**SECTION II – SPONSOR & COSPONSOR INFORMATION**

**a. Research Support Available**

I have no funding support currently available for a PhD student for the proposed training experience.

Support for the applicant, Steele, and for her PhD thesis research is guaranteed by the Center for Neural Science and NYU.

**b. Sponsor's Previous Fellows/Trainees**

Predoctoral: 9; Postdoctoral: 32.

B Ermentrout (1979-82) Univ Pittsburgh (Dept Math, Full Prof)

S Shamma (1983-84) Univ MD, College Park (EE Dept, Full Prof)

G Svirskis (1998-05) Kaunas Medical Univ, Lithuania (Group leader)

P Jercog (2004-08) Columbia Univ (postdoc w/ E Kandel, neurosci)

E Shea-Brown (2004-07) Univ Washington (Applied Math Dept, Asst Prof)

**Co-sponsor Elyse Sussman:**

Total trainees: 28

J Rimmelle (2008-11) Postdoc, Hamburg University

A Panasse (2010-11) Research Scholar, Columbia University

E Dinces (2004-pres) Associate Prof.,Montefiore Medical Center, Dept. Otorhinolaryngology HNS

S Chen (2009-pres) Postdoctoral

J Sussman-Fort (2010-pres) Predoctoral

C Max (09-pres) Predoctoral

**c. Training Plan, Environment, Research Facilities**

Classes, seminars: Trainees in my group frequently take graduate-level applied math courses and experimental and computational neuroscience courses at NYU (the latter in either the Courant Institute of Mathematical Sciences or the Center for Neural Science, CNS). Steele has already had the foundational neuroscience courses in CNS. I will encourage her take as electives some of the following computationally oriented courses: Math aspects of neurophysiology; Modeling of neuronal systems; Neuronal networks; and importantly, a graduate level statistics course from our Psychology Department. There are numerous seminars and journal clubs, including the topics mathematical biology, nonlinear dynamics, computational neuroscience and auditory processing. In addition, in CNS there is a Student-Postdoc Forum (SPF) for graduate students and postdocs, in which participants meet weekly to discuss and critique recent journal articles in the field. Trainees also present at our Auditory Journal Club. I will also encourage Steele to submit applications to the intensive 2-4 week summer courses in computational neuroscience (MBI-Woods Hole, ACCN –currently in Poland, China course – primarily cognitive focus…). These courses recruit top-notch faculty over a broad range of topics; the students are welcomed into the international community.

Interaction with other groups and scientists: My working group (3 postdocs and 2-4 predocs) has a bi-weekly multi-lab meeting at which considerable interaction occurs. The meeting includes members of other working groups, those of Xiao-Jing Wang (CNS), Daniel Tranchina (Courant Institute) and Alex Reyes (CNS). Both mathematical and experimental issues and results are discussed. There is a rotation sequence for presentations of ongoing research by each group member. I encourage and facilitate interactions with other groups and scientists. I have established a working relationship for research and training in the area of auditory scene analysis with Dr Elyse Sussman at the Albert Einstein College of Medicine. Her work involves behavioral experiments with human subjects, including EEG analysis, and her interests overlap with Steele’s. Dr Sussman has agreed to serve as co-sponsor for Steele, offering guidance in training and in the research being proposed here. Since Sussman’s lab is a straightforward commute from NYU, we expect that Steele will make frequent visits. Over many years with training students and postdocs, in collaborative cross-disciplinary projects, I hold planning, assessment, working meetings regularly and jointly with co-mentors; I expect to have joint meetings with Steele and Sussman at Einstein and at NYU. Sussman has already invited Steele to present her preliminary results at her lab meeting. I urge my trainees to attend and present their results at one or two conferences per year including primarily experimental audiences (e.g., Society for Neuroscience meeting, and ARO Mid-winter meeting) as well as mathematical/computational audiences (e.g., the annual Computational Neuroscience meeting).

Interaction with PI: I meet with each of my trainees individually on a weekly/bi-weekly basis, and more during times of intense research activity or writing/presentation preparation or when they/I request a get-together; I am frequently available for lunch with them. These direct interactions with my postdocs and students involve problem formulation, experimental protocols, solution methodology, analysis, interpretation and presentation of results; the trainee usually writes the first draft of any paper or poster and I edit the manuscript.

Research environment: Each of my trainees has office space (in the CNS and/or in the Courant Institute) with a desk and computer workstation, and use of the computing facilities of the Courant Institute and the CNS. My computational “lab” in CNS has 450 square feet that includes a conference area (300 square feet) and with some workspace for postdocs/visitors. My lab will have (delivery expected in the next few weeks) a 4x6 sound proof booth (equipped with monitor, dedicated computer and quality head phones) for auditory psychoacoustic experiments.

Relationship of research training to Steele’s career goals: In joining my working group, Steele (coming from a cognitive science background) is placing herself into a multidisciplinary research environment that is unusually rich in theory. Several labs in the CNS are primarily computational: Rinzel, Simoncelli, Wang, Daw (joint with Psychology Dept). She will on a day-to-day basis be interacting with neuroscientist experimentalists (behavior and wet experiments) and theorists. This will naturally expose her to a broad range of research topics in systems and computational neuroscience that are actively being pursued; such exposure is one of her primary goals. The proposed research, especially the modeling component, will challenge Steele to think in new and general ways, to formulate new models, and to communicate effectively with both theorists and experimentalists. I will work directly with Steele in setting up the behavioral experiments in my lab; Sussman’s expertise will confirm and further guide our protocols. The co-mentoring by Sussman and myself will also illustrate for Steele how theory and experiment can synergize. Steele has expressed to me the wish to be challenged in these ways.

Relationship to Steele’s career goals of the skills and techniques that she will learn: Through our guidance Steele will learn to meet the challenges described above. She has already demonstrated during her pilot studies some proficiency with Matlab to generate sound stimuli, to gather and analyze data as well as to program and run the mechanistic competition and statistical (ARP) models. Acquisition of these multidisciplinary skills is important for becoming a practicing neuroscientist that seeks to wear two hats. During the duration of the project she develop more the abilities to formulate new models and to design experiments to test the models, disprove them, enhance them and to design new experiments. She will learn foundations of dynamical systems theory, neuromechanistic and statistical modeling and auditory scene analysis. The project is well-suited for learning these skills and techniques. She will develop empirical experience, intuition, and skills for modeling and performing auditory psychophysical experiments.

**d. Number of Fellows/Trainees to be Supervised During the Fellowship**

I anticipate 2-3 postdocs (currently 3) in my lab. I anticipate the current group of predocs to continue through Steele’s training period: 2 from Math and 2, including Steele, from Neural Science (each will be co-mentored).

**e. Applicant's Qualifications and Potential for a Research Career**

I have known Steele for about 1 year, first as a student in my introductory neural modeling course then as a rotation student in my lab since Spring, 2012. She did a good class project related to the neural competition models that we had developed for perceptual bistability in vision (over the past 5 years), using dynamic plaids. In conversations that we had about perception and auditory streaming Sara would ask very good questions and raise interesting ideas for experiments to do. I proposed to her as a rotation project the issue of buildup, the time course of the probability for the 2-stream percept of the triplet pattern, ABA\_ABA\_.., in the ambiguous regime. I was unsure about the level of math that Sara could take on. The project could have been a totally simulation based study of my statistical model idea. But, interestingly, my colleague Dan Tranchina in Math had seen similar phenomena in a completely different context. He with others in Math had formulated the math problem for this statistical model and had solved it analytically, using Fourier transform methods. Sara bit… she jumped in and implemented some of Tranchina’s methodology in order to fit the stat model to simulated data. Furthermore, she used our previously developed, neuromechanistic, competition model for perceptual bistability (the dynamics of alternations) as a testbed – it was our perceptual bistable neuronal system in the computer. She could fit the stat model’s parameters well to the buildup seen in the competition model.

Further, Sara successfully was able to read and analyze some data that I had gathered during my sabbatical on the Career Development award, the first behavioral data for me. This confirmed for me her strong determination and skills with data. Sara values the techniques and concepts from dynamical systems theory and stochastic dynamics that we apply to understand the dynamics of neuronal systems and she wants to learn more. This will be part of her training program.

Throughout our working together, Sara has shown an intense curiosity, ability to generalize concepts and ideas, capability to develop Matlab tools for modeling and data analysis, and productivity. She presented some of her early results at the 2012 SFN meeting and received enthusiastic feedback. I see that Sara has the motivation for research, the creativity to pose good questions and attack them from different angles, the confidence to learn and apply tools and concepts from math, stats, psychophysics and neuroscience to seek understanding of the issues at hand. She has strong potential for a successful career in research.