Birthing a mathematical biology community in the Philippines

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The International Workshop on Mathematical Biology, or IWOMB, has already been held for two consecutive years in the Philippines. The first workshop was held on January 7-10, 2018 at Costabella Tropical Beach Resort, Cebu City, Philippines [1]. The second workshop was held on January 6-10, 2019 at Bohol Bee Farm, Bohol, Philippines [2]. Like a mother bearing a child, the IWOMB has been thought of as an avenue to organize and build a strong mathematical biology community dedicated to the training and mentoring of young researchers. IWOMB participants include emerging researchers and graduate students from different provinces of the Philippines and neighboring countries, who are interested in diverse topics on mathematical biology. The workshop also aims to explore research breakthroughs and give birth to fresh ideas from scientific discussions between Filipino and foreign mathematical biology enthusiasts.

The history of mathematical biology in the Philippines can be traced back since the early 2000s [3]. The initiatives during the past decades were focused on capacity building and establishing collaborations. Several Filipino researchers and academics have been sent abroad to study and conduct researches at the forefront of the field of mathematical biology. Various universities in the Philippines have also offered courses and degree programs related to mathematical, computational and systems biology. Two of the key persons who catalyzed the formation of mathematical biology in the Philippines are Dr. Baltazar D. Aguda and Dr. Eduardo R. Mendoza, who both for a period of time served as 'Balik Scientists' (returning Filipino scientists based abroad). Drs. Aguda and Mendoza have greatly contributed to the research projects done by Filipinos in the field of Chemical Reaction Network Theory [4] and in advancing the 'omics' and research in the Philippines. In 2008, the International Conference on Molecular Systems Biology (ICMSB 2008), the oldest running conference on biochemical systems theory and modelling, was hosted by the University of the Philippines Diliman, with Avner Friedman and Eberhard Voit as two of the speakers. ICMSB 2019 will be held again in the Philippines hosted by De La Salle University.

Today, these initiatives are bearing fruit as the pool of mathematical biology enthusiasts, including young PhD graduates, visiting scientists, researchers and faculty members in tenure-track positions, is continuously expanding. The current initiatives still focus on promoting mathematical biology and training young scientists but with increasing funded interdisciplinary and multi-sectoral research projects, this could impact policy and decision-making in public agencies and various industries.

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Figure 1: Speakers and participants during IWOMB 2018 held at Cebu Philippines.

Figure 2: Speakers and participants during IWOMB 2019 held at Bohol Philippines.

A consensus among the participants of the workshop is that the mathematical biology initiatives in the Philippines will continue to grow along with and as a response to the emerging need for evidence- and science-based investigations of existing and emerging biological, environmental, agricultural, biomedical, and public health issues in the Philippines [5]. These issues require interdisciplinary approaches, where mathematical modelers, data scientists, and experimentalists need to work collaboratively. In a developing country such as the Philippines, there are several problems that mathematical biology could provide cost-effective and optimal solutions to. One of the concerns in mathematical biology is on the prevention, treatment and control of infectious diseases, such as tuberculosis, vector-borne diseases (e.g., dengue) and HIV/AIDS. Neglected tropical diseases including helminthic infections are also a big problem in the country. The Philippine government is already investing cutting-edge 'omics' technology as seen in the establishment of the Philippine Genome Center. Currently, the targets of drug discovery and development programs in the country include cancer, diabetes, cardiovascular and neurodegenerative diseases.

A large portion of the Philippine economy relies on agriculture. This provides opportunity for mathematical biologists to offer strategic quantitative solutions to assure sufficiency and sustainability of agricultural products, especially in the presence of diseases and pests. The collaboration between mathematicians and biologists under the Bee Program of the University of the Philippines Los Baños is a notable example of a successful partnership that resulted in researches and extension activities for optimizing the pollination services for agricultural crops. Mathematical modeling can offer descriptive, predictive and prescriptive analytics using a systems approach to environmental and eco-tourism issues in the country, especially considering that the Philippines is a high-risk country in terms of the effect of climate change.

The birthing of a mathematical biology community in the Philippines has not always been smooth, and it is facing various challenges. In the Philippines, there is a lack of students and academics working in the quantitative sciences. More so, biology has a wide range of sub-disciplines, and the number of mathematical biology practitioners in the Philippines, especially those focusing on pressing issues, is not enough. There is only limited efficient support from funding institutions and only few research-intensive universities in the Philippines are focused on mathematical biology. Despite these challenges, the situation is getting better and there are already organizations providing valuable support to the mathematical biology community such as the Philippine-American Academy of Science and Engineering (PAASE). IWOMB has been supported by the

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Several initiatives have been put forward in the IWOMB roundtable discussions such as the establishment of a professional organization that could help in sustaining the momentum, organizing the vision and mission, and advancing the current status of the community, especially in response to the Harmonized National Research and Development Agenda of DOST. Friends of the Philippine mathematical biology from South Korea and Japan, such as Eunok Jung, Jae Kyoung Kim, and Atsushi Mochizuki, are instrumental in moving these initiatives forward. The invited speakers in the first and second IWOMB include well-renowned mathematical biologists, such as Leah Edelstein-Keshet, Yoh Iwasa, Olaf Wolkenhauer, Aaron King, Franz Kappel and Johnny Ottesen, among others.

The next IWOMB will be held at the University of the Philippines Los Baños in January 2020.

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