Robert L. Peach

Research Associate / Postdoctoral Researcher

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Address : University Hospital Würzrbug, Würzrbug, Germany **Nationality :** UK/Irish Citizen

Researcher specialising in network science and machine learning, and its application to neuroscience at the University Klinik Würzburg. The central theme of my research is to understand how seemingly simple interactions can induce complex dynamics and behaviours, through the development of new mathematical and computational tools. Published 15+ articles in peer-reviewed journals and 5+ years experience teaching and supervising undergraduate/postgraduate students, including PhD students.

Education

2018 | **PhD in Applied Mathematics and Computational Biology**
Department of Chemistry, Imperial College London, London, UK
Thesis title : Exploring protein dynamics using graph theory and single-molecule spectroscopy
Thesis Supervisors : Prof. Mauricio Barahona, Prof. Sophia Yaliraki, Prof. Keith Willison, Prof. David Klug

2014 | **MRes in Chemical Biology, Distinction**
Department of Chemistry, Imperial College London, London, UK
Supervisors : Prof. Mauricio Barahona, Prof. Sophia Yaliraki, Prof. Keith Willison, Prof. David Klug

2012 | **MSci (Hons) Physics, 1st class**
Department of Physics, University of Bristol, Bristol, UK
Thesis title : A study of Penetration Depth Anisotropy in Sr_2RuO_4
Thesis Supervisors : Prof. Antony Carrington

Professional Appointments

Present
2020-10 | **Research Associate**
Department of Neurology, University Hospital Würzburg, Würzburg, Germany
Principal Researcher focused on developing tools for identifying higher-order interactions within complex signals, and translating this into network construction. Co-supervising 5 MD and 1 PhD student. Designed and taught Methods of Data Science lecture course for MSc in Translation Neuroscience.

Present
2020-10 | **Honorary Research Fellow**
Department of Brain Sciences, Imperial College London, London, UK
Closely affiliated with Dr. Nir Grossman, Prof. Mauricio Barahona, and Dr. David Lefevre. Co-supervising 3 PhD students, 12 MSc students, and running pilot project grant.

2020 | **Visiting Scholar**
Department of Biostatistics, School of Public Health, Harvard University, Boston, US
Research visit with Professor JP Onnela to study time-series data in healthcare.

2020-10
2017-10 | **Research Associate**
Centre for Mathematical Precision Healthcare, Department of Mathematics, Imperial College London, London, UK
Development of graph theoretical tools and methodologies within applied mathematics, with application to learning analytics and neuroscience. Supervising 5+ MSc students.

Publications

Peer-reviewed Publications

2022 ***** Peach, R. L., Arnaudon, A., and Barahona, M., ”Relative, local and global dimension in complex networks.” Nature Communications 13.1 : 1-11.

2022 Myall, A., Price, J., Peach, R., et al., ”Predicting hospital-onset COVID-19 infections using dynamic networks of patient contact : an international retrospective cohort study”, Lancet Digital Health, (accepted).

2022 Arnaudon, A., Peach, R., Petri, G., Expert, P., ”Connecting Hodge and Sakaguchi-Kuramoto : a mathematical framework for coupled oscillators on simplicial complexes”, Communication Physics, (accepted).

2021 ***** Peach, R. L., et al. ”HCGA : Highly comparative graph analysis for network phenotyping.” Patterns 2.4 : 100227.

2021 Liu, Zhaolu, et al. ”Listening to mental health crisis needs at scale : using Natural Language Processing to understand and evaluate a mental health crisis text messaging service.” Frontiers in Digital Health 3 : 779091.

2021 Ming, Damien K., et al. ”Informing antimicrobial management in the context of COVID-19 : understanding the longitudinal dynamics of C-reactive protein and procalcitonin.” BMC infectious diseases 21.1 : 1-7.

2021 ***** Peach, R. L., et al. ”Understanding learner behaviour in online courses with Bayesian modelling and time series characterisation.” Scientific reports 11.1 : 1-15.

2021 Myall, A. C., Peach, R. L., et al. ”Network memory in the movement of hospital patients carrying antimicrobial-resistant bacteria.” Applied Network Science 6.1 (2021) : 1-23.

2021 Chrysostomou, S., et al. ”Repurposed floxacins targeting RSK4 prevent chemoresistance and metastasis in lung and bladder cancer.” Science translational medicine 13.602 : eaba4627.

2021 Knorr, S., et al. ”The evolution of dystonia-like movements in TOR1A rats after transient nerve injury is accompanied by dopaminergic dysregulation and abnormal oscillatory activity of a central motor network.” Neurobiology of Disease 154 : 105337.

2021 ***** Schreglmann, Sebastian R., Wang, D., Peach, R. L., et al. ”Non-invasive suppression of essential tremor via phase-locked disruption of its temporal coherence.” Nature communications 12.1 : 1-15.

2020 ***** Arnaudon, A., Peach, R. L., and Barahona, M. ”Scale-dependent measure of network centrality from diffusion dynamics”. Physical Review Research, 2.3 : 033104.

2020 ***** Peach, R. L., Arnaudon, A., and Barahona, M., ”Semi-supervised classification on graphs using explicit diffusion dynamics.” Foundations of Data Science 2.1 : 19.

2019 ***** Peach, R. L., et al. ”Data-driven unsupervised clustering of online learner behaviour.” npj Science of Learning 4.1 : 1-11.

2019 Sowley, H., et al. ”Detection of Drug Binding to a Target Protein Using EVV 2DIR Spectroscopy.” The Journal of Physical Chemistry B 123.17 : 3598-3606.

***** First or joint-first author publications.

Other Publications

2022 Rönn, AJ., Friedrich, M., Palmisano, C., Rhodes, E., Peach, R., Reich, MM., Markerless, video-based kinematic Tremor Analysis : machine vision in movement disorders, Clinical Neurophysiology, 137 : e48

2022 Friedrich, M ; Peach, R ; Fronemann, L ; Volkmann, J ; Reich, MM ; Ip, CW ; ”POSe EstimatoR for Cervical Dystonia (POSER-CD) : Automatized assessment of clinical severity and kinematic pathosignatures of Cervical Dystonia using convolutional neural networks”, Clinical Neurophysiology, 137 : e13

2022 Friedrich, M ; Taeger, J ; Bürklein, M ; Hartig, J ; Volkmann, J ; Ip, CW ; Peach, R ; Zeller, D ; ”Deep learning derived quantitative Video-NystagmoGraphy using smartphone cameras : DeepVNG”, Clinical Neurophysiology, 137 : e47-e48

2022 Peach, R., Selzam, V., Häring, V., Schreglmann, S., ”Phenotypical characterization of tremor syndromes using unbiased time-series feature analysis”, Clinical Neurophysiology, 137 : e4

2022 Myall, A., et al. ”Prediction of hospital-onset COVID-19 using networks of patient contact : an observational study.” International Journal of Infectious Diseases 116 : S109-S110.

2022 Myall, A., et al. ”Improved contact tracing using network analysis and spatial-temporal proximity.” International Journal of Infectious Diseases 116 (2022) : S20.

2021 Schreglmann, S., et all, ”Non-invasive Suppression of Essential Tremor via Phase-Locked Disruption of its Temporal Coherence”, Clinical Neurophysiology, 132.8 : e35-e36

2021 Myall, Ashleigh, et al. ”Characterising contact in disease outbreaks via a network model of spatial-temporal proximity.” medRxiv.

2019 Peach, R. L., Saman, D., Yaliraki, S. N., Klug, D. R., Ying, L., Willison, K. R., and Barahona, M. Unsupervised graph-based learning predicts mutations that alter protein dynamics. bioRxiv, 847426.

Honors and Awards

2017 30-under-30 Award, Forbes

2015 CDT Poster Prize, Imperial College and Warwick collaborative conference, Imperial College London

2011 Commendation for excellence, Faculty of Science, University of Bristol

2010 Commendation for excellence, Faculty of Science, University of Bristol

2008 Award for best scientist in 2008, De-Lisle Science College

2006 Gold in the Intermediate National Maths Olympiad award, De-Lisle Science College

Grants and Fellowships

2021 Digital Innovation Fund, £141,537, Imperial College London

2020 Pilot project grant, £40k, UK Dementia Research Institute

2017 Innovation Competition Prize, £5k, Shell Livewire

2017 Innovation competition prize, £10k, CDT den, Imperial College London

2017 Travel grant, £1k, IC Trust, Imperial College London

2017 Travel grant, £1k, Analytical Biosciences, Royal Society of Chemistry

2016 Innovation Grant, £5k, Climate-KIC, Imperial College London

2015 Innovation Grant, £5k, Greenhouse Climate-KIC, Imperial College London

Conferences

Invited Talks

2022 Characterization of tremor via un-biased, feature-based signal analysis, DGKN, Wuerzburg, Germany.
2021 Neural membrane frequency mixing phenomenon mechanically linked to neural circuit memory impairment, Connectome, Dementia Research Institute, London, UK.
2021 Diffusion on networks and peaks in the transient responses, Hatano-lab, Osaka University, Japan
2021 Highly comparative graph analysis, SNAC, Sydney, Australia.
2020 Highly comparative graph analysis, Complex Networks conference, Rome, Italy.
2020 Overshooting behaviours in networks, COXIC, London, UK.
2019 Good practices in distributed and online learning, iFest 2019, Alexandria, US.
2019 Tremor Analysis in Essential Tremor patients, Complexity in the 21st Century, Institute of Physics, London.
2019 Using time-series engagement data to predict student performance, GMAC Leadership conference, Fort Lauderdale, US.
2019 Highly comparative graph analysis, Onnela Lab, Harvard School of Public Health, Boston, US.
2018 Learning analytics dashboard and student engagement behaviours, FOME, Oslo, Norway.

Campus talks

2022 Centre of Mathematical Precision Healthcare, Imperial College London, UK.
2021 Detecting Endogenous Frequency Mixing in Animals and Humans, Grundlagenwissenschaftlichen Seminaren, University Hospital Wuerzburg, Germany.
2018 Business School Round Table, Imperial College Business School, Imperial College London, UK.
2018 Predicting patient tremor response to TACS, CMPH, Imperial College London, UK.

Teaching Experience

Lecture courses

Present – 2022 | **Methods of Data Science : Applications to the Life Sciences**
Department of Neurology, Universitaet Klinik Wuerzburg, Wuerzbug, Germany
Developed and ran the lecture course.

Teaching Assistant

2022 – 2019 | **Imperial Business School**
Imperial College London, London, UK
Business Analytics MSc : Statistics and Econometrics, Network Analytics, Maths and Statistics, Workforce analytics.

2019 – 2018 | **Department of Mathematics**
Imperial College London, London, UK
Methods of Data Science

2015 – 2014 | **Department of Chemistry**
Imperial College London, London, UK
2nd year Thermodynamics, 2nd year electronics lab

Additional Activities

External Work

2021 | **Consultant**
Imperial Consultants, Imperial College London, London, UK
Provided academic insights into the translation of natural language processing into healthcare applications for a London GP company.

2018 – 2015 | **Chief Finance Officer**
FreshCheck Ltd, London, UK
Co-Founded a biotech spin-out company from Imperial College London. Successfully seed-funded and still operational.

2011 | **MBDA**
Stevenage, UK
Systems Design Engineer.

Outreach

2018 Visualising deep learning, Imperial Lates, Imperial College London.
2017 Ambassador to Tokyo Tech collaboration workshop on behalf of Imperial College.
2016 + 2017 Detecting bacteria with a colour change, Festival of Science, Imperial College London.

Software Packages

- Dimension of networks : `https://github.com/barahona-research-group/DynGDim`
- Graph diffusion reclassification : `https://github.com/barahona-research-group/GDR`
- Highly comparative graph analysis : `https://github.com/barahona-research-group/hcga`
- Multiscale centrality : `https://github.com/barahona-research-group/MultiscaleCentrality`

Languages and Skills

Languages English - Native ; German - Advanced ;
Programming Python ; MatLab ; R ; Bash ;
Patents PCT for chemical invention that changes colour in presence of bacteria of harmful chemicals, IPN : WO 2018/185486 A1, Owner : Fresh Check Ltd.

References

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