



# Evaluation Report

Multi-scale Analysis of Cortical Networks

Working Group

May 19-21, 2010

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July, 2010

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## **Executive Summary**

### **Brief Synopsis of Event**

This report is an evaluation of a NIMBioS Working Group entitled “Multi-scale Analysis of Cortical Networks” (Cortical Networks), which held its first meeting at NIMBioS May 19-21, 2010. 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 (10-12 participants with a maximum of 15), 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 Cortical Networks group comprised 10 participants, including organizers Ravishankar Rao (IBM Research Laboratories) and Ehud Kaplan (Mount Sinai School of Medicine). Participants came from seven universities and one business in the United States (See Appendix A).

The Cortical Networks Working Group brought together physicists, neurologists, and computer scientists to adapt statistical network theory into a unifying mathematical model that can be applied to the analysis of a wide sampling of neuroscientific data, ranging from single neurons to the entire brain. Several challenges the Working Group hopes to overcome include designing a technique for constructing a functional network from a set of spatio-temporal cortical measurements, determining the best network characterization technique that can withstand experimental conditions such as noise, and understanding the structure-function relationships in the resulting networks.

## Evaluation Design

An electronic survey aligned to the following evaluation questions was designed by the 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 mInterview. Links to the survey were sent to eight Working Group participants (organizers Ravishankar Rao and Ehud Kaplan were not included in the survey) on May 24 2010. Reminder emails were sent to non-responding participants on June 1 and 3, 2010. By June 10, 2010, six participants had given their feedback, for a response rate of 75%.

An electronic demographic survey aligned to the reporting requirements of the National Science Foundation was designed by the NIMBioS Evaluation Coordinator with input from the NIMBioS Director. The final instrument was hosted online via the University of Tennessee's online survey host mInterview. Links to the survey were sent to the 10 Working Group participants who had not previously attended a NIMBioS event on April 19, 2010. Reminder emails were sent to non-responding participants on April 26 and May 3. By May 10, 10 participants had filled out the survey for a response rate of 100%.

Demographic questions regarding gender, race, and ethnicity, and disability status were optional (disability status is not reported in this evaluation report). All demographic information is confidential, and results are reported only in the aggregate. When feasible, the evaluator filled in missing demographic data from other sources (e.g. address, institution, field of study). The evaluator did not assume race, ethnicity, or disability status for any participant who did not report this information.

## 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.
- All respondents agreed that they had a better understanding of the main issues related to cortical networks as a result of participating in the Working Group.
- All respondents said the ability to discuss the state of the field with a diverse group of researchers was the Working Group's most useful aspect.
- 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 its goals.
- Five of the six respondents said they left this meeting with a good idea of what their contribution will be at the next meeting.
- Five respondents said they planned to take the knowledge they gained during the Working Group and apply it to their own research, while one said the potential existed.
- Five respondents reported they developed solid plans for collaborative research with other Working Group participants, while one said collaborative research was a possibility.

## Conclusions and Recommendations

Overall, the Working Group was very successful in making progress toward its goals. Working Group 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 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 understanding the research going on in other disciplines regarding cortical networks, as well as finding a common language across disciplines in the research area. All but one respondent 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 several said they had developed solid plans for collaborative research with other Working Group participants.

Respondent suggestions offered for improvement of future meetings included increasing institutional diversity and clarifying goals for the next meeting.

Based on analysis of participant response data, the recommendations to NIMBioS and/or Working Group organizers are as follows:

- The suggestion for more institutional diversity should be considered by organizers only if they feel, as the group progresses, that the range of perspectives is limited by the fact that several members attended the same graduate institution. Otherwise, this is not an issue.
- Consider providing a written statement of group goals to group members either before or during the next meeting so that all group members are aware of the direction in which their contributions should be headed.
- NIMBioS IT staff should look into the cause of the internet connectivity issue to see if it can be resolved.

# Cortical Networks Working Group Evaluation Report

## Background

### Introduction

This report is an evaluation of a NIMBioS Working Group entitled “Multi-scale Analysis of Cortical Networks” (Cortical Networks), which held its first meeting at NIMBioS May 19-21, 2010. The Cortical Networks group comprised 10 participants, including organizers Ravishankar Rao (IBM Researcher) and Ehud Kaplan (Mount Sinai School of Medicine). Participants came from seven universities and one business in the United States (See Appendix A).

The Cortical Networks Working Group brought together physicists, neurologists, and computer scientists to adapt the statistical network theory into a unifying mathematical model that can be applied to the analysis of a wide sampling of neuroscientific data, ranging from single neurons to the entire brain. Several challenges the Working Group hopes to overcome include designing a technique for constructing a functional network from a set of spatio-temporal cortical measurements, determining the best network characterization technique that can withstand experimental conditions such as noise, and understanding the structure-function relationships in the resulting networks.

### Working Group Background

There are numerous mathematical modeling challenges facing neuroscientists, including the computational processing of the massive amounts of data typical for neuroscientific investigations. The Cortical Networks Working Group hopes to overcome this and other roadblocks plaguing the field of neuroscience.

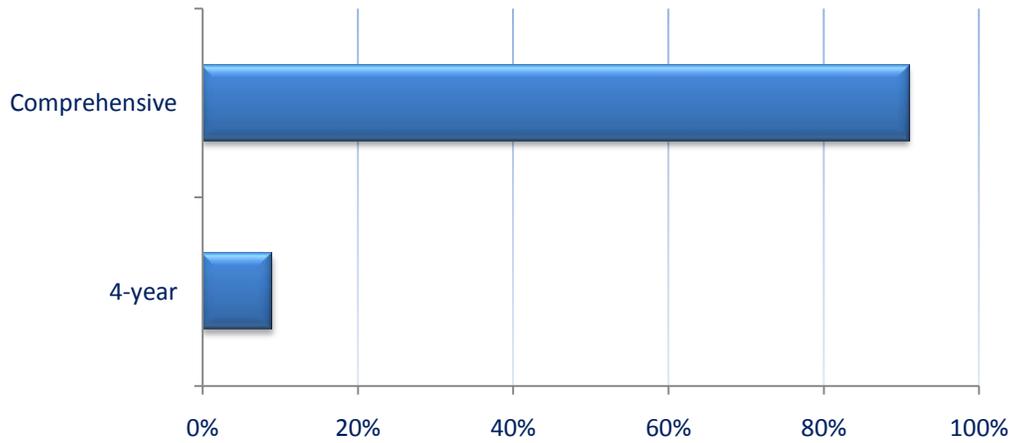
The Working Group has mapped out three basic steps they believe will assist in the collection and interpretation of neuroscientific data. The first is to convert cortical spatio-temporal measurements into a functional graph-based representation, where the nodes are cortical elements, and the edges represent correlations or other specific relations (such as causality) between their activities. The second step extracts basic network properties based on building blocks called motifs. The third step examines properties of the network as characterized by the distribution of motifs.

The Working Group plans to analyze the differences in motifs as a function of the state of the subject and the task being performed. This analysis, they believe, will allow them to determine whether functional network features can be used as bio-markers of the state of the brain. This analysis may prove useful in distinguishing diseased brains from normal ones, such as in the case of Alzheimer’s.

### Participant Demographics

The Cortical Networks Working Group participants, who were college/university faculty (80%) or business/industry employees (20%), came from seven different universities and one business in the United States (See Appendix A). Of the seven colleges/universities, 9% were classified as four-year institutions, and the remaining 91% were classified as comprehensive (Figure 1).

Figure 1. Classification of institutions (n =7)



Primary fields of study for the 10 participants included biological/biomedical sciences, computer & information sciences, and physics (Table 1).

Table 1. Participant fields of study and areas of concentration

Field of Study	Concentration	# Participants
Biological/Biomedical Sciences	Neurophysiology	1
	Neuroscience	7
Computer & Information Sciences	Computer Science	1
Physics	Biophysics	1

The three females and seven males (two of whom self-identified as being of Hispanic/Latino ethnicity) mostly self-identified racially as white (Figures 2 & 3).

Figure 2. Ethnic composition of program participants (n =10)

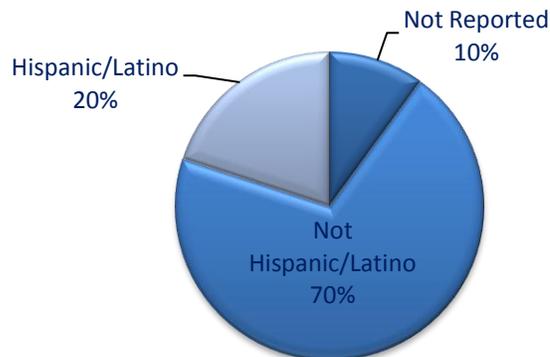
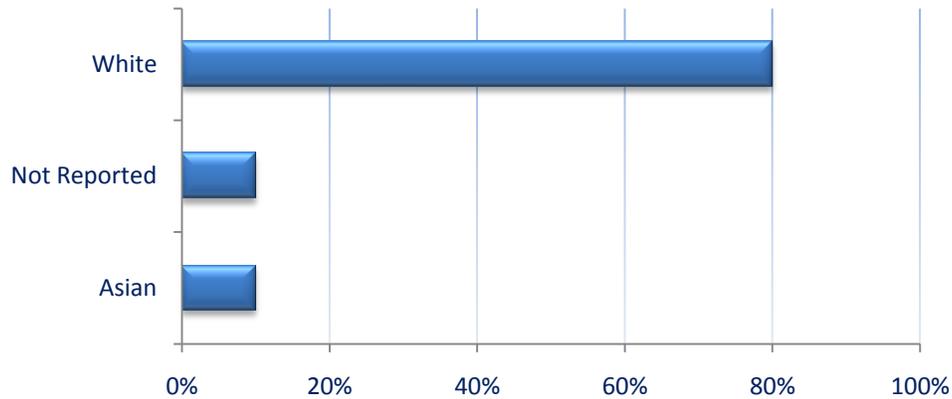


Figure 3. Racial composition of program participants (n =10)



Two respondents indicated their work is currently supported by a National Science foundation grant. (Table 2).

Table 2. NSF grants supporting participant research

Name of grant	Institution(s) at which grant is held
Causal connectivity and computations in hundreds of cortical neurons	Indiana University
Self-tuned critical networks	Rockefeller University

## 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>). 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?

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

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**

The final instrument was hosted online via the University of Tennessee’s online survey host mInterview. Links to the survey were sent to eight Working Group participants (organizers Ravishankar Rao and Ehud Kaplan were not included in the survey) on May 24 2010. Reminder emails were sent to non-responding participants on June 1 and 3, 2010. By June 10, 2010, six participants had given their feedback, for a response rate of 75%.

An electronic demographic survey aligned to the reporting requirements of the National Science Foundation was designed by the NIMBioS Evaluation Coordinator with input from the NIMBioS Director. The final instrument was hosted online via the University of Tennessee’s online survey host mInterview. Links to the survey were sent to the 10 Working Group participants who had not previously attended a NIMBioS event on April 19, 2010. Reminder emails were sent to non-responding participants on April 26 and May 3. By May 10, 10 participants had filled out the survey for a response rate of 100%.

Demographic questions regarding gender, race, and ethnicity, and disability status were optional (disability status is not reported in this evaluation report). All demographic information is confidential, and results are reported only in the aggregate. When feasible, the evaluator filled in missing demographic data from other sources (e.g. address, institution, field of study). The evaluator did not assume race, ethnicity, or disability status for any participant who did not report this information.

## **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:

*“My participation in the Working Group can only be qualified as excellent. I am looking forward to the next meeting, and to further interactions with my colleagues.”*

*“I loved it and greatly look forward to the next meeting!”*

*“This meeting surpassed my expectations. It was extremely useful, was carried out in a remarkably friendly and exciting atmosphere, and I got a lot from it.”*

All respondents thought the presentations were useful, and 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

	N	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I feel the Working Group was very productive	6	67%*	33%	0%	0%	0%
The Working Group met my expectations.	6	67%	33%	0%	0%	0%
The presenters were very knowledgeable about their topics	6	83%	17%	0%	0%	0%
The presentations were useful	6	83%	17%	0%	0%	0%
The group discussions were useful	6	83%	17%	0%	0%	0%
I would recommend participating in NIMBioS Working Groups to my colleagues	6	67%	33%	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 resources and facilities provided by NIMBioS during the Working Group (Table 5). While respondents indicated being satisfied with the accommodations, several complained about the lack of direct flights to Knoxville, and two said the wireless connection was unreliable:

*“It was difficult to maintain a smooth wireless connection in the room. We had one member who, for family reasons, could not attend but participated via Skype; the spotty coverage made the participation somewhat complicated.”*

*“The wireless network connection often disconnected for up to 30 minutes with no warning. This interrupted several skype video conferences. The ethernet connectors on the table did not have signal. Otherwise the conference room was quite fine...”*

Table 5. *Participant satisfaction with Working Group accommodations*

<b>Please indicate your level of satisfaction with the Working Group accommodations:</b>	<i>n</i>	Very satisfied	Satisfied	Neutral	Dissatisfied	Strongly dissatisfied
Comfort of the facility in which the Working Group took place	6	83%	17%	0%	0%	0%
Resources of the facility in which the Working Group took place	6	50%	50%	0%	0%	0%
Quality of meals	6	17%	67%	17%	0%	0%
Quality of drinks and snacks provided	6	17%	67%	17%	0%	0%

## **Working Group Format and Content**

### ***Participant Learning***

Respondents were also asked several questions to gauge their levels of learning about the main issues related to the research problem, including the research data available on the topic, the modeling techniques available, new techniques that need to be developed, and the types of data needed to better inform existing models.

Respondents reported high levels of learning, with 100% of respondents agreeing that they learned more about the central topics of the workshop (Table 6).

Table 6. *Participant 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 research data available on the Working Group’s topic	6	83%	17%	0%	0%	0%
The modeling techniques available on the Working Group’s topic	6	67%	33%	0%	0%	0%
New methods and modeling techniques that need to be developed	6	50%	50%	0%	0%	0%
The types of data needed to better inform existing models	6	67%	33%	0%	0%	0%

### **Most Useful Aspect**

Several respondents felt the most useful aspect of the Workshop was the ability to discuss the state of the field with a diverse group of researchers:

*“Giving us time to ask deep questions and to offer deep answers. In addition, the cross pollination of experimentalists and theoreticians.”*

*“The highly quality of the researchers, the complementarities of their work, and their open-mindedness.”*

*“Having a lot of time for discussion with colleagues.”*

*“Small size, different disciplines, time for informal discussion.”*

### **Progress Toward Goals**

All respondents agreed that the Working Group format allowed the group to make adequate progress toward its goals. All respondents said they felt that participating in the Workshop helped them understand the research going on in other disciplines regarding cortical networks:

*“This was one of the most useful and productive meetings I have ever attended. The intimate setting allowed us to ask in-depth questions of each other, with several rounds of discussion and refinement. This type of dialogue is not possible at most meetings. A key ingredient was giving us enough time to absorb what each person was saying. Another key ingredient was the mixture of theoretical and experimental people.”*

*“The experience of our first Working Group meeting was exceedingly good. Given the daunting task of coming up with sensible hypotheses to cope with the complexity of cortical networks, I was afraid that the participants would fall into their own comfortable zones - understandably. However, the small size of the group fostered an environment of collegiality that I have experienced only sporadically. I expect that the interactions established during the meeting will result in specific collaborations.”*

All respondents also felt the group made adequate progress, for its first meeting, toward finding a common language across disciplines in the research area:

*“I think we have settled on a set of issues that concern us. In the process of doing this, we had to clarify our terms.”*

*“The progress during the first meeting exceeded my expectations.”*

*“The discussion between experimentalists and theorists was excellent, and marked by a singularly informative back-and-forth.”*

*“I think that the members were engaged in one another's presentations to an extent that I had not anticipated.”*

All but one respondent said they had a good idea of what their contribution will be at the next meeting. Some participant comments:

*“Yes, we plan to meet again, and we discussed several possible ways in which we could proceed. Here, though, I do not think a strong consensus was formed. But I am not worried, as the demeanor of the group is excellent.”*

*“While we still need to draft an agenda, it is evident that we have converged on a number of ideas to explore as a group, and my contribution to that development, and the futures meetings, is clear.”*

*“I am not entirely clear what the follow-up will be. But, perhaps this is not expected as the group is a work in progress.”*

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

Five 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 indicated the possibility existed. Some participant comments:

*“Absolutely yes. As a theorist, I was exposed to a number of very interesting and surprising experimental observations, from the perspective of experimentalists who have a strong quantitative background. I believe that my colleagues found useful my contributions in terms of theory and analysis techniques.”*

*“In particular several areas of collaboration between my group and the three experimental groups in the meeting were outlined.”*

In addition to new ideas for research, five respondents said that they developed unanticipated plans for collaborative research with other Working Group participants, while one said the potential for collaboration was present:

*“I already have several collaborations in mind. The relationships are extremely valuable. I had read papers by several members of the group, but had not met the authors in person. I was finally able to ask them questions directly with the opportunity for follow-up questions. This naturally led to topics where we might perform research together.”*

*“Indeed. We have drafted a number of possible avenues of collaboration with all the participants.”*

*“I will exchange data with one group in order to look into new form of signal processing for the type of data I collect.”*

### **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. Two

respondents, however, did offer suggestions for future meetings, including increasing institutional diversity and clarifying goals for the next meeting:

*“Many members of the group have overlap at the same graduate institution. While I would not cite this as a problem at all (as this is a superb institution, and all the people are top-notch), I would try harder in the future to increase the institutional diversity. This might increase the range of perspectives.”*

*“I would like to develop an agenda for the goals of the next meeting.”*

## Conclusions and Recommendations

Overall, the Working Group was very successful in making progress toward its goals. Working Group 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 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 understanding the research going on in other disciplines regarding cortical networks, as well as finding a common language across disciplines in the research area. All but one respondent 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 several said they had developed solid plans for collaborative research with other Working Group participants.

Respondent suggestions offered for improvement of future meetings included increasing institutional diversity and clarifying goals for the next meeting.

Based on analysis of participant response data, the recommendations to NIMBioS and/or Working Group organizers are as follows:

- The suggestion for more institutional diversity should be considered by organizers only if they feel, as the group progresses, that the range of perspectives is limited by the fact that several members attended the same graduate institution. Otherwise, this is not an issue.
- Consider providing a written statement of group goals to group members either before or during the next meeting so that all group members are aware of the direction in which their contributions should be headed.
- NIMBioS IT staff should look into the cause of the internet connectivity issue to see if it can be resolved.

**Appendix A**  
*List of Participants*

## Participants

Last name	First name	Institution
Beggs	John	Indiana University, Bloomington
Cecchi	Guillermo	IBM Research Laboratories
Gallant	Jack	University of California, Berkeley
Geffen	Maria	Rockefeller University
Hirsch	Judith	University of Southern California
*Kaplan	Ehud	Mount Sinai School of Medicine
Magnasco	Marcelo	Rockefeller University
Nirenberg	Sheila	Cornell University
*Rao	Ravishankar	IBM Research Laboratories
Ringach	Dario	University of California, Los Angeles

**\* Organizer of Working Group**

## **Appendix B**

### *Cortical Networks Working Group Survey*

## Cortical Networks 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.

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 research data available on the Working Group's topic

the types of data needed to better inform existing models

new methods and modeling techniques that need to be developed

Do you feel the Working Group made adequate progress, for its first meeting, toward finding a common language across disciplines for analyzing complex evolutionary traits?

Yes

No

Comments:

Do you feel the participating in the Working Group helped you understand the research happening in other disciplines in the group's topic area?

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:

Please indicate your level of satisfaction with the Working Group accommodations:  
(Very satisfied, Satisfied, Neutral, Dissatisfied, Very dissatisfied)

Travel arranged by NIMBioS

Housing arranged by NIMBioS

Facility in which the Working Group took place

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

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

## **Appendix C**

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

## Open-ended responses, by question and response category

### **Do you feel participating in the Working Group helped you understand the research happening in other disciplines in the group's topic area? Comments: (n=4)**

This was one of the most useful and productive meetings I have ever attended. The intimate setting allowed us to ask in-depth questions of each other, with several rounds of discussion and refinement. This type of dialogue is not possible at most meetings. A key ingredient was giving us enough time to absorb what each person was saying. Another key ingredient was the mixture of theoretical and experimental people.

The experience of our first Working Group meeting was exceedingly good. Given the daunting task of coming up with sensible hypotheses to cope with the complexity of cortical networks, I was afraid that the participants would fall into their own comfortable zones - understandably. However, the small size of the group fostered an environment of collegiality that I have experienced only sporadically. I expect that the interactions established during the meeting will result in specific collaborations.

This meeting surpassed my expectations. It was extremely useful, was carried out in a remarkably friendly and exciting atmosphere, and I got a lot from it.

Overall, the meeting was a pleasure and informative and might pave the way to fruitful collaborations. For me, however, a main concern was time as, with travel, the meeting took 4 of 5 weekdays. So meetings might be one day shorter or include a Saturday. The travel service should be more effective. I was only able to get home without an additional overnight stay by a) researching all paths from Knoxville to LA and b) contacting a customer service supervisor who, after some wrangling, informed me that my complicated ticket permitted rebooking on different routes and carriers. I made my calls to the airline after speaking with the travel agency, who, I think, should have been more, rather than less efficient, than I was in rerouting. Also, because of the time it took for me to figure out what was possible, I just missed a flight that would have shaved travel time by 5 hours. Ultimately, I went without sleep for 23hrs, which is long if one must catch up on work after returning home.

### **Do you feel that the exchange of ideas that took place during the Working Group will influence your future research? Please explain: (n=3)**

I already have several collaborations in mind. The relationships are extremely valuable. I had read papers by several members of the group, but had not met the authors in person. I was finally able to ask them questions directly with the opportunity for follow-up questions. This naturally led to topics where we might perform research together.

Absolutely yes. As a theorist, I was exposed to a number of very interesting and surprising experimental observations, from the perspective of experimentalists who have a strong quantitative background. I believe that my colleagues found useful my contributions in terms of theory and analysis techniques.

In particular several areas of collaboration between my group and the three experimental groups in the meeting were outlined.

### **Did you develop unanticipated plans for collaborative research with other Working Group participants? Please explain: (n=3)**

I think I addressed this in my previous entry. Basically, the answer is a strong yes.

Indeed. We have drafted a number of possible avenues of collaboration with all the participants.

I will exchange data with one group in order to look into new form of signal processing for the type of data I collect.

**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)? Comments: (n=3)**

Yes, we plan to meet again, and we discussed several possible ways in which we could proceed. Here, though, I do not think a strong consensus was formed. But I am not worried, as the demeanor of the group is excellent.

While we still need to draft an agenda, it is evident that we have converged on a number of ideas to explore as a group, and my contribution to that development, and the futures meetings, is clear.

I am not entirely clear what the follow-up will be. But, perhaps this is not expected as the group is a work in progress

**What do you feel was the most useful aspect of the Working Group: (n=6)**

Exposure to some new methods I was not aware of.

Giving us time to ask deep questions and to offer deep answers. In addition, the cross pollination of experimentalists and theoreticians.

The highly quality of the researchers, the complementarities of their work, and their open-mindedness.

The atmosphere of openness and respect among participants.

Having a lot of time for discussion with colleagues.

Small size, different disciplines, time for informal discussion

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

Many members of the group have overlap at the same graduate institution. While I would not cite this as a problem at all (as this is a superb institution, and all the people are top-notch), I would try harder in the future to increase the institutional diversity. This might increase the range of perspectives.

At the moment, I would not change anything.

I would like to develop an agenda for the goals of the next meeting.

Some members could not attend, in part because of difficulty in reaching the meeting site.

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

**Name of NSF grant: (n=2)**

Proposal number: 0904912. Proposal title: Causal connectivity and computations in hundreds of cortical neurons.

NSF EF-092873. Self-tuned critical networks

**Institution at which NSF grant is held: (n=2)**

Indiana University

Rockefeller University

**Please indicate any changes NIMBioS can make to improve the resources and/or accommodations available to Working Group participants: (n=5)**

I was amazed at the quality of the overall event. It would be hard to improve things. But a question arose while I was there: What does NIMBioS get out of us being there? We didn't interact much with anyone from the University of Tennessee. This is not a problem, but I would assume that the reason you want us to come there is to interact with some of your people. Perhaps this could be clarified or considered in the future.

It was difficult to maintain a smooth wireless connection in the room. We had one member who, for family reasons, could not attend but participated via skype; the spotty coverage made the participation somewhat complicated.

The wireless network connection often disconnected for up to 30 minutes with no warning. This interrupted several skype video conferences. The ethernet connectors on the table did not have signal. Otherwise the conference room was quite fine. , I would have appreciated a choice of lighter calorie food, such as salads for lunch rather than sandwiches/rolls and more fruit for breakfast. These are the only reason I did not mark the highest grade.

It was difficult to get to the location in Knoxville by airplane, and several members did not make it in the end due to travel delays. It would be better to be in a place to which it's easy to fly to directly.

As mentioned, off site meetings might be a good idea to reduce travel time and related obstacles.

**Please provide any additional comments about your overall experience with the Working Group: (n=2)**

I loved it and greatly look forward to the next meeting!

My participation in the Working Group can only be qualified as excellent. I am looking forward to the next meeting, and to further interactions with my colleagues.

**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 the URL as well as a brief description of the topic of the blog: (n=1)**

<http://www.indiana.edu/~iubphys/research/faculty/Beggs.shtml>

**Brief description of your blog: (n=1)**

It is not a blog, but my departmental webpage. I only rarely update it.

**Please use this space for any comments you have about the Wiggio: (n=2)**

It is fine.

As I mentioned, we had one member participate through skype. We tried to look for a similar tool in the wiggio website without much success.

**Why did you not use the Wiggio? (n=1)**

confusing and unneeded.

**Do you feel the Working Group made adequate progress, for its first meeting, toward finding a common language across disciplines in the research area? Comments: (n=4)**

I think we have settled on a set of issues that concern us. In the process of doing this, we had to clarify our terms.

The progress during the first meeting exceeded my expectations.

The discussion between experimentalists and theorists was excellent, and marked by a singularly informative back-and-forth.

I think that the members were engaged in one another's presentations to an extent that I had not anticipated.