Statement of Interests and Goals for Instruction

I have benefited from a wide range of teaching experiences over the course of my academic career. My teaching career started when I became a lecturer at the University of Nizhny Novgorod from 1984-86, where I taught lab topics on nonlinear dynamics. After defending my PhD in 1990, I became an assistant professor at the Department of Mathematics of the Academy of Transport Engineers. In that position I taught a variety of courses for 100+ students, including all sections of Calculus, Probability Theory, and Algebra. As a visiting assistant professor, I also taught various undergraduate classes at both Georgia Institute of Technology and Cornell University, including Linear Algebra, Dynamical Systems and Calculus.

Since joining GSU in 2000, I have lectured more than 50 undergraduate and graduate courses. The list of these courses spans the entire calculus and linear algebra sequences, mathematical modeling, college algebra, ordinary and partial differential equations, applied and advanced topics in dynamical systems, mathematical biology, dynamical principles of neuroscience, computational neuroscience, vector calculus, vector geometry, and real analysis.

In my years at Georgia State University, I have actively taken part in updating and developing the curriculum for the Applied Mathematics and the Bioinformatics PhD I programs, as well as creating the program in Computational Neuroscience at Neuroscience Institute at GSU. I have (co)-developed the following new undergraduate and graduate courses over the last years: • "Mathematical Biology." This duel level course is cross-listed with the Department of Biology and Neuroscience. This class has become very popular in GSU with a roll of forty+ students every year. • A graduate level course "Advanced Topics in Ordinary Differential Equations and Dynamical Systems." I teach this class every second year. The textbook for this course is Shilnikov L.P., Shilnikov A., Turaev D. and Chua, L., "Methods of Qualitative Theory in Nonlinear Dynamics," Parts II and I. • Another graduate course I teach every second year is "Dynamical Foundations of Neuroscience." I really enjoy teaching purely mathematical courses and topics applied to the life sciences including neuroscience. I take a pride in the quality of my teaching achievements, which is reflected by my commitment to all my students’ needs and by presenting course material confidently, clearly and accessibly. These are some of the key principles in my approach to teaching.

I find that extending respect and courtesy towards students encourages them to adopt a more pro-active attitude about their education. Learning about the students prior and intended future academic, professional and research experiences is one way I do this. I also make sure I am aware of students’ individual strengths and weaknesses as they develop throughout a course. At the beginning, I like to survey my class about their backgrounds so that I can adapt the course accordingly. I am enthusiastic about the challenge of gearing my teaching toward the varied perspectives that students have on math. I am patient with students who get stuck on an exercise or a concept, or who require additional time in class or outside it. Additional attention to an individual's difficulties in class usually benefits all of the students because it encourages a spirit of openness and community in the classroom.

Major challenges facing the higher education in mathematics

Mathematics is an exciting field. Teaching mathematics is a great pleasure but also a great deal of responsibility. Teaching mathematics is teaching how to think in abstract terms and to communicate ideas with utmost precision. Mathematics is a language that keeps one’s mind clear and well-organized. I see my role as a mathematics instructor as teaching this language to students. As with any other language, mathematics is best learned when it
is presented within a real-life contexts. In a classroom full of undergraduate students, presenting different applications and illustrating the use of a particular method increases a student's motivation to study the subject and stimulates their interest in the course (which is also very important). As my general research interests are in biomathematics and engineering, I often use examples and problems derived from my own research to supplement the examples in the textbook. I do understand though, that most of the undergraduate students will not choose a career in mathematics, and that is why I always try to carefully explain the basic ideas along with the particular formulae and technical details.

In my opinion, sustaining high standards while merely covering a twenty-year-old curriculum is insufficient. It is necessary to adapt the curriculum and methods for teaching to the needs of the future workforce. I see multiple ways to achieve this goal.

• Mathematics needs to be integrated with concepts from other scientific disciplines, especially as modern science becomes increasingly interdisciplinary. Because of the cross-disciplinary nature of my own research, I always use examples and findings from this in classroom teaching. • Students should be exposed to the current scientific trends and shown the modern mathematical problems arising from these trends. For instance, recent developments in computational neuroscience and biology can serve as a source of contemporary applications for ODES and PDES, and Dynamical Systems. • Mathematics instructor needs to utilize the power of technological progress in the classroom and take advantage of the rapidly growing level of computer and software applications. • Students should be provided with hands-on experience in researching a subject. In mathematics, this is typically achieved by doing an independent study and/or an individual research project.

Mathematics is closely related to modern technology, and I always show my students the benefits of using computers for their individual projects. Computer technology has revolutionized the way we process the quantitative information, and this is precisely why we find it such an attractive tool. At the same time, I realize that technology can be a dangerous tool. There is a difference between really understanding a problem and being able to program the computer to solve it. It is very important that the students understand this difference. I use new findings from ongoing projects for teaching applied mathematics and physics courses to spark student interest. Another important educational aspect is that my research findings have been included in recent mathematics textbooks, both graduate and undergraduate, and in several articles in the peer-reviewed open-access encyclopedia Scholarpedia. Various multimedia supplements such as movies showing network dynamics and Poincare return mappings for neural models have been posted on www.youtube.com for open access and in-class demonstrations.

It is my philosophy that students should work hard and learn the material, and also enjoy the course. This is why I always thoroughly prepare for classes but leave room for spontaneous discussions. To stimulate creative thinking and capture students' attention, I often discuss special math problems (logical puzzles, mathematical riddles, etc.) at the beginning of class. While lecturing on a new material, I try to encourage in class discussions and welcome all questions from students. These discussions serve as feedback and enhance class participation. I do not believe that simply keeping students alert by giving numerous quizzes encourages hard work and helps them to learn. In my experience, self-study and home assignments provide a better opportunity to learn. I believe that doing homework is the first step before attempting an independent study project. Finally, I believe that such personal qualities as confidence, attention, fairness and flexibility are the necessary in a good instructor.

The interdisciplinary perspectives in my research help me illuminate the bridges between mathematics, biology, and computations in the classroom. I have extensive experience teaching courses in pure and applied mathematics, and have created several new undergraduate and graduate courses at GSU such as Mathematical Biology I and II, Applied and Advanced Dynamical Systems, Mathematical Foundation of Neuroscience, and Bioinformatics, which are available to students from various departments across the University System of Georgia. I firmly believe in the importance of inclusiveness and public outreach in the scientific profession, and have experience employing cross-disciplinary approaches in programs to increase public awareness of science and encourage the growth of a diverse, vibrant mathematical community.
Student Research

In my own lab at GSU I have also stressed the mentoring of undergraduates, graduate students and postdocs. I have published 8 papers with undergraduate co-authors and 29 papers with graduate student co-authors. My students have presented their research at many national and international conferences, such as SIAM on Applied Dynamical Systems, SIAM Life Sciences, Dynamic Days, Computational Neuroscience etc., and won several awards for best posters and presentations. Out of five graduate students who have received their Ph.D. with me two are women. Of my former graduate students one is doing a postdoc and three have R&D positions in industry. Of my 4 post-doctoral fellows 3 are in tenured or tenure-track positions abroad, and one is doing a second postdoc. Today I supervise research of two undergraduate and one MS students, five (fully funded) PhD candidates and two postdoctoral fellows in my lab.

Teaching is a highly rewarding process, as it gives the positive feedback that every professor needs to become a more effective scholar. Teaching or mentoring also includes the supervision of student research at undergraduate and graduate levels.

I am pleased to demonstrate my effectiveness as a mentor through my publication record and a history of conference presentations. Almost every recent paper of mine is done jointly with students, including undergraduates, from my research lab.

I have been instrumental in consistently funding student research through internal (B&B, Bridge Funds) and external (NSF, NSF REE) grants. Students enjoy being engaged in research and technology and I try to stay abreast of current trends and acquire novel hardware, such Graphics Processor Units, which are organically suited for networks simulations. This particular piece of undergraduate research was funded through the current REU supplement of my NSF grant. Moreover, teaching with new technology will likely raise odds of the students to find and get demanding jobs in industry as well.

My students have helped me co-organize three meetings on mathematical neuroscience in Atlanta. As seen in my enclosed CV, my past MS and current PhD students have presented many posters and oral talks at various local meetings in the South-East as well as nationwide over the last eight years. Seeing your student giving a presentation is both a pride and a responsibility, and hence I view the state-of-the-art training and passing of my academic knowledge over onto younger generations as a professional duty.

Providing hands-on learning experiences is critical for those students who will continue doing their own research after graduation. I have advised several undergraduate students taking individual study and/or reading courses in biomathematics and differential equations under my supervision. I have mentored several undergraduate honors projects in my lab that resulted in the publication of four research papers in peer-review journals. At the graduate level, I have co-directed seven graduate students.

At GSU, I supervise several ongoing independent and collaborative research projects with students actively working in my lab. The projects have allowed the students directly involved to develop the qualities of independent researchers in frontier sciences: critical thinking, cross-disciplinary brainstorming and team skills. This research, on the edge of math and life sciences, lets students foster research collaborations with peers in other disciplines including experimental neuroscience, biology and cardiology. The forward outreach of the REU supplement is a direct involvement in the outgoing research of several undergraduate students. My research projects provide interdisciplinary training and educational opportunities for graduate students and summer research experience for undergraduate students. Students are trained in state-of-the-art methods of bifurcation analysis, time series analysis, modeling of biological systems, GPU parallel programming for parameter sweeping and multi-functional network dynamics, creating a public Wiki portal, and gaining valuable skills for their future careers, academic or otherwise. Through weekly lab meetings, students have presented their progress and findings, and gain and substantially improved their presentation and discussion skills.
Post-Doctoral fellows
4. Dr. M. Fen, 2014-15
2. Dr. E. Gunay, 2011-12
1. Dr. O. Burylko, 2008.

Ph.D. Students
Current
1. Aaron Kelley, 08/2012 – present
2. Deniz Alacam, 06/2012 – present, B&B fellow, Mathematics & Statistics
3. Krishna Posuluri, 08/2014 – present, Neuroscience Institute
4. Jarod Collens, 05/2014 – present, B&B fellow, Neuroscience Institute
5. Huiwen Ju 08/2015 – present, Neuroscience Institute
6. Liza Latach 08/2015 – present, Neuroscience Institute

Defended
7. Tingli Xing, Ph.D. Thesis. Department of Mathematics and Statistics and Neuroscience Institute, Georgia State University, July 2015.

Master’s Thesis
5. Paul Channell, M.S. Thesis Poincare mapping for complex slow fast dynamics in an interneuron model, Brain and Behaviors program, Department of Mathematics and Statistics, December 2009
4. Jeremy Wojcik, moved to PhD program
2. Konstantin Mokhov, M.S. Thesis The role of Ca2+ dynamics in generation of oscillatory activity of a neuron, co-directed with Dr. Cymbalyuk (Physics and Astronomy) December 2004
1. C. Chen - B&B GRA, 2004

Member of the defense committees
1. T. Malashchenko, “A mechanism of coexistence of bursting and silent regimes of activity of a neuron” (Physics and Astronomy), April 2011. She co-authored 2 research papers with me.

Undergrads Honors Projects
7. Joseph Youker (Mathematics & Statistics) “Reduced phase models of CPGs” B&B Summer Fellowship $2,000 and NSF REU, Summer 2011, Summer 2013
6. Dane Allen (Mathematics & Statistics) ”CPG model of the Melibe”, funded through NSF REU. Summer 2011
5. Emmanuel Thomas (Mathematics & Statistics) “Reduced phase models of networked interneurons”, $2,000 Presidential stipend, 2009-10
2. Rene Gordon (Mathematics & Statistics) B&B Summer Fellowship $1,600, 2007

I am also pleased that my students have been able to present their research at various nationwide meetings. My PhD students have attended and presented research at nationwide meetings in 2010-14: SIAM Applied Systems, SIAM Life Sciences, Dynamics Days, Experimental Chaos and Complexity, Carolina Dynamical Systems, Computational Neuroscience, MBI Neural Networks, South Neural Net, Theory and Applications of Nonlinear Dynamics. Through the NSF REU umbrella several undergrads under my supervision have learned and developed research and other professional skills. They presented their research at annual GSU and Atlanta Spineless and Brains & Behaviors meetings and departmental student seminars, as well as volunteered to organize the 2012 Computational Neuroscience meeting in Atlanta.

In addition, I co-advis e ongoing research of several graduate students and postdocs at U Ohio, U Zaragoza (Spain) and Max Plank Institute (Germany). The list of 2011-15 presentations with the students in my CV (indicated by *) is a de-facto proof of the intensifying research-oriented environment in my lab.

**Future goals.** I plan to continue improving my effectiveness as a teacher, which is reflected in positive and rewarding student evaluations. I will continue integrating research activities into the undergraduate and graduate curriculum through developing cross-disciplinary under- and graduate courses in the fields of mathematical and biological sciences, as well as mentoring undergraduate and graduate research projects. I really enjoy watching young scientists grow as they discover how much fun science and research can be.
May 24, 2013

Congratulations, Ms. Xing!

This is to certify that you and Dr. Jeremy Wojcik were awarded the Red Sock Award on May 22, 2013, during the 2013 SIAM Conference on Dynamical Systems (DS13).

The Red Sock Award is awarded by the SIAM Activity Group on Dynamical Systems (SIAG/DS) for the best poster presentation in dynamical systems by a student or postdoc at the biennial SIAM Conference on Dynamical Systems as judged by a scientific committee. Four winning posters are selected at the conference. The award was established by James A. Yorke, who traditionally presents each winner with a red sock.

Title: Chaos: Stirred Not Shaken

Awardees: Jeremy Wojcik and Tingli Xing, Georgia State University

Co-authors: Roberto Barrio, University of Zaragoza, Spain
Andrey Shilnikov, Georgia State University

Thank you for your participation in the poster competition, and congratulations again to you on this well-deserved award!

Charles Doering
Co-Chair, DS13 Organizing Committee

George Haller
Co-Chair, DS13 Organizing Committee

cc: Professor Roberto Barrio, University of Zaragoza, Spain
Professor Andrey Shilnikov, Georgia State University

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Congratulations, Dr. Wojcik!

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