

Graham Webb

BEng(Hons), PGDip, MSc, PhD, SRCS

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Specialisations: Electronic Instrumentation
Human Movement Analysis
Physiological Measurement
Clinical Rehabilitation



A multi-skilled engineer driven by the desire to improve quality of life through education and the application of science and engineering in healthcare. I have focused my career on gaining clinical and engineering skills, and gained significant lived-experience of trauma that has shaped my values.

Qualifications

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| Interim Chartered Engineer | 2017 |
| State Registered Clinical Scientist with the Health and Care Professions Council (Covid Register TCS19893) | 2017 |
| Association of Clinical Scientists Certificate of Attainment | 2016 |
| PhD , University of Surrey, <i>Thesis title: "Real-time electro-tactile biofeedback for amputee gait re-training"</i> | 2013 |
| Postgraduate Diploma in Clinical Science , Institute of Physics and Engineering in Medicine | 2007 |
| MSc Biomedical Engineering, University of Surrey | 2007 |
| 1st Class BEng (Hons) in Robotics and Automated Systems, University of Plymouth | 2002 |
| Foundation Engineering degree with distinction, University of Plymouth | 1998 |
| City & Guilds Certificate Management of Electrical Equipment Maintenance | 2016 |
| City & Guilds Certificate Inspection and Testing of Electrical Equipment | 2016 |
| City & Guilds Certificate Computer Aided Engineering (NC/CNC) | 1994 |
| City & Guilds Certificate Mechanical Production | 1994 |
| City & Guilds Certificate General Engineering | 1994 |
| NVQ Levels 2 and 3 Engineering Manufacture | 1995 |
| NVQ Level 2 Business Administration | 1996 |
| Chamber of Commerce & Industry Basic Engineering Training Certificate | 1994 |
| GCSEs, City & Guilds and NVQs in mechanical engineering and business administration | 1992 |

Career - Summary

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|--------------------|--------------------------------------|--|---------------|
| 2022 - 2023 | Clinical Technologist | Clinical Engineering, Royal Berkshire Hospital | |
| <i>2021 - 2022</i> | <i>Pandemic voluntary work</i> | | |
| 2016 - 2021 | Experimental Officer | Faculty of Engineering and Physical Sciences, Surrey University | |
| 2016 | Software design consultancy | St Thomas Hospital Physiotherapy Department | Contract |
| <i>2016</i> | <i>Cancer diagnosis/treatment</i> | | |
| 2014 - 2016 | Clinical Scientist | One Small Step Gait Laboratory, Guy's and St Thomas' NHS Trust | |
| | Visiting Lecturer | School of Medicine, King's College London | |
| 2013 | Research Fellowship | Centre for Biomedical Engineering, Surrey University | Fixed term |
| 2012 | Clinical R&D Engineer | Chas A Blatchford & Sons Ltd | Fixed term |
| 2008 - 2013 | PhD Researcher | Centre for Biomedical Engineering, Surrey University | Fixed term |
| 2005 - 2008 | Trainee Clinical Scientist | St. George's Hospital NHS Trust and Queen Mary's Hospital, Roehampton | Fixed term |
| 2004 - 2005 | Science Technician | St. Boniface's RC School | Prep for NHS |
| 2004 - 2005 | Clerical Officer and Hospital Porter | Plymouth Hospitals NHS Trust | Prep. for NHS |
| 2002 - 2004 | Staff Training Co-ordinator | HM Young Offenders Institution Portland | Temp. |
| <i>2001</i> | <i>Homeless</i> | | |
| 2000 - 2001 | Research Engineer | Defence Evaluation Research Agency (now QinetiQ) | Placement |
| 1995 | Engineering Storeman | F.G. Metcalfe & Son Ltd | Temp. |
| 1995 | Production Progress Chaser | Masterfil Ltd | YT Scheme |
| 1992 - 1994 | Toolmakers Apprentice | Molins Tobacco Machinery Ltd | |

Employment History - Detailed

2022 - 2023 **Clinical Technologist**, Department of Clinical Engineering, Royal Berkshire Hospital

- Working within a busy hospital team undertaking planned preventative maintenance and repairs of a range of medical equipment, including infusion devices, ECGs, observations machines, defibrillators, ophthalmoscopes, otoscopes, nebulisers, suction units, beds, hoists and other devices.
- Commissioning and decommissioning medical equipment.
- Liaising with clinical staff and others on equipment audits, servicing and contract repairs.

2016 - 2020 **Experimental Officer**, Faculty of Engineering and Physical Sciences, University of Surrey

- Provided technical support to research centres across the Faculty. Notably the Surrey Space Centre and the Environmental Flow National Wind Tunnel Facility
- Design and construction of instrumentation for research projects (including a laser doppler anemometer probe positioning device, reaction speed tester, logic circuit demonstrator, thermoluminescent dosimeter prototype, air quality sampler and components for Mars rovers and orbital assembly robot arms. Installing failsafe devices for fixed installation equipment incorporating lasers, gases, HV and vacuums.
- Supported the development of two new laboratories for the UK FairSpace programme to enable orbital assembly, Mars rover and Martian surface tribology research. This work involved designing laboratory spaces in collaboration with stakeholders, and liaising with the projects and facilities teams to support infrastructure changes in accordance with a RIBA Plan of Work.
- Development of the Environmental Flow Wind Tunnel Facility included supporting the delivery of an IT upgrade programme, developing an interactive visitor display, decommissioning a hydrodynamic towing tank, developing electric ducted fan prototypes, and contributing to the design of a new aerothermal wind tunnel.
- Other duties included managing PAT tester calibration for the team, health and safety representation, capital project support, day-to-day purchasing, and student project support.

2016 **Independent Consultant**, St Thomas Hospital Physiotherapy Department

- Developed a new Dynamic Vestibular Acuity test to assess older patients with vestibular impairments, as part of a Guy's and St Thomas' Charity research project.
- Extensive LabVIEW programming, involving real-time data capture of a head-mounted inertia measurement device synchronised with intermittent rapid visual stimuli in the form of standardised fonts and shapes. The software incorporated a user interface that guided the clinician through inputting patient details, parameter selection, running the chosen test protocols, displaying results and report generation.
- White-box testing and delivery to a defined project plan.

2014 - 2016 **Honorary Lecturer**, School of Medicine, King's College London

- Lectured on a broad range of medical engineering topics and specialist modules
- MSc Examiner, co-supervisor and personal tutor

2014 - 2016 **Biomedical Engineer**, One Small Step Gait Laboratory, Guy's and St Thomas' NHS Trust

- Assessed the gait of people with mobility disorders (predominantly children with cerebral palsy). Mentoring trainee clinical scientists and supervising MSc students. Conducting mobility research.

2013 **Research Fellow**, Centre for Biomedical Engineering, University of Surrey

- Consultancy for UK-based SME. Reviewing the issues affecting the mobility of older people and providing recommendations for the development of lower limb exoskeletons

2012 **Clinical Research and Development Engineer**, Chas A Blatchford & Sons Ltd

- Lead the Companies involvement in an EU (FP7) project aimed at developing a lower limb exoskeleton to extend mobility. Worked with SMEs and academic partners in Germany, Spain, Sweden, Switzerland and the UK. Set up a UK end user group, advised partners on lower limb biomechanics and medical device regulation

2008 - 2013 **PhD Researcher**, Centre for Biomedical Engineering, University of Surrey

- Developed a new gait re-training device for trans-femoral amputees using electro-tactile sensory stimulation and real-time kinematics from an optical motion capture system (ProReflex, Qualysis). Design a multi-channel electro-tactile stimulator and electrode array with extensive software development to capture and calculate kinematics in real-time.
- Conducted studies with healthy individuals and trans-femoral amputees - involving submissions to the NHS Research Ethics Committee and University REC, subject recruitment, data collection, analysis and reporting

Additionally:

- Member of the University of Surrey Research Ethics Committee, and the Faculty of Health and Medical Sciences Research Ethics Committee reviewing ethics submissions and undertaking internal audits
- Lectured and supported students on medical engineering degree programmes.
- Reviewed articles for the IMechE Journal of Sports Engineering and Technology, and the Journal of Applied Bionics and Biomechanics
- Public outreach and widening participation activities with local schools, UCAS and education trusts.

2005 - 2008 **Trainee Clinical Scientist**, St. George's Hospital NHS Trust and Queen Mary's Hospital
Hospital-based training in three major areas:

1. *Biomechanical Evaluation and Function* (Douglas Bader Rehabilitation Centre, Queen Mary's Hospital): Assessed gait and functional capacity of adult and paediatric patients with upper and lower limb motor impairments, notably lower limb amputees and neurological patients (stroke, MS, children with CP)
2. *Physiological Measurement* (St George's Hospital): Training in the assessment of patients with a range of pathophysiologies in Audiology, Lung Function and Neurophysiology
3. *Medical Instrumentation* (St George's Hospital NHS Trust / St George's Hospital Medical School): Developed wireless power and data transceiver for a bone distractor implant for patients with leg length discrepancies

2004 - 2005 **Science Technician**, St. Boniface's RC Boys School and Lipson Community College

2004 **Clerical Officer and Hospital Porter**, Plymouth Hospitals NHS Trust

2002 - 2004 **Staff Training Co-ordinator**, HM Young Offenders Institution Portland

2000 - 2001 **Research Engineer**, Defence Evaluation Research Agency (now QinetiQ)

- Defence research as part of University industrial placement. Design from conception to delivery of an autonomous survey vessel. Including specification, purchasing and integration of side-scan sonar, motion reference unit, GPS, wireless WAN, underwater video, sensor pod winch and array. Software development of telemetry, autopilot, navigation, sensing and data logging systems.
- Reverse software engineering and development of a weapons system design effectiveness model

1995 **Engineering Storeman**, F.G. Metcalfe & Son Ltd

1995 **Production Progress Chaser**, Masterfil Ltd

1992 - 1994 **Mechanical Engineering Apprentice**, Molins Tobacco Machinery Ltd

Lecturing and Teaching

2014 - 2016 Teaching on the MSc in Clinical Science (Clinical Engineering) at Kings College London.
The King's MSc provides the academic component of the 3 year NHS Scientist Training Programme.

- *Year 1 Core lectures*: Audiology, Respiratory Assessment, Measurement of Human Movement
- *Year 2 Specialist lectures*: Kinematics, Mechanics, Biomaterials, ICF and Models of Physical Disability
- *Year 3 Further Specialist lectures*: Electrical Stimulation, Prosthetics, Orthotics, Orthopaedic Biomechanics

2008 - 2013 Supporting the MSc Biomedical Engineering and BEng/MEng Medical Engineering programmes at the University of Surrey.

- *Lectures and tutorials*: Gait Analysis and Human Movement, Safety and Physiological Measurement, Healthcare Practice, Engineering Projects, Medical Instrumentation, Control Engineering

2004 – 2008 International Baccalaureate and undergraduate mathematics - private tuition and school teaching
A-Level Physics (sixth form) private and school teaching

GCSE Science, Biology, Physics (key stages 1 to 4) private and school teaching

1990 – 1992 Principles of flight, air navigation, dress and discipline - Air Training Corps cadets aged 13-17

Outreach and Public Engagement

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| 2017 | Assessor for the Engineering Education Scheme, Engineering Development Trust | 16 to 17 years |
| 2008 - 2013 | Departmental public engagement, University of Surrey | General public |
| 2008 - 2010 | Tutor for the Headstart Programme, Engineering Development Trust | 16 to 17 years |
| 2006 | Smallpeice Trust Bioengineering Course Facilitator, University of Southampton | 15 to 17 years |
| 2004 - 2005 | Assistant presenter, Chemistry road show sponsored by the Royal Institution | General public |

Awards

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|------|--|
| 2008 | University of Surrey, EPSRC Case Studentship |
| 2002 | The Tektronix UK Prize for Project Engineering |
| 2002 | Honorary Life Membership of the University of Plymouth Students Union |
| 2000 | Certificate with distinction for industrial and professional experience (University placement) |

Publications

WEBB, G. D., CIROVIC, S., GHOUSSAYNI, S. & EWINS, D. J. **Electro-tactile sensation thresholds for an amputee gait-retraining system**, 3rd Annual Conference of the International Functional Electrical Stimulation Society (UK and Ireland Chapter). University of Birmingham, UK. 2012

WEBB, G.D. **Helping Amputees to Walk Naturally**, *EPSRC Pathways to Impact Case Study 2011*

WEBB, G. D., GHOUSSAYNI, S. & EWINS, D. J., **Electrotactile feedback for trans-femoral amputee gait re-education**, 1st Annual Conference of the International Functional Electrical Stimulation Society (UK and Ireland Chapter). University of Salford, UK. 2010

WEBB, G. D. **Providing Real-time Biofeedback for Amputee Gait re-training**, NI Days Worldwide Graphical Systems Design Conference 2009

Skills Summary

CLINICAL

Biomechanical Evaluation

Extensive experience of movement analysis of humans, animals and objects using:

- Kinematic analysis: Camera-based photogrammetry (Qualysis and Vicon)
Temporal-spatial measures
- Kinetic analysis: Force plates (Kistler and AMTI)
Plantar pressure techniques (Tekscan insoles and mat)
- Muscle strength and activity: Surface Electromyography (Delsys wired and wireless)
Dynamometry
- Muscle morphology: B and M mode ultrasound
- Observational gait analysis: Video and video vector
Qualitative methods, questionnaires and focus groups
- Activity and energy: ECG, heart rate indices, Douglas Bag (VO₂), ambulatory monitors
- Functional Electrical Stimulation: Device design and development, clinical trials, patient assessment
- Biofeedback and Virtual Rehabilitation: Device design and development, consultancy

Clinical Measurement

Training and use of a range of physiological measures:

- Audiology: Pure Tone Audiometry, Tympanometry, Auditory Brainstem Response
- Vestibular: ENG, EMG, EOG, ERG, VEPs, Caloric irrigation, rotating chair
- Lung Function / Sleep: Spirometry, Whole Body Plethysmography, Single Breath CO Diffusion Testing
- Neurophysiology: EEG and ENG
- Neonatal ICU: Patient monitoring, incubation, ventilation (limited experience)
- Urodynamics: Cystometrogram and VCMG (familiarity)
- Knowledge of Cardiology, Specialist Seating, Wheelchairs, Prosthetics R&D and fitting, and Orthotics

ENGINEERING

Electronics Design, Development and Repair

- Analogue and digital circuit design, microcontroller systems design (PIC, Atmel, 68000, 8051, Arduino, Raspberry Pi)
- Bluetooth, RF, RS232, SCI, I²C, TCP/IP, DC motor control, wireless power transmission, real-time data logging
- Medical instrumentation, GUI design and human-computer interaction, design for electromagnetic compatibility
- Surface mount and multi-layer board design, layout, PCB printing and assembly

Software and Programming

- LabVIEW (from v 7.1 to 2020)
- Assembly languages and embedded C for PIC and Atmel microcontroller families
- Matlab (Simulink and Stateflow), Microsoft C, Ada and Basic, GitHub
- Visual3D and Qualisys Track Manager (Motion analysis and biomechanical modelling)
- Proteus Virtual System Modelling and Electronics Workbench (Electronics CAD)
- AutoCAD and ProDesktop (Mechanical CAD)
- MathCad and Derive (Mathematics packages)
- Windows (from v 2.1), LINUX, DOS, Microsoft Office, Case tools, Endnote and statistical tools

Mechanical craft skills

- Turning, milling, grinding, jig boring, gear-cutting, fitting, sheet metal work, laser cutting, welding, heat treatments, forging, assembly, tool design, conventional and NC/CNC planning and operation, 3D printing

Professional and Transferrable

- Working within multi-disciplinary teams in high risk scenarios
- Working within regulatory frameworks, quality management systems, including: BS5750 and ISO9001 and designing healthcare technology in accordance to a large range of UK, EU and ISO standards, including 60601, 62353, the Medical Device Directive (MDD 93/42/EEC) in addition to industrial and H&S standards.
- Proofreader for ISO 13482
- Risk management
- Research ethics and auditing research activities (through own NRES submissions and Membership of the University of Surrey Research Ethics Committee and Faculty of Health and Medical Sciences REC)
- Research - Print, online, interviews, focus groups, experimentation / prototyping, Clinical studies
- Data analysis - Qualitative and quantitative methods