

**RESEARCH
EXCELLENCE
IN THE SCHOOL
OF BIOSCIENCES**





THE UNIVERSITY OF KENT

The University of Kent is a leading UK university producing world-class research, rated internationally excellent and leading the way in many fields of study. Our 20,000 students are based at campuses and centres in Canterbury, Medway, Athens, Brussels, Paris, Rome and Tonbridge.

With 97% of our research judged to be of international quality in the most recent Research Assessment Framework (REF2014), our students study with some of the most influential thinkers in the world.

We are also renowned for our inspirational teaching. Awarded a gold rating, the highest, in the UK Government's Teaching Excellence Framework (TEF), we were also presented with the Outstanding Support for Students award at both the 2017 and 2018 *Times Higher Education* (THE) Awards.

Our graduates are equipped for a successful future allowing them to compete effectively in the global job market. More than 95% of graduates find a job or study opportunity within six months.

Known as the 'UK's European university', our international outlook is a major focus and we believe in our students developing a global perspective. Many of our courses provide opportunities to study or work abroad; we have partnerships with more than 400 universities worldwide and are the only UK university to have postgraduate centres in Athens, Brussels, Paris and Rome.

The University is a truly international community with over 40% of our academics coming from outside the UK and our students representing over 150 nationalities.

We are a major economic force in south-east England, supporting innovation and enterprise. We are worth £0.9 billion to the economy of the south east and support more than 9,400 jobs in the region.

In March 2018, the Government and Health Education England (HEE) announced that the joint bid by the University of Kent and Canterbury Christ Church University for funded places to establish a medical school has been successful. The first intake of undergraduates to the Kent and Medway Medical School will be in September 2020.

We are proud to be part of Medway, Canterbury and the county of Kent and, through collaboration with partners, work to ensure our global ambitions have a positive impact on the region's academic, cultural, social and economic landscape.

Find out more on the University of Kent webpages: www.kent.ac.uk



SCHOOL OF BIOSCIENCES

The School of Biosciences is a vibrant and stimulating environment for research and teaching. In REF2014, Biosciences at Kent was ranked 7th on the basis of 'research intensity', and the appointment of a range of new staff since 2014 has meant that research quantity and quality have risen still further. This is now an extremely active research environment. The School has a collegiate atmosphere with around 40 academic staff and Research Fellows, and its critical mass and excellence are focused on a number of core research themes, namely:

- Industrial biotechnology
- Infection and drug resistance
- Cancer and age-related diseases
- Cellular architecture and dynamics
- Reproduction, evolution and genomics

The research is supported by the School's advanced research facilities, including nuclear magnetic resonance (NMR), mass spectrometry, fluorescence microscopy, electron microscopy, computation and protein purification/ analysis. All of these facilities are well supported in terms of staff and finances. Research groups are funded by a wide range of agencies including BBSRC, InnovateUK, Cancer Research UK, European Union Horizon2020 initiatives, British Heart Foundation, MRC, RCUK's Global Challenges Research Fund, and the Wellcome Trust. The vast majority of our staff have external grant income and Biosciences currently accounts for almost a quarter of the University's total grant income.

Biosciences' research excellence has been recognised by the planning of a new 'Institute of Biotechnology and Molecular Medicine' (iBaMM) research facility. This new building is scheduled for completion in late 2021, and will house additional staff and research facilities. Another notable development is the news that the University will develop a Medical School, jointly with Canterbury Christ Church University. This represents an opportunity to develop major new strands of biomedical research.



Research in the School of Biosciences

Industrial biotechnology

Applied research has always been a Kent strength and the Industrial Biotechnology group has played a central role in Biosciences' rising research profile. Members of the group work closely with a wide range of industrial partners in the IB area. The School has particular strengths in (i) application of pathway manipulation/introduction and synthetic biology applications (eg, for vitamin biosynthesis, biofuels, generation of bacterial microcompartments, metabolic rewiring of cellular systems, manipulation of mammalian cell secretory pathway) in prokaryotic and eukaryotic systems, (ii) cell engineering for re-wiring of bacterial, yeast and mammalian cell phenotypes and its application to industrial biotechnology (eg, to produce new and enhanced cell chassis for biotherapeutic production, for vaccine development, to generate small molecule and high value intermediates), (iii) the study of protein biochemistry and its industrial application in above areas, (iv) fermentation and tools for the selection/evolution of suitable traits.

The research is supported by research grants that include a range of substantial consortium grants, including £2.6m and £1.6m InnovateUK/BBSRC 'Industrial Biotechnology Catalyst' grants, two Horizon2020 Marie Curie Innovative Training Network grants (£1.2m), and a £2.4m BBSRC sLola grant. The research has furthermore taken on a global dimension with the recent award of a £4.9m 'Global Challenges Research Fund' grant led by Professors Robinson and Smales, which aims to enhance production of biotherapeutics and animal vaccines in South East Asia.

Infection and drug resistance

This highly dynamic and multidisciplinary group is focused on understanding basic mechanisms underlying virulence, pathogenicity and drug resistance in a wide variety of human pathogens (viruses, parasites, bacterial and fungal pathogens). The group also investigates the mechanisms by which proteins such as prions may serve as infectious agents. The group includes members of the Kent Fungal Group (www.kentfungalgroupp.com/) and the ResistAnce Pathogenicity and Infectious Diseases (RAPID) group and promotes links between academics, clinicians and enterprise.

Their research is supported by research grants from the BBSRC, Wellcome Trust, EPSRC, MRC and the Bill and Melinda Gates Foundation.

Cancer and other age-related diseases

This group investigates the molecular and cellular mechanisms underlying the ageing process, and in particular cancer as a major age-related disease. Research combines experimental wet lab-based approaches in human cancer models, *C. elegans*, and yeast with computational/ bioinformatics-based research. In terms of cancer research there is a focus on the investigation of anti-cancer therapies including the discovery and development of novel anti-cancer drugs, drug targets, and biomarkers.

As part of this research the school hosts the Resistant Cancer Cell Line (RCCL) collection, the largest collection worldwide of models of acquired cancer drug resistance comprising over 1,300 human cancers cell lines across 15 cancer entities and 67 anti-cancer drugs (both targeted and cytotoxic).

The group has received funding from research funders including the BBSRC, MRC, Cancer Research UK, Human Frontiers Science Program, Kent Cancer Trust, Breast Cancer Kent, the Royal Society, the Rosetrees Trust, and the Bill & Melinda Gates Foundation and works in collaboration with a range of industrial partners.

Cellular architecture and dynamics

The Cellular Architecture and Dynamics research group builds on School strengths in both cell biology and molecular protein science to study the generation, sensing and control of mechanical forces in living cells at all levels from the single molecule to the cell. These processes are relevant to important diseases such as cancer, infertility, heart disease, deafness, blindness, Parkinson's and autoimmune diseases. The core group studies molecular motors, cell adhesion and nuclear processes but brings in wide collaborations from across the School, Faculty and University to generate a multidisciplinary approach to address biological questions.

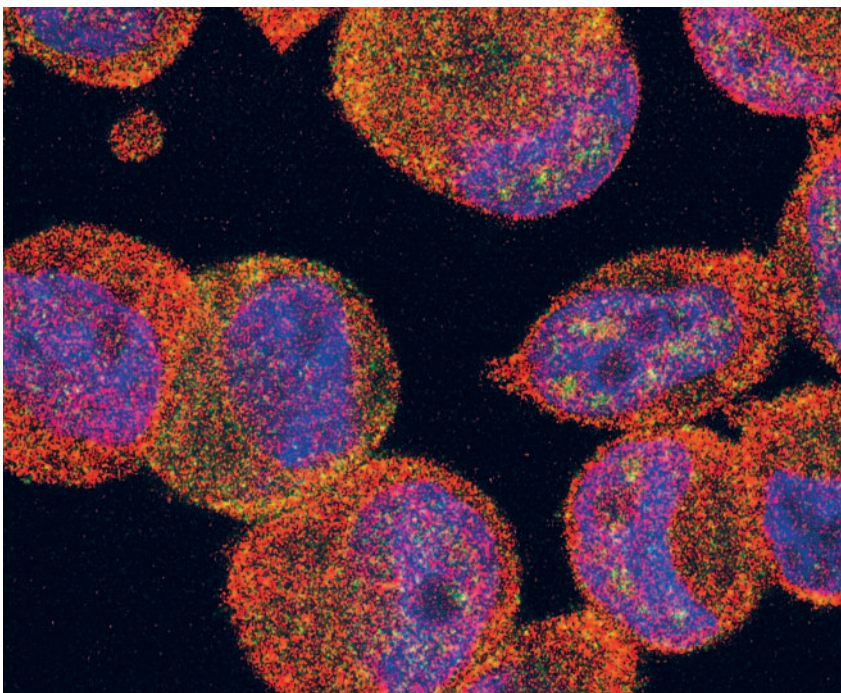
The group has a strong record of attracting funding (> £4m currently) and high quality Research Fellows currently including Chris Toseland (MRC Career Development Award), Alice Racca (EU Incoming Marie Skłodowska-Curie Fellowship) and Natali Fili (Newton Fund Fellow).

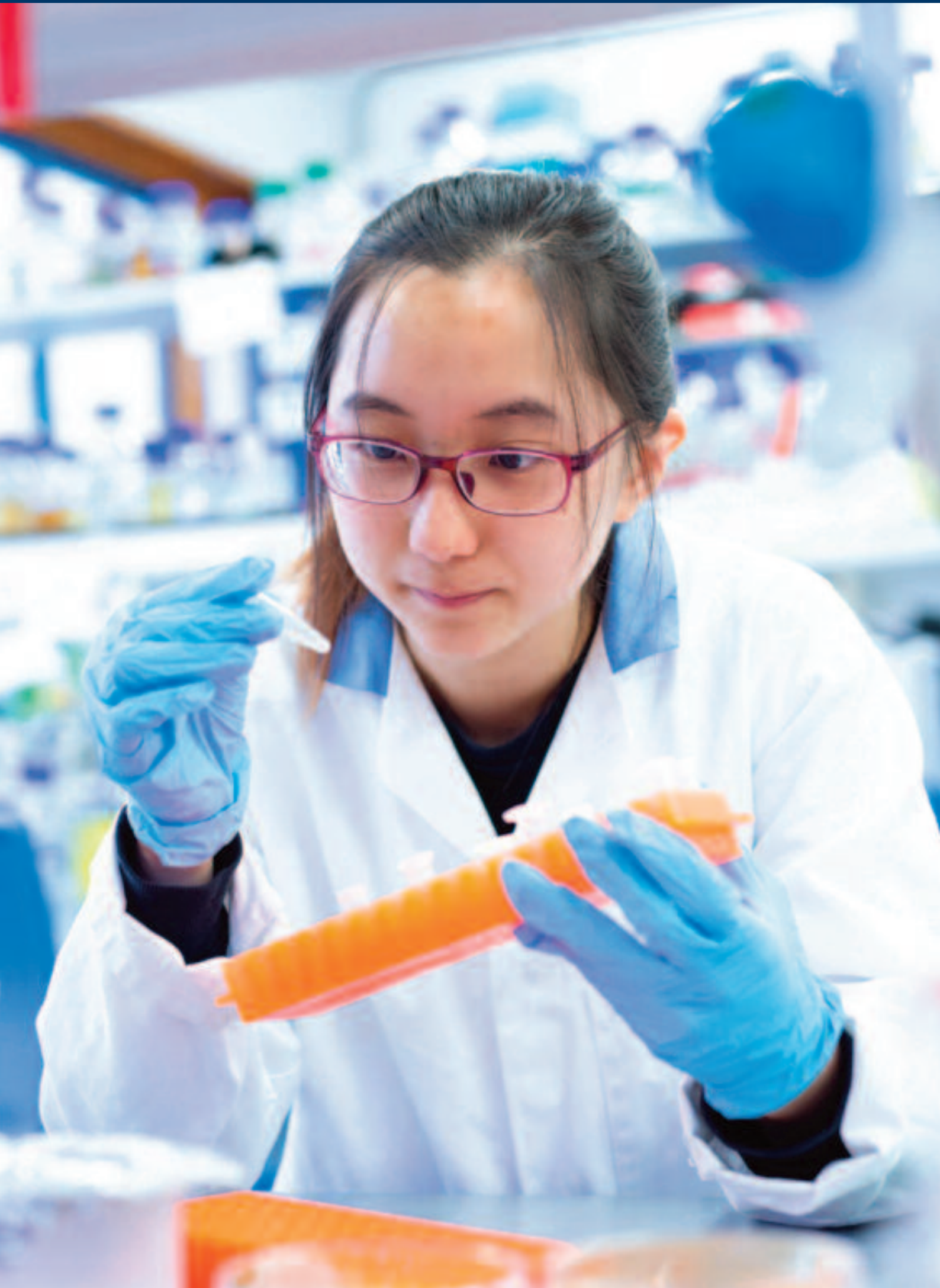
Reproduction, evolution and genomics

Research is focused on practical and therapeutic applications for the prognosis, prediction and diagnosis of genetic diseases in humans and on the application of genomics and assisted reproduction for improvement of agriculture and understanding genome evolution. A key challenge is to understand the molecular basis of impaired fertility, IVF failure, pregnancy loss and congenital malformation in newborns. There are strong links with end-users such as IVF clinics, and technology commonplace therein is being adapted to understand reproductive performance in agricultural species. Research is enhanced by interactions facilitated by the Centre for Interdisciplinary Studies of Reproduction that generates greater public engagement and impact.

Teaching in the School of Biosciences

The School currently teaches three undergraduate degrees - Biomedical Science, Biochemistry and Biology – each with 4-year variants providing professional working experience or a period studying abroad. In addition we offer a range of taught masters aligned with specific research specialisms in the School. Our programmes are professionally accredited by relevant professional bodies and are underpinned by our research excellence. See page 7 for further details.





RESEARCH EXCELLENCE

In the School of Biosciences, both undergraduate and postgraduate students are an integral part of our academic community. Our vibrant culture of innovation and discovery is based on excellence in research, pushing forward the frontiers of our knowledge in the biological sciences. From vaccine development to infection control, fundamental cell biology to drug development, cancer therapy to *in vitro* fertilisation, our research addresses 21st century real-world challenges of global significance.

Research also underpins our excellent undergraduate and postgraduate education. Students are taught and supported by experts, and our ethos is to inspire all of our students by drawing them in to this journey of discovery. Our students have many opportunities to participate in our research, developing their skills and future career opportunities while making their own contribution to our understanding of the biological sciences.

Sustaining an environment in which high-calibre research takes place is costly. The School of Biosciences is very successful in gaining support for research, and is funded by a wide range of external funding agencies. The average level of research grant income per member of academic staff is over £130,000 per year. This funding allows us to provide a modern research infrastructure, and an environment that adds value to the education and broader experience of our students.

How do our students benefit from research excellence?

Undergraduate programmes are delivered by staff with a research background able to bring topics to life and cover the most recent developments in the biological sciences. Practical classes make use of our excellent research infrastructure.



Students also have many opportunities to undertake their own research in our well-equipped laboratories; for example, they can apply for summer vacation internship at the end of their second year, and during their final year all students have an opportunity to undertake an independent research project under the guidance of staff members who are experts in their field.

Taught master's programmes offer advanced training in areas of particular research strengths in the School. They provide 120 credits of taught material, featuring small-group student-led learning at which our student discuss current research findings with our expert staff. They develop skills highly prized by sector employers through structured education and assessment informed by research. Training in cutting-edge genome editing technologies is further developed with specialised practical work, and an extended research project over the summer months embeds our students into our research culture.

Students present their independent research at a symposium in July. Recent graduates have published their work in the international peer-reviewed journal PLOS One, and our graduates are very successful in gaining research jobs in industry and elsewhere.

Research master's programmes allow students to carry out a specific independent research project for a full year in a member of staff's research group. As this is a research-focused master's course, students will take an interactive approach to learning, rather than taking traditional lectures. Instead, workshops and lab meetings will enable you to gain an in-depth understanding of the field. This is an increasingly popular option for students who prefer to gain extensive laboratory experience (or in some cases computational based research) as preparation for a PhD application or a career in the biotechnology or health sciences research areas. The MSc culminates in the submission of a written research dissertation and oral *viva voce* examination. Additionally, you present your results at the annual Postgraduate Symposium in July. Examples of project titles are available in a later section.

THE CITY OF CANTERBURY

The University's main campus is in Canterbury. This world-famous cathedral city was one of medieval Europe's great places of pilgrimage and knowledge. Today – with its international visitors and two universities – it still has a distinctly cosmopolitan feel. Less than an hour from London, it takes little more than that to visit France.

People come here from across the globe for world-class heritage, for culture and festivals, to visit and to study, to shop and visit some of the best restaurants in the region. The extraordinary Cathedral dominates the medieval streets within the city walls. Among the listed buildings, a boldly modern theatre – named after the city's famous son Christopher Marlowe – has been built on the river bank, and an art museum has been restored and

doubled in size. To the south of the city is St Augustine's Abbey, part of the World Heritage Site, and England's first seat of learning.

Canterbury's student population contributes to the city's buzz and the Experian Inner City Vibrancy Report (2013) ranked Canterbury as the 3rd most vibrant city in England and Wales. However, it's still easy to find areas of peace and quiet within the City walls.

Kent is known as being the Garden of England and you will find local produce in cafes, pubs and restaurants: Romney Marsh lamb, cherries, ale from local hops and award-winning wine from Kentish vineyards. To the north of the city is one of England's largest ancient woodlands, the Blean and a few miles away there is the seaside town of Whitstable, renowned for its oysters.

Canterbury and its immediate area have an increasingly rich cultural offer. Turner Contemporary, the nationally-acclaimed art gallery, is within easy reach and the Canterbury Festival, the Whitstable Biennale and the Folkestone Triennial are just some of the regular events taking place in the region.



PROGRAMMES AND PROJECTS

Undergraduate programmes

- BSc Biochemistry
- BSc Biology
- BSc Biomedical Science*

All our programmes are Accredited by the Royal Society of Biology, and are offered with a Sandwich Year** and Year Abroad .

*Also accredited by the Institute for Biomedical Science.

** Royal Society of Biology Advanced Accreditation.

Taught master's programmes

- MSc Biomedicine
- MSc Biotechnology and Bioengineering
- MSc Cancer Biology and Therapeutics
- MSc Infectious Diseases
- MSc Reproductive Medicine

All these programmes have received Master's Accreditation from the Royal Society of Biology.

In addition, the MSc Biotechnology and Business is recruiting for September 2019 entry (subject to approval).

Research master's programmes

See below for selected examples below of research projects available for September 2019, aligned with our specific research groupings. For further information about any of these projects or research in related areas, please contact the supervisor or email biopgadmin@kent.ac.uk

Cancer and Ageing

Dr Jennifer Tullet

Understanding the molecular basis of longevity

Dr Tim Fenton

How does wrongful expression of germline genes drive HPV cancer pathology?

Professor Martin Michaelis

Investigation of drug-adapted cancer cell lines.

Dr Chris Mulligan

Probing the mechanism of INDY (I'm not dead yet) transporters: a target for the treatment of cancer, diabetes and obesity.

Industrial Biotechnology

Professor Mark Smales

Evaluation of new Alkaline Phosphatases.

Dr Tobias von der Haar

Towards the biological degradation of plastic materials.

Dr Simon Moore

Development of xenobiotic antimicrobials by cell-free protein synthesis.

Genome mining for antimicrobials with CRISPR-Cas9 engineering

Characterisation of a *Streptomyces* metal-dependent endoglucanase for recalcitrant cellulose breakdown.

Dr Mark Shepherd

Fruit to fuels: assessment of Kent crops as feedstocks for butanol production by *Clostridium* Engineering microcompartments into biofuel bacteria: new (fluorescent) wheels on an old chassis.

Evolution, reproduction and genome organisation

Dr Mark Wass

Predicting the effects of genetic variation.

Dr Peter Ellis

Are Y-linked genes the explanation for the differential prevalence of certain cancers between men and women?

Dr Marta Farré Belmonte

Study genetic diversity of the Defassa waterbuck (*Kobus ellipsiprymnus*). This project is in collaboration with the Aspinall Foundation.

Optimisation of DNA and RNA extraction protocols from hair follicles and other samples of water voles (*Arvicola amphibus*) to establish the genetic diversity of the population in Wildwood Trust. This project is in collaboration with Wildwood Trust.

Identification of differentially expressed genes in ruminants and non-ruminants using publicly available RNA-Seq datasets.

Infectious Diseases

Dr Mark Shepherd

The CydDC transporter of *E. coli*: biochemical characterisation of an antimicrobial target.

Dr Anastasios Tsaousis

Establishing and developing an advance culturing platform for *Cryptosporidium*.

Exploring *Cryptosporidium* transportome and how it affects the intracellular interactions with its host.

Exploring the eukaryotic gut microbiome among animals.

Dr Alessia Buscaino

Understanding mechanisms of RNA interference in the human fungal pathogen *Candida albicans*.

Improving second-generation bioethanol production by manipulating the genome of the non-conventional yeast *Scheffersomyces stipitis*.

Centromere structure and Function in the bioethanol producing yeast *Scheffersomyces stipitis*.

Genome diversity and epigenetics in the most common human fungal pathogen *Candida albicans*.

Understanding mechanisms of RNA interference in the human fungal pathogen *Candida albicans*.

Dr Campbell Gourlay

Investigating the role of mitochondria in regulating cell health and ageing.

Cellular Architecture and Dynamics

Professor Michael Geeves

Protein based temperature sensors for use inside cells and organelles.

Live cell imaging under pressure.

Dr Wei-Feng Xue

Structural biology of amyloid aggregates.

Investigating the nano-scale properties of amyloid assembly.

Synthetic biology approach to self-assembled fibrous bio-materials.

Computational structural biology of amyloid aggregates.

Dr Neil Kad

How are genes activated?

Correcting the code of life.

Dr Ben Goult

New approaches to rapid protein structure determination by NMR.



RESEARCH NUMBERS

50 years! The School of Biosciences celebrates its 50th anniversary in 2020.

210 researchers (including 130 postgraduate research students, 36 postdoctoral researchers, 40 academic staff on teaching and research contracts, 2 research fellows and 3 facility managers) are affiliated with the School of Biosciences, forming our vibrant and powerful research base.

Source: School of Biosciences, January 2019.

5 nm, or five millionth of a millimetre, is the size of an average protein. The generation, structure and function of proteins is the focus of the majority of research groups in the school, alongside nucleic acids (genes) and other types of molecule.

Source: Bionumbers database, bionumbers.hms.harvard.edu.

£19.8 million of external research funding were awarded to School of Biosciences staff and fellows in the five year period between January 2014 and January 2019.

Source: University of Kent Research Services/ Kent Innovation and Enterprise, January 2019.

40% success rate, by number, for grant applications from the School to BBSRC (our most important funder), compared to a national average of 25%.

Source: BBSRC, 2017/18 academic year.

384 scientific articles were authored by scientists affiliated with the School of Biosciences in the five year period from January 2014 to January 2019.

Source: Medline/Pubmed search

CONTACT

Contact us for more information

T: +44 (0)1227 824125

E: bioadmin@kent.ac.uk

www.kent.ac.uk/biosciences