

# **Invited talk : Computational biomedicine –interdisciplinary training for the clinician scientists of the future**

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The realisation that biological processes can be explained in terms of the interactions between a limited set of fundamental chemical building blocks has driven progress in biomedical science for more than a century, and has resulted in the molecular biology revolution. The key interdisciplinary boundary during this period was the frontier between medicine and chemistry. Today, however, a new set of challenges is changing the frontier of biomedicine. Technological advances in every area of biology have resulted in an exponential increase in the rate of data acquisition, and in its complexity. There is a growing consensus that the rate at which we are acquiring new hyper-dimensional biological data now outstrips our ability to analyse, integrate, interpret and eventually exploit it to drive progress in medicine and improve health. In order to tackle these challenges, biomedical scientists need new sets of skills. Specifically, mathematics offers a framework with the potential to simplify the increasingly complex data which is being produced, and provide fundamental rules which capture the behaviour of physiological systems in health and disease, and allow us to predict how they may respond to different types of therapeutic intervention. In parallel, artificial intelligence provides a means to implement this mathematics, using the increasingly sophisticated algorithms of machine learning.

At present, the medical school curriculum, developed during the golden age of molecular biology, gives limited attention to either mathematics or computer science. This is resulting in a shortfall in doctors with the skills to understand and exploit the rapid advances in computational biomedicine. Specifically, we are struggling to identify and train the future clinician scientists who will develop research programs at this critical interdisciplinary boundary. In order to begin to address this problem, UCL has pioneered a new integrated BSc program, Mathematics, Computers and Medicine. The program was launched in the academic year 2018/2019 and is run jointly by the Division of Infection and Immunity (Faculty of Clinical Sciences) and the department of Computer Sciences (Faculty of engineering). In this presentation, I will outline the basic structure of the course, describe some of the challenges which arose in establishing a cross-faculty degree, and describe some of the research projects which are a key component of the degree.

In the future, as additional mathematical and computational components are incorporated into the main-stream medical curriculum, inter-disciplinary degrees such as the one described will allow medical schools to train a cohort of doctors who can be at the vanguard of exploiting the data-driven computational revolutions which will transform medical care in the 21st century.