Associate Professor Jae Kyoung Kim is the Chief Investigator of the Biomedical Mathematics Group at the Institute for Basic Science, Republic of Korea and an academic staff member in Mathematics at the National University in Daejeon, Republic of Korea. He will be a Plenary speaker at the Joint Annual Meeting of the Korean Society for Mathematical Biology and Society for Mathematical Biology in Seoul this year. Prof Kim conducts research across a variety of biological applications including biological oscillators and pharmacokinetics, and has conducted a large number of studies combining large real world data and mathematical modelling in these areas.

Who or what inspired you to pursue a career in mathematics, and particularly mathematical biology?

My interest in mathematics wasn't sparked by any grand experience. Throughout my school years, I struggled with the language subjects, feeling stressed despite dedicating considerable time to studying without seeing any improvement in my grades. In contrast, I naturally excelled in mathematics, which gradually heightened my interest in the subject. My peers would often seek my help with math problems, and I found joy in explaining mathematical concepts to them. Confident in my ability to understand and teach mathematics, I decisively chose to major in math education without any hesitation.

My journey towards becoming a mathematician began earnestly during my university years, where I actively participated in a mathematics club known as S.E.H.M. The club focused on solving mathematical problems, and we made it our mission to read as many math-related books as possible. I even went to the math section of the library and picked out any math book I could see and read it and solve math problems. At that time, I wondered, "Why do we need to study calculus?" I was ashamed that I was asking the question "why" for the first time as a college student. Throughout this experience, my dream slowly moved from teacher to mathematician (in particular the filed of algebraic geometry).

My foray into the unfamiliar field of mathematical biology was somewhat serendipitous. After graduating from college and while doing military service, I stumbled upon a news article about using mathematics to research heart diseases. I was taken aback, having never imagined mathematics could have applications in such research areas. Intrigued, I immediately sought out books related to the field and found the subject fascinating. The idea that mathematics could contribute to people leading healthier and happier lives deeply resonated with me. After much deliberation, I decided to pursue further studies in mathematical biology and leave to USA for Ph.D. at the University of Michigan, Ann Arbor.

What is something exciting you are currently working on?

Difficult to choose one. We are in the process of developing an application that utilizes Ordinary Differential Equations (ODEs) to create personalized sleep-wake schedules. This tool aims to minimize sleepiness during work hours for shift workers. Concurrently, we are enhancing our AI algorithm for diagnosing sleep disorders, which is already widely used with over 10,000 monthly applications. Additionally, we are dedicating efforts to formulate a mathematically and statistically solid data preprocessing methodology for single-cell sequencing. Finally, last year, we found an error in an equation predicting drug-drug interaction in FDA guidance and corrected it. We have recently found that another equation in FDA guidance has an error, so we are working on correcting it.

You have conducted research with a number of different collaborators, do you have any advice for new investigators looking to establish new collaborations?

It is important to spend quality time with your new collaborator to identify a good problem for collaboration. When initiating a new partnership with an experimental laboratory, my usual approach involves spending a few days at the lab, engaging in discussions with the team members to pinpoint a compelling problem. I often inquire whether they have encountered any experimental data that contradicts established knowledge or their own intuition, which might appear as nonsensical data. I have found that problems of this nature often present valuable opportunities for mathematicians to offer insights that go beyond what can be achieved through experiments alone.

Do you have a favourite paper in your field?

Choosing one is quite the challenge. However, I often suggest the following paper to my students as an exemplary model of how to formulate an important biological question that can be effectively addressed with mathematical contributions

Robust, tunable biological oscillations from interlinked positive and negative feedback loops, Science (2018)

On a lighter note, what does your perfect weekend look like?

Mornings are for me - reading, writing, activities often challenging during weekdays. Then, I enjoy outdoor adventures with my family.