MPhil / PhD
Statistical Science

www.ucl.ac.uk/prospective-students/graduate/research/degrees/statistical-science-mphil-phd
The Department of Statistical Science has played a major role in the development of the subject ever since its foundation in 1911 as the Department of Applied Statistics (the first department of statistics in the world), with Karl Pearson as its head. Since then, many famous names in statistics have been associated with the department, including Egon Pearson, R. A. Fisher and Jerzy Neyman.

Today the Department is among the three largest statistics groups in the UK with 30 academic members of staff and a research grant income of over seven million pounds.

**Degree summary**

The Statistical Science research programme aims to develop research students who can eventually make original contributions to the subject. Students are initially registered for the MPhil degree. No sooner than one year, they are transferred to the PhD degree with retrospective effect if they show a capacity for original work. The typical length of the PhD programme is three years for full-time students and five years for part-time students; an MPhil might be achievable in less.

Unlike the taught Statistics MSc programme, the MPhil/PhD has no required curriculum. However, students are expected to agree on a customised programme of study with their supervisor, which may involve specialisation courses (either at UCL or externally, for example, at the London Taught Course Centre or Academy for PhD Training in Statistics) or independent reading. Attendance at research seminars is encouraged, and students who have been upgraded to PhD status are required to present their research in a separate seminar stream once per year. Finally, the UCL Graduate School has its own requirements for training courses.

**Research Areas**

Research in Statistical Science is based on a blend of project-based research groups, multidisciplinary collaborations and individual research programmes. The Department's methodological research is organised into six areas:

- Biostatistics
- Computational statistics
- General theory and methodology
- Multivariate and high dimensional data
- Stochastic modelling and time series
- Financial risk, insurance, econometrics and stochastic finance.

Research often cuts across these areas. For example, externally funded projects in the following application areas are in progress:

- Cognitive neuroscience
- Ecology
- Econometrics
- Econometrics and Finance
- Epidemiology
- Environmetrics and hydrology
- Machine learning
- Population and systems biology
- Statistical imaging
- Stochastic optimisation in the energy sector

Much of this work is interdisciplinary and involves collaborations within and outside UCL.
**General Theory and Methodology**

Strong areas of current research in the general theory and methodology group are the theory of inference and decision making, particularly Bayesian techniques, which are used in many areas such as medicine, finance, biology and information retrieval, the use of statistics for the exploration of causality, which is a key concept in general science, the exploration of the general foundations of statistics and probability and methodology for various more specific tasks that can still be applied in many areas, such as pattern recognition, classification and clustering, model selection and high-dimensional data.

The research of the group is characterised by combining mathematical rigour with a strong awareness for the difficult questions of interpretation and meaning and concern for the requirements of applied statistics and practical considerations such as computational issues. The group work includes grants and several interdisciplinary collaborations.

**Biostatistics**

The strategy for the National Institute of Health Research (NIHR) is to conduct the best research for health. The Biostatistics group aims to enable the application of the best possible methods in health research and assist in the translation of the research findings to health care. This is achieved through the development and evaluation of statistical methodology and collaborative research with health researchers. The members of this theme have joint posts with the UCLH/UCL Biomedical Research Centre and the Primary Care and Mental Health Clinical Trials Unit. There are also strong links with the MRC Clinical Trials Unit.

Members of this theme have recently collaborated on around 20 successful grant applications in the areas of dementia, mental health and prognostic modelling. Two of the members have developed the first risk score to predict in-hospital mortality following heart valve surgery.

**Computational Statistics**

Researchers in the Computational Statistics group develop state-of-the-art mathematics and statistics necessary to tackle some of the toughest problems in Science and Engineering, most of which cannot be solved using conventional statistical techniques and algorithms. Much of what we do as a group is based around statistical inference; making predictions based on uncertain information and noisy data, with applications ranging from detecting telecommunications fraud, to reverse engineering the genetic networks being studied by cancer biologists.

After we have developed a new statistical method, we have to implement it; usually on a supercomputer using carefully written computer programs that can still take weeks to run on a machine that is hundreds of times faster than a standard desktop PC. Using such approaches we can help scientists advance our knowledge of the world around us and have an impact on the development of the technologies and products of the future.

**Multivariate and High Dimensional Data**

In many areas of science and technology new instruments coupled to powerful computers are collecting data in quantities undreamed of a few years ago. The analysis of such data poses computational and methodological problems. One big challenge concerns data where the number of variables is very large; 1000 variables measured on each of 100 cases is usual in some types of spectroscopy, and this is by no means an extreme example. With a data matrix of this shape, deriving stable predictors, e.g. of the electrical signals in an infant’s brain, is hard enough; inferring which variables are the important ones, e.g. when searching for disease markers, is even harder.

Driven by important problems in medicine, environmental science, food and agriculture, physics and chemistry, and working closely with researchers in these disciplines, we are developing new methods of analysis that can find patterns even in highly complex systems.

**Student view:**

"UCL is one of the leading universities world-wide. In particular, I like that statistics is a department on its own and not as often the case part of mathematics. Therefore, the research areas in statistics investigated in our department cover a huge variety. As a PhD student, I find it very important to be exposed to more than only your own field of research. Besides, due to the department being fairly large we are around 30 PhD students only in statistics all with similar problems. It creates an open and friendly environment for postgraduate studies."  

Beate Franke  
Statistical Science PhD
This research group works on the development of mathematical models that represent random variations, mostly in space and time, and their applications to a range of physical and biological sciences in modern analysis problems. For instance, we are currently modelling the spread of diseases; the nature and development of social networks and are estimating the heights of waves generated by hurricanes to build better oil rigs. We are running statistical models that can mimic computationally expensive tsunami models and thus could enable fast warnings to save lives.

Modern problems in climate studies have motivated our study into climate models and their ability to reflect trends in temperature and precipitations to improve understanding of future climate. Global development also motivates us to look at the relationship between carbon emissions and economic development, the effect of obesity on employment or the effect of education on women's fertility or the application of financial and operational research methods for pricing energy instruments and analyzing investment incentives.

This research theme covers a range of topics of fundamental significance to the understanding of financial markets, institutions and economies. In particular, there is a strong focus on risk and insurance based modelling for Basel II/III and Solvency II.

Researchers in this group develop state-of-the-art mathematics and statistics necessary to tackle core challenges posed by modern financial markets and regulations. The group focuses on both fundamental mathematical statistics in financial and insurance applications as well as important practical developments of methodology, models and algorithms for efficient statistical approaches to financial modelling.

Examples of current interests include, but are not limited to, insurance pricing, capital estimation, annuities, non-life insurance loss reserving, currency trade portfolio analysis and risk, yield curve and monetary policy, high frequency trading and modelling of fundamental features of limit order books and high frequency exchanges, time series and econometric algorithmic trading.

The department has strong connections with inter-disciplinary research institutes at UCL (e.g. the Centre for Computational Statistics and Machine Learning (CSML), the Centre for Mathematics and Physics in the Life Sciences and Experimental Biology (CoMPLEX), the UK PhD Centre in Financial Computing and the Energy Institute), which interface regularly with the public and private sectors. Staff members also collaborate directly with hospitals, power companies, government regulators, and the financial sector. Consequently, research students have ample opportunity to engage with external institutions in order to frame their work.

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### Fees and funding

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
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<tr>
<td>UK &amp; EU 2017–18</td>
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<tr>
<td>Overseas 2017–18</td>
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Research Council funding may be available for UK/EU students. Other funding opportunities may also be available. For details visit [www.ucl.ac.uk/statistics/prospective-postgraduates/studentships](http://www.ucl.ac.uk/statistics/prospective-postgraduates/studentships)

Further information about funding and scholarships can be found on the Fees, Costs and Funding page. For details visit [www.ucl.ac.uk/prospective-students/scholarships](http://www.ucl.ac.uk/prospective-students/scholarships)

### Contacts

- **Contact:** Dr Russell Evans
- **Email:** stats.pgr-admissions@ucl.ac.uk
- **Telephone:** +44 (0)20 7679 8311

### Key facts

- **REF:** 82% rated 4* (world-leading) or 3* (internationally excellent)
- **Academic Staff:** 30
- **Research Students:** 62

### Career prospects

Graduates of the PhD programme are well placed to continue as researchers in both academia and the private sector. In particular, greater data collection has created a demand for enhanced methodologies for analysis, which is a strength of most recent graduates. Top career destinations for this degree:

- Consultant Software Engineer, UCL
- Catastrophe Modeller, RMS (Risk Management Solutions)
- Lecturer, University of Dhaka
- Quantitative Analyst, Barclays
- Associate, Goldman Sachs

### Entry requirements

A minimum of an upper second-class UK Bachelor's degree, or a UK Master's degree in statistics, mathematics, computer science or a related quantitative discipline. Overseas qualifications of an equivalent standard are also acceptable.

International applicants can find out the equivalent qualification for their country by selecting from the list available at: [www.ucl.ac.uk/prospective-students/graduate/research/degrees/statistical-science-mphil-phd](http://www.ucl.ac.uk/prospective-students/graduate/research/degrees/statistical-science-mphil-phd)

### Your application

Research degrees may start at any time of the year, but typically start in September. Deadlines and start dates are often dictated by funding arrangements. Applications should be made online; for details visit: [www.ucl.ac.uk/prospective-students/graduate/research/application/](http://www.ucl.ac.uk/prospective-students/graduate/research/application/)