



# Evaluation Report

## Integrating Functional Evolutionary Dynamics at Multiple Scales Working Group

June 10-12, 2009

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## Executive Summary

### Brief Synopsis of Event

This report is an evaluation of a NIMBioS Working Group entitled “Integrating Functional and Evolutionary Dynamics at Multiple Scales,” (FE) which held its first meeting at NIMBioS June 10-12, 2009. NIMBioS Working Groups are chosen to focus on major scientific questions at the interface between biology and mathematics. 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. NIMBioS Working Groups are relatively small (10-15 participants), focus on a well-defined topic, and have well-defined goals and metrics of success. Working Groups will typically meet 2-3 times over a two-year period, with each meeting lasting 3-5 days; however, the number of participants, number of meetings, and duration of each meeting is flexible, depending on the needs and goals of the group.

The FE group comprised nine participants, including organizers Joan Roughgarden (Stanford University) and Erol Akçay (Stanford University). Participants came from seven institutions across six U.S. states (See Appendix A).

During its first meeting, the Working Group determined the conceptual issues and problems underscoring the group’s research interests and approaches. One broad conceptual issue focused on the constraints that occur with different functional dynamics and how these functional dynamics interact with evolutionary dynamics. The group identified several research questions that would benefit from an approach that integrates functional and evolutionary dynamics, such as the evolution of emotions and a dynamical and biological classification of different solution concepts for evolutionary game theory. The group developed an outline of a review paper that will survey the uses of evolutionary game theory and multi-tier approaches across broad scales of biological organization, from individual behavior to macroecology. In addition, several collaborative projects were initiated with the goal of having at least preliminary results by the next meeting, scheduled for March 2010.

### Evaluation Design

An electronic survey aligned to the following evaluation questions was designed by NIMBioS’ Evaluation Coordinator with input from the NIMBioS Director and Deputy Director:

1. Were participants satisfied with the Working Group overall?
2. Did the meeting meet participant expectations?
3. Do participants feel the Working Group made adequate progress toward its stated goals?
4. Do participants feel they gained knowledge about the main issues related to the research problem?
5. Do participants feel they gained a better understanding of the research across disciplines related to the Working Group’s research problem?
6. What impact do participants feel the Working Group will have on their future research?

7. Were participants satisfied with the accommodations offered by NIMBioS?
8. What changes in accommodations, group format, and/or content would participants like to see at future meetings?

The final instrument was hosted online via the University of Tennessee's online survey host mrInterview. Links to the survey were sent to six Working Group participants on June 15, 2009. FE Working Group co-organizers Erol Akçay and Joan Roughgarden, and NIMBioS Director Louis Gross, who was also participant, were not included in the evaluation. Reminder emails were sent to non-responding participants on June 23 and 26, 2009. By July 3, 2009, 5 participants had given their feedback, for a response rate of 83%.

## Highlights of Results

- Overall satisfaction with the Working Group was high among survey respondents, all of whom indicated they either agreed or strongly agreed that the Working Group was very productive and met their expectations.
- All respondents thought the presentations were useful and all thought that the presenters were very knowledgeable about their presentation topics.
- All respondents either agreed or strongly agreed that they would recommend participating in NIMBioS Working Groups to their colleagues.
- Overall, respondents reported being satisfied with the travel, housing, and other amenities provided by NIMBioS.
- The majority of respondents agreed that they had a better understanding of the main issues related to the research questions as a result of participating in the Working Group.
- All respondents said being able to have discussions with a variety of perspectives was the Working Group's most useful aspect, as they were able to learn from those in fields other than their own.
- 100% of respondents agreed that the format of the Working Group was very effective for achieving its goals, and that the Working Group made adequate progress for the first meeting toward all of its goals.
- Four of five respondents said they left this meeting with a good idea of what their contribution will be at the next meeting
- Four of five respondents said they planned to take the knowledge they gained during the Working Group and apply it to their own research.
- Four of five respondents reported they developed solid plans for collaborative research with other Working Group participants.

## Conclusions and Recommendations

Overall, the Working Group was very successful in making progress toward its goals. Evaluation survey respondents were satisfied with the meeting, indicating that it was a productive experience that met their expectations. Respondents were also satisfied with the travel, housing, and other amenities offered by NIMBioS.

Respondents overall reported high levels of learning, agreeing that they had a better understanding of the main research issues. All respondents agreed that the Working Group format allowed the group to make adequate progress toward its goals of integrating the dynamics of how biological systems function and how these functional dynamics evolve, and developing a theoretical framework for integrating both functional and evolutionary dynamics. Four of the five respondents also said they left this meeting with a good idea of what their contribution will be at the next meeting.

Most respondents indicated they planned to take the knowledge they gained during the Working Group and apply it to their own research, and that they had developed solid plans for collaborative research with other Working Group participants. Suggestions for improvement of future meetings included better communication regarding instructions and goals, having dinner as a group, and bringing in more mathematicians.

Based on analysis of participant response data, the recommendations are as follows:

- Participants were extremely satisfied with the Working Group content and format; but consider communicating specific group goals and clarifying individual roles more at future meetings.
- The Working Group had a multidisciplinary composition, but consider trying to recruit more mathematicians/modelers for future meetings.
- Keep participant diversity in mind (regarding gender, race, and ethnicity) if new participants are recruited for future meetings.
- Consider planning a dinner or another evening social event as a group during future meetings.

# Function and Evolution Working Group Evaluation Report

## Background

### Introduction

This report is an evaluation of a NIMBioS Working Group entitled “Integrating Functional and Evolutionary Dynamics at Multiple Scales,” (FE) which held its first meeting at NIMBioS June 10-12, 2009. The FE group comprised nine participants, including organizers Joan Roughgarden (Stanford University) and Erol Akçay (Stanford University). Participants came from seven institutions across six U.S. states (See Appendix A).

NIMBioS Working Groups are chosen to focus on major scientific questions at the interface between biology and mathematics. 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. NIMBioS Working Groups are relatively small (10-15 participants), focus on a well-defined topic, and have well-defined goals and metrics of success. Working Groups will typically meet 2-3 times over a two-year period, with each meeting lasting 3-5 days; however, the number of participants, number of meetings, and duration of each meeting is flexible, depending on the needs and goals of the group.

During its first meeting, the FE Working Group determined the conceptual issues and problems underscoring the group’s research interests and approaches. One broad conceptual issue focused on the constraints that occur with different functional dynamic and how these functional dynamics interact with evolutionary dynamics. The group identified several research questions that would benefit from an approach that integrates functional and evolutionary dynamics, such as the evolution of emotions and a dynamical and biological classification of different solution concepts for evolutionary game theory. The group developed an outline of a review paper that will survey the uses of evolutionary game theory and multi-tier approaches across broad scales of biological organization, from individual behavior to macroecology. In addition, several collaborative projects were initiated with the goal of having at least preliminary results by the next meeting, scheduled for March 2010.

### Working Group Background

The FE Working Group’s aim was to model the dynamics of biological systems at the functional and evolutionary levels, and integrate these two in a unified framework. From cells to human societies, biological organization emerges from the interaction of individual parts. The dynamics of these interactions are governed by the interaction mechanisms. Even though these mechanisms themselves are ultimately products of evolution, the functional dynamics they produce are not identical to the evolutionary dynamics and operate at different scales. In order to explain the emergence of biological organization, researchers need to integrate both functional and evolutionary dynamics.

The Working Group’s goal was to develop the theoretical framework for this task. Particular focal topics that were addressed were: the evolution of pay-offs and trade-offs in biological interactions, the evolution of interaction mechanisms, and the modeling of the interplay between different types of

functional dynamics. The Working Group’s intended outcome revolved around integrating the results from these focal investigations in a multi-scale theoretical framework and identify new avenues for theoretical and empirical research opened by this synthesis.

**Participant Demographics**

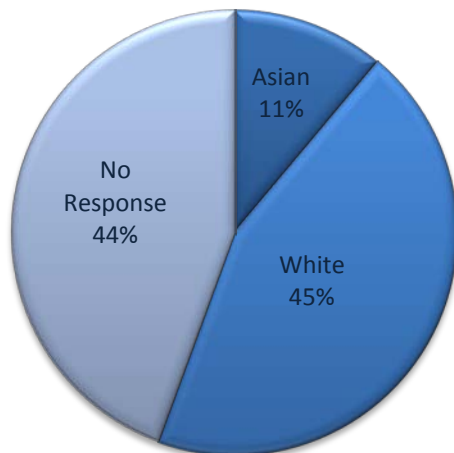
FE Working Group participants, who were college/university faculty (78%) or postdoctoral researchers (22%), came from seven institutions across six U.S. states. Included in these institutions were the Santa Fe Institute, NIMBioS, and several universities. Primary fields of study for the nine participants included biological/biomedical sciences, humanities, mathematics, and social sciences (Table 1).

Table 1. *Participant fields of study and areas of concentration*

Field of Study	Concentration	# Participants
Biological/Biomedical Sciences	Biology/Biological Sciences	1
	Endocrinology	1
	Evolutionary Biology	3
	Mathematical Biology	1
Humanities	Other Humanities	1
Mathematics	Applied Mathematics	1
Social Sciences	Economics	1

The 3 females and 6 males (none of whom self-identified as being of Hispanic/Latino ethnicity) mostly self-identified racially as white, although several did not indicate a racial background (Figure 1).

Figure 1. Racial composition of program participants (n = 9)





One respondent indicated his/her work is currently supported by a National Science foundation grant. Table 2).

Table 2. NSF grants supporting participant research

Name of grant	Institution at which grant is held
Collaborative Research: Supporting whole-class science investigations with spatial simulations	University of Illinois at Chicago

## Evaluation Design

### Evaluation Questions

The evaluation of the Working Group was both formative and summative in nature, in that the data collected from participants was intended to both gain feedback from participants about the quality of the current Working Group and also to inform future meetings. The evaluation framework was guided by Kirkpatrick's Four Levels of Evaluation model for training and learning programs (Kirkpatrick, 1994<sup>1</sup>). The evaluation questions were developed according to level one of the model, participants' reactions, in order to gather information about how participants felt about the content and format of the Working Group, as well as the accommodations provided by NIMBioS. Several questions constituted the foundation for the evaluation:

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

### Evaluation Procedures

NIMBioS' Evaluation Coordinator designed an electronic survey aligned to the evaluation questions with input from NIMBioS' Director and Deputy Director. The final instrument was hosted online via UT's online survey host mrlInterview. Links to the survey were sent to six Working Group participants on June 15, 2009. FE Working Group co-organizers Erol Akçay and Joan Roughgarden, and NIMBioS Director Louis Gross, who was a participant, and were not included in the evaluation. Reminder emails were sent

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

to non-responding participants on June 23 and 26, 2009. By July 3, 2009, 5 participants had given their feedback, for a response rate of 83%.

### Data Analysis

Data from the electronic survey included both forced-response and supply-item questions. All data were downloaded from the online survey host into the statistical software package SPSS for analysis. Quantitative data were analyzed using SPSS, while qualitative data were analyzed in SPSS Text Analysis for Surveys. Qualitative responses were categorized by question and analyzed for trends.

## Findings

### Participant Satisfaction

#### Overall Satisfaction

Overall satisfaction with the Working Group was high among respondents, 100% of whom indicated they either agreed or strongly agreed that the Working Group was very productive and met their expectations. Some general participant comments:

*“I thought it was great. Well done!”*

*“Wonderful experience!”*

All respondents thought the presentations were useful, and all thought that the presenters were very knowledgeable about their presentation topics. Additionally, 100% of respondents either agreed or strongly agreed that they would recommend participating in NIMBioS Working Groups to their colleagues (Table 4).

Table 4. Participant satisfaction with various aspects of the Working Group, by level of agreement

	<i>n</i>	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I feel the Working Group was very productive.	5	60%*	40%	0%	0%	0%
The Working Group met my expectations.	5	60%	40%	0%	0%	0%
The presenters were very knowledgeable about their topics.	5	80%	20%	0%	0%	0%
The presentations were useful.	5	60%	40%	0%	0%	0%
The group discussions were useful.	5	60%	40%	0%	0%	0%
I would recommend participating in NIMBioS Working Groups to my colleagues.	5	80%*	20%	0%	0%	0%

\* Note: Percentages in tables may not add to 100% due to rounding

### Satisfaction with Accommodations

Overall, respondents reported being satisfied with the travel, housing, and facilities provided by NIMBioS during the Working Group. NIMBioS arranged housing and travel for all five of the respondents, all of whom said they were satisfied with their accommodations. The majority of participants also reported being satisfied with the comfort and resources of the NIMBioS facility, as well as the quality of meals provided (Table 5). One participant’s comment about the hotel:

*“Very comfortable and close to NIMBioS and the downtown.”*

Table 5. Participant levels of satisfaction with Working Group accommodations

Please indicate your level of satisfaction with the Working Group accommodations:	n	Very satisfied	Satisfied	Neutral	Dissatisfied	Strongly dissatisfied
Comfort of the facility in which the Working Group took place	5	80%	20%	0%	0%	0%
Resources of the facility in which the Working Group took place	5	80%	20%	0%	0%	0%
Quality of meals	5	60%	40%	0%	0%	0%
Quality of drinks and snacks provided	5	60%	40%	18%	0%	0%

### Working Group Format and Content

#### Most Useful Aspects

Most respondents said being able to have discussions with a variety of perspectives was the Working Group’s most useful aspect, as they were able to learn from those in fields other than their own:

*“Face-to-face, informal, frank, exchange of ideas among people with different expertise. The very open interaction between the participants with a variety of perspectives was insightful in many ways.”*

*“Bringing together diverse perspectives of colleagues that otherwise would not happen. The exchanges were very good and helpful, and potentially deeper and more synthetic than would be possible from just reading each others' papers.”*

Other participants thought the field trip to the Smokies was a useful component of the meeting:

*“Superb. Field trip to Smokies was not only wonderful but it was a very productive step to the scientific progress.”*

### ***Participant Learning***

Respondents were asked several questions to gauge their levels of learning about the main issues related to the research problem, including the evolution of pay-offs and trade-offs in biological interactions, and mathematical models of the interplay between different types of functional dynamics. Respondents overall reported high levels of learning, agreeing that they had a better understanding of the main research issues, although some respondents felt “neutral” about the amount they learned on these topics (Table 6).

Table 6. *Participant self-reports of learning about issues related to the Working Group’s research problem*

<b>As a result of participating in this Working Group, I have a better understanding of:</b>	<i>n</i>	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
the evolution of pay-offs and trade-offs in biological interactions.	5	20%	40%	40%	0%	0%
the evolution of interaction mechanisms.	5	25%	25%	50%	0%	0%
modeling of the interplay between different types of functional dynamics.	5	20%	60%	20%	0%	0%

### ***Progress Toward Goals***

All respondents agreed that the Working Group format allowed the group to make adequate progress, for its first meeting, toward its goals of building integrating the dynamics of how biological systems function and how these functional dynamics evolve, and developing a theoretical framework for integrating both functional and evolutionary dynamics. Four of the five respondents also said they left this meeting with a good idea of what their contribution will be at the next meeting. One participant would have liked to have had a more solid plan in place for the next meeting, however:

*“Would have been nice to have had a better game plan for next time. But ..next time will likely be valuable and productive gauging the level of collegial exchange and interactions that took place. “*

### ***Impact on Future Research Plans***

Four respondents said they felt that the exchange of ideas that took place during the Working Group would initiate and/or influence their future research, while one was still uncertain what impact the meeting would have on his/her research. Some participant comments:

*“...This meeting improved my understanding of the issues with which ecologists (etc.) are currently concerned, and current developments in evolutionary game theory.”*

*“...There were many interesting ideas exchanged (such as biology borrowing from the study of human cultures to understand interactions, the role of models in biological understanding,*

*specific tools like mechanism design etc), and discussions on the philosophy of biology held during the workshop that will surely shape my thinking.”*

*“The diverse perspectives [were] extremely useful. I am optimistic about good research coming out of the collaborations.”*

In addition to new ideas for research, four respondents said that they developed unanticipated plans for collaborative research with other Working Group participants:

*Yes. I will now be working on several interesting and hopefully useful collaborations that otherwise would not have been possible*

*“...two collaborative papers that I did not anticipate and that I think are quite promising projects.”*

*“...there is a chance to meld some of my favored modeling approaches with others in the group. For instance, placing multi-tier models into a G-function framework, and chances to explore the philosophy of science through the lens of natural selection and game theory.”*

### **Suggestions for Future Working Group Meetings**

Respondents were asked several questions soliciting suggestions for future Working Group meetings. Overall, participants were highly satisfied with the content and format of the current meeting. Several suggestions, however, were made regarding various aspects of the meeting, including more clear instructions and goals, having dinner as a group, and bringing in more mathematicians:

*“Perhaps more (or clearer) advance instructions for the papers/presentations that we began with. As it was, the papers' content was all over the map”.*

*“Inclusion of more mathematicians, for expertise on modeling tools.”*

*“Perhaps be more specific about the goals in terms of concepts, mathematical tools, and future directions.”*

### **Conclusions and Recommendations**

Overall, the Working Group was very successful in making progress toward its goals. Evaluation survey respondents were satisfied with the meeting, indicating that it was a productive experience that met their expectations. Respondents were also satisfied with the travel, housing, and other amenities offered by NIMBioS.

Respondents overall reported high levels of learning, agreeing that they had a better understanding of the main research issues. All respondents agreed that the Working Group format allowed the group to make adequate progress toward its goals of integrating the dynamics of how biological systems function and how these functional dynamics evolve, and developing a theoretical framework for integrating both functional and evolutionary dynamics. Four of the five respondents also said they left this meeting with a good idea of what their contribution will be at the next meeting.

Most respondents indicated they planned to take the knowledge they gained during the Working Group and apply it to their own research, and that they had developed solid plans for collaborative research with other Working Group participants. Suggestions for improvement of future meetings included better communication regarding instructions and goals, having dinner as a group, and bringing in more mathematicians.

Based on analysis of participant response data, the recommendations are as follows:

- Participants were extremely satisfied with the Working Group content and format; but consider focusing more on communicating specific group goals and clarifying individual roles at future meetings.
- The Working Group had a multidisciplinary composition, but consider trying to recruit more mathematicians/modelers for future meetings.
- Keep participant diversity in mind (regarding gender, race, and ethnicity) if new participants are recruited for future meetings.
- Consider planning a dinner or another evening social event as a group during future meetings.

## **Appendix A**

### ***List of Participants***

## Participants

Last name	First name	Institution
*Akçay	Erol	Stanford University
Brown	Joel	University of Illinois Chicago
Gintis	Herbert	Santa Fe Institute
Gross	Louis	NIMBioS
Iyer	Priya	Stanford University
Mcgill	Brian	University of Arizona
Potochnik	Angela	Oklahoma State University Stillwater
*Roughgarden	Joan	Stanford University
Worden	Lee	University of California Berkeley

**\* Organizer of Working Group**



## **Appendix B**

### ***Function and Evolution Working Group Survey***

## Function and Evolution Working Group Survey

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

NIMBioS will send two reminder emails to Working Group participants who have not responded to this survey. If you would like to be excluded from these reminder emails, please enter your name below. Your survey results will still remain confidential and your name will not be associated with any of your responses in reporting of survey results.

Name:

Please check the appropriate box to indicate your level of agreement with the following statements about this Working Group: (Very satisfied, Satisfied, Neutral, Dissatisfied, Very dissatisfied)

I feel the Working Group was very productive.

The Working Group met my expectations.

The presenters were very knowledgeable about their topics.

The presentations were useful.

The group discussions were useful

I would recommend participating in NIMBioS Working Groups to my colleagues.

Please check the appropriate box to indicate your level of agreement with the following statements.

As a result of participating in this Working Group, I have a better understanding of:

(Strongly agree, Agree, Neutral, Disagree, Strongly disagree)

the evolution of pay-offs and trade-offs in biological interactions

the evolution of interaction mechanisms

modeling of the interplay between different types of functional dynamics

Do you feel the Working Group made adequate progress toward integrating the dynamics of how biological systems function and how these functional dynamics evolve?

Yes

No

Comments:

Do you feel the Working Group made adequate progress toward developing a theoretical framework for integrating both functional and evolutionary dynamics?

Yes

No

Comments:

Do you feel the expectations for the next Working Group are clear (in the sense that you are leaving this meeting with a good idea of what your contribution will be at the next meeting)?

Yes

No

Comments:

Do you feel that the exchange of ideas that took place during the Working Group will initiate or influence your future research? Please explain:

Did you develop unanticipated plans for collaborative research with other Working Group participants? Please explain:

What do you feel was the most useful aspect of the Working Group?

What would you have changed about the Working Group?

How do you feel about the format of the Working Group?

This was a very effective format for achieving our goals

This was not a very effective format for achieving our goals ->

The Working Group format would have been more effective if:

Is your work currently supported by an NSF grant?

Yes

No

Name of NSF grant:

Institution at which NSF grant is held:

Was your housing during the Working Group arranged by NIMBioS?

Yes ->

No

Overall, how satisfied were you with your housing arrangements?

Very satisfied

Satisfied

Neutral

Dissatisfied

Very dissatisfied

Comments about housing arrangements:

What could NIMBioS have done to make your stay in Knoxville more enjoyable (e.g. better information about nearby attractions, public transportation, etc.)?

Was your transportation to Knoxville arranged by NIMBioS?

Yes ->

No

Overall, how satisfied were you with your travel arrangements?

Very satisfied

Satisfied

Neutral

Dissatisfied

Very dissatisfied

Comments about travel arrangements:

Please indicate your level of satisfaction with the Working Group accommodations:

(Very satisfied, Satisfied, Neutral, Dissatisfied, Very dissatisfied)

Comfort of the facility in which the Working Group took place

Resources of the facility in which the Working Group took place

Quality of meals

Quality of drinks and snacks provided

Please indicate any changes NIMBioS can make to improve the resources and/or accommodations available to Working Group participants:

Additional comments about Working Group accommodations:

Please provide any additional comments about your overall experience with the Working Group:

## Demographics

Your participation in answering the following questions is completely voluntary and will be used for aggregated reporting only. Answer only those questions with which you feel comfortable.

I am a(n):

Graduate student

Postdoctoral researcher

University faculty—teaching/research

University faculty—teaching only

University faculty—research only

University staff

Government

Business/industry employee

Non-profit organization employee

Other:

If you are affiliated with a college/university, please describe your institution: (check all that apply)

2-year institution

4-year institution

Minority serving institution

Women's only institution

Not applicable

What is your general area of expertise/research/study?

(Select from a list)

What is your area of concentration within this general area?

(Select from a list)

Gender:

Male

Female

Are you Hispanic or Latino?

Yes

No

What is your racial background? (check all that apply)

American Indian or Alaska Native

Native Hawaiian or other Pacific Islander

Asian

Black or African American

White

## **Appendix C**

### ***Open-ended Survey Responses***

## Open-ended responses by question

**Do you feel the Working Group made adequate progress, for its first meeting, toward integrating the dynamics of how biological systems function and how these functional dynamics evolve? (n=1)**

I suspect that the group goals are evolving to some degree, but that seems like the result of a healthy group dynamic.

**Do you feel the Working Group made adequate progress, for its first meeting, toward developing a theoretical framework for integrating both functional and evolutionary dynamics? (n=0)**

**Do you feel that the exchange of ideas that took place during the Working Group will influence your future research? Please explain: (n=5)**

Absolutely. This meeting improved my understanding of the issues with which ecologists (etc.) are currently concerned, and current developments in evolutionary game theory.

I'm still not sure. I ordered three books to read on the topic and downloaded several articles.

Definitely. There were many interesting ideas exchanged (such as biology borrowing from the study of human cultures to understand interactions, the role of models in biological understanding, specific tools like mechanism design etc), and discussions on the philosophy of biology held during the workshop that will surely shape my thinking.

The diverse perspectives was extremely useful. I am optimistic about good research coming out of the collaborations

Yes. I will now be working on several interesting and hopefully useful collaborations that otherwise would not have been possible

**Did you develop unanticipated plans for collaborative research with other Working Group participants? Please explain: (n=4)**

Yes, two collaborative papers that I did not anticipate and that I think are quite promising projects.

Yes, I might collaborate with Joel Brown to test specific empirical predictions from a previously developed model, and plan to collaborate with Lee Worden to develop the applications of mechanism design (from political science) to evolutionary biology. The other participants are now supportive colleagues.

Yes - several papers not on my agenda prior to the meeting were conceived and planned in collaboration for the next 6 months

Yes, there is a chance to meld some of my favored modeling approaches with others in the group. For instance, placing multi-tier models into a G-function framework, and chances to explore the

philosophy of science through the lens of natural selection and game theory.

**Do you feel the expectations for the next Working Group are clear (in the sense that you are leaving this meeting with a good idea of what your contribution will be at the next meeting)? (n=2)**

Somewhat.

Would have been nice to have had a better game plan for next time. But .. next time will likely be valuable and productive gauging the level of collegial exchange and interactions that took place.

**The Working Group format would have been more effective if: (n=0)**

**Comments about housing arrangements: (n=1)**

Very comfortable, and close to NIMBioS and the downtown.

**What could NIMBioS have done to make your stay in Knoxville more enjoyable (e.g. better information about nearby attractions, public transportation, etc.)? (n=3)**

Nothing I can think of.

Superb. Field trip to Smokies was not only wonderful but it was a very productive step to the scientific progress

The week was excellent. I really enjoyed the afternoon in the Smokey Mountains National Park

**Comments about travel arrangements: (n=1)**

Good enough. Given how many people were traveling from the Bay Area, it was odd that none were on any of my flights.

**Please indicate any changes NIMBioS can make to improve the resources and/or accommodations available to Working Group participants: (n=1)**

I thought it was great. Well done!

**Additional comments about Working Group accommodations: (n=0)**



**Please provide any additional comments about your overall experience with the Working Group: (n=1)**

Wonderful experience!

**NIMBioS is creating a web page with links to blogs written by our participants about relevant research topics. If you maintain a blog and would like to be included in our list of links please provide your URL, as well as a brief description of the topic (n=0)**

**Brief description of your blog: (n=0)**

**What do you feel was the *most* useful aspect of the Working Group? (n=5)**

The discussions, both formal and informal.

Face-to-face, informal, frank, exchange of ideas among people with different expertise's.

The very open interaction between the participants with a variety of perspectives was insightful in many ways.

Diverse perspectives brought together

Bringing together diverse perspectives of colleagues that otherwise would not happen. The exchanges were very good and helpful, and potentially deeper and more synthetic than would be possible from just reading each others' papers.

**What would you change about the Working Group? (n=4)**

Perhaps more (or clearer) advance instructions for the papers/presentations that we began with. As it was, the papers' content was all over the map.

Dinners together.

Inclusion of more mathematicians, for expertise on modeling tools.

Perhaps be more specific about the goals in terms of concepts, mathematical tools, and future directions.