Molecular Analytical Science MSc

Full-time Taught Masters Programme

2017-18
Warwick's International Community contributes greatly to the vibrant, cosmopolitan atmosphere on campus. With over 100 different nationalities represented you will be working and living with people from all over the world.

Accommodation consists of modern, comfortable rooms on campus, mostly en-suite and with high-speed internet and network access. Residences are set in pleasant parklands close to all the campus facilities.

Warwick's Students' Union is one of the largest in the country with over 250 societies to choose from. Student events such as 'one world week' are internationally recognised and mirror the University’s reputation for innovation and dynamism.

Warwick Sport provides every opportunity for you to try something new or compete in your sport. It offers over 70 different sports clubs, a swimming pool, gym, indoor climbing wall, all-weather tennis courts, 60 acres of outdoor playing fields and much more.

Warwick Arts Centre houses two theatres, a cinema, a 1,400 seat concert hall, the Mead Art Gallery, and a specialised music centre. It is nationally recognised as an outstanding venue for both famous and new artists.

The International Office provides a wide range of services for both prospective and current students, including immigration advice, welfare support and an orientation programme for those new to the UK.

Warwick University's Campus is an award-winning 700 acre, self-contained campus in the heart of England yet just one hour from London. With fantastic facilities and excellent access to local towns, cities and countryside, it provides an attractive, safe and supportive environment in which to live and study.
The Library holds over 1 million printed titles and 16,000 electronic journals and offers outstanding resources. The University’s acclaimed 'Learning Grid' provides a 24/7 relaxed learning environment with an impressive range of multimedia equipment.

Warwick Careers Service gives students a real head-start in their job searches. Voted by students as the best in the country, the careers service provides outstanding guidance and support. Warwick University is widely recognised by employers as an ideal recruiting ground.

Language Support is offered by The Centre for Applied Linguistics. The Programme in English for Postgraduate Studies (PEPs) prepares students in academic English over 1, 2 or 3 terms. Six or ten week pre-sessional English courses may also be offered if you narrowly miss the English language criteria for Master’s study.

Worship is encouraged by the multi-faith Chaplaincy which welcomes all members of the University community. It is home to Christian, Jewish and Muslim chaplains who, as a valued part of the University’s welfare network, offer spiritual and emotional support.

A member of the Russell Group, Warwick has consistently been ranked within the UK ‘top ten’ and is positioned within the top 50 universities in the world.
About the Molecular Analytical Science MSc

The success and reputation of Masters study at Warwick is measured through track record; attracting the very best students for over ten years and having graduated over 100 students in the process.

General Overview
The Molecular Analytical Science MSc aims at producing a new generation of Analytical Scientists. With the world-leading facilities and expertise at Warwick at their disposal, our students will graduate with a unique combination of skills in exploiting synergies between different experimental methods and in harnessing the power of combining data collection with experimental design, statistical analysis, modelling, and simulation. They will become the future leaders in Analytical Science, equipped with a combination of scientific and complementary skills for addressing many of the key industrial and societal challenges faced today.

Learning Style
The taught component of the programme is a blend of formal lectures, seminars, syndicate work and practical exercises, which encourages teamwork and practical grounding of the material. E-learning and forum activities are widely used to complement these.

Modules are usually taught in an intensive block, allowing you to be fully immersed in each subject area. Tutors are highly qualified and work at the forefront of their specialisation.

Two 10 week research projects enable you to immerse yourself in real research, once again supervised by renowned academics in their field.

Assessment
Performance in modules is assessed by both module assignments and post module examinations. The research components are assessed through written work, posters and presentation.

Industrial interactions
Warwick has a long standing strong relationship with Industry. Several of the modules in the Molecular Analytical Sciences MSc course are taught in collaboration with Industry; the students have a chance to undertake industry led research projects and placements.

Careers
The Molecular Analytical Science MSc has been designed specifically to deliver excellent researchers in analytical sciences, our graduates are expected to continue onto PhD positions in Analytical Sciences or take up R&D jobs in the industry. The multidisciplinary character of the degree allows our graduates to take up challenging jobs in many different fields.

The Molecular Analytical Science MSc is delivered by internationally leading experts from the Departments of Chemistry, Physics, Statistics, Engineering and Life Sciences as well as guest lectures from our industrial partners.
Molecular Analytical Science MSc Overview

Our integrated and flexible portfolio of modules are designed to develop skills in analytical science with a highly technical background or those wishing to work in industry.

The academic programme is both highly challenging and rewarding. Innovative teaching methods are used to ensure our students engage practically with their studies and are well equipped on graduation to apply this to real world scenarios.

The Molecular Analytical Science MSc is structured so that each student takes a combination of eleven taught modules and completes completes two 10 week research projects.

Help at hand
A personal tutor is assigned to you from the outset of your MSc, whose role is to provide general academic advice on: (i) progress/development; (ii) pastoral/non-academic matters; (iii) assist you with induction and orientation into university life at Warwick; and (iv) a range of other advice from course changes to financial and accommodation issues.

Modules
Modules consist of nominally 50 hours of directed tuition usually delivered in an intensive, fully immersive block. A variety of innovative teaching methods are used to maximise learning and ensure students are well equipped to apply their knowledge in the work place on completion of the course.

Core modules are compulsory and relate specifically to the Molecular Analytical Science MSc. There is also a transferrable skills module that is common to all our MSc programmes as we recognise the crucial importance that these skills play in the real world.

Research Project
Each student has to undertake two major individual research projects. These account for 40% of the overall credit.

Near the mid point of the course you will be provided with a list of projects relevant to your degree course. However, we can also usually accommodate supervision of projects proposed by students specifically focused on their individual career paths or aspirations.

The project must fulfill the academic requirements of the course. All projects are supervised by a contributing department member of staff and many relate closely to research developments in industry or research at Warwick.

Work on your project runs subsequently to your module work, and offers you an opportunity to immerse yourself in an exciting and modern area of Molecular Analytical Science.
Molecular Analytical Science MSc Modules

Core Modules

CH915 Principles and Techniques in Quantitative and Qualitative Analysis
This module covers theoretical and practical fundamentals of qualitative and quantitative analysis. We will discuss sources of errors in chemical and instrumental analysis, and will consider practical aspects of sampling and calibration techniques. Theory and instrumentation of a range of spectroscopic techniques will be covered in lectures. Practical sessions will include quantitative analyses using volumetry, gravimetry, uv/visible spectroscopy, atomic absorption spectroscopy, and state-of-the-art inductively coupled plasma spectroscopy (ICP) techniques (OES and MS).

CH923 Statistics for Data Analysis
The aim of this module is to give students a basic understanding of the statistical methods appropriate to data analysis in analytical science, and to provide guidance on some statistical tools for more advanced study. Topics include: basic probability; error analysis and calibration; summarising data and testing simple hypotheses; statistical computing (software and practice, including simple graphics); experimental design and analysis of variance; sampling methods and quality control; simple analysis of multivariate data. Each session will combine lecture and data analysis workshop. At the end of the course the student should be able to appreciate the added value that statistical analysis can bring to research to perform basic statistical analyses of simple data sets using statistical software to design simple experiments.

CH921 Frontier Instrumental Techniques for Molecular Analytical Sciences
This module introduces students to advanced analytical science techniques, such as NMR, mass spectrometry, circular and linear dichroism, Raman spectroscopy, surface spectroscopies and sensor techniques. Aspects of instrument construction and design will be explored, with the aim of answering questions such as: What happens to the sample to create a signal that is recorded? What signal does the instrument produce and how is this transformed into the output the user receives? How is the instrument output used to deduce molecular structure or other analytical information.

CH922 Microscopy and Imaging
This module provides a foundation in the principles and applications of microscopy, starting with basics of light microscopy and progressing to state of the art confocal microscopy, electron microscopy and scanned probe microscopy. The latter includes atomic force microscopy and electrochemical imaging techniques for which Warwick is particularly well-known. The module includes workshops on image analysis and seminars that cover the most recent developments in the field.
Molecular Analytical Science MSc Modules

CH932 Introduction to Chemistry and Biochemistry
This module is designed as an introduction to chemical concepts for graduate students from non-chemistry backgrounds. The syllabus covers: An introduction to biomolecules: proteins, nucleic acids, lipids, carbohydrates, small molecules and their structures; an introduction to chemical laboratory work; preparation of chemical samples; basic synthesis methodologies and mechanisms; enzyme kinetics; thermodynamics and intermolecular forces; and bonding.

CH925 Computational Modelling
Students will learn fundamental numerical methods for root finding, solving single and multivariable ordinary and partial differential equations. They will understand how to use numerical methods to solve particular biological problems arising in population dynamics, chemical reaction kinetics and pattern formation (reaction diffusion systems). The will develop a critical awareness of current best practice in application of numerical methods to a range of problems in research at the physical/life sciences interface.

CH913 Team Research Project: Real World Analysis
Research questions in academia and industry generally require the development and integration of several analytical techniques. The aim of this module is to make students aware of these requirements. It is the culmination of the taught part of the course, and constitutes the ideal preparation for the research project and future careers in analytical laboratories. The practical work for this module involves team work to solve real analytical problems using at least two techniques and professional data analysis. Literature work will be required as the basis of method development. Research work is complemented by interactive sessions with industrial visitors.

CH948 Transferrable Skills
This module is designed to be integrated with all the other modules and research work you undertake during your Molecular Analytical Science MSc. CH948 aims to help you realise the skills that you have learned during your MSc that ‘transfer’ across the boundaries of any particular module. Its content is the kind of skills that future employers whether in academia or industry or elsewhere are concerned about. Frequently employers are less concerned about your specific technical skills than the fact that you can acquire such skills and use them in a diverse range of future projects.
Molecular Analytical Science MSc Modules

Elective Modules – choose 3

**CH914 Sensors**
This module provides a grounding in the fundamentals of electrochemistry, electroanalytical techniques and sensor technology. The module encompasses potentiometric methods, voltammetric/amperometric techniques, microfluidic devices, lab-on-a-chip methods, and electronic noses and tongues. Electrochemistry aspects draw on Warwick’s major strengths in this area and include developments in ion selective electrodes, electrode kinetics and mass transport and key techniques, such as linear sweep and cyclic voltammetry, hydrodynamic electrodes, stripping voltammetry, ultramicroelectrodes and array devices. Lectures and problems classes are supplemented by laboratory sessions which provide students with practical hands-on experience.

**CH911 Chromatography and Separation Science**
During this interdisciplinary module, students will learn about theory and practice of different types of chromatography and their application in real-world scenarios. They will develop the skills necessary to decide which methods are the most appropriate for a given separation problem – whether for analysis or purification of, for example, synthetic polymers, biomolecules, or biopharmaceuticals.

**CH908 Mass Spectrometry**
This module introduces the student to the many facets of modern mass spectrometry. Emphasis is placed both on the interpretation of spectra and also on instrumental methods, covering modern methods of ionisation (including ESI and MALDI) and mass analysis (including orthogonal TOF and FT-ICR) and the use of linked methods such as GC/MS, HPLC/MS and tandem mass spectrometry. Practical sessions include practice at interpretation and experiments using various mass spectrometric techniques.

**CH911 Chromatography and Separation Science**
During this interdisciplinary module, students will learn about theory and practice of different types of chromatography and their application in real-world scenarios. They will develop the skills necessary to decide which methods are the most appropriate for a given separation problem – whether for analysis or purification of, for example, synthetic polymers, biomolecules, or biopharmaceuticals.

**CH916 Magnetic Resonance**
Nuclear magnetic resonance (NMR) in both solution and the solid state as well as electron paramagnetic resonance (EPR) will be described. The module will cover the underlying theory of the experiments as well as practical aspects of recording spectra and their interpretation. The importance of magnetic resonance across science, in, e.g., organic chemistry, pharmaceuticals, proteins and polymers will be demonstrated.

**CH926 Molecular Modelling**
This module introduces students to molecular modelling techniques as applied to biophysical systems with particular emphasis on the methods used and their underlying theory. The student should gain a basic understanding of the available computational methods and their theoretical foundations; what time scales and length scales are accessible; what properties can be computed and to what level of accuracy; and what methods are most appropriate for different molecular systems and properties.
Each Molecular Analytical Science MSc student carries out two mini research projects (20 weeks full-time). Projects are proposed by members of staff from the Chemistry, Physics, Statistics, Life Sciences and Engineering Departments, and students join their respective research teams for the duration of the project. Projects cover a wide range of topics, from instrument and technique development to application of analytical methods and procedures. The students may spend some time at a sponsoring company facility during the project.

Many of our former students have published their project work and have gone on to study towards a Ph.D.

Example projects include:

- Addressing the challenges of proteomics data
- Design-led Nano-diagnostics
- Quantitative visualisation of dissolution and crystallisation
- Non-invasive analysis and modelling of trace metals in the human body
- Advanced experimental modelling study into nanoscopic and microscopic behaviour of polymer graphene nanocomposites
After you graduate

The diverse skills-set that you acquire during your Masters course will help shape your career. Former graduates have secured PhD studentships or positions within industry, the latter leveraged by our strong industrial links with some of the leading chemical companies.

Finding a job

Our greatest resource is the knowledge and network base of our world leading academics, which they have built over many years. They will provide you with guidance in making sure you utilise your skills-set to your fullest potential. The well established links with leading research groups, both in the UK and world wide, along with the strong links with chemical and pharmaceutical industries will ensure that a career path in academia or industry is well within your grasp. Our academics will assist you in many aspects of career advice including preparing your CV to providing you with practice interviews. Our track record of success speaks for itself!
“I really enjoyed the exposure to a wide range of disciplines and interaction with industry. The course opened my eyes to analytical science and has given me the opportunity to enter into an exciting world of research.”

Harriet
2015 Graduate
Entry Requirements and Application

Warwick is a world class university that will provide you with a qualification that is recognised internationally. While our standards are very high, we encourage you to contact us to discuss your potential study with us.

Entry Requirements
Admission onto the Molecular Analytical Sciences MSc programme requires at least a British Second Class Honors Degree or Overseas equivalent. The Molecular Analytical Sciences MSc programme requires a physical sciences background but candidates from other disciplines may also be considered – please feel free to contact us if you have any questions.

English Language Requirements
Non-native speakers of English must satisfy the English language requirements:
- IELTS 6.5*
- PTE (Pearson) 62*
- Three years of UG study in an English speaking country
*minimum element scores apply

Course Duration
- 12 months duration
- Start date: 25 September 2017

How to Apply
Applications are made online at: www2.warwick.ac.uk/pgapply
The cost of a single application is £50.
The following supporting documents are required:
- Academic transcripts and certificates
- Two academic references
- English language qualifications

Tuition Fees (2017-18)
- UK and EU fee payers £8,170
- Overseas fee payers £23,460
- New PGT loans information at: www.warwick.ac.uk/chemistry/masters/fees

Scholarships
The Department of Chemistry will be awarding scholarships for the October 2017 intake. For more details, www.warwick.ac.uk/chemistry/masters/fees

Dr Nikola Chmel
Molecular Analytical Science Course Director

Christina Forbes
PGT Course Coordinator

Dr Vasilios Stavros
Admissions Tutor

Contact us at: chem-pgt@warwick.ac.uk
Getting to Warwick

Warwick is located in central England, making it easy to reach by road, rail or air. Public transport links are plentiful, with bus stops across campus, train stations a short distance away and a national coach service operating close to our campus.

- 1 hour to London by train
- Nearest airport: Birmingham International 20 minutes
- Nearest train: Coventry
Getting in touch

Department of Chemistry
The University of Warwick
Coventry
CV4 7AL
+44 (0)24 7652 4621
chem-pgt@warwick.ac.uk
warwick.ac.uk/chemistry/masters