Ekaterina Nagornyak
Shoreline, WA 98177

November 25, 2011

UW School of Medicine
Department of Pathology
Attn: Prof. Kristin Swanson
Seattle, WA 98195

Dear Prof. Swanson,

I write to you respectfully to be considered a competitive candidate for the Research Scientist position posted on your group's webpage. With over ten years of experience developing statistical analysis methods and mathematical models to interpret large biological data sets, I am eager to apply my expertise towards your group's mathematical approach to understand and quantify brain tumor progression and effectiveness of cancer therapies.

During my master's program, I formulated non-linear mathematical models to describe turbulent blood flow in human heart and arteries, using partial differential equations, and chaos and bifurcation theories. Using our model written with Mathematica and Delphi programming languages, I was able to successfully simulate and identify the physiological parameters of non-equilibrium flow regime.

Throughout my doctoral and post-doctoral appointments in the Department of Bioengineering at the University of Washington, I investigated the mechanical properties of cardiac and skeletal muscle and biochemical activation factors utilizing single-molecule biophysics. The single molecule sensitivity was achieved through embedding custom noise-reduction algorithm to our Labview data acquisition system, which is now used by numerous laboratories around the world. Moreover, I performed extensive image processing and statistical analysis on large data sets using both Matlab and ImageJ, and was able to successfully develop a mathematical model to understand molecular mechanism of muscle contraction and filament interaction.

Along with my technical competency, I have considerable management and supervisory experience from my post-doctoral appointment; I supervised several senior staff members and graduate students on in vitro muscle experiments and the use of statistical analysis package we developed. I was also in charge of general laboratory managerial duties including purchasing, inventory and maintenance of general laboratory materials and major equipments.

My technical communication skills were honed through routine interactions with other scientists and engineers, and extensive experience in preparations of manuscripts and abstracts for publication and presentations at numerous international conferences. Further, through my active involvement in three competitive NIH grants, I became very familiar with NIH grant preparation process. I believe I contribute to securing external funding of the laboratory.

Having spent the past two years at home raising my first child—commonplace in my cultural tradition, I am eager to return to a full-time position at a meaningful work environment. While I find bench science interesting, I would like to be involved in studies with direct clinical applications. Development of statistical methods and mathematical models with a vision to improve cancer treatment is highly attractive prospect and poses exciting challenges. It is to this end that I envision myself aligning with your group and its philosophy, and I strongly believe I have what it takes to become a constructive member of your team.

I sincerely thank you for your time and consideration of my qualifications. I look forward to hearing from you soon to discuss available projects in more detail.

Sincerely,

Ekaterina Nagornyak

Enclosure: CV with references

EKATERINA NAGORNYAK
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EDUCATION

B.S. Biophysics, 1995-1999
Ural State University, Ekaterinburg, Russia

B.S. Management in science-related fields, 1995-1999
Ural State University, Ekaterinburg, Russia

M.S. Molecular Physics, 1999-2001
Ural State University, Ekaterinburg, Russia

Ph.D. Biophysics, 2001-2004
Russian Academy of Sciences
In collaboration with Department of Bioengineering, University of Washington, Seattle, WA

Additional coursework:
Biostatistics, University of Washington, Fall 2008;
The Biomaterials Intensive Short Course, University of Washington, 2009

EXPERIENCE

SENIOR POSTDOCTORAL FELLOW, Oct 2004- Oct 2009,
PI: Gerald H. Pollack, PhD., Department of Bioengineering, School of Medicine and College of Engineering, University of Washington

- Developed noise reduction algorithm and data acquisition software for pN force transducer system
- Performed biophysical experiments to study influence of activation factors on elastic properties of myosin protein microfilament *in vitro*.
- Performed statistical analysis on large data sets and image data using Matlab and imageJ
- Developed mathematical model of muscle protein interactions and defined physiological parameters
- Performed cell isolation and protein purification and analysis
- Redesigned and fabricated of pN nano-transducers at Cornell National NanoScience facility.
- Trained senior research staff, graduate students and undergraduate students.
- Wrote/reviewed NIH R01 grant proposals and manuscripts for publication, and presentation of results at national conferences
- Designed and managed Long-term consultation sessions on the use of pN force transducer instrument for faculty members and senior scientist from Toyota Corporation Research Center (Japan), University of Washington (Seattle), and McGill University (Canada).

RESEARCH ASSOCIATE, Oct 2003- Oct 2004,
PI: Felix Blyakhman, PhD., Department of Physics, Ural State University

- Performed biophysical experiments to investigate the sliding movement of single filaments (myosin and actin), including force of interaction between the filaments in vitro.
- Developed mathematical theoretical model of muscle contraction: model design of single thin-thick filament sliding interaction as well as in sarcomere.
- Tracked changes in mechanical properties of cardiac muscle as a result of heart attack from real patient data sets (clinical study)

RESEARCH SCIENTIST, Sept 2001- Sept 2003,
PI: Gerald H. Pollack, PhD., Department of Bioengineering, University of Washington
Co-PI: Felix Blyakhman, PhD., Department of Physics, Ural State University

- Performed in vitro experiments to understand the dynamics of sarcomere length change: measurements and quantitative assessment of the stepwise shortening phenomenon in single sarcomeres of rabbit cardiac and psoas muscle, using nanofabricated cantilevers in vitro.
- Developed the software for analysis of data (LabView, MatLab). Analyzed test results, identified problem areas in the software. Made recommendations for improvements before delivering software to users.
- Supervsed of students and teaching assistance.

RESEARCH ASSOCIATE, Sept 1999- Sept 2001
PI: Gennadij Bystraj, PhD., Department of Physics, Ural State University

- Developed kinetic description of turbulent liquid flow at high flow speed to model blood flow in human heart
- Designed empirical mathematical models of the phenomena, using differential equations, statistical physics and theories of bifurcation and chaos

TEACHER ASSISTANT, Febr 2001- Sept 2001
Emploer: Gennadij Bystraj, PhD., Department of Physics, Ural State University

Course: computer simulation of biological processes, Delphi and Mathematica programming languages instruction.

RESEARCH ASSISTANT, Sept 1997- Sept 1999
PI: Felix Blyakhman, PhD., Department of Physics, Ural State University

- Theoretical investigations of muscle contraction: studied the role of titin in the process
- Statistical analysis of experimental data of sarcomere length change
- Development of new models of single sarcomere contraction

GRANT PROPOSAL ACTIVITIES

◊ Nature of Water at Hydrophilic Interface. T-R01, Submitted to NIH, January 2009. Awarded $ 3.8M/5 yrs. September 2009. Experimental program design and comprehensive review. (PI: Gerald H. Pollack)

◊ Stepwise translation of myofilaments. R01, Submitted to NIH, July 2008. Awarded $ 5M/5 yrs. September 2009. Experimental program design, writing up preliminary results and comprehensive review. (PI: Gerald H. Pollack)

◊ Stepwise translation of myofilaments. R01 (supplement), Submitted to NIH, March 2008. Awarded $400,000/2 yrs. September 2009. Experimental program design, writing up preliminary results and comprehensive review. (PI: Gerald H. Pollack)

PUBLICATIONS AND CONFERENCE PROCEEDINGS

In biophysics field:

1. Nagornyak E.M., Letfulova L.B., et al. Dynamics of muscle contraction// Proc. of the 5th Annual Conference of Physicist Association, Yekaterinburg, 1999.
2. Letfulova L., Nagornyak E., Studenok S. and Tourovskaya A. The research of quintal nature of the single sarcomere length changes// Physics in Biology and Medicine, Proc. of the Conf., Yekaterinburg, 1999.
3. Sokolov S., Blyahkman F., Nagornyak E. and Yakovenko O. The new algorithm for calculation of A-band width in single sarcomeres. Proc. of the Conf. "New bio-cybernetic and telemedicine technologist", 2002, CD.
4. Liu X., Nagornyak K., Yakovenko O., Blyakhman F., and Pollack G., Step size in single filaments and myofibrils is equal to the actin-monomer spacing along the thin filament. Proc. of the 19th Canadian Congress of Applied Mechanics, 2003.
5. Nagornyak E.M., Blyakhman F.A., Pollack G.H. Step size in activated rabbit sarcomeres is independent of overlap of the filaments. Abstracts of 13th international conference on mechanics in medicine and biology, Taiwan, November 2003, p.166.
6. Nagornyak E.M., Blyakhman F.A., Pollack G.H. Dependence of step size on initial sarcomere length in single rabbit psoas myofibrils. Biophysical Journal. Abstracts from 47th Annual Meeting, San Antonio 2003, p. 560a
7. Nagornyak E.M., Pollack G.H. A-band width changes in relaxed rabbit psoas myofibrils. Biophysical Journal. Suppl., 2004, 84 (1), p 556a.
8. Nagornyak E.M., Blyakhman F.A. and Pollack G.H. Stepwise length changes in single invertebrate thick filaments. Intern. Symp. "Biological Motility". Pushchino, 2004, p. 94.
9. Nagornyak E.M., Blyakhman F.A., Pollack G.H. Relation between step size and sarcomere length in relaxed and activated rabbit psoas myofibrils. Biophysical Journal. Suppl., 2004, 84 (1), p 556a.
10. Nagornyak E.M., Pollack G.H. Stepwise dynamics of invertebrate thick filaments. Biophysical Journal. Suppl., 2004, 84 (1), p 404a.
11. Nagornyak E., Blyakhman F., Pollack G. Step size in activated rabbit sarcomeres is independent of filament overlap. Journal of Mechanics in Medicine and Biology. V4, # 4, 2004, p. 485-498.
12. Nagornyak E.M., Blyakhman F.A., Pollack G.H. Effect of sarcomere length on step size in relaxed rabbit psoas muscle. J Musc Research Cell Motil., 25, 2004, p. 37-43.
13. Gerald H. Pollack, Felix A. Blyakhman, Xiumei Liu, Ekaterina Nagornyak. Sarcomere dynamics, stepwise shortening, and the nature of contraction. In book: "Mysteries on the sliding filament mechanism of muscle contraction". Ed. Sugi, Kluwer, 2005.
14. Nagornyak E.M., Pollack G.H. Connecting Filament Mechanics in the Relaxed Sarcomere. J Musc Research Cell Motil, V 26, N 6-8, 2005, p. 303-306.

15. Nagornyak E.M., Blyakhman F.A. and Pollack G.H. Stepwise length changes in single invertebrate thick filaments. Biophys. J., V 89(5), 2005, p. 1-8.
16. Nagornyak E., Liu X., Blyakhman F., and Pollack G.H. Quantal length changes in sarcomeric and sub-sarcomeric systems. Colima muscle Symposium, 2005.
17. Nagornyak E.M., Pollack G.H. Appreciable length changes in invertebrate thick filaments. Biophysical Journal. Suppl., V 90, 2006.
18. Nagornyak E.M., Pollack G.H. Length changes in single invertebrate thick filaments. The International Muscle Energetics Conference (IMEC2006), Banff, Canada. July 22-27, 2006.
19. Nagornyak E.M., Pollack G.H. Character of thick filaments length changes. Biophysical Journal. Suppl., 2007, p.637a.
20. Wang M., Nagornyak E.M., Dass R., Pollack G.H. Automatic step-detection algorithm for analysis of sarcomere dynamics. Computer Methods in Biomechanics and Biomedical Engineering, 11(6), 2008, 609-14.
21. Binghua Chai, Ivan Klyuzhin, Laura Marshall, Nagornyak E.M, Kate Ovchinnikova, Rainer Stahlberg, Adam Wexler, Hyok Yoo, Qing Zhao and Gerald H. Pollack. Unexpectedly Critical Rold of Hydrophilic Surfaces on Nearby Water, Third Annual Conference on the Physics, Chemistry and Biology of Water, Mt. Snow Resort, VT, 2008.
22. Nagornyak E., Yoo H. and Pollack G.H. Mechanism of Attraction between Like-Charged Particles in Aqueous Solution. Soft Matter, 5, 2009, p. 3850-3857. (Cover Article)
23. Hyok Yoo, Adam Wexler, Nagornyak E.M and Gerald H. Pollack. Synchrotron radiation FTIR Spectromicrosopy of interfacial water near hydrophilic surfaces. (in preparation)

In hydrodynamics field:

1. Bystray G., Studenok S. and Nagornyak E. The moments of resistance of rotating disk in infinite volume of liquid for turbulent mode of flow. Proc. of the Conf "Mathematical modeling in nature and humanitarian sciences", 2000.
2. Nagornyak E., Bystray G. and Ivanova S. Kinetic description of phase transition and metastable states in turbulence flow. Proc. of the Conf "Metastable states an phase transitions". # 4, 2000.
3. Nagornyak E., Bystray G. Computer modeling of phase transitions and critic phenomena for turbulent flow. Proc. of the Conf "Phase transitions and nonlinear phenomena in condensate surroundings", 2000.
4. Bystray G., Nagornyak E. et al. Nonlinear model of permissible level finance risk formulation. Ekaterinburg, Ural RAS, 2001.
5. Nagornyak E. Kinetic description of well-developed turbulence. Proc. of the 7th Annual Conference of Physicist, 2001.
6. Nagornyak E. Kinetic aspects of time evolution of turbulence fluid. Proc. of the Conf. of students, 2001.

AWARDS:

- President's Gold medal graduate of high school (1995).
- Award of Gubernator (1999-2001).
- Civilian Research & Development Foundation grant (2000-2001).

- Grant of High Education Ministry of Russian Federation (2003-2004).
- Nomination for “Best student scientific work” in Ural State University

AFFILIATIONS

- User, National Nanotechnology Center, Cornell University
- Member, Biophysical society
- Member, American chemical society
- User, Center for Nanotechnology, University of Washington

PROFESSIONAL REFERENCES

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