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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 Professor de Ruyter van Steveninck:

This letter is to provide the highest possible recommendation in regard to **Dmitri Toptygin** who is being considered for a faculty position in your department. This candidate is an extraordinary individual who merits your serious consideration. His basic training is in Physics but he is also well trained in Biophysics, Biochemistry and Biology. His training in Physics was at the Moscow Institute of Physics and Technology and at the Lebedev Physics Institute of the Russian Academy of Sciences in Moscow. Since 1994, he has been at The Johns Hopkins University in Baltimore using spectroscopic approaches to investigate biological problems.

Dr. Toptygin has been an outstanding colleague. His background in optics, quantum electrodynamics and laser technology could not be more impressive. At Johns Hopkins, he has demonstrated expertise in all areas of spectroscopy. He constructed our current single photon-counting pico second time-resolved fluorescence spectrometer and greatly improved the YAG laser used as the light source. Dr. Toptygin made a fantastic contribution to our research since he developed most of the software now in use by the research group. This includes software that runs the instrumentation and collects both steady-state, and pico-second time-resolved fluorescence data but of even greater importance includes the software that is used for data analysis and presentation. I should point out that analysis of picosecond time-resolved fluorescence data as applied to biological macromolecules is more complex than might be expected. Analysis of both fluorescence intensity and fluorescence anisotropy decay is involved. The decays are influenced by rotational motion, energy transfer and electrostatic interactions that take place during the excited-state lifetime. To evaluate the multi-parametric decay laws that apply, data obtained under a variety of conditions must be analyzed simultaneously. In addition, systematic errors in the instrumentation must be taken into account.

Dr. Toptygin has worked on several basic problems in Biophysics. Biological membranes have properties in common with liquid crystals, yet are more complex being made up of a number of different types of molecules. They are also heterogeneous. Various spectroscopic tools are of value to study the static structures and dynamics of membranes.

Using diphenylhexatriene (DPH) as an example, Toptygin has worked out the theory and experimental procedures for determining order parameters for the probe in unoriented bilayer vesicles. This approach can be applied to real biological membranes.

Understanding changes in the composition of multicomponent systems is an important problem in Biophysics. Control of enzymatic activity as well as control of the binding of oxygen to hemoglobin involves changes in conformations of proteins (allosteric control). Toptygin has developed new and innovative ways to unravel mixtures of spectroscopic signals that in turn can be used measure changes in the heterogeneous composition of proteins.

Dr. Toptygin's recent interests have included both theoretical and experimental work related to rapid dynamic interactions in proteins. This is of key importance in relating structure to function in protein molecules. He has studied electrostatic interactions in proteins, making use of dynamic internal Stark effects of tryptophan to initiate protein motion during the lifetime of the excited state. He has recently published an important paper on the effect of solvent refractive index on the radiative decay rate of a fluorophore.

Dima is an excellent teacher. I have observed him teaching a large class as well as talking to small groups or teaching on a one on one basis. He has a thorough knowledge of the fundamentals and quickly learns new aspects of biophysics. He has a knack for figuring out the level of a student's knowledge in Physics, Math or Biophysics and then tuning his explanations to a level that a student can understand. It is clear that he really enjoys the teaching aspect of academic life. Dima has taught in our advanced biochemistry course and has helped students to understand non-linear least squares procedures for data analysis. He has also given lectures on the binding of small molecules to macromolecules. He has been an active teacher in our graduate course in Fluorescence Spectroscopy. His lectures emphasized the more theoretical aspects of fluorescence and were the highlight of the course. He would do an outstanding job teaching any course in Physics or Biophysics. He has less of a background in astrophysics than in other areas.

Dima interacts very well with others and it has been a joy having him at Hopkins. This individual will make major contributions in Physics and Biophysics it would be a great honor to have him as a colleague in our department but I know that his heart is in Physics. I obtained the Ph.D. at Indiana University and have the fondest memory of my graduate days there. It would give me particular pleasure to see Dima in Bloomington interacting between physics and the life science community.

In summary, Dima Toptygin is an extraordinary scientist. He is highly innovative and also very solid in his approach to science. He is able to impart this to his students. This recommendation is written with the greatest of enthusiasm.

Sincerely yours,

Ludwig Brand

Ludwig Brand
Professor of Biology and Biophysics