

An interdisciplinary approach to medicine through mathematics - opinion of a student

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Biology in general, and medicine in particular, have been traditionally reductionist sciences. Ever since the thorough application of scientific principles to biology in the 19th century, mankind has been able to dissect further and further, gaining a wealth of details about the living world. The results, for a while, kept up with the scientific enthusiasm. It was hoped that with the discovery of the cell's most intimate mechanisms (i.e. DNA and protein synthesis) biology would be "solved", with medicine to follow soon after. Yet, even with this exponential growth of information, the pace slowed. Antibiotics started losing efficiency. Genetics didn't deliver on the huge promises it made. Cancer remained (and remains) a deadly and frightening disease. What happened?

Well, it turns out that taking the puzzle apart is harder than putting it back together. The simple accumulation of knowledge is not enough, especially with such a complex system as the human body. One needs to organize all the pieces, and to find the dynamic interactions between them. The stage is thus set for mathematical biology.

Men sought to describe the living world with the help of mathematics since ancient times. However, mathematical biology as a separate discipline came

into its own only in the second half of the 20th century, aided by the incredible growth of computing power. It is now in a unique position to discern meaningful patterns in the vast amount of data generated by basic research. Moreover, it can create models that, aside from describing the complex behavior of living systems, can also create testable hypotheses that feed back into empirical research. And with the help of such (relatively simple) models, it can weave different strands of basic research into a picture more resembling the intricate whole.

With this in mind, we gladly took up on the offer to participate in a semester-long course of mathematical biology. The course, organized by Prof. Maria Dorobantu (UMF "Carol Davila") and Prof. Liviu Ornea (Faculty of Mathematics, University of Bucharest) aimed at introducing us to fundamental concepts in the mathematical modeling of biology. We started with basic differential equations. We then learned about systems of equations, and their behavior at equilibrium, or otherwise. We used both mathematical and computational methods for solving such systems. Along the way, we discovered simple but powerful models describing competing populations, predator-prey interactions, spread of disease in

a population, and enzyme dynamics. By the end of the semester we were able to understand and present models used in current medical research today.

It was a unique experience, and a potentially very useful one for the future. We now have a firm basis for deepening our own study of mathematical biology. The course also serves as a starting point for projects of our own, having provided us with the

starting tools. It is also refreshing to see such an approach in Romania, as the subject is seldom discussed here. And, last but not least, it was an interesting and challenging way to spend a Wednesday afternoon.

All in all, it was a great opportunity for learning, and one that hopefully will grow and develop further next year.