



2014 Annual Report
National Institute for Mathematical and Biological Synthesis

Reporting Period September 2013 - August 2014
Submitted to the National Science Foundation May 2014

Preview of Award 1300426 - Annual Project Report

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Accomplishments

* What are the major goals of the project?

A major goal of mathematical models and analysis in biology is to provide insight into the complexities arising from the non-linearity and hierarchical nature of biological systems. The primary goals of NIMBioS are to foster the maturation of cross-disciplinary approaches in mathematical biology and assist in the development of a cadre of researchers who are capable of conceiving and engaging in creative and collaborative connections across disciplines to address fundamental and applied biological questions. NIMBioS has been developed to efficiently utilize NSF funding: 1) to address key biological questions by facilitating the assembly and productive collaboration of interdisciplinary teams; and 2) to foster development of the critical and essential human capacity to deal with the complexities of the multi-scale systems that characterize modern biology.

Our efforts have included a variety of routes to achieve the above goals, based upon the successes of our leadership team in developing new interdisciplinary collaborations nationally and internationally, and on the successful efforts at other NSF-supported Synthesis Centers. A major goal has been to encourage the development of small Working Groups, which focus on emphasis areas at several levels of biological organization that will benefit from interdisciplinary efforts. Working Groups arise from community requests for NIMBioS support and are vetted by our external Advisory Board. A second component to meet our goals is through encouraging community requests for Investigative Workshops. These assemble larger groups of researchers to assess

somewhat broader problems, with dual goals of fostering language-building across disciplines and defining specific issues to be addressed by future Working Groups.

Human capacity building goals are fostered through: direct mentoring of new researchers (including undergraduate and graduate students and post-doctoral fellows); outreach efforts in collaboration with diverse professional organizations to educate biologists about mathematical and computational approaches found to be broadly useful in biological applications; connections to institutions serving under-represented groups; a summer research experience program targeted at undergraduates and high school teachers; and varying levels of tutorials designed to enlighten biologists about key quantitative methods, with particular emphasis on the application of high performance computing methods to analyze biological problems which involve large datasets, spatial information, and dynamics. A further objective is to assist mathematicians in identifying new mathematical challenges arising from current biological research.

The questions addressed by NIMBioS span all of biology, thus impacting both basic and applied science. The impacts are therefore necessarily broad, ranging from those arising due to the application of specific models to particular challenges such as controlling zoonotic disease spread, to fundamental questions about human origins, biosphere functioning, and the emergence of biological patterns at diverse scales. An objective is for NIMBioS to provide the effective infrastructure so that it becomes a primary location for the careful analysis of numerous questions of direct public policy concern, a particular emphasis of which has included issues arising from infectious diseases of zoonotic origin. To carry out research and address the challenging nature of modern biology, NIMBioS fosters the continuing development of individuals trained at this interface of biology and mathematics as well as the development of entire programs that are equipped to educate the array of mathematically competent, biologically knowledgeable and computationally adept researchers needed to address the vast array of challenging questions in this century of biology. Fostering high quality interdisciplinary programs, including a diverse representation of individuals involved in life science and mathematical research, is a major emphasis of NIMBioS.

*** What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?**

Major Activities: Over the reporting period from September 1, 2013 through August 31, 2014, NIMBioS hosted (or will host this summer) 19 meetings of 14 different Working Groups (one joint Working Group held an additional meeting offsite), 8 Investigative Workshops, and 5 Tutorials. There are projected to be over 1,050 participants in NIMBioS-hosted activities during this period with 20 Postdoctoral Fellows in residence, five Sabbatical Fellows, and 72 Short-term Visitors.

The Working Groups meeting during this period were:

Play, Evolution and Sociality (October 2013), Within-Host Modeling of Mycobacterium avium subsp. paratuberculosis Infections (December 2013 and July 2014), Biotic Interactions (September 2013, May 2014), Hierarchy and Leadership (November 2013, April 2014), Ocean Viral Dynamics (January 2014), Agent-Based Models of Biological Systems (January 2014), Nonautonomous Systems and Terrestrial Carbon Cycle (March 2014), Plant-Soil Feedback Theory (November 2013, April 2014), Climate Change and Vector-Borne Diseases (December 2013, June 2014), Evolution of Institutions (March 2013), Evolutionary Approaches to Sustainability (April 2014), Habitat for Migratory Species (May 2014), Computational Landscape Genomics (May 2014), and Integrating Human Risk Perception of Global Climate Change into

Dynamic Earth System Models (a joint activity with SESYNC, January 2014 meeting held at NIMBioS and June 2014 meeting held at SESYNC).

The Investigative Workshops were: Analyzing Animal Vocal Sequences (October 2013), Insect Pest Resistance Evolution (November 2013), Animal Social Networks (March 2014), Vectored Plant Viruses (March 2014), Interface Disease Models (March 2014), Modeling Contamination of Fresh Produce (April 2014), Predictive Models for Ecological Risk Assessment (April 2014), and Leptospirosis Modeling (June 2014). We also hosted a workshop on Evolutionary Approaches to Peace Science (October 2013) organized by the Peace Science Society and a workshop on Opportunities for Women in Mathematical Sciences (April 2014) organized in collaboration with the NSF-supported Mathematical Sciences Institutes Diversity Committee.

The Tutorials were: Computing in the Cloud: What Every Computational Life Scientist Should Know (April 2014) organized in collaboration with the NSF-supported Remote Data Analysis and Visualization Center, Parameter Estimation for Dynamic Biological Models (May 2014), Algebraic and Discrete Biological Models for Undergraduate Courses (June 2014), Biology by Numbers: Bringing Math to the High School Biology Classroom (July 2014), and Evolutionary Quantitative Genetics (August 2014), cosponsored with NESCent and the American Society of Naturalists.

Ongoing this period were efforts in collaboration with the NSF-funded XSEDE Remote Data Analysis and Visualization Center to develop new high performance-computing tools, particularly using the R-language, to encourage broader use of computational methods in a variety of biological areas. This collaboration resulted in the Tutorial on Computing in the Cloud and supported an interdisciplinary-group of researchers and students from statistics, biology, mathematics and computer science to develop tools in R for application to biological problems including Bayesian mixed models in genomics, phylogenetic biogeography, approximate Bayesian computation, and multivariate data reduction in ecological models.

Demographics data on all participants at events from September 1, 2013 through March 31, 2014 are presented in detail in the NIMBioS Evaluation Report (see section Y6-2 of the attached addendum to this Annual Report) and summarized below. There were 595 participants through March 31, 2014 from 24 countries and 43 U.S. states as well as the District of Columbia representing 259 different institutions. International participants amounted to 15% of all participants. Most participants were college or university faculty (45%), but undergraduates (22%), post-doctoral researchers (14%), and graduate students (10%) accounted for a significant fraction of participants. Across all events the gender ratio was 57% male to 43% female, and minority representation was near 14%. Representation of various minority categories was slightly above current levels of minority representation for doctoral recipients in the biological sciences and the mathematical sciences.

Short-term Visitors from September 1, 2013 through March 31, 2014 were from

35 different institutions and collaborated with NIMBioS post-doctoral and sabbatical fellows, faculty from four University of Tennessee departments, and 27 researchers external to NIMBioS/Univ. Tennessee.

Specific Objectives: A goal of NIMBioS is to encourage research activities at the interface of mathematics and biology by encouraging requests from the broad community for activities to be held at NIMBioS. These activities are evaluated by the external Advisory Board. The Board met once physically and twice virtually during this reporting period, evaluating 22 requests for Working Groups and Investigative Workshops, and recommending support of 13 of them. The Board also evaluated 53 requests for postdoctoral fellowships of which six were supported with one pending offer, and the Board recommended support for three Sabbatical Fellow requests.

One specific objective, supported by a supplement to the main award, involves a collaboration with the Remote Data Analysis and Visualization project of NSF-XSEDE. This includes ongoing efforts to extract biologically meaningful information from genomic sequence data. This includes developing a statistical and computational framework, using parallel methods linking C codes to statistical tools in R, to fit mechanistic models to genomic sequence data using likelihood functions derived from population genetics. This has provided 200 time speed-ups and has been applied to predicting protein production rates of genes based upon the evolutionary patterns in their usage of codons. RDAV's developers of the pbdR parallel framework within R (see r-pbd.org) collaborated with NIMBioS staff and students to prepare a Tutorial emphasizing parallel computing in R, which has many components useful for the analysis of biological and ecological data. The Tutorial was motivated using examples and data from biology and held at NIMBioS in April 2014.

Another specific objective of NIMBioS is to foster the development of a cadre of scholars who are able to effectively carry out research at the interface of mathematics and biology. NIMBioS supported activities using several different methods in order to meet this objective for individuals at diverse levels of experience.

NIMBioS supported an array of outreach activities for the general public, K-12 students and teachers that illustrated, including in a hands-on manner, the connections between math and biology. The Biology in a Box program, Girls in Science, SHADES, and Adventures in STEM Camp are all examples of efforts to reach out to K-12 students and pique their interest in math and the sciences. NIMBioS' teacher collaboration and math/biology curriculum programs, Junior Science and Humanities Symposium, and Summer Research Experience for undergraduates program (which includes two high school teachers this year) help participants gain the skills and make the connections between mathematics and biology that are a core component of the NIMBioS mission.

At other levels of experience, NIMBioS hosted a Summer Research Experience for undergraduates program which included undergraduates in math and

biology fields from 16 different institutions, carrying out team research projects on six different topics including statistical techniques for predicting cardiac rhythm disorder, mathematical models of granuloma formation in John's disease, location effects on genetics and individual fitness, modeling transmission and control of bovine respiratory disease, dynamic systems approach to tracking facial expressions, and agent-based modeling of ant community dynamics. The emphasis on these projects is developing quantitative approaches to answering biological questions. NIMBioS hosted an undergraduate research conference at the interface of math and biology, which included over 60 undergraduate research talks and posters and was attended by more than 150 students and faculty from academic institutions across North America.

Graduate students have been regular participants in many NIMBioS research activities, particularly workshops, tutorials, and short-term visits. NIMBioS co-organized, jointly with the Mathematical Biosciences Institute and the Centre for Applied Mathematics in Bioscience and Medicine, a Summer Research Workshop on Modeling Rhythm and Oscillations, designed as a bootcamp to introduce graduate students to mathematical tools and techniques used in studying biological rhythms. NIMBioS supported six UT graduate students to carry out research in collaboration with NIMBioS post-docs and researchers and to provide assistance with specific programs. A new Visiting Graduate Fellow program supported four Fellows from outside the University of Tennessee for longer visits to collaborate with NIMBioS post-docs and staff and/or University of Tennessee faculty.

Post-doctoral Fellows at NIMBioS are independent researchers who develop their own proposed research activity, and receive mentoring from both a mathematical sciences and a biological sciences faculty member. Of the 20 Postdoctoral Fellows in residence for at least part of this reporting period, six had completed a Ph.D. in mathematical or computational sciences and fourteen had backgrounds in areas of biology. An objective of NIMBioS is to enhance career opportunities for current and former Post-doctoral Fellows, and career development seminars and workshops are held regularly. During this reporting period, seven past or current Fellows accepted new faculty positions, and two accepted research positions with federal agencies.

Significant Results: NIMBioS relies upon participants to self-report products that were derived from their participation in NIMBioS activities. There were a total of 275 products reported from the time of preparation of the Sept 2012-Aug 2013 annual report (June 2013) and April 30, 2014, including 107 journal articles, 2 book chapters, 2 dissertations and theses, and 2 other one-time publications. One website/web-related utility, 73 video and audio products, 6 software or netware products, 1 model, and 3 educational aids or curricula were also reported. Also, during this period a total of 72 presentations, 3 grant requests, and 3 meetings, workshops or symposiums were reported. Details on publications in journals, books, and conference proceedings are included in the Products section; details on featured articles, websites, and media coverage are included as Additional

Products in Section Y6-5 of the Addenda to this annual report.

NIMBioS-supported activities have resulted in publications in a broad range of topics as designated by ISI Web of Science categories. Ecology was the most common subject category, followed by Evolutionary Biology, Multidisciplinary Sciences, Mathematical & Computational Biology, Biology, and Genetics & Heredity. Figure 1 (provided as an attached supporting file to this section) illustrates the diversity of scientific topics covered by working groups and workshops hosted by NIMBioS between September 1, 2013 and March 31, 2014 (more information on interpretation of this figure is available in the NIMBioS Evaluation Report, Section Y6-2 of the addendum to this annual report, see Figure 2).

A number of the publications resulting from NIMBioS activities appeared in top national and international journals with high impact factors, including Nature, Science, Ecology Letters, Trends in Ecology and Evolution, PLOS Biology, Systematic Biology, and the Proceedings of the National Academy of Sciences. Table 1 in the supporting file included with this section provides details on NIMBioS-derived publications in certain high-impact journals.

Key outcomes or
Other achievements:

Metrics of success for NIMBioS include establishing new connections between researchers from diverse backgrounds leading to new interdisciplinary science. Illustrations of the outcomes NIMBioS has in this regard appear in Figure 2 (attached as a supporting file for this section). Figure 2 shows the fields of expertise of participants in NIMBioS Working Groups during the current reporting period and the connections fostered between individuals with different backgrounds by participation in the Working Groups. The nodes on the graphic correspond to the participant's major field of expertise, with the node size being a non-linearly scaled metric for the number of participants in that field. While the majority of participants identify themselves as being in fields of mathematical sciences or biological/biomedical sciences, there are a number of participants from the social sciences as well as agricultural sciences, earth sciences, and marine sciences. As the width of the connecting line segments in this graphic illustrates, these NIMBioS Working Groups have generated a large number of connections between individuals from diverse fields.

A major emphasis at NIMBioS has been ongoing efforts to evaluate activities in light of NIMBioS objectives as outlined in the Strategic Plan. The NIMBioS evaluation program follows the CIPP systems approach (Context, Inputs, Process, Products), which takes into account not only the outcomes of the Center, but also how the outcomes are achieved. The Process Evaluation seeks to evaluate congruence between goals and activities, monitoring and judging activities at NIMBioS, mainly through periodic evaluative feedback surveys from participants and organizers. The Products Evaluation seeks to monitor, document, and assess the quality and significance of the outcomes of NIMBioS activities. It provides guidance for continuing, modifying, or terminating specific efforts. Previous evaluation case studies found that affiliation with a NIMBioS Working Group has a significant positive effect on participant collaboration

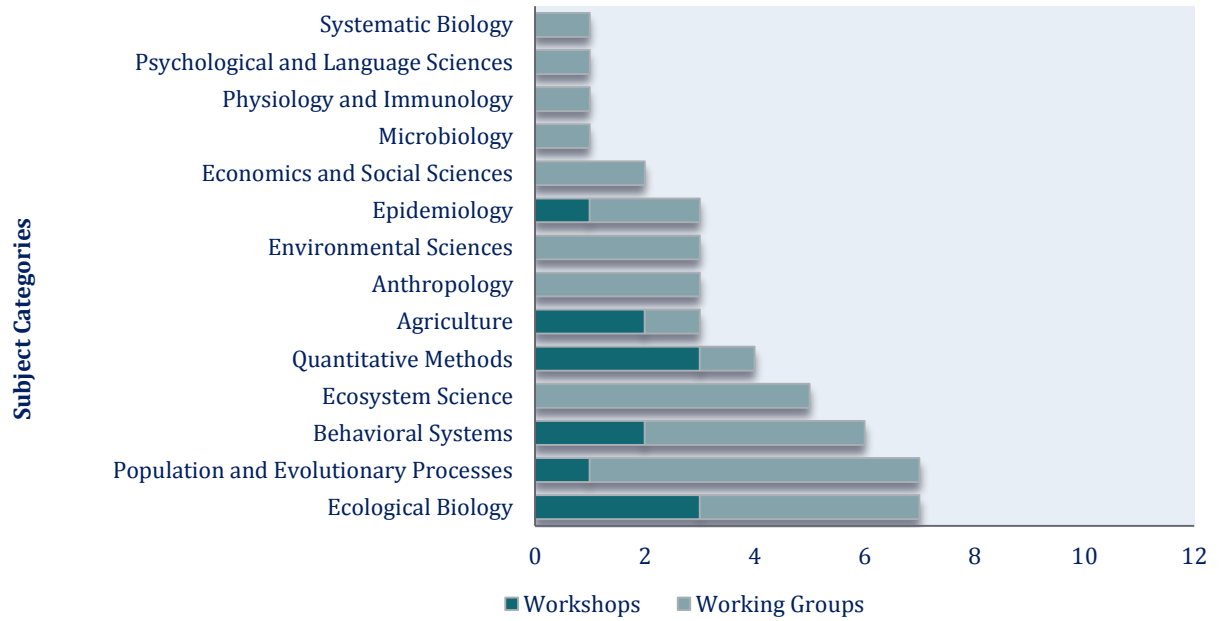


Figure 1. Diversity of scientific topics represented in NIMBioS working groups and workshops during the period from September 1, 2013 – March 31, 2014.

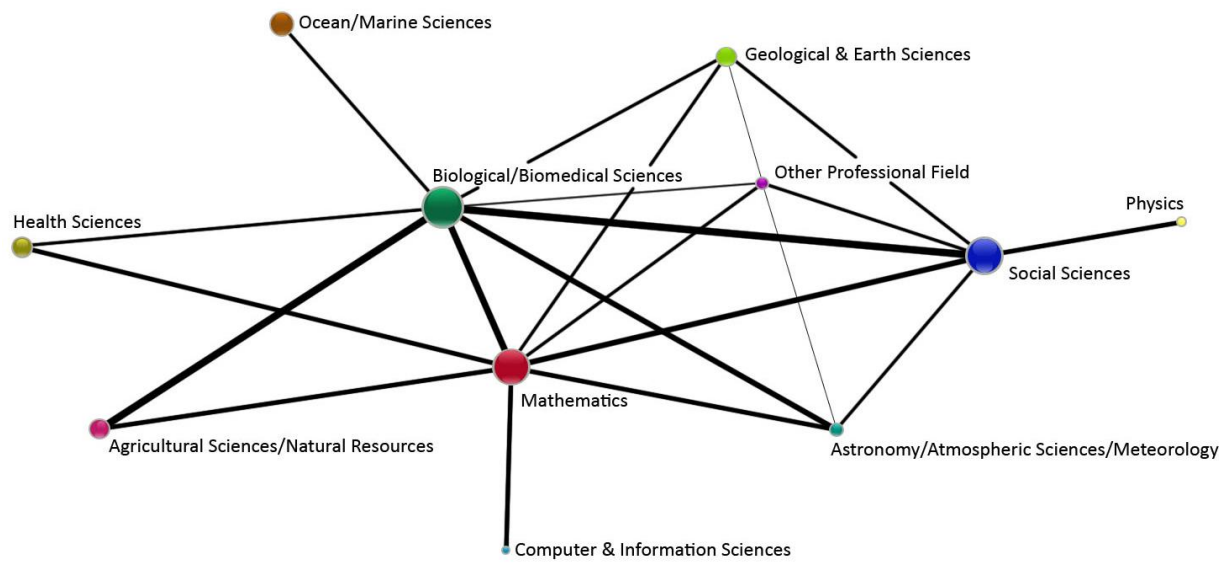


Figure 2. Cross-disciplinary connections fostered among Working Group members through the meetings hosted at NIMBioS during the period from September 1, 2013-March 31, 2014. Node radius is representative of the log-scaled number of participants in each field of study. Line size is representative of the number of times researchers from each field were brought together to collaborate and problem-solve at NIMBioS.

Table 1. Number of NIMBioS articles published in a selection of high-impact journals during the current reporting period and since NIMBioS' inception as of April 2014, sorted by journal 5-Year Impact Factor

Journal Title	5-Year Impact Factor	# of NIMBioS publications in Year 6	# of NIMBioS publications since inception
Nature	38.16	1	3
Cell	34.37	0	1
Science	33.59	1	4
Ecology Letters	18.50	3	9
Trends in Ecology and Evolution	17.11	1	5
PLoS Biology	13.45	2	2
Systematic Biology	13.32	2	4
Proceedings of the National Academy of Sciences	10.58	3	12
Current Biology	10.45	1	1
Nature Communications	10.02	1	1
PLoS Genetics	9.44	0	2
Nucleic Acids Research	8.06	0	2
Phil Trans of the Royal Soc B-Biological Sciences	7.30	1	2
Molecular Ecology	6.79	2	2
Ecology	6.37	3	5
PLoS Computational Biology	5.94	4	6
Proc of the Royal Soc B-Biological Sciences	5.83	3	6
Evolution	5.40	4	9
The American Naturalist	5.33	3	9
Journal of Animal Ecology	5.17	1	3
Journal of the Royal Society Interface	5.17	2	2
PLoS One	4.24	9	20
BMC Bioinformatics	3.51	1	1
Animal Behaviour	3.41	2	3

* The journal impact factor is a measure of the frequency with which the “average article” in a journal has been cited in a particular year. The impact factor is an indicator of a journal’s relative importance, especially as compared to other journals in the same field. Impact factor calculation: $\frac{\text{cites in year } n}{\text{articles published in year } (n-1 + n-2)}$ /number of articles published in year $(n-1 + n-2)$.

activities (i.e. number of co-authors, number of international co-authors, number of cross institutional co-authors), and a moderate effect on publication activities (i.e. publishing in new fields). Qualitative analysis of interdisciplinarity showed a shift in publication Web of Science subject categories toward mathematical fields. A current evaluation case study examines the growth and productivity of NIMBioS working group teams using social network analysis, bibliometric measures, and psychometric surveys regarding views and experiences with interdisciplinary research. This study seeks to answer the following questions:

- o What are the patterns of change in the composition of Working Group participants over time?
- o What do the patterns of connectedness look like among Working Group participants across disciplinary and geographic boundaries and over time?
- o To what extent do the network characteristics and views of interdisciplinary research of Working Group members correlate with productivity?

One issue common across all Synthesis Centers is the need for a viable comparison group for Outcome Evaluations. NIMBioS is currently working on an evaluation case study that will use a matched comparison group of journal articles based on several criteria to compare with NIMBioS-affiliated products on several bibliometric indicators, including influence (citation analysis, H-indices), interdisciplinarity (subjects covered), collaboration (levels of coauthorship), and diversity (gender, discipline area, geographic location, of coauthors). NIMBioS participated in the first international gathering of synthesis centers, held in October 2013 at CESAB (Center for the Synthesis and Analysis of Biodiversity) in Aix-en-Provence, France and attended by representatives from synthesis centers from the US, France, Australia, China, Germany and the UK. NIMBioS led discussion of center evaluation activities at this gathering, and has collaborated with other attendees in composing a perspectives paper on the benefits of center-scale activities to foster synthetic research.

*** What opportunities for training and professional development has the project provided?**

NIMBioS carries out extensive training and professional development activities. Detailed listing of activities during this reporting period are included in the attached supporting file (TrainingandDevelopment.pdf). We summarize below the activities focused on Visiting Graduate Fellows and Post-doctoral Fellows.

A new visiting graduate student fellowship program was implemented in Fall 2013 and will have supported four fellow visits by August 2014. A student from University of Washington-St. Louis visited NIMBioS for five weeks in Fall 2013 to collaborate with a NIMBioS postdoc and faculty member on development of an agent-based model to simulate fungal growth and morphology. A second student, from Georgia Institute of Technology, visited in Spring 2014 and will return in Summer 2014, each for one-week periods, to work with Microbiology faculty on the development of a dynamical model to examine the effect of viruses on nutrient recycling in the marine environment. A third student, from Ohio State, will visit for a one week period during Summer 2014 to work with a NIMBioS faculty member to create a framework for modeling trait evolution in hybrid species. Finally, a fourth student, from The University of Texas at El Paso, will visit for two months over the Summer 2014 to work with a NIMBioS postdoc on optimization of algorithms for epitope prediction. The intent of this program is to provide opportunities for graduate students to spend time at NIMBioS and to expand their abilities to work at the interface

of math and biology.

As of the time of writing, there are 13 Post-doctoral Fellows in residence, and a total of 13 Fellows have completed their fellowships, with three of these leaving during this reporting period. Each post-doc is assigned two mentors, one with more mathematical/computational expertise and one with more biological expertise. These mentors are not directing the research efforts of the post-docs, but they are expected to discuss research with the post-doc, suggest possible new projects, and provide career and training suggestions as well. Mentors are expected to meet routinely with each post-doc. The meetings may be part of any regular lab group meetings the mentor organizes. Based on reports from post-docs, all are meeting regularly or as needed with their mentors and many are attending lab meetings supervised by their mentors or others.

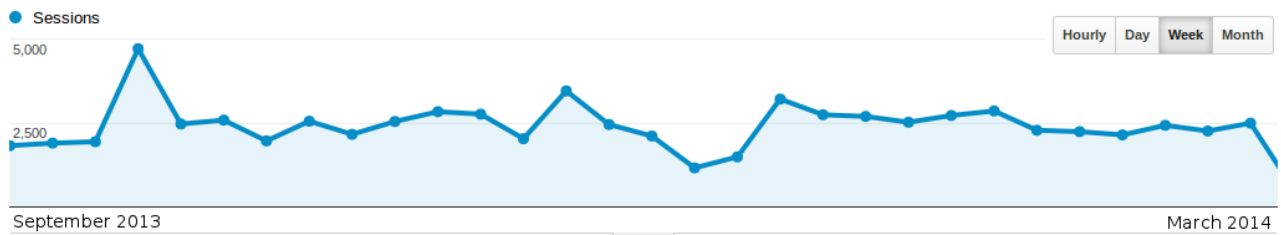
The Professional Development Seminar series established during the previous reporting period has continued this year. It meets approximately monthly. Topics for the series are chosen by the Post-doctoral Fellows themselves. The most frequently requested topics concern aspects of the job application and interview process, which was the subject of four seminars during this reporting period. Examples of recent successful job applications by mentors and previous NIMBioS post-docs (cover letters, research and teaching statements, etc.) have been posted on a dedicated web site only available to post-docs. Other topics of high interest identified by the Fellows concerned aspects of the peer review process (e.g., being a peer reviewer for manuscripts or journal and how to write a cover letter when submitting as an author). In one change to how these professional development sessions run, we have involved teams of Fellows and their mentors in the design of some of these sessions. We have also encouraged mentor-Fellow pairs to have follow-up discussions of some of the professional development topics covered. These innovations aim to give the Fellows more ownership over their own professional development and to maximize synergies between the mentoring program and the Professional Development Seminar series. New post-docs also participated in a training session on how to communicate their science to the media and to non-scientific audiences; topics included using social media, talking to a reporter, on-camera interviewing, and poster and slide presentation tips. Post-docs are informed of other opportunities (e.g., workshops, short-courses, web sites and other information relevant to professional development) that are occurring on campus and elsewhere. All post-docs participated in ScienceLives by providing online profiles that required them to succinctly describe their work. Post-docs are provided with a travel allowance to promote their development as scientists and for career development. Presentations by post-docs are included in the listing of presentations addendum to this report.

Annual reviews of post-docs are conducted with a focus on professional and scientific development. Submission of manuscripts is an expected goal for all post-docs and other goals include presentations at national/international meetings, mentoring of undergraduates/graduate students, teaching if that is an individual career goal, and to have visited at least one of the NIMBioS minority serving institution partners. Four NIMBioS postdocs will serve as mentors for undergraduates during the 2014 Summer Research Experiences for Undergraduates and Teachers program.

*** How have the results been disseminated to communities of interest?**

The award-winning website of the National Institute for Mathematical and Biological Synthesis (URL: <http://www.nimbios.org>) is the primary vehicle for communicating the scientific endeavors of NIMBioS, for both internal and external audiences. The NIMBioS website was initiated when the Institute was established in October 2008 with 40 html pages. As of April 2014, the website contained 938 pages and 688 pdf documents. Its performance is monitored regularly. For the year ending April 1, 2014, unique visitors increased 18% and site visits increased 9% compared to the previous year. Table 2 and Figure 3 in the attached supporting file illustrate the increasing trend in number of site visits over the current reporting year and over the full range of NIMBioS operations. The purpose of the website is to provide information about research at the interface of mathematics

(a)



(b)

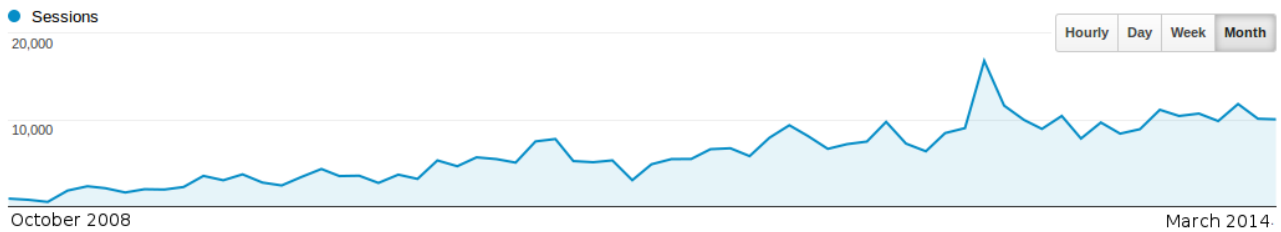


Figure 3. Number of *nimbios.org* website visits for (a) the 2014 reporting year (weekly, September 1, 2013 through Mar 31, 2014) and (b) monthly for the period October 1, 2008 through Mar 31, 2014. The peaks in Figure 3 (a) show the impact of significant products on the number of website visits in the reporting period. Figure 3 (b) documents the overall increasing trend in visits since the inception of NIMBioS (site use data from Google Analytics).

Table 2. Number of *nimbios.org* website visits and unique visitors for NIMBioS reporting years (site use data from Google Analytics).

Reporting year	Unique visitors	Visits
Sep 1, 2008 - Aug 31, 2009	9259	19951
Sep 1, 2009 - Aug 31, 2010	21278	41700
Sep 1, 2010 - Aug 31, 2011	33449	65208
Sep 1, 2011 - Aug 31, 2012	45084	88398
Sep 1, 2012 - Aug 31, 2013	74123	116473
Sep 1, 2013 - Mar 31, 2014*	49047	74121

*Partial year

and biology and attract potential scientists/researchers to participate in the work of NIMBioS while also providing scientific information to a general audience. The audience for nimbios.org is multifaceted with a wide range of needs and interests, primarily consisting of scientists from academic institutions, state and federal government agencies and non-governmental organizations. Viewers searching online for information about science-related topics visit NIMBioS pages where they can view videos on science topics, read feature stories about science and scientists, interact using social media tools including sharing posts or leaving comments on the NIMBioS blog. The website provides up-to-date and accurate information about the wide range of topics addressed by NIMBioS groups and researchers, while familiarizing viewers with the NIMBioS mission and activities. The site is updated with new content on a daily basis.

Another key channel for disseminating information to NIMBioS communities of interest is the bi-monthly newsletter called "NIMBioS News." Each newsletter includes a science story, an education and outreach-related feature, a video from the library of NIMBioS-produced videos, and a listing of future educational and research opportunities. There are currently more than 4,600 subscribers, and the newsletter typically has an average click-through rate of about 30 percent.

NIMBioS regularly distributes e-blasts of announcements about upcoming research and educational and outreach opportunities as well as calls for support. The e-blast reaches individual email addresses and also goes to a variety of interdisciplinary listservs and websites for placement. NIMBioS also distributes a weekly, "NEXT@NIMBioS," email with a listing of the next week's events and visiting scientists; this email is circulated to a more internal audience.

To reach a wider audience for the purposes of enhancing public understanding and increasing interest in learning about science, NIMBioS publicizes its extensive library of more than 140 NIMBioS-produced videos featuring groundbreaking research, interviews with top scientists, seminars, workshops, tutorials and other educational topics. The videos are hosted on the NIMBioS YouTube channel and also featured on the NIMBioS website.

As a new initiative established this reporting period, NIMBioS now provides live streaming of many of its events, including Investigative Workshops, Tutorials and seminars. Live streaming is accessed through the NIMBioS website via a log-in page, is open to any interested viewer at no charge, and a live chat window is provided to allow viewer feedback and questions to the presenters.

NIMBioS maintains a subscription account with EurekAlert!, an online, global news service which reaches thousands of journalists. NIMBioS press releases are disseminated via EurekAlert! as well as via its private list of media contacts. The press releases are written for a non-specialized audience interested in science topics.

Other ways NIMBioS reaches wider audiences are through its social media sites, including Facebook, Twitter, LinkedIn, Flickr, Storify, the NIMBioS WordPress Blog, and the WordPress Blogs established by NIMBioS for NIMBioS Investigative Workshops and Tutorials. Each account is set to receive and respond to comments by individuals using these websites.

*** What do you plan to do during the next reporting period to accomplish the goals?**

In accordance with its Strategic Plan, NIMBioS will continue to utilize the following specific methods to meet its general goals: Focused research projects (Working Groups) to build collaboration among diverse communities;

Building collaborations through more open-ended general problems, addressed through multiple approaches (Investigative Workshops); Skill and methods-based programs (Tutorials) that foster a broader understanding of potential applications of modern math and computational science in biology; Increasing and diversifying the workforce in cross-disciplinary research through Postdoctoral Fellowships; Visiting researcher programs including Sabbatical, and Short-term opportunities for visitors to collaborate with post-docs and students, and participate in other activities; and an expansive set of education-linked-to-research endeavors from elementary through post-doctoral level that provide diverse opportunities at the math/biology interface.

A recently initiated new program that will continue to be expanded based upon demand during the next reporting period is support for NIMBioS Visiting Graduate Fellows who will be in residence for periods of several weeks to months. This program has expanded our efforts to support graduate students from diverse institutions beyond our support for such students to participate in Investigative Workshop and Tutorial activities and as Short-term Visitors. Over the initial period of this program, we have supported four Fellows, and we will continue to advertise this new program for visits for up to several months by graduate students interested in pursuing research with NIMBioS senior personnel, postdoctoral fellows or working group participants. These Visiting Graduate Fellows work on-site at NIMBioS. The program is designed to facilitate graduate student training while fostering research at the interface of mathematics and biology.

A key component of the Strategic Plan has been a formal evaluation process, following the Evaluation Plan approved by our Advisory Board, which provides a mechanism to assess the variety of activities NIMBioS supports in terms of how effectively they contribute to meeting the NIMBioS mission. The success of the programs is evident from past participant evaluations and from Site Reviews. We have continued to re-envision our evaluation program in part because participant responses have been so highly positive that we gain little additional information by continuing to evaluate each individual activity. Over this next period we will thus continue to transition our evaluation effort toward the science of evaluating collaborative interdisciplinary activities and the effectiveness of centers such as NIMBioS. An emphasis over this period will be the development of appropriate comparison groups to which to compare the impacts of NIMBioS programs. This includes building comparison datasets of journal publications to which to compare those arising from NIMBioS activities in a variety of bibliographic metrics and group collaboration metrics. In coordination with our communication and education staff members, we will continue to develop methods to assess the effectiveness of interdisciplinary education and collaboration efforts as part of the science of team science. A component that will assist this effort is the planned completion of the NIMBioS Administrative DataBase system, which will more effectively allow us to coordinate all aspects of the demographic information and evaluation responses we obtain from participants.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
Figure_1_and_Table_1_signifresults.pdf	Diversity of Scientific Topics and Publication Impact Factors	Louis Gross	05/16/2014
Fig2_KeyOutcomes_Cross_Disciplinary_Collab.pdf	Figure of Cross Disciplinary Collaboration Network for NIMBioS Working Groups	Louis Gross	05/16/2014

Filename	Description	Uploaded By	Uploaded On
Table_2_and_Figure_3_Dissemination_sitevisits.pdf	Table and Figure Illustrating Trends in NIMBioS Website Visits	Louis Gross	05/16/2014
TrainingandDevelopment.pdf	Summary of Additional Training and Development Activities	Louis Gross	05/16/2014

Products

Books

Book Chapters

Laubenbacher R, Hinkelmann F, Oremland M (2013). Agent-based models and optimal control in biology: A discrete approach. *Mathematical Concepts and Methods in Modern Biology 1*. R. Robeva, T. Hodge. Elsevier. San Diego, CA. 143. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Lenhart S, Bodine E, Zhong P, Joshi H (2013). Illustrating optimal control applications with discrete and continuous features. *Advances in Applied Mathematics, Modeling, and Computational Science, Fields Institute Communications* 66. Melnik R, Kotsireas IS. 209. Status = PUBLISHED; Acknowledgement of Federal Support = Yes ; DOI: 10.1007/978-1-4614-5389-5_9.

Conference Papers and Presentations

Inventions

Journals

Agusto F, Lenhart S (2013). Optimal control of the spread of malaria superinfectivity. *Journal of Biological Systems*. 21 (4), . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1142/S0218339013400020

Agusto FB, Gumel AB (2013). Qualitative dynamics of lowly- and highly-pathogenic avian influenza strains. *Mathematical Biosciences*. 243 (2), 147. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.mbs.2013.02.001

Alonso LM, Proekt A, Schwartz TH, Pryor KO, Cecchi GA, Magnasco MO (2014). Dynamical criticality during induction of anesthesia in human ECoG recordings. *Frontiers in Neural Circuits*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes

Berec L, Maxin D (2014). Why have parasites promoting mating success been observed so rarely?. *Journal of Theoretical Biology*. 342 47. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.jtbi.2013.10.012

Blayneh KW, Mohammed-Awel J (2014). Insecticide-resistant mosquitoes and malaria control. *Mathematical Biosciences*. 252 14. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.mbs.2014.03.007

- Boete C, Agosto FB, Reeves RG (2014). Impact of mating behaviour on the success of malaria control through a single inundative release of transgenic mosquitoes. *Journal of Theoretical Biology*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes
- Bolnick DI, Araujo MS (2011). Partitioning the relative fitness effects of diet and trophic morphology in the threespine stickleback. *Evolutionary Ecology Research*. 13 439. Status = PUBLISHED; Acknowledgment of Federal Support = Yes
- Bolnick DI, Otto SP (2013). The magnitude of local adaptation under genotype-dependent dispersal. *Ecology and Evolution*. 37 (14), 4722. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1002/ece3.850
- Borstein SR, Mcgee MD, Wainwright PC (2013). Mouthbrooding does not constrain craniofacial diversity in Lake Tanganyika cichlids. *Integrative and Comparative Biology*. 53 (1), E251. Status = PUBLISHED; Acknowledgment of Federal Support = Yes
- Bossu CM, Beaulieu JM, Ceas PA, Near TJ (2013). Explicit tests of palaeodrainage connections of southeastern North America and the historical biogeography of Orangethroat Darters (Percidae: Etheostoma: Ceasia). *Molecular Ecology*. 22 (21), 5397. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/mec.12485
- Buhnerkempe MG, Grear DA, Portacci K, Miller RS, Lombard JE, Webb CT (2013). A national-scale picture of U.S. cattle movements obtained from Interstate Certificate of Veterinary Inspection data. *Preventive Veterinary Medicine*. 112 (3-4), 318. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.prevetmed.2013.08.002
- Camacho ET, Melara LA, Villalobos MC, Wirkus S (2013). Optimal control in the treatment of Retinitis Pigmentosa. *Bulletin of Mathematical Biology*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1007/s11538-013-9919-1
- Cantrell RS, Cosner C, Lou Y, Ryan D (2012). Evolutionary stability of ideal free dispersal strategies: A nonlocal dispersal model. *Canadian Applied Mathematics Quarterly*. 20 (1), 15. Status = PUBLISHED; Acknowledgment of Federal Support = Yes
- Carstens BC, Satler JD, Jordan, D (2013). The carnivorous plant described as *Sarracenia alata* contains two cryptic species. *Biological Journal of the Linnean Society*. 109 (4), 737. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/bij.12093
- Chaffee DW, Griffin H, Gilman RT (2013). Sexual imprinting: What strategies should we expect to see in nature?. *Evolution*. 67 (12), 3588. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/evo.12226
- Chary M, Kaplan E (2014). Synchrony can destabilize reward-sensitive networks. *Frontiers in Neural Circuits*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.3389/fncir.2014.00044
- Chen S, Sanderson MW, White BJ, Amrine DE, Lanzas C (2013). Temporal-spatial heterogeneity in animal-environment contact: Implications for the exposure and transmission of pathogens. *Scientific Reports*. 3 3112. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1038/srep03112
- Chen S, White BJ, Sanderson MW, Amrine DE, Ilany A, Lanzas C (2014). Highly dynamic animal contact network and implications on disease transmission. *Scientific Reports*. 4 4472. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1038/srep04472
- Collins C, Shen J, Wise SM (2013). An efficient, energy stable scheme for the Cahn-Hilliard-Brinkman system.

Communications in Computational Physics. 13 (4), 929. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.4208/cicp.171211.130412a

Connor EF, Collins MD, Simberloff D (2013). The checkered history of the checkerboard distributions. *Ecology*. 94 (11), 2403. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1890/12-1471.1

Cordoni G, Palagi E (). Fair play and honest signals in immature chimpanzees. *Proceedings Societa Toscana*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes

Dall SRX, Bell AM, Bolnick DI, Ratrieks FLW (2012). An evolutionary ecology of individual differences. *Ecology Letters*. 15 (10), 1189. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/j.1461-0248.2012.01846.x

de Waal FBM, Gavrilets S (2013). Monogamy with a purpose. *Proceedings of the National Academy of Sciences*. 110 (38), 15167. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1073/pnas.1315839110

DeAngelis D (2013). The case for ratio dependence in trophic ecology. *Trends in Ecology & Evolution*. 28 (5), 259. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.tree.2012.12.002

DeGiorgio M, Degnan JH (2014). Robustness to divergence time underestimation when inferring species trees from estimated gene trees. *Systematic Biology*. 63 (1), 66. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1093/sysbio/syt059

Degnan JH (2013). Anomalous unrooted gene trees. *Systematic Biology*. 62 (4), 574. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1093/sysbio/syt023

Donahue K (2013). Why ontogeny matters during adaptation: Developmental niche construction and pleiotropy across the life cycle in *Arabidopsis thaliana*. *Evolution*. 68 (1), 32. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/evo.12284

Dorazio RM, Connor EF (2014). Estimating abundances of interacting species using morphological traits, foraging guilds, and habitat. *PLOS One*. 94 (4), e94323. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pone.0094323

Duncan SI, Lenhart S, Sturmer KK (2014). Activities for students: Measuring Biodiversity with probability. *Mathematics Teacher*. 107 (7), 547. Status = PUBLISHED; Acknowledgment of Federal Support = Yes

Earl JE, Castello PO, Cohagen KE, Semlitsch RD (2014). Effects of subsidy quality on reciprocal subsidies: How leaf litter species changes frog biomass export. *Oecologia*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1007/s00442-013-2870-x

Earl JE, Semlitsch RD (2013). Carryover effects in amphibians: Are characteristics of the larval habitat needed to predict juvenile survival?. *Ecological Applications*. 23 (6), 1429. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1890/12-1235.1

Earl JE, Zollner PA (2014). Effects of animal movement strategies and costs on the distribution of active subsidies across simple landscapes. *Ecological Modelling*. 283 (10), 45. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.ecolmodel.2014.03.020

Edelaar P, Bolnick DI (2012). Non-random gene flow: An underappreciated force in evolution and ecology. *Trends in Ecology & Evolution*. 27 (12), 659. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.tree.2012.07.009

- Federico P, Gross LJ, Lenhart S, Ryan D (2013). Optimal control in individual-based models: Implications from aggregated methods. *American Naturalist*. 181 (1), 64. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1086/668594
- Finotti H, Lenhart S, Phan T (2012). Optimal control of advection director for reaction-diffusion population models. *Evolution Equations and Control Theory*. 13 (1), 81. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.3934/eect.2012.1.81
- Ganusov VV, Auerbach J (2014). Mathematical modeling reveals kinetics of lymphocyte recirculation in the whole organism. *PLOS Computational Biology*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes
- Gaoue OG, Horvitz CC, Ticktin T, Steiner UK, Tuljapurkar S (2013). Defoliation and bark harvesting affect life-history traits of a tropical tree. *Journal of Ecology*. 101 (6), 1563-1571. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/1365-2745.12140
- Gaydos TL, Heckman NE, Kirkpatrick M, Stinchcomb JR, Schmitt J, Kingsolver JG, Marron JS (2013). Visualizing genetic constraints. *Annals of Applied Statistics*. 7 (2), 860. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1214/12-AOAS603
- Godsoe W (2014). Inferring the similarity of species distributions using Species' Distribution Models. *Ecography*. 37 (2), 130. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/j.1600-0587.2013.00403.x
- Gonzalez-Forero M, Gavrilets S (2013). Evolution of manipulated behavior. *The American Naturalist*. 182 (4), 439. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1086/671932
- Gorecki P, Eulenstein O (2014). DrML: Probabilistic modeling of gene duplications. *Journal of Computational Biology*. 21 (1), 89. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1089/cmb.2013.0078
- Gorecki P, Eulenstein O, Tiuryn J (2013). Unrooted tree reconciliation: A unified approach. *IEEE-ACM Transactions on Computational Biology and Bioinformatics*. 10 (2), 522. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1109/TCBB.2013.22
- Gross L (2013). Selective ignorance and multiple scales in biology: Deciding on criteria for model utility. *Biological Theory*. 8 (1), 74. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1007/s13752-013-0123-1
- Hoban S (2014). An overview of the utility of population simulation software in molecular ecology. *Molecular Ecology*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes ; DOI: 0.1111/mec.12741
- Hoban SM, McCleary TS, Schlarbaum SE, Romero-Severson J (2014). Spatial genetic structure in 21 populations of butternut, a temperate forest tree (*Juglans cinerea* L.), is correlated to spatial arrangement, habitat, and land-use history. *Forest Ecology and Management*. 314 50. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.foreco.2013.11.001
- Hoban SM, Mezzavilla M, Gaggiotti OE, Benazzo A, van Oosterhout C, Bertorelle G (2013). High variance in reproductive success generates a false signature of a genetic bottleneck in populations of constant size: A simulation study. *BMC Bioinformatics*. 14 1309. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1186/1471-2105-14-309
- Ingersoll TE, Sewall BJ, Amelon S (2013). Improved analysis of long-term monitoring data demonstrates marked regional declines of bat populations in the eastern United States. *PLoS ONE*. 8 (6), e65907. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pone.0065907

- Ingram T, Stutz WE, Bolnick DI (2011). Does intraspecific size variation in a predator affect its diet diversity and top-down control of prey?. *PLoS ONE*. 6 (6), e20782. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1371/journal.pone.0020782
- Jhwueng DC (2013). Assessing the Goodness of Fit of phylogenetic comparative methods: A meta-analysis and simulation study. *PLoS ONE*. 8 (6), e67001. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pone.0067001
- Jhwueng DC, Maroulas V (2014). Phylogenetic Ornstein-Uhlenbeck regression curves. *Statistics and Probability Letters*. 89 110. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.spl.2014.02.023
- Jiang J, DeAngelis D (2013). Strong species-environment feedback shapes plant community assembly along environmental gradients. *Ecology and Evolution*. 3 (12), 4119. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1002/ece3.784
- Jiang J, DeAngelis DL, Anderson GH, Smith TJ (2013). Analysis and simulation of propagule dispersal and salinity intrusion from storm surge on the movement of a marsh-mangrove ecotone in south Florida. *Estruaries and Coasts*. 37 (10), 24. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1007/s12237-013-9666-4
- Jiang W, Sullivan AM, Su C, Zhao X (2012). An agent-based model for the transmission dynamics of *Toxoplasma gondii*. *Journal of Theoretical Biology*, 293(21): 15-26. 293 (21), 15. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.jtbi.2011.10.006
- Kershenbaum A (2013). Entropy rate as a measure of animal vocal complexity. *Bioacoustics*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1080/09524622.2013.850040
- Kershenbaum A, Blank L, Sinai I, Merila J, Blaustein L, Templeton AR (2014). Landscape influences on dispersal behaviour: A theoretical model and empirical test using the fire salamander, *Salamandra atra*. *Oecologia*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1007/s00442-014-2924-8
- Kershenbaum A, Roch MA (2013). An image processing based paradigm for the extraction of tonal sounds in cetacean communications. *The Journal of the Acoustical Society of America*. 134 (6), 4435. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1121/1.4828821
- Kershenbaum A, Sayigh LS, Janik VM (2013). The encoding of individual identity in dolphin signature whistles: How much information is needed?. *PLoS ONE*. 8 (10), e77671. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pone.0077671
- Kreft JU, Plugge CM, Grimm V, Prats C, Leveau JHJ, Banitz T, Baines S, Clark J, Ros A, Klapper I, Topping CJ, Field AJ, Schuler A, Litchman E, Hellweger FL (2013). Mighty small: Observing and modeling individual microbes becomes big science. *Proceedings of the National Academy of Sciences*, 110(45):. 110 (45), 18027. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1073/pnas.1317472110
- Krivan V (2013). Behavioral refuges and predator-prey coexistence. *Journal of Theoretical Biology*. 339 112. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.jtbi.2012.12.016
- Kroetz K, Sanchirico JN, Armsworth PR, Banzhaf HS (2013). Benefits of the ballot box for species conservation. *Ecology Letters*. 17 (3), 294. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/ele.12230
- Lameira AR, de Vries H, Hardus ME, Hall CPA, Mitra-Setia T, Spruijt BM, Kershenbaum A, Sterck EHM, van

Noordwijk M, van Schaik C, Wich SA (2013). Predator guild does not influence orangutan alarm call rates and combinations. *Behavioral Ecology and Sociobiology*. 67 (3), 519. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1007/s00265-012-1471-8

Lelu M, Langlais M, Pouille ML, Gilot-Fromont E, Gandon S (2013). When should a trophically and vertically transmitted parasite manipulate its intermediate host? The case of *Toxoplasma gondii*. *Proceedings of the Royal Society B*. 208 (1765), 20131143. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1098/rspb.2013.1143

Lendemmer JC, Hodkinson BP (2013). A radical shift in the taxonomy of *Lepraria* s.l.: Molecular and morphological studies shed new light on the evolution of asexuality and lichen growth form diversification. *Mycologia*. 105 (4), 994. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.3852/12-338

Magombedze G, Dowdy D, Mulder N (2013). Latent tuberculosis: Models, computational efforts and the pathogen's regulatory mechanisms during dormancy. *Frontiers in Bioengineering and Biotechnology*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.3389/fbioe.2013.00004

Magombedze G, Eda S, Ganusov VV (2014). Competition for antigen between Th1 and Th2 responses determines the timing of the immune response switch during *Mycobacterium avium* subspecies paratuberculosis infection in ruminants. *PLoS Computational Biology*. 10 (1), e1003414. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pcbi.1003414

Magombedze G, Ngonghala CN, Lanzas C (2013). Evaluation of the "Iceberg Phenomenon" in Johne's Disease through mathematical modelling. *PLoS ONE*. 8 (10), e76636. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pone.0076636

Magombedze G, Reddy PBJ, Eda S, Ganusov VV (2013). Cellular and population plasticity of helper CD4+ T cell responses. *Frontiers in Physiology*. 4 . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.3389/fphys.2013.00206

Mancini G, Ferrari PF, Palagi E (2013). In play we trust. Rapid facial mimicry predicts the duration of playful interactions in Geladas. *PLoS ONE*. 8 (6), e66481. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pone.0066481

Martin RA, Garnett SC (2013). Relatedness and resource diversity interact to influence the intensity of competition. *Biological Journal of the Linnean Society*. 110 (38), 689. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/bij.12146

Martin RA, Riesch R, Heinen-Kay JL, Langerhans RB (2013). Evolution of male coloration during a post-pleistocene radiation of Bahamas mosquitofish (*Gambusia hubbsi*). *Evolution*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/evo.12277

Massaro T, Lenhart S, Spence M, Drakes C, Yang G, Agosto F, Johnson R, Whitlock B, Wadhwa A, Eda S (2013). Modeling for cost analysis of Johne's disease control based on EVELISA testing. *Journal of Biological Systems*, 21(4): 21 (4), 1340010. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1142/S021833901340010X

Meyer K, Houle D (). Sampling based approximation of confidence intervals for functions of genetic covariance matrices. *Proceedings from the 20th Conference of the Association for the Advancement of Animal Breeding and Genetics*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes

Mieszkowska N, Milligan G, Burrows MT, Freckleton R, Spencer M (). Dynamic species distribution models from categorical survey data. *Journal of Animal Ecology*. . Status = ACCEPTED; Acknowledgment of Federal Support

= Yes

Moran EV, Bewick S, Cobbold C (2013). Effects of plant genotype and insect dispersal rate on the population dynamics of a forest pest. *Ecology*. 94 (12), 2792. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1890/12-1708.1

Morin BR, Fenichel EP, Castillo-Chavez C (2013). SIR dynamics with economically driven contact rates. *Natural Resource Modeling*. 26 (4), 505. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/nrm.12011

Ngonghala CN, Plucinski MM, Murray MB, Farmer PE, Barrett CB, Keenan DC, Bonds MH (2014). Poverty, disease, and the ecology of complex systems. *PLoS Biology*. 12 (4), e1001827. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pbio.1001827

Oremland M, Laubenbacher R (2013). Mathematical conversion of SugarScape to a system of analytical difference equations. *Journal of Economic Interaction and Coordination*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes

Oremland M, Laubenbacher R (2013). Optimal control of agent-based models: Scaling methods and heuristic algorithms. *Journal of Artificial Societies and Social Simulation*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes

Oremland M, Laubenbacher R (2013). Optimal harvesting of a predator-prey agent-based model using difference equations. *Bulletin of Math Biology*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes

Parker JD, Torchin ME, Hufbauer RA, Lemoine NP, Alba C, Blumenthal DM, Bossdorf O, Byers JE, Dunn AM, Heckman RW, Hejda M, Jarosik V, Kanarek AR, Martin LB, Perkins Se, Pysek P, Schierenbeck K, Schloder C, van Klinken R, Vaughn KJ, Williams W, Wolfe LM (2013). Do invasive species perform better in their new ranges?. *Ecology*. 94 985. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1890/12-1810.1

Pienaar J, Ilany A, Geffen E, Yom-Tov Y (2013). Macroevolution of life-history traits in passerine birds: Adaptation and phylogenetic inertia. *Ecology Letters*. 16 (5), 571. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/ele.12077

Portacci K, Miller R, Riggs P, Buhnerkempe M, Abrahamsen L (2013). Assessment of paper interstate certificates of veterinary inspection to support disease tracing in cattle. *Journal of the American Veterinary Medical Association*. 243 (4), 555. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.2460/javma.243.4.555

Pringle EG, Akcay E, Raab TK, Dirzo R, Gordon DM (2013). Water stress strengthens mutualism among ants, trees, and scale insects. *PLoS Biology*. 11 (11), e1001705. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pbio.1001705

Rannala B, Yang Z (2013). Improved reversible jump algorithms for Bayesian species delimitation. *Genetics*. 194 (1), 245. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1534/genetics.112.149039

Rao AR, Cecchi GA, Kaplan E (2014). Topic editors for special issue: Towards an integrated approach to measurement, analysis and modeling of cortical networks. *Frontiers in Neural Circuits*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes

Remien CH, Sussman NL, Adler FR (2013). Mathematical modelling of chronic acetaminophen metabolism and liver injury. *Mathematical Medicine and Biology*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes

Rice WR, Friberg U, Gavrillets S (2013). Homosexuality via canalized sexual development: A testing protocol for a new epigenetic model. *Bioessays*, 35(9): 764-770. 35 (9), 764. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1002/bies.201300033

Riesch R, Martin RA, Lerp H, Plath M, Wronski T (2013). Size and sex matter: Reproductive biology and determinants of offspring survival in *Gazella marica*. *Biological Journal of the Linnean Society*. 110 (1), 116. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/bij.12121

Rodder D, Lawing AM, Flecks M, Ahmadzadeh F, Dambach J, Engler JO, Habel JC , Hartmann T, Hornes D, Ihlow F, Schidelko K, Stiels D, Polly PD (2013). Evaluating the significance of paleophylogeographic species distribution models in reconstructing Quaternary range-shifts of Nearctic chelonians. *PLoS ONE*. 8 (10), e72855. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pone.0072855

Ryan D, Daley BJ, Wong K, Zhao X (2013). Prediction of ICU in-hospital mortality using a deep Boltzmann machine and dropout neural net. *Proceedings of the Biomedical Sciences and Engineering Conference (BSEC)*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes

Ryan D, Papamichail D (2013). Rational design of orthogonal libraries of protein coding genes. *ACS Synthetic Biology*. 2 (4), 237. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1021/sb300086d

Shimada M (2013). Dynamics of the temporal structures of playing clusters and cliques among wild chimpanzees in Mahale Mountains National Park. *Primates*. 54 (3), 245. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1007/s10329-013-0348-4

Shimada M (2013). Wild chimpanzees can perform social grooming and social play behaviors simultaneously. *Primates*. 54 (4), 315. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1007/s10329-013-0369-z

Spencer M (). Measuring the rate of succession using the growth space of a community. *The American Naturalist*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes

Sturner KK, Golden B, Lenhart SL (2013). Modeling the forest. *Science Scope*. 37 (1), 70. Status = PUBLISHED; Acknowledgment of Federal Support = Yes

Sullivan AM, Zhao X, Suzuki Y, Ochiai E, Crutcher S, Gilchrist MA (2013). Evidence for finely-regulated asynchronous growth of *Toxoplasma gondii* cysts based on data-driven model selection. *PLoS Computational Biology*. 9 (11), e1003283. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pcbi.1003283

Turchin P, Currie TE, Turner EAL, Gavrillets S (2013). War, space, and the evolution of Old World complex societies. *Proceedings of the National Academy of Sciences*. 110 (41), 16384. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1073/pnas.1308825110

Turner M, Lenhart S, Rosenthal B, Zhao X (2013). Modeling effective transmission pathways and control of the world's most successful parasite. *Journal of Theoretical Population Biology*, 86: 50-61. 86 50. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.tpb.2013.04.001

Urban MC, Burger R, Bolnick DI (2013). Asymmetric selection and the evolution of extraordinary defences. *Nature Communications*. 4 2085. Status = ACCEPTED; Acknowledgment of Federal Support = Yes ; DOI: 10.1038/ncomms3085

Van Dyken JD, Muller MJI, Mack KML, Desai MM (2013). Spatial population expansion promotes the evolution of cooperation in an experimental prisoner's dilemma. *Current Biology*. 23 (10), 919. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.cub.2013.04.026

Wang YP, Chen BC, Wieder WR, Luo YQ, Leite M, Medlyn BE, Rasmussen M, Smith MJ, Agosto FB, Hoffman F (2013). Oscillatory behavior of two nonlinear microbial models of soil carbon decomposition. *Biogeosciences Discussions*. 10 19661. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.5194/bgd-10-19661-2013

Wehe A, Burleigh JG, Eulenstein O (2013). Efficient algorithms for knowledge-enhanced supertree and supermatrix phylogenetic problems. *IEEE-ACM Transactions on Computational Biology and Bioinformatics*. 10 (6), 1432. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1109/TCBB.2012.162

Willis L, Graham TA, Alarcon T, Alison MR, Tomlinson IPM, Page KM (2013). What can be learnt about disease progression in breast cancer dormancy from relapse data?. *PLoS ONE*. 8 (5), e62320. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1371/journal.pone.0062320

Yee SH, Carriger JF, Bradley P, Fisher WS, Dyson B (2014). Developing scientific information to support decisions for sustainable coral reef ecosystem services. *Ecological Economics*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.ecolecon.2014.02.016

Yee SH, Dittmar JA, Oliver LM (2014). Comparison of methods for quantifying reef ecosystem services: A case study mapping services for St. Croix, USVI. *Ecosystem Services*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.ecoser.2014.01.001

Zaccarelli N, Bolnick DI, Mancinelli G (). RInsp: An R package for the analysis of intra-specific variation in resource use. *Methods in Ecology and Evolution*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes

Zanne AE, Tank DC, Cornwell WK, Eastman JM, Smith SA, FitzJohn RG, McGlenn DJ, O'Meara BC, Moles AT, Reich PB, Royer DL, Soltis DE, Stevens PF, Westoby M, Wright IJ, Aarssen L, Bertin RI, Calaminus A, Govaerts R, Hemmings F, Leishman MR, Oleksyn J, Soltis PS, Swenson NG, Warman L, Beaulieu JM (2013). Three keys to the radiation of angiosperms into freezing environments. *Nature*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1038/nature12872

Licenses

Other Products

Audio or Video Products.

Margination of white blood cells in microvessels. 7 February 2014. http://www.youtube.com/watch?v=Uyb2_g4FWtI

Audio or Video Products.

(Modeling) wildlife and livestock disease - the European perspective. 18 April 2014. <http://www.youtube.com/watch?v=iSnjdIJ8LEU>

Audio or Video Products.

Animal Communication sequence analysis using information theory. 15 November 2013. <http://www.youtube.com/watch?v=rLm71H71r5U>

Audio or Video Products.

Animals, Nutrients and Toxins. 21 June 2013. <http://www.youtube.com/watch?v=eFk-f1tObvU>

Audio or Video Products.

Attitudes, not aptitude: Understanding the roots of gender gaps in STEM education. 14 April 2014. <http://www.youtube.com/watch?v=gnYP9FvgcVM>

Audio or Video Products.

Can phenotypic plasticity initiate the evolution of resistance?. 4 December 2013. <http://www.youtube.com/watch?v=z2iaznMwP54>

Audio or Video Products.

Climate Change Threatens Turtles. 9 October 2013. <http://www.youtube.com/watch?v=7TSh2K2ETQI>

Audio or Video Products.

Cloud computing: A review of options, costs, and benefits. 16 April 2014. <http://www.youtube.com/watch?v=e4GPunc3Tpk>

Audio or Video Products.

Complexity and the evolution of intelligence. 20 February 2014. <http://www.youtube.com/watch?v=IOiRcCyu5OY>

Audio or Video Products.

Computation for Chagas. 5 May 2014. <http://www.youtube.com/watch?v=Zbr-sJotlzg>

Audio or Video Products.

Computational analysis of dynamic interaction networks. 27 March 2014. <http://www.youtube.com/watch?v=1C3vmviUXzo>

Audio or Video Products.

Controlling pests and resistance with 'sterile' males. 4 December 2013. <http://www.youtube.com/watch?v=DZnYycxA5k4>

Audio or Video Products.

Cultural evolution of human cooperation and conflict. 9 October 2013. <http://www.youtube.com/watch?v=XyDBqv2L1co>

Audio or Video Products.

Disease at the wildlife-livestock interface. 18 April 2014. http://www.youtube.com/watch?v=OOFme-bE_p4

Audio or Video Products.

Diseases at the wildlife/livestock interface: Gaps and challenges. 18 April 2014. <http://www.youtube.com/watch?v=2c0cW43JAwc>

Audio or Video Products.

Diseases at the wildlife/livestock interface: A livestock perspective. 17 April 2014. http://www.youtube.com/watch?v=plHV08yfq_M

Audio or Video Products.

Disorderly manakins. 25 March 2014. <http://www.youtube.com/watch?v=5946gmOg4iY>

Audio or Video Products.

Dr. Tom Hallam: Reflections. 30 January 2014. <http://www.youtube.com/watch?v=WQaQRy1jpyE>

Audio or Video Products.

Ecology of Lyme disease in California (and issues to consider for modeling transmission). 18 March 2014. <http://www.youtube.com/watch?v=uxcYOK4TDis>

Audio or Video Products.

Explaining the complex lives of malaria parasites. 28 February 2014. <http://www.youtube.com/watch?v=LygDN96tH9s>

Audio or Video Products.

Extracting information on protein translation from genomic sequences. 22 April 2014. <http://www.youtube.com/watch?v=8hjSvidLPv0>

Audio or Video Products.

Fitting complex mixed models using HPC. 22 April 2014. http://www.youtube.com/watch?v=-E2U_8H566k

Audio or Video Products.

Generalization of the central models of molecular evolution in the (post) genomic era. 27 March 2014. <http://www.youtube.com/watch?v=YqIXtlPpdr0>

Audio or Video Products.

Generating manakin social networks with exponential random graph models. 3 April 2014. <http://www.youtube.com/watch?v=h4SrsPSelGY>

Audio or Video Products.

Getting the most out of rivers: Sustainable hydropower development. 3 April 2014. <http://www.youtube.com/watch?v=9z7ZINjxdZ8>

Audio or Video Products.

High performance computing with R. 16 April 2014. <http://www.youtube.com/watch?v=3Giofl77Rpg>

Audio or Video Products.

How Will Climate Change Affect the Spread of Disease?. 6 December 2013. <http://www.youtube.com/watch?v=N0cA2WG6ySE>

Audio or Video Products.

Incorporating bioenergy into sustainable landscape designs. 26 February 2014. <http://www.youtube.com/watch?v=ZZWEd5wKY8g>

Audio or Video Products.

Information theoretic principles of human language and animal behavior. 15 November 2013. <http://www.youtube.com/watch?v=SZH8TmEvHXw>

Audio or Video Products.

Introduction to Rcpp. 14 April 2014. <http://www.youtube.com/watch?v=P6UGpagOJ5s>

Audio or Video Products.

Machine learning for the classification of animals vocalizations. 15 November 2013. <http://www.youtube.com/watch?v=7BpLybPIkT0>

Audio or Video Products.

Machine learning for the classification of animals vocalizations. 15 November 2013. <http://www.youtube.com/watch?v=7BpLybPIkT0>

Audio or Video Products.

Machine-learning methods to infer networks: Unraveling the social structure of birds and baboons. 27 March 2014. <http://www.youtube.com/watch?v=OXXIAgquidM>

Audio or Video Products.

Math, disease and 100 important questions facing plant biology research. 17 March 2014. <http://www.youtube.com/watch?v=u2NADsn-Oho>

Audio or Video Products.

Mechanisms of resistance to Bt toxins. 4 December 2013. http://www.youtube.com/watch?v=hVBd7sh_bAY

Audio or Video Products.

Modeling environmental impacts of engineered nanomaterials. 17 December 2013. <http://www.youtube.com/watch?v=5jE60lo1P4E>

Audio or Video Products.

Modeling social network dynamics in spotted hyenas using SIENA. 3 April 2014. <http://www.youtube.com/watch?v=zDhbEGYa5Ss>

Audio or Video Products.

Modeling the immune reaction to Hepatitis Delta infection. 12 September 2013. http://www.youtube.com/watch?v=S78_xg9xh20

Audio or Video Products.

Modelling transmission: The key to understanding plant virus disease dynamics. 18 March 2014. <http://www.youtube.com/watch?v=moOzEkfm2w4>

Audio or Video Products.

More HPC R. 16 April 2014. <http://www.youtube.com/watch?v=JOHhdijZz4E>

Audio or Video Products.

N-tangle: A network comparison method. 7 April 2014. <http://www.youtube.com/watch?v=OIKLH7NKu48>

Audio or Video Products.

Name That Dolphin Tune. 16 October 2013. <http://www.youtube.com/watch?v=QK7t8UfcjvU>

Audio or Video Products.

Networks and culture. 4 April 2014. <http://www.youtube.com/watch?v=jPGZ40uhchg>

Audio or Video Products.

Networks and dynamics. 27 March 2014. <http://www.youtube.com/watch?v=rQeRHoKN6FY>

Audio or Video Products.

New Models in the Tree of Life. 19 June 2013. <http://www.youtube.com/watch?v=HvEqBYFduUg>

Audio or Video Products.

Phenology and behaviors in models of resistance evolution. 4 December 2013. <http://www.youtube.com/watch?v=t4Mik2vQJWg>

Audio or Video Products.

Phylogenetics in the cloud. 17 April 2014. <http://www.youtube.com/watch?v=dYGx9qe2xR0>

Audio or Video Products.

Prospects and challenges for the behavioural ecology of animal social networks. 25 March 2014. http://www.youtube.com/watch?v=J6_m4pNV83Q

Audio or Video Products.

R in the classroom - I. 11 April 2014. http://www.youtube.com/watch?v=wKU7Q_qp34

Audio or Video Products.

R in the classroom - II. 11 April 2014. <http://www.youtube.com/watch?v=sMO6Aek3Oq8>

Audio or Video Products.

Searching for Rare Birds, WBIR-TV. 16 July 2013. <http://www.youtube.com/watch?v=73qxG6iHoQA>

Audio or Video Products.

Selection in the Wild. 20 June 2013. <http://www.youtube.com/watch?v=5WKePH8PtVE>

Audio or Video Products.

Singing isn't just for the birds. 15 November 2013. <http://www.youtube.com/watch?v=gws177n9JtE>

Audio or Video Products.

Social fidelity, demographic turnover and community stability in wintering migrant birds. 3 April 2014. <http://www.youtube.com/watch?v=K1sc6lfELrM>

Audio or Video Products.

Statistical model choice in phylogenetic biogeography. 15 April 2014. <http://www.youtube.com/watch?v=ae7aSafs9vU>

Audio or Video Products.

Statistical model choice in phylogenetic biogeography. 30 October 2013. <http://www.youtube.com/watch?v=HaSOBNiox18>

Audio or Video Products.

Structural balance in marmot groups. 8 April 2014. <http://www.youtube.com/watch?v=cJvXvpnAHYA>

Audio or Video Products.

The Interface of Mathematics and Biology. 25 February 2014. <http://www.youtube.com/watch?v=7LiltCEdiq4>

Audio or Video Products.

The importance of distinguishing between heterogeneous and homogeneous changes. 7 April 2014. <http://www.youtube.com/watch?v=iMX8FATwNo0>

Audio or Video Products.

Understanding individual, temporal, and spatial heterogeneity. 2 October 2013. <http://www.youtube.com/watch?v=20xdEcltIEo>

Audio or Video Products.

Unraveling dolphin communication complexity: Past approaches and next steps. 23 January 2014. <http://www.youtube.com/watch?v=X-Nr41KLGaY>

Audio or Video Products.

Using the Relational Event Model (REM) to investigate non-human behaviour. 7 April 2014. <http://www.youtube.com/watch?v=XwcoWKj-URo>

Audio or Video Products.

Visualization in R. 14 April 2014. <http://www.youtube.com/watch?v=Qtu7v28AzWU>

Audio or Video Products.

pbdR: Input, PCA, and movies. 11 April 2014. <http://www.youtube.com/watch?v=P6UGpagOJ5s>

Audio or Video Products.

A receiver's perspective on analyzing animal vocal sequences. 15 November 2013. <http://www.youtube.com/watch?v=j5psl9lqVlo>

Audio or Video Products.

Automated identification of bird individuals using machine learning: A hierarchical approach. 15 November 2013. <http://www.youtube.com/watch?v=FJfsw6uR7g>

Audio or Video Products.

Computational characterization of GPI-anchored proteins in *Trypanosoma cruzi*. 6 November 2013. <http://www.youtube.com/watch?v=xY9Fx0RY2iA>

Audio or Video Products.

From virtual to reality: Applying IRM Model outcomes to agricultural systems. 4 December 2013. http://www.youtube.com/watch?v=T_WBqL9-2RQ

Audio or Video Products.

How to plan an effective and efficient population genetics sampling strategy. 14 January 2014. <http://www.youtube.com/watch?v=BQaYiQdE8CQ>

Audio or Video Products.

Identifying hidden rate change in the evolution of a binary morphological character. 28 August 2013. <http://www.youtube.com/watch?v=TPlenNqD9GM>

Audio or Video Products.

Network models to guide national sampling and mitigation for insects of stored grain. 5 December 2013. <http://www.youtube.com/watch?v=PYQJ7pHXyml>

Audio or Video Products.

Preferential oviposition in Bt crops and its effect on the evolution of resistance. 4 December 2013. <http://www.youtube.com/watch?v=1kJcHqjlaYM>

Audio or Video Products.

Understanding the evolution of resistance to chemotherapeutants in marine ectoparasite. 4 December 2013. <http://www.youtube.com/watch?v=QfLeXh3ypMs>

Software or Netware.

Boone J, Slater M. 2013. A generalized population monitoring program to inform the management of free-roaming cats.

Software or Netware.

Kershenbaum A, Roch M. 2013. IPRiT software library.

Software or Netware.

Schmidt D, Chen WC, Ostrouchov G, Patel P, R Core Team. 2013. pbdDMAT: An R package update.

Software or Netware.

Schmidt D, Chen WC, Ostrouchov G, Patel P. 2013. pbdBASE: An R package update.

Software or Netware.

Shah P, Fitzpatrick BM, Fordyce JA. 2013. iteRates: Parametric rate comparison (version 3.1).

Software or Netware.

Zanne AE, Tank DC, Cornwell WK, Eastman JM, Smith SA, FitzJohn RG, McGlenn DJ, O'Meara BC, Moles AT, Reich PB, Royer DL, Soltis DE, Stevens PF, Westoby M, Wright IJ, Aarssen L, Bertin RI, Calaminus A, Govaerts R, Hemmings F, Leishman MR, Oleksyn J, Soltis PS, Swenson NG, Warman L, Beaulieu JM. 2013. Tree, data, and source code: Three keys to the radiation of angiosperms into freezing environments.

Models.

Miller P, ACC&D Cat Population Model Working Group. March 2013. Completed simulation model of free-ranging cat populations and multiple management scenarios, and accompanying report. ACC&D and the ASPCA (submitted).

Educational aids or Curricula.

Duncan S, Lenhart S, Sturner K. 2014. Quantifying Biodiversity. Hands on the Land Website, Educator Resources.

Educational aids or Curricula.

Spada G. 2012-2013. Gioco sociale e comunicazione multimodale in Lemur catta: Uno studio etologico in natura. Universita di Pisa.

Educational aids or Curricula.

Sturner K, Welsh C. 2013. Education module: Discover birds! Changing populations and birds champions.

Grant/Proposal.

Earl J, Gray M, Sutton W, Miller D. 2013-2014. Determining the extinction probability for the most endangered frog in North America (*Rana sevosa*) following exposure to the emerging pathogen, ranavirus. Morris Animal Foundation Grant. \$40,224. Accepted.

Grant/Proposal.

Hota S, Nelms B, Qian L. 2013. Targeted infusion project: Development of an undergrad bioinformatics and biomathematics track at Fisk University to enhance undergrad STEM education, research, and future careers. National Science Foundation. \$399,928. Accepted.

Grant/Proposal.

Schreiber SJ, terHorst C. 2013. Collaborative Research: Trait evolution and the stability of ecological communities. National Science Foundation. \$594,760. Accepted.

Meeting/Workshop.

Allison D, Thomas D. 12-16 May 2014. The Mathematical Sciences in Obesity Research. Univ. of Alabama, Birmingham, AL.

Meeting/Workshop.

Sturner K. November 2013. Modeling a Forest: Math and Science are Better Together! Tennessee Science Teacher's Association Conference, Murfreesboro, TN.

Presentation.

Beckmann C, Bloom J, Lambert J, Ward R, Ilany A, Jiang J. 2 August 2013. Modeling animal social network

dynamics. REU 2013 Presentations, NIMBioS, Univ. of Tennessee, Knoxville, TN.

Presentation.

Jiang J. 18 September 2012. Modeling mangrove-hardwood hammock ecotone. NIMBioS Seminar Series, NIMBioS, University of Tennessee, Knoxville, TN.

Presentation.

Jiang J. 27 January 2014. Modeling complex ecological dynamics. Invited Talk, Dept. of Biological Sciences, University of Texas, El Paso, El Paso, TX.

Presentation.

Kelly, MR. August 2013. Optimal fishery harvesting on a nonlinear parabolic differential equation in a heterogeneous spatial domain. Workshop for Young Researchers in Mathematical Biology, Mathematical Biosciences Institute (MBI), The Ohio State University, Columbus, OH.

Presentation.

Kelly, MR. January 2014. Optimal fishery harvesting on a nonlinear parabolic differential equation in a heterogeneous spatial domain. American Mathematical Society (AMS) Special Session on Reaction Diffusion Equations and Applications, Joint Mathematics Meetings, Baltimore Convention Center, Baltimore, MD.

Presentation.

Kelly, MR. March 2014. Optimal fishery harvesting on a nonlinear parabolic differential equation in a heterogeneous spatial domain. Special Session: Diversity of Modeling and Optimal Control: A Celebration of Suzanne Lenhart's 60th Birthday, American Mathematical Society (AMS) Southeastern 2014 Sectional Meeting, Knoxville, TN.

Presentation.

Kelly, MR. November 2013. The impact of human and pathogen movement on optimal vaccination strategies in a cholera epidemic. Invited Graduate Student Seminar, Maryville College, Maryville, TN.

Presentation.

Kelly, MR. October 2013. Optimal fishery harvesting on a nonlinear parabolic differential equation in a heterogeneous spatial domain. Southeastern-Atlantic Regional Conference on Differential Equations, Univ. of Tennessee, Knoxville, TN.

Presentation.

Kershenbaum A. 2014 March 4. What and where is the information in animal vocalisations?. Evolutionary Biology Weekly Seminar, Edinburgh University, UK.

Presentation.

Waller S. 23 April 2014. Coyote consciousness: Social predator vocalization and communication. Toward a Science of Consciousness Conference, Tucson, AZ.

Presentation.

Adams R, Oballe C, Rudy N, Gilchrist M, Phan T. 2013 August 2. Modeling protein translation and genome

evolution. REU 2013 Presentations, NIMBioS, Univ. of Tennessee, Knoxville, TN.

Presentation.

Adler B, Knapp M, Wilmouth L, Golden B, Sturner K. 2013. Teaching science in a climate of denial: From Darwin Day Tennessee. Tennessee Science Teachers' Association Conference, Murfreesboro, TN.

Presentation.

Allesina S. 2011 July. Inference in food webs based on maximum likelihood and Bayesian approaches. TIES 2011 Third North American Regional Meeting, La Crosse, WI.

Presentation.

Banks D. 2009 January 21. Vector field visualization in neurobiology. BCMB Spring Seminar Series 2009, Univ. of Tennessee, Knoxville, TN.

Presentation.

Baudry J. 2009 March 25. Computational molecular biophysics. BCMB Spring Seminar Series 2009, Univ. of Tennessee, Knoxville, TN.

Presentation.

Beckmann C, Lambert J. 2013 November 16-17. Social structure and rank predict fitness in spotted hyenas. NIMBioS Undergraduate Research Conference at the Interface of Biology and Mathematics, Knoxville, TN.

Presentation.

Bender N, Mason C, Shahi S, Kershenbaum A, Buehler D. 2013 August 2. Automatic detection of rare birds from audio recordings. REU 2013 Presentations, NIMBioS, Univ. of Tennessee, Knoxville, TN.

Presentation.

Bender N, Mason C, Shahi S. 2013 November 16-17. Automatic detection of rare birds from audio recordings. NIMBioS Undergraduate Research Conference (URC 2013), Knoxville, TN.

Presentation.

Bender N. 2013 November. Automatic detection of rare birds from audio recordings. Mid-Hudson Mathematics Conference, Bard College.

Presentation.

Bender N. 2013 September. Automatic detection of rare bird species. Mathematics Dept, Marist College.

Presentation.

Bender N. 2014 January. Automatic detection of rare bird species using neural networks. Joint Math Meetings, Baltimore, MD.

Presentation.

Blake J. 2009 April 22. Comparative genome informatics. BCMB Spring Seminar Series 2009, Univ. of Tennessee, Knoxville, TN.

Presentation.

Boone J. 2013 June 20-22. From data to implementation: Using modeling results and field studies to generate management guidance for free-roaming cats. 5th International Symposium on Non-Surgical Contraceptive Methods of Pet Population Control, Alliance for Contraception in Cats and Dogs, Portland, OR.

Presentation.

Connor EF, Dorazio RM. 2011 May. Estimating abundance-based patterns of species co-occurrence using foraging guilds spatial covariates. San Francisco State University, San Francisco, CA.

Presentation.

Earl JE, Gray MJ, Sutton WB. 2013. Ranavirus could speed up extinction for the endangered frog, *Rana Sevosa*. Ranavirus Symposium, Knoxville, TN.

Presentation.

Earl JE, MJ Gray. 2013. Capability of ranavirus to cause extinction in local populations of wood frogs. Wildlife Disease Association, Knoxville, TN.

Presentation.

Earl JE. 2014 February. Moving resources between systems: Reciprocal and active subsidies. Seminar, Oak Ridge National Lab, Oak Ridge, TN.

Presentation.

Hale B, Hoang K, Schaber K, Lenhart S, Eda S, Kennedy M. 2013 August 2. Modeling animal disease from coronavirus. REU 2013 Presentations, NIMBioS, Univ. of Tennessee, Knoxville, TN.

Presentation.

Hale B, Schaber K. 2013 November 16-17. Modeling feline infectious peritonitis in a cattery. NIMBioS Undergraduate Research Conference (URC 2013), Knoxville, TN.

Presentation.

Ilany A. 2013 July. Modeling social network dynamics over 22 years in a wild spotted hyena population. 50th Annual Conference of the Animal Behavior Society, University of Colorado, Boulder.

Presentation.

Jiang J. 2013 November 6. Regime shift in a self-organized coastal wetland ecotone. 22nd Biennial Conference of the Coastal and Estuarine Research Federation, San Diego, CA.

Presentation.

Kanarek A. 2011 November 18. FishHeads Seminar Series speaker. FishHeads Seminar Series.

Presentation.

Kershenbaum A. 2013 August 5. Animal vocal sequences and their statistical properties: A cross-taxa comparison. International Ethological Conference, Newcastle.

Presentation.

Kershenbaum A. 2013 December 5. What and where is the information in animal vocalisations?. Behavioural Ecology Group Weekly Seminar, University of Michigan.

Presentation.

Kershenbaum A. 2013 January. Syntactic analyses of bird song. University of Haifa.

Presentation.

Kershenbaum A. 2013 January. Where is identity information hidden in dolphin signature whistles?. Ad hoc Seminar, Tel Aviv University.

Presentation.

Kershenbaum A. 2013 January. Where is identity information hidden in dolphin signature whistles?. University of Haifa.

Presentation.

Kershenbaum A. 2013 July 29. Animal vocal sequences and their statistical properties: A cross-taxa comparison. Animal Behaviour Society, Boulder.

Presentation.

Kershenbaum A. 2013 March 13. Perceptual techniques to interpret cetacean vocal information. Ad hoc Seminar, Scripps Institute of Oceanography.

Presentation.

Kershenbaum A. 2013 March 14. Analysing sequences in animal vocal communication. NIMBioS MSI Outreach Lecture, California State University, San Marcos.

Presentation.

Kershenbaum A. 2013 September 10. Can we talk to dolphins?. Science Café, Ijams Nature Center, Knoxville, TN.

Presentation.

Kershenbaum A. 2014 February 28. What and where is the information in animal vocalisations?. Ad hoc Seminar, Queen Mary University of London, UK.

Presentation.

Kershenbaum A. 2014 March 4. What and where is the information in animal vocalisations?. Evolutionary Biology Weekly Seminar, Edinburgh University, UK.

Presentation.

Kershenbaum A. 2014 March 5. What and where is the information in animal vocalisations?. Ad hoc seminar, Dept. of Zoology, University of Cambridge, UK.

Presentation.

Keung J, Napoles M. 2013 August. Agent-based model to investigate seasonality in Escherichia coli O157 transmission between pastoral beef cattle. Undergraduate Research Capstone Conference, Mathematical Biosciences Institute.

Presentation.

Keung J. 2013 November 16-17. Agent-based model to investigate seasonality in Escherichia coli O157 transmission between pastoral beef cattle. NIMBioS Undergraduate Research Conference at the Interface of Biology and Mathematics, Knoxville, TN.

Presentation.

Knisley D. 2009 February 18. Graph theory and structural analysis in molecular biology. BCMB Spring Seminar Series 2009, Univ. of Tennessee, Knoxville, TN.

Presentation.

Kueng J, Napoles M, Vella M, Lanzas C, Chen S. 2013 August 2. Modeling the environmental transmission of infectious diseases: Escherichia coli transmission in cattle. REU 2013 Presentations, NIMBioS, Univ. of Tennessee, Knoxville, TN.

Presentation.

Ladau J, Connor EF. 2011 July. Horse racing and the assembly of ecological communities: A novel application of the Plackett-Luce model to biology. TIES 2011 Third American Regional Meeting, La Crosse, WI.

Presentation.

Lambert J. 2013 August. Modeling social network dynamics in the spotted hyena (*Crocuta crocuta*). Undergraduate Capstone Conference, Mathematical Biosciences Institute.

Presentation.

Lawing AM. 2013 October 5. Using evolutionary biology to inform our understanding of species and community responses to environmental change. Society for the Advancement of Chicanos and Native Americans in the Sciences Annual Conference, San Antonio, TX.

Presentation.

Lawing AM. 2013. Integrated climate change biology: Using the past to predict future species response to climate change. Bioinformatics Symposium, University of Texas, El Paso.

Presentation.

Lawing AM. 2013. Integrated climate change biology: Using the past to predict future species response to climate change. Texas A&M University, College Station, TX.

Presentation.

Martin RA. 2012. Disruptive selection and the evolution of resource polymorphism. HOFF lab group meeting, Dept of Ecology & Evolutionary Biology, University of Tennessee, Knoxville, TN.

Presentation.

McMillan L. 2009 April 1. Visualization. BCMB Spring Seminar Series 2009, Univ. of Tennessee, Knoxville, TN.

Presentation.

Meyer K, Houle D. 2013 October. Sampling based approximation of confidence intervals for functions of genetic covariance matrices. 20th Conference of the Association for the Advancement of Animal Breeding and Genetics,

Napier, New Zealand.

Presentation.

Milt AW, Armsworth PR. 2013 December. Poster: Environmental impacts of Marcellus gas development: Tradeoffs among impacts and siting practices. The Nature Conservancy's All Science Meeting, Santa Clara, CA.

Presentation.

Numfor E. 2012 October. Optimal control applied in coupled within-host and between-host models. SEARCDE, Winston Salem, NC.

Presentation.

Numfor E. 2013 July. Optimal control applied in coupled within-host and between-host models. SIAM Annual Meeting, San Diego, CA.

Presentation.

Numfor E. 2013 March. Optimal control applied in coupled within-host and between-host models. SIAM-SEAS Annual Meeting, Knoxville, TN.

Presentation.

Shimada M. 2012 August 13-17. Balance theory and the dynamics of temporal structures of playing clusters and cliques among wild chimpanzees. The 24th Congress on the International Primatological Society, Cancun, Mexico.

Presentation.

Shimada M. 2013 August 20. Dynamics and network of social play among wild chimpanzees in Mahale Mountains National Park. Wildlife Research Center, Kyoto University, Kyoto, Japan.

Presentation.

Shimada M. 2013 May 21-26. The network of social play among wild chimpanzees. SUNBELT33, International Network for Social Network Analysis, Hamburg, Germany.

Presentation.

Slater M. 2013 June 20-22. Counting cats: Some guidance and an example. 5th International Symposium on Non-Surgical Contraceptive Methods of Pet Population Control, Alliance for Contraception in Cats and Dogs, Portland, OR.

Presentation.

Sturner K. 2013. Modeling the forest - math and science are better together!. Tennessee Science Teachers' Association Conference, Murfreesboro, TN.

Presentation.

Utsey K, Estes S. 2013 November 16-17. Mathematical modeling of fetal electrocardiograms. NIMBioS Undergraduate Research Conference (URC 2013), Knoxville, TN.

Presentation.

Weitz JS, Stock CA, Wilhelm SW, Bourouiba L, Buchan A, Coleman ML, Follows MJ, Fuhrman JA, Lennon JT,

Middelboe M, Sonderegger DL, Suttle CA, Thingstad TF, Wilson WH, Wommack KE. 2013 November 3-7. A multitrophic model to quantify the effects of marine viruses on microbial feed webs and ecosystem processes. Plenary, Aquatic Virus Workshop 7, St. Petersburg, FL.

Presentation.

Welch M. 2009 April 8. Microsatellite evolution. BCMB Spring Seminar Series 2009, Univ. of Tennessee, Knoxville, TN.

Presentation.

Wilhelm SW, Sonderegger DL, Stock CA, Weitz JS, Suttle CA, Bourouiba L, Buchan A, Middelboe M, Coleman ML, Follows MJ, Fuhrman JA, Lennon JT, Thingstad TF, Wilson WH, Wommack KE. 2013 November 3-7. Mapping global distributions and activity of marine viruses. Opening Plenary, Aquatic Virus Workshop 7, St. Petersburg, FL.

Presentation.

Zawistowski S, Miller P, Boone J, Lawler D, Slater M, Levy J, Nutter F, Briggs J. 2013 November 9. Simulating different approaches for managing free-roaming cat populations. National Council on Pet Population and Society of Animal Welfare Administrators Research Symposium, Tempe, AZ.

Presentation.

Zawistowski S. 2013 June 20-22. Focus on felines: Tools to help you plan your programs and measure your success. 5th International Symposium on Non-Surgical Contraceptive Methods of Pet Population Control, Alliance for Contraception in Cats and Dogs, Portland, OR.

Working Group.

Webb C, Odoi A. 2010-2011. Modeling the impact of cattle movements on transmission dynamics of bovine tuberculosis (*Mycobacterium bovis*) in the United States at local and national scales. NIMBioS. Accepted.

Other Publications

DeBruyn J, Sturner K, Duncan S, Lenhart SL (2013). *Biodiversity counts!*. Student Handout and Leader's Guide. Backyard STEM for Tennessee 4-H. <https://ag.tennessee.edu/watersheds/Pages/BackyardSTEM.aspx>. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Sturner K, Lenhart S, Duncan S (2014). *STEM Opportunity: NIMBioS Education Module*. Hands on the Land Newsletter. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Patents

Technologies or Techniques

Thesis/Dissertations

Grunloh NR. *A stochastic dynamic model of the behavioral ecology of play*. (2013). University of California, Santa Cruz. Acknowledgement of Federal Support = Yes

Pannkuk EL. *Fungal metabolism of chiropteran integument and biomechanical damage by *geomyces* species*. (2010). Arkansas State University. Acknowledgement of Federal Support = Yes

Websites

HowlCoder crowdsourcing site

<http://howlcoder.appspot.com/>

Kershenbaum A, Smuts B, Owens J, Koler-Matznick J, Comiskey J. March 2014. Come listen to the enchanting, haunting, sounds of wolves, coyotes, and dogs, and help us better to understand and conserve these species.

Participants/Organizations

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Gross, Louis	PD/PI	11
Gavrilets, Sergey	Co-Investigator	3
Lenhart, Suzanne	Co-Investigator	4
Armsworth, Paul	Faculty	2
Brothers, Ernest	Faculty	3
Buchan, Alison	Faculty	2
Burghardt, Gordon	Faculty	1
Collins, Charles	Faculty	1
Day, Judy	Faculty	2
Eda, Shige	Faculty	3
Finotti, Heather	Faculty	1
Ganusov, Vitaly	Faculty	2
Huang, Jian	Faculty	1
Lanzas, Cristina	Faculty	2
Larsen, Jeff	Faculty	1
O'Meara, Brian	Faculty	1
Riechert, Sue	Faculty	2
Russ, Zaretski	Faculty	1

Name	Most Senior Project Role	Nearest Person Month Worked
Schmidt, Drew	Faculty	5
Zhao, Xiaopeng	Faculty	1
Comer, Megan	K-12 Teacher	2
McDowell, Rebecca	K-12 Teacher	2
(Zimmerman) Zefferman, Matthew	Postdoctoral (scholar, fellow or other postdoctoral position)	11
Aguilar, Clemente	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Beaulieu, Jeremy	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Earl, Julia	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Hoban, Sean	Postdoctoral (scholar, fellow or other postdoctoral position)	11
Hobson, Elizabeth	Postdoctoral (scholar, fellow or other postdoctoral position)	3
Ilany, Amiyaal	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Jiang, Jiang	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Kershenbaum, Arik	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Lawing, Michelle	Postdoctoral (scholar, fellow or other postdoctoral position)	4
Mack, Keenan	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Magombedze, Gesham	Postdoctoral (scholar, fellow or other postdoctoral position)	11

Name	Most Senior Project Role	Nearest Person Month Worked
Martin, Ryan	Postdoctoral (scholar, fellow or other postdoctoral position)	3
Matzke, Nicholas	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Ngonghala, Calistus	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Remien, Chris	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Ryan, Daniel	Postdoctoral (scholar, fellow or other postdoctoral position)	9
Cao, Yang	Other Professional	4
Carr, Eric	Other Professional	11
Comiskey, Jane	Other Professional	11
Crawley, Catherine	Other Professional	12
Donohue, Kathleen	Other Professional	3
Eskridge, Chandra	Other Professional	12
Forde, Jonathan	Other Professional	9
Koosman, Toby	Other Professional	12
Peek, Michael	Other Professional	11
Richters, Ana	Other Professional	12
Spar, Jennifer	Other Professional	12
Strand, Allan	Other Professional	4
Sturner, Kelly	Other Professional	12
Bishop, Pamela	Staff Scientist (doctoral level)	12

Name	Most Senior Project Role	Nearest Person Month Worked
Welsh, Christopher	Staff Scientist (doctoral level)	11
Auerbach, Jeremy	Graduate Student (research assistant)	5
DeCotes, Mark	Graduate Student (research assistant)	6
Favi, Pelagi	Graduate Student (research assistant)	5
Kelly, Michael	Graduate Student (research assistant)	5
Martin, John	Graduate Student (research assistant)	6
Milt, Austin	Graduate Student (research assistant)	5
Balthrop, Lindsey	Undergraduate Student	2
Bratton, Kelsey	Undergraduate Student	1
Denison, Elizabeth	Undergraduate Student	2
Anyaeche, Vivian	Research Experience for Undergraduates (REU) Participant	2
Boribong, Brittany	Research Experience for Undergraduates (REU) Participant	2
Cruz, Michelle	Research Experience for Undergraduates (REU) Participant	2
Go, Veronica	Research Experience for Undergraduates (REU) Participant	2
Handagama, Winode	Research Experience for Undergraduates (REU) Participant	2
Hong, Fangyuan	Research Experience for Undergraduates (REU) Participant	2
James, Tashika	Research Experience for Undergraduates (REU) Participant	2
Krishna, Nitin	Research Experience for Undergraduates (REU) Participant	2

Name	Most Senior Project Role	Nearest Person Month Worked
Kuramoto, Taylor	Research Experience for Undergraduates (REU) Participant	2
Marken, John	Research Experience for Undergraduates (REU) Participant	2
Massaro, Marina	Research Experience for Undergraduates (REU) Participant	2
McDaniel, Margaret	Research Experience for Undergraduates (REU) Participant	2
Moran, Kelly	Research Experience for Undergraduates (REU) Participant	2
Nelsen, Taylor	Research Experience for Undergraduates (REU) Participant	2
Roberson, Benjamin	Research Experience for Undergraduates (REU) Participant	2
Rooks, Nicole	Research Experience for Undergraduates (REU) Participant	2
Shamshoian, John	Research Experience for Undergraduates (REU) Participant	2
Whyte, Brian	Research Experience for Undergraduates (REU) Participant	2

Full details of individuals who have worked on the project:

Louis J Gross

Email: gross@NIMBioS.org

Most Senior Project Role: PD/PI

Nearest Person Month Worked: 11

Contribution to the Project: Dr. Gross is the NIMBioS Director. He supervises and coordinates all activities, including hiring staff, coordinating activities of the Associate Directors, interacting with the Advisory Board, communicating the mission of NIMBioS to numerous institutions through formal and informal presentations, and developing relationships with leaders of other NSF BIO Centers.

Funding Support: UT

International Collaboration: Yes, Australia, Canada, France, Germany, United Kingdom

International Travel: Yes, France - 0 years, 0 months, 6 days; Canada - 0 years, 0 months, 2 days

Sergey Gavrilets

Email: sergey@nimbios.org

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 3

Contribution to the Project: Dr. Gavrilets is the NIMBioS Associate Director for Scientific Activities and member of the NIMBioS Leadership Team. He leads the assessment of requests for support in conjunction with the rest of the Leadership Team and Board of Advisors. He is co-organizer of an active working group on Hierarchy and Leadership and participant in working groups on The Evolutionary Origins of Complex Institutions and Evolutionary Approaches to Sustainability. He is a mentor for NIMBioS post-docs Amiyaal Ilany and Matt Zimmerman and was a member of the Director Search Committee.

Funding Support: University of Tennessee

International Collaboration: Yes, Canada, Finland, Germany, Japan, Netherlands, Norway, Sweden, United Kingdom

International Travel: Yes, United Kingdom - 0 years, 0 months, 9 days; Austria - 0 years, 0 months, 6 days; Canada - 0 years, 0 months, 6 days; Canada - 0 years, 0 months, 3 days; Germany - 0 years, 0 months, 10 days

Suzanne Lenhart

Email: lenhart@math.utk.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 4

Contribution to the Project: Dr. Lenhart is the Associate Director for Education and Outreach and member of the NIMBioS Leadership Team. She oversees all education and outreach activities and supervises the Outreach and Education Coordinator. She is the organizer of an active working group on agent-based models in biology and a regular contributor to many of the activities hosted at NIMBioS. She was also a member of the Director search committee.

Funding Support: UT

International Collaboration: Yes, Netherlands

International Travel: Yes, Canada - 0 years, 0 months, 6 days

Paul Armsworth

Email: parmsworth@nimbios.org

Most Senior Project Role: Faculty

Nearest Person Month Worked: 2

Contribution to the Project: Dr. Armsworth is the NIMBioS Associate Director for Post-doctoral Activities. He manages the NIMBioS post-doctoral training program, planning monthly workshops and conducting performance reviews for all post-docs.

Funding Support: University of Tennessee

International Collaboration: Yes, Australia, United Kingdom

International Travel: No

Ernest Brothers

Email: ebrother@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 3

Contribution to the Project: Dr. Brothers is the NIMBioS Associate Director for Diversity Enhancement. He has been instrumental in developing diversity and cultural training opportunities for NIMBioS post-docs and plays a key role in developing and implementing a strategy to increase participation by under-represented groups in NIMBioS activities. He was also a member of the Director search committee.

Funding Support: University of Tennessee

International Collaboration: No

International Travel: No

Alison Buchan

Email: abuchan@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 2

Contribution to the Project: Dr. Buchan is the NIMBioS Associate Director for Graduate Education. She manages NIMBioS graduate research assistants as well as the Visiting Graduate Fellow program.

Funding Support: None

International Collaboration: Yes, Denmark, Norway, United Kingdom

International Travel: No

Gordon Burghardt

Email: gburghar@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Burghardt is a Professor in the Department of Psychology at the University of Tennessee. He is co-organizer of the working group on Play as a Window into Cognitive Evolution and the Rules of Sociality.

Funding Support: UT

International Collaboration: Yes, Canada, Czech Republic, Germany, Italy

International Travel: No

Charles Collins

Email: collins@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Collins is Associate Professor of Mathematics. He served as SRE mentor in Summer 2014.

Funding Support: University of Tennessee

International Collaboration: No

International Travel: No

Judy Day

Email: judyday@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 2

Contribution to the Project: Dr. Day is an Assistant Professor in the Department of Mathematics at the University of Tennessee. She is a mentor for post-doc Arik Kershenbaum. She is a co-organizer of the working group on Modeling Low Dose Exposure to Inhalation Anthrax.

Funding Support: UT

International Collaboration: Yes, Canada

International Travel: No

Shige Eda

Email: seda@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 3

Contribution to the Project: Dr. Eda (Associate Professor in Forestry, Wildlife, & Fisheries at the University of Tennessee) is one of the Senior NIMBioS Personnel. He is a mentor for post-doc Gesham Magombedze, a mentor for the summer 2014 SRE program, and a co-organizer of the Within-host Modeling of Mycobacterium avium subsp. paratuberculosis (MAP) Infections Working Group.

Funding Support: UT

International Collaboration: Yes, Japan

International Travel: No

Heather Finotti

Email: hfinotti@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Finotti is a lecturer in the Department of Mathematics at the University of Tennessee and serves as a mentor for the summer 2014 SRE program.

Funding Support: UT

International Collaboration: No

International Travel: No

Vitaly Ganusov

Email: vitaly@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 2

Contribution to the Project: Dr. Ganusov (Assistant Professor, Microbiology) is one of the Senior NIMBioS Personnel. He is active in NIMBioS working groups, a mentor for NIMBioS post-doc Clemente Aguilar, and a mentor for the 2014 Summer Research Experience program.

Funding Support: UT

International Collaboration: Yes, Australia, Netherlands, Russian Federation

International Travel: No

Jian Huang

Email: huangj@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Huang is Professor of Electrical Engineering and Computer Science. He served as co-organizer of the tutorial in cloud computing for life scientists in Spring 2014.

Funding Support: UT

International Collaboration: Yes, New Zealand

International Travel: No

Cristina Lanzas

Email: clanzas@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 2

Contribution to the Project: Dr. Lanzas (Assistant Professor of Epidemiology in the Department of Comparative Medicine at the University of Tennessee's College of Veterinary Medicine) is one of the Senior NIMBioS Personnel. She is a mentor for the summer 2014 SRE program.

Funding Support: University of Tennessee

International Collaboration: No

International Travel: No

Jeff Larsen

Email: jeff.larsen@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Larsen (Associate Professor in the Department of Psychology, University of Tennessee) is a mentor for the summer 2014 SRE program.

Funding Support: UT

International Collaboration: No

International Travel: No

Brian O'Meara

Email: bomeara@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Dr. O'Meara is an Assistant Professor in the Department of Ecology & Evolutionary Biology at the University of Tennessee. He was a mentor for post-docs Jeremy Beaulieu, Michelle Lawing, and Ryan Martin and a frequent contributor to post-doc professional development activities. He was a member of the working group on Play as a Window into Cognitive Evolution and the Rules of Sociality.

Funding Support: University of Tennessee

International Collaboration: Yes, Poland, Taiwan

International Travel: No

Sue Riechert

Email: riechert@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 2

Contribution to the Project: Dr. Riechert is a Distinguished Service Professor in the Department of Ecology & Evolutionary Biology at the University of Tennessee. She brings a major outreach program to the Institute: the Biology in a Box Project provides K-12 schools throughout the state of Tennessee materials and exercises that address biological concepts and that are designed to enrich science and math curriculum content.

Funding Support: UT

International Collaboration: No

International Travel: No

Zaretski Russ

Email: rzaretsk@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Zaretski (Department of Statistics, University of Tennessee) He served as co-organizer of the tutorial in cloud computing for life scientists in Spring 2014.

Funding Support: University of Tennessee

International Collaboration: No

International Travel: No

Drew Schmidt

Email: schmidt@math.utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 5

Contribution to the Project: Mr. Schmidt is a math instructor and staff associate at the Joint Institute for Computational Sciences. He assisted with the development of a tutorial on cloud computing for life scientists.

Funding Support: None

International Collaboration: No

International Travel: No

Xiaopeng Zhao

Email: xzhao9@utk.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Zhao is an Assistant Professor in the Department of Mechanical, Aerospace, and Biomedical Engineering at the University of Tennessee. He is a mentor for the summer 2014 SRE program.

Funding Support: UT

International Collaboration: Yes, France

International Travel: No

Megan Comer

Email: comerm2@k12tn.net

Most Senior Project Role: K-12 Teacher

Nearest Person Month Worked: 2

Contribution to the Project: High school teacher participating in NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Rebecca McDowell

Email: rebecca.mcdowell@knoxschools.org

Most Senior Project Role: K-12 Teacher

Nearest Person Month Worked: 2

Contribution to the Project: High school teacher participating in NIMBioS' summer 2014 Summer Research

Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Matthew (Zimmerman) Zefferman

Email: mrz1@nimbios.org

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 11

Contribution to the Project: Dr. Zefferman is a current full-time post-doctoral fellow at NIMBioS. His research focuses on the evolutionary origins of complex institutions. He is a mentor for the summer 2014 SRE program.

Funding Support: None

International Collaboration: No

International Travel: Yes, Brazil - 0 years, 0 months, 6 days

Clemente Aguilar

Email: clemen@nimbios.org

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 12

Contribution to the Project: Dr. Aguilar began as a full-time post-doctoral fellow in July 2013, coming from the Computational Science program at the University of Texas at El Paso. He is developing methods for the prediction and rule inference of major histocompatibility complex (MHC) class II epitope binders through the Logic Minimization Method.

Funding Support: None

International Collaboration: Yes, Brazil, Mexico

International Travel: No

Jeremy Beaulieu

Email: jbeaulieu@nimbios.org

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 12

Contribution to the Project: Dr. Beaulieu is a current full-time post-doctoral fellow at NIMBioS. He came to NIMBioS from Ecology and Evolutionary Biology at Yale University. He is developing a new set of ancestral state reconstruction methods that make more realistic assumptions about how characters evolve across very large phylogenies. He has established a collaboration with researchers from the Remote Data and Visualization center to enhance use of high-performance computing in his work.

Funding Support: None

International Collaboration: No

International Travel: No

Julia Earl

Email: jearl@nimbios.org

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 12

Contribution to the Project: Dr. Earl began as a full-time post-doctoral fellow in August 2012, coming to NIMBioS from the University of Missouri. She is building spatially explicit individual-based models to determine how movement ecology affects spatio-temporal patterns of cross-ecosystem transfer of energy and nutrients. She has been active in Outreach and Education, assisting with programs encouraging girls in STEM fields and educating children and their parents about ecology and conservation. She is also a mentor for the 2014 Summer Research Experience for undergraduates program.

Funding Support: None

International Collaboration: No

International Travel: No

Sean Hoban

Email: shoban@nimbios.org

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 11

Contribution to the Project: Dr. Hoban is a current full-time postdoc at NIMBioS. His research focuses on developing simulation-based sampling guidelines for conserving the genetic resources of rare or economically important plant species. He is serving as a mentor for the summer 2014 Summer Research Experience for undergraduates program.

Funding Support: None

International Collaboration: Yes, Germany, Italy, Netherlands, Spain, United Kingdom

International Travel: Yes, South Africa - 0 years, 0 months, 13 days

Elizabeth Hobson

Email: emoseman@nmsu.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 3

Contribution to the Project: Dr. Hobson is beginning her post-doctoral fellowship in June 2014. Her research is on the evolution of social complexity across taxa.

Funding Support: None

International Collaboration: Yes, Australia, United Kingdom

International Travel: No

Amiyaal Ilany**Email:** amiyaal@nimbios.org**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 12

Contribution to the Project: Dr. Ilany began as a full-time post-doctoral fellow in October 2012, coming to us from Tel Aviv University. He is modeling causes and consequences of temporal change in animal social networks. He helped co-organize the March 2014 investigative workshop on Animal Social Networks.

Funding Support: None**International Collaboration:** No**International Travel:** No**Jiang Jiang****Email:** jjiang@nimbios.org**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 12

Contribution to the Project: Dr. Jiang is a current full-time post-doctoral fellow at NIMBioS. His research focus is on developing models that couple ecological-hydrologic processes to understand vegetation regime shifts associated with climate change. He is collaborating with other NIMBioS post-docs on additional projects and participated in the NIMBioS working group on Non-autonomous Systems and the Terrestrial Carbon Cycle.

Funding Support: None**International Collaboration:** Yes, Malaysia**International Travel:** No**Arik Kershenbaum****Email:** arik@nimbios.org**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 12

Contribution to the Project: Dr. Kershenbaum began as a full-time post-doctoral fellow in August 2012, coming from the University of Haifa. He is analyzing cetacean vocalizations to identify significant syntactic trends to relate them to behavioral and environmental cues. He is co-organizer of the October 2013 workshop on multidisciplinary approaches to analyzing animal vocal communication sequences. He is also mentoring two graduate students and has assisted with outreach and education activities for high school students.

Funding Support: None**International Collaboration:** Yes, Brazil, France, Israel, Japan, Mexico, Spain, Switzerland, United Kingdom**International Travel:** Yes, United Kingdom - 0 years, 0 months, 8 days**Michelle Lawing****Email:** alawing@nimbios.org**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 4

Contribution to the Project: Dr. Lawing ended her post-doc in December 2013 and is now assistant professor of spatial sciences in the department of ecosystem science and management at Texas A&M. Her research focused on developing and applying new methodology for incorporating evolution into models of species response to climate change. She presented her work at professional meetings and has submitted papers for publication. She has joined two collaborative projects aimed at understanding the spatial structure of the community trait-environment relationship at different scales and has been active in Outreach and Education activities.

Funding Support: None

International Collaboration: Yes, Finland, Germany, Italy

International Travel: No

Keenan Mack

Email: kmlmack@nimbios.org

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 12

Contribution to the Project: Dr. Mack began as a full-time post-doctoral fellow in August 2012, coming to NIMBioS from the University of Indiana. He studies the evolution and maintenance of cooperation, particularly how it relates to resource use efficiency as a currency for cooperative interaction. He is a mentor for the summer 2014 SRE program.

Funding Support: None

International Collaboration: Yes, Netherlands

International Travel: No

Gesham Magombedze

Email: gmagombedze@nimbios.org

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 11

Contribution to the Project: Dr. Magombedze is a full-time post-doctoral fellow, coming to NIMBioS from the National University of Science and Technology in Zimbabwe. He is developing mathematical models to understand the major factors involved in Mycobacterium avium subspecies paratuberculosis infection and host interaction in order to enhance understanding of resistance and susceptibility patterns between pathogens and persistence of infection. He has extended his research to include investigation of Johne's Disease and Toxoplasma gondii. He participated in tutorials, working groups, and workshops.

Funding Support: None

International Collaboration: Yes, Netherlands, South Africa, Zimbabwe

International Travel: Yes, China - 0 years, 0 months, 5 days; South Africa - 0 years, 0 months, 5 days

Ryan Martin

Email: ram225@case.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 3

Contribution to the Project: Dr. Martin completed his post-doctoral research in December 2013 and is currently an assistant professor of Biology at Case Western. His research focused on exploring patterns between agents of selection and estimates of phenotypic selection from natural populations and manipulative experiments in order to gain a more thorough understanding of the causes of selection in the wild. He has constructed a significant database of studies on phenotypic selection. He has been active in collaboration with a NESCent Working Group on Environmental and demographic determinants of natural selection.

Funding Support: None

International Collaboration: Yes, Canada, Sweden, United Kingdom

International Travel: No

Nicholas Matzke

Email: matzke@nimbios.org

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 12

Contribution to the Project: Dr. Matzke is a current full-time post-doctoral fellow at NIMBioS. His research focuses on unification of phylogenetic biogeography and species distribution modeling.

Funding Support: None

International Collaboration: Yes, Mexico, United Kingdom

International Travel: Yes, Australia - 0 years, 0 months, 7 days; French Guiana - 0 years, 0 months, 7 days

Calistus Ngonghala

Email: cngonghala@nimbios.org

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Ngonghala completed his postdoc in October 2013. His project focused on developing a mathematical model to study the role of mosquito demography in the dynamics of malaria transmission. Dr. Ngonghala accepted a postdoctoral position at Harvard School of Public Health and is now a research fellow in the Department of Global Health and Social Medicine at Harvard Medical School.

Funding Support: None

International Collaboration: Yes, Cameroon, France

International Travel: Yes, France - 0 years, 0 months, 7 days

Chris Remien

Email: cremien@nimbios.org

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 12

Contribution to the Project: Dr. Remien began as a full-time post-doctoral fellow in August 2012, coming from the Mathematics Department at the University of Utah. He is developing dynamic mathematical models to

understand the role of diet and metabolism on stable isotope ratios of animal tissues. He has taken an active role in organizing the NIMBioS Post-doctoral Fellows Invited Distinguished Visitors program. He has accepted a faculty position at the University of Idaho.

Funding Support: None

International Collaboration: No

International Travel: No

Daniel Ryan

Email: ryan@nimbios.org

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 9

Contribution to the Project: Dr. Ryan is a current post-doctoral fellow at NIMBioS. Dan came to NIMBioS from the Department of Mathematics at University of Miami. He is investigating the role non-random movement strategies play in the population dynamics of multi-trophic communities living in a heterogeneous environment as well as looking at optimal control of individual-based models. He is a member of the NIMBioS working group on Extensions of Optimal Control for Ecological Systems.

Funding Support: None

International Collaboration: No

International Travel: No

Yang Cao

Email: ycao@cs.vt.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 4

Contribution to the Project: Dr. Cao (Computer Science Dept, Virginia Tech) was a sabbatical visitor from February to May 2014. His research focuses on developing rigorous mathematical theories and efficient numerical algorithms for multiscale biochemical systems and stochastic reaction--diffusion (RD) systems, and applying them to biological and ecological models.

Funding Support: None

International Collaboration: Yes, United Kingdom

International Travel: No

Eric Carr

Email: carr@nimbios.org

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 11

Contribution to the Project: Eric is the full-time NIMBioS high-performance computing (HPC) specialist. He provides support for all participant and staff HPC. He provides scientific computing support for groups as needed, provides IT support for all participants, and researches and recommends resources for virtual collaborations. He is also a doctoral student in Geography.

Funding Support: None

International Collaboration: No

International Travel: No

Jane Comiskey

Email: ecomiske@nimbios.org

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 11

Contribution to the Project: Jane is a Senior Analyst and Webmaster for NIMBioS. She developed and maintains the award-winning NIMBioS website, provides IT support, provides coding support for scientific activities, and supports web-communications for activity participants.

Funding Support: None

International Collaboration: No

International Travel: No

Catherine Crawley

Email: ccrawley@nimbios.org

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 12

Contribution to the Project: Dr. Crawley is the NIMBioS Communications Manager. She is the main point of administrative contact for media, writes press releases on NIMBioS activities, conducts interviews with visiting scientists, produces print and video pieces highlighting NIMBioS activities and research, and consults with other staff on strategies to increase awareness of NIMBioS opportunities worldwide.

Funding Support: None

International Collaboration: No

International Travel: No

Kathleen Donohue

Email: k.donohue@duke.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 3

Contribution to the Project: Dr. Donohue (Department of Biological Sciences, Duke University) was a NIMBioS Sabbatical Fellow from September through November 2013. Her research focused on how genetic pathways influence organismal responses to climate change.

Funding Support: None

International Collaboration: No

International Travel: No

Chandra Eskridge**Email:** ceskridge@nimbios.org**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 12

Contribution to the Project: Chandra serves as Executive and Business Assistant for NIMBioS, supporting the Director and operating as a key member of the business and travel staff. She manages the main office and processes reimbursement requests for all staff and visitors.

Funding Support: None**International Collaboration:** No**International Travel:** No**Jonathan Forde****Email:** forde@hws.edu**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 9

Contribution to the Project: Dr. Forde, Department of Mathematics and Computer Science at Hobart and William Smith Colleges, was a NIMBioS Sabbatical Fellow from September 2013 through May 2014. His research focused on developing a mathematical model of the dynamic interactions of populations in both immunological and ecological contexts.

Funding Support: None**International Collaboration:** No**International Travel:** No**Toby Koosman****Email:** tkoosman@nimbios.org**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 12

Contribution to the Project: Toby is the NIMBioS Business Manager. She handles all accounting, inventory, contracting, and personnel procedures and has primary responsibility for all purchasing and financial management of participant support activities. She is the direct supervisor of the Event and Travel Coordinator and generally oversees the entire business office.

Funding Support: None**International Collaboration:** No**International Travel:** No**Michael Peek****Email:** peek@nimbios.org**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 11

Contribution to the Project: Michael is the NIMBioS Information Technology (IT) Manager. He provides all IT support, basic hardware and connectivity, software and applications for collaborative services. He oversees the IT staff, which includes a high-performance computing specialist, a senior analyst, and a graduate technician/programmer.

Funding Support: None

International Collaboration: No

International Travel: No

Ana Richters

Email: richters@nimbios.org

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 12

Contribution to the Project: Ana is a full-time Database Specialist and manages the NIMBioS participant database as well as video archives.

Funding Support: UT

International Collaboration: No

International Travel: No

Jennifer Spar

Email: jspar@nimbios.org

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 12

Contribution to the Project: Jennifer Spar (formerly Jennifer Thomas) is the NIMBioS Event and Travel Coordinator. She handles all aspects of event management, contracting with hotels, planning catering, providing support for visitors, and arranging travel for all participants.

Funding Support: None

International Collaboration: No

International Travel: No

Allan Strand

Email: stranda@cofc.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 4

Contribution to the Project: Dr. Strand (Grice Marine Laboratory, Dept of Biology, College of Charleston) was a NIMBioS Sabbatical Fellow from September through December 2013. His research focused on creating an approximate Bayesian framework for estimating ecological processes from population genetic data. During his sabbatical he established collaborations with members of the Plant-Soil Feedback Working Group and continues to be active with that group.

Funding Support: None

International Collaboration: Yes, Australia, Italy, Netherlands

International Travel: No

Kelly Sturner

Email: ksturner@nimbios.org

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 12

Contribution to the Project: Kelly is the NIMBioS Outreach and Education Coordinator. She works closely with Associate Director for Outreach and Education Lenhart to develop and manage all NIMBioS outreach and education activities.

Funding Support: None

International Collaboration: No

International Travel: No

Pamela Bishop

Email: pbaird@utk.edu

Most Senior Project Role: Staff Scientist (doctoral level)

Nearest Person Month Worked: 12

Contribution to the Project: Dr. Bishop is the NIMBioS Program Evaluation Manager. She has developed evaluation instruments for NIMBioS activities to support NSF reporting requirements and to assess the success of individual activities and the Center as a whole. She is a leader in developing methods for Center-scale assessment. She has a significant role in planning and managing the NIMBioS participant database and online interface.

Funding Support: UT

International Collaboration: Yes, Australia, France, Germany, United Kingdom

International Travel: Yes, France - 0 years, 0 months, 6 days

Christopher Welsh

Email: cwelsh@nimbios.org

Most Senior Project Role: Staff Scientist (doctoral level)

Nearest Person Month Worked: 11

Contribution to the Project: Dr. Welsh is the NIMBioS Deputy Director and member of the NIMBioS Leadership Team. He is responsible for overseeing day-to-day operations of the center, supervises most of the staff, and interacts regularly with activity organizers, visitors, and other collaborators. He is also involved in Outreach and Education efforts developing math bio training activities for the Discover Birds program. He was a member of the Director search committee.

Funding Support: None

International Collaboration: No

International Travel: No

Jeremy Auerbach**Email:** jauerbac@utk.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 5

Contribution to the Project: Jeremy is a doctoral student in mathematics. His research focuses on modeling the evolution and maintenance of leadership in small-scale societies.

Funding Support: UT**International Collaboration:** No**International Travel:** No**Mark Blaise DeCotes****Email:** bdecoate@utk.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 6

Contribution to the Project: Blaise is a master's student in computer science whose research focuses on high performance computing and large data visualization. His work at NIMBioS is part of a joint project with RDAV (Remote Data and Visualization) through a supplement to base funding, investigating potential cases in biology to which RDAV capabilities can apply.

Funding Support: None**International Collaboration:** No**International Travel:** No**Pelagi Favi****Email:** pfavi@utk.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 5

Contribution to the Project: Pelagie is a doctoral student in materials science and engineering. Her research focuses on designing bacterial cellulose scaffolds for tissue engineering of stem cells.

Funding Support: UT**International Collaboration:** No**International Travel:** No**Michael Kelly****Email:** mkelly14@utk.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 5

Contribution to the Project: Mike is a doctoral student in mathematics. His research focuses on optimal control of ordinary and partial differential equations with applications to spatial-temporal management in epidemiological and natural resources models.

Funding Support: UT

International Collaboration: No

International Travel: No

John Martin

Email: jmartin@nimbios.org

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 6

Contribution to the Project: John is a doctoral student in computer science. He is developing and implementing an administrative database system to be used for all NIMBioS activities, beginning with submission of requests for support and including tracking of products from participants and activities.

Funding Support: UT

International Collaboration: No

International Travel: No

Austin Milt

Email: austin.milt@utk.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 5

Contribution to the Project: Austin is a doctoral student in ecology and evolutionary biology. His research focuses on estimating and reducing future terrestrial habitat impacts from natural gas surface infrastructure development in the Appalachian region.

Funding Support: UT; Nature Conservancy

International Collaboration: No

International Travel: No

Lindsey Balthrop

Email: lbalthro@utk.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 2

Contribution to the Project: Lindsey is an undergraduate majoring in Public Relations. She assists with clerical tasks and meeting setup.

Funding Support: UT

International Collaboration: No

International Travel: No

Kelsey Bratton

Email: kelbbrat@utk.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 1

Contribution to the Project: Kelsey was an undergraduate intern for the Outreach and Education Biology in a Box program.

Funding Support: UT

International Collaboration: No

International Travel: No

Elizabeth Denison

Email: edenison@utk.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 2

Contribution to the Project: Elizabeth is an undergraduate majoring in Wildlife and Fisheries Science. She assists with basic clerical tasks and meeting setup.

Funding Support: UT

International Collaboration: No

International Travel: No

Vivian Anyaeche

Email: viviananyaeche@gmail.com

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Sophomore

Home Institution: Fisk University

Government fiscal year(s) was this REU participant supported: 2014

Brittany Boribong

Email: brittany.boribong@scranton.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No
International Travel: No
Year of schooling completed: Junior
Home Institution: University of Scranton
Government fiscal year(s) was this REU participant supported: 2014

Michelle Cruz

Email: cruz072@csusm.edu
Most Senior Project Role: Research Experience for Undergraduates (REU) Participant
Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No
International Travel: No
Year of schooling completed: Junior
Home Institution: California State University - San Marcos
Government fiscal year(s) was this REU participant supported: 2014

Veronica Go

Email: yjk112@utk.edu
Most Senior Project Role: Research Experience for Undergraduates (REU) Participant
Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No
International Travel: No
Year of schooling completed: Sophomore
Home Institution: University of Tennessee - Knoxville
Government fiscal year(s) was this REU participant supported: 2014

Winode Handagama

Email: winode.handagama@my.maryvillecollege.edu
Most Senior Project Role: Research Experience for Undergraduates (REU) Participant
Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No
Year of schooling completed: Junior
Home Institution: Maryville College
Government fiscal year(s) was this REU participant supported: 2014

Fangyuan Hong
Email: hong22f@mtholyoke.edu
Most Senior Project Role: Research Experience for Undergraduates (REU) Participant
Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No
International Travel: No
Year of schooling completed: Sophomore
Home Institution: Mount Holyoke College
Government fiscal year(s) was this REU participant supported: 2014

Tashika James
Email: tashikajames26@yahoo.com
Most Senior Project Role: Research Experience for Undergraduates (REU) Participant
Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No
International Travel: No
Year of schooling completed: Sophomore
Home Institution: LeMoyne Owen College
Government fiscal year(s) was this REU participant supported: 2014

Nitin Krishna
Email: nitin.krishna@live.com
Most Senior Project Role: Research Experience for Undergraduates (REU) Participant
Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No
International Travel: No

Year of schooling completed: Sophomore
Home Institution: Western Kentucky University
Government fiscal year(s) was this REU participant supported: 2014

Taylor Kuramoto

Email: kuramoto@augsborg.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Junior

Home Institution: Augsburg College

Government fiscal year(s) was this REU participant supported: 2014

John Marken

Email: jpmarken@email.wm.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Freshman

Home Institution: College of William and Mary

Government fiscal year(s) was this REU participant supported: 2014

Marina Massaro

Email: marina.massaro@gmail.com

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Junior

Home Institution: State University of New York Geneseo
Government fiscal year(s) was this REU participant supported: 2014

Margaret McDaniel

Email: mmcdan15@utk.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Junior

Home Institution: University of Tennessee - Knoxville

Government fiscal year(s) was this REU participant supported: 2014

Kelly Moran

Email: krmoran@clemson.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Junior

Home Institution: Clemson University

Government fiscal year(s) was this REU participant supported: 2014

Taylor Nelsen

Email: tnelsen@live.unc.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Sophomore

Home Institution: University of North Carolina - Chapel Hill

Government fiscal year(s) was this REU participant supported: 2014

Benjamin Roberson

Email: benroberson2@gmail.com

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Freshman

Home Institution: University of Tennessee - Knoxville

Government fiscal year(s) was this REU participant supported: 2014

Nicole Rooks

Email: zfy267@mocs.utc.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Sophomore

Home Institution: University of Tennessee - Chattanooga

Government fiscal year(s) was this REU participant supported: 2014

John Shamshoian

Email: jshamsho@calpoly.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 2

Contribution to the Project: Participant in the NIMBioS' summer 2014 Summer Research Experience for undergraduate program.

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Junior

Home Institution: California Polytechnic State University

Government fiscal year(s) was this REU participant supported: 2014

What other organizations have been involved as partners?

Name	Type of Partner Organization	Location
4H	Other Nonprofits	Knoxville, TN
AAAS-American Association for Advancement of Science	Academic Institution	Washington, D.C.
Center for Synthesis and Analysis of Biodiversity	Academic Institution	Aix-en-Provence, France
DIMACS-Center for Discrete Mathematics & Theoret. Comp. Sci.	Academic Institution	Rutgers University
Ecological Society of America	Other Nonprofits	Washington, D.C.
Fisk University	Academic Institution	Nashville, TN
Great Smoky Mountains Institute at Tremont	Other Nonprofits	Townsend, TN
Great Smoky Mountains National Park	Other Organizations (foreign or domestic)	Gatlinburg, TN
Greater Knoxville Math/Science Coalition	Academic Institution	Knoxville, TN
Howard Hughes Medical Institute	Other Nonprofits	Chevy Chase, MD
Howard University	Academic Institution	Washington, D.C.
Institute of Biomedical Engineering	Academic Institution	University of Tennessee
AIBS-American Institute of Biological Sciences	Academic Institution	Reston, VA
International Business Machines	Industrial or Commercial Firms	Armonk, NY
JICS-Joint Institute for Computational Science	Academic Institution	University of Tennessee
MBI-Mathematical Biosciences Institute	Academic Institution	Ohio State University
MSRI-Mathematical Sciences Research Institute	Academic Institution	Berkeley, CA
Mathematics of Planet Earth	Academic Institution	University of Montreal, Canada

Name	Type of Partner Organization	Location
NCEAS-National Center for Ecological Analysis and Synthesis	Academic Institution	University of California - Santa Barbara
NEON-National Ecological Observatory Network, Inc.	Academic Institution	Boulder, CO
NESCent-National Evolutionary Synthesis Center	Academic Institution	Durham, NC
NICS-National Institute for Computational Science	Academic Institution	Oak Ridge, TN
NSF Mathematical Sciences Diversity Committee	Academic Institution	various
AWM-Association for Women in Mathematics	Other Nonprofits	Fairfax, VA
NSF Mathematical Sciences Institutes	Academic Institution	various
NSF-XSEDE Extreme Science and Engineering Environment	Academic Institution	various
National Center for Medical Intelligence	Other Organizations (foreign or domestic)	Washington, D.C.
North Carolina A&T University	Academic Institution	Greensboro, NC
Oak Ridge National Laboratory	Other Organizations (foreign or domestic)	Oak Ridge, TN
PEER-Program for Equity and Excellence in Research	Academic Institution	University of Tennessee
Peace Science Society	Other Nonprofits	Pennsylvania State University
QUBES (Quantitative Undergraduate Biology Education and Synt	Academic Institution	Unity College, Unity, ME
RDAV-Center for Remote Data Analysis and Visualization	Academic Institution	University of Tennessee

Name	Type of Partner Organization	Location
SACNAS-Society for the Advancement of Chicanos and Native Am	Academic Institution	Santa Cruz, CA
American Society of Naturalists	Other Nonprofits	University of Chicago
SAMSI-Statistical and Applied Mathematical Sciences Institut	Academic Institution	Research Triangle Park, NC
SCALE-IT-Scalable Computing & Leading Edge Innovative Tech.	Academic Institution	University of Tennessee
SESYNC-National Social-Environmental Synthesis Center	Academic Institution	University of Maryland
SHADES-Sharing Adventures in Engineering & Science	Academic Institution	Knoxville, TN
SIAM-Society for Industrial and Applied Mathematics	Academic Institution	Philadelphia, PA
SMB-Society for Mathematical Biology	Academic Institution	international
TN-SCORE (Tennessee Solar Conversion and Storage using Outre	Academic Institution	Knoxville, TN
Tennessee Ornithological Society	Other Nonprofits	Clinton, TN
Tennessee Science Teachers Association	Other Nonprofits	Tennessee
Tennessee State University	Academic Institution	Nashville, TN
BioQUEST Curriculum Consortium	Other Nonprofits	Madison, WI
U.S. Army Research Office	Other Organizations (foreign or domestic)	Research Triangle Park, NC
USDA - APHIS - WS - National Wildlife Research Center	Other Organizations (foreign or domestic)	Fort Collins, CO
University of Tennessee - Biology in a Box	Academic Institution	Knoxville, TN
University of Texas El Paso	Academic Institution	El Paso, TX

Name	Type of Partner Organization	Location
University of the Virgin Islands	Academic Institution	U.S. Virgin Islands
VolsTeach	Academic Institution	University of Tennessee
iPlant Collaborative	Academic Institution	Tucson, AZ
CAMBAM-Centre for Applied Mathematics in Bioscience & Med.	Academic Institution	McGill University, Montreal, Canada
CEEMS-UT Center for Enhancing Education in Mathematics & Sci	Academic Institution	University of Tennessee
CURRENT: Center for Ultra-wide-area Resilient Electric Energy	Academic Institution	University of Tennessee
California State University San Marcos Foundation	Academic Institution	San Marcos, CA

Full details of organizations that have been involved as partners:

4H

Organization Type: Other Nonprofits

Organization Location: Knoxville, TN

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: NIMBioS collaborated with 4-H to provide new 4-H curriculum materials which were shared with 4-H club educators.

AAAS-American Association for Advancement of Science

Organization Type: Academic Institution

Organization Location: Washington, D.C.

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: NIMBioS is involved in the AAAS-led effort on Vision and Change in Undergraduate Biology Education. NIMBioS Director Gross is a member of the steering committee.

AIBS-American Institute of Biological Sciences

Organization Type: Academic Institution

Organization Location: Reston, VA

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: NIMBioS has cooperated with the AIBS to communicate opportunities and discuss co-sponsoring an outreach and education symposium. NIMBioS staff have presented at AIBS meetings.

AWM-Association for Women in Mathematics

Organization Type: Other Nonprofits

Organization Location: Fairfax, VA

Partner's Contribution to the Project:

Collaborative Research

Personnel Exchanges

More Detail on Partner and Contribution: Co-sponsored NIMBioS' Spring Opportunities for Women in Mathematics workshop (April 2014)

American Society of Naturalists

Organization Type: Other Nonprofits

Organization Location: University of Chicago

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: The American Society of Naturalists is a co-sponsor of the NIMBioS Quantitative Evolutionary Genetics tutorial.

BioQUEST Curriculum Consortium

Organization Type: Other Nonprofits

Organization Location: Madison, WI

Partner's Contribution to the Project:

Collaborative Research

Personnel Exchanges

More Detail on Partner and Contribution: BioQuest and NIMBioS have collaborated to conduct several workshops at NIMBioS. During this reporting period NIMBioS hosted BioQuest's Biology by Numbers - Bringing Math to the High School Biology Classroom workshop (July 2014). BioQUEST's Kristin Jenkins is a member of the NIMBioS Board of Advisors.

CAMBAM-Centre for Applied Mathematics in Bioscience & Med.

Organization Type: Academic Institution

Organization Location: McGill University, Montreal, Canada

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: NIMBioS co-sponsored and hosted a summer graduate workshop jointly with MBI and CAMBAM in summer 2014. The theme of this workshop, held in July 2014, was "Modeling Rhythm and Oscillations".

CEEMS-UT Center for Enhancing Education in Mathematics & Sci

Organization Type: Academic Institution

Organization Location: University of Tennessee

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: NIMBioS collaborates with CEEMS on a variety of programs, including VolsTeach, to improve preparation of math and science teachers and STEM education.

CURENT: Center for Ultra-wide-area Resilient Electric Energy

Organization Type: Academic Institution

Organization Location: University of Tennessee

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: NIMBioS is collaborating with the engineering research center CURENT (Center for Ultra-wide-area Resilient Electric Energy Transmission Networks), an NSF and DOE engineering research center, to coordinate a week-long Adventures in STEM summer day camp for middle school girls in June 2014. NIMBioS, CURENT, and TNSCORE are co-hosting the July 2014 UT STEM REU Symposium.

California State University San Marcos Foundation

Organization Type: Academic Institution

Organization Location: San Marcos, CA

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: NIMBioS staff are working with CSUSM faculty and staff to increase underrepresented individuals in science careers, with particular connections through the NIH-funded MARC Phase II award at CSUSM. NIMBioS and CSUSM have signed a formal partnership agreement, and NIMBioS scientists have visited and presented at CSUSM.

Center for Synthesis and Analysis of Biodiversity

Organization Type: Academic Institution

Organization Location: Aix-en-Provence, France

Partner's Contribution to the Project:

Other: See detail

More Detail on Partner and Contribution: NIMBioS participated in the first international gathering of synthesis centers, held in October 2013 at CESAB(Center for the Synthesis and Analysis of Biodiversity) in Aix-en-Provence, France and attended by representatives from synthesis centers from the US, France, Australia, China, Germany and the UK. NIMBioS led discussion of center evaluation activities at this gathering, and has collaborated with other attendees in composing a perspectives paper on the benefits of center-scale activities to foster synthetic research.

DIMACS-Center for Discrete Mathematics & Theoret. Comp. Sci.

Organization Type: Academic Institution

Organization Location: Rutgers University

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: NIMBioS staff and leadership are collaborating with DIMACS on the planning of workshops for Mathematics of Planet Earth 2013+.

Ecological Society of America

Organization Type: Other Nonprofits

Organization Location: Washington, D.C.

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: NIMBioS has begun discussions with ESA to plan a diversity and ecology workshop in 2015.

Fisk University

Organization Type: Academic Institution

Organization Location: Nashville, TN

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: NIMBioS staff are working with Fisk University faculty and staff to increase underrepresented individuals in science careers. Fisk students and faculty have participated in the NIMBioS REU program, the undergraduate research conference, and as short-term visitors. NIMBioS and Fisk have signed a formal partnership agreement, and NIMBioS researchers have visited and presented at Fisk.

Have other collaborators or contacts been involved? Yes

Impacts

What is the impact on the development of the principal discipline(s) of the project?

Activities supported by NIMBioS have had strong impact on a number of biological sub-disciplines. The following provides some highlights grouped by the type of activity. We have chosen these examples as they cover most of the subject areas present in Figure 1 in the supporting file uploaded to the Accomplishments portion of this report. However, what we present is a sample of the activities in the subject areas.

Post-doctoral Fellow Jeremy Beaulieu was the senior author on a paper in *Nature* studying the radiation of angiosperms into freezing environments. Beaulieu with co-authors assembled a large species-level database of growth habit (woody or herbaceous; 49,064 species), as well as leaf phenology (evergreen or deciduous), diameter of hydraulic conduits (that is, xylem vessels and tracheids) and climate occupancies (exposure to freezing). To model the evolution of species' traits and climate occupancies, they combined these data with an unparalleled dated molecular phylogeny (32,223 species) for land plants.

Post-doctoral Fellow Calistus Ngonghala was the first author on a paper in *PLOS Biology* arguing that by coupling insights from ecology and economics, one can begin to model and understand the complex dynamics that underlie the generation and maintenance of poverty traps, which can then be used to inform analyses and possible intervention policies. To illustrate the utility of this approach, the authors developed a simple coupled model of infectious diseases and economic growth, where poverty traps emerge from nonlinear relationships determined by the number of pathogens in the system.

A Working Group on Multiscale Modeling of the Life Cycle of *Toxoplasma gondii* published a paper in *Mathematical Biosciences* modeling the coupling between within-host and between-host dynamics in an environmentally-driven infectious disease. The authors defined new reproductive numbers for the within-host and between host dynamics for both the isolated systems and the coupled system. These reproductive numbers determine the stability of the infection-free and the endemic equilibrium points.

A Working Group on Cross-Topology Registration published a paper in the *Annals of Applied Statistics* offering a new way to study the subspace spanned by low variance principal components by determining vectors in this subspace that are simplest. Their method and accompanying graphical displays enhance the biologist's ability to visualize the subspace and identify interpretable directions of low genetic variability that align with simple directions.

A Working Group on Gene Tree Reconciliation published three papers developing efficient algorithms for knowledge-enhanced supertree and supermatrix phylogenetic problems.

The Working Group on Multi-scale Analysis of Cortical Networks led to a series of 18 articles in a special issue of the open access journal *Frontiers in Neural Circuits: Towards an integrated approach to measurement, analysis and modeling of cortical networks*.

Following an Investigative Workshop on Individual-Based Ecology of Microbes: Observations and Modeling, a team of 15 researchers published an opinion paper in the *Proceedings of the National Academy of Sciences* on the future of microbiology. They argue that technological advances allowing observation and experimentation on

the level of single bacterial cells are generating a flood of new data. In order to make the best use of these data, individual-based observations should be combined with individual-based modelling, leading to microbial Individual-Based Ecology (μ IBE).

An Investigative Workshop on Modeling Social Complexity has resulted in a high profile paper in the Proceedings of the National Academy of Sciences using mathematical models to accurately describe certain aspects of the territorial dynamics of historical empires over the period of 3,000 years. This paper has generated a lot of discussion and interest in general public and is currently ranked #37 in social media attention among all papers ever published in PNAS.

A NIMBioS graduate research assistantship has led to a paper on the evolution of manipulated behavior published in *American Naturalist*.

NIMBioS Sabbatical Fellow James Degnan (Univ. of Canterbury, New Zealand) published a paper in *Systematic Biology* comparing the robustness of several computationally efficient approaches—MP-EST, STAR, STEAC, STELLS, and STEM—for inferring species trees from gene trees estimated using maximum likelihood and Bayesian approaches. Sabbatical Fellow Katherine Donahue published a paper in *Evolution* studying developmental niche construction and pleiotropy across the life cycle in *Arabidopsis thaliana*. Yet another Sabbatical Fellow Vlastimil Krivan published a study of two-patch population models with adaptive dispersal in the *Journal of Mathematical Biology*.

What is the impact on other disciplines?

Social sciences: anthropology, history, political sciences, economics:

A paper on modeling historical events that was published in the Proceedings of the National Academy of Sciences is briefly discussed in the section above. The paper on the links between poverty and disease in *PLOS Biology* by Postdoctoral Fellow Calistus Ngonghala is also briefly discussed above. NIMBioS Associate Director for Postdoctoral Activities Paul Armsworth published a paper in *Conservation Biology* studying the ability of landowners and their cooperatives to leverage payments greater than opportunity costs from conservation contracts. Another paper in *Ecology Letters* by Armsworth undertook an assessment of the potential ancillary benefits from the ballot box in the United States, in which citizens vote on referenda to conserve lands for reasons that may not include biodiversity directly but that indirectly might enhance biodiversity conservation.

Human sexuality:

A collaboration in a Working Group on Intragenomic Conflict followed by a short-term visit resulted in publication of a paper in *BioEssays* by Bill Rice and co-authors offering an experimental protocol for testing a new epigenetically-based hypothesis for the maintenance of homosexuality in humans.

Psychology:

Participation in a Working Group on Coalitions and Alliances resulted in a publication in the Proceedings of the National Academy of Sciences on monogamy and infanticide. Collaboration at an Investigative Workshop on Modeling Social Complexity has led to a paper in *Nature Communications* on human psychology of altruism and leadership as evolved under natural selection to solve the collective action problem. Participation in a Working

Group on Play, Evolution and Sociality resulted in a publication by Elisabetta Pelagi in Human Evolution on the origins and functions of smiling and primate play faces.

Medicine and medical engineering:

Senior NIMBioS Personnel Xiaopeng Zhao published a paper using state-of-the-art machine learning techniques to estimate the in-hospital mortality probability of a patient using various physiological measurements taken within the first forty-eight hours of patient admission.

What is the impact on the development of human resources?

In our 2014 Summer Research Experience (SRE) for Undergraduates and Teachers Program, four of the 18 undergraduate students are from underrepresented groups. Among the students, there are 12 females and two males; the two high school teacher participants are female. Research and presentation skills, working in a group, and learning about future career opportunities are emphasized in this program.

At our Undergraduate Research Conference at the Interface Between Biology and Mathematics, about three-fourths of the 150 attendees were students. There were 73 undergraduate research talk and poster presentations. The activities provided students with exposure to the scientific community, career information, and networking opportunities.

Additional research activities and career opportunities sessions for students were held at the Modern Math workshop at the SACNAS meeting and at the Joint MBI-CAMBAM-NIMBioS summer graduate student workshop. More details about these workshops and our other tutorials (for faculty, post-docs and teachers) are in the training and the professional development section of this report.

Our visitor program with our Minority-Serving Institution Partners (Howard University, Tennessee State University, Fisk University, California State University-San Marcos, and University of Texas-El Paso) fosters research and education interactions and collaborations. The NIMBioS post-docs gain cross-cultural experiences during these visits.

K. Sturner and S. Lenhart co-organize and participate in many activities to encourage students and teachers to learn about the interface of biology and mathematics, and we mention some of the activities here. They will lead a quantitative biology session for the Girls in Science week at Tremont in the Great Smoky Mountains National Park in June 2014. NIMBioS was a 2014 sponsor of the Southern Appalachian Science & Engineering Fair, and K. Sturner, J. Auerbach, S. Lenhart and A. Milt served as judges for poster awards prizes in April 2014. NIMBioS collaborated on a Adventures in STEM Camp to offer a week-long summer day camp for rising 7th and 8th grade girls on STEM in June 2014. S. Lenhart and K. Sturner helped to organize three visits to Pond Gap Elementary School by graduate students in the Program for Equity and Excellence in Research. K. Sturner and C. Welsh visited four schools during this reporting period in connection with math and biology activities related to the Discover Birds program in cooperation with the Tennessee Ornithological Society. S. Lenhart and C. Collins worked on a modeling research project with four Bearden High School students this school year.

NIMBioS organized and presented at a booth at the USA Science & Engineering Festival, a large public outreach event and celebration of STEM in Washington, DC, in April 2014. The booth was co-organized with the Ecology &

Evolutionary Biology Department at UTK and included three students. K. Sturner arranged for the group to meet staff from Senator Corker, Senator Alexander, and Congressman Duncan's office to talk about the importance of STEM education and outreach in creating the next generation of innovative STEM professionals.

The Biology in a Box Program, first begun by S. Riechert in 1993 offers an engaging solution to the lack of depth in traditional STEM education in the United States. Exercises are provided in a format that teaches important biological concepts through hands-on community learning. Lessons are packaged within 10 current thematic units that are available in boxes at most school systems in Tennessee and offered to the worldwide audience at the project's web-site <http://biologyinabox.utk.edu>. Some of the NIMBioS collaborative activities included several teacher workshops and working on two new thematic units (Biomechanics and Cell Processes boxes). K. Bratton, a VolsTeach intern working with K. Sturner, also completed a project to create guides showing which activities align to Common Core Math standards; these guides are now posted on the Biology in a Box website.

NIMBioS Associate Director for Diversity Enhancement Ernest Brothers assisted the College of Arts and Sciences with developing a Graduate Diversity Pipeline Initiative, which is designed "to encourage multi-year partnerships between University of Tennessee faculty and their counterparts in undergraduate disciplines at Historically Black Colleges and Universities (HBCUs) or other institutions that offer promising diversity recruitment opportunities." This effort was also used to assist NIMBioS in identifying potential faculty members at HBCUs and other minority serving institutions who may have an interest to participate in Working Groups and Investigative Workshops. Ernest Brothers attended the Diversity and Inclusion Summit for HBCUs (DISH) at Tennessee State University March 23-25, 2014 to promote research and resource opportunities in NIMBioS, and to identify new partner institutions and campus visits for post-docs. Ernest Brothers has communicated with Dr. Ansley Abraham, Director of the Southern Regional Education Board (SREB) Doctoral Scholars Program, about partnering to identify potential post-docs for NIMBioS. The goal of the SREB Doctoral Scholars Program is to produce more minority Ph.D. students who seek careers as faculty on college campuses.

What is the impact on physical resources that form infrastructure?

NIMBioS space in the Claxton Building at the University of Tennessee was renovated prior to our occupying the space in April 2012. The renovation created high-quality meeting rooms controlled by NIMBioS that include two large conference rooms, two classrooms (one equipped for video-conferencing), and a tiered auditorium (with A/V recording capabilities) as well as offices for staff, visitors, and post-doctoral and sabbatical fellows. One of the classrooms and the auditorium were renovated in 2013 to facilitate participant interactions and to increase capacity of the rooms above the previous limit of 49 in the auditorium. A movable wall between the two rooms now allows for expansion of the auditorium to accommodate an audience of up to about 60 participants. This renovation also included the capability for live-streaming of many NIMBioS activities, allowing access to individuals dispersed around the world who could not be accommodated locally for these activities. Live streaming and associated opportunities for virtual feedback through chats to speakers was made available starting in March 2014. NIMBioS allows use of these high quality meeting rooms by other groups both internal and external to the University when not being used for NIMBioS activities providing the other group's activities complement the NIMBioS mission.

What is the impact on institutional resources that form infrastructure?

NIMBioS staff have been directly involved with establishing University policies and practices that streamline the process of arranging lodging for participants and other visitors. NIMBioS has garnered institutional salary support that greatly facilitates collaboration across departments and across campuses. The NIMBioS Director developed a model for interdepartmental faculty hiring across multiple disciplines that other departments are using now. The NIMBioS Director search has resulted in a commitment for a new tenure track faculty line as the new Director will

have a departmental faculty appointment. The new Director will also have input into two additional faculty lines with the intent of enhancing expertise in areas of need. The University of Tennessee has co-located four major projects, each of which receives NSF support. These are NIMBioS, the UT/ORNL Joint Institute for Computational Science, the Computational Geography Research Group, and the Innovative Computing Laboratory. This physical proximity on different floors of the same building enhances the likelihood of further collaborations, and also includes a shared computer facility that more efficiently utilizes machine room space for several users.

What is the impact on information resources that form infrastructure?

NIMBioS has been collaborating with the NSF-XSEDE RDAV project to develop new toolsets, particularly in R, for high-performance computers. These toolsets are designed to allow investigators from several different areas of biology to investigate problems they might have otherwise avoided due to the computational complexity involved. These toolsets are components of presentations at a Tutorial held at NIMBioS and are being distributed as open source to enhance the opportunity for broad dissemination and use. An objective is to facilitate opportunities for their application on platforms of quite different scales, from single workstations with a small number of processors, to clusters with hundreds to thousands of processors, to supercomputers with many thousands of processors. A compilation of the resources made available at this Tutorial, with guidance on how to apply these, is being deployed through the NIMBioS website.

NIMBioS is developing a database system to effectively manage the variety of data it requests of participants, to manage applications for activities, and to support the variety of evaluation activities carried out under NIMBioS auspices. This database system is being developed so that it could be deployed at other similar centers with the diverse range of activities and requirements that NIMBioS has. NIMBioS IT staff have developed a general method to manage and deploy the Linux operating system across many machines, including automated reboot procedures that are minimally disruptive to users. The methods to carry this out are being made available through open-source methods.

What is the impact on technology transfer?

Nothing to report.

What is the impact on society beyond science and technology?

Many of the activities supported by NIMBioS have the potential for direct impacts on public policy. For example, the activities of the Working Group "'Pretty Darn Good' Control: Extensions of Optimal Control for Ecological Systems" could have direct implications for regulations in fisheries management, but also have broader impacts with regard to regulations that must account for uncertainty in future conditions. The joint NIMBioS/SESYNC Working Group on Human Risk Perception and Climate Change considers the implications of potential changes in climatic conditions to modify societal attitudes towards long-term risk from climatic impacts and considers the feedbacks of these on integrated assessment models that account for economic impacts of climate change. Another example related to human responses to climate is a paper authored by NIMBioS Post-doctoral Fellow Jiang Jiang and collaborators that elaborates the potential impacts of storm surge producing major changes to the coastal mangrove–freshwater marsh systems that are critical natural systems providing important ecosystem services to many human communities around the world. NIMBioS has sponsored numerous activities related to infectious disease and its potential impacts as well as associated public policy issues related to the control of organisms that might spread the disease. A recent Investigative Workshop on Modeling microbial contamination of fresh produce along the post-harvest supply chain is another example of an activity at NIMBioS that can provide scientific input to policies on food safety.

Changes/Problems

Changes in approach and reason for change

Nothing to report.

Actual or Anticipated problems or delays and actions or plans to resolve them

Nothing to report.

Changes that have a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects

Nothing to report.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use or care of biohazards

Nothing to report.

What opportunities for training and professional development has the project provided?

NIMBioS carries out extensive training and professional development activities. The Visiting Graduate Fellow and Post-doctoral Fellow activities are described in the report text. Other activities during this reporting period are summarized in this supporting file.

Eighteen undergraduates and two high school teachers are participating in the 2014 NIMBioS Summer Research Experience (SRE) for undergraduates and teachers. During the eight-week program, participants live on campus at the University of Tennessee, Knoxville (UT), and work in teams with NIMBioS postdocs and UT faculty to conduct research at the interface of mathematics and biology. The award includes a stipend, housing and some funding to support travel. The projects this year are: (1) The prospects for the continued global Argentine ant supercolony, (2) Modeling transmission and control of bovine respiratory disease, (3) A dynamic systems approach to tracking the facial expressions and conscious experience of emotion, (4) Living on the edge: How location within a geographic range affects genetics and individual fitness, (5) Statistical techniques for predicting cardiac rhythm disorder, and (6) Mathematical modeling of granuloma formation in Johne's Disease. Discussions on career options, networking, making presentations, and graduate school opportunities are included. (Dates: June-August 2014).

Visits were arranged for NIMBioS researchers, leadership and staff to visit our minority-serving institution partners: Howard University (C. Aguilar, November 2013); Tennessee State University (C. Remien, September 2013); and University of Texas-El Paso (A. Lawing, October 2013; N. Matzke, February 2014). Also, a visit was made to discuss developing an additional partnership: University of the Virgin Islands (L. Gross, January 2014). S. Lenhart visited Fisk University for discussion of curriculum and course issues in May 2014.

At the Field of Dreams Conference, G. Magombedze attended and presented research and discussed opportunities at NIMBioS during this conference focused on encouraging diversity in the mathematical sciences, held in Mesa, Arizona. (Date: November 2013)

At the Joint Math Meetings, Jan. 15-18, 2014, NIMBioS and the Mathematics Institutes sponsor a reception with presentations on opportunities available through these NSF-funded Institutes. S. Lenhart displayed NIMBioS opportunities at the Mathematics Institutes Reception and co-organized a session on "Modeling Modules and Activities for Students."

Undergraduate students who are engaged in research in biology and mathematics, their faculty mentors, Minority Serving Institution partners and high school teachers were invited to the fifth annual NIMBioS Undergraduate Research Conference at the Interface Between Biology and Mathematics. The conference included student talks and posters, two guest plenary speakers, a career panel to take questions about research and careers in math biology, and a graduate school showcase. Over 150 undergraduates and faculty from academic institutions across North America were in attendance. There were over 60 undergraduate research talks and posters. (Date: November 2013)

Three STEMSpark workshops (half day) exposed middle school teachers from the following school systems to Biology in a Box exercises: Alcoa City, Anderson Co., Blount Co., Campbell Co., Claiborne Co., Clinton City, Grainger Co. (Rutledge and Washburn School Systems), Jefferson Co., Knox Co., Lenoir City, Loudon Co.,

Maryville City, Morgan Co., Oak Ridge City, Oneida Special, Roane Co., Sevier Co., Sweetwater (in Monroe Co.), Union Co., and Girl's Prep School. S. Lenhart and K. Sturner led part of the activities at these workshops. (Dates: September and November 2013)

K. Sturner spoke to Tennessee high school teachers from across the state visiting UT for the Junior Science Symposium about NIMBioS and shared an education module on measuring trees. (Date: February 2014)

NIMBioS contributed to the annual Modern Math Workshop immediately before the SACNAS annual conference. The goal of this project was twofold: to reinvigorate the research careers of minority faculty and post-docs and mathematics faculty at minority-serving institutions by recruiting them to participate in the 2014-2015 research programs and workshops of US-based Mathematics Institutes and to increase awareness of math-based career paths among minority undergraduates. The workshop took place in San Antonio, TX, October 2-3, 2013. This directly preceded the Annual Meeting of SACNAS, the Society for Advancement of Chicanos and Native Americans in Science in Seattle. This allowed people who were already coming to the SACNAS meeting to attend the Modern Math workshop and also allowed people who came for the Modern Math workshop to stay for the SACNAS meeting. Programs of all NSF-funded mathematics institutes were represented at this workshop, and a representative of each institute was present: AIM, ICERM, IMA, IPAM, MBI, MSRI, NIMBioS, PCMI, and SAMSI. NIMBioS sent postdoc G. Magombedze to speak about NIMBioS and his research, and K. Sturner presented about opportunities at NIMBioS. Also, NIMBioS co-sponsored ecology and evolutionary biology events at SACNAS organized by NESCent, and NIMBioS post-doc A. Lawing also presented in an ecology-themed symposium with researchers from NESCent and NCEAS and helped handle Q&A on climate science after screening a documentary on climate change. (Date: October 2013)

NIMBioS helped inspire sixth and seventh grade girls about careers in math, science and engineering at the annual SHADES (Sharing Adventures in Engineering and Science) workshop organized by the Greater Knoxville Math/Science Coalition. K. Sturner and S. Lenhart volunteered and led math activities at this event, which was hosted at NIMBioS. (Date: October, 2013)

NIMBioS co-organizes a monthly seminar on issues in teaching STEM (science, technology, engineering and mathematics) with VolSTeach. The third round of seminars was hosted at the UT Center For Enhancing Education in Mathematics and Sciences, and centered on the theme of teaching math and science in an integrated manner. (Dates: January-March, 2014). S. Lenhart spoke in this series on "Modeling Across the Curriculum" in February 2014.

K. Sturner, representing NIMBioS, served on the organizing committee and also helped to facilitate this workshop for area K-12 teachers as a part of the week of Darwin Day events on the UTK campus. About 12 teachers participated in activities to teach the science supporting evolution, discussed the challenges of teaching evolution in their classrooms, and also had the opportunity to ask questions from a panel of education experts. (Date: February 2014)

In addition, NIMBioS helped with the session "Teaching Science in a Climate of Denial" workshop at the annual Tennessee Science Teachers Association (TSTA) conference in Murfreesboro, TN. The session highlighted several useful activities for teaching evolution, climate change, and the nature of science, and was presented by K. Sturner, three area high school biology teachers, B. Adler, M. Knapp and L. Wilmoth, and UTK professor B. Golden. K. Sturner presented another session on Modeling the Forest. Teachers attended from across the state. (Date: November 2013)

At the annual UT Pro2Serve Math Contest, individual and team competitions were held to promote interest in mathematics among Tennessee high school students, to encourage them toward careers in mathematics, science, and engineering, and to recognize their mathematical prowess by awarding scholarships, trophies, plaques, and certificates. K. Sturner and S. Lenhart presented NIMBioS education & outreach to teachers from across the state at this conference. (Date: November 2013)

Our tutorial, Computing in the Cloud: What Every Computational Life Scientist Should Know, brought together a diverse set of computational biologists and modelers who wanted to expand their expertise and learn how to harness big data and computation using the R language. A wide range of HPC/Cluster/Cloud computing resources exist and are accessible to researchers, such as Amazon EC2, NSF XSEDE, local clusters, and simple multiprocessor shared memory machines. Participants learned about the strengths and weaknesses of the various platforms and how to enable R to utilize them. The strengths and limitations of R for big data and big computation were also discussed. Moving beyond these basics, further sessions provided participants with hands on experience in the following areas:

- Learn about the packages, tools, and data structures that are available in R for computing on HPC resources
- Understand tools such as Rcpp that allow R to easily interface with compiled code for improved performance
- Handle big matrix computations with the pbdR packages
- Produce elegant, publication quality graphics with the ggplot2 package

In addition to the fundamentals, the tutorial gave attendees a perspective on how these tools can be put to use in biological research. Tutorial examples included applications such as Bayesian mixed models in genomics, phylogenetic biogeography, approximate Bayesian computation, and multivariate data reduction in ecological models. Finally, a special session on teaching with R provided insights on how to bring computational science research into the undergraduate classroom. This hands-on tutorial gave participants an opportunity to begin applying these tools to their own problems. Presentations and sample codes were available for all tutorial sessions. Attendees also consulted with presenters and platform experts to identify the right tools for their problems. (Date: April 2014)

Our tutorial, Parameter Estimation for Dynamic Biological Models, was for biologists interested in doing statistics with more complex non-linear models of their data and for mathematicians interested in learning how to apply their modeling skills to the unique demands of real dynamic biological data. Methods for parameter estimation taught included maximum likelihood and ordinary least squares. Additional tools of model identifiability and sensitivity analysis were covered. Through a mixture of introductory instruction and hands-on computer-based learning, participants learned software and tools they can use for biological data. Familiarity with simple differential equation models or difference equation models was a prerequisite. (Date: May 2014)

Our tutorial, Algebraic and Discrete Biological Models for Undergraduate Course, will expose participants to algebraic and discrete approaches to problems from modern biology including gene regulation, gene identification, RNA folding, phylogenetics, and metabolic pathway analysis. The tutorial format will include interactive lectures with quick exercises on each topic, followed by structured hands-on activities during which participants will work in small groups on exercises and projects. During lectures and interactive sessions,

participants will learn web-based software systems and databases that students in their courses can use. This tutorial is appropriate for both mathematics and biology faculty. In particular, it targets undergraduate faculty teaching modern algebra, finite mathematics or mathematical modeling, or intermediate and advanced undergraduate biology, but many topics may also be appropriate for introductory biology courses. All introductory lectures to the tutorial topics will be accessible for both math and biology faculty and will cover the basic biology and mathematical methods, models, heuristics, computational approaches, and the relevant software. Participants will have the opportunity to customize their tutorial experience by opting for lectures and activities at two different levels - one introductory and one more advanced. (Date: June 2014)

The NIMBioS/Bioquest Curriculum Workshop (Tutorial): Biology by Numbers: Bringing Math to the High School Biology Classroom, is planned for high school biology teachers to encourage them to develop comfort with the quantitative side of biology. The program will feature hands-on experience with inquiry activities that use biological data, tools for graphing, and modeling. The Biology in a Box project will supply some of the activities integrating math and science. Teachers will work collaboratively to add or enrich the quantitative aspects of their favorite biology labs. This tutorial will be led by the BioQUEST Curriculum Consortium, a 25-year biology education reform community that focuses on helping faculty develop and implement innovative curricula. (Date: July 2014)

The tutorial on Evolutionary Quantitative Genetics will review the basics of theory in the field of evolutionary quantitative genetics and its connections to evolution observed at various time scales. Quantitative genetics deals with the inheritance of measurements of traits that are affected by many genes. Quantitative genetic theory for natural populations was developed considerably in the period from 1970 to 1990 and up to the present, and it has been applied to a wide range of phenomena including the evolution of differences between the sexes, sexual preferences, life history traits, plasticity of traits, as well as the evolution of body size and other morphological measurements. Textbooks have not kept pace with these developments, and currently few universities offer courses in this subject aimed at evolutionary biologists. There is a need for evolutionary biologists to understand this field because of the ability to collect large amounts of data by computer, the development of statistical methods for changes of traits on evolutionary trees and for changes in a single species through time, and the realization that quantitative characters will not soon be fully explained by genomics. This tutorial aims to fill this need by reviewing basic aspects of theory and illustrating how that theory can be tested with data. Participants will learn to use R, an open-source statistical programming language, to build and test evolutionary models. The intended participants for this tutorial are graduate students, post-docs, and junior faculty members in evolutionary biology. (Date: August 2014)

The Joint MBI-CAMBAM-NIMBioS Summer Graduate Workshop is an annual 10-day workshop for graduate students in math and biology, and the theme this year is "Modeling Rhythm and Oscillations." This graduate workshop will have instructors from across North America whose research expertise is on this topic. The workshop will include lectures on techniques and modeling using specific data sets, and there will be daily computer activities focusing on learning techniques. In addition, each student will work on a research project over the duration of the program with a team of four or five participants. Researchers from the mathematical and biological sciences will be featured speakers. X. Zhao from UT is one of the speakers, and A. Buchan, K. Sturner, and S. Lenhart assisted with the participant selection process. (Date: July 2014)

NIMBioS will co-organize a poster symposium with several STEM-oriented REU programs on the campus of the University of Tennessee during the summer of 2014. TNSCORE and CURENT NSF engineering centers are the other co-hosts. NIMBioS SRE students will present. (Date: July 2014)

The Spring Opportunities Workshop for Women in the Mathematical Sciences familiarized women in the mathematical sciences with professional opportunities in academics, industry and government labs and help them thrive in mathematics-related fields. Graduate students and PhD's in the early stages of their post-graduate careers were invited to apply to attend. Speakers, panelists and discussion leaders were women in research and management positions in industry and government labs as well as women in academia. Participants were encouraged to present a poster on their research. NIMBioS hosted the workshop this year, and was lead co-organizer with SAMSI. The event was primarily supported through a grant to MSRI that the NSF Mathematical Sciences Diversity Committee collaborates on. The Association of Women in Mathematics was also a co-sponsor this year. As a part of this workshop, NIMBioS cooperated with the UT Women's Studies on a special lecture by N. Else-Quest on "Attitudes, not Aptitude: Understanding the Roots of Gender Gaps in STEM Participation." (Date: April 2014)

During AY13-14, NIMBioS supported six graduate students on research fellowships. These students represented four departments across campus (Materials Science and Engineering, Electrical Engineering and Computer Science, Ecology and Evolutionary Biology, and Mathematics). Four of the students were granted these awards based on an annual competitive application process. These students performed research in areas such as decision-making in conservation, modeling the evolution and maintenance of leadership in small-scale societies, design of bacterial celluloses for tissue engineering of stem cells, and optimal control for spatial-temporal management in epidemiological and natural resources models. Two of the students were computer science students, one supported to assist in development and implementation of an administrative database for NIMBioS and one supported by the collaborative project between NIMBioS and the Remote Data Analysis and Visualization Center to facilitate high performance computing and large data visualization for the Computing in the Cloud tutorial for biologists held in April 2014.

Addendum to NIMBioS Annual Report

Sep 1, 2013 –Aug 31, 2014

Y6-1. NIMBioS Board of Advisors Meeting Summaries

Y6-2. NIMBioS Evaluation Report

Y6-3. Participant List for NIMBioS Events and Activities

Y6-4. Description of Activities

Y6-5. Additional Products

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Addendum to NIMBioS Annual Report

Sep 1, 2013 -Aug 31, 2014

Y6-1. NIMBioS Board of Advisors Meeting Summaries

SUMMARY REPORT OF NIMBIOS BOARD OF ADVISORS MEETING HELD OCTOBER 16-17, 2013

Board Members attending: Sarah Brosnan, Erika Camancho, Eli Fenichel, Julius Jackson, Colleen Jonsson, Laura Kubatko, Raymond Meijia, Carl Panetta, Lea Popovich, Raina Robeva, Lisa Sattenspiel, Marcy Uyenoyama, Jianhong Wu. In addition, the following members participated remotely: Troy Day, Kristen Jenkins, Tamar Schlick, Colleen Webb, Nancy Zhang.

As Board Chair Colleen Webb was participating remotely, Lisa Sattenspiel agreed to manage the meeting locally. This is a brief summary of the discussions and recommendations made by the Advisory Board during the meetings held from 09:00 on October 16 to noon on October 17. The agenda for the meeting is included below. A little over three weeks prior to the meeting, information on all requests for support submitted by the September 1, 2013 deadline was provided to the Board via a password-protected link on the NIMBioS website. This included links to original requests, and board members were each assigned 4-5 requests to review for the various activities, with the assignments made based upon Board member expertise, the topic of the application and their stated preference for evaluating post-doctoral fellow applications or other requests. An online review form allowed all Board members to report their comments and overall rating for the variety of requests and these were collated and summarized just prior to the meeting. These reviews were open to all Board members at the time of the meeting, and served as the starting point for discussions during the meeting. In addition, NIMBioS leadership provided access to a variety of documents including the 4-Year Site Visit Report, the NIMBioS response to the Site Visit Report, the NIMBioS renewal proposal, the NIMBioS Annual Report and Strategic Plan, latest summaries of evaluations of NIMBioS activities, a report on diversity of NIMBioS participants, a summary of education and outreach activities and the Postdoctoral Research Fellow Mentoring Plan.

Following a brief pause to reflect on the contributions to NIMBioS by Associate Director for Postdoctoral Activities Dr. John New, who had passed away suddenly the previous evening, NIMBioS Director Louis Gross gave introductory remarks about NIMBioS activities over the last five years and status of current issues including the renewal, the search for a new Director and efforts on sustainability planning. Associate Director Suzanne Lenhart discussed the past and current activities in Education and Outreach at NIMBioS. The summary report from the last physical Board meeting was approved.

Requests for support

Discussion of the various support requests proceeded following the order in the agenda. Any individual who had a conflict of interest regarding any request did not participate in the discussion of that request and left the room so as not to hear the comments. Those attending remotely who had a conflict were asked to hang up and call back when the discussion on the request for which there was a conflict was completed. The Board discussion led to the following recommendations:

1. Working Groups – Of the seven requests, the Board recommended that two of the requests be approved, two be requested to do a quick revision for expedited review, one be encouraged to request a short-term visit by the organizers to construct a more effective request, and two be denied. For those recommended to be approved or resubmitted, the Board provided advice to the Leadership Team regarding potential changes to the suggested participants.

2. Sabbatical fellows – the Board recommended accepting one of the two applicants and rejecting the other one.

3. Postdoctoral Fellowships – Of the total of 24 applications received, the NIMBioS Leadership Team submitted eight post-doc requests for review by the Board, and an additional four were noted as potentially feasible for Board members to comment upon if they wished. These applicants were reviewed and discussed in detail during the meeting. The Board recommended four of these for approval and suggested that three additional individuals may be appropriate, but due to weaknesses in the applications, left the final decision to the Leadership Team including the option to encourage any of these individuals to revise and resubmit an application for the December round of applications.

4. Workshops – There were nine requests submitted and the Board recommended approval of four of these with a fifth one being recommended pending a revision that would undergo an expedited review. The Board noted that the remaining four requests had significant weaknesses that should be relayed to the organizers who could be encouraged to resubmit for the March application deadline.

Updates and Discussions concerning other Programs and Plans

Visiting Graduate Fellow Program: There was a general discussion of this new initiative, which is now attracting applications. Two expected outcomes of the program are diversifying the career status of people at NIMBioS and providing mentoring opportunities for NIMBioS post-docs.

Post-doctoral Fellow Career Development: General discussion was held on the NIMBioS post-doc career development program, touching on career development seminars, teaching opportunities, mentoring opportunities, and ability for post-docs to be PIs/Co-PIs on grant proposals.

Women in Research Workshop: There was extensive discussion of the possibility of NIMBioS supporting a workshop geared toward promoting women in math biology. One Board member has participated in one of these run by IMA and found it useful and productive. A question discussed was whether it is appropriate for NIMBioS to focus on just one group in this way, especially given that women in math biology are not as underrepresented as women in other areas of math. It was agreed that such an activity could be beneficial in developing more women organizers as well as bringing awareness to NIMBioS of potential organizers. Including men in such an activity could change the group dynamic and make this less beneficial for the women. In sum, the Board suggested that the Leadership Team move forward with trying to identify possible organizers for such an activity.

Strategic and Business Planning: A general discussion by the Board included comments on opportunities for long-term sustainability of NIMBioS beyond the NSF funding period. As a preface to this, there was discussion of the University's commitment to NIMBioS, including whether space would continue to be provided, whether support from the development office would be available and what NIMBioS could do to leverage additional external support. The Director provided a summary of what has been committed by UTK and what opportunities are available to a new Director in utilizing available un-committed

resources to assist long-term planning. This included the possibility of hiring a development director. The Board commented that it may be more effective to employ a scientifically-trained individual to assist in development, rather than someone trained in university development, though there was encouragement to work with the Alumni Office to determine if there may be some alumni who would have a particular interest in activities that NIMBioS could provide. A wide range of additional topics and suggestions were discussed including: establishing partnership arrangements including fees for access to NIMBioS resources such as new MOOCs or courses or for localized workshop activities in quantitative biology training; furthering alignment with data and analytics opportunities in possible conjunction with the new UTK programs in business analytics, through the development of software products that may for example use evolutionary computation methods; establish NIMBioS as a core facility for other components of the University or other institutions to come to for modeling or analytics support, with an appropriate charge-back scheme; training programs that could generate extra resources in areas such as bioinformatics tools or HPC translation, including assisting biological resources in speeding up their workflows; and potential collaboration with ORAU in the array of educational and fellowship programs that they manage for various agencies.

Diversity Enhancement: Dr. Ernest Brothers, NIMBioS Associate Director for Diversity Enhancement and Assistant Dean of the UTK Graduate School led an extensive discussion of the NIMBioS diversity benchmarks and how NIMBioS has been progressing to broaden participation. He pointed out the differences between managing diversity, which involves changing the culture of the field and institutions, and simply implementing diversity. He discussed the components of diversity management and how NIMBioS' multiple benchmarks are tied to standards. The Board discussion ranged broadly and included possibly tweaking NIMBioS communication efforts to better reach under-represented groups; assisting MSIs to modify their curriculum to incorporate quantitative components in biology and align with the variety of national reports encouraging this; potentially focusing on sensitivity to diversity efforts at the major institutions with math bio programs, though it was noted that places such as ASU and Cornell have long-standing very successful diversity programs; consider targeting diversity efforts differently at the different levels of interactions that NIMBioS supports; being careful in not equating programs which have been mainly successful in recruiting URM individuals who had been raised outside the US to those who were raised in the US; and ensuring that we are incorporating appropriate evaluation procedures in our programs that account for how we manage diversity.

Leadership Evaluation and Future Board Planning: It was noted that in years that there is not a formal NSF site review, the NIMBioS policy is to have a formal leadership evaluation carried out by a committee of the Board, followed by a discussion with the Board and presentation of results to the UTK Vice Chancellor for Research. Given the timing of leadership transition expected (e.g. a new Director is expected to have transitioned into the position by summer 2014), the Board discussed the evaluation procedures and decided that it was appropriate to have the next leadership evaluation carried out as part of the next NSF site review that would be in Spring 2015. A brief discussion was held regarding the possibility of establishing a separate Science Advisory Board from a Board of Trustees who would focus on long-term sustainability including issues of business planning. This arose in part from a suggestion to include as potential Board members individuals with extensive business experience. The Board did not

reach any conclusion as to whether this was an appropriate route, but did encourage the Leadership Team to ask past organizers of NIMBioS activities to suggest potential new Board members, as a way to reach out to a broader pool of potential members.

Fall 2013 Advisory Board Meeting Agenda:

Tuesday, October 15

6:30 pm For those able to attend, meet Lou in Hotel Lobby to walk to dinner

Wednesday, October 16

8:00-9:00 Breakfast at NIMBioS

9:00-9:15 Introductions

9:15-9:30 Quick summary of current status, including Director position, renewal efforts (Lou Gross)

9:30-10:45 Review of requests for support - Working Groups, Investigative Workshops (Sergey Gavrillets)

10:45-11:00 Break

11:00-12:30 Review of requests for support (cont.)

12:30-1:30 Lunch (joined by postdocs and graduate students)

1:30-3:30 Review of requests for support - Postdocs and Sabbaticals

3:30-3:45 Break

3:45-4:30 Completion of reviews of requests and summary recommendations

4:30-5:30 Planning for Renewal Period - discussion of new initiatives, metrics for evaluation, potential methods to improve topical diversity

5:30-6:30 Reception

Thursday October 17

8:00-9:15 Breakfast meetings with NIMBioS post-docs

9:15-10:00 Revising the NIMBioS strategic plan, including planning for long-term sustainability

10:00-10:45 Diversity enhancement and benchmark assessment (Ernest Brothers)

10:45-11:00 Break

11:00-11:30 Review of NIMBioS policies including expanding Advisory Board, Leadership Evaluation

11:30-12:00 Wrap up

1200- Lunch

NIMBIOS VIRTUAL BOARD MEETING – JANUARY 28, 2014

Board members participating: Sarah Brosnan, Erika Camancho, Troy Day, Eli Fenichel, Julius Jackson, Kristen Jenkins, Colleen Jonsson, Laura Kubatko, Raymond Meijia, Carl Panetta, Lea Popovich, Raina Robeva, Lisa Sattenspiel, Marcy Uyenoyama, Colleen Webb, Jianhong Wu.

The NIMBioS Board met via teleconference and using WebEx to review applications received in December 2013 for Postdoctoral Fellowships. The Board was provided access to all applications three weeks prior to the meeting, and each Board member was asked to review 3-4 applications. Each Board member provided feedback on the applicants, and a summary of their comments was provided to guide discussion during the meeting. Of the total of 15 applications reviewed, the Board strongly recommended that the Leadership Team make offers to five of the applicants, and suggested that further information be obtained about two of the applicants before a final decision be made by the Leadership Team.

NIMBIOS VIRTUAL BOARD MEETING – APRIL 7, 2014

Board members participating: Erika Camancho, Troy Day, Eli Fenichel, Julius Jackson, Kristen Jenkins, Laura Kubatko, Raymond Meijia, Carl Panetta, Lea Popovich, Raina Robeva, Lisa Sattenspiel, Marcy Uyenoyama, Colleen Webb, and Nancy Zhang.

The NIMBioS Board met via teleconference and using WebEx to review applications received in March 2014 for Sabbatical Fellowships, Working Groups and Investigative Workshops. The Board was provided access to all applications three weeks prior to the meeting and each Board member was asked to review 2-3 applications. Each Board member provided feedback on the applicants and a summary of their comments was provided to guide discussion during the meeting. For the two Sabbatical Fellow requests, the Board requested that further details be obtained on the planned research projects and once these

were obtained, the Leadership Team should make a decision about support. It was also suggested that the guidance to applicants on the NIMBioS website be further clarified so that applicants are aware of the expected level of detail of statements regarding their research plans. Of the four Investigative Workshop requests, the Board approved one, encouraged that an expedited review be carried out for two other requests based upon suggestions from the Board for revisions with the expectation that following adequate revisions the requests would be approved by the Leadership Team, and did not recommend that the other request be supported. Of the two Working Group requests, the Board strongly supported one of these subject to revision of the suggested membership based upon its suggestions and encouraged the other applicant to revise the request substantially based upon its comments and resubmit for consideration during the next Board review.

Addendum to NIMBioS Annual Report

Sep 1, 2013 -Aug 31, 2014

Y6-2. NIMBioS Evaluation Report



NIMBioS EVALUATION REPORT

REPORTING PERIOD SIX

SEPTEMBER 1, 2013-APRIL 1, 2014

NATIONAL INSTITUTE FOR MATHEMATICAL AND BIOLOGICAL SYNTHESIS
APRIL 2013

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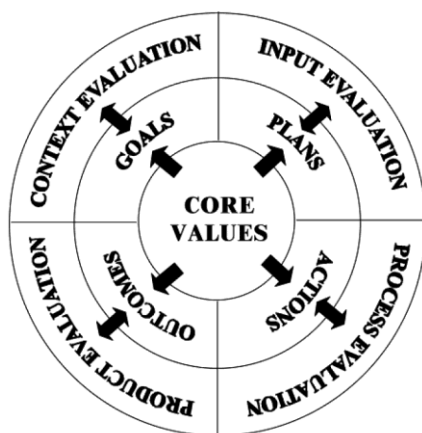
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NIMBIOS EVALUATION REPORT, REPORTING PERIOD SIX

INTRODUCTION

This is an evaluation summary of NIMBioS activities during the sixth annual reporting period (RP 6) to the National Science Foundation. This report covers the period of September 1, 2013-March 31, 2014. The NIMBioS evaluation program follows the CIPP systems approach, which takes into account not only the outcomes of the center, but how the outcomes are achieved. The evaluation addresses four main interconnected evaluation phases as seen in Figure 1¹:

Figure 1. The CIPP Model for Evaluation used to guide the NIMBioS evaluation process



For all parts of the system, the NIMBioS evaluation process is grounded in its core values of (1) taking a collaborative approach to science and science education, and (2) increasing the diversity of researchers and educators at the interface of mathematics and biology.

CONTEXT (GOALS)

Context is not a specific phase of the evaluation process, but rather a constant form of evaluation that takes place during the input, process, and product evaluations as NIMBioS seeks to ensure that it is meeting its goals for each part of the system and that those goals are relevant and in line with its core values.

INPUTS

The input evaluation seeks to assess the responsiveness of NIMBioS' inputs to its goals. Specifically, NIMBioS is interested in ensuring that we are continuously maintaining a diverse atmosphere in a number of ways. Data sources for input evaluations include the participant demographic survey and accepted requests for support. At this phase, several goals comprise the context for the input evaluation:

1. NIMBioS participants will represent diverse gender, racial, ethnic, institutional, career, disciplinary, and geographic backgrounds.

¹ Stufflebeam, D.L. (2003). The CIPP model for evaluation. In T. Kelleghan & D.L. Stufflebeam (Eds.) *International Handbook of Education Evaluation* (pp. 31-61). London: Kluwer Academic Press.

2. NIMBioS will meet or exceed its participant diversity benchmarks.
3. NIMBioS will support activities across the spectrum of categories of requests for support.
4. NIMBioS will support Working Group and Investigative Workshop requests from a range of discipline areas.

PROCESS

The process evaluation seeks to evaluate congruence between goals and activities. This type of evaluation is situated in monitoring and judging activities at NIMBioS, mainly through periodic evaluative feedback surveys from participants and organizers. Other process evaluation data sources include evaluation case studies which look more closely at what factors of NIMBioS participation contribute to positive changes in participants' research and/or academic careers. Although the context at this phase will differ for different types of NIMBioS events, several overarching goals comprise the context for the process evaluation:

1. Participants will be satisfied with the event/program overall.
2. The event/program will meet participant expectations.
3. Participants will feel the event/program made adequate progress toward its stated goals.
4. Participants will feel they gained knowledge during the event/program.
5. Participants feel that participating in the event/program will have an impact on their future research/academic career.
6. Participants will be satisfied with the accommodations offered by NIMBioS.

PRODUCTS

The products evaluation seeks to monitor, document, and assess the quality and significance of the outcomes of NIMBioS activities. It provides guidance for continuing, modifying, or terminating specific efforts. Data sources for product evaluations include participant self-report of NIMBioS products resulting from affiliation (e.g. journal articles, student education, software), Web of Science data, data collected from participant evaluation forms and follow-up surveys. At this phase, several goals comprise the context for the evaluation:

1. NIMBioS publications will be highly interdisciplinary.
2. NIMBioS publications will be highly cited.
3. NIMBioS publications will highly collaborative.
4. NIMBioS participants will produce other scholarly products, including book chapters, presentations, proposals for follow-on research, meetings/Workshops, student education, data/software, and/or publicity in other media.

INPUT EVALUATION

The input evaluation seeks to assess the responsiveness of NIMBioS' inputs to its goals. Specifically, NIMBioS is interested in ensuring that it is continuously maintaining a diverse atmosphere in a number of ways. Data sources for input evaluations include the participant demographic survey and accepted requests for support.

CONTEXT

1. NIMBioS participants will represent diverse gender, racial, ethnic, institutional, career, disciplinary, and geographic backgrounds.
2. NIMBioS will meet or exceed its participant diversity benchmarks.
3. NIMBioS will support activities across the spectrum of categories of requests for support.
4. NIMBioS will support Working Group and Investigative Workshop requests from a range of discipline areas.

SUMMARY OF ACTIVITIES

Research program activities during RP 6 included:

- 12 Working Group meetings
- 5 Investigative Workshops
- 38 Short-term visitors
- 16 Postdoctoral Fellows
- 2 Sabbatical Fellows
- 1 Graduate Student Fellow
- 6 Graduate Research Assistantships

Education and Outreach program activities during RP 6 included (see Annual Report for more details on these events):

- A NIMBioS Seminar Series
- Biology in a Box Program
- Research Experiences for Undergraduates Program
- Undergraduate Research Conference at the Interface of Biology and Mathematics
- Teacher Collaboration Program

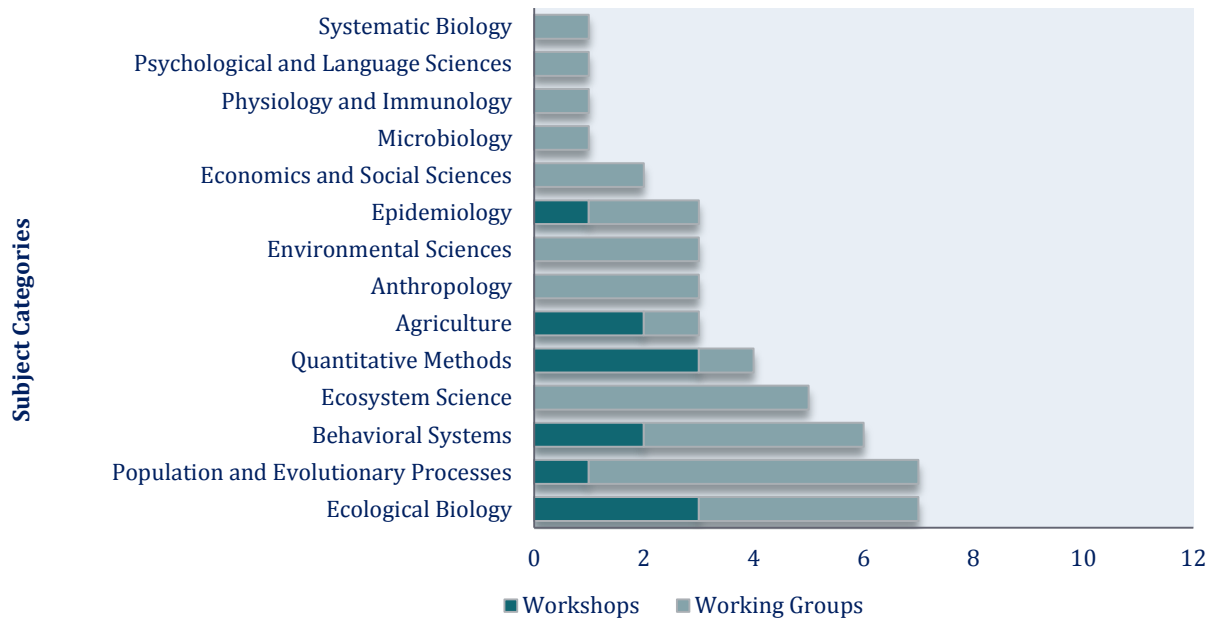
Other events included:

- 1 Advisory Board Meeting

DIVERSITY OF RESEARCH ACTIVITIES

NIMBioS is interested in supporting research activities from diverse subject areas. Working Group and Investigative Workshop Organizers are asked to categorize their proposed events into preselected research categories to help NIMBioS leadership ensure that a broad range of research areas are covered. Figure 2 shows the diversity of subject areas associated with NIMBioS Working Groups and Investigative Workshops during RP 6 (each supported event may have up to three subject areas).

Figure 2. Diversity of Subject Areas of Working Groups and Investigative Workshops, RP 6



DIVERSITY OF PARTICIPANTS

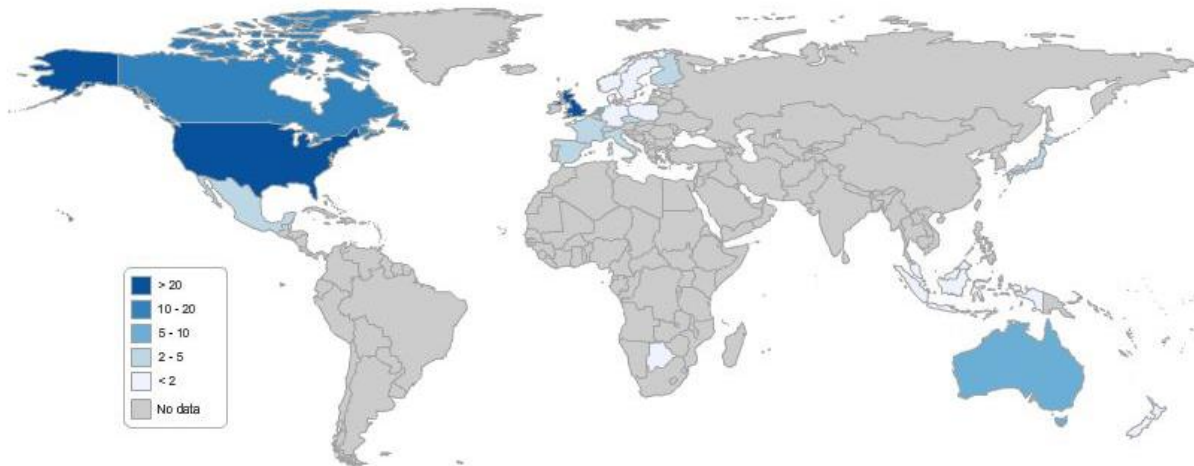
One of the core values of NIMBioS is to increase the diversity of researchers and educators at the interface of mathematics and biology. NIMBioS collects voluntary demographic data from event applicants to gauge whether our program is fairly reaching and benefitting everyone regardless of demographic category and to ensure that those in under-represented groups have the same knowledge of and access to programs and other research and educational opportunities, and to assess involvement of international participants in the program. An electronic demographic survey aligned to the reporting requirements of the National Science Foundation was sent to all participants before their arrival at NIMBioS. Four weeks before the date of each event, a link to the survey was sent to each participant who had not visited NIMBioS within the last year. Reminder emails were sent to non-responding participants at one and two weeks after the initial contact date. The overall response rate for the demographic survey during RP 6 was 98%. Demographic questions regarding gender, race, ethnicity, and disability status were optional. When feasible, the evaluation staff supplied missing demographic data from other sources (e.g. institution, primary field of study). The evaluation staff did not assume race, ethnicity, or disability status for any participant who did not report this information. All demographic information is confidential, and results are reported only in the aggregate.

PARTICIPANT DEMOGRAPHICS

GEOGRAPHIC DIVERSITY

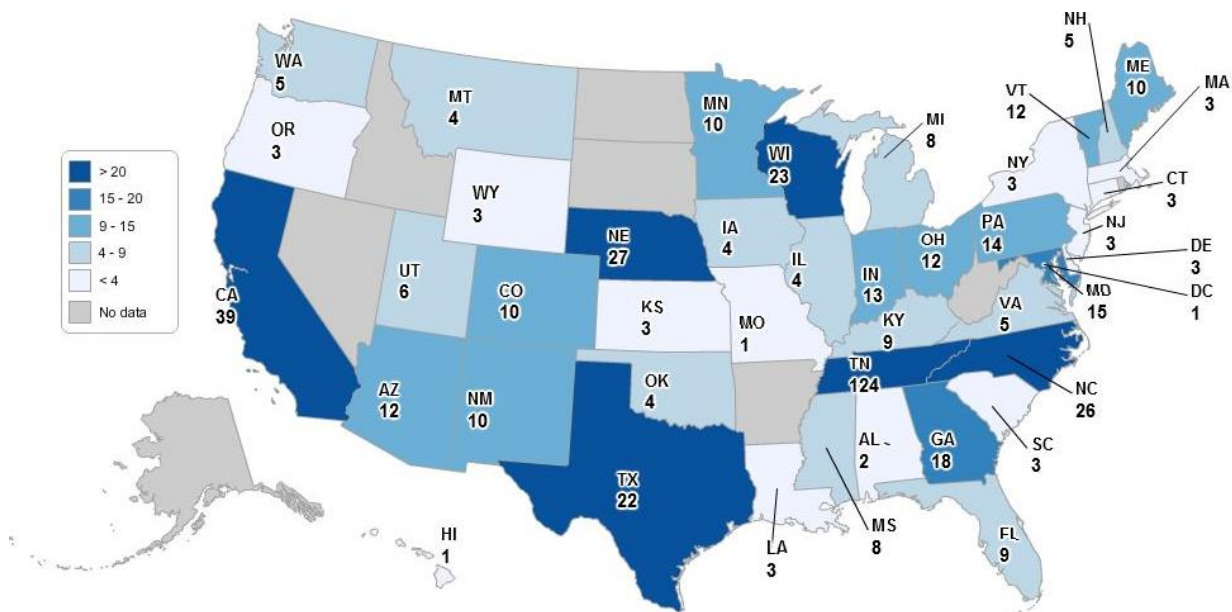
During RP 6, a total of 595 participants (543 different individuals) from 24 countries participated in NIMBioS events. Most participants came from the United States (85%), followed by the United Kingdom (4%), and Canada (3%) (Figure 3).

Figure 3. NIMBioS RP 6 Participants by Country



Within the U.S., 43 different states were represented. The largest percentage of participants came from within Tennessee (25%), followed by California (8%), North Carolina (5%), New York (5%), and Wisconsin (5%), and Texas (4%) (Figure 4).

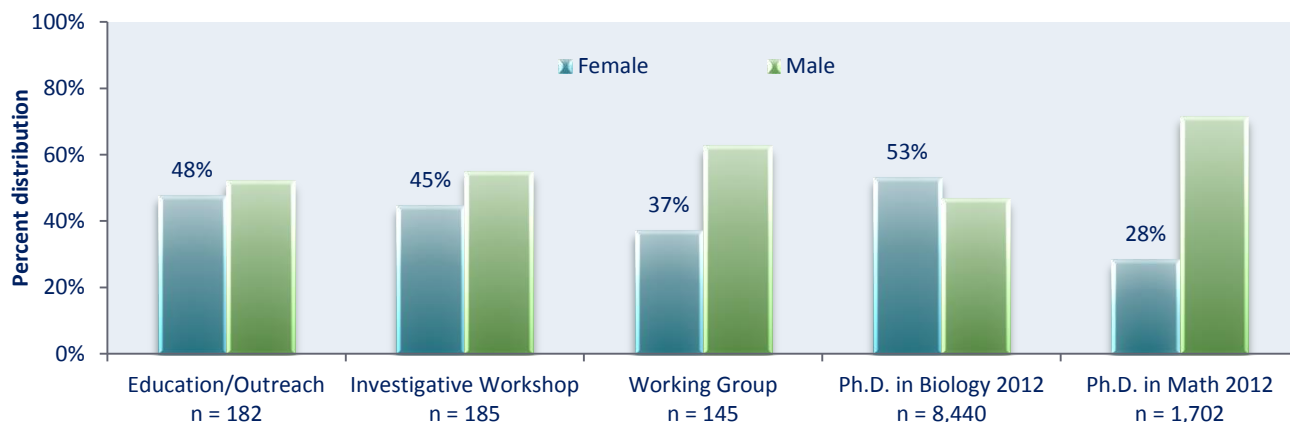
Figure 4. NIMBioS RP 6 Participants by U.S. State



GENDER, RACIAL, AND ETHNIC DIVERSITY

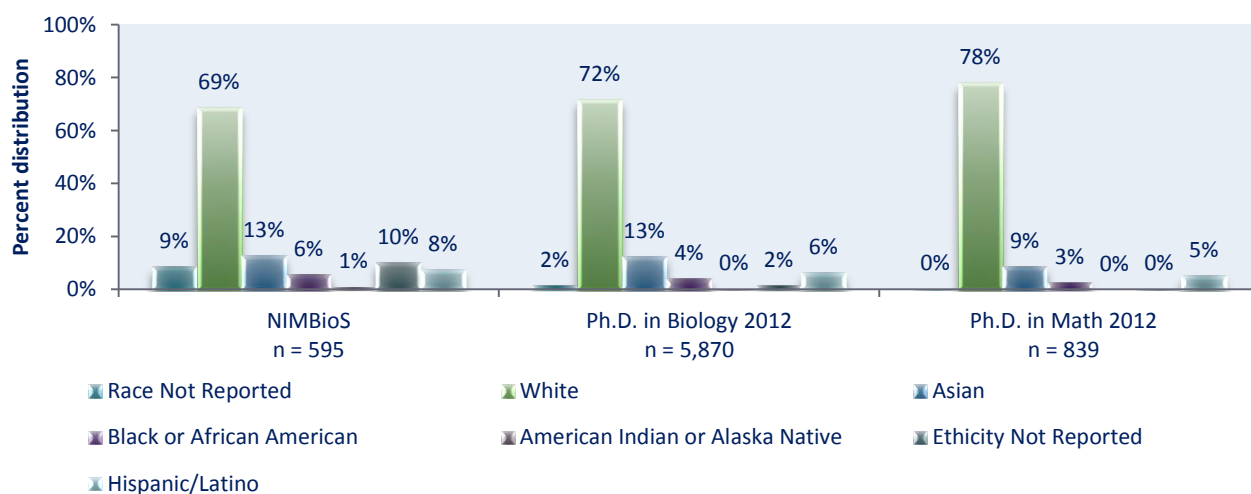
Across all events during RP 6, the gender ratio was 57% male to 43% female. Within specific activity types, the gender ratio varied slightly, with the greatest gender equity seen in Education and Outreach activities and the least in Working Groups (Figure 5). Two comparison groups shown are all individuals receiving doctorates in biology and mathematics in the U.S. in 2012². The distribution of females in NIMBioS activities falls within the range of practicing Ph.D.'s in biology and mathematics in the U.S.

Figure 5. Gender composition of participants by event type



Overall minority representation³ during RP 6 was around 12%. Representation of various minority categories was on par with current trends in minority representation for doctoral recipients in the biological sciences, and greater than that in the mathematical sciences (Figure 6). Two comparison groups shown are all individuals receiving doctorates in biology and mathematics in the U.S. in 2012⁴.

Figure 6. Minority representation of NIMBioS participants (n = 595)



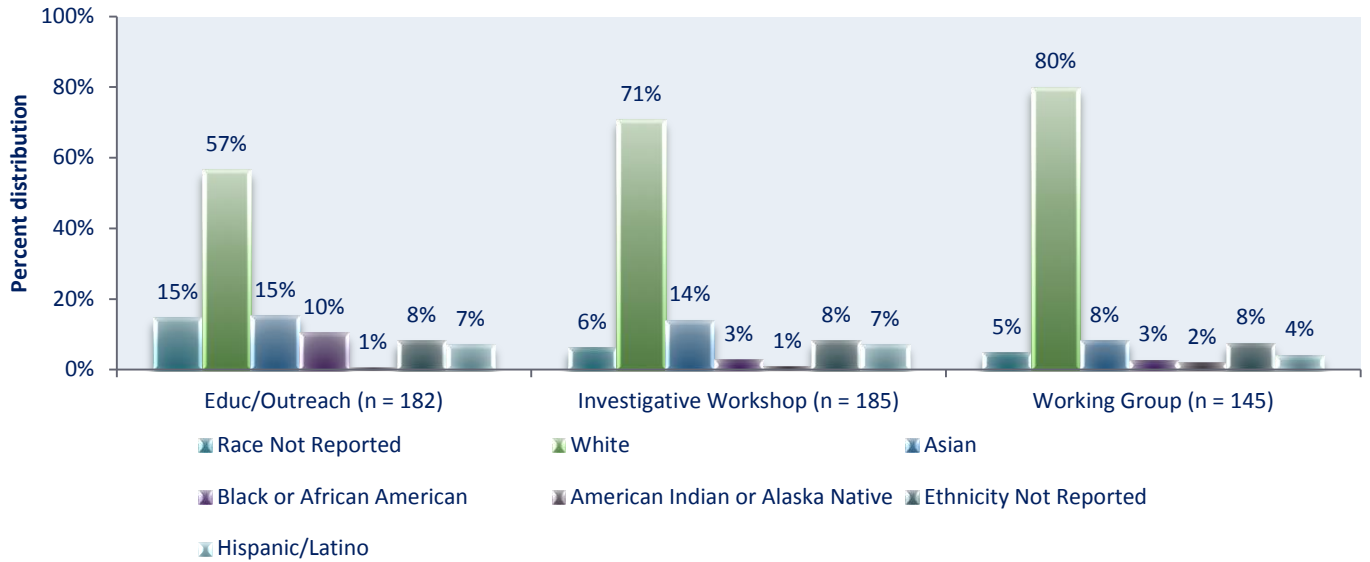
² Data from the 2012 NSF Survey of Earned Doctorates, http://www.nsf.gov/statistics/sed/2012/data_table.cfm

³ For the purposes of this report, “underrepresented minority” refers to those who self-identify as American Indian or Alaska Native, black or African American, and/or Hispanic or Latino (NSF Survey of Earned Doctorates, 2012)

⁴ Data from the 2012 NSF Survey of Earned Doctorates, http://www.nsf.gov/statistics/sed/2012/data_table.cfm

Minority representation varied considerably among programs. Education and Outreach and Investigative Workshop activities showed greatest percentage of Hispanic/Latino participants (7%). Among the different event types, participants self-identifying racially as white were always in the majority, however, each minority group tracked at NIMBioS was represented in each major event type (Figure 7).

Figure 7. Minority representation of participants, by event type (n = 595)



DIVERSITY BENCHMARKS

Per the suggestion of the Site Review carried out at NIMBioS in June 2010, the NIMBioS Leadership Team has consulted with the NIMBioS Advisory Board in response to the recommendation by the Site Review that we establish a variety of benchmarks for our programs.

The Site Review particularly recommended that benchmarks be developed on participation in Working Groups and Investigative Workshops relative to gender and under-represented groups, and on geographical diversity of participants.

Benchmarks for diversity in participants at NIMBioS activities:

1. Gender: Across all Working Groups and Investigative Workshops, the proportion of female participants will be at least 30%.
2. Geographic - International participation: Across all Working Groups and Investigative Workshops, at least 10% of participants will be from outside the USA.
3. Under-represented groups (overall): Across all NIMBioS activities, we will increase the percent of participants from under-represented groups by approximately 10% per year. [$F(t+1) = 1.1 F(t)$ where $F(t)$ is the proportion of total participants from underrepresented groups in Year t , and $F(t+1)$ is the proportion of total participants from underrepresented groups in Year $(t+1)$].
4. Underrepresented groups (Working Groups and Investigative Workshops): Comparable to the overall goal for all activities, we aim to increase the proportion of participants from under-represented groups in Working Groups and Investigative Workshops by 10% per year.
5. Local participants: To avoid overrepresentation of the University of Tennessee community in activities, we will limit participation by UT/ORNL faculty/staff to approximately 15% of the total participants in Working Groups and Investigative Workshops.

Benchmarks for diversity in activity organizers:

1. Gender: Across all Working Groups and Investigative Workshops, approximately 30% of the organizers will be female.
2. Local: No more than 25% of Working Group/Investigative Workshop organizers will be UT faculty/staff.
3. Underrepresented groups: We will encourage researchers from underrepresented groups to be organizers/co-organizers of requests for support, but no specific goal is set because of the small number of organizers.

Table 1 shows values by year for the above benchmarks.

Table 1. Diversity measures for NIMBioS Working Groups, Investigative Workshops, and all events (including Tutorials and Education and Outreach activities in addition to Working Groups and Workshops) by year

		Yr 1*	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6**	Overall
Participant diversity								
Gender	(Benchmark: approximately 30% female)							
	Working Groups	19%	22%	27%	34%	34%	37%	29%
	Investigative Workshops	40%	40%	38%	39%	39%	45%	40%
	All events	37%	42%	38%	39%	39%	43%	40%
International								
	(Benchmark: approximately 10% outside USA)							
	Working Groups	20%	19%	19%	18%	24%	25%	21%
	Investigative Workshops	10%	22%	21%	19%	5%	22%	17%
	All events	7%	12%	14%	16%	14%	15%	13%
URG								
	(Benchmark: increase proportion approximately 10% per year)							
	Working Groups	9%	10%	7%	8%	9%	8%	9%
	Investigative Workshops	7%	10%	14%	14%	11%	12%	11%
	All events	9%	11%	11%	13%	11%	14%	12%
Local								
	(Benchmark: No more than 15% from UT/ORNL)							
	Working Groups	14%	15%	16%	18%	14%	14%	15%
	Investigative Workshops	22%	23%	10%	7%	11%	6%	13%
	All events	35%	20%	16%	13%	16%	10%	18%
Organizer diversity								
Gender	(Benchmark: approximately 30% female)							
	Working Groups	11%	13%	16%	28%	27%	56%	25%
	Investigative Workshops	25%	29%	38%	39%	0%	31%	27%
	All events	23%	28%	27%	34%	30%	37%	30%
Local								
	(Benchmark: No more than 25% UT Faculty/Staff)							
	Working Groups	28%	22%	20%	28%	21%	11%	22%
	Investigative Workshops	75%	36%	12%	17%	0%	21%	27%
	All events	57%	42%	33%	27%	21%	20%	33%

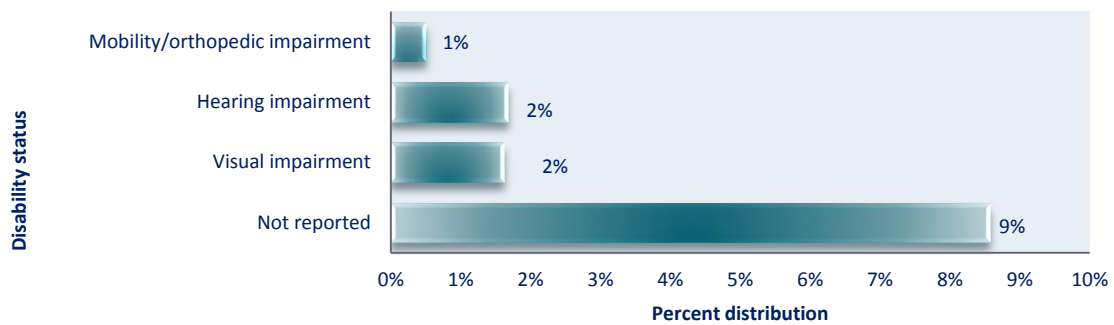
*Year 1 includes activities from March-August 2009

** Year 6 includes activities from September 2013-March 2014

DISABILITY STATUS

Disclosure of disability status by participants to NIMBioS is optional. Close to 2% overall indicated having some sort of disability during RP 6 (nearly 90% reported no disability, and almost 9% did not report disability status). Nearly 2% indicated having some sort of visual impairment, while 1% indicated having a hearing or mobility impairment (Figure 8).

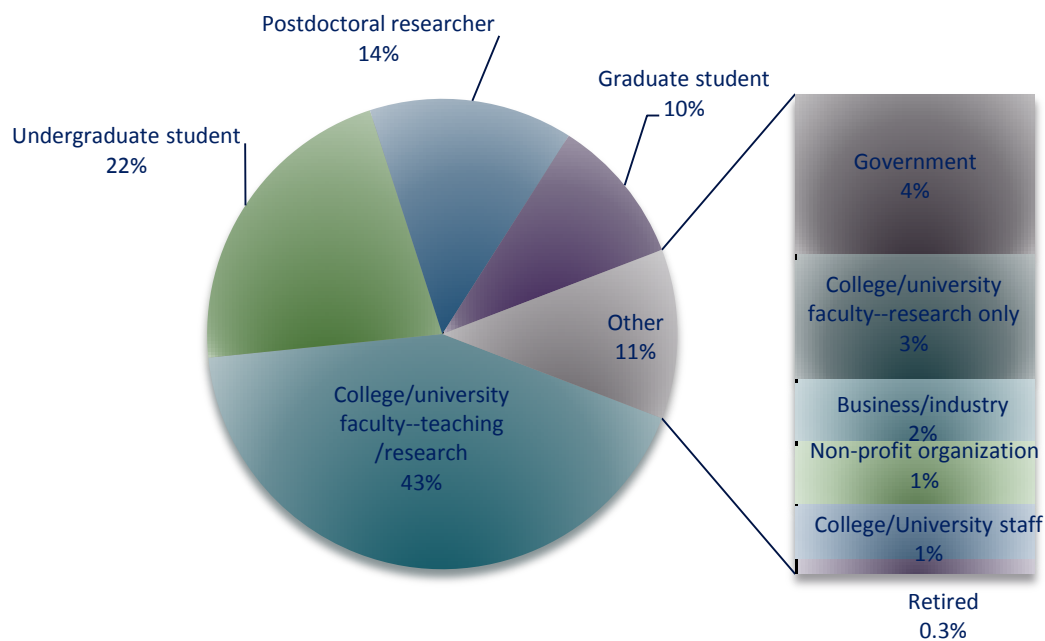
Figure 8. Disability status of participants (n = 595)



INSTITUTIONAL AND DISCIPLINARY DIVERSITY

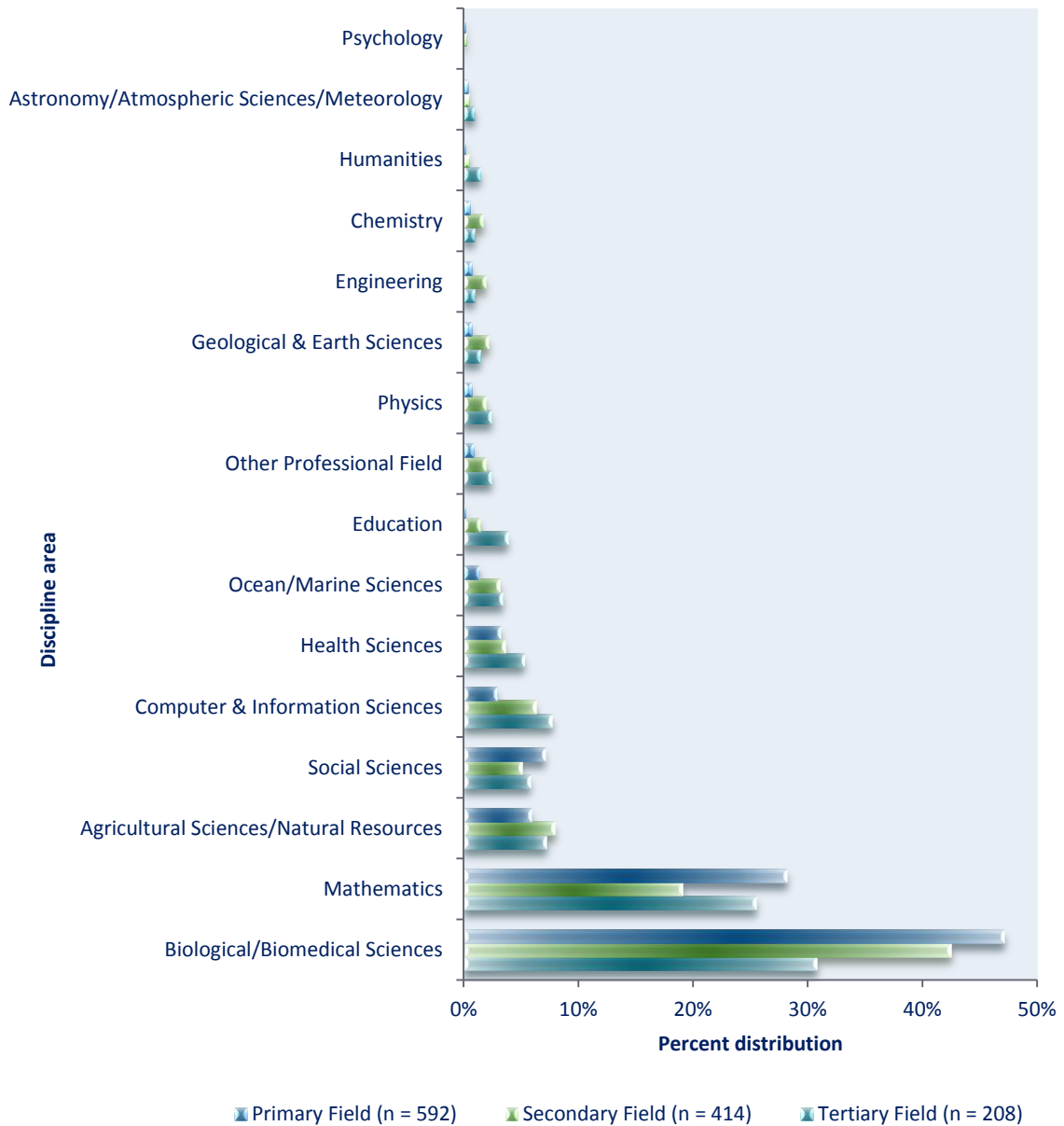
The majority of NIMBioS participants were college/university faculty or staff, undergraduate students, or postdoctoral researchers; however, participants came from government, non-profit, or other positions as well (Figure 9).

Figure 9. Employment status of participants (n = 595)



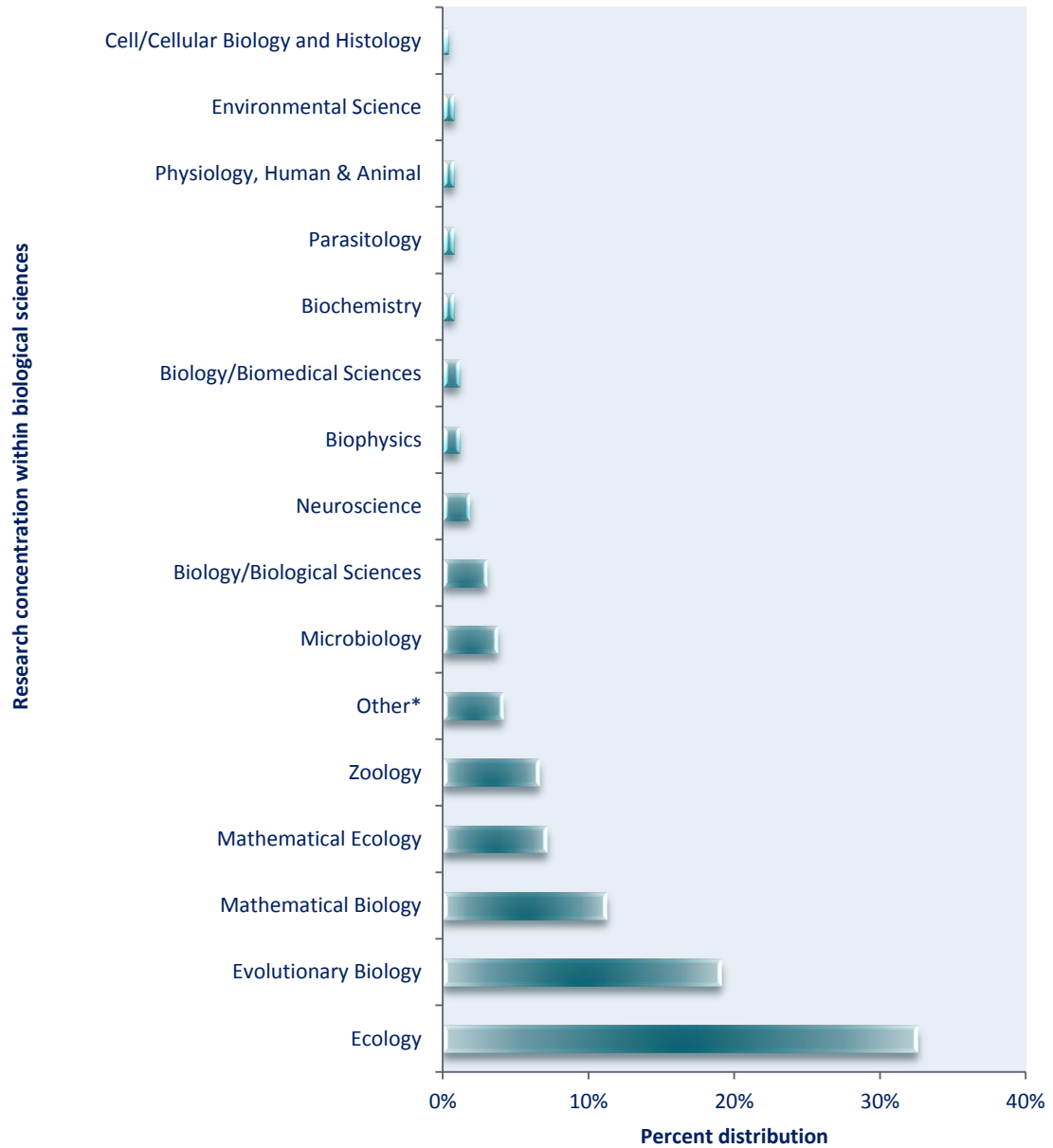
Most participants at NIMBioS indicated their primary fields of study, as well as areas of concentration within those fields. Many indicated their secondary and tertiary fields of study as well. The most commonly reported fields of study included biological/biomedical sciences, mathematics, and agricultural sciences/natural resources, although many other disciplines were represented (Figure 10).

Figure 10. Primary, secondary, and tertiary discipline areas of participants



The 267 participants naming Biological/Biomedical Sciences as their primary field of study indicated 27 different areas of concentration within which they would classify their primary areas of research/expertise. The most commonly indicated area of concentration was ecology (33%), followed by evolutionary biology (19%) and mathematical biology (11%) (Figure 11).

Figure 11. Participant research/expertise area concentrations within biological/biomedical sciences field of study (n = 267)



* Other concentrations having fewer than 0.75% of participants each: Wildlife/Range management, Chemistry, Immunology, Theoretical Biology, Plant Physiology, Developmental Biology/Embryology, Wildlife Health, Cell/Cellular Biology and Histology, Molecular Biology, Behavioral Ecology, Genetics, Human & Animal

Participants during RP 6 represented 259 different institutions, including colleges and universities, government institutions, private businesses, non-profits, and high schools (Figure 12). Of the colleges/universities represented, most were classified as comprehensive (having undergraduate and graduate programs) (Figure 13).

Figure 12. Types of institutions represented (n = 259)

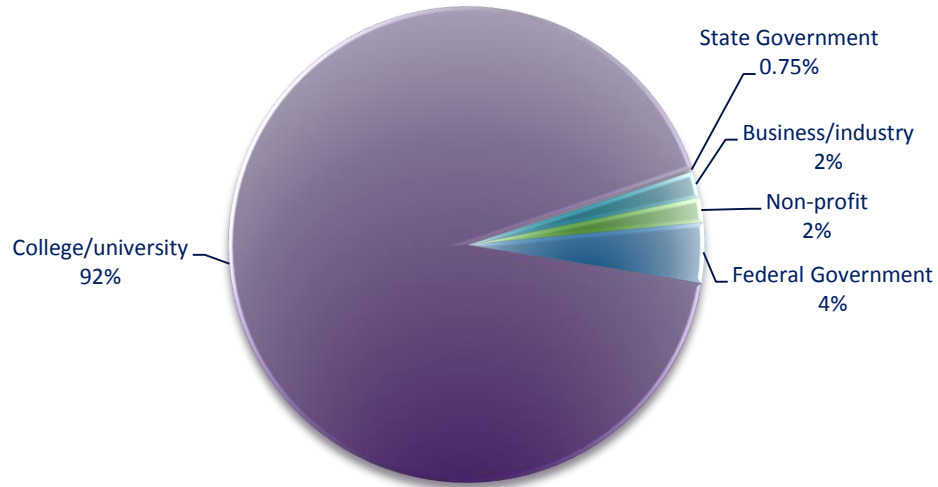
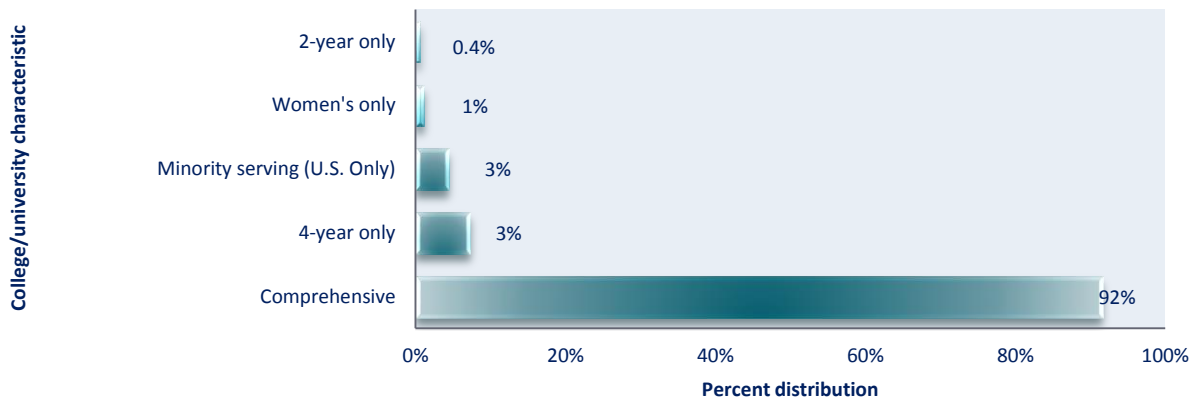


Figure 13. Characteristics of participants' colleges/universities



PROCESS EVALUATION

The process evaluation seeks to evaluate congruence between activities and goals. This type of evaluation is situated in monitoring and judging activities at NIMBioS, mainly through periodic evaluative feedback surveys from participants and event organizers. Other process evaluation data sources include evaluation case studies which look more closely at what factors of NIMBioS participation contribute to positive changes in participants' research and/or educational careers.

NIMBioS conducted formal process evaluations of its first and last Working Group meetings, Investigative Workshops, Undergraduate Research Conference at the Interface of Biology and Mathematics, Postdoctoral Fellowship program, and Research Experiences for Undergraduates/Veterinary Students programs. An evaluation of the 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 summary of the process evaluations of NIMBioS' major activities during RP 6.

Process Evaluation of Research Program Activities

Working Group and Tutorial evaluation highlights are aggregated across all events in their respective categories.

CONTEXT

1. Participants will be satisfied with the event overall.
2. The event will meet participant expectations.
3. Participants will feel the group made adequate progress toward its stated goals.
4. Participants will feel they gained knowledge about the main issues related to the research problem.
5. Participants will feel they gained a better understanding of the research across disciplines related to the group's research problem.
6. Participants feel that participating in the event will have on their future research.
7. Participants will be satisfied with the accommodations offered by NIMBioS.

WORKING GROUPS

NIMBioS Working Groups are chosen to focus on major scientific questions at the interface between biology and mathematics that require insights from diverse researchers. The questions to be addressed may be either fundamental, applied or both, and may be focused around a particular biological topic, or one from mathematics that is driven by biological insight. NIMBioS is particularly interested in questions that integrate diverse fields, require synthesis at multiple scales, and/or make use of or require development of new mathematical/computational approaches.

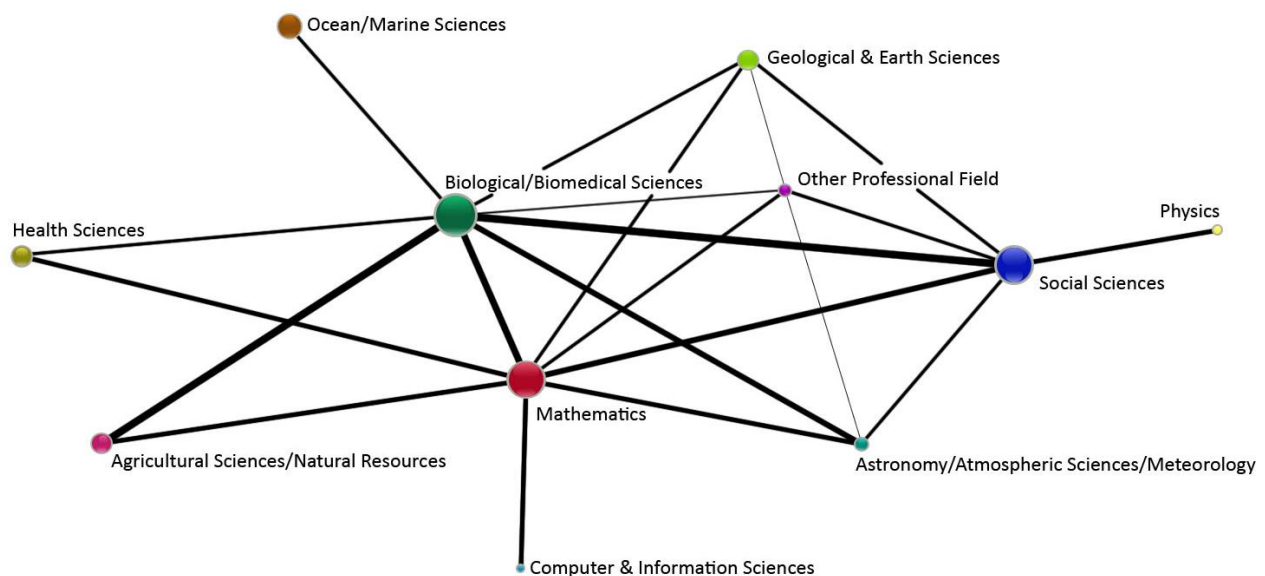
Working Groups are relatively small (10-12 participants, with a maximum of 15), focus on a well-defined topic and have well-defined goals and metrics of success (e.g., publications, databases, software). Selection of Working Groups is based upon the potential scientific impact and inclusion of participants with a diversity of backgrounds and expertise that match the scientific needs of the effort. Organizers are responsible for identifying and

confirming participants with demonstrated accomplishments and skills to contribute to the Working Group. Given this emphasis, Working Group activities rarely involve recently-trained researchers such as postdocs and graduate students. Participation by international researchers is encouraged; though generally there will not be more than 2-3 individuals from outside North America in a Working Group. Working Groups typically meet 2-4 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. Plans can include visits to NIMBioS for subsets of Working Group members to collaborate with NIMBioS IT staff and researchers on Working Group needs.

WORKING GROUP SUMMARY, RP 6

During RP 6, NIMBioS hosted a total of 12 Working Group meetings, including the start of four new groups and the return of 8 established groups. A total of 145 participants from 87 institutions took part in the Working Groups. During RP 6, participants came together from 11 different major fields of study to focus on the respective scientific questions of their groups. Figure 14 shows the cross-disciplinary connections fostered among Working Group members through the meetings hosted at NIMBioS during RP 6. Node radius is representative of the log scaled number of participants in each field of study. Line size is representative of the number of times researchers from each field were brought together to collaborate and problem-solve at NIMBioS.

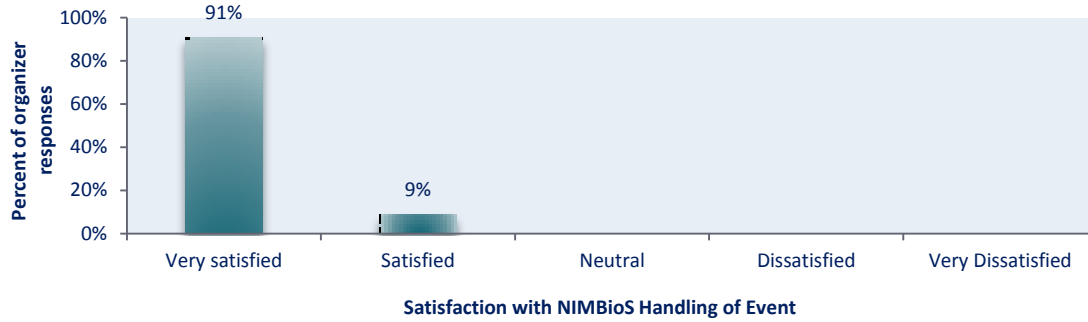
Figure 14. Working Group cross-disciplinary collaboration



ORGANIZER FEEDBACK

Beginning in November 2011, NIMBioS began collecting satisfaction feedback from Working Group organizers to the following question: As an event organizer, how satisfied were you overall with the way your event was managed by NIMBioS (from the application process through the wrap-up of the event)? Figure 15 summarizes the responses to this question for RP 6 organizers of beginning Working Groups.

Figure 15. Working group organizer satisfaction with NIMBioS handling of event (n = 11)



FIRST MEETINGS

During RP 6, NIMBioS hosted the first meetings of four Working Groups, with a total of 49 participants (

Table 2) (See <http://www.nimbios.org/workinggroups/> for more details about specific Working Groups).

Evaluation surveys were sent to all participants. A total of 40 participants took part in the evaluation of the first meetings of their Working Groups. Eleven of these participants were organizers and only answered questions about how well they felt NIMBioS managed their events.

Table 2. Working Group First Meetings Hosted by NIMBioS

Title of Working Group	Dates	# Participants
Climate Change and Vector-borne Diseases	December 3-5, 2013	14
Evolution of Institutions	March 13-14, 2014	13
Evolution of Sustainability	March 26-28, 2014	10
Plant-Soil Feedback Theory	October 31-September 2, 2013	12

HIGHLIGHTS OF WORKING GROUP FIRST MEETING EVALUATION RESPONSES

Figure 16. Overall satisfaction with the content and format of the Working Groups

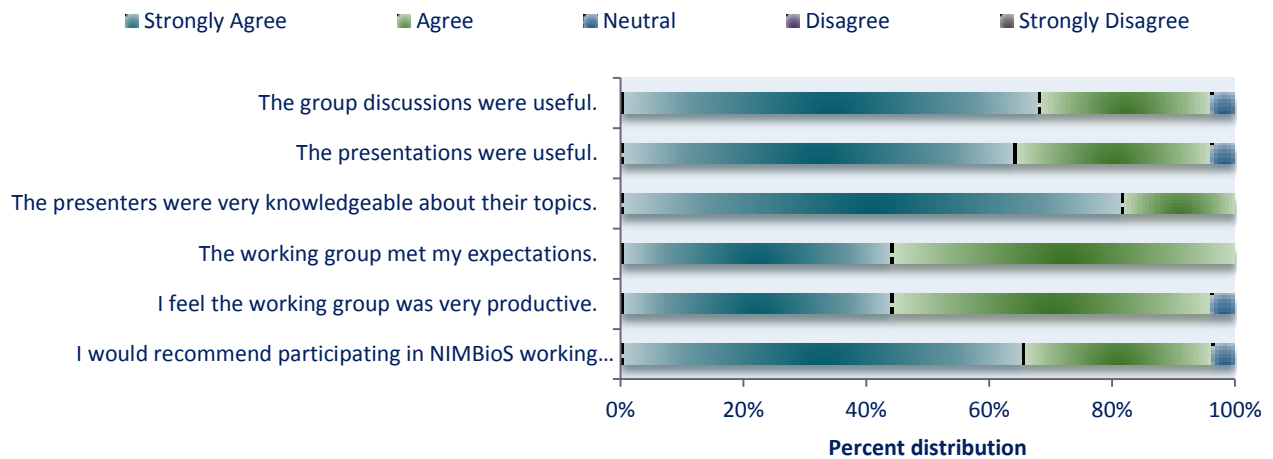


Figure 17. Participant responses to the following question--As a result of participating in this Working Group, I have a better understanding of:

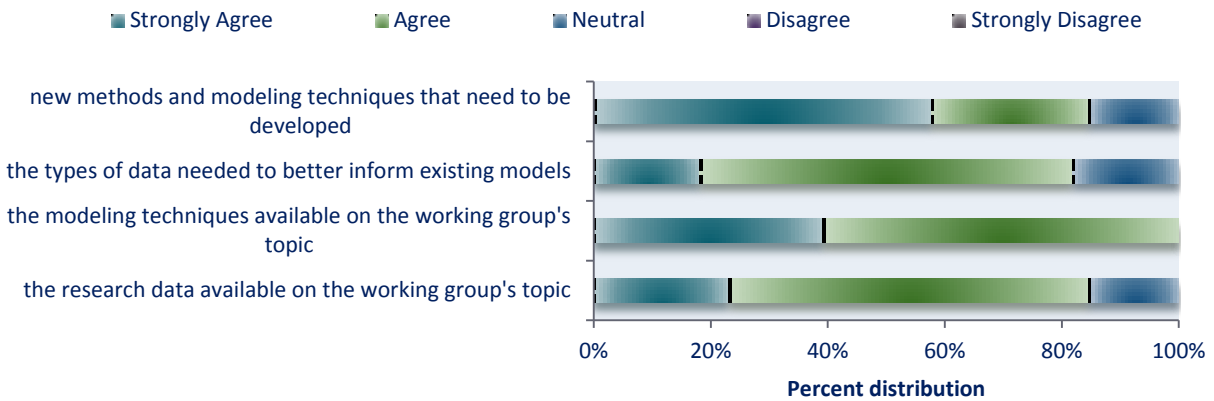


Figure 18. Percent of participants in first meetings of Working Groups who:



WORKING GROUP SECOND, THIRD, AND FOURTH MEETINGS

During the reporting period, NIMBioS hosted the second meetings of four Working Groups, with a total of 49 participants, and the third meeting of two Working Groups, with a total of 23 participants. Two groups held their fourth meetings with 24 participants (Table3).

Table 3. Working Group Second and Third Meetings Hosted by NIMBioS

Title of Working Group	Dates	# Participants
Second Meetings		
Biotic Interactions	September 23-26,2013	14
Hierarchy and Leadership	September 18-20, 2013	12
Human Risk Perception and Climate Change	January 21-23, 2014	11
Nonautonomous Systems and Terrestrial Carbon Cycle	March 17-21, 2014	12
Third Meetings		
Play, Evolution, and Sociality	October 30-September 1, 2013	12
Within-host Modeling of Mycobacterium avium subsp. paratuberculosis (MAP) Infections	December 9-11, 2013	11
Fourth Meetings		
Ocean Viral Dynamics	January 7-9, 2014	12
Optimal Control for Agent-based Models	January 21-24, 2014	12

Beginning in March 2011, NIMBioS changed its policy on evaluation of Working Group meetings to only sending full evaluation surveys to participants after the first and final meetings, rather than after every meeting, however, comments were solicited about the general feeling about the group's progress. Some participant comments:

Very positive. Exceeded my expectations. There will be products (papers from the collective group) that result from these Working Groups.—Ocean Viral Dynamics Participant, Meeting 3

My experience with this Working Group is extremely positive. The group brought together experts in animal behavior, evolution and mathematical modelling that would have otherwise never met as one group. This fostered new ideas and created environment in which a systematic pursuit of these ideas can be established. The group started new working relationships and enabled establishment of several international working teams that focus on the mathematical analysis and modelling of play from different perspectives. Due to the team work of the group, these perspectives are complementary and stimulate each other.—Play, Evolution, and Sociality Participant, Meeting Two

CONCLUDING WORKING GROUPS

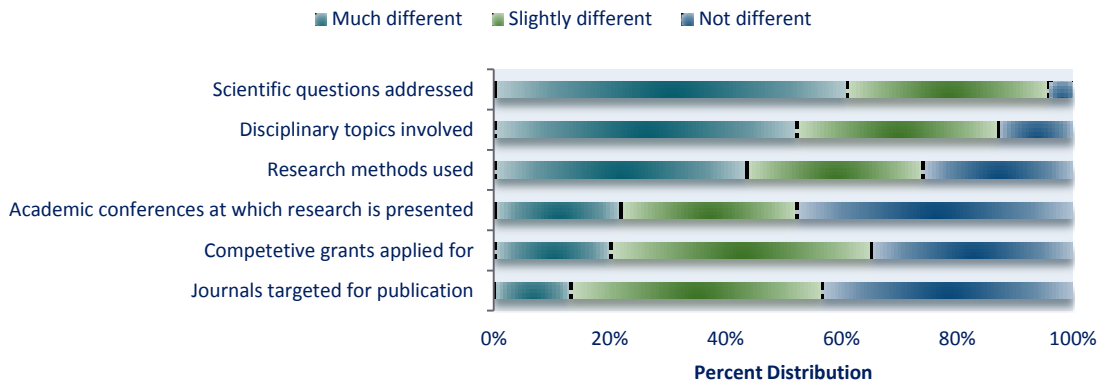
NIMBioS received notification that four Working Groups had reached their conclusions (Table 4). It is the policy of NIMBioS to send follow-up evaluation surveys to Working Group participants after the final meeting summary has been received from Working Group organizers. A total of 26 participants responded to the final evaluation for their groups.

Table 4. Concluded Working Groups, RP 6

Title of Working Group	Dates	# Participants
Multiscale Modeling of the Life Cycle of <i>Toxoplasma gondii</i>	May 2011- January 2014	20
Optimal Control for Agent-based Models	April 2011- July 2013	17
Ocean Viral Dynamics	April 2012-January 2014	16

HIGHLIGHTS OF WORKING GROUP FOLLOW-UP EVALUATION RESPONSES

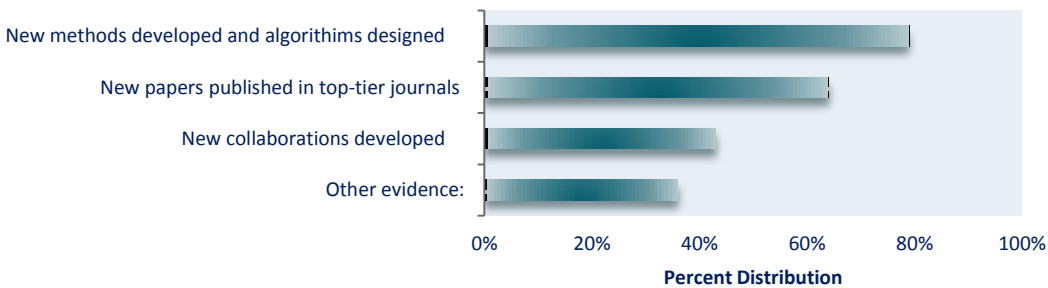
Figure 19. Ways in which Working Group research collaborations differed from participants’ other research collaborations



Comments: *“The multiscale approach was specifically original, also with the possibility to interact in small groups (contrarily to conferences)”*

“The new and highly interesting for me was the interdisciplinarity of the collaboration.”

Figure 20. Evidence to support new insights and collaborations within the group



Comments: *“There is ongoing work from a collaboration of several members. It might not be totally correct to say that there were “New methods developed and algorithms designed,” but certainly there was a new approach to a previously poorly explored task/problem.”*

“More papers to be submitted this year”

INVESTIGATIVE WORKSHOPS

NIMBioS Investigative Workshops differ from Working Groups in that they focus on a broader topic or set of related topics at the interface of biology and mathematics and have relatively large size (30-40 participants). Workshops attempt to summarize/synthesize the state of the art and identify future directions, and they have potential for leading to one or more future Working Groups. Organizers invite 15-20 key participants, and the remaining 15-20 participants are filled through open application from the scientific community.

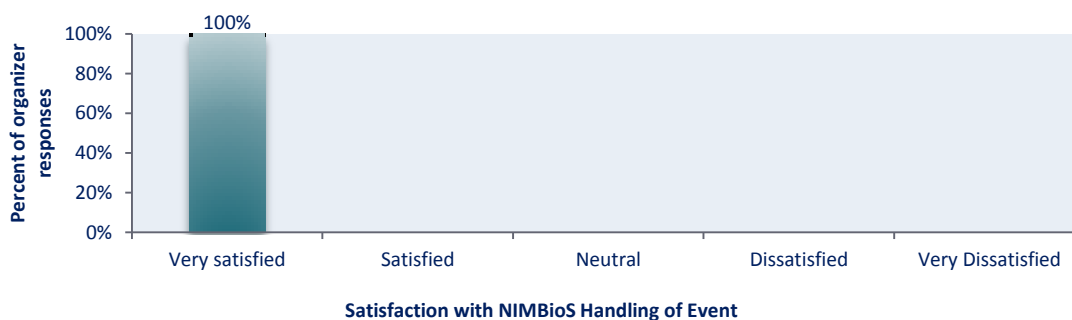
NIMBioS hosted five Investigative Workshops during RP 6 with a total of 185 participants (Table 5). Evaluation surveys were sent to all Workshop participants. A total of 141 participants took part in the evaluation of the Workshops.

Table 5. Workshops Hosted by NIMBioS

Title of Working Group	Dates	# Participants
Analyzing Animal Vocal Sequences	October 21-23, 2013	43
Animal Social Networks	March 6-8, 2014	44
Insect Pest Resistance Evolution	November 14-15, 2013	29
Interface Disease Models	March 11-13, 2014	36
Vectored Plant Viruses	March 17-19, 2014	33

HIGHLIGHTS OF WORKSHOP EVALUATION RESPONSES

Figure 21. Workshop organizer satisfaction with NIMBioS handling of event (n = 13)



Organizer comments:

A great group of attendees and wonderful logistical support from the staff. We expect to have several to many concrete outcomes from the Workshop.

NIMBioS staff were wonderful!

Outstanding support staff. Thanks!!!

Figure 22. Overall satisfaction with the content and format of the Workshop

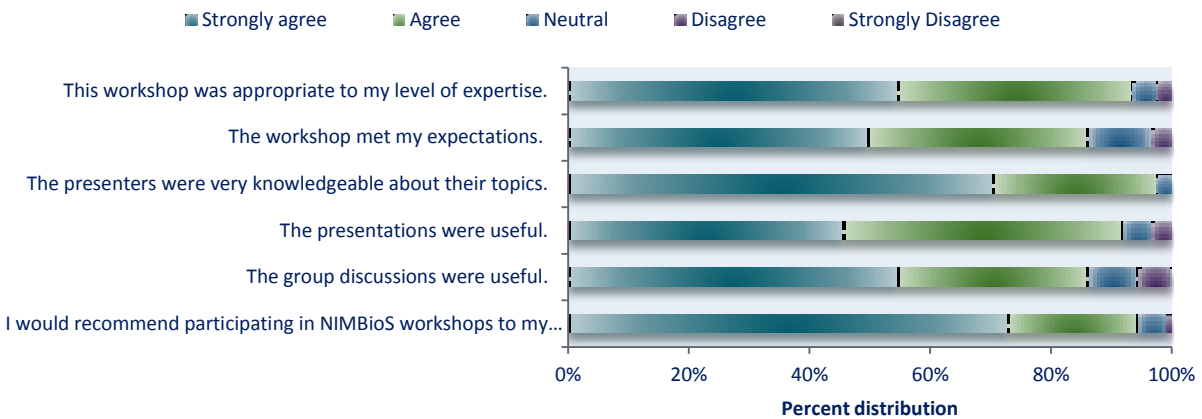
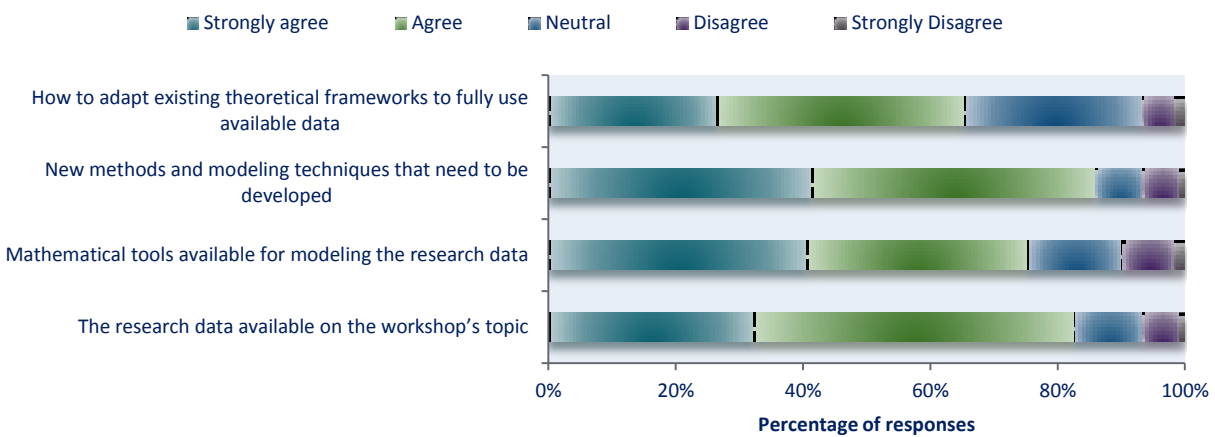


Figure 23. Participant responses to the following question-- As a result of participating in this Workshop, I have a better understanding of:



Participant comments:

I believe that it was a very good Workshop. I am starting to collaborate with some people I met in the Workshop and I am now aware of different methods that I did not know they exist.

I learned a great deal about different types of population models that may be useful in interpreting our research group's data sets.

I was very impressed and stimulated by the range of studies discussed during the meeting. I think I gained a new appreciation for some areas that I had never thought of as subjects where modeling could provide valuable insights.

I am already in touch with some people I met at the Workshop and exist the possibility to collaborate.

This was one of the most fertile Workshops for developing new collaborations I have ever attended!

Process Evaluation of Education and Outreach Program Activities

RESEARCH EXPERIENCES FOR UNDERGRADUATE STUDENTS

The NIMBioS *Research Experiences for Undergraduates* (REU) program took place on the University of Tennessee, Knoxville (UT) Knoxville campus June 10–August 2, 2013. Nineteen undergraduates were chosen to participate in the program. (While this REU program technically fell within the dates of reporting period five (RP 5), the REU program for 2013 will not conclude until after the RP 6 annual report is due, so results from the previous year’s REU evaluation are provided each year.)

During the eight-week program, participants lived on campus at UT, and worked in teams with 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 Sturmer (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), Xioapeng Zhao (Computational Biology, Disease Modeling), Heather Finotti (Mathematics), Mike Gilchrist (Evolutionary Bioinformatics), Tuoc Phan (Mathematics), and Amiyaal Ilany (Animal Social Networks).

CONTEXT

1. Participants will be satisfied with the program overall.
2. The research experience will meet participant expectations.
3. The research experience will impact participant plans to go to graduate school.
4. Participants will increase their research skills during the program.
5. Participant will feel they gained knowledge about the research process.
6. Participants will be satisfied with their mentors.
7. Participants will be satisfied with the accommodations offered by NIMBioS.

HIGHLIGHTS OF REU EVALUATION RESPONSES

Figure 24. Overall satisfaction with the research experience

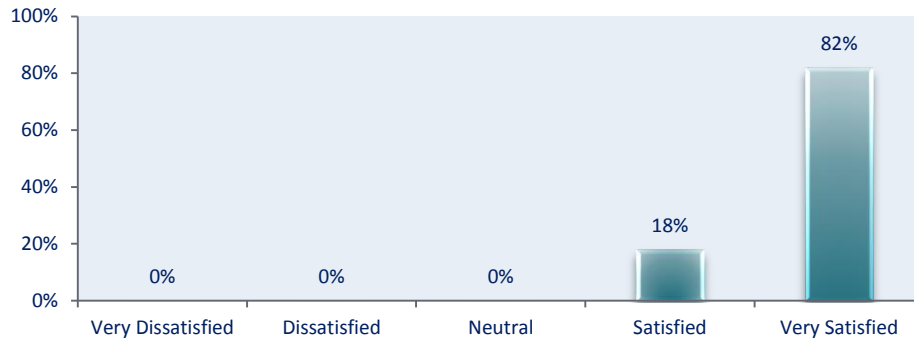


Figure 25. Participant pre-and post-program skills, response scale of -2 = extremely poor at the skill to 2 = excellent at the skill

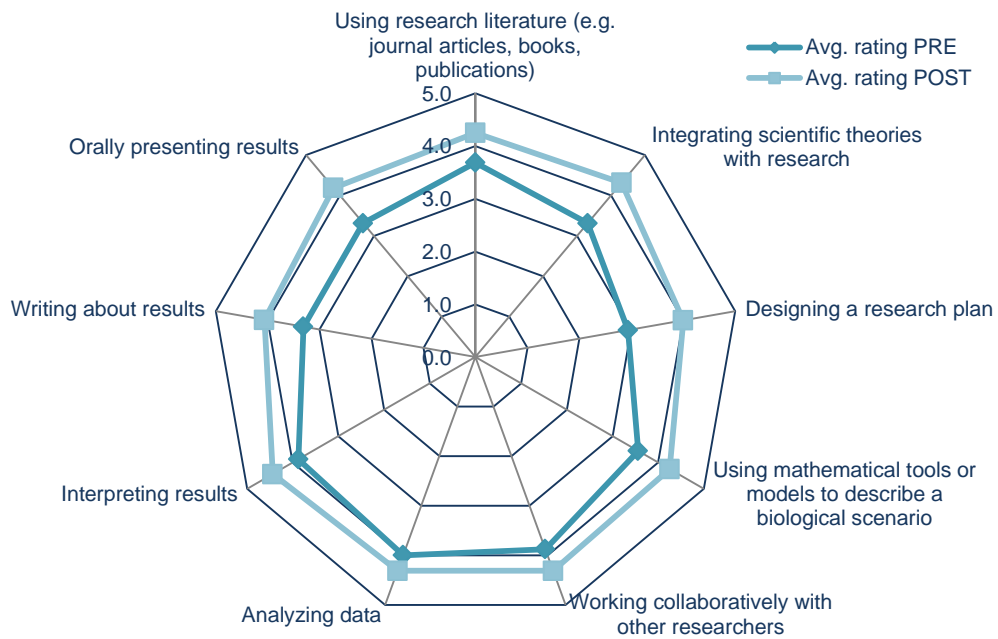
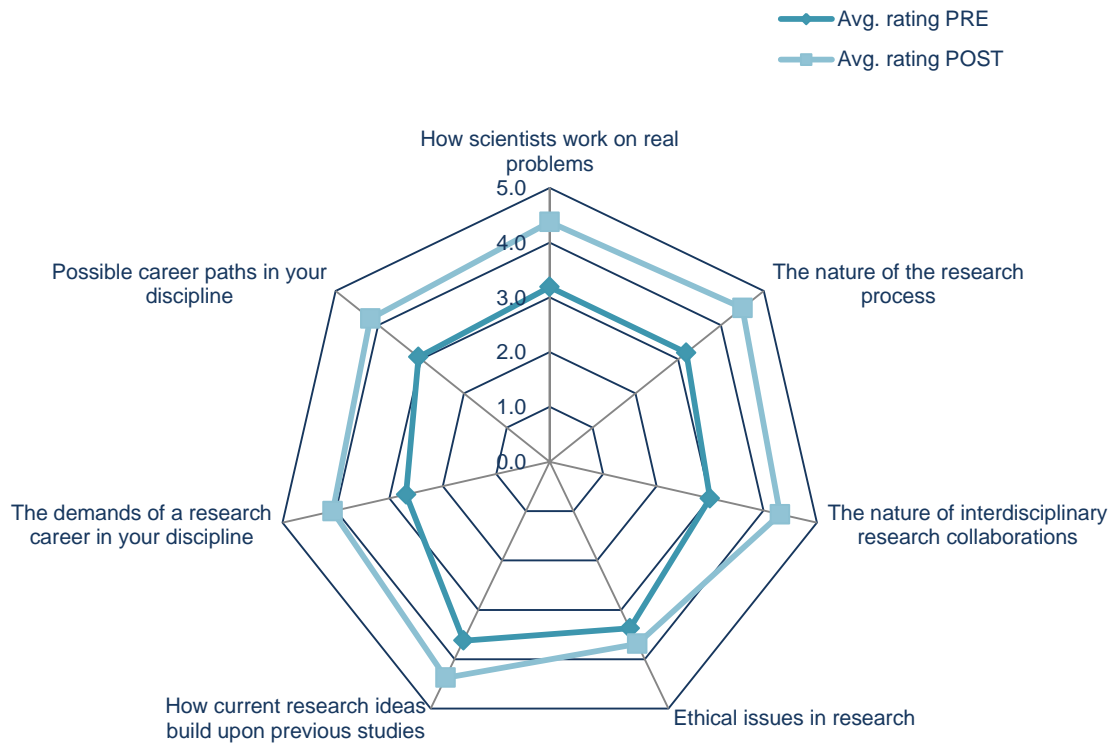


Figure 26. Participant pre- and post-program knowledge, response scale of -2 = extremely poor understanding to 2 = excellent understanding



UNDERGRADUATE RESEARCH CONFERENCE AT THE INTERFACE OF BIOLOGY AND MATHEMATICS (URC)

The NIMBioS fifth annual Undergraduate Research Conference at the Interface of Biology and Mathematics took place at the University of Tennessee's Conference Center in downtown Knoxville November 16-17, 2013. 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 Kelly Sturner.

Nearly 158 participants from 66 institutions throughout the United States participated in the event. The fifth annual undergraduate research conference provided opportunities for undergraduates to present their research at the interface of biology and mathematics. Student talks and posters were featured as well as a panel discussion on career opportunities. Evaluation surveys were sent to all participants in the conference, with the exception of NIMBioS affiliates and event organizers. A total of 65 participants took part in the evaluation.

CONTEXT

1. Participants will be satisfied with the conference overall.
2. The conference will meet participant expectations.
3. Participants will feel the conference allowed them to make new connections with others in math and biology.
4. Participants will feel they gained a better understanding of undergraduate research happening at the interface of mathematics and biology.
5. Undergraduate participants feel the conference will have an impact on their future career plans.
6. Participants will be satisfied with the accommodations offered by NIMBioS.

HIGHLIGHTS OF URC EVALUATION RESPONSES

Figure 27. Respondent agreement levels with statements about various aspects of the conference

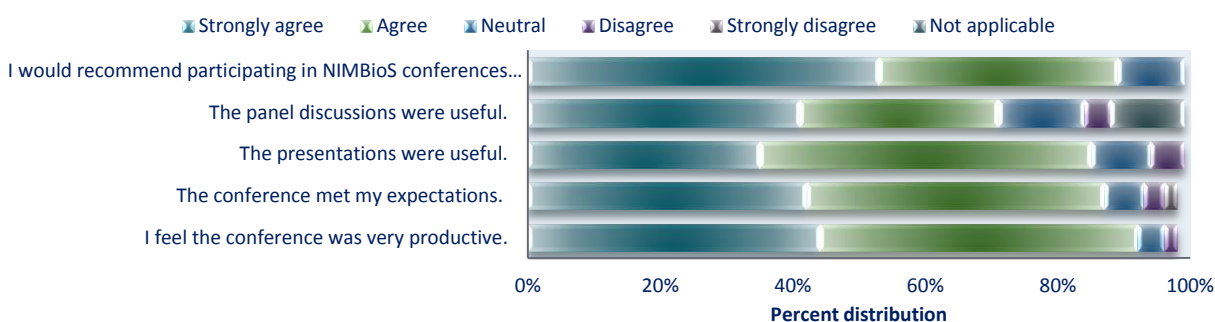
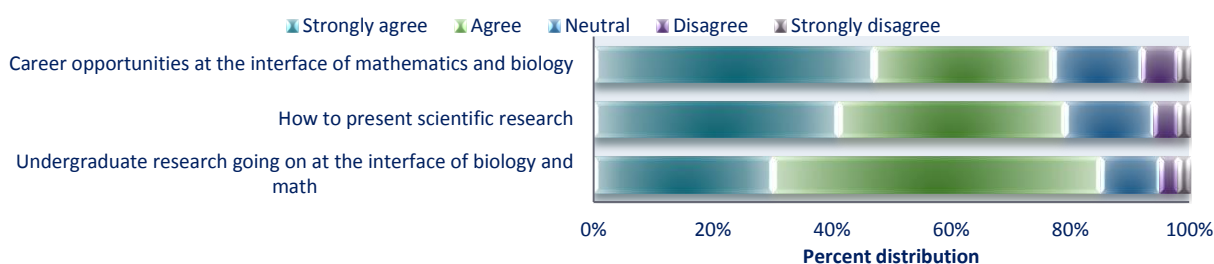


Figure 28. As a result of attending this conference, I have a better understanding of



NIMBIOS POSTDOCTORAL FELLOW EXIT SURVEY HIGHLIGHTS

NIMBioS provides an opportunity for postdoctoral scholarship at the interface between mathematics and biological science that builds upon the experiences gained through the many successful postdoctoral fellows who have been in residence at the University of Tennessee, Knoxville over the past decades. Postdoctoral scholars propose synthetic projects that require an amalgam of mathematical and biological approaches, and are expected to include explicit opportunities to expand the scholar’s previous education. Projects should not require the collection of additional empirical data, but may involve many aspects (collating, formulating data bases, developing models) of synthesizing existing data. Applications are welcome from those with a range of both biological and mathematical prior experience, with highest priority given to those with explicit plans to develop their ability to effectively carry on research across these fields.

Postdoctoral Fellowships are for two years (assuming satisfactory progress toward research goals in year one). Under appropriate circumstances applicants may request periods shorter than two years, and in special circumstances a Fellow may request an extension beyond two years. NIMBIOS Postdoctoral Fellows are encouraged to participate in grant proposal development Workshops offered through UT and Fellows are permitted to serve as a Principal Investigator on grant proposals submitted through NIMBioS.

Upon leaving the Postdoctoral Fellowship program at NIMBioS, program participants are asked to fill out a short exit evaluation form that examines several aspects of satisfaction with the program’s operations. To date, 15 alumni from the program have filled out the form.

CONTEXT

1. Participants will be satisfied with the structure of the program.
2. Participants will feel the program has been valuable to their academic careers.
3. Participants will be satisfied with the accommodations offered by NIMBioS to conduct research.
4. Participants will be with their mentors overall.
5. Participants will be satisfied with the types of advice/assistance received from their mentors.
6. Participants will be satisfied with the opportunity to participate in education and outreach activities.

HIGHLIGHTS OF POSTDOCTORAL FELLOWSHIP PROGRAM RESPONSES

Figure 29. Postdoctoral fellow satisfaction with program mentors

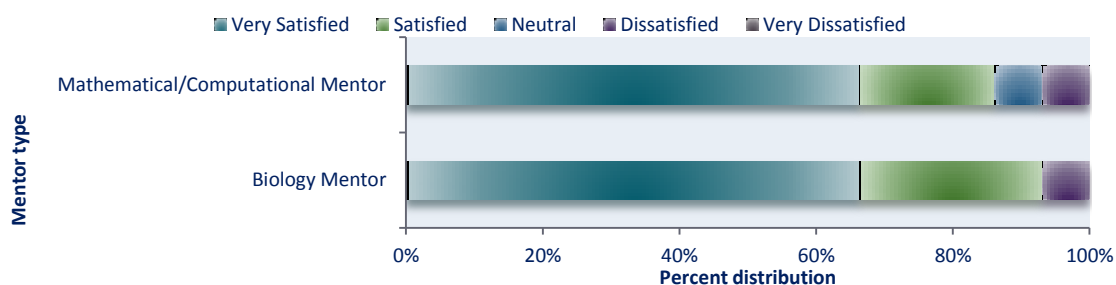


Figure 30. Postdoctoral fellow satisfaction with advice/assistance received from program mentors

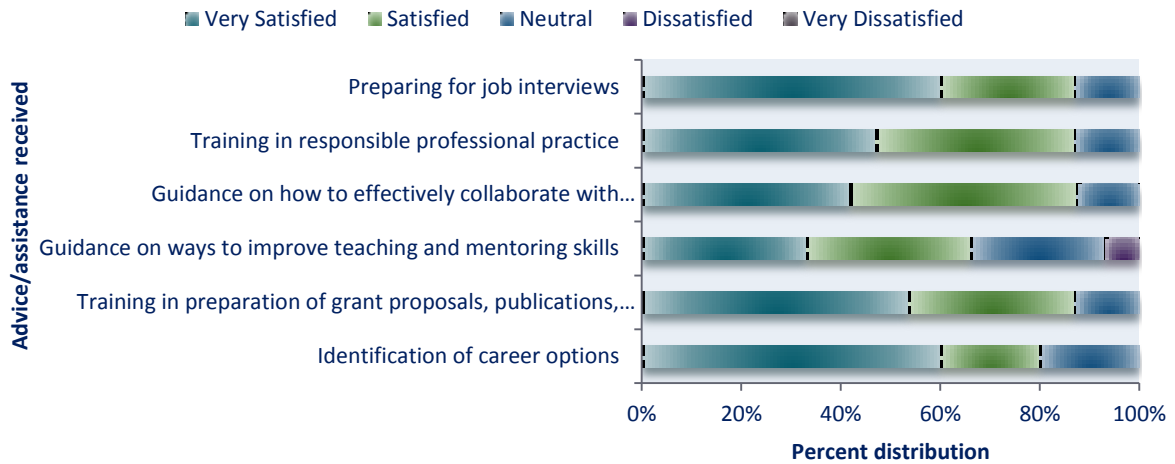
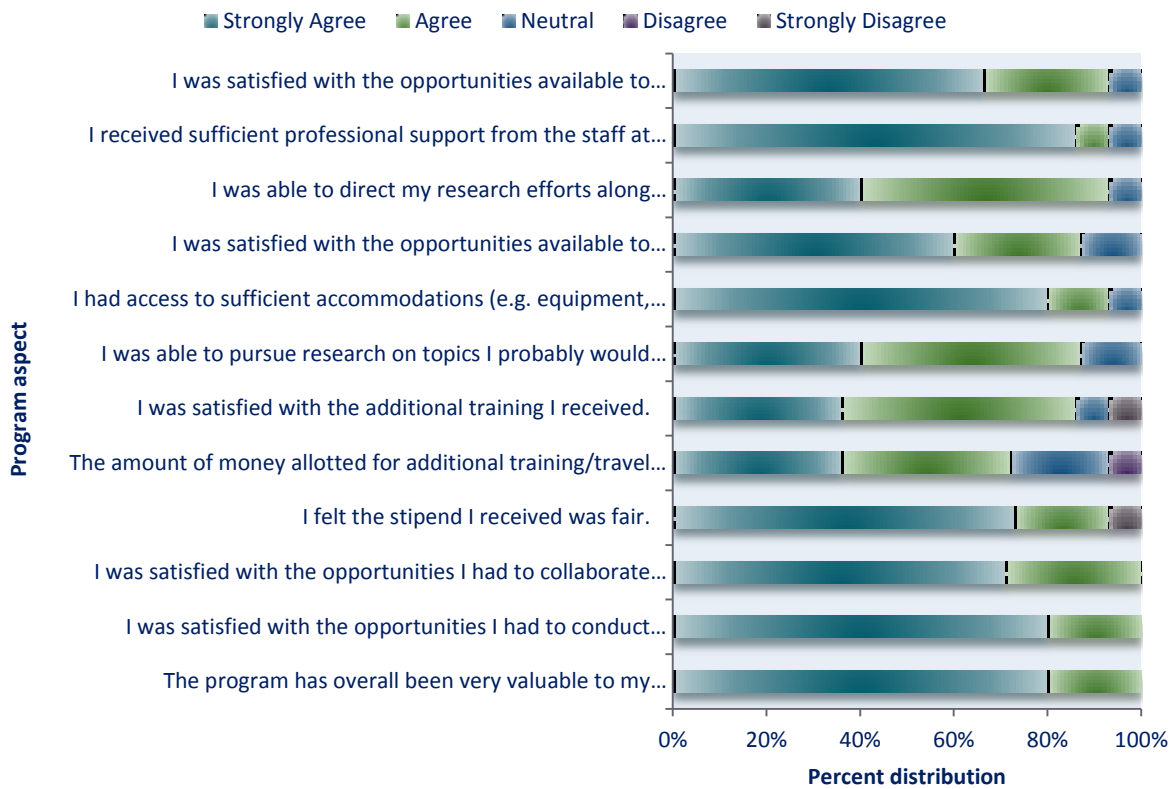


Figure 31. Postdoctoral fellow satisfaction with overall program experience



NIMBioS products are published in many high-ranking journals in their respective fields. **Table 6** highlights the number of products in a selection of high-impact journals according to the Web of Science impact factor.

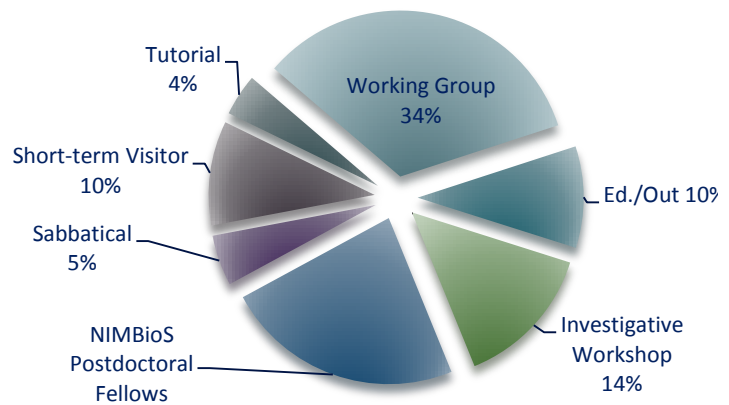
Table 6. Number of NIMBioS articles published in a selection of high-impact journals, sorted by journal 5-Year Impact Factor

Journal Title	5-Year Impact Factor	# of NIMBioS Publications in Year 6	# of NIMBioS Publications as of April 2014
Nature	38.16	1	3
Cell	34.37	0	1
Science	33.59	1	4
Ecology Letters	18.50	3	9
Trends in Ecology and Evolution	17.11	1	5
PLoS Biology	13.45	2	2
Systematic Biology	13.32	2	4
Proceedings of the National Academy of Sciences	10.58	3	12
Current Biology	10.45	1	1
Nature Communications	10.02	1	1
PLoS Genetics	9.44	0	2
Nucleic Acids Research	8.06	0	2
Phil Trans of the Royal Soc B-Biological Sciences	7.30	1	2
Molecular Ecology	6.79	2	2
Ecology	6.37	3	5
PLoS Computational Biology	5.94	4	6
Proc of the Royal Soc B-Biological Sciences	5.83	3	6
Evolution	5.40	4	9
The American Naturalist	5.33	3	9
Journal of Animal Ecology	5.17	1	3
Journal of the Royal Society Interface	5.17	2	2
PLoS One	4.24	9	20
BMC Bioinformatics	3.51	1	1
Animal Behaviour	3.41	2	3

* The journal impact factor is a measure of the frequency with which the “average article” in a journal has been cited in a particular year. The impact factor is an indicator of a journal’s relative importance, especially as compared to other journals in the same field. Impact factor calculation: $\text{cites in year } n \text{ to articles published in year } (n-1 + n-2) / \text{number of articles published in year } (n-1 + n-2)$.

NIMBioS publications come from a variety of activities, although Working Group participants tend to publish the largest portion of journal articles (34%), followed by NIMBioS Postdoctoral Fellows (21%) (Figure 34).

Figure 34. Distribution of journal publications submitted to NIMBioS by participants



BIBLIOMETRIC INDICATORS

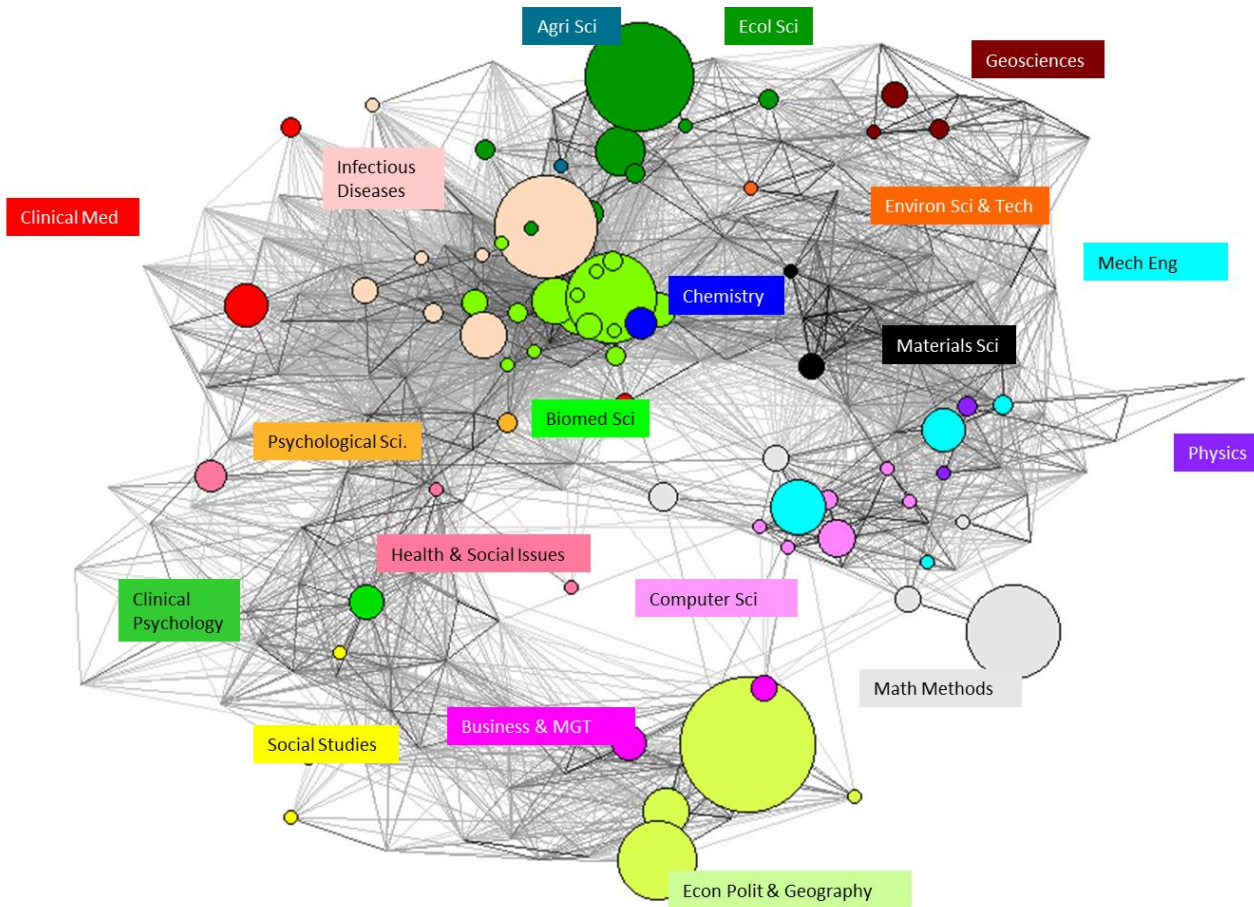
Of the 347 journal articles reported by NIMBioS participants, 299 are indexed in the Institute for Scientific Information’s (ISI) Web of Science (WOS). Data in the following sections are based on these articles, which involved 775 researchers from 350 unique institutions spanning 42 countries. These articles have appeared in 151 different publications, many of which are considered to have high-impact in the academic community. These articles have been collectively cited 2,462 times, with an average of 8.23 cites per article. The cites per article falls within the range of the two major research fields of the publications during the last 10 years; mathematics (3.65 citers/paper) and biology (15.65 citers/paper).

DISCIPLINARY SPAN OF PUBLICATIONS

The 299 published articles span 74 discipline areas, as designated by the ISI WOS Categories. Categories are assigned at the journal level based upon a combination of citation patterns and editorial judgment at the ISI. Subject categories are used in bibliometric research as a representation of the research areas in which scientists work.

Figure 35 locates the subject categories of the 297 NIMBioS articles on a network map of the WOS Categories. The gray background intersections are the 224 WOS Categories, located based on cross-citation relationships among all WOS journals in 2007 (from Rafols, Porter, and Leydesdorff, 2009). The 19 labeled “macro-disciplines” are based on factor analysis of that cross-citation matrix also. Nearness on the map indicates a closer relationship among disciplines. Circular node sizes reflect the relative number of NIMBioS participant publications. The most common subject category in which NIMBioS publications fell was Ecology (86), followed by Evolutionary Biology (54), Multidisciplinary Sciences (49), Mathematical & Computational Biology (41), Biology (39), and Genetics & Heredity (30).

Figure 35. Web of Science Categories for 297 WoS journal articles to date

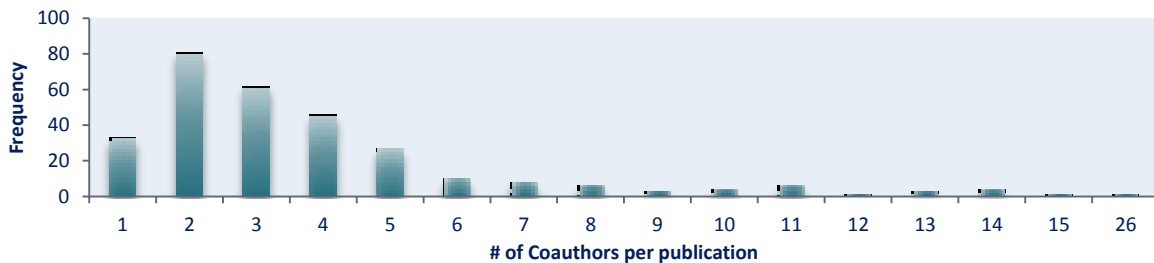


Method from Rafols, Porter and Leydesdorff (2009)

COLLABORATION

One of the core values of NIMBioS is to take a collaborative approach to science and science education. We are interested, therefore, in examining the number of co-authors on NIMBioS-related publications as one indicator of scientific collaboration. For the 297 publications reported thus far, the average number of co-authors per paper is 3.9 (Figure 36).

Figure 36. Coauthorship of NIMBioS publications



Network analysis reveals key producers within the body of NIMBioS work as well. In Figure 37, grey circles represent authors and squares represent papers, colored by major event type. NIMBioS Postdoctoral Fellows (light blue squares) have produced 69 papers, while Working Groups (dark blue squares) overall have produced 121. NIMBioS Postdoctoral Fellows also frequently publish with Working Group members and Short-Term Visitors (dark green squares). Twenty-four participants have authored more than 5 papers each as a result of NIMBioS affiliated collaborations.

Figure 37. Participant paper collaboration for all NIMBioS events

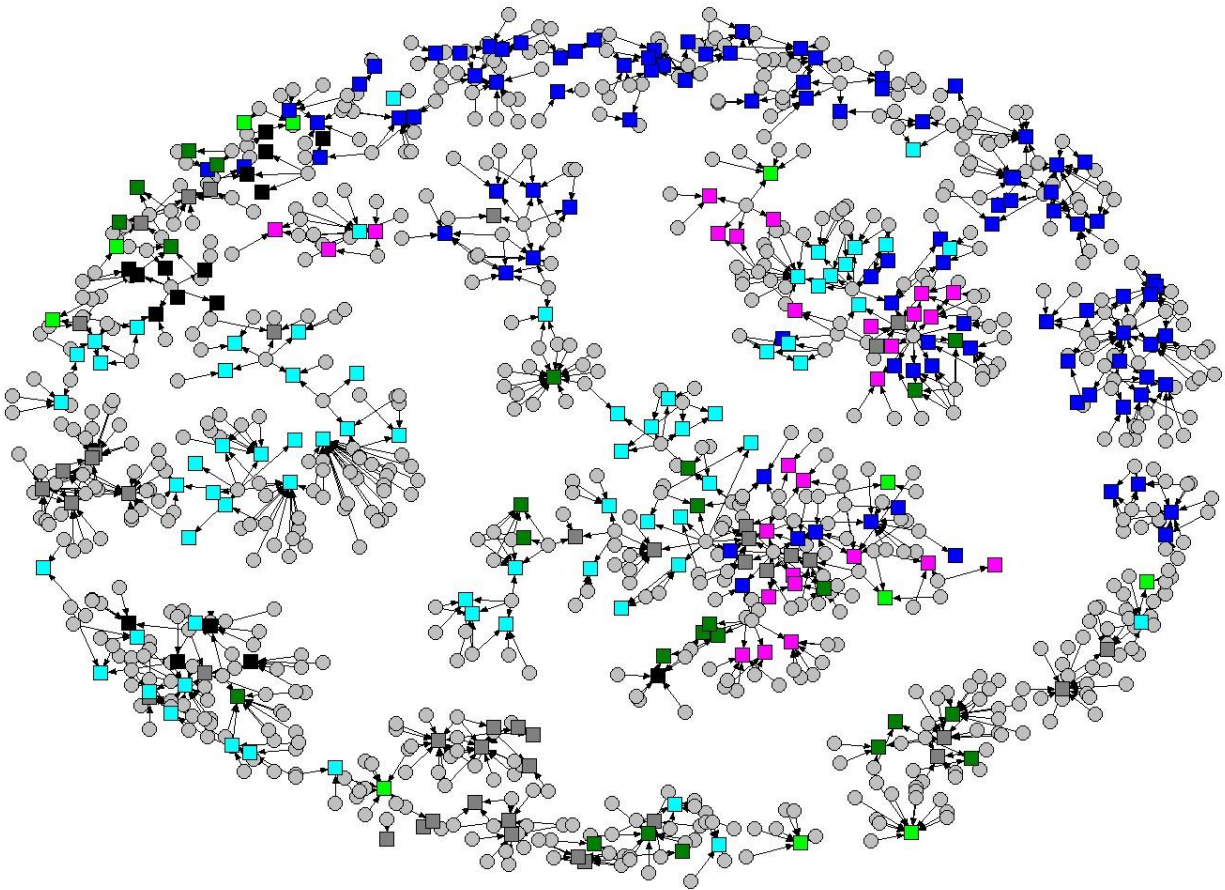
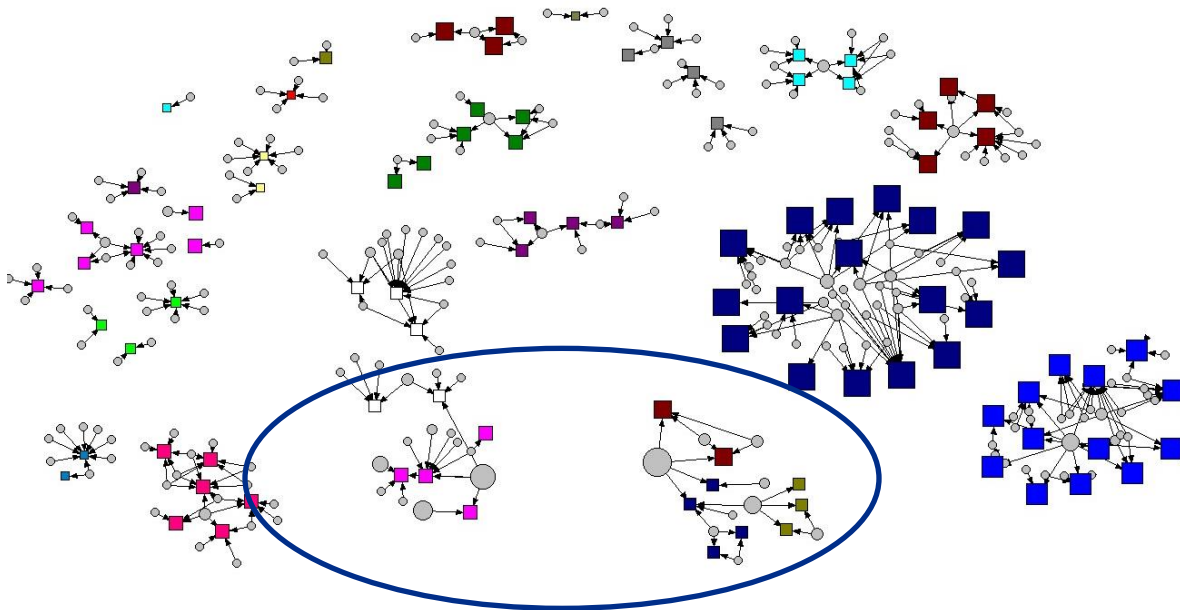


Figure 38 shows the paper-author network for Working Groups only. Grey circles represent authors and colored squares represent papers. Nodes are sized by numbers of publications for each group (squares) or a person's total number of NIMBioS affiliated publications (circles). The Synthesizing and Predicting Infectious Disease (SPIDER) Working Group (large navy blue cluster, started in 2009), has been the most prolific group with 17 publications, followed by Population and Community Ecology Consequences of Intraspecific Niche Variation (royal blue cluster, started 2009). Overall, Working Groups do not cross-fertilize with regard to co-authorship, however, some members who participate in multiple groups do author papers with members of two or more groups, as is the case with the two circled clusters at the bottom middle of the figure.

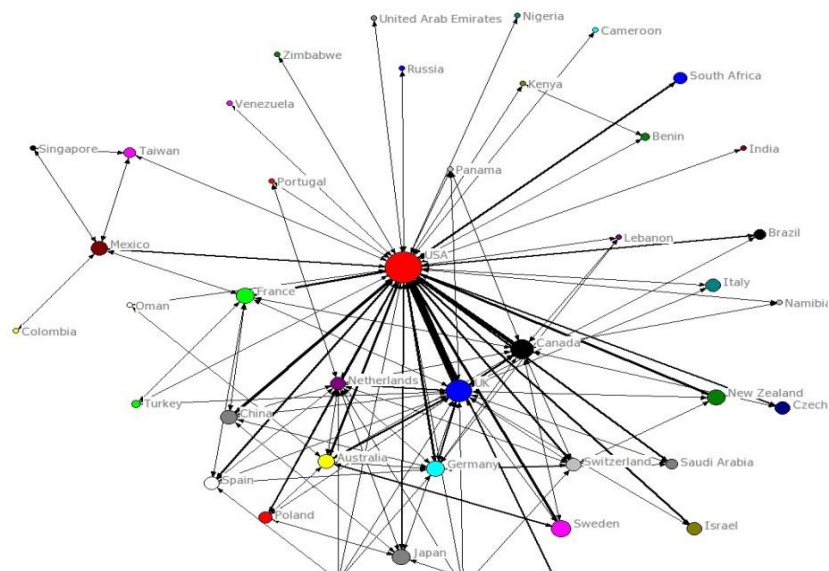
Figure 38. Participant paper collaboration network for all Working Groups



NIMBioS also fosters international collaboration among researchers. While 42 different countries have been represented by NIMBioS coauthorship through the current reporting period, the average number of countries of coauthors per paper is 1.6, with a range of 1-6 countries represented per paper (Figure 39).

Node radius represents the log scaled number of NIMBioS-affiliated papers from each country, and line size represents the number of collaborations among countries on these papers.

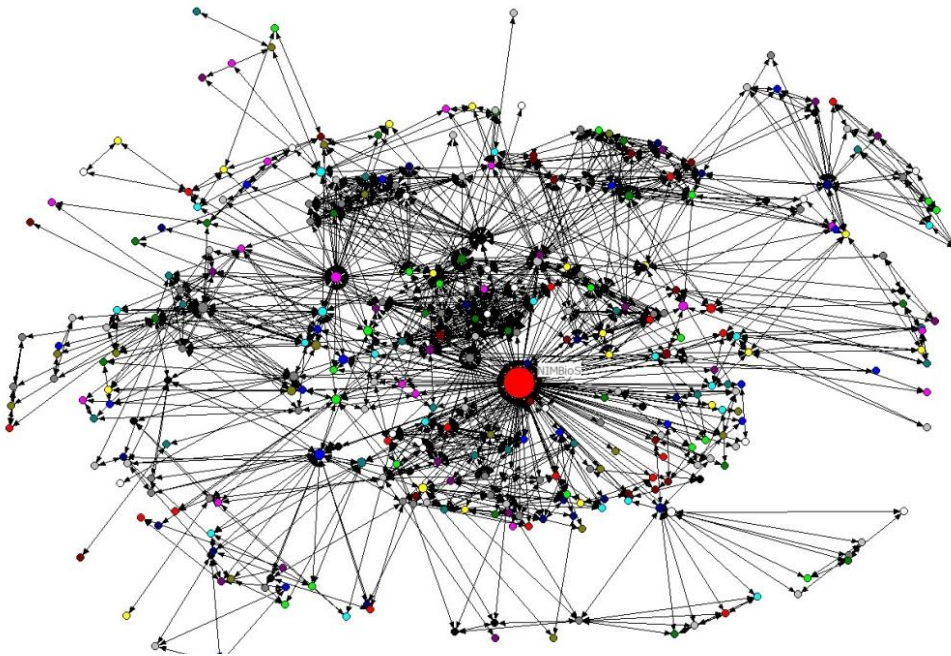
Figure 39. International collaboration of NIMBioS publications



Coauthors of NIMBioS publications through the current reporting period came from 350 unique institutions. The average number of institutions represented per paper was 2.74, with a range of 1-21 institutions per paper (Figure 40).

Node radius represents the log scaled number of NIMBioS-affiliated papers from each institution, and line size represents the number of collaborations among institutions on these papers. NIMBioS is at the center of the graph.

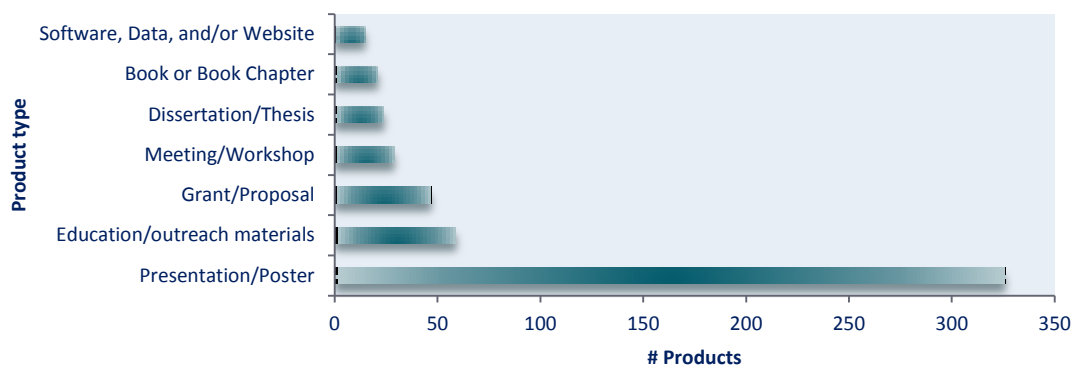
Figure 40. Cross-institutional collaboration of NIMBioS publications



OTHER SCHOLARLY PRODUCTS

In addition to journal publications, participants report other types of products that have resulted from their activities at NIMBioS. Figure 41 summarizes these types of products for the six-year period.

Figure 41. Non-journal publication products arising from NIMBioS events



Addendum to NIMBioS Annual Report

Sep 1, 2013 -Aug 31, 2014

Y6-3. Participant List for NIMBioS Events and Activities

Advisory Board Event	Start Date	End Date
BoA Meeting Oct. 2013	16-Oct-13	17-Oct-13

Sarah Brosnan (Biological/Biomedical Sciences)
 Ernest Brothers (Biological/Biomedical Sciences)
 Alison Buchan (Biological/Biomedical Sciences)
 Erika Camacho (Mathematics)
 Troy Day (Mathematics)
 Eli Fenichel (Agricultural Sciences/Natural Resources)
 Sergey Gavrilets (Biological/Biomedical Sciences)
 Louis (Lou) Gross (Biological/Biomedical Sciences)
 Julius Jackson (Biological/Biomedical Sciences)
 Kristin Jenkins (Education)
 Colleen Jonsson (Biological/Biomedical Sciences)
 Laura Kubatko (Mathematics)
 Suzanne Lenhart (Mathematics)
 Raymond Mejia (Other Professional Field)
 Carl (John) Panetta (Biological/Biomedical Sciences)
 Lea Popovich (Mathematics)
 Raina (Rayna) Robeva (Mathematics)
 Lisa Sattenspiel (Social Sciences)
 Tamar Schlick (Mathematics)
 Marcy Uyenoyama (Biological/Biomedical Sciences)
 Colleen Webb (Biological/Biomedical Sciences)
 Chris Welsh (Biological/Biomedical Sciences)
 Jianhong Wu (Mathematics)
 Nancy Zhang (Mathematics)

Advisory Board Event	Start Date	End Date
BoA Virtual Meeting January 2014	28-Jan-14	28-Jan-14

Paul Armsworth (Biological/Biomedical Sciences)
 Sarah Brosnan (Biological/Biomedical Sciences)
 Ernest Brothers (Biological/Biomedical Sciences)
 Alison Buchan (Biological/Biomedical Sciences)
 Erika Camacho (Mathematics)
 Troy Day (Mathematics)
 Eli Fenichel (Agricultural Sciences/Natural Resources)
 Sergey Gavrilets (Biological/Biomedical Sciences)
 Louis (Lou) Gross (Biological/Biomedical Sciences)
 Julius Jackson (Biological/Biomedical Sciences)
 Kristin Jenkins (Education)
 Colleen Jonsson (Biological/Biomedical Sciences)

Laura Kubatko (Mathematics)
 Suzanne Lenhart (Mathematics)
 Raymond Mejia (Other Professional Field)
 Carl (John) Panetta (Biological/Biomedical Sciences)
 Raina (Rayna) Robeva (Mathematics)
 Lisa Sattenspiel (Social Sciences)
 Colleen Webb (Biological/Biomedical Sciences)
 Chris Welsh (Biological/Biomedical Sciences)
 Jianhong Wu (Mathematics)
 Nancy Zhang (Mathematics)

Education/Outreach Event	Start Date	End Date
NIMBioS Seminar Series		

Jonathan (Jon) Forde (Mathematics)	10-Sep-13	10-Sep-13
Shi Chen (Biological/Biomedical Sciences)	24-Sep-13	24-Sep-13
Matthew (Matt) Zimmerman (Social Sciences)	08-Oct-13	08-Oct-13
Nicholas (Nick) Matzke (Biological/Biomedical Sciences)	29-Oct-13	29-Oct-13
Clemente Aguilar (Biological/Biomedical Sciences)	05-Nov-13	05-Nov-13
Roger Nisbet (Biological/Biomedical Sciences)	19-Nov-13	19-Nov-13
Sean Hoban (Biological/Biomedical Sciences)	14-Jan-14	14-Jan-14
Thomas (Tom) Hallam (Biological/Biomedical Sciences)	30-Jan-14	30-Jan-14
Kay Holekamp (Biological/Biomedical Sciences)	18-Feb-14	18-Feb-14
Virginia Dale (Biological/Biomedical Sciences)	25-Feb-14	25-Feb-14
Nicole Mideo (Biological/Biomedical Sciences)	27-Feb-14	27-Feb-14
Eugene Koonin (Biological/Biomedical Sciences)	25-Mar-14	25-Mar-14

Education/Outreach Event	Start Date	End Date
Undergraduate Research Conference (URC) 2013	16-Nov-13	17-Nov-13

Donald Adongo (Mathematics)		
Folashade Augusto (Mathematics)		
Laura Asaro (Mathematics)		
Tri Sri Noor Asih (Mathematics)		
Dorjsuren Badamdorj (Mathematics)		
Kristen Bales (Mathematics)		
Kathryn Barry (Biological/Biomedical Sciences)		
Thomas Bate (Biological/Biomedical Sciences)		
Conrad Beckmann (Biological/Biomedical Sciences)		
Nicole Bender (Mathematics)		
Barb Bennie (Mathematics)		
John Berges (Ocean/Marine Sciences)		
Ghan Bhatt (Mathematics)		

Zeyad Boodoo (Mathematics)
Christian Brown (Biological/Biomedical Sciences)
Brianna Burlock (Biological/Biomedical Sciences)
Wendy Caldwell (Mathematics)
Edwin Carbajal (Biological/Biomedical Sciences)
Ashley Carter (Biological/Biomedical Sciences)
Matthew Cattivera (Not reported)
Sami Cheong (Mathematics)
Jackie Chism (Mathematics)
Ariel Cintron-Arias (Biological/Biomedical Sciences)
Nathaniel Clause (Mathematics)
Yesenia Cruz Pascual (Not reported)
Clark Cunningham (Not reported)
Victoria Darling (Biological/Biomedical Sciences)
Dominick DeFelice (Biological/Biomedical Sciences)
Rudy Dehaney (Mathematics)
Ryan DeMuse (Mathematics)
Philip Dishuck (Not reported)
Ryan Doherty (Biological/Biomedical Sciences)
Cecilia Dorado (Mathematics)
Natalya Dungee (Not reported)
Kayla Echols (Not reported)
Jordan Edgren (Not reported)
Kate Ehnis (Mathematics)
Andrea Ekey (Mathematics)
Samuel Estes (Mathematics)
Jonathan (Jon) Forde (Mathematics)
Jamel Foster (Engineering)
William Frazier (Not reported)
Benjamin Freedman (Mathematics)
Samuel Frickle (Biological/Biomedical Sciences)
Tyler George (Mathematics)
Candace Ghent (Mathematics)
Cheyenne Gies (Mathematics)
Deborah Goddard (Biological/Biomedical Sciences)
Joana Gonzalez (Mathematics)
John Gowins (Mathematics)
Ava Greenwood (Biological/Biomedical Sciences)
Harvir Grewal (Biological/Biomedical Sciences)
Louis (Lou) Gross (Biological/Biomedical Sciences)
Pamela Guerron (Not reported)
Anthony Gusman (Mathematics)
Sarah Hagans (Health Sciences)

Brittany Hale (Mathematics)
Seth Haney (Mathematics)
Dylan Hardwick (Chemistry)
Roger Haro (Agricultural Sciences/Natural Resources)
Bradley Hart (Mathematics)
Liv Heidenreich (Chemistry)
Zachary Helbert (Mathematics)
Miranda Henderson (Mathematics)
Akira Horiguchi (Mathematics)
Sanjukta Hota (Mathematics)
Jennifer Houser (Mathematics)
Brooke Hudgens (Biological/Biomedical Sciences)
Shante Hutchinson (Biological/Biomedical Sciences)
Mackenzie Hutton (Health Sciences)
Daniel Igel (Not reported)
Abigail Jackson (Biological/Biomedical Sciences)
Brittany Jackson (Mathematics)
D'von Jackson (Not reported)
Elliott Jackson (Not reported)
Matthew Jastrebski (Not reported)
Jocelyn Keung (Mathematics)
Maryam Khan (Mathematics)
Kristen Knight (Not reported)
Jeffrey Kopsick (Biological/Biomedical Sciences)
Sarah Kramer (Biological/Biomedical Sciences)
Nitin Krishna (Mathematics)
Jacob Lambert (Mathematics)
Matthew Le (Biological/Biomedical Sciences)
Suzanne Lenhart (Mathematics)
Ethan Levien (Mathematics)
Aihua Li (Mathematics)
Andrew (Sandy) Liebhold (Biological/Biomedical Sciences)
Weifan Liu (Mathematics)
Thomas Madsen (Mathematics)
Benjamin Manifold (Mathematics)
Christian Mason (Biological/Biomedical Sciences)
Marina Massaro (Mathematics)
Chris McGraw (Mathematics)
Christopher Mecklin (Mathematics)
Paige Miller (Mathematics)
Thomas Moore (Biological/Biomedical Sciences)
Nicholas Myers (Mathematics)
Saba Nafees (Mathematics)

Shayla Nolen (Not reported)
Christopher Oballe (Mathematics)
Omomayowa Olawoyin (Mathematics)
Jessica Ortega (Mathematics)
Jenna Palmer (Mathematics)
Jiyoon Park (Biological/Biomedical Sciences)
James Peirce (Mathematics)
Hannah Pennington (Health Sciences)
Rebecca Peot (Not reported)
Stacy Philip (Mathematics)
Joseph Phillips (Biological/Biomedical Sciences)
Joan Ponce (Mathematics)
Tyler Poppenwimer (Biological/Biomedical Sciences)
Hannah Lily Postman (Mathematics)
Hong Qin (Biological/Biomedical Sciences)
Alex John Quijano (Computer & Information Sciences)
Carolynn Rafa Todd (Biological/Biomedical Sciences)
Tyler Raphael (Not reported)
Janeth Rodriguez (Biological/Biomedical Sciences)
Caitlin Ross (Computer & Information Sciences)
Pam Ryan (Mathematics)
Jan Rychtar (Mathematics)
Gregory Sandland (Biological/Biomedical Sciences)
Kathryn Schaber (Mathematics)
Richard Schugart (Mathematics)
Travis Sellers (Not reported)
Sunil Shahi (Mathematics)
Shan Shan (Not reported)
Kimberly Siegler (Mathematics)
Maria Siopsis (Mathematics)
Michael Stevens (Not reported)
Will Stevens (Not reported)
Robert Stolz (Mathematics)
Kelly Sturner (Agricultural Sciences/Natural Resources)
Germaine Suiza (Biological/Biomedical Sciences)
Hasan Sumdani (Biological/Biomedical Sciences)
David Sykes (Mathematics)
Octavious Talbot (Mathematics)
Javier Tapia (Mathematics)
Michelle Thomas (Chemistry)
Michael Thomas (Mathematics)
Andrea Thompson (Biological/Biomedical Sciences)
Aileen Toja (Biological/Biomedical Sciences)

Martin Tran (Biological/Biomedical Sciences)
 Audrey Utkus (Mathematics)
 Kiersten Utsey (Mathematics)
 Lucas van der Merwe (Mathematics)
 Mariel Vazquez (Mathematics)
 Talitha Washington (Mathematics)
 Andrew Watson (Not reported)
 Hannah Weber (Mathematics)
 Alicia Weeks (Not reported)
 Jake Weissman (Mathematics)
 Leighton Wilson (Mathematics)
 Andrea Wurm (Biological/Biomedical Sciences)
 Sara Yazdi (Mathematics)
 Jason Zellmer (Mathematics)
 Emily Ziegler (Not reported)
 Nejc Zupan (Mathematics)

Education/Outreach Event	Start Date	End Date
Graduate Research Assistant	01-Aug-13	30-Apr-14

Jeremy Auerbach (Mathematics)
 Mark (Blaise) DeCotes (Computer & Information Sciences)
 Pelagie Favi (Engineering)
 Michael Kelly (Mathematics)
 John Martin (Computer & Information Sciences)
 Austin Milt (Biological/Biomedical Sciences)

Education/Outreach Event	Start Date	End Date
Graduate Student Fellow		

Stephen (Gang) Wu (Engineering)	31-Oct-13	12-Dec-13
Luis Jover (Biological/Biomedical Sciences)	23-Mar-14	29-Mar-14

Education/Outreach Event	Start Date	End Date
Visiting Scholar		

Anupam Priyadarshi (Mathematics)	01-Feb-14	31-Jul-14
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Postdoctoral Fellowship Event	Start Date	End Date
Postdoctoral Fellow		

Calistus Ngonghala (Mathematics)	01-Aug-11	07-Oct-13
Daniel (Dan) Ryan (Mathematics)	01-Aug-11	

Gesham Magombedze (Mathematics)	01-Jan-12	
Jiang Jiang (Biological/Biomedical Sciences)	30-Jul-12	
Arik Kershenbaum (Biological/Biomedical Sciences)	06-Aug-12	
Keenan Mack (Biological/Biomedical Sciences)	15-Aug-12	
Julia Earl (Biological/Biomedical Sciences)	27-Aug-12	
Jeremy Beaulieu (Biological/Biomedical Sciences)	04-Sep-12	
Ryan Martin (Biological/Biomedical Sciences)	10-Sep-12	02-Dec-13
Christopher (Chris) Remien (Mathematics)	17-Sep-12	
Amiyaal Ilany (Biological/Biomedical Sciences)	08-Oct-12	
Anna (Michelle) Lawing (Biological/Biomedical Sciences)	03-Dec-12	31-Dec-13
Clemente Aguilar (Biological/Biomedical Sciences)	08-Jul-13	
Nicholas (Nick) Matzke (Biological/Biomedical Sciences)	09-Sep-13	
Matthew (Matt) Zimmerman (Social Sciences)	23-Sep-13	
Sean Hoban (Biological/Biomedical Sciences)	30-Sep-13	

Sabbatical Fellowship Event

Start Date

End Date

Sabbatical Research

Kathleen (Kathy) Donohue (Biological/Biomedical Sciences)	02-Sep-13	27-Nov-13
Allan Strand (Biological/Biomedical Sciences)	02-Sep-13	15-Dec-13
Jonathan (Jon) Forde (Mathematics)	02-Sep-13	30-Apr-14
Yang Cao (Computer & Information Sciences)	03-Feb-14	30-May-14

Short-term Visitor Event

Start Date

End Date

STV Research

Jemal Mohammed-Awel (Mathematics)	20-Sep-13	22-Sep-13
Ruijun Zhao (Mathematics)	20-Sep-13	22-Sep-13
Aaron Miller (Biological/Biomedical Sciences)	21-Oct-13	25-Oct-13
Megan Powell (Mathematics)	23-Oct-13	25-Oct-13
Angela Reynolds (Mathematics)	23-Oct-13	25-Oct-13
Sarah Taft (Biological/Biomedical Sciences)	23-Oct-13	25-Oct-13
Watal Iwasaki (Biological/Biomedical Sciences)	03-Nov-13	08-Nov-13
Masakado Kawata (Biological/Biomedical Sciences)	03-Nov-13	08-Nov-13
Brian Beckage (Biological/Biomedical Sciences)	07-Nov-13	08-Nov-13
Sara Metcalf (Social Sciences)	07-Nov-13	08-Nov-13
Roger Nisbet (Biological/Biomedical Sciences)	18-Nov-13	21-Nov-13
Ivan Erill (Biological/Biomedical Sciences)	21-Nov-13	22-Nov-13
Patrick O'Neill (Biological/Biomedical Sciences)	21-Nov-13	26-Nov-13
Sandy Kawano (Biological/Biomedical Sciences)	08-Dec-13	14-Dec-13
Sonia Altizer (Biological/Biomedical Sciences)	09-Dec-13	13-Dec-13
Richard Hall (Biological/Biomedical Sciences)	09-Dec-13	13-Dec-13
Ryan Norris (Biological/Biomedical Sciences)	09-Dec-13	13-Dec-13

Carline (Caz) Taylor (Biological/Biomedical Sciences)	09-Dec-13	13-Dec-13
Ariel Cintron-Arias (Biological/Biomedical Sciences)	16-Dec-13	20-Dec-13
Gabriela Hamerlinck (Biological/Biomedical Sciences)	14-Jan-14	19-Jan-14
Nathan Lemoine (Biological/Biomedical Sciences)	14-Jan-14	19-Jan-14
Sivan Leviyang (Mathematics)	19-Jan-14	25-Jan-14
Ariel Cintron-Arias (Biological/Biomedical Sciences)	30-Jan-14	01-Feb-14
Douglas Begg (Agricultural Sciences/Natural Resources)	01-Feb-14	04-Feb-14
Yaniv Brandvain (Biological/Biomedical Sciences)	05-Feb-14	07-Feb-14
Roger Cousens (Biological/Biomedical Sciences)	05-Feb-14	07-Feb-14
Kathleen (Kathy) Donohue (Biological/Biomedical Sciences)	05-Feb-14	07-Feb-14
Allan Strand (Biological/Biomedical Sciences)	05-Feb-14	07-Feb-14
Charles Willis (Biological/Biomedical Sciences)	05-Feb-14	07-Feb-14
Kay Holekamp (Biological/Biomedical Sciences)	17-Feb-14	21-Feb-14
Nicole Mideo (Biological/Biomedical Sciences)	26-Feb-14	01-Mar-14
Carolyn Ayers (Biological/Biomedical Sciences)	03-Mar-14	05-Mar-14
Heather Briggs (Biological/Biomedical Sciences)	03-Mar-14	05-Mar-14
Berry Brosi (Biological/Biomedical Sciences)	03-Mar-14	05-Mar-14
Elise Filotas (Biological/Biomedical Sciences)	03-Mar-14	06-Mar-14
Patrick James (Biological/Biomedical Sciences)	03-Mar-14	06-Mar-14
Vlastimil Krivan (Mathematics)	03-Mar-14	06-Mar-14
Eugene Koonin (Biological/Biomedical Sciences)	25-Mar-14	27-Mar-14

Investigative Workshop Event

Analyzing Animal Vocal Sequences WS

Start Date	End Date
21-Oct-13	23-Oct-13

Caglar Akcay (Biological/Biomedical Sciences)
Gregory Backus (Biological/Biomedical Sciences)
Mark Bee (Biological/Biomedical Sciences)
Daniel Blumstein (Biological/Biomedical Sciences)
Kirsten Bohn (Biological/Biomedical Sciences)
Yan Cao (Mathematics)
Gerald Carter (Biological/Biomedical Sciences)
Cristiane Casar (Not reported)
Michael Coen (Computer & Information Sciences)
Stacy DeRuiter (Biological/Biomedical Sciences)
Laurance Doyle (Physics)
Shimon Edelman (Computer & Information Sciences)
Ramon Ferrer-i-Cancho (Computer & Information Sciences)
Todd Freeberg (Psychology)
Ellen Garland (Biological/Biomedical Sciences)
Morgan Gustison (Biological/Biomedical Sciences)
Heidi Harley (Social Sciences)
Chloe Huetz (Biological/Biomedical Sciences)

Melissa Hughes (Biological/Biomedical Sciences)
 Julia Hyland Bruno (Biological/Biomedical Sciences)
 Amiyaal Ilany (Biological/Biomedical Sciences)
 Vincent Janik (Biological/Biomedical Sciences)
 Dezhe Jin (Physics)
 Michael Johnson (Engineering)
 Chenghui Ju (Biological/Biomedical Sciences)
 Jeremy Karnowski (Social Sciences)
 Sasahara Kazutoshi (Computer & Information Sciences)
 Arik Kershenbaum (Biological/Biomedical Sciences)
 Bernard Lohr (Biological/Biomedical Sciences)
 Marta Manser (Biological/Biomedical Sciences)
 Brenda McCowan (Health Sciences)
 Eduardo Mercado (Biological/Biomedical Sciences)
 Peter Narins (Biological/Biomedical Sciences)
 Alex Piel (Social Sciences)
 Megan Rice (Social Sciences)
 Marie Roch (Computer & Information Sciences)
 Roberta Salmi (Social Sciences)
 Sayigh Laela (Biological/Biomedical Sciences)
 Yu Shiu (Computer & Information Sciences)
 Charles Taylor (Biological/Biomedical Sciences)
 Edgar Vallejo (Computer & Information Sciences)
 Sara Waller (Humanities)
 Veronica Zamora Gutierrez (Biological/Biomedical Sciences)

Investigative Workshop Event	Start Date	End Date
Insect Pest Resistance Evolution WS	14-Nov-13	15-Nov-13

Nina Alphey (Biological/Biomedical Sciences)
 Ruisheng An (Biological/Biomedical Sciences)
 Michael Caprio (Agricultural Sciences/Natural Resources)
 Yolanda Chen (Biological/Biomedical Sciences)
 Haridas Chirakkal (Biological/Biomedical Sciences)
 David Crowder (Biological/Biomedical Sciences)
 Nicholas Friedenbergl (Biological/Biomedical Sciences)
 Aaron Gassmann (Agricultural Sciences/Natural Resources)
 Luis Gordillo (Agricultural Sciences/Natural Resources)
 Maya Groner (Biological/Biomedical Sciences)
 John Fredy Hernandez Nopsa (Agricultural Sciences/Natural Resources)
 Jessica Hua (Biological/Biomedical Sciences)
 Neelendra Joshi (Biological/Biomedical Sciences)
 Juan Luis Jurat-Fuentes (Agricultural Sciences/Natural Resources)

Miles Lepping (Agricultural Sciences/Natural Resources)
 Michael McCarville (Biological/Biomedical Sciences)
 Emily Mohl (Biological/Biomedical Sciences)
 David Onstad (Biological/Biomedical Sciences)
 Isaac Oyediran (Agricultural Sciences/Natural Resources)
 James Powell (Mathematics)
 Ben Raymond (Biological/Biomedical Sciences)
 Kevin Shoemaker (Biological/Biomedical Sciences)
 Joseph Spencer (Biological/Biomedical Sciences)
 Nicholas Storer (Agricultural Sciences/Natural Resources)
 Brigitte Tenhumberg (Biological/Biomedical Sciences)
 Khai (Jeremy) Tran (Biological/Biomedical Sciences)
 Ana Velez (Agricultural Sciences/Natural Resources)
 Xujing Wang (Biological/Biomedical Sciences)
 Alan Willse (Mathematics)

Investigative Workshop Event

Start Date

End Date

Animal Social Networks WS

06-Mar-14

08-Mar-14

Caglar Akcay (Biological/Biomedical Sciences)
 Erol Akcay (Biological/Biomedical Sciences)
 Dieter Armbruster (Mathematics)
 Yael Artzy-Randrup (Biological/Biomedical Sciences)
 Shweta Bansal (Biological/Biomedical Sciences)
 Adi Barocas (Biological/Biomedical Sciences)
 Tanya Berger-Wolf (Computer & Information Sciences)
 Erika Camacho (Mathematics)
 Yang Cao (Computer & Information Sciences)
 Shi Chen (Biological/Biomedical Sciences)
 Margaret Crofoot (Biological/Biomedical Sciences)
 Darren Croft (Biological/Biomedical Sciences)
 Darren Croft (Biological/Biomedical Sciences)
 Janis Dickinson (Biological/Biomedical Sciences)
 Andrew Edelman (Biological/Biomedical Sciences)
 Damien Farine (Biological/Biomedical Sciences)
 Katherine Faust (Social Sciences)
 Nina Fefferman (Biological/Biomedical Sciences)
 Jennifer Fewell (Biological/Biomedical Sciences)
 Steffen Foerster (Biological/Biomedical Sciences)
 Bailey Fosdick (Mathematics)
 Mathias Franz (Biological/Biomedical Sciences)
 Eli Geffen (Biological/Biomedical Sciences)
 Stephanie Godfrey (Biological/Biomedical Sciences)

Allison Hilbun (Biological/Biomedical Sciences)
 Elizabeth Hobson (Biological/Biomedical Sciences)
 Amiyaal Ilany (Biological/Biomedical Sciences)
 Richard James (Biological/Biomedical Sciences)
 Ferenc Jordan (Biological/Biomedical Sciences)
 Arik Kershenbaum (Biological/Biomedical Sciences)
 Jessica Kropczynski (Computer & Information Sciences)
 Anna (Michelle) Lawing (Biological/Biomedical Sciences)
 Charlotte Lee (Biological/Biomedical Sciences)
 Stephan Leu (Biological/Biomedical Sciences)
 Ryan Martin (Biological/Biomedical Sciences)
 David McDonald (Biological/Biomedical Sciences)
 Ann-Elizabeth Nash (Biological/Biomedical Sciences)
 David Pappano (Biological/Biomedical Sciences)
 Noa Pinter-Wollman (Biological/Biomedical Sciences)
 Daizaburo Shizuka (Biological/Biomedical Sciences)
 Jennifer Smith (Biological/Biomedical Sciences)
 Ariana Strandburg-Peshkin (Biological/Biomedical Sciences)
 Kelly Sturner (Agricultural Sciences/Natural Resources)
 Colby Tanner (Biological/Biomedical Sciences)
 Mark Tranmer (Social Sciences)
 Jeremy Van Cleve (Biological/Biomedical Sciences)
 Jorge Alberto Vazquez Diosdado (Mathematics)
 Chris Welsh (Biological/Biomedical Sciences)
 Tina Wey (Biological/Biomedical Sciences)
 Hal Whitehead (Ocean/Marine Sciences)
 Senay Yitbarek (Biological/Biomedical Sciences)
 Matthew (Matt) Zimmerman (Social Sciences)

Investigative Workshop Event	Start Date	End Date
Interface Disease Models WS	11-Mar-14	13-Mar-14

Clemente Aguilar (Biological/Biomedical Sciences)
 Faruku Bande (Health Sciences)
 John Baroch (Biological/Biomedical Sciences)
 Michael Buhnerkempe (Biological/Biomedical Sciences)
 Mary Conner (Agricultural Sciences/Natural Resources)
 Meggan Craft (Biological/Biomedical Sciences)
 Paul Cross (Biological/Biomedical Sciences)
 Wandu Ding (Mathematics)
 Julia Earl (Biological/Biomedical Sciences)
 Shigetoshi Eda (Agricultural Sciences/Natural Resources)
 Eva Enns (Health Sciences)

Kimberly Forde-Folle (Agricultural Sciences/Natural Resources)
 Graeme Garner (Agricultural Sciences/Natural Resources)
 Christian Gortazar (Agricultural Sciences/Natural Resources)
 Daniel Grear (Agricultural Sciences/Natural Resources)
 Hayriye Gulbudak (Mathematics)
 Murali Haran (Mathematics)
 Lindsey Holmstrom (Health Sciences)
 Mevin Hooten (Mathematics)
 Kathryn Huyvaert (Biological/Biomedical Sciences)
 Claire Jardine (Biological/Biomedical Sciences)
 Damien Joly (Biological/Biomedical Sciences)
 Maxwell Joseph (Biological/Biomedical Sciences)
 Rowland Kao (Biological/Biomedical Sciences)
 Suzanne Lenhart (Mathematics)
 Giovanni Lo Iacono (Physics)
 Edward Lungu (Mathematics)
 Kezia Manlove (Biological/Biomedical Sciences)
 Michael Martin (Health Sciences)
 Ryan Miller (Agricultural Sciences/Natural Resources)
 Anuj Mubayi (Mathematics)
 Sergio Munoz (Computer & Information Sciences)
 Pauline Nol (Other Professional Field)
 Mayra Nunez Lopez (Mathematics)
 Daniel O'Brien (Agricultural Sciences/Natural Resources)
 Kathy Orloski (Health Sciences)
 Kelly Patyk (Health Sciences)
 Kerri Pedersen (Agricultural Sciences/Natural Resources)
 Barbara Porter-Spalding (Health Sciences)
 Alison Power (Biological/Biomedical Sciences)
 Stacie Robinson (Biological/Biomedical Sciences)
 Robin Russell (Agricultural Sciences/Natural Resources)
 Michael Sanderson (Health Sciences)
 Brant Schumaker (Health Sciences)
 Josephine Walker (Biological/Biomedical Sciences)
 Daniel Walsh (Agricultural Sciences/Natural Resources)
 Chris Welsh (Biological/Biomedical Sciences)

Investigative Workshop Event

Start Date

End Date

Vectored Plant Viruses WS

17-Mar-14

19-Mar-14

Gordon Akudibillah (Biological/Biomedical Sciences)
 Linda Allen (Mathematics)
 G. Kai Blaisdell (Biological/Biomedical Sciences)
 Vrushali Bokil (Mathematics)

Elizabeth Borer (Biological/Biomedical Sciences)
 Cheryl Briggs (Not reported)
 David Crowder (Biological/Biomedical Sciences)
 Karen Garrett (Agricultural Sciences/Natural Resources)
 Kevin Gross (Biological/Biomedical Sciences)
 Louis (Lou) Gross (Biological/Biomedical Sciences)
 Mohammad (Reza) Hajimorad (Agricultural Sciences/Natural Resources)
 Frederic Hamelin (Biological/Biomedical Sciences)
 Marshall Hampton (Biological/Biomedical Sciences)
 Mary Hebert (Mathematics)
 Parvize Hosseini (Biological/Biomedical Sciences)
 Michael John (Mike) Jeger (Agricultural Sciences/Natural Resources)
 Michele Joyner (Mathematics)
 Yang Kuang (Mathematics)
 Cristina Lanzas (Health Sciences)
 Jo Ann Lee (Mathematics)
 Suzanne Lenhart (Mathematics)
 Chelsea Lewis (Mathematics)
 Jing Li (Mathematics)
 Carrie Manore (Mathematics)
 Katherine Marchetto (Biological/Biomedical Sciences)
 May Anne Mata (Mathematics)
 Jan Medlock (Health Sciences)
 Anuj Mubayi (Mathematics)
 Alex Perkins (Biological/Biomedical Sciences)
 Alison Power (Biological/Biomedical Sciences)
 Holly Prendeville (Biological/Biomedical Sciences)
 Anupam Priyadarshi (Mathematics)
 Noam Ross (Biological/Biomedical Sciences)
 Rakefet Sharon (Agricultural Sciences/Natural Resources)
 Allison Shaw (Biological/Biomedical Sciences)
 Sara Thomas (Agricultural Sciences/Natural Resources)
 Chris Welsh (Biological/Biomedical Sciences)

Working Group	Start Date	End Date
Biotic Interactions WG M2	23-Sep-13	26-Sep-13
Frederick (Fred) Adler (Biological/Biomedical Sciences)		
Guillaume Blanchet (Biological/Biomedical Sciences)		
Michael Bode (Mathematics)		
Lauren Buckley (Biological/Biomedical Sciences)		
George (Chris) Cosner (Mathematics)		
Jane Elith (Biological/Biomedical Sciences)		

Janet Franklin (Biological/Biomedical Sciences)
 William (Will) Godsoe (Biological/Biomedical Sciences)
 Robert Holt (Biological/Biomedical Sciences)
 Henriette (Yetta) Jager (Agricultural Sciences/Natural Resources)
 Jill Jankowski (Biological/Biomedical Sciences)
 Bruce Kendall (Biological/Biomedical Sciences)
 Anthony (Tony) King (Biological/Biomedical Sciences)
 Otso Ovaskainen (Biological/Biomedical Sciences)
 Robin Snyder (Biological/Biomedical Sciences)

Working Group	Start Date	End Date
Play, Evolution, and Sociality WG M3	30-Oct-13	01-Nov-13
Jeremy Auerbach (Mathematics)		
Gordon Burghardt (Biological/Biomedical Sciences)		
Giada Cordonì (Biological/Biomedical Sciences)		
Hillary Fouts (Social Sciences)		
Kerrie Graham (Social Sciences)		
Peter Hammerstein (Biological/Biomedical Sciences)		
Marc Mangel (Biological/Biomedical Sciences)		
Brian O'Meara (Biological/Biomedical Sciences)		
Elisabetta Palagi (Biological/Biomedical Sciences)		
Sergio Pellis (Biological/Biomedical Sciences)		
Milada Rehakova (Biological/Biomedical Sciences)		
Jeffrey Schank (Social Sciences)		
Barbara Smuts (Biological/Biomedical Sciences)		

Working Group	Start Date	End Date
Plant-Soil Feedback Theory WG M1	31-Oct-13	02-Nov-13
Karen Abbott (Biological/Biomedical Sciences)		
Mara Baudena (Biological/Biomedical Sciences)		
Jonathan Bauer (Biological/Biomedical Sciences)		
James (Jim) Bever (Biological/Biomedical Sciences)		
Liza Comita (Biological/Biomedical Sciences)		
Kerri Crawford (Biological/Biomedical Sciences)		
Maarten Eppinga (Agricultural Sciences/Natural Resources)		
Jiang Jiang (Biological/Biomedical Sciences)		
Daniel (Dan) Johnson (Biological/Biomedical Sciences)		
Keenan Mack (Biological/Biomedical Sciences)		
Scott Mangan (Biological/Biomedical Sciences)		
Allan Strand (Biological/Biomedical Sciences)		
Katherine Suding (Biological/Biomedical Sciences)		
James (Jim) Umbanhowar (Biological/Biomedical Sciences)		

Working Group	Start Date	End Date
Hierarchy and Leadership WG M2	18-Nov-13	20-Nov-13
Jeremy Auerbach (Mathematics)		
Monique Borgerhoff Mulder (Social Sciences)		
Claire El Mouden (Biological/Biomedical Sciences)		
Sergey Gavrilets (Biological/Biomedical Sciences)		
Christoph Hauert (Physics)		
Paul Hooper (Social Sciences)		
Daniel Nettle (Biological/Biomedical Sciences)		
Susan Perry (Social Sciences)		
Anne Pusey (Biological/Biomedical Sciences)		
Eric Smith (Social Sciences)		
Jennifer Smith (Biological/Biomedical Sciences)		
Geoff Wild (Mathematics)		
Matthew (Matt) Zimmerman (Social Sciences)		

Working Group	Start Date	End Date
Climate Change and Vector-borne Diseases WG M1	03-Dec-13	05-Dec-13
Folashade Agosto (Mathematics)		
Katherine (Kate) Evans (Astronomy/Atmospheric Sciences/Meteorology)		
Nina Fefferman (Biological/Biomedical Sciences)		
Holly Gaff (Mathematics)		
Abba Gumel (Mathematics)		
Shannon LaDeau (Biological/Biomedical Sciences)		
Suzanne Lenhart (Mathematics)		
Ronald Mickens (Mathematics)		
Elena Naumova (Health Sciences)		
Richard Ostfeld (Biological/Biomedical Sciences)		
Paul Parham (Biological/Biomedical Sciences)		
Paul Ready (Biological/Biomedical Sciences)		
Matthew Thomas (Biological/Biomedical Sciences)		
Jorge Velasco-Hernandez (Biological/Biomedical Sciences)	03-Dec-13	05-Dec-13

Working Group	Start Date	End Date
Within-host Modeling of Mycobacterium avium subsp. paratuberculosis (MAP) Infections WG M3	09-Dec-13	11-Dec-13
Shigetoshi Eda (Agricultural Sciences/Natural Resources)		
Vitaly Ganusov (Health Sciences)		
Yrjo Grohn (Health Sciences)		
Dieudonne (Don) Klinkenberg (Health Sciences)		

Ad Koets (Biological/Biomedical Sciences)
 Suzanne Lenhart (Mathematics)
 Yoram Louzoun (Mathematics)
 Gesham Magombedze (Mathematics)
 Maia Martcheva (Mathematics)
 Rebecca Mitchell (Biological/Biomedical Sciences)
 Eiichi Momotani (Agricultural Sciences/Natural Resources)
 Ynte Schukken (Health Sciences)

Working Group	Start Date	End Date
Ocean Viral Dynamics WG M4	07-Jan-14	09-Jan-14
Lydia Bourouiba (Mathematics)		
Alison Buchan (Biological/Biomedical Sciences)		
Maureen Coleman (Biological/Biomedical Sciences)		
Michael (Mick) Follows (Ocean/Marine Sciences)		
Jed Fuhrman (Ocean/Marine Sciences)		
Mathias Middelboe (Ocean/Marine Sciences)		
Derek Sonderegger (Mathematics)		
Charles (Charlie) Stock (Ocean/Marine Sciences)		
Frede (Tron) Thingstad (Ocean/Marine Sciences)		
Joshua Weitz (Biological/Biomedical Sciences)		
Steven Wilhelm (Biological/Biomedical Sciences)		
Willie Wilson (Ocean/Marine Sciences)		

Working Group	Start Date	End Date
Human Risk Perception and Climate Change M2	21-Jan-14	23-Jan-14
Brian Beckage (Biological/Biomedical Sciences)		
Nina Fefferman (Biological/Biomedical Sciences)		
Travis Franck (Other Professional Field)		
Louis (Lou) Gross (Biological/Biomedical Sciences)		
Forrest Hoffman (Geological & Earth Sciences)		
Peter Howe (Social Sciences)		
Katherine Lacasse (Social Sciences)		
Sara Metcalf (Social Sciences)		
C. Adam Schlosser (Other Professional Field)		
Jonathan Winter (Astronomy/Atmospheric Sciences/Meteorology)		
Asim Zia (Social Sciences)		

Working Group	Start Date	End Date
Optimal Control for Agent-based Models WG M4	21-Jan-14	24-Jan-14
Gary An (Biological/Biomedical Sciences)		
Scott Christley (Computer & Information Sciences)		
Paula Federico (Mathematics)		

Benjamin (Ben) Fitzpatrick (Mathematics)		
David Gurarie (Mathematics)		
Andrew Kanarek (Biological/Biomedical Sciences)		
Reinhard Laubenbacher (Mathematics)		
Suzanne Lenhart (Mathematics)		
Rachael Miller Neilan (Mathematics)		
Matthew (Matt) Oremland (Mathematics)		
Rene Salinas (Mathematics)		
Jie Xiong (Mathematics)	21-Jan-14	24-Jan-14

Working Group	Start Date	End Date
Evolution of Institutions WG M1	13-Mar-14	14-Mar-14

John Anderies (Social Sciences)
 Jenna Bednar (Social Sciences)
 Sergey Gavrilits (Biological/Biomedical Sciences)
 Russell Golman (Social Sciences)
 Marco Janssen (Social Sciences)
 Sarah Mathew (Social Sciences)
 Peter Richerson (Social Sciences)
 Amanda Robinson (Social Sciences)
 John Roemer (Social Sciences)
 Daria Roithmayr (Social Sciences)
 Peter Turchin (Social Sciences)
 Olivia Woolley (Mathematics)
 Matthew (Matt) Zimmerman (Social Sciences)

Working Group	Start Date	End Date
Nonautonomous Systems and Terrestrial Carbon Cycle WG M2	17-Mar-14	21-Mar-14

Folashade Agosto (Mathematics)
 Benito Chen-Charpentier (Mathematics)
 Alan Hastings (Mathematics)
 Forrest Hoffman (Geological & Earth Sciences)
 Jiang Jiang (Biological/Biomedical Sciences)
 Maria Leite (Mathematics)
 Yiqi Luo (Biological/Biomedical Sciences)
 Martin Rasmussen (Mathematics)
 Matthew Smith (Biological/Biomedical Sciences)
 Katherine Todd-Brown (Geological & Earth Sciences)
 Ying-Ping Wang (Geological & Earth Sciences)
 Ying Wang (Mathematics)

Working Group	Start Date	End Date
Evolution of Sustainability WG M1	26-Mar-14	28-Mar-14
Jacopo Baggio (Social Sciences)		
Jenna Bednar (Social Sciences)		
Sergey Gavrilets (Biological/Biomedical Sciences)		
Vicken Hillis (Biological/Biomedical Sciences)		
Marco Janssen (Social Sciences)		
Cristina Moya (Social Sciences)		
Karthik Panchanathan (Social Sciences)		
Karolina Safarzynska (Social Sciences)		
Paul Smaldino (Biological/Biomedical Sciences)		
Timothy Waring (Social Sciences)		
Matthew (Matt) Zimmerman (Social Sciences)		

Addendum to NIMBioS Annual Report

Sep 1, 2013 -Aug 31, 2014

Y6-4. Description of Activities

DESCRIPTION OF MAJOR ACTIVITIES SEPTEMBER 1, 2013 – AUGUST 31, 2014

During September 1, 2013 through August 31, 2014 reporting period, NIMBioS hosted (or will host this summer) 19 meetings of 14 different Working Groups (one joint working group held an additional meeting offsite), eight Investigative Workshops, and five Tutorials. There were projected to be more than 1050 participants in NIMBioS-hosted activities during this period with 20 Postdoctoral Fellows in residence, five Sabbatical Fellows, and 72 Short-term Visitors.

Demographics data on all participants are available for events from September 1, 2013 through March 31, 2014 and are presented in detail in the NIMBioS Evaluation Report (see section Y6-2 of the attached addendum to this Annual Report) and summarized below. There were 595 participants through March 31, 2014 from 24 countries and 43 U.S. states as well as the District of Columbia representing 259 different institutions. International participants amounted to 15% of all participants. Most participants were college or university faculty (45%), but undergraduates (22%), post-doctoral researchers (14%), and graduate students (10%) accounted for a significant fraction of participants. Across all events the gender ratio was 57% male to 43% female, and minority representation was near 14%. Representation of various minority categories was slightly above levels of minority representation for doctoral recipients in the biological sciences and the mathematical sciences. Short-term Visitors from September 1, 2013 through March 31, 2014 were from 35 different institutions and collaborated with NIMBioS post-doctoral and sabbatical fellows, faculty from four University of Tennessee departments, and 27 researchers external to NIMBioS/Univ. Tennessee.

Below is a short description of each of the Working Groups, Investigative Workshops, and Tutorials held September 1, 2013 – August 31, 2014 as well as a listing of short-term visitors and their projects and Outreach and Education activities. A listing of participants in each activity is provided in Section Y6-3 of this addendum.

WORKING GROUPS

Working group: When are biotic interactions necessary to model species distributions?

http://www.nimbios.org/workinggroups/WG_biotic_interactions

Organizers: William Godsoe (School of Biological Sciences, Univ. of Canterbury, Christchurch, New Zealand) and Robert D. Holt (Univ. of Florida, Gainesville)

This working group seeks to formally link ecological theory on species interactions to empirical species' distribution models as a strong understanding of distributions is essential to making predictions about the distribution of biodiversity and biosecurity threats. It is investigating the relative importance of species interactions and the abiotic environment at large spatial scales, determining whether omitting some species interactions (e.g. predation) produces poorer inferences than omitting other interactions (e.g. competition), and identifying the conditions under which the effects of species interactions must be separated from dispersal and population stochasticity.

Meeting dates: September 2013, May 2014

Working group: Play as a window into cognitive evolution and the rules of sociality

Organizers: Gordon M. Burghardt (Depts. of Psychology and Ecology & Evolutionary Biology, Univ. of Tennessee, Knoxville), Marc Mangel (Dept. of Applied Mathematics and Statistics, Jack Baskin School of Engineering, Univ. of California, Santa Cruz), Elisabetta Palagi (Centro Interdipartimentale Museo di Storia Naturale e del Territorio, Università di Pisa, Pisa, Italy), Sergio M. Pellis (Canadian Centre for Behavioural Neuroscience, Dept. of Neuroscience, Univ. of Lethbridge, Lethbridge, Alberta, Canada)
http://www.nimbios.org/workinggroups/WG_play

The goals of this group were to use mathematical tools to uncover the factors predicting the dynamics, occurrence and trajectory of play in diverse taxa and the ecological, physiological and life history factors that facilitate and maintain it.

Meeting dates: October 2013

Working group: Theory of plant-soil feedback: phenomenological, mechanistic and spatial models

Organizers: James Bever (Biology, Indiana Univ., Bloomington) and Maarten Eppinga (Environmental Science, Copernicus Institute, Utrecht Univ., The Netherlands)
http://www.nimbios.org/workinggroups/WG_plantsoilfb

The framework of plant-soil community feedback has been successful at integrating the effects of soil microbes into plant-plant interactions. A major strength of this framework is that its theoretical predictions are closely connected with the setup of experiments, enabling a direct assessment of how plant-soil interactions scale up to a net feedback effect at the plant community level. However, observations from real ecosystems show that positive and negative plant-soil feedbacks may act concurrently, but current theory has yet to incorporate simultaneous negative and positive feedbacks and their consequences for plant community structure within a spatio-temporal mosaic. The goals of this group are 1) to extend current spatial and mean-field models of plant-soil feedback to more fully incorporate both positive and negative feedbacks between soil micro-organisms and individual plant species and the consequences of these interactions for plant community structure and change over time; and 2) to parameterize and test these models with existing data sets on plant-soil feedback and community structure.

Meeting dates: October-November 2013, April 2014

Working group: Emergence of hierarchy and leadership in mammalian societies

http://www.nimbios.org/workinggroups/WG_leadership

Organizers: Eric Alden Smith (Dept. of Anthropology, Univ. of Washington), Claire El Mouden (Dept. of Zoology, Univ. of Oxford), and Sergey Gavrilets (Depts. of Ecology & Evolutionary Biology and Mathematics, Univ. of Tennessee)

The goal of the working group is to analyze factors favoring the emergence of leadership and hierarchies (and resultant inequality in power, resources, and reproductive outcomes) across a range of animal species and humans. Of particular interest to the working group is the transition from systems where differences in power are based on individual characteristics or kin-based alliances to ones with hierarchical structures and clear leadership roles that extend beyond dyadic dominance relations and kinship ties. The working group effort will involve a combination of advanced modeling (based on game-theoretic, population genetics, behavioral ecology, and agent-based models) and empirical synthesis.

The aim of the working group is to produce a series of high-impact collaborative research papers that would be of interest to researchers in multiple disciplines.

Meeting dates: November 2013, April 2014

Working group: Climate change and vector-borne diseases

http://www.nimbios.org/workinggroups/WG_vbds

Organizers: Nina Fefferman (Ecology, Evolution, and Natural Resources, Rutgers Univ.), Abba Gumel (Mathematics, Univ. of Manitoba), and Richard Ostfeld (Ecology, Cary Institute for Ecosystem Studies)

Vector-borne diseases (VBDs), such as malaria, dengue fever, Lyme disease, West Nile virus, yellow fever and leishmaniasis, continue to pose major public health and socio-economic burdens in many regions of the world, especially the tropical and sub-tropical regions. Climatic factors, such as temperature, humidity, rainfall and vapor pressure, are known to significantly affect the incidence of VBDs. Although mathematical modeling has been extensively used to gain insight into the transmission dynamics of VBDs, the resulting models only rarely incorporate the effect of climate change. The purpose of this Working Group is to bring together a cross-disciplinary team of relevant experts, notably modelers, ecologists, and epidemiologists, to study the impact of climate change on the spread of VBDs. The short-term objective of the Working Group is to develop a new and realistic modeling framework for studying the effects of climate change on the transmission dynamics and control of VBDs. Although the emphasis will be on the two most important VBDs, malaria and dengue fever, the framework will be robust enough to be applicable to other VBDs, such as Lyme disease and West Nile virus. The long-term objective is to contribute to the concerted global effort to find effective ways to combat the spread of VBDs in animal and human populations.

Meeting dates: December 2013, June 2014

Working Group: Within-host modeling of *Mycobacterium avium* subsp. *paratuberculosis* (MAP)

Infections. http://www.nimbios.org/workinggroups/WG_map

Organizers: Ynte H. Schukken (Cornell Univ., Ithaca, NY.), Ad Koets (Utrecht Univ., the Netherlands), Srinand Sreevatsan (Univ. of Minnesota), Maia Martcheva (Univ. of Florida), and Shigetoshi Eda (Univ. of Tennessee)

This group is an outgrowth of the 2011 NIMBioS Investigative Workshop on Modeling Johne's Disease. The objective of the group is to develop a within-host MAP infection model, using observational data on infection patterns and within-host immune response data. The ultimate goal of the model is to provide an understanding of progression of disease in response to MAP infection and to devise better mitigation strategies for Johne's disease.

Meeting date: December 2013, July 2014

Working group: Modeling viral effects on global carbon and biogeochemical cycles

http://www.nimbios.org/workinggroups/WG_ocean_viral_dyn

Organizers: Joshua S. Weitz (School of Biology & Physics, Georgia Inst. of Technology) and Steven W. Wilhelm (Dept. of Microbiology, Univ. of Tennessee)

The goal of this working group is to identify and devise analytical approaches to quantifying viral effects on the biogeochemical dynamics of carbon and other key nutrients in the oceans. The group plans to: (i)

assemble and synthesize available empirical information on how viruses affect carbon and nutrient flow in microbial communities; (ii) design and analyze dynamic models of viral effects on microbes in a modular format suitable for inclusion in global-scale earth systems models. The working group includes viral ecologists specializing in aquatic ecosystems, microbiologists focusing on carbon and nutrient cycles and theorists with expertise in viral ecology and large-scale ecosystem models who will work together toward these shared goals.

Meeting dates: January 2014

Working group: Integrating human risk perception of global climate change into dynamic earth system models. Joint with SESYNC. http://www.nimbios.org/workinggroups/WG_risk

Organizers: Brian Beckage (Plant Biology, Univ. of Vermont), Louis Gross (NIMBioS and Univ. of Tennessee), and Asim Zia (Community Development and Applied Economics, Univ. of Vermont)

The integrative, multidisciplinary team in this working group is considering feedbacks between climate, ecological, and human belief systems using a quantitative modeling approach. It seeks to link models of human belief systems concerning risk associated with climate change with models of the ecological and climate systems into a coupled earth system model.

Meeting dates: January 2014 (at NIMBioS), June 2014 (at SESYNC)

Working group: Agent-based models of biological systems: Pathways to control and optimization
http://www.nimbios.org/workinggroups/WG_ABMs

Organizers: Gary An (University of Chicago Pritzker School of Medicine), Reinhard Laubenbacher (Virginia Bioinformatics Institute), Suzanne Lenhart (Department of Mathematics, University of Tennessee), and Jie Xiong (Department of Mathematics, University of Tennessee)

Building on a NIMBioS Investigative Workshop held in December 2010, this working group is exploring mathematical and control/optimization frameworks and tools for agent-based/individual-based models.

Meeting dates: January 2014

Working group: Evolutionary origins of complex institutions

http://www.nimbios.org/workinggroups/WG_inst

Organizers: Peter J. Richerson (Environmental Science and Policy, Univ. of California, Davis), Jenna Bednar (Political Science, Univ. of Michigan, Ann Arbor), and Peter Turchin (Ecology and Evolutionary Biology, Mathematics, Univ. of Connecticut, Storrs)

A persistent puzzle in evolutionary biology is explaining why humans cooperate with much larger groups of non-kin than other animals. This working group seeks to develop mathematical and computational tools for understanding the evolutionary transition from relatively small-scale societies to large-scale institutional organizations, such as complex chiefdoms, empires, and nation states. Since this research exists where the current "bottom-up" approach of evolutionary biology and anthropology intersects the "top-down" approach of political science and economics, this working group incorporates mathematically and evolutionarily-oriented researchers from these disciplines as well as mathematical and computational modelers.

Meeting dates: March 2014

Working group: Nonautonomous linear system of the terrestrial carbon cycle: Mathematical and ecological properties and their uses in guiding carbon research

http://www.nimbios.org/workinggroups/WG_ccycle

Organizers: Yiqi Luo (Dept. of Microbiology and Plant Biology, University of Oklahoma) and Maria Leite (Dept. of Mathematics and Statistics, University of Toledo)

This working group examines theoretical properties of the nonautonomous linear system of the terrestrial carbon cycle and explores uses of those properties to guide observational, experimental, and modeling research. This group also has the potential to make seminal contributions to establish theoretical ecosystem ecology as a subdiscipline in ecology.

Meeting dates: March 2014

Working group: A cultural evolutionary approach to social-ecological systems change

http://www.nimbios.org/workinggroups/WG_sustainability

Organizers: Timothy Waring (Sustainability Solutions Initiative, Univ. of Maine), Marco Janssen (School of Human Evolution and Social Change, Arizona State Univ.), and Karolina Safarzyńska (Warsaw Univ.)

Understanding the processes of change in social-ecological systems is a pressing problem in our world of dwindling resources, but a unifying framework has remained absent. The goal of this working group is to develop a new modeling framework by integrating models of endogenous cultural evolution with models of social-ecological system change. This project brings together scholars who work on cultural evolution with modelers of social and ecological systems to develop a collaborative network on the evolutionary dynamics of social-ecological systems. The Working Group will develop a series of models that couple environmental resource use with multilevel selection processes, following three themes of inquiry: environmental and resource dynamics; individual strategic and informational environments; and populations of organizations and their environments.

Meeting dates: March 2014

Working group: Estimating area-specific contributions to the population dynamics of migratory species

http://www.nimbios.org/workinggroups/WG_migratorysp

Organizers: Wayne Thogmartin (US Geological Survey, Upper Midwest Environmental Sciences Center), Jay Diffendorfer (US Geological Survey, Geosciences and Environmental Change Science Center), Rusцена Wiederholt (Univ. of Arizona, Tucson), Brady Mattsson (Univ. of Natural Resources and Life Sciences, Vienna, Austria)

Understanding the value of specific areas used by a migratory species is important to theoretical ecology, decision analyses, habitat conservation, and conservation spending. The objective of this working group is to define a comprehensive framework for estimating the contribution of discrete habitat areas for migratory population viability. While similar metrics have been defined in a metapopulation context, translating these ideas to migratory populations, which spend time in multiple habitats over the course of their annual cycle, poses challenges. One goal is to continue development and refinement of a generalizable framework for habitat-specific contributions that accounts for (1) various migratory patterns, (2) density-dependence, and (3) carry-over effects. Optimal spatial prioritization approaches identify robust strategies for reserve design, and the group will consider the consequences of area contribution for migratory species for identifying optimal reserve networks. These

efforts will be useful for conservation and management activities for migratory species. The working group includes participation by statisticians, quantitative ecologists, and landscape ecologists with experience in metapopulation theory, parameter estimation, decision analysis, scenario analysis and population modeling.

Meeting dates: May 2014

Working group: Addressing the computational challenges in landscape genomics

http://www.nimbios.org/workinggroups/WG_genomics

Organizers: Andrew Storfer (Biological Sciences, Washington State Univ.), Gilles Guillot (Applied Mathematics, Technical Univ. of Denmark), Mike Antolin (Biology, Colorado State Univ.), and Mary Poss (Biology, Penn State Univ.)

Rapid advances in our ability to obtain genomic data have also caused a paradigm shift in the way we view "genes." Once thought to be directly related to phenotype, genes operate in complex genomic landscapes, rather than in isolation. A gene's location and copy number within a genome may regulate its expression, as well as its interaction with other genes and noncoding RNA. Genes are expressed differently in different environments, and selection varies spatially across the ecological landscape. A major challenge, then, is to analyze data sets that integrate both the genomic landscape and the ecological landscape to understand the spatial distribution of adaptive genetic variation. This working group will address this challenge by advancing analytical and computational methods with an interdisciplinary collaboration of experts in genomics, statistics, mathematics, bioinformatics and population genetics.

Meeting dates: May 2014

INVESTIGATIVE WORKSHOPS

Investigative workshop: Multidisciplinary approaches to analyzing animal vocal communication sequences. http://www.nimbios.org/workshops/WS_vocal

Organizers: Dan Blumstein (Ecology & Evolutionary Biology, Univ. of California, Los Angeles), Marie A. Roch (Computer Science, San Diego State Univ.), and Arik Kershenbaum (NIMBioS, Univ. of Tennessee, Knoxville).

The aim of this workshop was to bridge the gap between mathematical and biological researchers with an interest in the quantitative analysis of animal vocal sequences. Recent developments in the mathematical analysis of complex animal communication have generated opportunities to understand the functional aspects of animal vocalizations, their role in social organization, and ultimately to explore the origins and evolution of human language. Until now, however, the collaboration between mathematicians/computer scientists and biologists/zoologists in this field has been very limited. The workshop aimed to define the state of the art in this field, explore new horizons for collaboration, and provide new techniques through a synthesis of the mathematical and biological approaches to communication analysis. The workshop also defined some of the key questions that need to be posed to

address ultimate and proximate hypotheses about behavior, in the context of animal vocal communication systems.

Meeting dates: October 2013

Investigative workshop: The evolution of pest resistance to crop protection strategies: What we know, the models we have, and the models we need. http://www.nimbios.org/workshops/WS_pestresist
Organizers: Nicholas A. Friedenberg (Applied Biomathematics, Inc., Setauket, NY) and David Crowder (Dept. of Entomology, Washington State Univ., Pullman)

This workshop explored links between pest population dynamics, behavior, and evolution and agricultural practices for the purpose of increasing our ability to forecast the time and location at which pest control measures will fail due to resistance. Workshop presentations and discussions focused on biological complexity currently missing from models of pest resistance, such as dynamic host preference, selection for resistance by agents in the natural environment, specific mechanisms for resistance, and the evolutionary origins of pest variants within native species. Participants also discussed statistical and risk-analytical methods necessary for using resistance evolution models to inform real-world decisions under uncertainty. We are developing working group proposals to build on areas of strength among participants. These include the evolutionary origins of pests, integrating multi-scale movement behavior into resistance models, and using models to harmonize integrated pest management with resistance management.

Meeting dates: November 2013

Investigative workshop: The dynamics of small non-human social networks

http://www.nimbios.org/workshops/WS_socialnet

Organizers: David B. McDonald (Zoology & Physiology, Univ. of Wyoming), Tanya Berger-Wolf (Computer Science, Univ. of Illinois at Chicago), Jennifer Fewell (Center for Social Dynamics and Complexity, Arizona State Univ.), Amiyaal Ilany (NIMBioS), Bryan Shader (Mathematics, Univ. of Wyoming), and Tina Wey (Biology, New Mexico State Univ.)

This workshop explored problems and opportunities raised by small (tens to hundreds of individuals) social networks as they develop over time, with special focus on three issues: 1) how temporal dynamics affect network function and emergent properties, 2) the response of the network to perturbations such as births, deaths, immigration and emigration from the social group, and 3) the tension between a focus on network structure (e.g., importance of roles and network centrality) and process (e.g., flow of information, disease transmission). The group brought together empiricists interested in a diversity of animal social groups (ants, fish, birds, mammals) and quantitative scientists (network scientists, mathematicians, computer scientists, physicists) interested in the special problems posed by the dynamics of small social networks. Discussions focused on identifying issues of general concern, steps needed for bridging the gap between empirical data and theoretical work, and identifying relevant analytical techniques for major questions in ecology and evolution. Another major issue that emerged was the need for standardizing the collection and analysis of animal social network data to allow comparative analyses and move beyond system-specific analyses. There is currently active continuing research between new collaborators on specific questions, as well as a group working on a proposal to develop a Research Coordination Network for animal social networks.

Meeting dates: March 2014

Investigative workshop: Modeling disease transmission at the interface of wildlife, livestock, and poultry populations. http://www.nimbios.org/workshops/WS_interface

Organizers: Kate Huyvaert (Fish, Wildlife, and Conservation Biology, Colorado State University), Paul Cross (U.S. Geological Survey, Northern Rocky Mountain Science Center), Kelly Patyk (USDA/APHIS/Veterinary Services, Centers for Epidemiology and Animal Health), and Daniel Walsh (U.S. Geological Survey, National Wildlife Health Center)

An interdisciplinary group of veterinarians, biologists, epidemiologists, statisticians, and mathematicians gathered to evaluate the gaps and challenges in modeling pathogen transmission at the interface between free-ranging wildlife populations and livestock and poultry populations. A central focus of the workshop was to identify gaps in modeling transmission in four high importance interface disease systems including foot-and-mouth disease, tuberculosis, highly pathogenic avian influenza, and classical swine fever. Through a combination of targeted presentations from both mathematical and biological standpoints and open discussion, several common gaps were identified including: the need to 1) better link biological data with modeling approaches, 2) exploit new advances in modeling to "marry" mechanistic mathematical with statistical frameworks when examining disease systems, and 3) develop an understanding of the importance of peridomestic species in wildlife-livestock diseases. Several interdisciplinary collaborations and model-based projects emerged as products of the workshop.

Meeting dates: March 2014

Investigative workshop: Vector transmission of plant viruses.

http://www.nimbios.org/workshops/WS_plantviruses

Organizers: Linda J. S. Allen (Mathematics and Statistics, Texas Tech Univ.), Vrushali A. Bokil (Mathematics, Oregon State Univ.), Elizabeth T. Borer (Ecology & Evolutionary Biology, Univ. of Minnesota), and Alison G. Power (Ecology & Evolutionary Biology, Cornell Univ.)

Plant viruses are among the greatest limiting factors to modern agriculture. Climate change and the emergence of new viral strains affect the health and biodiversity of crops and of plants in general, while the continued growth of the human population emphasizes the need for sustainable agriculture. This workshop provided a forum for discussion of current problems on vectored transmission of plant viruses, with the goal of identifying mathematical, computational, and statistical methods, as well as insights derived using these methods. The problems in vector transmission of plant viruses are not simple; they are multiscale and often are driven by data from specific crops or fields. This workshop brought together experts in plant pathogens, agronomy, and vector and plant virology, physiology, and ecology with mathematical and statistical modelers to discuss problems in prevention and control of vector transmission of plant pathogens. These experts focused on four topics: (1) Evolution of virulence and resistance in vectored plant viruses, (2) Multi-scale modeling and heterogeneity in plant disease epidemics, (3) Vector movement, and (4) Vector transmission in plants versus animals. The workshop ended with one preliminary working group proposal on vector movement to be submitted and three papers in preparation on evolution of virulence, multi-scale modeling and significance of vector transmission in plants.

Meeting dates: March 2014

Investigative workshop: Modeling microbial contamination of fresh produce along the post-harvest supply chain. http://www.nimbios.org/workshops/WS_produce

Organizers: Yaguang Luo (Environmental Microbial and Food Safety Lab, USDA) and Daniel Munther (Mathematics, Cleveland State Univ.)

Food borne diseases associated with fresh produce continue to cause serious difficulties for public health in North America. As globalization has broadened the food supply chain and increased its complexity, more sophisticated methods of surveillance are needed at key links to ensure the safety of fresh produce. In particular, recent studies have identified the sanitization juncture as well as packaging and shipping as important players that can promote contamination or even cross-contamination of produce. Focusing on each of these areas, our investigative workshop will pursue four goals: (1) develop novel models that capture contamination and pathogen growth dynamics involved in sanitization, packaging and shipping, (2) discuss and develop multi-scale models that connect these supply chain links to form a global picture, (3) explore how these new models can aid in more relevant data collection to test and inform model predictions at both the local and global levels, and (4) provide a venue for collaboration among mathematical modelers, food technologists, statisticians, microbiologists, and industrial and government agency representatives in order to synthesize knowledge in a way that establishes modeling as an indispensable tool for pathogen surveillance and control in the fresh produce industry.

Meeting dates: April 2014

Investigative workshop: Predictive systems models for the ecological risk assessment of chemicals http://www.nimbios.org/workshops/WS_era

Organizers: Valery Forbes (School of Biological Sciences, Univ. of Nebraska, Lincoln) and Richard Rebarber (Mathematics, Univ. of Nebraska, Lincoln)

Workshop presentations and breakout discussions focused on how the incorporation of more quantitative, mechanistic models could add value to ecological risk assessment and on the need for broad stakeholder dialogue to develop models that can provide an acceptable basis for decision making. The workshop identified a critical gap between models linking molecular responses to organismal responses and models linking individual responses to responses at higher levels of biological organization. One or more working groups, conference sessions, and research proposals are being planned to address the most outstanding issues.

Meeting dates: April 2014

Investigative workshop: Mathematical modeling of *Leptospira* infection, transmission, and intervention strategies. http://www.nimbios.org/workshops/WS_leptospirosis

Organizers: Claudia Munoz-Zanzi (Div. of Epidemiology and Community Health, School of Public Health, Univ. of Minnesota), Michael Begon (Evolution, Ecology, and Behavior, Institute of Integrative Biology, Univ. of Liverpool), and Xiaopeng Zhao (Mechanical, Aerospace and Biomedical Engineering, Univ. of Tennessee, Knoxville)

Leptospirosis is a zoonotic disease of global public health importance with complex transmission dynamics. This workshop will explore mathematical tools and approaches for describing 1) within-host

dynamics of *Leptospira* infection and immunity in reservoir and incidental hosts; 2) multi-host, multi-species *Leptospira* transmission dynamics in urban and rural settings; and 3) environmental drivers of leptospirosis transmission in animals and people. The workshop will bring together expertise in bacteriology, molecular biology, epidemiology, statistics, veterinary medicine, human medicine, ecology, hydrology, mathematical modeling, network dynamics, evolutionary dynamics, and nonlinear analysis. As a result of this workshop, we will have an improved understanding of the conceptual models of *Leptospira* transmission in various ecological systems and of the gaps in data and methods.
Meeting dates: June 2014

SHORT-TERM VISITORS

Aaron Miller (Biology, Univ. of Utah) visited NIMBioS to collaborate with Chris Remien on a project to model population dynamics of the mammalian gut microbiota. (October 21-24, 2013)

Megan Powell (Univ. of St. Francis); Angela Reynolds (Virginia Commonwealth); and Sarah Taft (US EPA) visited NIMBioS on a project to develop mathematical models for understanding low dose anthrax exposure in vivo and in vitro. (October 23-25, 2013)

Masakado Kawata (Evolutionary Biology and Biodiversity, Graduate School of Life Sciences, Tohoku Univ) and Watal Iwasaki (Evolutionary Studies of Biosystems, Graduate Univ. for Advanced Studies, Sōkendai) visited NIMBioS to collaborate with Sergey Gavrilets to build a model of the adaptive radiation of *Anolis* lizards. (November 3-8, 2013)

Brian Beckage (Plant Biology, Univ. of Vermont) and Sara Metcalf (SUNY Buffalo) visited NIMBioS to collaborate with Louis Gross on a project to develop mathematical models that integrate human behavioral systems to ecological and climate systems in a coupled Earth system model. (November 7-8, 2013)

Roger Nisbet (Ecology, Evolution and Marine Biology, Univ. of California, Santa Barbara) visited with NIMBioS postdoctoral fellows and gave a seminar as a NIMBioS Postdoctoral Fellow Invited Distinguished Visitor. (November 19-21, 2013)

Patrick O'Neill and Ivan Erill (Biological Sciences, Univ. of Maryland, Baltimore) visited NIMBioS to collaborate with Mike Gilchrist and Russ Zaretski on a project to develop materials for use in upcoming NIMBioS tutorial on HPC. (November 21-26, 2013)

Sandy Kawano (Biological Sciences, Clemson Univ.) visited NIMBioS to conduct a comprehensive comparison of existing computational methods for quantifying patterns of morphological selection. (December 8-14, 2013)

Sonia Altizer and Richard Hall (Ecology, Univ. of Georgia), Ryan Norris (Integrative Biology, Univ. of Guelph) and Caz Taylor (Ecology & Evolutionary Biology, Tulane Univ.) visited NIMBioS to collaborate on a project to develop a mechanistic modeling framework to describe the population dynamics, movement patterns and phenology of migratory animals in a spatio-temporally varying landscape, and will ground truth models with Monarch butterfly data. (December 9-13, 2013)

Ariel Cintron-Arias (Mathematics and Statistics, East Tennessee State Univ.) visited NIMBioS to collaborate with Jon Forde and Suzanne Lenhart to explore a mathematical model of the dynamics of hepatitis B virus infection that accounts for therapy. (December 16-20, 2013; Jan. 21-Feb. 1, 2014)

Gabriela Hamerlinck (Biology, Univ. Iowa) and Nathan Lemoine (Biology, Florida International Univ.) visited NIMBioS to collaborate on a project to develop and parameterize models of parasitoid host shifts. (January 14-19, 2014)

Sivan Leviyang (Mathematics and Statistics, Georgetown Univ.) visited NIMBioS to collaborate with Vitaly Ganusov on a project to develop multi-epitope models of cytotoxic T lymphocytes effects on HIV infection. (January 19-25, 2014)

Doug Begg (Veterinary Science, Univ. Sydney) visited NIMBioS to collaborate with Shigetoshi Eda, Vitaly Ganusov and Gesham Magombedze to discuss mathematical modeling of MAP infection in ruminants. (February 1-4, 2014)

Anupam Priyadarshi* (Biosystematics and Ecology, Institute of Entomology, Czech Republic) was here as a visiting post-doctoral fellow from the Biology Centre of the Czech Academy of Sciences developing a mathematical model that describes the spatial and temporal processes involved in irruptive forest insect outbreaks. (February 2 - July 31, 2014)

*Support for his visit came from the Biology Centre of the Czech Academy of Sciences.

Roger Cousens (Resource Mgmt & Geography, Univ. Melbourne); Yaniv Brandvain (Plant Biology, Univ. Minnesota); Kathleen Donohue (Biology, Duke Univ.); Allan Strand (Biology, College of Charleston); Charles Willis (Center for the Environment, Harvard Univ.) visited NIMBioS to collaborate on a projected investigating population-genetic and genomic approaches for inferring species invasions and range expansion. (February 5-7, 2014)

Kay Holekamp (Zoology, Michigan State Univ.) visited NIMBioS to collaborate with Amiyaal Ilany on a project to describe the factors affecting social network dynamics in the spotted hyena and to identify the consequences of these dynamics in terms of individual life history and fitness. (February 12-19, 2014)

Nicole Mideo (Ecology & Evolutionary Biology, Univ. of Toronto) visited NIMBioS is collaborating with Judy Day and Ed LeGrand to answer the question what drives synchronicity in malaria infections. (February 26-31, 2014)

Elise Filotas (Science and Technology, Université du Québec); Patrick James (Biological Sciences, Université de Montréal); Vlastimil Krivan (Theoretical Ecology, Biology Research Center Academy of Sciences of the Czech Republic); and Anupam Priyadarshi (Biosystematics and Ecology, Institute of Entomology, Czech Republic) visited NIMBioS to collaborate on a project investigating trophic-interactions and diversity-stability relationships in insect outbreak systems. (March 3-6, 2014)

Carolyn Ayers (Population Biology, Ecology and Evolution, Emory Univ.); Heather Briggs, Environmental Studies, UC Santa Cruz; and Berry Brosi (Environmental Science, Emory Univ.) visited NIMBioS to collaborate on a project with Paul Armsworth to investigate mathematical approaches for pollinator ecology and biodiversity and ecosystem functioning. (March 3-5, 2014)

Eugene Koonin (National Center for Biotechnology Information, National Library of Medicine, National Institutes of Health) visited with NIMBioS postdoctoral fellows and gave a seminar as a NIMBioS Postdoctoral Fellow Invited Distinguished Visitor. (March 25-27, 2014)

Leah Edelstein-Keshet (Mathematics, Univ. of British Columbia) visited with NIMBioS postdoctoral fellows and gave a seminar as a NIMBioS Postdoctoral Fellow Invited Distinguished Visitor. (April 30, 2014)

Yu Shiu (Bioacoustic Research Program, Cornell Univ.) and Sara Waller (Philosophy, Montana State Univ.) visited NIMBioS to collaborate on a social predator vocalization project with Arik Kershenbaum and Todd Freeberg. (Shiu, April 30-May 2, 2014; Waller, April 30-May 15, 2014)

Pawel Gorecki (Institute of Informatics, Univ. of Warsaw) and Oliver Eulenstein (Computer Science, Iowa State Univ.) visited NIMBioS to collaborate on a project begun during the Gene Tree/Species Tree Reconciliation Working Group to study the mathematical properties and distributions of reconciliation costs. (May 11-25, 2014)

Fabiola Soto-Trejo (Biological Sciences, Universidad Nacional Autonoma de Mexico) visited NIMBioS to collaborate with Nick Matzke on a project to conduct biogeographical analyses of the genus *Florestina* using BioGeoBEARS software. (May 12-16, 2014)

Angie Peace (Mathematics, Arizona State Univ.) visited NIMBioS to collaborate with Louis Gross on a project to investigate the formulation of stoichiometric food web models of three trophic levels; planktonic algae, zooplankton, and zooplanktivorous fish, using two currencies; carbon and phosphorus. (May 13-16, 2014)

Rachael Neilan (Mathematics, Duquesne Univ.); Scott Christly (Mathematics, Univ. of Chicago); Rene Salinas (Mathematical Science, Appalachian State Univ.); and Matt Oremland (Mathematics, Virginia Tech) visited NIMBioS to develop optimal control approaches for agent-based models. (May 18-21, 2014)

Tinevimbo Shiri (Physics, Ryerson Univ.) visited NIMBioS to collaborate with Gesham Magombedze on a project to predict bacteria shedding patterns of cattle with Johne's Disease. (June 2014)

Katsuya Tanaka (Environmental and Natural Resources, Economics, Shiga Univ.) visited NIMBioS to develop a cost-effective payment system for forest carbon sequestration in Shiga prefecture of central Japan. (Summer 2014)

Paul Blischak (Evolution, Ecology, Organismal Biology, Ohio State Univ.) visited NIMBioS to work on a project to extend the comparative method using explicit models of hybridization with coalescence. His visit was part of the NIMBioS Visiting Graduate Fellow program (Summer 2014)

Sarah Taft (EPA); Stephanie Hines (Battelle); Hyang Mi Kim (Mathematics and Statistics, Calgary Univ.); Megan Powell (Mathematics, Univ. of St. Francis); and Angela Reynolds (Mathematics, Virginia Commonwealth University) visited NIMBioS to collaborate with Judy Day on a project to develop and analyze appropriate mathematical models for understanding low dose anthrax exposure in vivo and in vitro. (June 2-4, 2014)

Cristian Dambros (Biology, Univ. of Vermont); Michelle Lawing (Spatial Sciences, Texas A&M Univ.); Antonin Machac (Biology, SUNY Stonybrook); James Bullock (Biology, CEH Oxford, UK); Katriona Shea (Biology, Penn State); Priyanga Amarasekare (Biology, UCLA); Sergei Petrovskii (Math, Univ. of Leicester, UK); and Mark Lewis (Mathematics, Univ. of Alberta, Canada), and Brittany Teller (Biology, Pennsylvania State University) visited NIMBioS on a project to construct spatially explicit mechanistic models of population spread under rapidly changing climates and to synthesize many plant dispersal capabilities with respect to their potential responses to future climate changes. (June 8-11, 2014)

Ben Johannes (Cognitive and Evolutionary Anthropology, Univ. Oxford) visited NIMBioS to collaborate with Sergey Gavrillets on a project to refine an agent-based evolutionary model to investigate the trade-offs between in-group cohesion and out-group conflict. (Summer 2014)

William Morris (Statistics, Univ. of Melbourne) visited NIMBioS on a project investigating optimal allocation for addressing uncertainty in environmental project benefits. (Summer 2014)

Suzanne O'Regan (Math and Ecology, Univ. of Georgia) and Vasilis Dakos (Biology and Ecology, Estación Biológica de Doñana, Sevilla, Spain) visited NIMBioS on a project investigating the onset of spatial synchrony as early warning of metapopulation collapse. (August 18 – 29, 2014)

EDUCATION & OUTREACH ACTIVITIES:

Outreach and Education is a significant component of NIMBioS activities, covering a broad audience from K-12 (Biology in a Box), middle school (Girls in Science, SHADES, Adventures in STEM Camp), high school (teacher collaboration and math/biology curriculum programs, Junior Science and Humanities Symposium, REU or SRE Program), and undergraduates (undergraduate math/biology research conference, visits to MSI partners, SRE program) to graduate students and the general science population (summer graduate school with MBI, seminars, presentations).

The section below describes NIMBioS outreach and education activities completed between September 1, 2013 and August 31, 2014.

2014 Summer Research Experience (SRE) for Undergraduates and Teachers Program

Eighteen undergraduates and two high school teachers are participating in the 2014 NIMBioS Summer Research Experience (SRE) for undergraduates and teachers. During the eight-week program, participants live on campus at the University of Tennessee, Knoxville (UT), and work in teams with NIMBioS postdocs and UT faculty to conduct research at the interface of mathematics and biology. The award includes a stipend, housing and some funding to support travel. The projects this year are: (1) The prospects for the continued global Argentine ant supercolony, (2) Modeling transmission and control of bovine respiratory disease, (3) A dynamic systems approach to tracking the facial expressions and conscious experience of emotion, (4) Living on the edge: How location within a geographic range affects genetics and individual fitness, (5) Statistical techniques for predicting cardiac rhythm disorder, and (6) Mathematical modeling of granuloma formation in John's Disease. (Dates: June-August 2014)

Minority-Serving Institution Partner Visits

Visits were arranged for NIMBioS researchers, leadership and staff to our minority-serving institution partners: Howard University (C. Aguilar, November 2013); Tennessee State University (C. Remien, September 2013); and University of Texas-El Paso (A. Lawing, October 2013; N. Matzke, February 2014). Also, a visit was made to discuss developing an additional partnership: University of the Virgin Islands (L. Gross, January 2014). S. Lenhart visited Fisk University for discussion of curriculum and course issues in May 2014.

Joint Math Meetings

Co-sponsored with NSF Mathematics Institutes, the Joint Mathematics Meetings are held for the purpose of advancing mathematical achievement, encouraging research, and to provide the communication necessary to progress in the field. Annually, NIMBioS and the Mathematics Institutes sponsor a reception with presentations on opportunities available through these NSF-funded Institutes. At the January 2014 meeting in Baltimore, MD, S. Lenhart attended the Directors meeting of the Mathematical Sciences Institutes and the corresponding Diversity Committee meeting. S. Lenhart also displayed NIMBioS opportunities at the Mathematics Institutes Reception and co-organized a session on "Modeling Modules and Activities for Students."

Great Smoky Mountains National Park (GSMNP) Outreach

NIMBioS led quantitative biology sessions for the Girls in Science week at Tremont. (June 2014).

Undergraduate Research Conference at the Interface Between Biology and Mathematics

Undergraduate students interested in research in biology and mathematics, their faculty mentors, Minority Serving Institution partners and high school teachers were invited to this fifth annual conference. The conference included student talks and posters, two guest plenary speakers, a career

panel to take questions about research and careers in math biology, and a graduate school showcase. Over 150 undergraduates and faculty from academic institutions across North America were in attendance. There were over 60 undergraduate research talks and posters. (November 2013)

NIMBioS Interdisciplinary Seminars

The NIMBioS Interdisciplinary Seminar Series is held on alternating Tuesdays during the fall and spring semesters. On Tuesdays when no formal seminar is scheduled, NIMBioS hosts an Afternoon Tea for NIMBioS staff, visitors, faculty, and post-docs as well as faculty and students from across the UT community. The teas provide an opportunity for informal collaboration, discussion and networking. (Dates: Fall 2013 and Spring 2014)

Biology in a Box

The Biology in a Box Program, first begun by S. Riechert in 1993 offers an engaging solution to the lack of depth in traditional STEM education in the United States. Exercises are provided in a format that teaches important biological concepts through hands-on community learning. Lessons are packaged within 10 current thematic units that are offered to the worldwide audience at the project's web-site <http://biologyinabox.utk.edu>. Activities this last year in collaboration with NIMBioS are outlined below:

Formal assessment continues on two Biology in a Box exercise groups: Black Box Experiment series and Snack Slap game series.

The Black Box Experiment series (NSTA publication planned) offers students from elementary to college grade levels an in-depth understanding of how science works as well as a review of and practice with the mathematical concept of probability. This experiment has been evaluated in elementary, middle school, high school and college classrooms. Initial data reduction has been completed.

With Slap Snack Alarm and Mimic card games, students gain experience with the concept of individual fitness and natural selection. Four classrooms participated in the evaluation of the exercise this past year and publication is planned for NABT.

Riechert also authored a book chapter on the project's new Biomechanics Unit, which is in press in the Cary Snieder edited book entitled "High School Engineering Curricula Ready -To-Go," Corwin Press. The chapter is titled "Learning STEM through Inquiry Involving Nature's Designs Applied to Technology." Unit 11 Biomechanics is being assembled at the Biology in a Box Project's website: Exercise 1. From Skeletons to Bridges is available at the site and the other five exercises are in final proofing. Production of the physical units is underway as well.

The Project's workshop activity level was exceptionally high this year:

- 1) Three STEMSpark workshops (half day) exposed middle school teachers from the following school systems to Biology in a Box exercises: Alcoa City, Anderson Co., Blount Co., Campbell Co., Claiborne Co., Clinton City, Grainger Co. (Rutledge and Washburn School Systems), Jefferson Co., Knox Co., Lenoir City, Loudon Co., Maryville City, Morgan Co., Oak Ridge City, Oneida Special, Roane Co., Sevier Co., Sweetwater (in Monroe Co.), Union Co., and Girl's Prep School. Teachers were to choose several exercise series that they would be utilizing in their classrooms this coming year, with classroom visitations planned by the project facilitator/instructor. S. Lenhart and K. Sturner led part of the activities at these workshops.
- 2) Workshops were offered to the following new school districts joining Biology in a Box during this reporting period: Carter Co., Coffee Co., Marshall Co., Sequatchie Co., and Weakley Co.
- 3) Other workshops offered included the TN Junior Science and Humanities Symposium 2/28, Haywood Co. 5/29, Cumberland Co. 7/8, Carter Co. 8/6, Marshall Co. 8/9, Weakley Co. 9/11, Nestle' Water Festival 120 students 9/20, LEADS Conference 1,900 participants-18 counties represented 10/28-29, TSTA 12 counties represented 11/7.
- 4) Unit Upgrades were made for the following long term partners of the Biology in a Box Project: 9/14 Grainger Co. Rutledge School System and Washburn School System, Oak Ridge City, Clinton City, Morgan Co., Loudon Co., Sweetwater, Sevier Co., Claiborne Co., Blount Co., and Anderson Co.
- 5) Unit Changes and additions were made during this period as well. In addition to finalizing Unit 11-Biomechanics, work has begun on development of Unit 12-Of Cells and Cell Processes. Changes were made to improve the materials offered in Units 2 (Of Skulls & Teeth), 4 (Simple Measures), 6 (Animal Kingdom), 7 (Everything Varies) and 10 (Animal Behavior).
- 6) K. Bratton, VolsTeach intern, also completed a project to create guides showing which activities align to Common Core Math standards. These guides are now posted on the Biology in a Box website.

Tennessee Junior Science and Humanities Symposium

NIMBioS spoke to Tennessee high school teachers from across the state visiting UT for the Junior Science Symposium. K. Sturner talked about NIMBioS and demonstrated an education module on measuring trees. (February 2014)

Advancing Hispanics/Chicanos & Native Americans in Science (SACNAS) Annual Conference

NIMBioS contributed to the annual Modern Math Workshop immediately preceding the SACNAS annual conference. The goal of this project was twofold: to reinvigorate the research careers of minority faculty and post docs and mathematics faculty at minority-serving institutions by recruiting them to participate in the 2014-2015 research programs and workshops of US-based Mathematics Institutes and to increase awareness of math-based career paths among minority undergraduates. The workshop took place in San Antonio, TX, October 2-3, 2013. This directly preceded the Annual Meeting of SACNAS, the Society for Advancement of Chicanos and Native Americans in Science in Seattle. This allowed people

who were already coming to the SACNAS meeting to attend the Modern Math workshop and also allowed people who came for the Modern Math workshop to stay for the SACNAS meeting. Programs of all NSF-funded mathematics institutes were represented at this workshop, and a representative of each institute was present: AIM, ICERM, IMA, IPAM, MBI, MSRI, NIMBioS, PCMI, and SAMSI. NIMBioS sent postdoc G. Magombedze to speak about NIMBioS and his research, and K. Sturner presented about opportunities at NIMBioS. Also, NIMBioS co-sponsored ecology and evolutionary biology events at SACNAS organized by NESCent, and postdoc A. Lawing presented in an ecology-themed symposium with researchers from NESCent and NCEAS and helped handle Q&A on climate science after screening a documentary on climate change. (October 2013)

SHADES (Sharing Adventures in Engineering and Science)

NIMBioS helped inspire sixth and seventh grade girls about careers in math, science and engineering at this annual workshop organized by the Greater Knoxville Math/Science Coalition. K. Sturner and S. Lenhart volunteered and led math activities at this event, which was hosted at NIMBioS. (October 2013)

STEM Education Seminar Series

NIMBioS co-organizes a monthly seminar on issues in teaching STEM (science, technology, engineering and mathematics) with VolsTeach. The third round of seminars was hosted at the UT Center for Enhancing Education in Mathematics and Sciences and centered on the theme of integrated teaching of math and science. (January-March 2014) S. Lenhart spoke in this series on “Modeling Across the Curriculum” in February 2014.

Teaching Workshops

K. Sturner, representing NIMBioS, served on the organizing committee and also helped to facilitate this workshop for area K-12 teachers as a part of the week of Darwin Day events on the UTK campus. About 12 teachers participated in activities to teach the science supporting evolution, discussed the challenges of teaching evolution in their classrooms, and also had the opportunity to ask questions of a panel of education experts. (February 2014)

In addition, NIMBioS helped with the session “Teaching Science in a Climate of Denial” workshop at the annual Tennessee Science Teachers Association (TSTA) conference in Murfreesboro, TN. The session highlighted several useful activities for teaching evolution, climate change, and the nature of science, and was presented by K. Sturner, three area high school biology teachers, B. Adler, M. Knapp and L. Wilmoth, and UTK professor B. Golden. K. Sturner presented another session on Modeling the Forest. Teachers attended from across the state. (November 2013)

Southern Appalachian Science & Engineering Fair

NIMBioS was a 2014 sponsor of the fair. K. Sturner, J. Auerbach and A. Milt served as judges for a special NIMBioS award: the NIMBioS Prize for Research at the Interface of Mathematics and Biology. Junior and senior level division prizes were awarded. S. Lenhart judged for the Association for Women in Science and the Mu Alpha Theta prizes. (April 2014)

University of Tennessee Pro2Serve Math Contest

Annual contest of individual and team competitions to promote interest in mathematics among Tennessee high school students, to encourage them toward careers in mathematics, science, and engineering, and to recognize their mathematical prowess by awarding scholarships, trophies, plaques, and certificates. K. Sturner and S. Lenhart presented NIMBioS education & outreach to teachers from across the state at this conference (November 2013)

Adventures in STEM Camp

NIMBioS collaborated with CURENT and 4-H to offer a week-long summer day camp for rising 7th and 8th grade girls on STEM (Science, Technology, Engineering, Mathematics) (June 2014)

TUTORIALS

NIMBioS Tutorial: Computing in the Cloud: What Every Computational Life Scientist Should Know

This tutorial, organized in collaboration with the NSF-supported Remote Data Analysis and Visualization Center, brought together a diverse set of computational biologists and modelers who wanted to expand their expertise and learn how to harness big data and computation using the R language.

A wide range of HPC/Cluster/Cloud computing resources exist and are accessible to researchers, such as Amazon EC2, NSF XSEDE, local clusters, and simple multiprocessor shared memory machines.

Participants learned about the strengths and weaknesses of the various platforms and how to enable R to utilize them. The strengths and limitations of R for big data and big computation were also discussed.

Moving beyond these basics, further sessions provided participants with hands on experience in the following areas:

- Learn about the packages, tools, and data structures that are available in R for computing on HPC resources
- Understand tools such as Rcpp that allow R to easily interface with compiled code for improved performance
- Handle big matrix computations with the pbdR packages
- Produce elegant, publication quality graphics with the ggplot2 package

In addition to the fundamentals, the tutorial gave attendees a perspective on how these tools can be put to use in biological research. Tutorial examples included applications such as Bayesian mixed models in genomics, phylogenetic biogeography, approximate Bayesian computation, and multivariate

data reduction in ecological models. Finally, a special session on teaching with R provided insights on how to bring computational science research into the undergraduate classroom.

This hands-on tutorial gave participants an opportunity to begin applying these tools to their own problems. Presentations and sample codes were available for all tutorial sessions. Attendees also consulted with presenters and platform experts to identify the right tools for their problems. (April 2014)

NIMBioS Tutorial: Parameter Estimation for Dynamic Biological Models

Modeling biological data requires powerful mathematical and statistical tools and techniques. This tutorial was for biologists interested in doing statistics with more complex non-linear models of their data and for mathematicians interested in learning how to apply their modeling skills to the unique demands of real dynamic biological data. Methods for parameter estimation taught included maximum likelihood and ordinary least squares. Additional tools of model identifiability and sensitivity analysis were covered. Through a mixture of introductory instruction and hands-on computer-based learning, participants learned software and tools they can use for biological data. Familiarity with simple differential equation models or difference equation models was a prerequisite. (May 2014)

NIMBioS Tutorial: Algebraic and Discrete Biological Models for Undergraduate Courses

The field of mathematical biology has been transformed over the past 15 years by researchers using novel tools from discrete mathematics and computational algebra to tackle old and new problems. This tutorial will expose participants to algebraic and discrete approaches to problems from modern biology including gene regulation, gene identification, RNA folding, phylogenetics, and metabolic pathway analysis. The tutorial format will be interactive lectures with quick exercises on each topic, followed by structured hands-on activities during which participants will work in small groups on exercises and projects. During lectures and interactive sessions, participants will learn web-based software systems and databases that students in their courses can use.

This tutorial is appropriate for both mathematics and biology faculty. In particular, it targets undergraduate faculty teaching modern algebra, finite mathematics or mathematical modeling, or intermediate and advanced undergraduate biology, but many topics may also be appropriate for introductory biology courses. All introductory lectures to the tutorial topics will be accessible for both math and biology faculty and will cover the basic biology and mathematical methods, models, heuristics, computational approaches, and the relevant software. Participants will have the opportunity to customize their tutorial experience by opting for lectures and activities at two different levels - one introductory and one more advanced.

Tutorial objectives:

- Participants will be introduced to the importance of algebraic and discrete methods and models in modern biology, as an alternative to classical continuous methods based on calculus and differential equations. They will learn how to use such methods and/or build and analyze

models in the context of the tutorial's topics and will work in small groups to experience how to use the methodology to describe, simulate, and analyze the relevant biological systems.

- Participants will be exposed to software that implements the mathematical methods, aids visualization, and facilitates the computations and analyses.
- Participants will learn of existing curricular resources related to the tutorial's topics, including exercises, projects, solution guidelines, and/or computer code and data. They will receive guidance on how the tutorial materials may fit into mathematics and biology courses or be used as an introduction to independent studies or undergraduate research.
- Databases and software to be covered will include (but not limited to) DVD and ADAM (for visualization and analysis of Boolean and finite dynamical systems models), CpG Educate (for CpG island identification), BioNJ and TreeDyn and/or related analogues (for phylogenetic tree reconstruction), Metacyc, KEGG, and/or BIGG (for metabolic pathways), and Pfold (for RNA secondary structures).

Possible courses this tutorial would apply to in either math or biology or integrated curriculum: finite mathematics, discrete structures, linear algebra, modern algebra, graph theory, topology, probability, statistics, modeling, bioinformatics and biostatistics, cell and molecular biology, biochemistry, ecology, phylogenetics, and evolution. (June 2014)

NIMBioS/Bioquest Curriculum Workshop (Tutorial): Biology by Numbers: Bringing Math to the High School Biology Classroom

This tutorial is planned for high school biology teachers to encourage them to develop comfort with the quantitative side of biology. The program will feature hands-on experience with inquiry activities that use biological data, tools for graphing, and modeling. The Biology in a Box project will supply some of the activities integrating math and science. Teachers will work collaboratively to add or enrich the quantitative aspects of their favorite biology labs. This tutorial will be led by the BioQUEST Curriculum Consortium, a 25-year biology education reform community that focuses on helping faculty develop and implement innovative curricula. (July 2014)

NIMBioS Tutorial: Evolutionary Quantitative Genetics

This tutorial will review the basics of theory in the field of evolutionary quantitative genetics and its connections to evolution observed at various time scales. Quantitative genetics deals with the inheritance of measurements of traits that are affected by many genes. Quantitative genetic theory for natural populations was developed considerably in the period from 1970 to 1990 and up to the present, and it has been applied to a wide range of phenomena including the evolution of differences between the sexes, sexual preferences, life history traits, plasticity of traits, as well as the evolution of body size and other morphological measurements. Textbooks have not kept pace with these developments, and currently few universities offer courses in this subject aimed at evolutionary biologists. There is a need for evolutionary biologists to understand this field because of the ability to collect large amounts of data by computer, the development of statistical methods for changes of traits on evolutionary trees and for

changes in a single species through time, and the realization that quantitative characters will not soon be fully explained by genomics. This tutorial aims to fill this need by reviewing basic aspects of theory and illustrating how that theory can be tested with data. Participants will learn to use R, an open-source statistical programming language, to build and test evolutionary models. The intended participants for this tutorial are graduate students, post-docs, and junior faculty members in evolutionary biology. (August 2014)

School Visits

Bearden High School – S. Lenhart visits Bearden High School once a week during the school year for math club enrichment activities. Also she and C. Collins worked a traffic modeling research project with four seniors this school year.

University Visits – During the reporting dates, S. Lenhart gave seminars about NIMBioS opportunities to student groups at East Tennessee State University, Clemson University, University of Kentucky, University of Nebraska and Kennesaw State University.

S. Lenhart and K. Sturner helped to organize three visits to Pond Gap Elementary School by graduate students in the Program for Equity and Excellence in Research.

Discover Birds

C. Welsh and K. Sturner previously designed two math and biology activities to be included in the Discover Birds activity booklet, published by the Tennessee Ornithological Society. The books were donated to schools that the Knoxville Chapter of the Tennessee Ornithological Society visited. K. Sturner and C. Welsh visited some of the schools during this reporting period. (Visits: Ijams Nature Center, 33 homeschool K-12 students and parent/teachers, November 2013; Nature's Way Montessori, 47 elementary students, February 2014; Sevierville Primary, 260 elementary students, May 2014; Clayton Bradley Academy, 34 elementary students, May 2014)

Joint MBI-CAMBAM-NIMBioS Summer Graduate Workshop

NIMBioS is co-organizing this annual 10-day workshop for graduate students in math and biology, and the theme this year is "Modeling Rhythm and Oscillations." This graduate workshop has instructors from across North America with research expertise on the topic. The workshop includes lectures on techniques and modeling using specific data sets, and there are daily computer activities focusing on learning techniques. In addition, each student will work on a research project over the duration of the program with a team of four or five participants. Researchers from the mathematical and biological sciences are featured speakers. X. Zhao from UT is one of the speakers, and A. Buchan, K. Sturner, and S. Lenhart will assist with the participant selection process. (July 2014)

UT STEM REU Symposium

NIMBioS co-organized a poster symposium with several STEM-oriented REU programs on the campus of the University of Tennessee during the summer of 2014. TNSCORE and CURENT NSF engineering centers are the other co-hosts. NIMBioS SRE students will present. (July 2014)

Field of Dreams Conference

G. Magomedze attended and presented on research and opportunities at NIMBioS at this conference focused on encouraging diversity in the mathematical sciences in Mesa, Arizona. (November 2013)

Spring Opportunities Workshop for Women in the Mathematical Sciences

This workshop familiarized women in the mathematical sciences with professional opportunities in academics, industry and government labs to help them thrive in mathematics-related fields. Graduate students and PhDs in the early stages of their post-graduate careers were invited to apply to attend. Speakers, panelists and discussion leaders were women in research and management positions in industry and government labs as well as women in academia. Participants were encouraged to present a poster on their research. NIMBioS hosted the workshop this year, and was lead co-organizer with SAMSI. The event was primarily supported through a grant to MSRI that the NSF Mathematical Sciences Diversity Committee collaborates on. The Association of Women in Mathematics was also a co-sponsor this year. As a part of this workshop, NIMBioS cooperated with the UT Women's Studies on a special lecture by N. Else-Quest on "Attitudes, not Aptitude: Understanding the Roots of Gender Gaps in STEM Participation."

(April 2014)

USA Science & Engineering Festival

NIMBioS organized and presented at a booth at this large public outreach event and celebration of STEM in Washington, DC. The booth was co-organized with the Ecology & Evolutionary Biology Department at UTK. The team included K. Sturner from NIMBioS, UTK lab manager C. Patterson co-organized the booth, and two UTK undergraduate senior students (B. Pieper and N. Dunkirk). K. Sturner also arranged for the group to meet staff from Senator Corker, Senator Alexander, and Congressman Duncan's office to talk about the importance of STEM education and outreach in creating the next generation of innovative STEM professionals. (April 2014)

Addendum to NIMBioS Annual Report

Sep 1, 2013 –Aug 31, 2014

Y6-5. Additional Products

Featured Articles

Websites

Media Coverage

Addenda

Feature Articles (by Catherine Crawley, NIMBioS Communications Manager)

May 2, 2014. Researchers receive top honors for ecology paper

March 26, 2014. The altruistic side of aggressive greed: Study explains new twist in group cooperation

December 22, 2013. Study offers clues to how plants evolved to cope with cold

October 23, 2013. Name that tune: Algorithm used in music retrieval systems applied to help identify dolphin whistles

October 9, 2013. Climate change threatens Northern American turtle habitat

September 23, 2013. Math explains history: Simulation accurately captures the evolution of ancient complex societies

August 27, 2013. Tennessee high school students publish in top science journal

August 19, 2013. Altruism or manipulated helping?

August 5, 2013. Chronic harvesting threatens tropical tree

July 17, 2013. NIMBioS wins \$18 million renewal award from National Science Foundation

Websites

Title: The NIMBioS Website

URL: www.nimbios.org

Short Description of the Website: The NIMBioS website became operational October 1, 2008.

As of April 2014, the website contained 938 pages and 688 pdf documents. Visitor traffic is monitored by Google Analytics. For the year ending April 1, 2014, unique visitors increased 18% and site visits increased 9% compared to the previous year.

Title: NIMBioS Investigative Workshop: Insect Pest Resistance Evolution

URL: <http://nimbios.org/wordpress-training/insectpest/>

Short Description of the Website:

The site is a WordPress blog for the NIMBioS Investigative Workshop: Insect Pest Resistance Evolution, which was held Nov. 14-15, 2013. The site was designed to facilitate group communication and information sharing before, during and after the workshop.

Title: NIMBioS Investigative Workshop: Animal Social Networks

URL: <http://nimbios.org/wordpress-training/animalsocialnet/>

Short Description of the Website:

The site is a WordPress blog for the NIMBioS Investigative Workshop: Animal Social Networks, which was held March 6-8, 2014. The site was designed to facilitate group communication and information sharing before, during and after the workshop.

Title: NIMBioS Investigative Workshop: Vectored Plant Viruses

URL: <http://nimbios.org/wordpress-training/plantviruses/>

Short Description of the Website:

The site is a WordPress blog for the NIMBioS Investigative Workshop: Vectored Plant Viruses, which was held March 17-19, 2014. The site was designed to facilitate group communication and information sharing before, during and after the workshop.

Title: NIMBioS Investigative Workshop: Interface Disease Models

URL: <http://nimbios.org/wordpress-training/interface/>

Short Description of the Website:

The site is a WordPress blog for the NIMBioS Investigative Workshop: Interface Disease Models, which was held March 11-13, 2014. The site was designed to facilitate group communication and information sharing before, during and after the workshop.

Title: NIMBioS Tutorial: Computing in the Cloud
URL: <http://nimbios.org/wordpress-training/cloud/>

Short Description of the Website:

The site is a WordPress blog for the NIMBioS Tutorial: Computing in the Cloud, which was held April 6-8, 2014. The site was designed to facilitate group communication and information sharing before, during and after the tutorial.

Title: NIMBioS Investigative Workshop: Modeling Contamination of Fresh Produce
URL: <http://nimbios.org/wordpress-training/produce/>

Short Description of the Website:

The site is a WordPress blog for the NIMBioS Investigative Workshop: Modeling Contamination of Fresh Produce, which was held April 24-25, 2014. The site was designed to facilitate group communication and information sharing before, during and after the workshop.

Title: NIMBioS Investigative Workshop: Predictive Models for ERA
URL: <http://nimbios.org/wordpress-training/era/>

Short Description of the Website:

The site is a WordPress blog for the NIMBioS Investigative Workshop: Predictive Models for ERA, which was held April 28-30, 2014. The site was designed to facilitate group communication and information sharing before, during and after the workshop.

Title: NIMBioS Tutorial: Parameter Estimation for Dynamic Biological Models
URL: <http://nimbios.org/wordpress-training/parameter/>

Short Description of the Website:

The site is a WordPress blog for the NIMBioS Tutorial: Parameter Estimation for Dynamic Biological Models, which was held May 19-21, 2014. The site was designed to facilitate group communication and information sharing before, during and after the tutorial.

Title: NIMBioS Investigative Workshop: Leptospirosis Modeling
URL: <http://nimbios.org/wordpress-training/leptospirosis/>

Short Description of the Website:

The site is a WordPress blog for the NIMBioS Investigative Workshop: Leptospirosis Modeling, to be held June 3-5, 2014. The site was designed to facilitate group communication and information sharing before, during and after the workshop.

Title: NIMBioS Tutorial: Algebraic and Discrete Biological Models for the Undergraduate Classroom

URL: <http://nimbios.org/wordpress-training/mathbio/>

Short Description of the Website:

The site is a WordPress blog for the NIMBioS Tutorial: Algebraic and Discrete Biological Models for the Undergraduate Classroom, which will be held June 18-21, 2014. The site was designed to facilitate group communication and information sharing before, during and after the tutorial.

Title: NIMBioS Twitter

URL: <https://twitter.com/nimbios>

Short Description of the Website:

The NIMBioS Twitter account is an interactive social media site with 1,603 followers and 1,603 tweets (as of May 15, 2014) that feature NIMBioS news events and happenings as well as re-tweets of relevant news to the scientific community.

Title: NIMBioS Facebook

URL: <https://www.facebook.com/nimbios>

Short Description of the Website: NIMBioS Facebook page is an interactive social media site with 689 “likes” and posts that feature NIMBioS news, events and photos of interest to the NIMBioS Facebook community.

Title: NIMBioS Storify

URL: <http://storify.com/NIMBioS>

Short Description of the Website: The NIMBioS Storify site is an interactive social media site with stories created by NIMBioS that comprise all related URL content and photos.

Title: NIMBioS Flickr

URL: <http://www.flickr.com/photos/nimbios/>

Short Description of the Website: The NIMBioS Flickr features sets of photos from various NIMBioS activities and events, both formal and informal.

Title: NIMBioS Blog

URL: <http://www.nimbios.org/wordpress/>

Short Description of the Website: The NIMBioS blog is an interactive social media site established in August 2010 to showcase NIMBioS news and provide an outlet for readers’ commentary.

Media Coverage (Sept. 1, 2013 – March 31, 2014)

9/17/13, Calistus N. Ngonghala: Break the vicious cycles of poverty and disease, Scientific American, <http://blogs.scientificamerican.com/guest-blog/2013/09/17/calistus-n-ngonghala-break-the-vicious-cycles-of-poverty-and-disease/>

9/19/13, Transmission of vectored plant viruses, MPE12013 blog, <http://mpe2013.org/2013/09/18/vector-transmission-of-plant-viruses/>

9/23/13, Math explains history: Simulation accurately captures the evolution, ScienceDaily, <http://www.sciencedaily.com/releases/2013/09/130923155538.htm>

9/23/13, Math explains history: Simulation accurately captures the evolution, NSF News from the Field, http://as102.http.sasm3.net/news/news_summ.jsp?cntn_id=129223&org=NSF&from=news

9/23/13, Empires, bureaucracies and religion arise from war, Nature, <http://www.nature.com/news/empires-bureaucracies-and-religion-arise-from-war-1.13796>

9/23/13, Data geeks say war, not agriculture, spawned complex societies, Wired, http://www.wired.com/wiredenterprise/2013/09/cliodynamics_war/

9/23/13, Count on war to build a society, Pacific Standard, <http://www.psmag.com/politics/count-war-build-society-66821/>

9/23/14, 3,000 years of human history described in one set of mathematical equations, Smithsonian, <http://blogs.smithsonianmag.com/science/2013/09/3000-years-of-human-history-described-in-one-set-of-mathematical-equations/>

9/23/14, Warfare the key to evolution of complex society? Popular Archaeology, <http://popular-archaeology.com/issue/09012013/article/warfare-the-key-to-evolution-of-complex-society>

9/24/13, Mystery behind evolution of complex societies solved using math model, National Monitor, <http://natmonitor.com/2013/09/24/mystery-behind-evolution-of-complex-societies-solved-using-math-model/>

9/24/13, New math model predicts evolution of large complex human societies, Science World Report, <http://www.scienceworldreport.com/articles/9671/20130924/new-math-model-predicts-evolution-large-complex-human-societies.htm>

9/24/13, La guerra, 'madre' de la civilización humana, El Mundo, <http://www.elmundo.es/elmundo/2013/09/24/ciencia/1380020844.html>

9/24/13, What led to the rise of civilizations? Austrian Tribune, <http://austriantribune.com/informationen/132490-what-led-rise-civilizations>

9/24/13, Computer simulations reveal war drove the rise of civilizations, The Conversation, <http://theconversation.com/computer-simulations-reveal-war-drove-the-rise-of-civilisations-18538>

9/24/13, Mathematical simulation accurately predicts rise of complex societies, Red Orbit, <http://www.redorbit.com/news/science/1112955681/math-and-history-collide-in-new-society-evolution-model-092413/>

9/24/13, Professor uses math to explain history, Tennessee Today, <http://www.utk.edu/tntoday/2013/09/24/ut-professor-math-explain-history/>

9/24/13, Scientists use math – and computer war games – to show how society evolved, LATimes, <http://www.latimes.com/science/sciencenow/la-sci-sn-is-war-the-foundation-for-civilization-20130923,0,5336680.story#axzz2iYso5AKU>

9/24/13, Can math predict the rise and fall of empires? Popular Mechanics, http://www.popularmechanics.com/technology/digital/fact-vs-fiction/can-math-predict-the-rise-and-fall-of-empires-15960155?click=pm_latest

9/24/13, Mathematical model of human history 'explains rise Of civilisation' claims study, Huffington Post, http://www.huffingtonpost.co.uk/2013/09/24/maths-explains-history-model_n_3980533.html

9/25/13, Does math explain media, culture, and history? Simulation accurately captures it. Examiner, <http://www.examiner.com/list/does-math-explain-media-culture-and-history-simulation-accurately-captures-it>

9/30/13, Research at UT may improve treatment of acetaminophen overdose victims, Tennessee Today, <http://www.utk.edu/tntoday/2013/09/30/ut-research-may-improve-treatment-of-acetaminophen-overdose-victims/>

10/8/13, Climate change threatens Northern American turtle habitat, Science Daily, <http://www.sciencedaily.com/releases/2013/10/131008182339.htm>

10/8/13, Climate change causes turtles to travel 45 miles in search of new habitats, study finds iScience Times, <http://www.isciencetimes.com/articles/6182/20131008/turtles-climate-change-north-america-habitat-study.htm>

10/9/13, Turtles on the run as habitats shift and sink, RedOrbit, <http://www.redorbit.com/news/science/1112970773/turtles-are-on-the-run-as-habitats-shift-100913/>

10/10/13, Study finds climate change threatens Northern American turtle habitat, Tennessee Today, <http://tntoday.utk.edu/2013/10/10/study-finds-climate-change-threatens-northern-american-turtle-habitat/>

10/10/13, UT study: Turtles may have trouble adapting to climate change, WUOT-Radio, <http://wuot.org/post/ut-study-turtles-may-have-trouble-adapting-climate-change>

10/10/13, UT study finds climate change threatens North American turtle habitat, Oak Ridge Today, <http://oakridgetoday.com/2013/10/10/ut-study-finds-climate-change-threatens-north-american-turtle-habitat/>

10/10/13, North American turtles losing their habitats to climate change, ReptileChannel.com, <http://www.reptilechannel.com/reptile-news/2013/10/10/turtles-losing-habitats-to-climate-change.aspx>

10/23/13, Shazam at sea: Music lookup techniques can distinguish dolphin calls, The Verge.com, <http://www.theverge.com/2013/10/23/4950734/music-lookup-service-algorithm-used-to-identify-dolphin-whistles>

10/23/13, 'Name that tune' algorithm used to identify signature whistles of dolphins, Science Daily, <http://www.sciencedaily.com/releases/2013/10/131023183240.htm>

10/23/13, Name that tune: Algorithm used in music retrieval systems applied to help identify dolphin whistles, Computer Magazine, <http://computermagazine.com/2013/10/23/name-that-tune-algorithm-used-in-music-retrieval-systems-applied-to-help-identify-dolphin-whistles/>

10/24/13, Research finds method to help understand dolphin communication, Tennessee Today, <http://tntoday.utk.edu/2013/10/24/research-finds-method-understand-dolphin-communications/>

10/24/13, Flipper on Line 1? UT researchers closer to figuring out how dolphins talk, WVLT-TV, <http://www.local8now.com/news/headlines/dolphin-communication-229120811.html>

10/25/13, Research helps understand dolphin talk, Science Blog.com, <http://scienceblog.com/67460/research-finds-method-to-help-understand-dolphin-talk/>

10/25/13, New method to identify signature whistles of dolphins, ZeeNewsIndia, http://zeenews.india.com/news/eco-news/new-method-to-identify-signature-whistles-of-dolphins_885867.html

10/25/13, New method to identify signature whistles of dolphins, Business-Standard, Press Trust of India, http://www.business-standard.com/article/pti-stories/new-method-to-identify-signature-whistles-of-dolphins-113102500704_1.html

10/28/13, Algorithm can identify dolphin whistles, New York Times Science Times, <http://www.nytimes.com/2013/10/29/science/algorithm-can-identify-dolphin-whistles.html>

10/28/13, Um algoritmo para reconhecer canção distingue as vozes dos golfinhos, Oceano Magazine, Brazil, <http://magazineoceano.com/um-algoritmo-para-reconhecer-cancoes-distingue-as-vozes-dos-golfinhos/#.UqtrlPim0ak>

11/5/13, Shazam-like dolphin system ID's their whistles, Scientific American 60-Second Science Podcast, <http://www.scientificamerican.com/podcast/episode.cfm?id=shazam-like-dolphin-system-ids-thei-13-11-05>

11/14/13, Maryville College senior completes internship, Knoxnews.com Maryville edition, <http://www.knoxnews.com/news/2013/nov/14/maryville-college-senior-completes-internship-3623/>

11/22/13, Agents of selection: Scientist synthesizes the myriad causes, LiveScience, <http://www.livescience.com/41440-natural-selection-ryan-martin-nsf-sl.html>

11/25/13, Lindsay Lee named Rhodes Scholar; seventh in UT history, Tennessee Today, <http://tntoday.utk.edu/2013/11/25/lindsay-lee-named-rhodes-scholar/>

12/06/13, Faces of Rhodes: Rachael Ward '14, Rhodes College, <http://www.rhodes.edu/news/27267.asp>

12/10/13, NIMBioS names Associate Director of Postdoctoral Activities, Tennessee Today, <http://tntoday.utk.edu/2013/12/10/nimbios-names-associate-director-postdoctoral-activities/>

12/18/13, Top thirteen 'In the News' stories for 2013, Tennessee Today, <http://tntoday.utk.edu/2013/12/18/top-thirteen-news-stories-2013/>

12/22/13, Study offers clues to how plants evolved to cope with the cold, Tennessee Today, <http://tntoday.utk.edu/2013/12/22/study-offers-clues-plants-evolved-cope-cold/>

12/22/13, Plant evolution study shows how some plants prevent freezing, Liberty Voice, <http://guardianlv.com/2013/12/plant-evolution-study-shows-how-some-plants-prevent-freezing/>

12/22/13, Clues to how plants evolved to cope with cold, Science Daily, <http://www.sciencedaily.com/releases/2013/12/131222161805.htm>

12/23/13, Largest evolutionary tree of flowering plants mapped, Press Trust of India, http://www.business-standard.com/article/pti-stories/largest-evolutionary-tree-of-flowering-plants-mapped-113122300464_1.html

12/23/13, Study finds how flowering plants cope with the cold, Nature World News, <http://www.natureworldnews.com/articles/5402/20131223/study-finds-flowering-plants-cope-cold.htm>

12/23/13, Evolve like plants to withstand freezing cold, Business Standard India, http://www.business-standard.com/article/news-ians/evolve-like-plants-to-withstand-freezing-cold-113122300223_1.html

12/31/13, These three coping mechanisms help plants deal with cold weather, International Science Times, <http://www.isciencetimes.com/articles/6566/20131222/three-coping-mechanisms-help-plants-deal-cold.htm>

1/4/14. Helping Tennessee students discover birds. Tennessee Conservationist. Jan/Feb 2014. By Vickie Henderson.

1/1/14, 5th annual Undergraduate Research Conference at the Interface of Biology and Mathematics by Hannah Lily Postman, SIAM Newsletter

1/10/14, High school project lands freshman in top journal, Duke News, <http://sites.duke.edu/dukeresearch/2013/11/13/high-school-project-lands-freshman-in-top-journal/>

2/25/14, Investigating the molecular mechanisms of disease goes digital, Live Science, <http://www.livescience.com/43644-investigating-the-molecular-mechanisms-of-disease-goes-digital.html>

3/7/14, UT battles Sex Week bills, Knox Sentinel, <http://www.knoxnews.com/news/2014/mar/07/ut-battles-sex-week-bills/>

3/8/14, UT marshals students, faculty and alumni to fight bills inspired by Sex Week, Humphrey Hill Knox Blog, <http://knoxblogs.com/humphreyhill/2014/03/08/ut-marshals-students-faculty-alumni-fight-bills-inspired-sex-week/>

3/12/14, Speak up, stop activity fees legislature from hurting campus, Daily Beacon, <http://utdailybeacon.com/opinion/letters/2014/mar/12/speak-stop-activity-fees-legislature-hurting-campus/>

3/12/14, UT prof to direct national Biology Ideas Lab, Knox Sentinel, <http://www.knoxnews.com/news/2014/mar/12/ut-prof-to-direct-national-biology-ideas-lab/>

3/13/14, UT professor tapped to lead national STEM education effort, Tennessee Today, <http://tntoday.utk.edu/2014/03/13/lou-gross-to-lead-national-stem-education-effort/>

3/14/14, UT professor tapped to lead national STEM education effort, Oak Ridge Today, <http://oakridgetoday.com/2014/03/13/ut-professor-tapped-lead-national-stem-education-effort/>

3/26/14, UT study explains new twist in group cooperation, Tennessee Today, http://www.business-standard.com/article/pti-stories/largest-evolutionary-tree-of-flowering-plants-mapped-113122300464_1.html

3/26/14, The altruistic side of aggressive greed, Science Codex, http://www.sciencecodex.com/the_altruistic_side_of_aggressive_greed-130458

3/26/14, The altruistic side of aggressive greed: Study explains new twist in group cooperation, Phys.org, <http://phys.org/news/2014-03-altruistic-side-aggressive-greed-group.html>

3/26/14, Altruistic side of aggressive greed, Science Daily, <http://www.sciencedaily.com/releases/2014/03/140326092600.htm>

3/26/14, The altruistic side of aggressive greed, ScienceNewsline, <http://www.sciencenewsline.com/summary/2014032611580002.html>

3/28/14, Science proves it: Greed is good, Time magazine online, <http://time.com/41680/greed-is-good-science-proves/>

3/31/14, Conservation efforts not just for tree huggers, Live Science, <http://www.livescience.com/44507-computers-aid-plant-conservation-sean-hoban-nsf-sl.html>

Spring 2014, Students to watch: The scholar: Lindsay Lee, Torchbearer UT Alumni Magazine