Name: Jianming Li

Education (degrees, when and where): BSE in Mechanical Engineering from University of Michigan

Degree Sought: Ph.D in Biomedical Engineering

Department and/or Lab: Center for Paralysis Research and Biomedical Engineering

Research Advisor: Riyi Shi

Research Focus:
My research field is tissue engineering with special emphasis on the peripheral nervous system. Currently, a significant clinical problem is the use of same patient nerve grafts for severe peripheral nervous system injuries. However, problems associated with same patient grafts include donor site morbidity and unsatisfactory regeneration of the damaged nerves. The goal of my research is to therefore develop artificial constructs that replace same patient grafts. Using biodegradable polymers and surface topography (micron and nanometer scale surface grooves), our laboratory is able to improve the speed and direction of regenerating neurons \textit{in vitro}. These initial results are promising and the next step will be to implant these constructs in animals for further evaluation.

Teacher Partner: Martin Hale and Jeff Bracken

Why did you choose to participate in the GK-12 program? What do you hope to gain from and contribute to this program?
As a fellow of the GK12 program, my goal is to prepare and inspire students in a manner similar to how my seventh grade teacher impacted me. Middle school students are very curious and impressionable, and I understand that these next few years will be crucial in fostering their mental development, personal attitudes and future planning. I also recognize the lingering effects of negative teaching experiences, as even the most fascinating topic can be rendered unappealing by ineffective instructors. As a fellow, I hope to work closely with school instructors to develop methods and experiments that will generate significant interest in science, math and engineering. For me, there is nothing more satisfying than having a positive impact in a young person’s life.

From a professional standpoint, I think that the GK12 experience will help me further develop my communication and social interaction skills. Especially important is the ability to translate highly technical concepts into a form that the
general audience can comprehend. I believe this skill requires creativity and practice. In instances such as grant writing, public presentation or less technical speaking, being able to convey the main message without unnecessary technical jargon is essential. Similarly, compacting highly evolved concepts into a structure that middle school students can understand will be beneficial in my future professional development. Finally, I also think that being able to closely interact with teachers and observing various teaching methodologies will help me in my role as a future educator. From this program, I hope to further evolve my teaching philosophies and be educated in the various ways of reaching students.

**How do you plan to integrate your research into the GK-12 experience?**

Although, my field of study is a specialized topic, the concepts of paralysis, mechanical injury to the nervous system and engineering are common themes suitable for classroom instruction. For instance, nerve/brain injury information can be incorporated into the physics or biology curriculum. Using a combination of videos, demonstrations and hands-on activities, the relationship between impact forces, energy, mass, momentum, etc. to bodily injury can be discussed. Students would also learn about the devastating consequences of nerve trauma and the research community’s search for cures. On the other hand, engineering can be approached with activities that entail planning, designing and testing. Moreover, students will also be able to learn via trial and error experiments or other forms of iterative processing.

As a biomedical engineer, I also understand the pressing ethical concerns relating to human and animal research. As the children are the leaders of tomorrow, I am convinced that discussion regarding controversial topics (stem cells, cloning, organ harvests, etc.) will be beneficial in preparing children for future ethical and human issues. The discussions will emphasize more than just bioethics. Instead, I would like the students to adapt a new mindframe, one where dealing with differing cultures, beliefs and values become integral in any decision making process.

**How will you approach the interdisciplinary goal of the program and how will you integrate interdisciplinarity into the lessons with your team/partnership?**

I believe that interest in math and science can be generated by packaging the fundamental knowledge into non-traditional problems and applications. For instance, I remember as a seventh grader, my math teacher gave us a weekly assignment that was really a math problem in disguise. For the in-class assignment, he gave us a map of the U.S. and a food menu that he had concocted. Our “work” was to plan a weekly vacation trip to anywhere in the country. In addition to writing about our make believe vacation, we had to tabulate all miles traveled, all food and gas costs and souvenir expenditures. I can remember how much fun everyone had (including the instructor) and at no
time did I hear anyone complain about how much they had to add, multiply, etc. In a similar fashion, transforming mundane textbook problems to problems that students can relate to (hobbies, sports, etc.) will make homework and class assignments more appealing and personal.

Additionally, I also intend to draw in concepts from other classes (math, English, etc.) or from current news trends. For example, a science problem that covers concurrent mathematical concepts or that involves writing/oral communication would tend to reinforce skills and knowledge retention. Ultimately, my goal is to work closely with the middle school instructor to create a learning environment where knowledge is connected and not isolated.