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Reference letter for **Hugh R. MacMillan**

It with great pleasure that I write in support of Dr. Hugh MacMillan, who is applying for a position at your institution. Dr. MacMillan is a very talented applied and computational mathematician who has a variety of interests, all of which he pursues with great success.

Dr. MacMillan is currently in the second year of a postdoctoral associateship here at Florida State University, and I am very fortunate to serve as his mentor. For his dissertation at the University of Colorado, Boulder, Dr. MacMillan worked on least-squares finite element methods and their application to electrical impedance tomography. This work was very well balanced between novel algorithmic development and the rigorous analyses of the resulting algorithms. He came out of UC very-well trained in both practical and theoretical aspects of numerical analysis and scientific computing. His dissertation led to an excellent publication in the leading numerical analysis journal. Because of the background he gained as a doctoral student and the very high quality of his dissertation, I was very pleased to have him come to FSU; however, by the time Dr. MacMillan arrived here, there was much more to him than that.

After receiving his Ph.D., Dr. MacMillan served two years as a Sloan Foundation/Department of Energy Postdoctoral Fellow at the University of California at San Diego. While occupying this prestigious position, Dr. MacMillan worked in a completely new research direction. He began by applying his knowledge and experience in finite element methods to an important problem in neuromuscular junctions. This work resulted in another excellent paper that has appeared in a top biophysics journal. But this entry into mathematical and computational biology just whetted his appetite for biological problems.

While at UCSD, he became interested in the modeling and computations of the influence of DNA damage and repair during cortical neurogenisis; he has continued working in this area while at FSU. Dr. MacMillan is extremely careful, thorough, and honest about applied research. So, instead of yielding to the temptation to get quick results that he could publish somewhere (and which probably would have been of no interest to biologists and biochemists), he took the time to learn everything available about the problems that interested him. He also talked extensively with scientist in these fields to make sure that his ideas were sound from their point of view. He did not take the easy way out of treating simplistic models, but made sure to incorporate all that was needed to get useful, practical results. For example, he included uncertainty effects and several multiscale phenomena. I was personally pleased that he was able to take some of my own interests (uncertainty quantification, model reduction, sampling theory) which he learned about from seminars and conversations, and mold that knowledge into something he could use in his work. This attention to the science (as well as the mathematics) of the problems has paid off handsomely; Dr. MacMillan has now submitted a really important paper summarizing the state of knowledge about several mathematical and scientific aspects of the problems; this paper is not just a review, but contains many original contributions. Even in this endeavor, he had drafts of his paper read by applications scientists so that in the end, he made sure that it was very relevant to their interests. Although I am no expert in this aspect of Dr. MacMillan's research (which, of course, means that this research was completely the product of Dr. MacMillan's ideas and effort). I have been very impressed with his dedication and accomplishments, his attention to detail, and his ability to make a very significant contribution to an important area of research that has been very underserved by the mathematical community.

I was, of course, very pleased to have Dr. MacMillan continue working on his biological interests; when he arrived at FSU, he had in place a very active and independent research program and I felt that the problems he was interested in should, without doubt, be pursued. It turned out I was right and that Dr. MacMillan was the right person to do it. It is also true that he now has a stupendous plan of action for future research in mathematical and computational biology and biochemistry and I fully expect that he will make additional important contributions to these areas.

However, Dr. MacMillan came to FSU not only because he could continue his pursuits in biological directions, but also because he maintained an interest in finite element methods and more traditional numerical analysis topics. So, Dr. MacMillan and I have embarked on an ambitious research project involving developing, analyzing, and implementing meshless least-squares finite element algorithms for the approximate solution of partial differential equations. This work promises to result in truly meshless methods that have all the desirable attributes of the least-squares finite element approach. Again, in this work, Dr. MacMillan was not happy to just take the quick approach; he has instead worked on the whole framework of meshless methods: point placement strategies, basis function definition, variational formulation and discretization, numerical integration, and fast solution methods. He has now completed the framework and has developed and analyzed what promise to be some very practical and efficient methods. All that remains is the implementation and testing of the methods he has developed; he is currently doing just these things, as well as preparing two papers about his work. I expect that by next summer, there may be additional papers coming out of this endeavor. I should note that Dr. MacMillan is the lead contributor to this work; he not only has supplied most of the detailed work, but he has also supplied the great majority of the novel ideas.

Dr. MacMillan has positioned himself to have an outstanding career in mathematical biology and computational mathematics. His mathematical and applications interests are diverse. He has shown that he can develop new models of complex natural phenomena and that he can design, analyze, and implement algorithms for solving the models. He also knows how to go the other way, i.e., how to use computations to help develop and refine models, e.g., through parameter identification approaches. He is a very careful and thorough researcher and, in all aspects of what he does, he is independent. He works very well with both mathematicians and application scientists and his work is and will be of interest to both. He has formulated ambitious plans and goals for his future research, and has the ability and knowledge to be successful.

I would be remiss if I did not write something about Dr. MacMillan's teaching. He is, without doubt, one of the most dedicated and committed teachers I have met. He is genuinely interested in having students learn, so much so that he volunteers to teach, not only at the college level, but also in local middle and high schools. In the former regard, I have been told that he was very effective in a undergraduate numerical analysis course he volunteered to teach at FSU; students not only loved him, but they learned. In the latter regard, he volunteers to help students at underperforming schools in disadvantaged neighborhoods. His interest in teaching is 100% genuine and is matched by his ability to make students learn mathematics. He has very well thought out, ambitious plans for his future university teaching activities and I also expect that he will maintain his interest in helping K-12.

In addition to his many outstanding professional attributes, Dr. MacMillan is a very personable and caring individual. It is a pleasure to interact with him both at work and socially. He would be a wonderful colleague wherever he goes. I close this letter by again recommending Dr. MacMillan in the highest possible terms. Please feel free to contact me should you need any more information on this matter.

Sincerely,