Duke University Biodynamics Laboratory

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December 8, 2003

Biocomplexity Faculty Search Committee
c/o Prof. Rob de Ruyter van Steveninck
Biocomplexity Institute
Indiana University
Swain Hall West 117
Bloomington, IN 47405-7105

Dear Professor de Ruyter van Steveninck:

I am writing to recommend enthusiastically Dr. Alena Talkachova for a position as an Assistant Professor of Biocomplexity at Indiana University. I have collaborated with Dr. Talkachova for the past 18 months as a post-doctoral researcher in my group working on projects related to characterization and control of the dynamics of cardiac muscle. She has been extremely productive during the period (two published papers, both selected by the *Virtual Journal of Biological Physics* that recognizes important papers in the field), two submitted manuscripts, and a third that will be submitted shortly. In addition, she has played a large role in mentoring graduate students from different disciplines, allowing her to make important connections between experimental observations and the predictions of the mathematical models she has been developing. Dr. Talkachova is highly qualified and is at the point of her career to develop an active experimental biophysics laboratory as well as taking on the responsibilities of teaching and service.

Before discussion more of her qualifications, it may be helpful to know more about the Duke research environment. Our cardiac dynamics program is an highly multi-disciplinary effort involving myself (primary appointment in Physics, secondary in Biomedical Engineering), Profs. Wanda Krassowska, Patrick Wolf, and Craig Henriquez (Biomedical Engineering), Prof. David Schaeffer (Mathematics), and Dr. Salim Idriss (Pediatric Cardiology). Other group members include, from the various department, two post-doctoral research associates, seven graduate students, and two undergraduates. We have a small grant from the NSF focused on controlling cardiac dynamics and a recent larger grant from NIH on characterizing dynamics. Our goal is to develop simple mathematical models

that capture important features of the dynamics we observe in experiments, where there is a substantial interplay between both. To achieve this goal, we create teams that cross the disciplines so that the experimenters work closely with the model developers.

When Dr. Talkachova joined our group, she primarily worked on analysis of mathematical models, demonstrating how to derived a so-called mapping model of cardiac dynamics starting from a simplified ionic-based model. She worked closely with Prof. Schaeffer and me on this work, where she implemented ideas that were originally developed and outlined by Prof.Schaeffer. She did very well on these initial projects and is starting to make the transition from carrying out projects to being the originator of new projects. As the work proceeded, we came up with new experimental pacing protocols that would give us data needed to determine whether the models agree with the response of the actual tissue. Developing the protocol was very much a group effort where Dr. Talkachova had substantial input. In addition, she has been working closely with the graduate students in the group, teaching them the mathematics they need to understand her work and compare it to the experiments. I have recently asked her to act as if she were a faculty mentor to the students, where she guides the students in the work rather than just doing the work on her own.

The goal of her research proposal is to apply ideas that she has developed to various experimental situations. In particular, our group has developed a new technique for more fully characterizing the restitution properties of myocardium, called the *restitution portrait*. The restitution portrait appears to be a powerful tool for characterizing both the short-and long-term rate-dependent changes in restitution and may lead to new methods for assessing vulnerability for fibrillation. Currently, we have measured the restitution portrait for frog ventricles. Dr. Talkachova will develop a laboratory to measure the restitution portrait for a variety of mammalian species. She will then use her mathematical skills to make a comparison of her experimental observations with the predictions of various models of cardiac dynamics. Combining experimental skills with such a strong theoretical background will position her to make sustained contributions to the field of biophysics and electrophysiology.

In the area of teaching, Alena has worked closely with me to develop and teach a new first-year, discussion-based seminar at Duke, entitled "PHY 49S: Clocks, Chaos, and Complexity in the Living World," taught for the first time in Fall 2003. She worked with me to read several books related to the topic of the course, select the ones that would be used in the course, and to develop the schedule and activities for the semester. She attended every class to help with moderating the discussion, helped to grade the student presentations, and we

met once a week with me to discuss the class progress as well as teaching methods. Based on this experience, I am confident that she is ready to create her own courses at any level, or to contribute effectively to your ongoing courses.

On a personal level, Dr. Talkachova is a good colleague who cares about the research and teaching programs and works hard. Her spoken English is very good and she gives very good presentations (with some advice about keeping the detailed mathematics to a minimum). Her written English is good and has improved immensely since joining our group. I don't see either of these factors hindering her academic career. I recommend Dr. Tolkachova for the Assistant Professorship without reservation.

Sincerely,

Daniel J. Gauthier

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