Christopher. W. Davies-Jenkins | Research Fellow

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I am a post-doctoral research fellow at Johns Hopkins University. My area of interest is acquisition, data processing and analysis methods for magnetic resonance spectroscopy (MRS), particularly for low concentration metabolites, such as gamma-aminobutyric acid (GABA), and emerging subsidiary fields of MRS, such as diffusion-weighted MRS.
Within the context of MRS, I have a strong background in data acquisition, quantum mechanical simulation, data pre-processing, and spectral quantification. All of which is underlined by my education and practical experience within physics, mathematics, and scientific computing.

Employment

- **Radiology - Johns Hopkins University**
  Research Fellow, Development of magnetic resonance spectroscopy methods. *2022–Present*
- **CUBRIC - Cardiff University**
  Research associate, Development of magnetic resonance spectroscopy methods. *2018–2021*

Education

- **Swansea University**
  PhD - MR Physics *2014–2018*
- **Swansea University**
  MPhys - Physics, First class (hons) *2009 – 2014*

Training

- **Staff development** **CUBRIC**
  MR operator, Trained MR operator for 3T and 7T human participant scanning. *2019–Present*
- **Staff development** **NVIDIA-DLI**
  Fundamentals of deep learning, Training in Tensorflow and Python for deep learning. *2020*
- **Staff development** **CUBRIC**
  First aid, Completed QA level 3 award in first aid at work. *2019*
- **Staff development** **Swansea**
  Good clinical practice, Completed NHS GCP workshop studying ethical, scientific and practical standards in clinical research. *2019*

Other skills

- **Scientific computing -** Proficiency in numerical simulation, image processing, and spectral analysis, working with multiple programming languages, including Matlab, Python, C^{++}, bash, and R. Furthermore, I have experience using Git-based workflow for version control and collaborative software development.
- **MRS pre-processing and simulation -** Experience using Gamma, FID-A, NMRSCOPE-B, and custom Matlab code for MRS data pre-processing and quantum mechanical simulations.
- **Quantification of MRS data -** Experience using TARQUIN, jMRUI, LCModel, and Gannet for MRS quantification. Moreover, I have developed custom simulated basis sets for MRS fitting, and voxel segmentation pipelines for partial volume correction.
- **IDEA pulse sequence design -** Underwent introductory training into the use of the Siemens IDEA pulse sequence programming environment during my PhD.
- **MR quality assurance -** Experience utilising various QA protocols for MRI, including ACR standards. Furthermore, I have utilised both automated and manual QA protocols for MRS data, as a part of a large-scale multi-modal study.
- **Good laboratory practice -** Experience working in a controlled laboratory environment, proficiency using equipment therein, management of hazardous substances and associated safety measures.
- **MRI/MRS phantoms -** Utilised practical chemistry for the creation of MRI and diffusion-kurtosis phantoms under laboratory conditions. Our group also developed solution and gel phantoms, optimised for MRS QA and benchmarking of novel MRS quantification approaches.
- **Writing skills -** Experience preparing presentations and reports, using Adobe Photoshop, LaTeX, and BibTeX.

Research Experience

PhD summary

- **MRS simulations -** Developed code in C^{++} and Matlab to simulate MR pulse sequences and spectra using NMR models of brain metabolites, refined by experimental data. Worked with both Hamiltonian and full Liouville-space models to enable simulation of relaxation effects during RF-pulses.
- **Optimisation framework -** Collaborated with Cardiff University's computer science department to develop an optimisation framework around this simulator, with a view to producing chemically selective RF-pulses using quantum optimal control. Excitation pulses were identified to discriminate Glu/Gln and GABA/Cr/NAA at 3T. RF-pulses were trained with robustness to B_0 and B_1 inhomogeneity, transmitter limitations, and relaxation effects during long RF-pulses.
- **Design and characterisation of MRS Phantoms -** Designed and prepared phantoms for quantitative imaging. Developed solution and tissue-mimicking gel phantom with controllable properties including T_1, T_2, diffusion/kurtosis and spectral lineshape.
- **Experimental MRI/MRS -** Implemented and optimised MRS protocols (PRESS, STEAM, MEGAPRESS, HERMES), relaxometry methods (MPRAGE, variable flip angle methods, inversion/saturation recovery), diffusion/kurtosis methods (PGSE, EPI diffusion), and protocols for characterisation of optimised RF pulses.
- **Quantification of MR spectra -** Analysed spectroscopy data using a variety of popular analysis tools e.g. JMRUI, Gannet, and Tarquin, as part of a comparative analysis of GABA-edited MRS quantification.
- **Quantitative relaxometry -** Conducted statistical analysis of relaxometry acquisition methods for both phantoms and in-vivo data (brains, prostate).
- **Quality assurance -** Ensured quality of acquired data through manual shimming, transmitter voltage calibration, B_0 and B_1 field mapping, and protocol parameter optimisation.

Publications & Pre-prints

[1] DW-MRS with ultra-strong diffusion gradients. **Jenkins, Christopher**, Elena Kleban, Lars Mueller, C. John Evans, Umesh Rudrapanta, Derek Jones, Francesca Branzoli, Itamar Ronen, and Chantal Tax. (2021). *Pre-print: In production*

[2] MRSNet: Metabolite Quantification from Edited Magnetic Resonance Spectra With Convolutional Neural Networks. Chandler M, **Jenkins C**, Shermer S, Langbein F. (2021) *Pre-print: arXiv:1909.03836*

[3] Benchmarking GABA Quantification: A Ground Truth Data Set and Comparative Analysis of TARQUIN, LCModel, jMRUI and Gannet. **Jenkins C**, Chandler M, Langbein F, Shermer S. (2021) *pre-print: arXiv:1909.02163*

[4] Magnetic resonance spectroscopy data for GABA quantification using MEGAPRESS pulse sequence. Shermer S, **Jenkins C**, Chandler M, Langbein F. (2019) *Experimental dataset. DOI: 10.21227/ak1d-3s20*

[5] New techniques for quantification of biomarkers and metabolites by magnetic resonance imaging and spectroscopy. **Jenkins C**. (2019) *Thesis. DOI: 10.23889/suthesis.50804*

[6] Comparison of R1 Mapping Protocols: What are we measuring? **Jenkins C**, Papadopoulos I, Shermer S. (2019) *Pre-print: arXiv:1909.12984*

[7] Design and Characterization of Tissue-Mimicking Gel Phantoms for Diffusion Kurtosis Imaging. Ziyafer G, Shermer S, **Jenkins C**, Spezi E, Perrett T, Tuncel N, Phillips J. (2018) *DOI:1608.08542.*

Talks & Posters

[1] ISMRM Virtual meeting, 2021, "The influence of spectral registration on diffusion-weighted magnetic resonance spectroscopy ADC estimates". Poster talk.

[2] ISMRM Virtual meeting, 2020, "DW-MRS with ultra-strong diffusion gradients". E-poster

[3] ISMRM Montreal, 2019, "Quantification of edited magnetic resonance spectroscopy: a comparative phantom based study of analysis methods". E-Poster

[4] Cardiff University neuroimaging research conference, 2019, "Enhanced methods in edited magnetic resonance spectroscopy". Talk

[5] South west Wales cancer centre research meeting, Swansea University, 2017, "Modelling, Optimization & QA for quantification of Magnetic Resonance Spectroscopy". Talk

[6] All Wales medical physics meeting, 2017, Village hotel Swansea, "Modelling, Optimization & QA for Magnetic Resonance Spectroscopy". Talk/Poster

[7] All Wales medical physics meeting, 2017, Village hotel Swansea, "Evaluation of MRI and MRS artefacts induced by common cosmetics using field mapping". Poster

[8] Image guided therapy network meeting, 2016, "Advanced detection and quantification of biomarkers in magnetic resonance spectroscopy". Poster

[9] All Wales medical physics meeting, 2016, Swalec stadium Cardiff, "Advanced detection and quantification of biomarkers in magnetic resonance spectroscopy". Poster

[10] QUAINT, 2015, Marriot hotel Swansea, "Overcoming challenges in clinical application of magnetic resonance spectroscopy using quantum control". Poster