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## Postgraduate Virtual **Open Days**

# Introduction to the Financial Mathematics MSc programmes



Dr Stefan Engelhardt

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# Welcome to Edinburgh

- Historic and cultured city of breath-taking beauty and world-class attractions
- Population of 500,000, around one tenth are students
- Year-round destination and festival city
- UNESCO World Heritage Site



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# School of Mathematics

- We are located in the James Clerk Maxwell Building at the King's Buildings campus in south Edinburgh.
  - This is about 2.5km from main campus.
  - About 35 min walk, 20 min bus, 10 min cycle.
- 
- Around 140 academic research and teaching staff and over 150 PhD students.
  - Around 1000 undergraduate students.
  - Around 250 MSc students each year, of which around 50 study a Financial Mathematics MSc.



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# CMF/FMO MSc: Student cohort

- Super cosmopolitan cohort
- This year our students are from:
  - Austria
  - Bahrain
  - Bulgaria
  - China
  - Finland
  - Germany
  - India
  - Ireland
  - Norway
  - Ukraine
  - United Kingdom



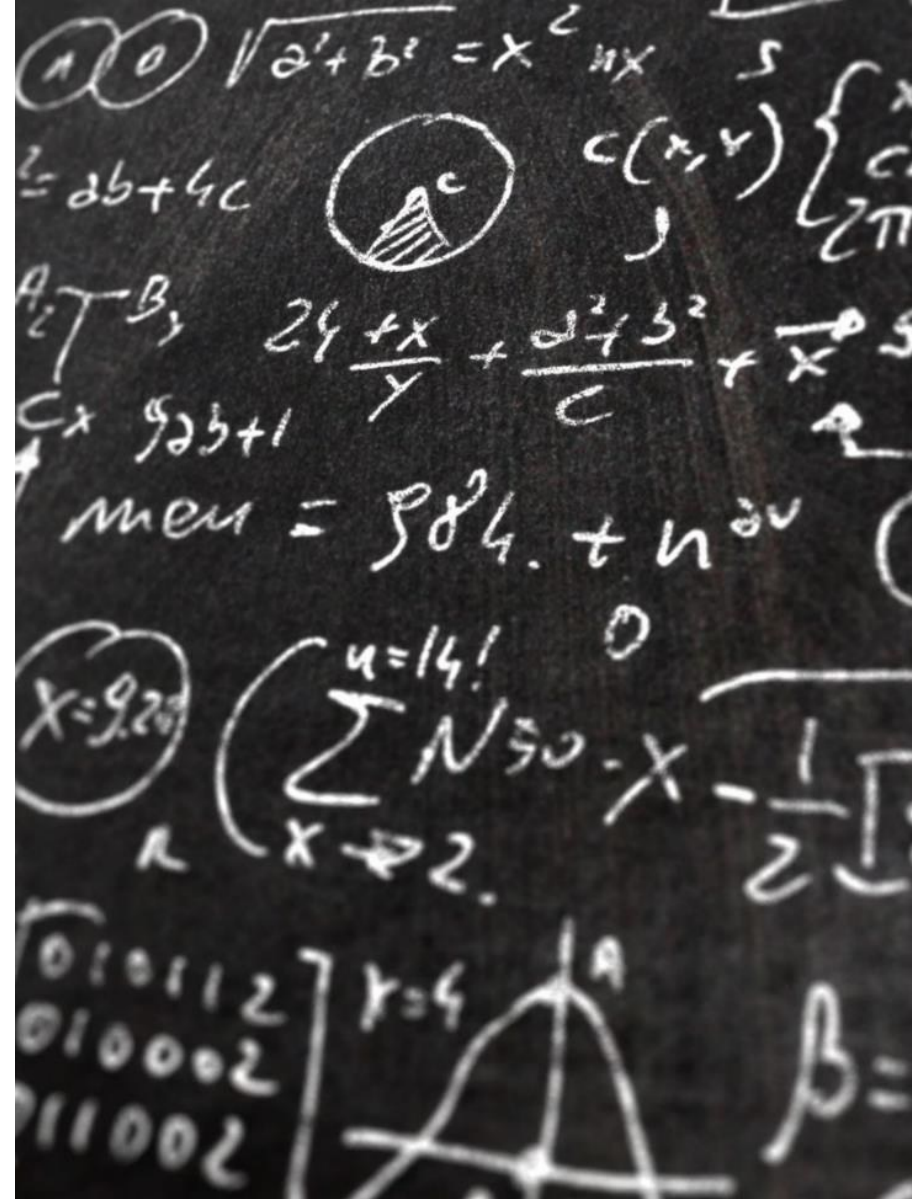
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# General framework of the MSc

- Taught component: 120 credits
  - Mix of compulsory and optional courses
  - 80 credits of compulsory courses
  - 40 credits of optional courses
- Dissertation (research project): 60 credits
- Duration: 12 months (full-time)

FYI: 10 credits correspond to 100 hours of work / study of which typically only about 20 are lectures and 5 are workshops.



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# Core courses for both CMF and FMO

- **Discrete Time Finance:** introduce measure theoretic probability, filtrations, martingales, stopping times and finance applications.
- **Stochastic Analysis in Finance:** stochastic processes in continuous time, Wiener process, Itô integral, Itô isometry and Itô formula and all tools required for Black-Scholes framework of derivative pricing.
- **Risk-Neutral Asset Pricing:** builds on DTF and SAF to further explore pricing and hedging in various models, arbitrage, incomplete markets and interest rate models.
- **Numerical Probability and Monte Carlo:** Monte Carlo method and numerical methods to find solutions to stochastic differential equations, both are key in derivative pricing and many other applications.
- **Research-Skills for Financial Mathematics.**



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# Further core courses - CMF

- **Python Programming:** Introduction to Python programming with focus on solving mathematical problems and working with data.
- **Stochastic Control and Dynamic Asset Allocation:** Bellman principle and equation, connection to Reinforcement Learning, Pontryagin's optimality principle and BSDE and applications: Merton asset allocation problem, Optimal order execution and more.



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# Further core courses - FMO

- **Fundamentals of Optimization:** Linear Programming, Simplex Method, Duality in Linear Programming, Lagrangian Relaxation . . .
- **Optimization Methods in Finance:** Mean-Variance portfolio selection, Conic Optimization, Asset/liability management, Stochastic Gradient Descent, Scenario Generation



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# Optional courses

Some of the most popular include:

- Algorithmic Game Theory and Its Applications (School of Informatics)
- Bayesian Data Analysis
- Blockchains and Distributed Ledgers (School of Informatics)
- Credit Scoring
- Finance, Risk and Uncertainty
- Machine Learning in Python
- Optimization Methods in Finance
- Programming Skills (School of Informatics)
- Robot and Reinforcement Learning (School of Informatics)



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# Research Skills for Financial Mathematics

- Worth a total of 10 credits, running in Semester 2.
- Skills component: where / how to find relevant research.
- Ethics component: working with models and data, communicating technical results to others.
- Talks by industry practitioners and researchers in maths finance.
- Guided reading on a given topic presented (book chapters, papers).
- Group project consisting of an essay and a presentation.



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# Sample timetable (Semester 1)

	09:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00
Monday		Discrete-Time Finance lecture	Finance, Risk and Uncertainty lecture		Python Programming lecture		Discrete-Time Finance workshop (every 2 <sup>nd</sup> week)	Stochastic Analysis in Finance lecture	
Tuesday		Bayesian Theory lecture			Bayesian Theory workshop (every 2 <sup>nd</sup> week)	Finance, Risk and Uncertainty workshop			
Wednesday				Stochastic Analysis in Finance workshop					
Thursday		Discrete-Time Finance lecture					Stochastic Analysis in Finance lecture		
Friday					Python Programming workshop				



# Dissertation – summer projects

- During the period from June to August, candidates for the MSc work on a project on an approved topic, and write a dissertation based on this work.
- Some projects are offered by industrial partners (often via the Scottish Financial Risk Academy, SFRA) that offer summer placements to MSc students who work on short research projects and write their MSc dissertations under the joint supervision of an industrial partner and a member of an academic department.
  - Industrial projects have a flexible format: student may spend whole period working at company or interact through a series of visits.
  - Industrial projects will be advertised in Semester 2 (coordinated with SFRA) and you may need to submit a CV / go through an interview.
- Academic summer project topics will be made available towards the end of Semester 2.



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# Academic summer projects

Past project topics offered included:

- A regularity structure for rough volatility,
- Chaos expansions for regressions and Credit valuation adjustment calculations,
- Efficient calibration of a LIBOR market model with stochastic volatility,
- Efficient Model Calibration with Machine Learning,
- Fractional Brownian motion and a stochastic volatility model,
- Levy processes in financial modelling,
- Local volatility modelling,
- Machine Learning and Rough Paths,
- Machine Learning Techniques for Path-Dependent Derivatives
- ...



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# Industrial summer projects

Industrial project partners in the past included:

- **Aberdeen Standard Investments:** Systematic strategies for trade execution optimisation, . . .
- **Royal Bank of Scotland:** Machine learning techniques for stress testing, Forecasting methodologies for stress testing, . . .
- **Lloyds Banking Group:** Pro-cyclicality of Credit Risk Impairment Losses Under the IFRS9 Accounting Standard,
- **Moody's Analytics:** Bond return risk factor modelling, Vine Copulas For Stressing Correlations, Quantitative analytics of dynamic asset management, . . .
- **Hymans Robertson:** Pensions decision simulation framework, Pensions guidance data analysis, . . .
- **Scottish Widows:** AI/Machine Learning insights for actuarial models, . . .
- **Morgan Stanley:** Government Bond Risk Aggregation, . . .



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# After graduation

The MScs in CMF / FMO equip you with the skills needed to work in quantitative analytics or risk management roles in the financial industry or PhD study.



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# Support during your studies

- Student support
  - Student Advisers
  - Academic Cohort Leads
  - Advice on study technique
  - Employability/careers guidance
  - General pastoral support
- MSc community
  - MScHub dedicated study space
  - MScBase study support from tutors
  - MathSoc



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# How to Apply

- Apply using the [University's Degree Finder](#)
- No application fee
- You will need to provide: personal statement, details of relevant knowledge/training skills, degree certificates and academic transcripts, evidence you meet English language requirements, one reference
- If documents are not in English, certified translations must be provided

Round	Application deadline	Decisions made or applications rolled to the next deadline
1	15 December	1 March
2	31 March	31 May
3	31 May	31 July



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# Scholarship opportunities

- [School of Mathematics Masters Scholarships](#) – 25% or 50% tuition fee discount
  - Various countries eligible
- [British Council GREAT Scholarships](#) - £10,000
  - Ghana, Mexico, Thailand
- [European Merit Scholarship](#) - £10,000
  - France, Germany, Spain
- [India Merit Scholarship](#) - £5,000



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Now over to our  
alumni...

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# Ananya Jaishankar

- From: India
- Programme: MSc Computational Mathematical Finance
- Year of graduation: 2024
- Current Role: Credit Strategy Analyst at Zopa Bank



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# Q&A

Type your questions into the chat area

# Next steps...

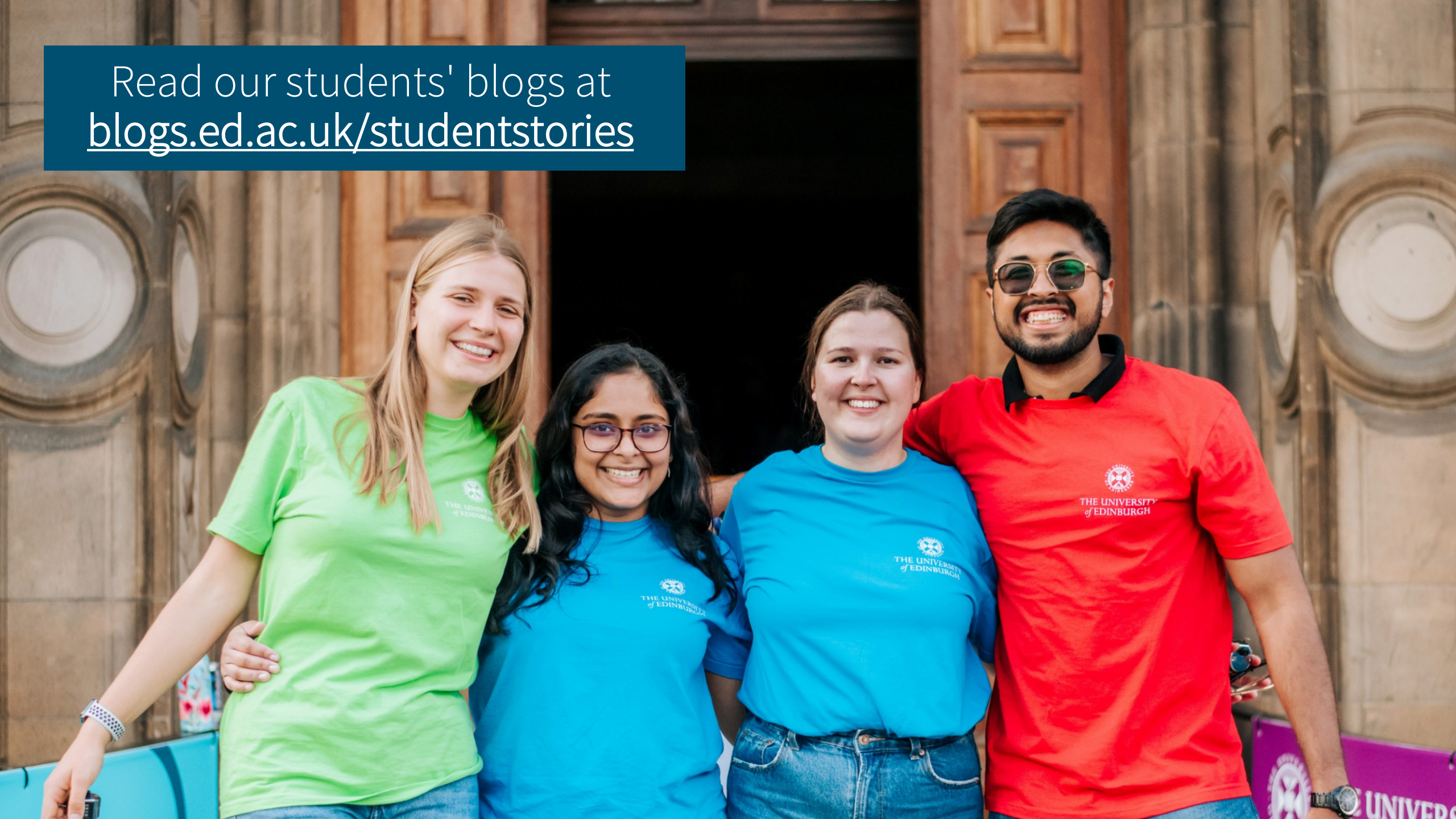
- Programme-specific info: <https://postgraduate.degrees.ed.ac.uk/>
- Chat to our Students: <https://edin.ac/student-chat-pg>
- Any other questions (including, Fees & Admissions) email: [futurestudents@ed.ac.uk](mailto:futurestudents@ed.ac.uk)



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Read our students' blogs at  
[blogs.ed.ac.uk/studentstories](https://blogs.ed.ac.uk/studentstories)





# Contact details for follow-up questions

- We apologise if we did not get through all of your questions in the time allotted for this session. If you have further questions that have not been answered, please email: [futurestudents@ed.ac.uk](mailto:futurestudents@ed.ac.uk)



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# Thank you

Further questions?

[futurestudents@ed.ac.uk](mailto:futurestudents@ed.ac.uk)

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