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Biocomplexity Faculty Search Committee
c/o Prof. Rob de Ruyter van Steveninck
Department of Physics
Swain Hall West 117
Indiana University
Bloomington, IN 47405-7105

Dear Search Committee,

I am writing to support Chinlin Guo's application for a junior faculty position in biophysics. I have known Chinlin quite well since the time when he was a graduate student at UCSD. During that time, he took 3 of my classes in advanced statistical field theory and nonlinear dynamics, serving as a TA in another. In addition, I was on his thesis committee, and we often discussed biophysics problems of mutual interest.

Chinlin is one of the most special scientists I have encountered in my career. He already had a M.D. degree from Taiwan before coming to the UCSD physics program as a graduate student. (He told me that he was not satisfied with the amount of science in medicine, and went to engineering before finally turning to physics.) During his first year at UCSD, he displayed good experimental skills, and we explored the possibility of having him help me set up a lab to do some simple biophysics experiments. But Herbie snatched him quickly before we got anything going. Then he wanted to take a class I was teaching on critical phenomena and renormalization group theory. I warned him that this was the 2nd half of a two-quarter series, and that it would be difficult for him to follow without the first. But he took it anyway, learned the first half on his own, and got an A+ for the class. In another instance, I was a member of Chinlin's oral exam committee. He was assigned to talk about quantum computing. He gave perhaps the most lucid lecture I can recall on the subject, together with possible implementation using NMR. After the lecture the committee members looked at each other in disbelief. I remember Vivek Sharma, a particle physicist, remarking that whoever his advisor was was a really lucky person.

Despite his excellent theoretical abilities, Chinlin did not follow the growth trajectory of a typical theory student in statistical physics, which would be to solve pet problems to build up a repertoire of theoretical tools. From his vast knowledge of biology and medicine, Chinlin knew the important/relevant problems of biology that he wanted to work on, and he was able to teach himself the necessary skills to tackle these problems (as he demonstrated in my stat mech class when he taught himself the mechanics of the renormalization group theory). I learned a great deal from interacting with him, and I was not the only one. It was amusing to observe the way Chinlin interacted with Herbie Levine his thesis supervisor: Chinlin would propose a problem, convince Herbie that the problem was interesting/important, give him the 5 - 10 background papers to read, and propose ways to solve the problem. He was clearly operating beyond the post-doc level as a graduate student.

I should add that aside from his multiple talents, Chinlin was extremely hardworking in everything he engaged in. In the classes he took from me, he would type the homeworks and turn them in a good

number of days before they were due. (And I would of course use them as the solution set.) When we had journal clubs, he would read every related paper listed, as well as additional papers he dug up from the references. In his "spare" time, he would build computers for people in his group from components. Many of us wonder where he got all the time and energy.

Chinlin went to Andrew Murray's lab to do a post-doc because he wanted to be able to do molecular and cell biology like a real biologist. As it turned out, he did better than that. In the last several years, I have intermittently followed his progress at Harvard. I remembered that he was a bit overwhelmed during his first year, with the large number of skills and phenomenology to catch up in the lab. For perhaps the first year and half, he learned these skills one by one, by following the direction suggested by his advisor. However, despite technical improvements he was not making progress scientifically. Over a year ago, he said he was going to do everything differently. Now I see results that will likely form a new paradigm in our understanding of polarity formation in eukaryotic cells.

The essence of the polarity formation problem that Chinlin tackled was one of direction selection, i.e., how does a yeast cell decide the direction to project its shmoo. It is an example of a broad and important class of problems on how eukaryotic cells sense directions. The predominant current theory is based on reaction-diffusion systems. According to this theory, bias in direction is initially generated by environmental perturbation, and subsequently quenched in and reinforced through the dynamics of a reaction-diffusion system. What Chinlin discovered in yeast polarity formation is a fundamentally different process, where initial perturbation is not necessary. Instead direction selection is seen as a result of spontaneous symmetry breaking due to a dynamic self-organization process involving long-distance transport. To reach this conclusion, Chinlin examined polarity formation in the absence of external gradient, and overcame difficulties imposed by intracellular heterogeneity. I cannot overemphasize the significance of Chinlin's finding. It is the kind of material that will end up in textbooks. From now on, every lab that studies eukaryotic sensing and motion will have to consider Chinlin's mechanism as an alternative to reaction-diffusion. And if his mechanism is found further in other systems, it may become the default mechanism of a cell's directional response.

I do not know what Chinlin plans to do in the future, but I envy his position -- he has every option open, including wet-lab biology, experimental biophysics, and theoretical biology. He has proven the ability to excel in each of these areas, as well as the ability to grow in new areas. I am confident that Chinlin will become an accomplished scientist in whatever subject he wants to get into at the interface of biology and physics, and do not know of anyone comparable to him in terms of promise for success at this stage of his career. You cannot go wrong hiring Chinlin as a junior faculty. In fact, I am working to create a position for him at UCSD. He will be the ideal next-door neighbor.

Sincerely,



Terence Hwa, Professor