Peter Charlton

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Broers Building, 21 JJ Thomson Avenue, Cambridge, CB3 0FA

Education

2013-2017: **PhD, Department of Biomedical Engineering, King's College London**

'Continuous respiratory rate monitoring to detect clinical deteriorations using wearable sensors'

Supervisors: Dr Jordi Alastruey-Arimon; Prof Richard Beale; Prof David Clifton

2006-2010: **MEng, Engineering Science, University of Oxford**

First Class Honours. Specialised in Biomedical and Civil Engineering.

Research Experience

2025-present: **Senior Research Scientist, Device Intelligence team, Nokia Bell Labs**

- Wearables for healthcare.

2020-2025: **British Heart Foundation Immediate Basic Science Research Fellow, Department of Public Health and Primary Care, University of Cambridge**

- Principal Investigator on a prestigious, five-year fellowship researching how to use mobile health devices to screen for atrial fibrillation including leading a clinical study in Primary Care.
- Developing and validating fundamental signal processing algorithms for wearable photoplethysmogram and electrocardiogram signals; establishing physiological patterns of atrial fibrillation (AF); developing pipelines to detect AF in real-world screening.
- Leading a clinical study using wearables to detect AF in older adults. Responsible for all aspects: study design; ethics; recruitment; data collection, curation and analysis; dissemination.
- Contributing to electrocardiogram analysis for the SAFER Trial (largest ever AF screening trial).
  - → Two award-winning Journal papers published.
  - → Collaborations with: City, University of London; Technion - Israel Institute of Technology; Kaunas University of Technology; University of Sheffield.
  - → Open resources: *ppg-beats* (algorithms to detect heartbeats in photoplethysmogram signals); *pyPPG* (algorithms for photoplethysmogram signal processing).

2017-2020: **Research Associate, Department of Biomedical Engineering, King's College London**

- Created a database of synthetic cardiovascular signals representative of an adult population.
- Extended computational modelling methodology to simulate arterial pulse waves during healthy ageing and at the microcirculation (mimicking wearable photoplethysmogram signals).
- Developed signal processing algorithms to assess arterial stiffness, a marker of vascular health, from wearable pulse wave signals using synthetic and epidemiological data.
  - → Received award for the computational modelling work at the BioMedEng18 Conference.
  - → Collaborations with: Polar Electro Oy (wearable manufacturer); Imperial College London.
  - → Open resources: *Pulse Wave Database* (simulated arterial pulse waves for research into haemodynamics and pulse wave indices); *PulseAnalyse* (pulse wave analysis tool).

2010-2017: **Research Assistant, Faculty of Life Sciences and Medicine, King's College London**

Member of Critical Care Department, Guy's and St Thomas' NHS Trust

- Developed signal processing algorithms for unobtrusive respiratory rate monitoring using wearable electrocardiogram and photoplethysmogram signals.
- Conducted two studies using wearables: (i) a hospital study of over 200 patients investigating the feasibility of using wearable devices to detect clinical deteriorations; (ii) a laboratory study collecting wearable data from volunteers to develop signal processing algorithms. Responsible for data collection, curation, signal processing, analysis, and dissemination. EPSRC-funded.
- Developed machine learning algorithms to detect clinical deteriorations in acutely-ill hospital patients using wearable sensor and electronic health record data.
  → Two award-winning Journal papers published.
  → Collaborations with: University of Oxford; Massachusetts Institute of Technology; University of Surrey.
  → Resources: *RRest* (algorithms to estimate respiratory rate from wearable sensor signals); *Vortal Dataset* (dataset of wearable sensor signals alongside reference respiratory signals).

2009: **Research Assistant, Advanced Manufacturing Research Centre, Sheffield University**

- Developed theoretical framework to employ kites to harness wind power, providing auxiliary power for large vessels. Later prototyped by project partners.
- Collaboration across nine European partners, funded by the European Commission.

Teaching Experience

Research Project Supervision: Supervised undergraduate, Master's and PhD students, including Engineering and Medical students. This has led to 13 papers led by students. I have formalised my approach to supervising research projects in these guidelines.

Engineering projects: Using deep learning, machine learning, and computational modelling to develop biomedical signal processing algorithms and apply them to clinical problems.

- **5 PhD students:** 2 completed, 3 ongoing. 1 as primary supervisor.
- **16 Master's projects:** 16 completed. 15 individual projects and 1 group project.
- **4 Bachelor's projects:** 4 completed.
- **5 Undergraduate Summer projects:** all completed.

Medical projects: Optimising the implementation of mobile technologies in healthcare.

- **1 PhD student:** ongoing.
- **1 Junior Doctor Foundation Year research placement:** completed.
- **7 Medical Student 6-week research projects:** 7 completed.
- **2 Undergraduate Summer projects:** all completed.

Teaching: Taught Engineering and Medical students:

- **2025: MPhil in Advanced Computer Science, University of Cambridge:**
  Created and delivered lecture on wearable electrocardiography.
- **2025: MSt in Healthcare Innovation, University of Cambridge:**
  Created and delivered lecture on wearables and their integration into clinical settings.
- **2022-2024: MPhil in Population Health Sciences, University of Cambridge:**
  Project supervisor (2022-2023) and Dissertation marker (2024).
- **2021, 2024: Medical student supervisions, University of Cambridge:**
  Running supervisions on using mobile health devices to identify disease.
- **2019: Biomedical Engineering undergraduate summer research module, King's College London:**
  Established this module, designed the course consisting of six-week research projects, provided seminars, and conducted student assessment.

- **2017-2018: Applied Maths undergraduate summer school, King's College London:**
  Created and delivered lectures, seminars, and practicals on the course, providing an introduction to Engineering.
- **2015-2019: Modelling Flow and Transport undergraduate module, King's College London:**
  Delivered tutorials ranging from the fundamentals of fluid flow to cardiovascular haemodynamics.

Educational Events:

- **2025: IEEE Engineering in Medicine and Biology Workshop, Copenhagen:**
  Helped design and deliver a workshop on 'Open Biomedical Multimodal AI Research: From Pixels to Molecules'. Attended by ≈ 40 participants who worked through case studies in groups.

Developed and delivered the following events using my teaching materials here:

- **2023: AIUK Fringe Event, Online:**
  Designed and delivered workshop on 'Multimodal signal processing and learning for wearables'. Attended by 105 participants who engaged in technical and clinical issues surrounding use of wearables in healthcare.
- **2022: IEEE Engineering in Medicine and Biology Workshop, Glasgow:**
  Designed and delivered workshop on 'Open research in Biomedical Signal Processing' teaching fundamental biomedical signal processing algorithms. Attended by ≈80 conference delegates from academia and industry.
- **2021, 2023: VascAgeNet Training Schools:**
  Designed and delivered workshops on arterial pulse wave simulation and arterial pulse wave analysis. Each attended by ≈30 researchers, primarily PhD students.

Grants

Funding secured from engineering and clinical funders, including the EPSRC, BHF (British Heart Foundation), and NIHR (National Institute for Health Research):

2024: **EPSRC Network Plus: Tomorrow's Engineering Research Challenges, £1.75mill (co-lead):**

UK Open Multimodal AI Network.

Funding networking activities and collaborative research on multimodal AI. Funding for three years at 0.1FTE and travel costs.

2023: **European Partnership on Metrology Project, €2.2mill (co-applicant):**

Uncertainty quantification for machine learning models applied to photoplethysmography signals.

Instigated an international consortium of researchers from National Measurement Institutes and universities. Funding for three years at 0.1FTE and travel costs.

2023: **NIHR Carbon Reduction and Sustainability Grant, £50k (named collaborator)**

Helped develop proposal to investigate strategies for reducing the environmental impact of screening for atrial fibrillation.

2022: **W.D. Armstrong PhD Studentship, School of Technology, University of Cambridge, £91k (PI):**

Using artificial intelligence to enhance screening for atrial fibrillation.

Developed a collaboration between the Engineering Department and School of Clinical Medicine and led proposal for a joint PhD studentship. Now primary supervisor to student.

2021: **EPSRC Impact Acceleration Award, £9.7k (PI):**

Verifying algorithms to monitor respiratory rate in daily life with potential application to COVID-19.

Funding for three months' salary to translate PhD research into practice.

2020: **BHF Immediate Postdoctoral Basic Science Research Fellowship, £251k (PI):**

Using clinical and consumer devices to enhance screening for atrial fibrillation.

Five-year fellowship funding salary and research costs. Developed research proposal and established academic and industrial collaborations.

2019: **European Cooperation in Science and Technology (secondary proposer):**

Network for research in vascular ageing

Funding to establish European network of researchers, through which I have established new collaborations and contributed to nine journal papers.

2018: **London Interdisciplinary Doctoral Programme Research Experience Placement, £2.5k (PI):**

Measuring vascular recovery rate after exercise.

Funding to pay for a summer intern to research a new cardiovascular risk marker derived from a wearable. Disseminated through conference paper.

2017: **King's Health Partners Grand Challenge Fund, £54k (collaborator):**

Attractor Reconstruction: A novel mathematical approach for the early recognition of sepsis.

To perform a proof-of-concept for a novel signal processing technique using clinical data.

2016: **EPSRC Strategic Research Fund Award, £19k (designed and wrote application):**

An evaluation of the clinical- and cost-effectiveness of wearable sensors for inpatient monitoring.

To perform a clinical study of a wearable device in the hospital setting.

2015: **EPSRC Impact Acceleration Award, £11k (PI):**

Attractor Reconstruction: A novel mathematical approach for the early recognition of sepsis.

Funding to develop a novel signal processing technique and assess its clinical utility.

Travel grants

2021, 2024: **Two travel grants, European Cooperation in Science and Technology, €1.8k (PI)**

To visit academic and industrial partners (Kaunas University of Technology, Lithuania; Oura, Finland).

2015: **NIHR Biomedical Research Centre Early Career Award, £1k (PI):**

To present our novel signal processing technique at an international conference.

2014-2015: **Four travel grants, King's College London (PI)**

Awards

My work has been recognised by awards from local, national and international bodies:

2024: **American Journal of Physiology - Heart and Circulatory Physiology:** Best Review Article Award

Led a group of 16 researchers from 11 countries to produce a comprehensive review paper.

2023: **Institute of Physics and Engineering in Medicine (IPEM):** Martin Black Prize for the best paper published in Physiological Measurement in 2022

A systematic analysis of photoplethysmography beat detection algorithms, leveraging three collaborations.

2021: **Institute of Physics and Engineering in Medicine (IPEM):** Academic Early Career Award

Recognising contribution to academic practice, including research, income generation, collaboration, engagement with the scientific community, and teaching.

2021: **Institute of Electrical and Electronics Engineers (IEEE):** Engineering in Medicine and Biology Prize Paper Award, 3rd Prize

Prize for a paper which is often amongst the most popular published in *IEEE Reviews in Biomedical Engineering*.

2018: **5th International Electronic Conference on Sensors and Applications:** Best Paper Award

2018: **Publons:** Peer Review Award for the top 1% of reviewers in their field

2018: **BioMedEng18 Conference:** Best Early Career Researcher Award

Awarded for research into computational modelling of the arterial pulse wave.

2017: **Institute of Physics and Engineering in Medicine (IPEM):** Martin Black Prize for the best paper published in Physiological Measurement in 2016

A systematic analysis of respiratory rate algorithms.

2015: **King's College London:** Prize for a poster on attractor reconstruction signal processing

2010: **University of Oxford:** Prize for a poster on research into elastic stability theory

Consultancy Work

Performed consultancy work for seven health technology companies (primarily signal processing work for wearable device manufacturers). Five remain under non-disclosure agreements, the others being:

2015: Designed clinical study to evaluate OBS Medical's wearable monitoring system on hospital wards.

2014: Evaluated Philips' wireless patient monitoring system on an acute hospital ward.

Public Engagement

2021-2022: Trained to write bedtime stories to engage young children in engineering. Published a story here. Funded by the Royal Academy of Engineering.

2017-2018: Ran an interactive course on the causes and effects of hypertension for school students.

2016-present: Designed research proposals in dialogue with Public and Patient Involvement groups.

Academic Service

2025-present: **Executive Board member:** UK Open Multimodal AI Network.

2024-present: **Editorial Board member:** 'Diagnostics' Section Editor for *PLOS Digital Health*.

2024: **Special Session organiser:** Computing in Cardiology 2024, titled 'Open questions in open research in cardiovascular data science'.

2023: **Special Session organiser:** Computing in Cardiology 2023, titled 'Wearable photoplethysmography: the road ahead'.

2022-2024: **Group organiser:** The Alan Turing Institute's Special Interest Group on 'Meta-learning for multimodal data'. Co-organised the 2023 Multimodal AI Research Sprint and the 2024 Multimodal AI Forum.

2022-2024: **Group chair:** IPEM's Special Interest Group on 'Physiological Measurement'.

2022: **Webinar series organiser:** Organised an IPEM series of webinars on photoplethysmography.

2021-2024: **Working Group Vice-Leader:** VascAgeNet.

2021-2023: **PhD examiner:** Performed three PhD thesis examinations.

2021: **Conference organiser:** IPEM's Medical Physics and Engineering Conference.

2020-2025: **Editorial Board member:** Executive Editorial Board for *Physiological Measurement*.

2018-2020: **Board member:** International Advisory Board for *Physiological Measurement*.

2017-2019: **Committee member:** 'Diversity, Development and Inclusion' and 'Early Career Researcher' committees at King's College London.

2015-2016: **Textbook Editor:** 'Secondary Analysis of Electronic Health Records', used in MIT's 'Collaborative Data Science for Healthcare' course.

2015-present: **Peer reviewer:** for leading journals including *New England Journal of Medicine*, *IEEE Transactions on Biomedical Engineering*, and *Physiological Measurement*. Reviewer Profile

2014: **Event Organiser:** Massachusetts Institute of Technology Critical Datathon, London.

Invited Talks

2025: **IEEE Engineering in Medicine and Biology Conference, Copenhagen:** Using simulated wearable signals to guide algorithm development

2025: **University of Oxford, UK:** Using wearables to screen for atrial fibrillation

2025: **Korea Advanced Institute of Science and Technology, South Korea (remote):** Harnessing photoplethysmography for equitable healthcare

2024: **Institute of Physics & Engineering in Medicine (IPEM) Science, Engineering and Technology Forum, UK:** Towards accurate wearable data for clinical decision making

2024: **MDPI 'State-of-the-Art Photoplethysmography and Applications' Webinar, online:** Equitable Photoplethysmography in Wearables: Accurate Data for All

2024: **BHF CRE / Cambridge Cardiovascular Annual Symposium, UK:** Using wearables to detect atrial fibrillation in daily life

2024: **Oura, Finland:** Using wearables in healthcare

2024: **E-textiles for Healthcare Workshop, UK:** Using wearables in health and research

2023: **Emory University, USA:** Using wearables to inform clinical decision making

2023: **University of Southampton, UK:** Using consumer wearables for clinical decisions

2022: **Huawei Future Device Summit, Finland:** Wearable devices for health monitoring

2022: **IEEE Engineering in Medicine and Biology Conference, UK:** Wearable photoplethysmography devices for cardiovascular monitoring

2022: **Conference on the Future of Europe - Prescribing a healthier future for Europeans, Hungary (remote):** Opportunities for photoplethysmography in Public Health

2021: **Technion Institute of Technology, Israel (remote):** Improving the efficiency of atrial fibrillation screening

2021: **Institute of Physics & Engineering in Medicine (IPEM) Medical Physics & Engineering Conference, online:** Screening for atrial fibrillation: questions and potential answers

2021: **Kaunas Institute of Technology, Lithuania:** Wearable photoplethysmography: engineering principles and applications for health monitoring

2021: **Institute of Physics & Engineering in Medicine (IPEM) Webinar:** Realising the potential of wearables for health monitoring.

2020: **Workshop on synthetic data generation, Health Data Research UK, online:** Generating synthetic wearable sensor data.

2020: **Health Data Research UK, online:** Harnessing wearable data for cardiovascular health monitoring.

2019: **National Physical Laboratory, UK:** Using clinical and consumer devices to identify atrial fibrillation and reduce stroke risk.

2019: **Ghent University, Belgium:** Assessing cardiovascular health from the pulse wave.

2018: **University College London, UK:** Estimating physiological parameters from wearable sensors to detect deteriorations.

2018: **University of Oxford, UK:** Estimating physiological parameters from the photoplethysmogram for smart wearables.

2018: **BioMedEng18, UK:** A database for developing pulse wave analysis algorithms.

2018: **Clinical Science & Engineering for Digital Health Workshop, UK:** Capitalising on smart wearables to improve health monitoring.

2018: **University of Southampton, UK:** Achieving clinical quality from wearable sensors: the role of signal processing.

2018: ***Physiological Measurement*** **Webinar:** Estimating respiratory rate from the electrocardiogram and photoplethysmogram.

2017: **MEIBioeng / MPEC 2017, UK:** An assessment of algorithms to estimate respiratory rate from the electrocardiogram and photoplethysmogram.

2016: **Science and Engineering South Data Dialogue Meeting, UK:** The processes and benefits of sharing clinical data.

2015: **European Signal Processing Conference (EURASIP), France:** Measurement of cardiovascular state using attractor reconstruction analysis.

2015: **University College London, UK:** Monitoring physiological trajectories.

2015: **Liverpool Heart and Chest Hospital, UK:** The Respond Study.

2014: **IEEE Engineering in Medicine and Biology Society Conference, USA:** Achieving clinical quality from wireless sensors.

Examinations

2024: PhD Defense, *Dartmouth College, USA*

2024: PhD Defense, *University of Zaragoza, Spain*

2023: PhD Thesis and Oral Examination, *University of Southampton, UK*

2023: PhD Thesis and Oral Examination, *EPFL: Swiss Federal Institute of Technology Lausanne, Switzerland*

2023: PhD Thesis Review, *University of Ferrara, Italy*

2023: PhD Thesis and Oral Examination, *University of Sydney, Australia*

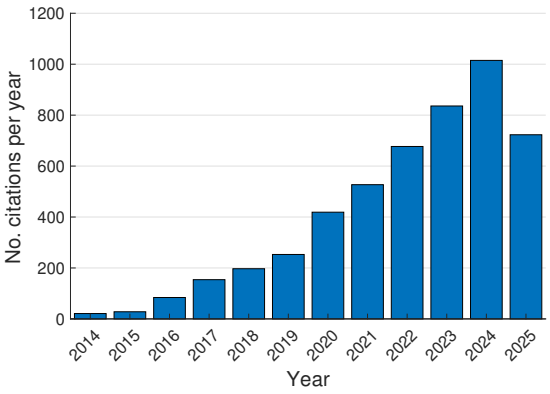
Professional Memberships

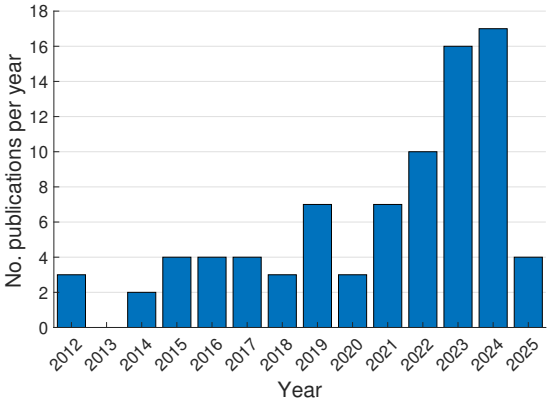
Full member of the Institute of Physics and Engineering in Medicine (IPEM)
Member of the Institute of Electrical and Electronics Engineers (IEEE)

Summary of Publications

Publications: 50 Journal Papers 6 Book Chapters 28 Conference Papers

Citations: Google Scholar: 5,015 citations, h-index: 29
Scopus: 2,994 citations, h-index: 27





A complete list of publications is available here.