Executive Summary for the Final Evaluation Report for *Neurons in Action Version 2: Understanding the Behavior of Normal and Abnormal Neurons* (NSF DUE Award #0442748)

Principle Investigators

Ann Stuart, Ph.D., University of North Carolina at Chapel Hill

Evaluators

Mary E. Searcy, Ph.D. and Jill E. Thomley, Ph.D., Appalachian State University

Project Goals

The specific aims (i.e., goals) of the *Neurons in Action Version 2: Understanding the Behavior of Normal and Abnormal Neurons* project were as follows.

- Specific Aim #1. To restructure, refine, and add features to the existing tutorials.
- Specific Aim #2.To extend the range of NIA downward to the chatter of single channels and upward to the behavior of simple circuits.
- Specific Aim #3.To add new tutorials to the original prototype.

Major Findings

In order to fully capture the scope and the objectives of this project, a variety of complementary data collection methodologies were used: (1) evaluator reviews of all of the project materials (in print and on the NIA2 CD) as well as the contents of the project web site; (2) biology consultant review of NIA2 book and CD; (3) surveys of faculty and students who used NIA2, including the participants in the 2007 and 2008 Summer Program in Neuroscience, Ethics & Survival at MBL in Woods Hole, who were personally instructed by PI Ann Stuart; (4) communications with PIs, including telephone, e-mail, and in-person interviews; (6) e-mail communications with various other individuals involved in the project, including instructors, TAs, and programmers; and (7) site visits (including classroom observations, interviews, and artifact collection) to institutions using the NIA2 materials with undergraduate and graduate/post-doctoral students. These data provided a rich, multi-layered picture of the project materials in action from a variety of angles. Information gathered from all data collection methods described were combined and synthesized to address and evaluate the three project objectives. The major findings are outlined below.

- Within the current version of NIA2, the PIs have essentially completed all of the goals that were listed in Specific Aim #1 and Specific Aim #2. PI John Moore is currently working on the tutorials that were outlines in Specific Aim #3. Understandably, this last set of tutorials was delayed by the need to substantially restructure and revise the user interface from the prototype NIA1. This was done in part to adapt to changes in computer technology and to take advantage of improved web-based presentation formats such as XML. We feel this investment of time and energy was more than worthwhile.

- We have evidence that the student learning objectives embedded within the tutorials outlined in the NSF proposal have been largely achieved. Students are incredibly excited to be able to visualize neuroscience concepts that until now could only be presented as a static collection of facts and equations to be memorized.

- This educational tool not only changes the way instructors are teaching but also what they are teaching. Many instructors have told us that at the undergraduate level, many topics they can cover with NIA2 would be impossible to address otherwise.

- This education tool not only changes the way that students learn concepts in neuroscience, but also what they learn. Learning is not simply a matter of observing *what* happens, but of making connections to the underlying physiology and answering the question of *why* things happen.

- Making the connection to *why* is not a trivial exercise. NIA2 has made substantial progress in guiding students toward a dynamic way of exploring these ideas. However, we observed that most undergraduate students struggled with these deeper levels of thinking and answering the *why* questions.

- Instructors who teach the lowest-level introductory neuroscience course find it extremely challenging to incorporate NIA2 for many reasons. The introductory neuro curriculum is typically packed with a variety of topics. Also, these courses are more likely to have less computationally literate students, or students who are not neuroscience majors.

- One "side effect" of the NIA2 experience is that some students are spontaneously starting to catch the "scientific inquiry bug." This is extending beyond simply exploring the questions that are posed in the NIA2 tutorials. Students are asking their own questions and actually taking steps to seek the answers on their own.

- Not only are students asking questions and exploring, but faculty using NIA2 have reported learning new things about neuroscience concepts themselves.

- The more students and instructors use NAI2, they more they want. It is rare that NIA2 covers all concepts in a course. Once students get a taste of interactive learning for the concepts that are included, they want it for everything. In fact, we were told by one student that those who have not been able to learn neuroscience concepts using NIA2 are at a *disadvantage* in their courses.

- NIA2 is closing the gap between what researchers are doing right now in their labs and what undergraduates are learning in the classroom.

In conclusion, the evaluation team would like to state that we believe that the *Neurons in Action Version 2* project is one of the most exciting and necessary innovations currently in development for neuroscience education today. It was a tremendous pleasure to be involved in such a dynamic process with investigators and educators as visionary as Ann Stuart and John Moore. For them, the NIA2 project is the realization of concepts and ideas that they have explored and struggled with presenting to students throughout their careers. Technology has finally made implementing many of their visions a reality. We want to encourage them to consider the comments we have

made about the achievements of NIA2 to date, as well as the suggestions made by everyone who provided feedback about the NIA2 materials, in order to make even greater gains in the future. It is clear that the instructors using NIA2 see its worth, and are clamoring for more.

The attached report expounds on the major findings in much greater depth, including a point by point analysis of the changes made from NIA1 to NIA2, summaries of survey items, descriptions of observed classroom use of the materials, direct quotes from the students and faculty who used these materials during the grant period regarding various aspects of NIA2, and detailed feedback from faculty and students about what they liked (and disliked) about the current version and what they would really like to see in any future updates. Finally, the evaluators offer their conclusions regarding the extent to which the project's three Specific Aims as well as the implicit educational goals were met, and make recommendations for future directions.