Nottingham BBSRC DLA Programme : Quantum computing applications in bioscience for human health (CASE project)

University of Nottingham, School of Chemistry

Start date September 2026

About

Thanks to £14m of funding awarded by the Biotechnology and Biological Sciences Research Council (BBSRC), the University of Nottingham and Nottingham Trent in partnership with the National Biofilms Innovation Centre (NBIC) are offering fully funded innovative four-year cohort-based training in frontier science.

Postgraduate researchers will be recruited to a research cluster within each of the overarching research areas:

- Alternative and Emerging Protein sources for Sustainable food and feed (Sustainable Agriculture and Food Security) - Cluster lead Professor John Brameld
- RIC@N-DLA: Multiscale RNA Science from mechanisms to applications (Bioscience for Human Health) – Cluster lead Dr Federico Dajas-Bailador
- Future Genomes Across Life – Engineering biology for sustainability and innovation (Biotechnology for Sustainable Growth) – Cluster lead Professor Thorsten Allers

Project description

We invite applications for a BBSRC fully funded CASE studentship to investigate quantum computing applications in bioscience for human health. This sits under our Bioscience for Human Health theme and is offered through partnership with Sygnature Discovery.

Biomedical and healthcare research needs to be ready for the impending quantum revolution. Quantum computing is still a nascent technology, which has not yet been used for practical applications [Nat. Med. 2025, 31, 4], but the speed of development of both hardware and algorithms is exciting. By exploiting unique properties of quantum systems for information processing, quantum computers can solve problems that are not tractable using today's "conventional" computers. The discovery of new drugs has long been one of the most challenging tasks facing medical innovation. This project will demonstrate how we can harness the combined power of quantum computing and classical simulation methods to accelerate drug discovery.

This study will apply quantum neural networks to various problems within drug discovery. Quantum Machine Learning (QML) involves using quantum algorithms to train models by encoding classical or quantum data into quantum states. These states are adaptively refined to fit the data, via gradient descent or variational approaches. Quantum computing is based on gates of quantum registers made up of quantum bits (or qubits). In contrast to classical bits, which can only take values of either 0 or 1 and are the bedrock of conventional computers, qubits can exhibit superpositions of quantum states (a sort of admixture of 0 and 1). An important consequence is that qubits store an exponentially larger amount of information compared to classical bits and, in principle, quantum computers could solve certain computational problems exponentially faster.

The project will focus on datasets of relevance to drug discovery, utilising data from the literature and from the CASE partner, Sygnature Discovery. Problems of interest include the prediction of RNA structure. Such predictions are essential if we are to understand how to target the mutant RNA. Leveraging new algorithmic insights, we will use predicted structures as a starting point for simulations of the binding of bivalent ligands to r(CUG) hairpins. Objectives are: (i) to assess predictive accuracy and training times; (ii) to devise algorithmic enhancements; (iii) to provide new scientific insight.

Why choose this project?

The successful candidate will be joining an outstanding research environment. The School of Chemistry has a vigorous and dynamic postgraduate training programme. A tailored selection of modules will be utilised, including "Introduction to Practical Quantum Computing", which provides an introduction to quantum computing with an emphasis on being able to run quantum circuits on existing and near-term quantum computers. The module introduces essential elementary concepts from quantum mechanics and quantum information, as well as exploring how quantum computers may be utilized in the context of machine learning.

Work is supported by a High Performance Computing (HPC) Facility at the University of Nottingham as well as the EPSRC-funded HPC Midlands Plus tier-2 regional centre, involving a £3.2M investment in e-Infrastructure. The University HPC comprises 7,008 AMD CPU cores and 221,184 cuda cores (A100s). In addition, the team have exclusive use of an NVIDIA HGX H200 8-GPU cluster, which is a cutting-edge facility for the proposed quantum computing emulations. The lead supervisor, Professor Hirst, currently holds a £2.8M 10-year Royal Academy of Engineering Chair in Emerging Technologies, with a focus on machine learning in chemistry, and is the Principal Investigator on a $4.25M Wellcome Leap award as part of their Quantum 4 Bio (Q4Bio) challenge program. Our Q4Bio collaborators will be a source of additional expertise, through informal discussions. Both organisations are world leaders in quantum computing.

Sygnature Discovery is a world-leading integrated drug discovery contract research organization based in the UK and Canada with headquarters in Nottingham. Additional sites are located in Alderley Park, Macclesfield, and Glasgow, as well as Montreal and Quebec City. Its team of over 1,000 employees, which includes 900 scientists, partners with global biotech, pharma and NFP organizations. Since 2011, Sygnature Discovery has delivered 60+ novel pre-clinical and 35+ clinical compounds, with its scientists named on over 235 patents. Therapeutic areas of expertise include oncology, inflammation and immunology, neuroscience, metabolic diseases, infectious diseases, fibrotic diseases, and more.

For informal enquiries about the project please contact Professor Jonathan Hirst.

Requirements

Applications are invited from candidates with backgrounds in Bioscience, Biochemistry, Biotechnology, Chemistry, Chemical/Biochemical/Process Engineering, Pharmacy, Computer Science, Maths or related disciplines who have/expect to graduate with a first/upper-second UK honours degree, or equivalent qualifications gained outside the UK.

Applications are also welcome from candidates with a 2:2 undergraduate degree or lower, who hold a Masters degree in a relevant area or three or more years of full-time work experience relevant to your undergraduate degree, or to the PhD projects you are applying for.

Funding details

Funding is available for four years from October 2026. The award covers tuition fees at the UK rate, plus an annual stipend. The UK Research and Innovation (UKRI) stipend is tax free and was set at £20,780 for 2025/26 entry.

UK and International candidates are eligible to apply.