

# Martin Burke <sup>PhD</sup>

Quantitative Researcher | AI, Model Validation & Computational Science | PhD, Imperial College London

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## PROFILE

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Martin Burke is a quantitative researcher working at the intersection of AI and quantitative finance. Currently researching AI-safety debate frameworks for the UK AI Safety Institute — with broader interests across mechanistic interpretability and applied AI — he previously spent a decade validating derivatives and counterparty-credit-risk models at banks including Citi. He holds a PhD in Theoretical Chemistry from Imperial College London, where he pioneered the application of sum-of-squares optimisation — a technique from real algebraic geometry — to molecular energy minimisation.

## EXPERIENCE

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### Contractor — AI Safety Research

Oct 2025 – Present

*Deloitte LLP (client: AI Safety Institute (UK))* — London

- Designed and stress-tested **recursive debate frameworks** for AI safety, formalising honest vs. dishonest debater structure, ground-truth separation from main claims, and construction of high-difficulty **obfuscated arguments** to probe robustness against hidden flaws and verification intractability.
- Developed programmatic pipelines using multiple **LLM APIs** to generate and analyse structured debate artefacts (multi-level claims, LaTeX exports, PDF generation).
- Empirically investigated whether elevated reasoning modes improve detection of subtly false sub-claims, exploring implications for **scalable oversight** and **alignment**.

### Model Validation Quantitative Analyst (VP)

Nov 2021 – Feb 2025

*Citi* — London

- For model-change submissions, completed initial **materiality assessment** based on Front Office (FO) Quant submissions.
- Performed **Model Eligibility Assessment** of submitted Model Developer Documents and worked with FO Quants to achieve compliance with validation policies.
- Performed independent testing including **calibration assessment, model benchmarking, PAA, stress testing and risks-not-in-model** assessment.

### Quantitative Analyst (Manager → Senior Manager)

Feb 2017 – Nov 2021

*Deloitte LLP* — London

- **Libor Transition upgrade** — Citi (EQTG / QLX front-office equity & equity-IR hybrid library) — 10 months
- **CCAR stress-testing framework validation** — Deutsche Bank — 3 months
- **Front-office exotic equity-IR hybrid model validation** — Citi (GSST programme) — 2 years

### Quantitative Developer

Jun 2015 – Feb 2017

*SunGard (now FIS)* — Oxfordshire, U.K.

- **Mediobanca** — SA-CCR implementation in **Adaptiv Risk™**
- **Standard Chartered Bank** — **Adaptiv Credit Risk / Adaptiv Analytics**

### Assistant Quantitative Analyst

Dec 2014 – Jun 2015

*VTB Capital PLC* — 14 Cornhill, London

### Research & Development Director

May 2007 – Jun 2014

*Veryan Medical Ltd.* — Galway, Ireland

### Research & Development Engineer

Oct 1999 – Sep 2001

*Biocompatibles Cardiovascular Ltd.* – U.K.

## Research & Development Engineer

*Medtronic Inc.* – Ireland

Jun 1995 – Sep 1999

## EDUCATION

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### Certificate in Quantitative Finance (CQF)

May 2012

*Fitch Learning* – U.K.

### PhD, Theoretical Chemistry

Mar 2007

*Imperial College London* – London, U.K.

External examiner. Prof. Pablo A. Parrilo (MIT)

**Awards.** 1st Prize (Physical Chemistry), Imperial College Postgraduate Symposium – oral, 2005; 1st Prize (Physical Chemistry), Imperial College Postgraduate Symposium – poster, 2004

**Funded by.** US Office of Naval Research (ONR)

### Master of Research (MRes), Biomolecular Science (Distinction)

Sep 2002

*Imperial College London* – London, U.K.

### Bachelor of Engineering (BEng), Mechanical Engineering (2.1 Honours)

Jun 1995

*University of Limerick* – Limerick, Ireland

## SKILLS

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**AI & machine learning:** **AI safety & scalable oversight:** recursive debate protocols (honest vs. dishonest debaters), construction and analysis of obfuscated arguments, detection of subtly false sub-claims, adversarial / red-team evaluation. • **LLMs & applied AI:** LLM-API pipelines; programmatic generation and analysis of structured artefacts; prompt design; automated LaTeX / PDF generation. • **Foundations underpinning ML:** convex & non-convex optimisation, semidefinite programming, sum-of-squares / convex relaxations, advanced linear algebra – the mathematics behind much of modern machine learning. • **Active interests:** mechanistic interpretability; trustworthy and verifiable AI.

**Optimisation & applied mathematics:** Convex optimisation; relaxation of non-convex / NP-hard problems; semidefinite and second-order cone programming; sum-of-squares decompositions; interior-point methods. • Numerical methods: Monte Carlo, finite-difference methods; stochastic differential equations. • Probability, statistics and stochastic calculus.

**Programming & software:** **Languages:** Python, C++, C#, SQL, VBA. • **Environments & tooling:** Visual Studio, VS Code; Git, GitHub, Bitbucket, JIRA; LaTeX; Linux, macOS, Windows.

**Quantitative finance:** **Model validation:** first-time validations, re-validations and model-change workflows; calibration, benchmarking, PAA, stress testing, risks-not-in-model. • **Pricing & models:** stochastic & local volatility (Gyöngy), Linear/Quadratic Gaussian Markov rate models, Monte Carlo & PDE methods; equity & equity-rates hybrids; exotics. • **Counterparty credit risk:** SA-CCR, IMM, PFE simulation, CVA; CCAR stress testing; regulatory frameworks (CRR, Basel/IOSCO).

**Scientific & computational modelling:** Molecular dynamics; dissipative particle dynamics; coarse-grained simulation. • Finite element analysis (FEA) and computational fluid dynamics (CFD).

**Earlier domain & leadership:** Medical-device R&D and regulatory pathways (FDA IDE/PMA, CE Mark); IP / freedom-to-operate strategy. • Building and leading R&D teams from the ground up (start-up first employee); project management of complex technical programmes; strong written and oral communication.