Evaluation Summary Report of NIMBioS Activities Year Two

April 1, 2009-March 31, 2010

National Institute for Mathematical and Biological Synthesis
March, 2010

Evaluation Summary of Major NIMBioS Activities

Executive Summary

This is a report of NIMBioS evaluated activities during the second annual reporting period (RP 2) to the National Science Foundation. The report covers the period of April 1, 2009-March 31, 2010. During RP 2, 618 different people from 249 institutions participated in NIMBioS sponsored activities. Research program activities during RP 2 included:

- 10 Working Groups (with a total of 15 meetings)
- 4 Investigative Workshops
- 20 Short-term visitors
- 6 Postdoctoral Fellows
- 1 Sabbatical Fellow
- 6 Graduate Research Assistantships

Education and outreach program activities during RP 2 included:

- 1 Tutorial
- 4 Education/Outreach Workshops
- A NIMBioS Seminar Series
- Biology by Numbers (Kids U at the University of Tennessee)
- Research Experiences for Undergraduates/Veterinary Students Program
- Mu Alpha Theta 2009 National Convention
- Vision and Change Undergraduate Education Reform Meeting
- Undergraduate Conference at the Interface between Mathematics and Biology
- Project Kaleidoscope Webinar
- Teacher Collaboration Program Pilot

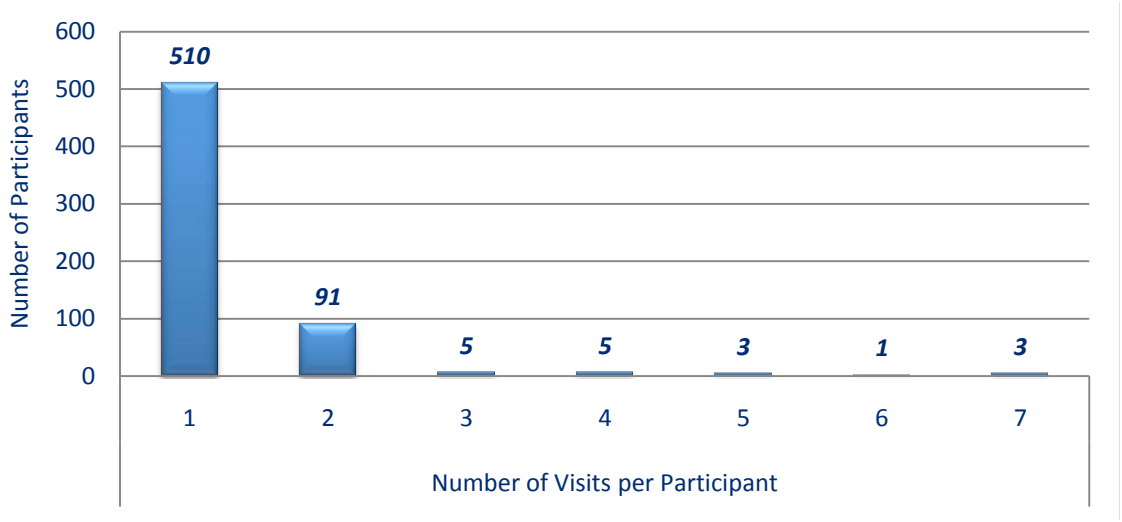
Other events included:

- 2 Advisory Board Meetings
- BioSongs Meeting

Participants came from colleges/ universities, government institutions, non-profit organizations, business organizations, and high schools (See Participant Diversity Report for complete demographic details).

Of the 618 participants, 108 visited NIMBioS more than once (Figure 1). Most participants making return visits to NIMBioS during RP 2 were participating in subsequent meetings of a Working Group; however, 49 participants took part in two different types of events (e.g. a Working Group and a Workshop), while five participated in three different types of events.

Figure 1. Number of events per participant



NIMBioS conducted evaluations of its Working Groups, Workshops, Tutorial, Undergraduate Conference at the Interface between Mathematics and Biology, and Research Experiences for Undergraduates/Veterinary Students programs. An evaluation of the pilot Teacher Collaboration program is ongoing as well. Evaluations were carried out via electronic surveys sent to all participants either after participation in a NIMBioS event, or both before and after participation if a pre/post comparison of responses was warranted. Evaluation findings, along with suggestions for improvement, were shared with event organizers, as well as NIMBioS staff as needed. Improvements to program content and format, as well as NIMBioS' overall operations, are made accordingly. Following is a brief synopsis of the evaluations of NIMBioS' major activities during RP 2.

Research Program Activities

Working Group and Investigative Workshop evaluation highlights are aggregated across all events in their respective categories. Evaluations of Working Groups and Workshops sought to answer the following common questions:

1. Were participants satisfied with the event overall?
2. Did the event meet participant expectations?

3. Do participants feel the group made adequate progress toward their stated goals?
4. Do participants feel they gained knowledge about the main issues related to the research problem?
5. Do participants feel they gained a better understanding of the research across disciplines related to the group's research problem?
6. What impact do participants feel participating in the event will have on their future research?
7. Were participants satisfied with the accommodations offered by NIMBioS?
8. What changes in accommodations, group format, and/or content would participants like to see at future meetings?

Working Groups

First Meetings

NIMBioS Working Groups are chosen to focus on major scientific questions at the interface between biology and mathematics. NIMBioS Working Groups are relatively small (10-15 participants), focus on a well-defined topic, and have well-defined goals and metrics of success. Working Groups typically meet 2-3 times over a two-year period, with each meeting lasting 3-5 days; however, the number of participants, number of meetings, and duration of each meeting is flexible, depending on the needs and goals of the group. During RP 2, NIMBioS hosted the first meetings of ten Working Groups, with a total of 130 participants (Table 1) (See http://www.nimbios.org/workinggroups/ for more details about specific Working Groups). Evaluation surveys were sent to all participants, with the exception of Working Group organizers and NIMBioS employees who were participating in the Working Groups. A total of 82 participants took part in the evaluation of the first meetings of their Working Groups.

Table 1. *Working Group First Meetings Hosted by NIMBioS*

Title of Working Group	Dates	# Participants
Coalitions and Alliances	4/16-18/09	10
Intragenomic Conflict	4/20-22/09	14
Feral Swine/Pseudo-rabies in Great Smoky Mountains National Park	4/27-29/09	13
Biological Problems Using Binary Matrices	5/ 26-29/09	10
Synthesizing and Predicting Infectious Disease while Accounting for Endogenous Risk (SPIDER)	6/7-9/09	14
Integrating Functional and Evolutionary Dynamics at Multiple Scales	6/10-12/09	10
Population and Community Ecology Consequences of Intraspecific Niche Variation	7/27-29/09	15
Darwinian Morphometrics: Cross-Topology Registration of Shape	1/10-12/10	16
Modeling Bovine Tuberculosis	2/17-18/10	14
Modeling Forest Insects	2/22-26/10	14

Synopsis of First Meeting Evaluation Results

- Overall satisfaction with first meetings was high among survey respondents, the majority of whom (97%) indicated they either agreed or strongly agreed that their respective meetings were very productive and met their expectations (95%).
- Almost all respondents (95%) thought the presentations were useful and the presenters were very knowledgeable about their topics (99%).
- The majority of respondents (83%) agreed that they had a better understanding of the main issues related to their group's research problem as a result of participation.
- A large majority (98%) said they planned to take the knowledge they gained during the Working Group and apply it to their own research.
- Forty-two percent of respondents reported they developed *unanticipate*d plans for collaborative research with other Working Group participants.
- Ninety-nine percent of respondents either agreed or strongly agreed that they would recommend participating in NIMBioS Working Groups to their colleagues.
- Almost all respondents said that the most useful aspect of their Working Groups was its multidisciplinary composition.

- Ninety-nine percent of respondents agreed that the format of their Working Group was very effective for achieving the group's goals.
- Ninety-two percent of respondents felt their Working Group made adequate progress toward its stated goals for the first meeting.
- Ninety-two percent of respondents said they left their respective meetings with a good idea of what their contribution will be at the next meeting.
- Overall, respondents reported being satisfied with the travel, housing, and other amenities provided by NIMBioS.

Second Meetings

During the reporting period, NIMBioS hosted the second meetings of five Working Groups, with a total of 53 participants (Table 2). Evaluation surveys were sent to all participants, with the exception of Working Group organizers and NIMBioS employees who were participating in the Working Groups. A total of 29 participants took part in the evaluation of the second meetings of their Working Groups.

Table 2. *Working Group Second Meetings Hosted by NIMBioS*

Title of Working Group	Dates	# Participants
Synthesizing and Predicting Infectious Disease while Accounting for Endogenous Risk (SPIDER)	11/9-11/09	11
Biological Problems Using Binary Matrices	12/10-13/09	11
Feral Swine/Pseudo-rabies in Great Smoky Mountains National Park	1/25-26-10	14
Coalitions and Alliances	2/4-6/10	9
Integrating Functional and Evolutionary Dynamics at Multiple Scales	3/1-3/10	8

Synopsis of Second Meeting Evaluation Results

- Overall satisfaction with the Working Group meetings was high among survey respondents, 97% of whom indicated they either agreed or strongly agreed that their meeting was very productive, while 93% indicated it met their expectations.
- One-hundred percent of respondents thought the presentations were useful and that the presenters were very knowledgeable about their presentation topics.
- Ninety-seven of respondents agreed that participating in the meeting increased their understanding of the work being done in by others in the group, while 83% agreed that it

increased their understanding of how everyone's work would come together to achieve the goals of the group.

- Many (79%) of respondents said that participating in the Working Group had influenced their research agendas. Several participants noted that the group had lead to collaborations that otherwise may not have occurred.
- Most respondents (86%) agreed that the format of the Working Group was very effective for achieving its goals.
- Almost all respondents (97%) felt that their Working Group made adequate progress toward reaching its intended goals.
- Most (86%) respondents said they left the second meeting with a good idea of what their contribution would be at the next meeting.
- Overall, respondents reported being satisfied with the travel, housing, and other amenities provided by NIMBioS.

Workshops

NIMBioS Investigative Workshops involve 30-40 participants, focus on a broad topic or a set of related topics, attempt to summarize/synthesize the state of the art and identify future directions, and have potential for leading to one or more future Working Groups. NIMBioS hosted four Investigative Workshops during RP 2, with a total of 149 participants (Table 3). Evaluation surveys were sent to all participants, with the exception of Workshop organizers and NIMBioS employees who were participating in the Workshops. A total of 124 participants took part in the evaluation of the Workshops.

Table 3. *Investigative Workshops Hosted at NIMBioS*

Title of Workshop	Dates	# Participants
Modeling White Nose Syndrome (WNS) in Bats at the Individual, Colony and Regional Levels: Epizootiology and Management	6/29-7/1/09	35
Modeling Bovine Tuberculosis	7/7-9/09	38
New Soil Black Box Strategies	10/15-17/09	33
Optimal Control and Optimization for Individual-based and Agent-based Models	12/1-3/09	43

Synopsis of Workshop Evaluation Results

- Overall satisfaction was high among survey respondents, the majority of whom (93%) indicated they either agreed or strongly agreed that their Workshop was very productive. Most (89%) also agreed it met their expectations.
- Almost all respondents thought the presentations were useful (98%) and that the presenters were very knowledgeable about their topics (92%).
- Ninety-eight percent of respondents either agreed or strongly agreed that they would recommend participating in NIMBioS Workshops to their colleagues.
- Most respondents (94%) felt that participating in their Workshops helped them to better understand the research going on in other disciplines regarding the research problems.
- Most (86%) said the exchange of ideas that took place during the Workshop would influence their future research.
- The majority of respondents agreed that they had a better understanding of the main issues related to their Workshop's research problem as a result of participation.
- Ninety-five percent of respondents agreed that the format of their Workshop was very effective for achieving its goals.
- Ninety percent of respondents felt the participants of their Workshops, overall, made adequate progress toward the Workshop's stated goals.
- A large majority (97%) said they were satisfied with the opportunities provided during the Workshop presentations and discussions to ask questions and/or make comments.
- Overall, respondents reported being satisfied with the travel, housing, and other amenities provided by NIMBioS.

Education and Outreach Program Activities

Tutorial: Optimal Control and Optimization for Individual-based and Agent-based Models

NIMBioS hosted one Tutorial during RP 2. The Optimal Control and Optimization for Biologists Tutorial was conducted at NIMBioS December 1-3, 2009. The Tutorial comprised 37 participants, including co-organizers Suzanne Lenhart (University of Tennessee, Department of Mathematics and NIMBioS Associate Director for Education, Outreach and Diversity) and Michael Bevers (USDA Forest Service, Fort Collins, Colorado). Participants included a diverse collection agricultural scientists, biologists, engineers, and mathematicians.

The Tutorial was designed to introduce selected topics in optimal control and optimization with an emphasis on biological applications. Introductory material on optimal control of ordinary differential equations and difference equations, and some interactive computer labs were included in sessions led by Dr. Lenhart. Mathematical programming and spatial optimization techniques were demonstrated for managing natural resources under conditions of risk. Lectures and computer lab exercises, led by Dr. Bevers, introduced linear, integer, nonlinear, stochastic and chance-constrained programming methods. Renee Fister of Murray State University gave a lecture on optimal control techniques applied to cancer modeling. Paul Armsworth of the University of Tennessee lectured on applications in conservation and natural resource management.

Evaluation surveys were sent to all participants, with the exception of Tutorial organizers and NIMBioS employees who were participating in the Tutorial. A total of 26 participants took part in the evaluation of the Tutorial.

The evaluation of the Tutorial sought to answer the following questions:

1. Were participants satisfied with the Tutorial overall?
2. Did the Tutorial meet participant expectations?
3. Was the Tutorial appropriate to the participants' levels of expertise?
4. Did participants feel they learned an appropriate amount of information?
5. How did participants feel about the amount of content and format of the Tutorial?
6. Were participants satisfied with the accommodations offered by NIMBioS?
7. What changes in accommodations, group format, and/or content would participants like to see at future similar meetings?

Synopsis of Tutorial Evaluation Results

- One-hundred percent of respondents either agreed or strongly agreed that they would recommend participating in NIMBioS Tutorials to their colleagues.
- Almost all respondents agreed the Tutorial met their expectations (96%) and was appropriate to their level of expertise (92%).
- All respondents thought the instructors were knowledgeable about their topics, and 92% thought the presentations were useful.
- The majority of participants thought the hands-on exercises were useful (96%), while a smaller majority felt the group discussions were useful (89%).

- Ninety-two percent of respondents agreed that the format of the Tutorial was very effective for achieving its goals.
- The majority of respondents (69%) indicated they felt the amount of content offered during the Tutorial was "just right," while 31% felt there was too much material presented for the allotted time.
- One-hundred percent of participants agreed that they had a better understanding of optimal control of ordinary differential equations and difference equations as a result of attending the Tutorial.
- A smaller majority of participants (58%) agreed that they had a better understanding of linear, integer, nonlinear, stochastic and chance-constrained programming methods as a result of attending the Tutorial.
- A large majority (92%) said they were satisfied with the opportunities provided during the Tutorial to ask questions and/or make comments.
- Overall, respondents reported being satisfied with the travel, housing, and other amenities provided by NIMBioS.

Research Experiences for Undergraduates/Veterinary Students

The NIMBioS *Research Experience for Undergraduates* (REU) and *Research Experience for Veterinary Students* (REV) programs took place simultaneously on the UT campus June 1-July 24, 2009. During the program, veterinary students and undergraduate students majoring in math, biology, and related fields lived on campus and worked in four-person research teams mentored by UT professors. The teams worked on state-of-the-art research projects at the interface of math and biology both in the lab and in the field. Participants learned how to write computer programs to model their research findings mathematically. Besides the research projects, program activities included lectures on modeling and background on the projects, lab work, tutorials on Matlab and R, an ethics session, a career advice session, progress and finale presentations, a written report, and social activities. The program was designed to give participants the opportunity to actively participate in the various components of the scientific research process. Each project group had a math/computational mentor and a biology/vet mentor.

The REU/REV program comprised 16 participants who came from a diverse array of backgrounds, including agricultural sciences/natural resources, biological/biomedical sciences, engineering, veterinary medicine, and mathematics. A high school math teacher and biology teacher were also included in the

16. Four veterinary students and four undergraduate math majors participated in the REV program projects, while the remaining six undergraduates and two teachers participated in the REU program projects.

Evaluation surveys were sent to all student and high school teacher participants in the program. All 16 participants took part in the evaluation.

The evaluation of the REU/REV sought to answer the following questions:

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

Synopsis of REU/REV Evaluation Results

- Overall satisfaction with the program was high among participants, 100% of whom said they were “satisfied” or “very satisfied” with their experience and would recommend the program to others.
- Fourteen of the sixteen participants said most or all of their expectations were met or exceeded during the program.
- Participants rated their mentors highly, with the average biology mentor rating at 4.8 and the average math mentor rating at 4.3 (on a scale of 1-5, with 5 being the most favorable).
- Participants reported gains in several research-related skills, with an average rating of 3.4 for all skill levels on the pre survey and 3.9 on the post survey (on a scale of 1 = extremely poor at the skill and 5 = excellent at the skill).
- Participants reported gains in knowledge regarding several research related topics. Before the program, participants on average rated themselves 3.2 on a 5-point scale (1 = extremely poor understanding of the topic, 5 = excellent understanding). After participation, the average rating was 4.0.

- While most participants' plans to go to graduate school remained unchanged as a result of participating in the program, one student said the experience encouraged him/her to attain a doctoral degree when he/she previously planned to attain only a bachelor's degree.
- Overall, respondents reported being satisfied with the travel, housing, and other amenities provided by NIMBioS.

Undergraduate Conference on the Interface between Mathematics and Biology

The NIMBioS first annual Undergraduate Research Conference at the Interface Between Biology and Mathematics took place at the University of Tennessee's Conference Center in downtown Knoxville October 23-24, 2009. The event was organized by the NIMBioS Education and Outreach Associate Director for Education, Outreach, and Diversity, Suzanne Lenhart, and the Education and Outreach Coordinator Sarah Duncan.

The conference comprised nearly 200 participants, including college/university undergraduates, college/university faculty and staff, government employees, graduate students, and postdoctoral researchers. Undergraduates in biology, mathematics, computer science and related fields gave talks and presented posters on topics ranging from modeling diseases to using mathematics to understand population dynamics and biological phenomena. The conference featured 40 student talks and 40 student posters.

Keynote speakers at the conference included Lisa J. Fauci, professor of mathematics at Tulane University, who discussed the dynamics of cilia and flagella, and Paul E. Super, Science Coordinator at the Great Smoky Mountains National Park (GSMNP), who talked about research, inventories, and monitoring used in protection efforts at GSMNP. The conference also included a panel discussion with university faculty on career opportunities at the interface of mathematics and biology.

The evaluations for the conference sought to answer the following questions:

1. Were participants satisfied with the conference overall?
2. Did the conference meet participant expectations?
3. Do participants feel the conference allowed them to make new connections with others in math and biology?
4. Do participants feel they gained a better understanding of undergraduate research happening at the interface of mathematics and biology?

5. What impact do undergraduate participants feel the conference will have on their future career plans?
6. Were participants satisfied with the accommodations offered by NIMBioS?
7. What changes in accommodations, group format, and/or content would participants like to see at future similar meetings?

Synopsis of UBM Conference Evaluation Results

- Overall satisfaction with the conference was high among respondents, the majority of whom indicated they either agreed or strongly agreed that the conference was productive (86%) and met their expectations (88%).
- Most respondents thought the presentations were useful (87%), while a smaller majority felt the panel discussion was useful (73%).
- Ninety-one percent of respondents either agreed or strongly agreed that they would recommend participating in NIMBioS conferences to their colleagues.
- Overall, respondents reported being satisfied with the conference accommodations provided by NIMBioS.
- Respondents reported relatively high levels of learning on how to present scientific research. Learning gains, however, were slightly lower regarding career opportunities at the interface of mathematics and biology.
- Most respondents felt the most useful aspect of the conference was the student presentations followed by the good atmosphere for student interaction and the career panel.
- Ninety-five percent of undergraduate respondents said they felt that participating in the conference helped them become more knowledgeable about undergraduate research going on at the interface of biology and math.
- Ninety-two percent of respondents felt the conference format was effective.
- The majority of respondents (97%) agreed that the conference made adequate progress toward its goal of creating a forum through which undergraduates could present research and make new connections at the interface of math and biology.
- Eighty-one percent of undergraduate respondents said they felt that the exchange of ideas that took place during the conference would (or potentially would) influence their career plans.
- The majority of respondents (86%) said they felt that participating in the conference helped them make connections with others within the interdisciplinary field of math and biology.