University of Birmingham

Chemical Engineering PhD (Bioprocessing specialism)

Postgraduate PhD degree Chemical Engineering PhD/MSc by research (Bioprocessing specialism):

Bioprocessing is concerned with development of new methods for production of bioactive molecules and their delivery to the human body, and incorporates research groups in biochemical engineering, cell and tissue engineering, biological products recovery, waste processing and environmental bioremediation.

Taken together, this is one of the largest biochemical engineering activities in the UK, and is housed in a purpose-built Biochemical Engineering building.

Chemical Engineering is dynamic and evolving. It provides many solutions to problems facing industries in the pharmaceutical, biotechnological, oil, energy and food and drink sectors. It is vital to many issues affecting our quality of life; such as better and more economical processes to reduce the environmental burden, and more delicious and longer lasting food due to the right combination of chemistry, ingredients and processing.

Birmingham is a friendly, self-confident, School which has one of the largest concentrations of chemical engineering expertise in the UK. The School is consistently in the top five chemical engineering schools for research in the country.

It has a first-class reputation in learning, teaching and research, and is highly placed in both ***The Guardian*** and ***The Times*** league tables. The School was recently awarded the **Queen's Anniversary Prize for Higher Education.**

THE QUEEN'S ANNIVERSARY PRIZES
FOR HIGHER AND FURTHER EDUCATION
2011

Study here and find out why the University of Birmingham was awarded The Times and The Sunday Times University of the Year 2013-14 (http://www.birmingham.ac.uk/news/latest/2013/09/20-sep-Birmingham-announced-as-University-of-the-Year.aspx)

Course fact file

Type of Course: Doctoral research

Study Options: Full time, part time

Duration: PhD: 3 years full-time; MPhil: 1 year full-time, 2 years part-time

Start date: Research degrees can start at any time by agreement with the supervisor

Related courses

Research degrees - School of Chemical Engineering (/schools/chemical-engineering/postgraduate/research-degrees.aspx)

Contact

Admissions Tutor: Professor Mark Simmons

Contact us online (http://bham.hobsons.co.uk/ask.aspx?cid=1223&did=24) or at +44 (0)121 414 3947.

School of Chemical Engineering (/schools/chemical-engineering/index.aspx)

Details

Bioprocessing is concerned with development of new methods for production of bioactive molecules and their delivery to the human body, and incorporates research groups in biochemical engineering, cell and tissue engineering, biological products recovery, waste processing and environmental bioremediation. Taken together, this is one of the largest biochemical engineering activities in the UK, and is housed in a purpose-built Biochemical Engineering building.

Our research strengths are animal cell culture, bioselective separations and formulation of bioactive dosage forms, micromanipulation of single cells, flow cytometry and microbial physiology. These strengths are harnessed to solve post-genomic and proteomic issues of manufacture, measurement and modification of new products characterised by extreme molecular complexity and purity specifications. These products are commonly macromolecular proteins, and are likely to be nanoparticulate in nature, including virus, virus-like and nucleic acid formulations.

Initial enquiries about the research opportunities available in bioprocessing should be made to Dr Neil Rowson, who will put you in touch with the appropriate member of staff.

Research themes

Our research is structured into four industry themes:

- Nanoparticulate, cell and tissue engineering
- Image analysis and micromechanical techniques
- Waste processing and bioremediation

Nanoparticulate, cell and tissue engineering is concerned with identification of strategies for the manufacture of nanoparticulate bioproducts, including viral gene therapy vectors, plasmids and supramolecular assemblies, and production of efficient and reproducible processes for gene therapy products.

Current work includes:

- Development of novel bioseparation routes
- Intensification of enzyme production by direct product separation from batch fermentations
- Development of animal cell culture processes for large-scale production of pharmaceuticals, particularly intensive systems with cell and product retention
- Control of cell proliferation and cell death (apoptosis)
- Development of flow cytometric methods for selection of high producers; monitoring performance and productivity of industrial-scale processes
- Tissue engineering of bone and cartilage tissue, and development of bio-artificial liver systems
- Improvement of packaging cell lines and production systems of viral vectors for gene therapy
- Brewing and environmental processing
- Scale-up and -down of bioprocesses using flow cytometry as a physiological probe

Image analysis and micromechanical techniques for characterising the behaviour of single cells have been pioneered here and are applied to key bioprocess engineering problems, such as:

- Determination of the effect of biomass and mycelial morphology on fermentation broth rheology
- Damage to mycelia in penicillin fermentation and development of structured models for control of penicillin fermentations
- Mechanical properties of cell walls in bioproducts
- Shear effects in aggregate formation and break-up, using both model and bacterial aggregates
- Cell-surface adhesion, biofouling and surface cleaning
- Determination of the mechanical properties of a wide range of microparticles, such as skin cells for human skin care applications,and vitamin granules and microspheres for food and pharmaceutical applications
- Probiotic formulations for preservation and targeted delivery
- Micro-encapsulation for pressure-sensitive materials, artificial organs, cell engineering and drug delivery
- Nanomanipulation under the Environmental Scanning Electron Microscope (ESEM)

Waste processing and bioremediation is concerned with the development of clean-up technologies at the theoretical and practical level. Many projects are collaborative with the School of Biosciences (on wastewater treatment and metals recovery) and the Centre for Environmental Research and Training (CERT).

Topics include:

- A patented process for precious metal recovery from catalysts
- Adsorption of reactive dyes for wastewater treatment
- Wastewater treatment by supercritical water oxidation
- Bioremediation of food and agricultural wastes
- Bioreactors for dairy water treatment
- Control of thermophilic aerobic waste treatments
- Oxidation and photocatalytic techniques for aqueous media

Related links

School of Chemical Engineering (/schools/chemical-engineering/index.aspx)

Fees and funding

Standard fees (/postgraduate/dr-fees/tuition.aspx) apply, **contact the School (mailto:pg-admis-chem-eng@bham.ac.uk)** for further information.
Learn more about **fees and funding (/postgraduate/dr-fees/index.aspx)**

Scholarships and studentships
EPSRC and BBSRC studentships are available for PhDs. Other sources of funding are the Knowledge Transfer Partnership (KTP), the European Union and industrial funding for UK and EU students.

International students can often gain funding through overseas research scholarships, Commonwealth scholarships or their home government.

For further information contact the School directly or email **sfo@contacts.bham.ac.uk (mailto:sfo@contacts.bham.ac.uk)**

Entry requirements

The normal entry qualification for PhD study is either at least an upper second-class Honours degree, or a first degree of a lower classification, along with an MSc or evidence of substantial relevant industrial experience

Learn more about **entry requirements (/postgraduate/requirements-dr/step1.aspx)**

International students
We accept a range of qualifications from different countries – learn more about **international entry requirements (/postgraduate/requirements-dr/step1.aspx)**

Standard English language requirements (/postgraduate/requirements-pgt/international/index.aspx) apply

How to apply

Learn more about **applying (/postgraduate/requirements-dr/index.aspx)**

Apply now (https://pga.bham.ac.uk/lpages/EPS020.htm)

When clicking on the Apply Now button you will be directed to an application specifically designed for the programme you wish to apply for where you will create an account with the University application system and submit your application and supporting documents online. Further information regarding how to apply online can be found on the **How to apply pages (http://www.birmingham.ac.uk/students/courses/postgraduate/apply-pg/index.aspx)**

Apply now (https://pga.bham.ac.uk/lpages/EPS020.htm)

Related links

Postgraduate degree courses - School of Chemical Engineering (/schools/chemical-engineering/postgraduate/index.aspx)

Research vacancies and studentships at the School of Chemical Engineering (/schools/chemical-engineering/postgraduate/research-vacancies-studentships.aspx)

Related news and events

University of Birmingham wins Queen's Anniversary Prize for Higher Education (/news/latest/2011/11/queens-prize.aspx)

Research interests of staff

Our mission is to carry out research of the highest academic quality, which is novel, challenging and relevant to users.

Our strengths are in design and characterisation of microstructured products, and in heat and mass transfer, fluid flow, particle technology and materials engineering across chemical, biological and physical systems. We collaborate with world-class industry, and with leading edge engineering and science departments nationally and internationally.

Research centres

The Centre for Formulation Engineering

The Centre's mission is to carry out research of the highest academic quality, which is novel, challenging and relevant to users. Particular strengths are in design and characterisation of microstructured products, and in heat and mass transfer, fluid flow, particle technology and materials engineering across chemical, biological and physical systems. We collaborate with world-class industry, and with leading edge engineering and science departments nationally and internationally.

Interdisciplinary Research Centre in Materials Processing - IRC

The primary objective of the research programme in the Interdisciplinary Research Centre (IRC) is the development of materials, through materials processing and of manufacturing technologies so that the properties of the materials are fully exploited. Close interaction with industry is an essential part of this philosophy. The programmes that are in operation with industry vary from long term projects to short term problem-solving.

Related research

- **Bioengineering - Formulation Engineering Research - School of Chemical Engineering (/research/activity/chemical-engineering/bioengineering/index.aspx)**
- **The Centre for Formulation Engineering (/research/activity/chemical-engineering/index.aspx)**

Employability

University Careers Network

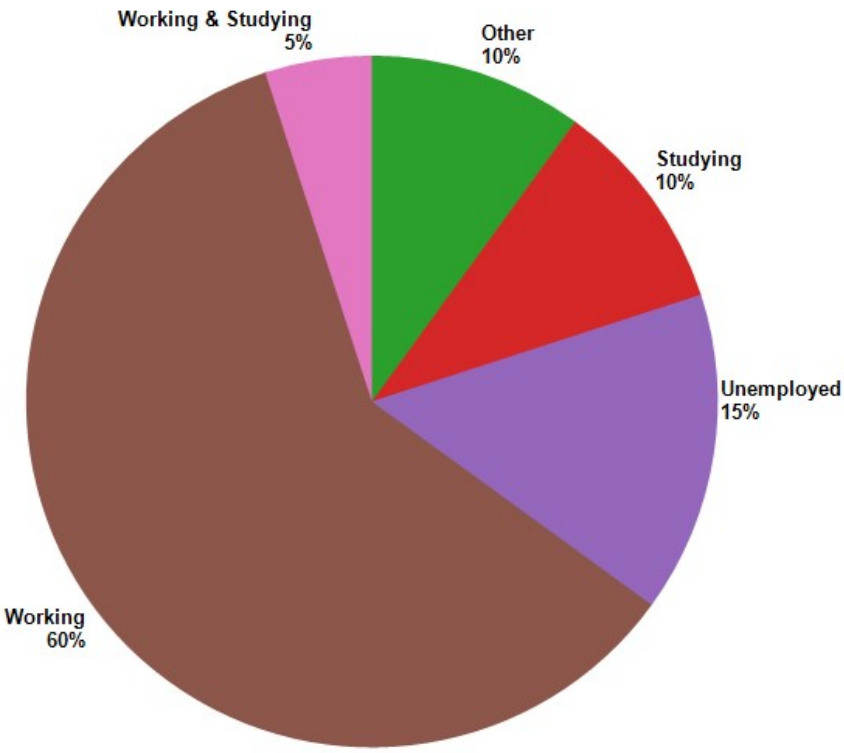
Preparation for your career should be one of the first things you think about as you start university. Whether you have a clear idea of where your future aspirations lie or want to consider the broad range of opportunities available once you have a Birmingham degree, our Careers Network can help you achieve your goal.

Our unique careers guidance service is tailored to your academic subject area, offering a specialised team (in each of the five academic colleges) who can give you expert advice. Our team source exclusive work experience opportunities to help you stand out amongst the competition, with mentoring, global internships and placements available to you. Once you have a career in your sights, one-to-one support with CVs and job applications will help give you the edge.

If you make the most of the **wide range of services (https://intranet.birmingham.ac.uk/as/employability/careers/college/eps/index.aspx)** you will be able to develop your career from the moment you arrive.

Destinations of Leavers from Higher Education (DLHE) 2011/12 (postgraduate taught graduates)

The DLHE survey is conducted 6 months after graduation.



Examples of employers:

- BP
- British Gypsum
- Citi
- Coca-Cola
- Foster Wheeler Energy
- Jacobs Engineering
- Johnson Matthey
- KBR
- Pepsico
- RBC Capital Markets

Examples of occupations:

- Chemical Engineer
- Development Engineer
- Finance Analyst
- Market Analyst
- Performance Engineer
- Process Engineer
- Process Development Technologist
- Process Support Engineer
- Team Leader
- Test and Validation Engineer

Further study - examples of courses:

- MRes Chemical Engineering Science
- MSc Advanced Chemical Engineering
- MSc Biochemical Engineering
- MSc Chemical Engineering
- PhD Chemical Engineering
- PhD Formulation Engineering
- PhD Regenerative Medicine
- PGCE Mathematics

Visit the **Careers section of the University website (https://intranet.birmingham.ac.uk/as/employability/careers/college/eps/index.aspx)** for further information.

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