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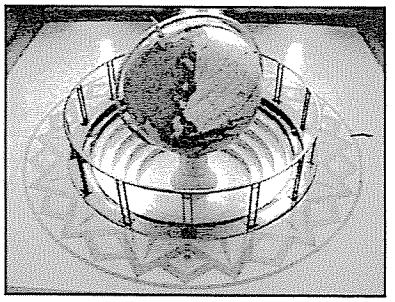
The Interdisciplinary Center for the Study of Biocomplexity



Prof. Yves Brun
Department of Biology
1001 East Third Street
Bloomington, IN 47405-3700

Dear Prof. Brun,

I am writing to offer my enthusiastic support for the application of Dr. Yi Jiang for a position in your department.

Dr. Jiang received her Ph.D. in biophysics from the University of Notre Dame. She wrote a first rate thesis under the supervision of James Glazier on extended Potts model from statistical mechanics and its applications to biology. She is currently an Adjunct Associate Professor in the Mathematics Department at the University of Notre Dame.

Modeling and simulation are becoming very important research tools in biology. The most advanced of these efforts have focused on single levels or scales, *e.g.*, genomic/proteomic, cellular, tissue, organ, whole body, behavioral, and population. Dr. Jiang is now working on the cutting edge research of developing mathematical and computational approaches to integrate models from micro-scales to macro-scales in a seamless fashion. Such multiscale models are essential for producing quantitative, predictive models of complex biological behaviors such as embryo development, cancer, cytoskeletal function and bacteria aggregation. At the same time, integration between scales will lead to a much deeper understanding of the universal or generic features of biological phenomena.

For the last 5 years I have collaborated with Dr. Jiang on modeling complex behavior and aggregation in Myxobacteria. In what follows I will briefly describe some of our most significant results.

Under starvation conditions, Myxobacteria populations glide and aggregate to form large fruiting bodies. During the gliding phase they form a pattern of equidistant ridges, or ripples, of higher cell density that travel periodically through the population. Dr. Jiang helped to design a lattice-gas cellular automaton (LGCA) model to investigate whether a refractory period, a minimum response time, a maximum oscillation period and non-linear dependence of reversals of cells on C-factor are necessary assumptions for rippling. Our results showed that a refractory period of 2-3 minutes, a minimum response time of up to 1 minute and no maximum oscillation period best reproduce rippling in the experiments of *Myxoccoccus xanthus*. These results have completely reshaped the previously held concepts in this field and have lead to the publication of three peer reviewed articles in the first rate journals.

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Dr. Jiang also helped our group to implement a novel multi-scale three dimensional model for swarming and aggregation in Myxobacteria which for the first time described all different stages including establishment of aggregation centers and fruiting body formation. Also, in collaboration with Dr. Jiang, we introduced the first 3D stochastic model of cell aggregation based on local cell–cell contact, and no chemotaxis. (These results were published in our recent PNAS paper.)

Dr. Jiang has been conducting novel research of the highest caliber—work that will be fundamental to her field, including a recent work on tumor growth modeling that presents a state-of-the-art in the multiscale modeling in biology. Dr. Jiang has a strong track record both of interdisciplinary collaborations and independent work (as you can see from her publication list). She has the skill and interest to reach out across disciplinary barriers to work with mathematicians, biologists, chemists, medical researchers and computer scientists. I am particularly impressed by the coherence of Dr. Jiang's research vision. Her breadth and, at the same time, focus on fundamental mechanisms is distinctively biophysical in philosophy and a perfect example of how biophysicists can make fundamental contributions to both biology and physics.

Further, Dr. Jiang is also a real team player with very strong communication skills. She is very reliable and has a pleasant personality. She and I co-organized several Workshops, including Workshop on Multiscale Modeling in Biology, University of Notre Dame, held from August 14 - 17, 2003, and International Workshop on Applications of Methods of Stochastic Systems and Statistical Physics to Biology held at the University of Notre Dame from October 28-30, 2005. We also were co-editors of a Special Issue on Multiscale Modeling in Biology, SIAM Journal: Multiscale Modeling and Simulation, Volume 3, Number 2, 2005. We have worked together on several proposals, which are now funded by NSF and DOE. I am sure that she will be able to quickly obtain her own funding.

Dr. Jiang and I have co-supervised two graduate students and postdoctoral associate Dr. Sozinova. One of the students, Maria Kiskowski-Byrne, is currently a postdoctoral associate at Vanderbilt University. Another student, Matthew L. Rissler, spent this past Summer at Los Alamos working with Dr. Jiang on modeling swarming behavior in myxobacteria. I heard several of Dr. Jiang's talks and lectures. Her presentation is always very clear and I am sure that she will be a great teacher.

To summarize, Dr. Jiang is an extremely strong biophysicist and computational biologist with excellent research abilities and outstanding biomodeling background. She has already obtained exciting and state of the art results on several biophysics frontlines. But what is even more important her results are getting better and better. She is regarded as a star researcher in her field. I therefore very strongly and enthusiastically recommend Dr. Jiang for a position in your department.

Sincerely,

Mark Alber
Director
The Center for the Study of Biocomplexity
Professor of Applied Mathematics
Concurrent Professor of Physics

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