their feedback, for a response rate of 89%.

Links to the mentor feedback survey were sent to 12 REU mentors (Suzanne Lenhart, program organizer, was excluded from the mentor evaluation) on August 14, 2013. Reminder emails were sent to non-responding mentors on August 21 and 24, 2013. By August 29, 2013, 10 participants had given their feedback, for a response rate of 83%.

### Data Analysis

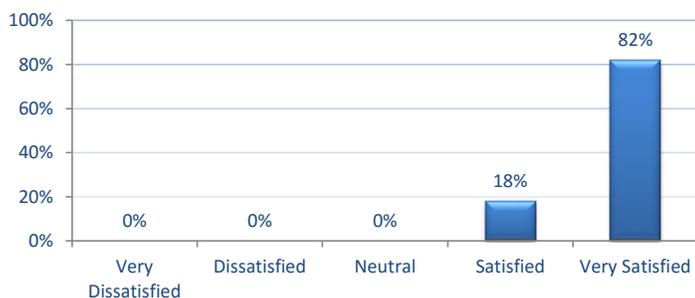
Data from the electronic surveys included both forced-response and supply-item questions. All data were downloaded from the online survey host into the statistical software package SPSS for analysis.

## Participant Evaluation Data

### Respondent Satisfaction

#### Overall Satisfaction

Figure 1. Overall satisfaction with the research experience



#### Overall comments:

*Thanks so much!*

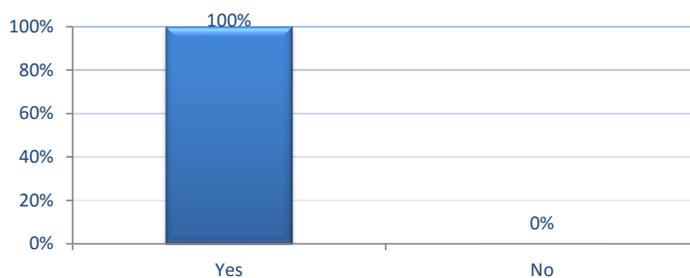
*I don't think conflict within groups was adequately diffused or addressed. Much of it was under the radar to mentors and program coordinators.*

*The only thing I would have liked to have changed is the timing of the poster symposium. I feel as if many of the groups agree that the information we put on our posters for the symposium changed so much that we would basically need to re-create the poster for it to reflect the end results of our projects. In other words, I feel like we all put in so much time and effort into making the posters for the*

*symposium, but by the end of the program, those posters have little value since they do not reflect the and results of our projects. I understand that having a poster, a paper, and a presentation all due in the same week would be very stressful, but I know that for future talks (such as the symposium in November that many of us wish to attend), we will have o spend a lot of time altering the poster so that it accurately reflects our final project.*

*This summer was a great experience, and I'm very grateful for everything the NIMBioS staff went through to make it happen. I built many relationships that I see lasting a lifetime, and I'm sure I'll have applications for the skills and relationships I built at NIMBioS for years to come.*

Figure 2. Would you recommend the NIMBioS REU program to others?



***Please explain why you would or would not recommend to program to others:***

*Absolutely! The program does an excellent job matching students to projects and balances each group with students of different backgrounds. Each student had something unique to contribute to the project, and we all worked off of each-other's strengths. This type of collaborative research is excellent preparation for our future research projects in graduate school and beyond.*

*Good research and opportunities.*

*I had a great experience that exceeded any expectations I had coming in. I learned so much about research and definitely grew as a person. I had a lot of fun this summer, but also worked hard.*

*I learnt the basics of research, made a lot of friends, build a lot of contacts. I learned scopes of my field.*

*It allows students to decide if their area of interest in definitely what they want to continue in and gives valuable research experience.*

*It helped me to get an idea of what scientific research is like and I met lots of different people.*

*It provides value information about graduate school and helps to cultivate several useful research skills, like programming and the ability to collaborate.*

*It was amazing.*

*It was organized and professional. NIMBioS offered many valuable resources and tools to us and I felt that they genuinely cared about us, our research, and our futures.*

*It's a great research experience and it definitely helped me out for my future goals.*

*It's a great work opportunity and great chance to begin understanding research under mentors and learning how to work with others on a research project*

*Not only did I get a great opportunity to perform research, I met a bunch of great people and made new friends. It helped a great deal, learning about graduate schools. All of the people I worked with at NIMBioS were great!*

*The staff was great. They really made the students feel like part of the NIMBioS team. Both Amiyaal and Jiang were excellent mentors. They were always positive and uplifting, and they had great insights and suggestions without being demanding or overly critical. Kelly did an excellent job of helping everyone become familiar with Knoxville, and her efforts to strengthen the group's dynamics were very successful. Also, Suzanne was an excellent program director. She really cared about our personal success; as she did her best to make sure everyone was doing well throughout the summer.*

*This REU allows you to start from the grassroots and make something very unique, integrative, and rewarding. I loved how I researched, used analytical skills, mathematically modeled, presented my findings, and have the option to continue this work as a senior thesis and publish the results.*

*This was a wonderful opportunity to learn about something that really interests me and to improve my knowledge and understanding of how mathematics and biology can be used together to achieve some important tasks. Also, it was a means through which I learned about more than simply biology and mathematics; I learned more about computer science as well, which is always a good thing to learn about. Furthermore, I think that meeting all of the people I was able to meet through NIMBioS has positively impacted my life.*

Figure 3. To what extent did this research experience meet your expectations?

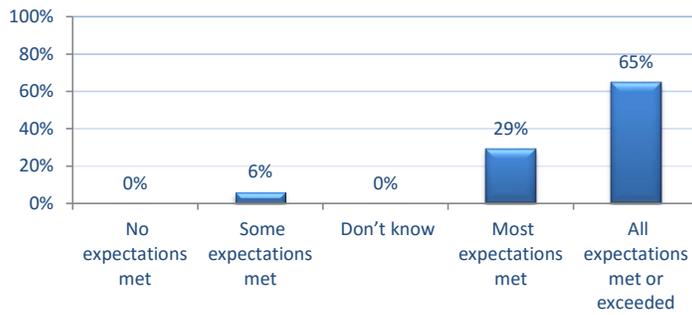
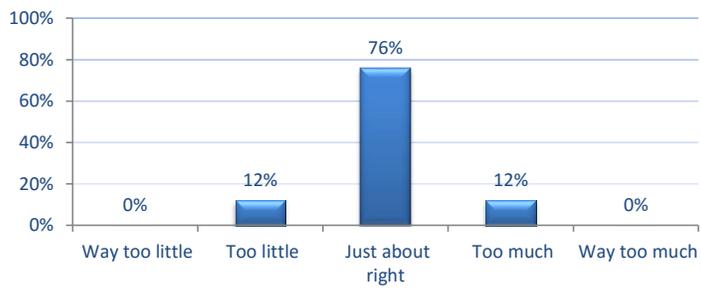
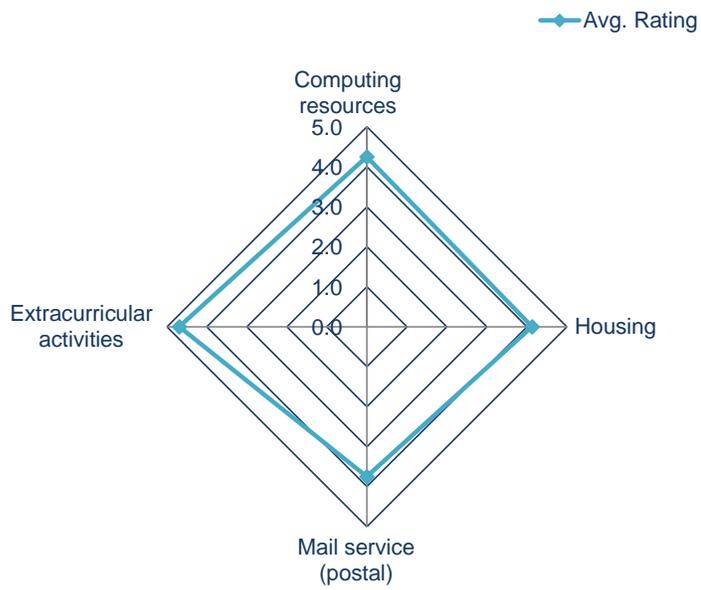


Figure 4. How did you feel about your workload overall?



### Satisfaction with Accommodations

Figure 5. Satisfaction with accommodations  
Scale:1 = Very dissatisfied to 5= Very satisfied



**Please describe any accommodations/supports you needed that were not supplied (if any):**

*Everything was great!*

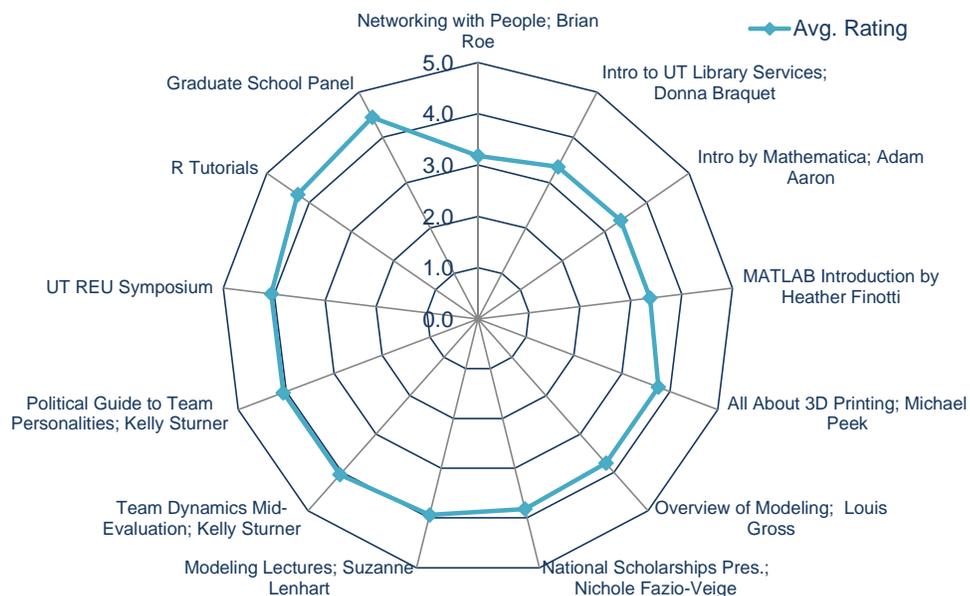
*Microwave Oven*

*Need better computing power for simulations!*

### Satisfaction with Lectures and Sessions

Figure 6. Ratings for Lectures and sessions

Scale: 1 = Not useful to 5 = Very useful



#### Other lectures or sessions you found valuable:

*Just talking with the people in NIMBioS about graduate school was very helpful.*

*The R Tutorial was very informative. However, I think if the presenter was more familiar with the types of programming we would be doing, he could tailor his presentation to better meet our needs. For example, many groups used R to manipulate data tables, and our group specifically ran into some problems with under-the-hood R processes.*

*The WDA meetings and lectures were awesome!*

#### Other comments about lecture or sessions:

*I learned a lot about how people have been working on different lectures and actually followed along because of what I've learned while working.*

*I wish the scholarship lecture had been about some mid-range scholarships. She went over the most competitive and prestigious ones which I will probably not apply to. I don't remember learning anything new from the library lecture. The networking lecture gave me a lot to think about, but was not particularly helpful with any skill development.*

*Many were not applicable to my project but I am very glad we had them. For the library services, I just used a proxy connect to my own school so that resource may have been useful but I personally did not need it.*

*The WDA conference was great. For many participants, it was their first conference experience, and I think most people enjoyed it and learned a lot. Also, the zoo and pool party were great events for team building.*

*Try to make lectures as short as possible. It is very difficult to pay attention to lectures when they get overly long.*

### Satisfaction with Mentors

Figure 7. Average rating by mentor characteristic

Scale: 1 = Strongly disagree to 5 = Strongly agree

**My mentor:**

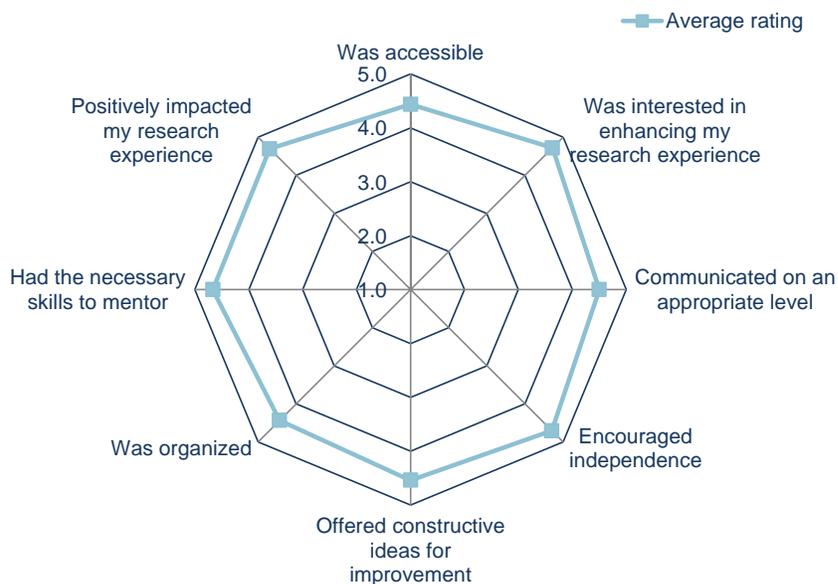


Figure 8. Average rating for all characteristics, by mentor

Scale: 1 = Strongly disagree to 5 = Strongly agree with each characteristics from Figure 7



**Please use this space for additional comments about your mentors:**

*Both mentors were amazing and made the experience very rewarding. They were incredibly helpful but allowed us to form ideas independently and always gave our ideas critical thought and respect. They pointed us in the direction of ways to improve our ideas and were generally great people to work with and talk to.*

*My mentors were amazing and taught me so much about modeling, researching, and thinking. I learned more about R and MatLab, how to read and analyze scientific papers, and how to think about models and factors that contribute to modeling*

*I found my mentor to sometimes be a bit negative. His tone while giving feedback was discouraging rather than encouraging. He was extremely helpful in the research but I do wish that he had a more positive attitude. Dr. Buehler was very enthusiastic and positive. He had a great energy at all times.*

## Communication and Group Dynamics

Figure 9. Did you find that Basecamp was a useful means of communicating within the REU group?

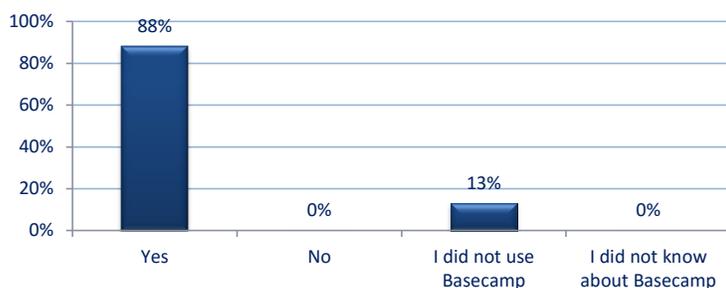
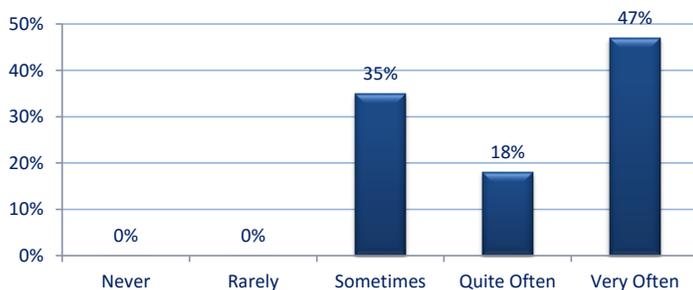


Figure 10. How often did you feel your research group worked well together?



***When your group worked well together, what factors do you feel contributed to the group's success?***

*-Having a set list of things we needed to accomplish -Everyone in the group working together on one task, as opposed to all of us working on something different in the same room*

*A clearly defined goal with somewhat of a deadline. An assignment which was challenging but still doable.*

*Clear communication.*

*Collaborative planning and division of tasks*

*Collaborative thinking, relaxed environment*

*Collaborative work, Professional attitude, Division of Work, Well Rounded Team*

*Communication, setting goals, having a positive atmosphere*

*Everyone understanding the amount of work that needed to be done, everyone being excited about the potential results of the work we needed to put in, and an understanding that time was of the essence*

*Everyone was present and ready to work. Meeting times were mutually decided on. Everyone was invested in the group's success.*

*Knowing what part each of us had to complete.*

*Our willingness to listen to each other. Positive attitudes about the work. Understanding our individual and group goals as we worked.*

*Talking, working together in person, working with the mentors, assigning and going over each other's' work, smiling, music*

*We were all aware of and working toward a unified goal.*

*We worked well together when no members were stressed. We also worked well when the group had an explicit goal in sight and everyone had tasks to complete.*

*When everyone paid full attention to each other and was dedicated to completing the tasks.*

*Working in the same room and checking in on one another throughout the day helped ensure the group stayed connected and made progress.*

*Working together in the same work space, delegating the work load*

***If/when your group was not functioning well, what were some barriers that prevented your group from working well together? How were these barriers overcome (or how do you feel they could have been overcome)?***

*We did not accomplish as much when we tried to work on things individually*

*Being physically apart, some misunderstandings*

*In the beginning there was a bit of communication problem but later as we understood our team dynamics we were very comfortable.*

*Individuals would get distracted when working. At times the work load was skewed. These barriers were usually overcome with extra communication about our goals.*

*Lack of communication and widely varying academic backgrounds were the largest barriers for my group. One member had very little math background, and that made communicating about mathematical concepts and ideas difficult. Our mentors presented basic tutorials on math topics that we would need for our project at the beginning of the summer. Although understanding of the concepts was not perfect, these tutorials definitely helped improve the function of our group.*

*Lack of data (we worked together to scale parameters instead)*

*Lack of interest in the less glamorous tasks/the tasks that were not as interesting. I think we could have overcome this more quickly and more easily if someone had piped up and said that the end result couldn't be obtained without completing the work at hand.*

*Not knowing our goal or what the others are working on. We fixed it by planning and talking.*

*Not sure of tasks for everybody to work on - make to-do lists.*

*One member of the group was more interested in being social than working on the project. In order for our group to manage the work load, we gave them the least because every time they were assigned a task it would never be done. A way to overcome it would have been to have our mentor actively involved in dividing the tasks and ensuring they were completed.*

*Our group struggled when one or more members felt they could not contribute. We could have overcome these barriers by setting more realistic/explicit goals on the front end of the project.*

*Poor communication and lack of a clear goal were barriers. It helped to be able to discuss things and meet frequently with our mentors.*

*Towards the end we lost productivity; this was overcome by setting frequent deadlines.*

*We didn't work well when we were not communicating with each other what we were trying to achieve.*

*We should have established a standard amount of work for everyone and been more collaborative to help one another in the beginning.*

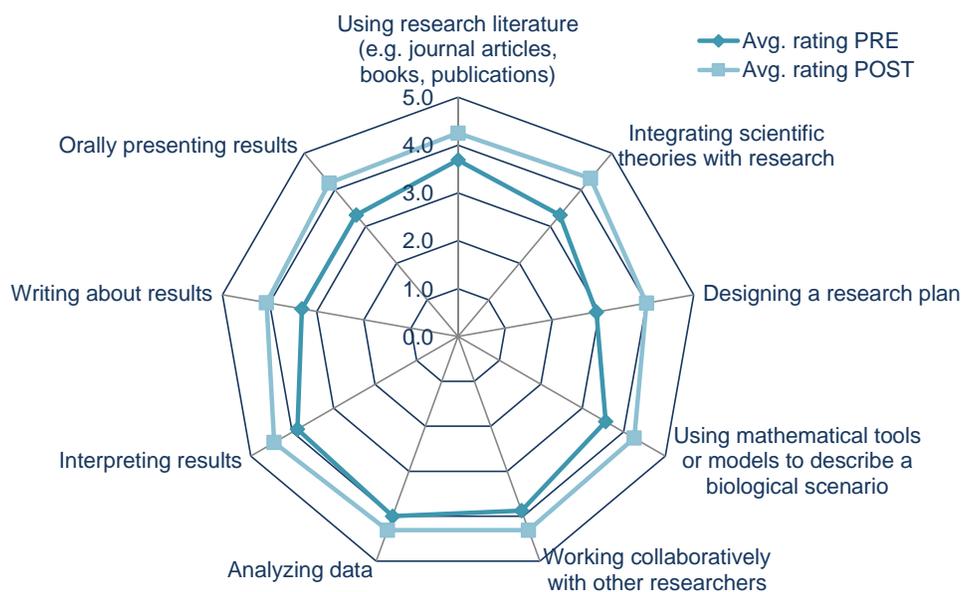
*When we weren't contributing ideas, when we worked separately.*

## Program Impact

### Participant Skills

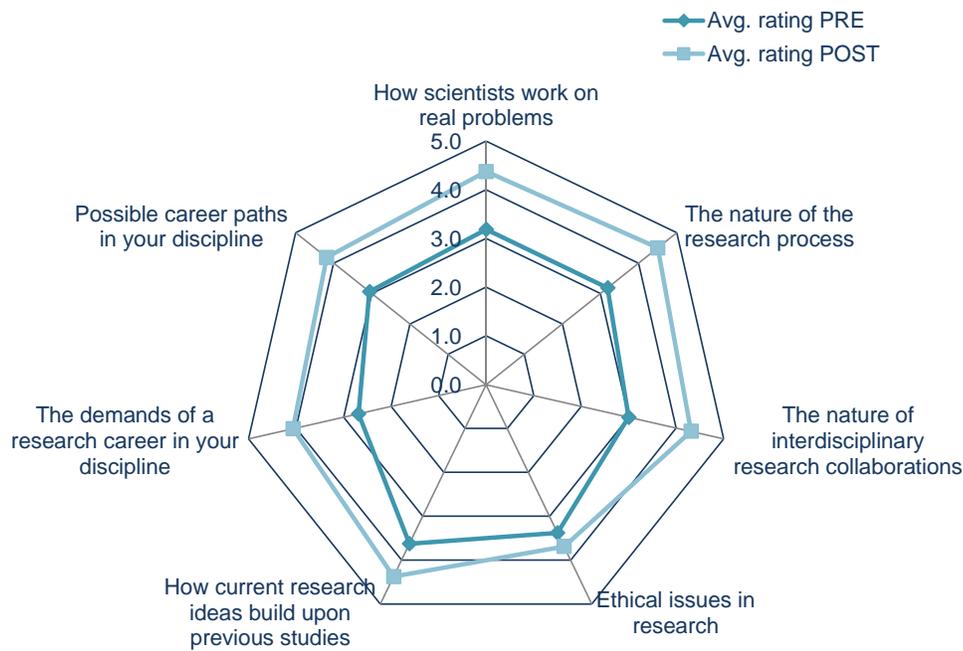
Figure 11. Participant pre-and post-program skills , self-reported

Scale : 1 = Extremely poor at the skill to 5 = Excellent at the skill



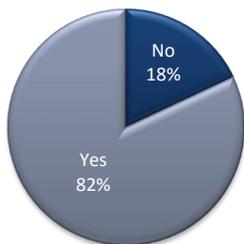
### Participant Knowledge

Figure 12. Participant pre- and post-program knowledge, self-reported  
Scale : 1 = Extremely poor understanding to 5= Excellent understanding



### Graduate School Plans

Figure 13. Did this research experience impact your plans to go to graduate school?



***Please explain how the research experience impacted your plans for graduate school:***

*I enjoyed the research environment and the challenging problems. Before I had not thought much either way about graduate school. Now I'm definitely planning on attending, although I don't yet know which field.*

*I now am considering a few more schools that I had not thought of before. I am looking into more interdisciplinary research.*

*I was in doubt whether I should go to graduate school or find a job after my undergrad. After this REU I am very certain that I will go to graduate school.*

*I was very unsure about graduate school, now I am almost certain that I will go.*

*It made me more aware of different sorts of schools that are out there and helped me focus on the application process.*

*It reassured that I want to go to graduate school.*

*It reinforced my decision on going to graduate school.*

*It reinforced what I had previously heard math graduate school would be like. Also, I received information that indicated that graduate school is a financial possibility.*

*It's made me consider going to graduate school more*

*Made me more aware of the process and opportunities.*

*Realizing how much I enjoyed being able to write computer functions that perform important tasks has made me spend a lot of time reflecting on my previous career choice and exploring the option of possibly pursuing a career in*

*something more computer intensive than I ever thought I would be interested in. In other words, it has opened my eyes to a career field I never thought I would enjoy and has really made me think about what I will value most in a job or for the next few years of my life.*

*This experience allowed me to consider the different paths I could take in graduate school, all of which would lead to different aspects of my area of interest. The program also helped me understand the application process better.*

*This research experience gave me the opportunity to learn more about the differences between math programs, biology programs, and integrated programs. The program also helped me identify my personal research interests, which will direct where I apply to graduate school.*

*This research showed me the area of research that I want to work in.*

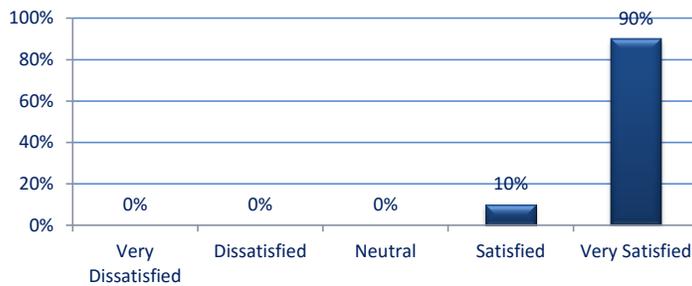
Table 1. Participant pre- and post-program degree plans

|                  |          | End of Program |       |       |
|------------------|----------|----------------|-------|-------|
|                  |          | Master's       | Ph.D. | Total |
| Start of program | Master's | 3              | 4     | 7     |
|                  | Ph.D.    | 0              | 9     | 9     |
|                  | Total    | 3              | 13    | 16    |

## Mentor Evaluation Survey Data

### Overall Satisfaction

Figure 14. Overall, how satisfied were you with the NIMBioS REU program?



### Overall comments about the program:

*I enjoyed the process - it was a very educational experience. I would be happy to serve as a mentor again.*

*I felt our project worked out great this year and I think the students enjoyed it and learned a lot. I am not sure about the specific assessment questions in terms of the specific gains for the individual students but overall I think the students gained a lot through the overall program. I really wouldn't change anything for next year!*

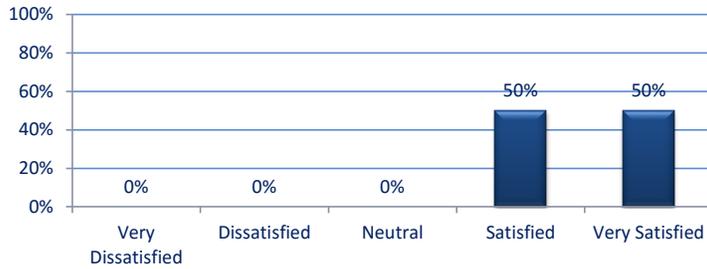
*I was greatly impressed with the students I had this semester. They were more serious and focused than students I have worked with in the past. They were incredibly sharp and worked together amazingly well, utilizing their diverse strengths incredibly well. They were a wonderful group of students.*

*Keep up the good work. The program has reached a good balance between social activities/training/research, and the quality of students seems to increase every year.*

*Perhaps the room for REU mid-term poster session could be larger, and more concentrated on REU.*

## Application Process

Figure 15. How satisfied were you that the student applications supplied the necessary information needed to choose qualified participants?

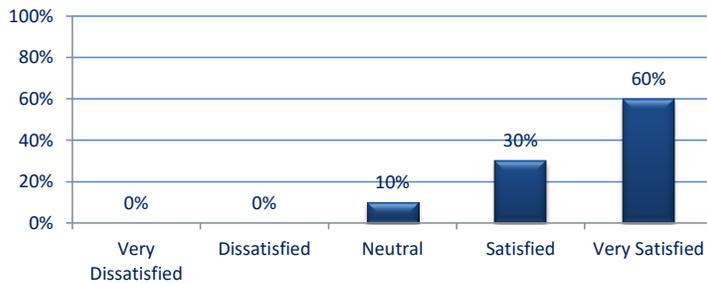


*Please provide any suggestions regarding questions or content that might be helpful to include in future applications:*

*No comments*

## Student Training and Supports

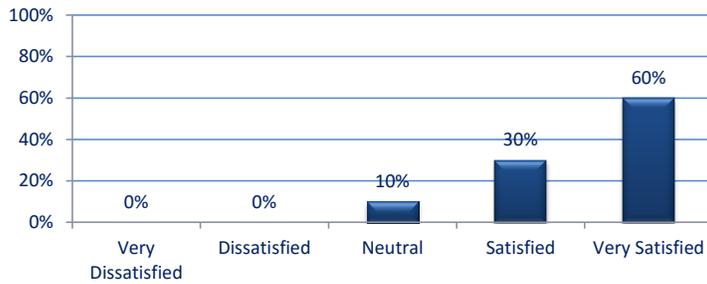
Figure 16. How satisfied were you with the training provided by NIMBioS to your students (lectures in R, MatLab, modeling, etc.)?



*Please let us know if there are any additional training that you feel would have benefitted your students:*

*No comments*

Figure 17. How satisfied were you with the other supports provided by NIMBioS to your students (computer resources, social activities, etc.)?

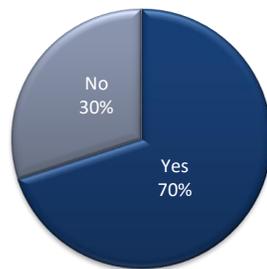


***Please let us know if there are any additional supports that you feel would have benefitted your students:***

*Eric set up a web service for us, an rstudio server, but we only had access to a single CPU which reduced it's utility. I think next year I might try to have them use the NIMBioS cluster, but would need NIMBioS to provide them with instruction on how to submit jobs.*

*It would be good if each group could get one room for the whole period, with no need to move between rooms.*

Figure 18. Did your students attend all research group meetings?



*If you answered "No" above, what were the reasons for not attending provided by your students?*

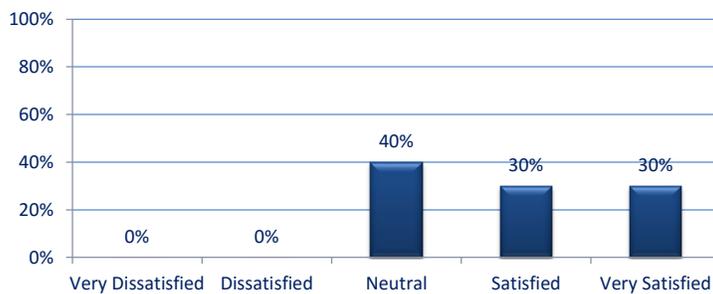
*A student took a week off for family activity and missed a couple of meetings. The other two attended all.*

*One student was out of town for a wedding and missed one meeting. Otherwise, they did not miss any.*

*Sick or unknown (rarely)*

### **Group Communications**

Figure 19. How satisfied were you with Basecamp for communicating with others in the program?



#### **Comments about Basecamp and/or communications within the program in general:**

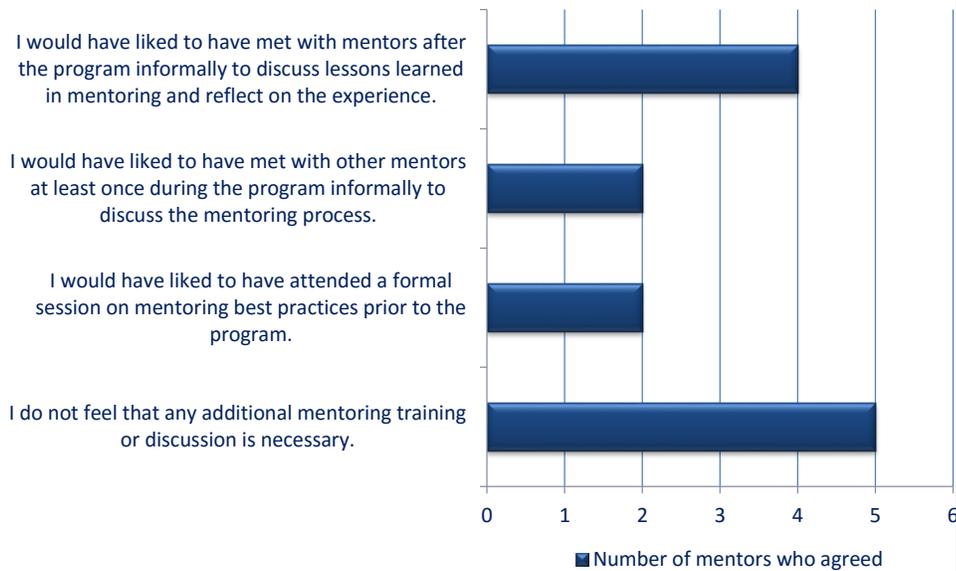
*I have no idea what basecamp is.*

*Kelly did a great job keeping me informed.*

*We use dropbox more often.*

## Mentor Training

Figure 20. Please indicate if you agree with the following statements:



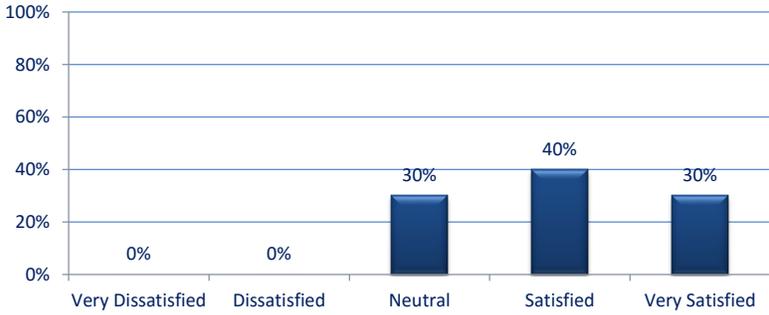
### Comments or suggestions about mentor training:

*I think an informal session on general mentoring processes might be helpful*

*I think some mentoring training useful for those mentors who participate in a REU for the first time.*

*Our group had two mentors who had previous experience with REU program and they helped the other mentor in working with the REU students. So, it worked out for our group. But if none of mentors in a REU group had experience, it would be a good idea for ne mentors to have a pre-program meeting with experienced mentor(s).*

Figure 21. How satisfied were you with your interaction with the other mentor(s) on your project?



**Comments about interactions with other mentors on your project:**

*His knowledge about the subject was minimal, so I don't think he was a good fit.*

## **Appendix A**

List of Participants

## Participants

| <b>Last</b> | <b>First</b> | <b>Institution</b>                     |
|-------------|--------------|--|
| Bender      | Nicole       | Marist College                         |
| Mason       | Christian    | Harvey Mudd College                    |
| Shahi       | Sunil        | Southeastern Louisiana Univ.           |
| Keung       | Jocelyn      | Univ. of North Carolina at Chapel Hill |
| Napoles     | Monica       | Humboldt State University              |
| Vella       | Michael      | Univ. of Notre Dame                    |
| Hale        | Brittany     | Univ. of Tennessee, Knoxville          |
| Hoang       | Kevin        | Emory Univ.                            |
| Schaber     | Kathryn      | Univ. of Dayton                        |
| Estes       | Samuel       | Univ. of Tennessee, Knoxville          |
| Kalobwe     | Erick        | LeMoyne-Owen College                   |
| Utsey       | Kiersten     | Carroll College                        |
| Adams       | Robert       | Maryville College                      |
| Oballe      | Christopher  | The Univ. of Texas at Austin           |
| Rudy        | Natasha      | Wofford College                        |
| Beckmann    | Conrad       | University of Vermont                  |
| Bloom       | Judy         | Eastern Connecticut State Univ.        |
| Lambert     | Jacob        | Univ. of Tennessee, Knoxville          |
| Ward        | Rachael      | Rhodes College                         |

## **Appendix B**

REU Pre and Post-surveys

## Research Experiences for Undergraduates/Veterinary Students

### Pre-survey

Thank you for taking a moment to fill out this survey. Your results will be used to enhance your experience at the University of Tennessee this summer, to improve the REU programs for future cohorts, and to track your progress during the program. Congratulations on your acceptance into the program. We hope you have an interesting and exciting experience.

How did you learn about this program?

What do you hope to gain through participation in this program?

What is the highest level of education you hope to complete?

*High school diploma*

*Associate's degree*

*Bachelor's degree*

*Master's degree*

*Doctoral degree*

Other degree planned, specify:

**The questions on this page will be used to track your progress as a researcher during the program. It's okay if you don't feel as though you have strong skills in all areas.**

How would you rate your ability regarding the following research skills?

*{Extremely poor, Below average, Average, Above average, Excellent}*

Using research literature (e.g. journal articles, books, publications)

Integrating scientific theories with research

Designing a research plan

Using mathematical tools or models to describe a biological scenario

Working collaboratively with other researchers

Analyzing data

Interpreting results

Writing about results

Orally presenting results

**The questions on this page will be used to track your progress as a researcher during the program. It's okay if you don't feel as though you have a good understanding of all the subjects listed.**

How would you rate your level of understanding in the following areas?

*{Extremely poor, Below average, Average, Above average, Excellent}*

How scientists work on real problems  
The nature of the research process  
The nature of interdisciplinary research collaborations  
Ethical issues in research  
How current research ideas build upon previous studies  
The demands of a research career in your discipline  
Possible career paths in your discipline

Please give any suggestions for activities you would like for us to do as a group (social and/or research related):

Please use this space for any additional comments:

## Research Experiences for Undergraduates/Veterinary Students

### Post-survey

Thank you for taking a moment to fill out this survey. Your results will be used to improve the REU programs for future cohorts, and to track your progress during the program. We hope you had an interesting and exciting experience!

### Overall Evaluation

Overall, how satisfied were you with your research experience?

- Very satisfied*
- Satisfied*
- Neutral*
- Dissatisfied*
- Very dissatisfied*

To what extent did this research experience meet your expectations?

- No expectations met*
- Some expectations met*
- Don't know*
- Most expectations met*
- All expectations met or exceeded*

How did you feel about your workload overall?

- Way too little*
- Too little*
- Just about right*
- Too much*
- Way too much*

How often did you feel your research group worked well together?

- Very often*
- Quite Often*
- Sometimes*
- Rarely*
- Never*

When your group worked well together, what factors do you feel contributed to the group's success?

If/when your group was not functioning well, what were some barriers that prevented your group from working well together? How were these barriers overcome (or how do you feel they could have been overcome)?

Did this research experience impact your plans to go to graduate school?

Yes → Please explain how the research experience impacted your plans for graduate school:  
No

What is the highest level of education you hope to complete?

*High school diploma*

*Associate's degree*

*Bachelor's degree*

*Master's degree*

*Doctoral degree*

*Other degree planned, specify:*

Please indicate how useful you found the following lectures or sessions: *{Very useful,*

*Somewhat useful, Not Useful, Did Not Attend}*

*Networking with People; Brian Roe*

*Intro to UT Library Services; Donna Braquet*

*Intro by Mathematica; Adam Aaron*

*MATLAB Introduction by Heather Finotti*

*All About 3D Printing; Michael Peek*

*Overview of Modeling; Louis Gross*

*National Scholarships Pres.; Nichole Fazio-Veige*

*Modeling Lectures; Suzanne Lenhart*

*Team Dynamics Mid-Evaluation; Kelly Sturner*

*Political Guide to Team Personalities; Kelly Sturner*

*UT REU Symposium*

*R Tutorials*

*Graduate School Panel*

Comments about lectures or sessions:

Please list any other sessions or lectures you found valuable:

**The questions on this page will be compared with your pre-survey answers to track your progress as a researcher during the program.**

How would you rate your ability regarding the following research skills?

*{Extremely poor, Below average, Average, Above average, Excellent}*

Using research literature (e.g. journal articles, books, publications)

Integrating scientific theories with research

Designing a research plan

Using mathematical tools or models to describe a biological scenario

Working collaboratively with other researchers

Analyzing data

Interpreting results

Writing about results

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Orally presenting results

**The questions on this page will be compared to your pre-survey answers to track your progress as a researcher during the program.**

How would you rate your level of understanding in the following areas?  
{*Extremely poor, Below average, Average, Above average, Excellent*}

How scientists work on real problems  
The nature of the research process  
The nature of interdisciplinary research collaborations  
Ethical issues in research  
How current research ideas build upon previous studies  
The demands of a research career in your discipline  
Possible career paths in your discipline

Would you recommend the NIMBioS REU program to others?

Yes

No → Please explain why you would or would not recommend the NIMBioS REU to others:

### **Accommodations Evaluation**

Please indicate your level of satisfaction with the following accommodations provided to you during your research experience:  
{*Very satisfied, Satisfied, Neutral, Dissatisfied, Very dissatisfied, Not applicable*}

Computing resources  
Housing  
Mail service (postal)  
Extracurricular activities

Did you find Basecamp was a useful means of communicating within the REU group?

Yes

No

*I did not use Basecamp*

*I did not know about Basecamp*

Please describe any accommodations/supports you needed that were not supplied (if any):

### **Mentor Evaluation**

**[Participants were given the opportunity to rate each mentor separately here]**

Your responses to the following questions will be kept confidential. Your name will not be associated with any of your responses regarding your mentors during reporting. Please select the name of one of your mentors:

My mentor:

*{Strongly agree, Agree, Neutral, Disagree, Strongly disagree}*

Was accessible

Was interested in enhancing my research experience

Communicated on an appropriate level

Encouraged independence

Offered constructive ideas for improvement

Was organized

Had the necessary skills to mentor

Positively impacted my research experience

Please use this space for additional comments about your mentors:

Please use this space for any additional comments about your research experience overall:

## Research Experiences for Undergraduates

### Mentor Feedback Survey

Thank you for taking a moment to complete this survey. Your responses will be used to evaluate and improve the REU programs hosted by the National Institute for Mathematical and Biological Synthesis. Information supplied on the survey will be confidential, and results will be reported only in the aggregate.

How satisfied were you that the student applications supplied the necessary information needed to choose qualified participants?

*Very satisfied*

*Satisfied*

*Neutral*

*Dissatisfied*

*Very dissatisfied*

Please provide any suggestions regarding questions or content that might be helpful to include in future applications:

Did your students attend all research group meetings?

Yes

No

If you answered "No" above, what were the reasons for not attending provided by your students?

How satisfied were you with the training provided by NIMBioS to your students (lectures in R, MatLab, modeling, etc.)?

*Very satisfied*

*Satisfied*

*Neutral*

*Dissatisfied*

*Very dissatisfied*

Please let us know if there are any additional training that you feel would have benefitted your students:

How satisfied were you with the other supports provided by NIMBioS to your students (computer resources, social activities, etc.)?

*Very satisfied*  
*Satisfied*  
*Neutral*  
*Dissatisfied*  
*Very dissatisfied*

Please let us know if there are any additional supports that you feel would have benefitted your students:

How satisfied were you with Basecamp for communicating with others in the program?

*Very satisfied*  
*Satisfied*  
*Neutral*  
*Dissatisfied*  
*Very dissatisfied*

Comments about Basecamp and/or communications within the program in general:

NIMBioS would like your input about providing opportunities to help our REU mentors increase their undergraduate mentoring skills next year. Please check the box next to each statement below that applies to you regarding your mentoring experience:

*I do not feel that any additional mentoring training or discussion is necessary.*  
*I would have liked to have attended a formal session on mentoring best practices prior to the program.*  
*I would have liked to have met with other mentors at least once during the program informally to discuss the mentoring process.*  
*I would have liked to have met with mentors after the program informally to discuss lessons learned in mentoring and reflect on the experience.*

Comments or suggestions about mentor training:

How satisfied were you with your interaction with the other mentor(s) on your project?

*Very satisfied*  
*Satisfied*  
*Neutral*  
*Dissatisfied*  
*Very dissatisfied*

If you were not satisfied with your interactions with the other mentor(s), please explain: (NOTE: your response will be kept confidential to NIMBioS staff)

The next few pages contain questions about the changes in knowledge and skills that you saw in your program participants from the beginning to the end of the program. You will have to opportunity to rate each of your participants separately. Please begin by selecting your project from the list below:

**[Projects listed here]**

*Mentors were asked, for each of the participants in their programs, to rate them on the following research skills at BEGINNING of program and again at the END of program on a 5-point scale as follows: 1 = Extremely poor 2 = Below average 3 = Average 4 = Above Average 5 = Excellent*

(Participant's Name) Research Skills:

Using research literature (e.g. journal articles, books, publications)  
Integrating scientific theories with research  
Designing a research plan  
Using mathematical tools or models to describe a biological scenario  
Working collaboratively with other researchers  
Analyzing data  
Interpreting results  
Writing about results  
Orally presenting results

*Mentors were asked, for each of the participants in their programs, to rate them on the following levels of understanding at BEGINNING of program and again at the END of program on a 5-point scale as follows: 1 = Extremely poor 2 = Below average 3 = Average 4 = Above Average 5 = Excellent*

(Participant's Name) Level of Understanding of:

How scientists work on real problems  
The nature of the research process  
The nature of interdisciplinary research collaborations  
Ethical issues in research  
How current research ideas build upon previous studies  
The demands of a research career in your discipline  
Possible career paths in your discipline

Overall, how satisfied were you with the NIMBioS REU program?

Very satisfied  
Satisfied  
Neutral

Dissatisfied  
Very dissatisfied

Please use this space for any additional comments or suggestions for improving the program next year: