UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

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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 Dr. Ruyter van Steveninck:

This letter is in support of Dr. **Vladislav Toronov** who is applying for a position at Indiana University.

Dr. Toronov worked in my laboratory, the Laboratory for Fluorescence Dynamics (LFD), from 1996 until 2000. As you may know, the LFD is a national biomedical research resource, funded by the National Institutes of Health and, in addition to providing a state-of-the-art laboratory for time-resolved fluorescence measurements to visiting scientists/users, we are a leader in the field of designing, testing, and implementing advances in the technology, especially in hardware, automation software, and applications to the biomedical arts.

I recruited Dr. Toronov from Russia to work on a project in the LFD to measure and analyze hemodynamics changes occurring in the brain upon sensory or motor stimulation using non-invasive near-ir frequency-domain methods. He rapidly adapted to the new environment in Urbana-Champaign and started the project by first evaluating the sensitivity and the time scale that can be reached with our instrumentation. Although this first task was essentially to establish the limit of a technology, he used this test to produce a very valid publication in *Physics Review E.* He showed that the methodology of fluctuation correlation spectroscopy could be applied *in vivo* with a time resolution of a few milliseconds. He then measured the fluctuation spectra at rest of different tissues and in particular the brain. He constructed a probe that can simultaneously measure different parts of the brain and he developed many of the mathematical routines that we now employ to extract correlations between the response of different parts of the brain. During this work, he noticed that the so-called baseline was not actually a constant baseline. He measured the spectrum of the fluctuations of the baseline to find out that the oscillation amplitude of the baseline is larger or the best comparable to the oscillations due to stimulation. On his own, he began to study how to describe the spectrum of the oscillations. He was able to use a theory of how to treat the problem of phase synchronization of signals derived from complex system analysis. He reinterpreted the data and has a relatively large paper describing his findings.

Dr. Toronov's major achievements have been in the mathematical modeling of data. This is not a trivial task in a field in which the physiological phenomena are very complex and relatively unknown. It is my opinion that his work stands as the pioneering work of a new way to analyze hemodynamic data. Dr. Toronov started a collaboration with a group at U of I working in

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functional MRI. He developed a near-ir sensor that can be placed inside the magnet to show the effect of the oscillations of the baseline on the fMRI data. He is now working on a comparison with the fMRI results.

Dr. Toronov is a team player, but he is also an independent researcher. His performance has always been outstanding. He sets his own goals and develops projects on his own. He has a genuine interest in mathematical modeling, but he is also very good in collecting the data and designing and performing the experiments. Teaching was not part of Dr. Toronov's duties, but he was very good at the lab, clearly explaining and helping the young graduate students and the frequent visitors we have to perform near-ir non-invasive measurements. He has presented his work in several meetings with clarity and profound knowledge.

Currently, Dr. Toronov is a senior research scientist, working at the Beckman Institute at UIUC, in the center for basic research and clinical studies of brain diseases such as Alzheimer's and Schizophrenia. He is in charge of the development of a non-invasive combined optical and MRI technique for studying blood flow to different regions of the brain, and how these are altered for normal, aged, and diseased brains. This technique has potential uses in a variety of diagnostic, prognostic, and clinical applications. For example, it could be used to find hematomas in children, or to study blood flow in the brain during sleep apnea. It could also be used to monitor recovering stroke patients on a daily or even hourly basis--something that would be impractical to do with MRI alone. The simultaneous application of optical and MRI techniques is unique in the United States. Clearly, his research is of great importance in the development of new technologies for medicine and biology.

I highly recommend Dr. **Vladislav Toronov** to you. If you need further information, please do not hesitate to contact me via email or telephone.

Sincerely yours,

Enrico Gratton

Enrico Gratton, Ph.D.
Principal Investigator of the
Laboratory for Fluorescence Dynamics
and Professor of Physics and Biophysics

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