

ROLAND SUTTON ACADEMIC RADIOLOGY TRUST

ACADEMIC REPORT 2019

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Approved by Dr Gordon D Waiter
Acting Director of ABIC
Aberdeen Biomedical Imaging Centre

INTRODUCTION

The Aberdeen Biomedical Imaging Centre is the overarching structure to facilitate communication and synergy across the many scientists and clinicians working in imaging research at the University of Aberdeen. This multidisciplinary group of imaging researchers includes radiologists, medical physicists, computer scientists, biologists, bioengineers, chemists and radiographers, supported by administrative and secretarial staff, who are key members of the team.

During 2019 development continued across the University as Professor Boyne, appointed as Principal in August 2018, steered the University towards his vision to ensure that the University of Aberdeen will continue to be open to all and dedicated to the pursuit of truth in the service of others. This included the development of “Aberdeen 2040”, the strategic plans for the next 20 years and a major recruitment drive aiming to significantly increase academic numbers across the University. Professor Siladitya Bhattacharya was appointed as Head of the School of Medicine, Medical Sciences and Nutrition in August and has shown his support for imaging research through his involvement in both the Philips 3T upgrade and FFC-MRI developments.

Staff compliment in 2019 remained relatively static and although there were some leavers, there were new appointments. We welcomed Dr Sai Man Cheung in April 2019 having been appointed as a research fellow on a CRUK grant awarded to Dr He, moving up from his time as a PhD research student. Dr Amir Dehsarvi was successful in the interviews for the research fellow post in a grant awarded to Dr G Waiter and was due to start in August 2019. Unfortunately, issues with his visa meant his start date was delayed until January 2020. Dr Tim Smith and Dr Dorota Chapko left in January and February respectively 2019, following completion of grants from which they were funded. June 2019 also saw the departure of Professor Alan Denison from his post as Deputy Director of Institute of Medical and Dental Education to become Dean of Postgraduate Medicine for the Scotland Deanery (North) within NHS Education for Scotland. We wish him well in his new post. We welcomed Dr Brian Morrissey as a SCREDS lecturer in October 2019. Finally, in November 2019, Dr Clarisse De Vries was appointed as a research assistant for a short-term appointment following her time as a PhD research student, which subsequently led to appointment as a research fellow in the iCAIRD project until February 2021. Further posts are expected to start during 2020.

This year continued to be a productive one for PhD students, some of whom mentioned above have moved to research posts. One new student started their PhD journey in May 2019, giving a student compliment of 15 at the end of December 2019. Four students were expected to complete their PhD journey during 2019. In addition, staff in the Lilian Sutton Building supported 6 MSc students during the project phase of their Masters degree and also hosted a Hotstart student for a short project with further information noted under the student section. These projects provided excellent opportunities for training in the value of brain imaging, beyond the familiar clinical use.

A major step forward for the year was the refurbishment of the Philips 3T MRI scanner. Work commenced in July 2019 with the programme of building works expected to finish in October. While the project was focused on upgrading the scanner, a significant portion of the time required was dedicated to extensive upgrading of the mechanical services supplying the new system. In particular, the air conditioning and water-cooling provision required substantial upgrades. During the building works required to deliver these upgrades, two significant issues presented themselves: a faulty Faraday cage and significant deterioration of the external flat roof in MRI East. Addressing these issues was vital before other elements of the project could continue. This resulted in a substantial extension to the project timeline of 5 months in total, with the system acceptance testing carried out in mid December. The scanner passed all quality control tests without any issues and the results for quality parameters such as sign-to-noise ratio and stability were substantially better than before the upgrade. As part of the upgrade, instrument features to enable new scanning capabilities were purchased – e.g. “Compressed Sense” – and these will help to significantly decrease scan time across all body areas. This will provide a significant improvement in image-quality by reducing motion artefacts.

Scanner installation



Scan room after the RF cage has been removed with a close-up of the “roller skates” used so the magnet can be moved around the room.



The new RF cage being installed with the magnet in the equipment room.



The final result

During the expected and additional downtime, the radiographic staff were able to undertake periods of in-depth training, either through course attendance or visiting other centres and shadowing staff. Applications training in late December and early January 2020, supervised by a specialist from Philips (the company delivering the upgrade to the system), focused on demonstrating the new capabilities to the radiography team and interested radiologists.

Professor David Lurie's group continues to see progress with the Fast Field Cycling project, to bring it closer to a clinical system and there are active plans to build and install a next generation system in the scanning suite on the ground floor of the Lilian Sutton Building. Design of the magnet is at an advanced stage and funding for the reconfiguration of the suite has been secured with a generous donation from the Hall Family Charitable Trust. Further public engagement activities by the team were carried out in 2019 (see **Public Engagement section** for more information) with a series of group meetings including Estates, and a formal Project Board team set-up from January 2020.

ABIC staff and students continue to be a part of the SINAPSE (Scottish Imaging Network: A Platform for Scientific Excellence) community, with Professor Alison Murray continuing with the Director's role during 2019.

This annual report lists the staff, the grant income, current projects, publications and presentations over the past year. Further information can be found at <http://www.abdn.ac.uk/ims/research/abic>.

LIST OF STAFF

Professor Alison D Murray	- Roland Sutton Chair of Radiology (<i>part-time from Oct 2018</i>)
Professor Alan R Denison	- Personal Professor in Radiology (<i>left June 2019</i>)
Dr Leela Narayanan	- Honorary Clinical Senior Lecturer in Radiology
Dr Arnab Rana	- Honorary Clinical Senior Lecturer in Radiology
Dr Rosalind Mitchell-Hay	- Honorary Clinical Senior Lecturer in Radiology
Professor David Lurie	- Professor
Professor Andy Welch	- Professor
Dr Gordon Waiter	- Senior Lecturer in Computational Neuroimaging
Dr Tim Smith	- Senior Research Fellow (<i>left January 2019</i>)
Dr Brian Morrissey	- SCREDS Clinical Lecturer in Radiology (<i>joined October 2019</i>)
Dr Jiabao He	- Lecturer in MR Physics
Dr Trevor Ahearn	- Honorary Lecturer
Dr Hugh Seton	- Lecturer (scholarship)
Dr Lutz Schweiger	- Senior Research Fellow & Senior Radiochemist
Dr Ian Fleming	- Lecturer (scholarship)
Dr Vesna Vuksanovic	- Research Fellow
Dr Anca Sandu-Giuraniuc	- Research Fellow
Dr Gareth Davies	- Research Fellow
Dr Lionel Broche	- Lecturer since XX/2019
Dr Chris McNeil	- Research Fellow
Dr Dorota Chapko	- Research Fellow (<i>left February 2019</i>)
Dr James Ross	- Research Fellow
Dr Gabriel Cheung	- Research Fellow (<i>joined May 2019</i>)
Dr Amir Dehsarvi	- Research Fellow (<i>due to commence post August 2019, started Jan 2020</i>)
Dr Nicholas Senn	- Research Assistant/Fellow (<i>joined October 2019</i>)
Dr Clarisse DeVries	- Research Assistant/Fellow (<i>joined November 2019</i>)
Dr Nicola Miller	- Honorary Research Fellow
Mr George Cameron	- Senior Research Assistant (scholarship)
Mr Gordon Buchan	- Research Technician (MRI)
Mr Stuart Craib	- Honorary Research Technician (PET)
Ms Eleanor Hutcheon	- Technician (scholarship)
Mrs Beverley MacLennan	- Lead Superintendent Radiographer
Mrs Nichola Crouch	- Radiographer
Ms Laura Reid	- Radiographer
Mr Michael Hendry	- Radiographer
Mrs Nicola Irwin	- Radiopharmacy technician (<i>on extended leave</i>)
Mr Mike Shek	- Radiopharmacy technician
Miss Kirsty Murray	- Radiopharmacy technician
Mrs Teresa Morris	- Imaging Facilities Co-ordinator
Mrs Dawn Younie	- Secretary

RESPONSIBILITIES AND ACTIVITIES OF STAFF

Professor Alison D Murray

1. Scottish Imaging Network: A Platform for Scientific Excellence (SINAPSE). Director.
2. Generation Scotland Executive Committee, University of Aberdeen representative.
3. British Society of Neuroradiologists, Academic Subcommittee, Member.
4. Scottish Radiological Society, Member.
5. Medical Research Council, CASE Studentship Review Panel, Member.
6. Scottish Dementia Research Consortium, Executive member.
7. Alzheimer's Research UK (Scotland) executive member.
8. Aberdeen Medico-Chirurgical Society, 2019-2020, President Elect
9. School of Medicine, Medical Sciences and Nutrition, Disability Co-ordinator.
10. Radiology Committee, NHS Grampian, Member.
11. Radiology Education and Training Committee, NHS Grampian, Member.
12. Radiology MRI Modality Group, NHS Grampian, Member.
13. Nuclear Medicine Service Committee, NHS Grampian, Member.

Professors Alison Murray acts as regent to 7 undergraduate medical students, to whom she provides advice and support, as and when required by the students.

Professor David J Lurie

1. Institute of Physics & Engineering in Medicine (IPEM), Academic Gold Medal award 2017.
2. Institute of Physics, Fellow
3. Institute of Physics and Engineering in Medicine, Fellow
4. International Society for Magnetic Resonance in Medicine, Member
5. International EPR (ESR) Society, Member
6. European Society of Radiology, Member
7. Fellowship Panel, Institute of Physics, Member
8. Course Accreditation Panel, Institute of Physics and Engineering in Medicine, Vice-chair
9. Research Degrees Committee, University of the Highlands and Islands, Member
10. Academic Line Manager, School of Medicine, Medical Sciences and Nutrition, University of Aberdeen
11. Quality Assurance Committee, University of Aberdeen, Member
12. Senatus Academicus, University of Aberdeen, Member
13. European Congress of Radiology, Physics in Radiology Subcommittee, Chair 2017 meeting
14. External Assessor, Master of Medical Physics degree programme, University of Malaya, Kuala Lumpur, 2014-2018.
15. European Congress of Radiology, Physics in Radiology Subcommittee, Chair 2017 meeting
16. European Congress of Radiology, Programme Planning Committee, Member for 2018 and 2019 conferences
17. Vice Chair of EU COST Action CA15209, "European Network on NMR Relaxometry" 2016-
18. External Assessor, Master of Medical Physics degree programme, University of Malaya, Kuala Lumpur, 2014-2018.
19. Hong Kong Association of Medical Physics, Part II Resident Physicist Examinations, Chief Examiner.
20. Royal Society Challenge Grants Panel, Member
21. Planning Committee of the 3rd European Congress of Medical Physics (ECMP 2020), Member
22. Communications and Publications Committee of the European Federation of Organisations for Medical Physics (EFOMP), Chair (Previously Vice-Chair of committee, from 2019.)

Professor Andy Welch

1. Institute of Physics and Engineering in Medicine, Corporate Member
2. Higher Education Academy, Fellow
3. Health and Care Professions Council (HCPC), Registered Clinical Scientist
4. HEE/NIHR ICA Clinical Doctoral Research Fellowship Panel, Member

5. M.Sc./Pg.Dip. programmes in Medical Physics and Medical Imaging, University of Aberdeen, Programme Co-ordinator.
6. University of Aberdeen, Radiation Hazards Sub-committee, Chair
7. Scottish Imaging Network: A Platform for Scientific Excellence (SINAPSE), Member
8. University of Glasgow, MSc in Medical Physics, External Examiner.
9. University of Aberdeen, School of Medicine, Medical Sciences and Nutrition, Academic Line Manager.

Dr Gordon D Waiter

1. Aberdeen Biomedical Imaging Centre, Acting Director (from Oct 2018)
2. Institute of Physics, Member
3. Institute of Physics and Engineering in Medicine (MIPeM), Corporate member
4. Health and Care Professions Council (HCPC), Registered Clinical Scientist.
5. SINAPSE Executive Committee, Aberdeen representative
6. SINAPSE Image Analysis Group, Lead
7. College of Life Sciences and Medicine Ethical Review Board (CERB), Deputy Chair
8. MR Responsible Person, University of Aberdeen
9. Honorary Clinical Scientist and MR Safety Expert, NHS Grampian
10. MSc in Medical Physics/Imaging: MR Imaging, course co-ordinator and lecturer (BP5503); Medical Image Processing (BP5505) Lecturer, Biomedical and Professional Topics in Healthcare Science (BP5003) Lecturer.

Dr Hugh Seton

1. MR Responsible Person for 4.7T preclinical MRI system, University of Aberdeen
2. MSc in Medical Physics/Imaging: IMAGING IN MEDICINE, course co-ordinator and lecturer (BP5005) MR Imaging, lecturer (BP5503).
3. Exams co-ordinator for MSc programmes in SMMSN.
4. Musculoskeletal Programme Executive Group, Member

Dr Jiabao He

1. International Society for Magnetic Resonance in Medicine, Member
2. International Society for Magnetic Resonance in Medicine British Chapter, Member
3. European Society for Magnetic Resonance in Medicine & Biology, Member
4. Biomedical Physics: MSc in Medical Physics, lecturer.
5. Course Co-ordinator, MBChB Year 4 Student Selected Component, Institute of Medical Sciences, University of Aberdeen

Dr Ian Fleming

1. Programme coordinator & lecturer BT3006, Working out: Placement & career skills
2. Programme coordinator BT5007, MSci Industrial Placement
3. Course coordinator & lecturer BP5003, Medical Physics/Medical Imaging
4. Course coordinator & lecturer PA3802, Pharmacology: Mechanisms of disease and principles of chemotherapy
5. Positive Outcomes Task Force (SMMSN representative).
6. Industry Liaison Group (member)
7. Coordinator IMS Hotstart programme
8. Student Support Group Committee (member)
9. Principle Investigator IMS Molecular Imaging laboratory
10. Radiation Protection Supervisor in IMS

All academic staff participate in the Personal Tutor Scheme for undergraduate students at the University of Aberdeen providing general support to students in matters such as achievement of the Graduate Attributes, Employability, Co-curricular opportunities and feedback as well as a pastoral support role.

The radiographic staff are actively encouraged to participate in departmental research, undertake a further qualification and during the upgrade of the MRI scanner a significant effort was made to engage in continuing professional development.

Mrs Beverly MacLennan

1. MRI Lead Superintendent Radiographer, University of Aberdeen & NHS Grampian
2. Aberdeen Biomedical Imaging Centre executive committee, University of Aberdeen, member
3. Radiology MRI Modality Group, NHS Grampian, member
4. Plain Film Orbit Reporting prior to MRI- referrer and reporting radiographer
5. Society of Radiographers, Professional Member
6. Health and Care Professions Council (HCPC), Registered Diagnostic radiographer
7. PgC Health Studies (Clinical Practice) University of Dundee
8. PgC Clinical Reporting (MRI-General Investigations) Canterbury Christchurch University
9. Reporting Radiographer, NHS Grampian (MRI-MSK imaging) including vetting of MSK MRI requests
10. MSc (Merit) Medical Imaging, Queen Margaret University

Continuous Professional Development during scanner upgrade

- Attended EPAD/SINAPSE Conference, King College, University of Aberdeen, Aug 2019
- Attended Prostate Imaging Study Day, Glasgow, Sept 2019
- 3 day visit to Cardiac Imaging Department, Royal Brompton Hospital Trust, London, Sept 2019
- Philips Users Meeting Study day, Manchester, Nov 2019
- Philips Applications training, Dec 2019.
- Provide support to clinical NHS MRI service
- Provide clinical support to UoA FFC facility

Mrs Nichola Crouch

1. Research MRI radiographer, University of Aberdeen & NHS Grampian
2. Plain Film Orbit Reporting prior to MRI- referrer and reporting radiographer
3. Society of Radiographers, Professional Member
4. Health and Care Professions Council (HCPC), Registered Diagnostic radiographer
5. MSc. Imaging (with distinction) at University of Edinburgh
6. Adviser role with FFC MRI Group
7. Vetting of specific neuroradiology MRI requests - from Dec 2019
8. Supervise and oversee student visits

Continuous Professional Development during scanner upgrade

- Attended EPAD/SINAPSE Conference, King College, University of Aberdeen, Aug 2019
- Attended Prostate Imaging Study Day, Glasgow, Sept 2019
- 3 day visit to Cardiac Imaging Department, Royal Brompton Hospital Trust, London, Oct 2019
- MR Interest Group Study Day, Edinburgh, Oct 2019
- Philips Users Meeting Study day, Manchester, Nov 2019
- Philips Applications training, Dev 2019.
- Provided support to clinical NHS MRI service
- Provide clinical support to UoA FFC facility
- Practice Educator Training Day - RGU

Mr Michael Hendry

1. Research MRI Radiographer, University of Aberdeen & NHS Grampian
2. Society of Radiographers, Professional Member
4. Health & Care Professions Council (HCPC), Registered Diagnostic Radiographer
5. Plain Film Orbit Reporting prior to MRI- referrer and reporting radiographer
6. CPR Cascade trainer, NHS Grampian

Continuous Professional Development during scanner upgrade

- Attended Neuro-anatomy course, London, July 2019

- Attended EPAD/SINAPSE Conference, King College, University of Aberdeen, Aug 2019
- 3 day visit to Cardiac Imaging Department, Royal Brompton Hospital Trust, London, Aug 2019
- Attended Prostate Imaging Study Day, Glasgow, Sept 2019
- Philips Applications training, Nov 2019
- Provided support to clinical NHS MRI service

Miss Laura Reid

1. Research MRI Radiographer, University of Aberdeen & NHS Grampian
2. NHS Grampian Key Handler for Moving & Handling
3. Society of Radiographers, Professional Member
4. Health & Care Professions Council (HCPC), Registered Diagnostic Radiographer
5. MRI In Practice Course, Essential Guide to Philips in MRI
6. Plain Film Orbit Reporting prior to MRI- referrer and reporting radiographer

Continuous Professional Development during scanner upgrade

- Attended EPAD/SINAPSE Conference, King College, University of Aberdeen, Aug 2019
- Philips Applications training, Nov 2019

PhD STUDENTS

Mr Ahmad Tawfiq Alenezi originally started his PhD in May 2018 under the supervision of Prof Matteo Zanda. Following Prof Zanda's departure in December 2018, it took a couple of months to find a new project and supervisor. He commenced his current PhD entitled "Investigating synchrony and entropy parameters derived from nuclear ventriculography to predict cardiotoxicity in breast cancer patients" in March 2019. Supervisors - Prof Andy Welch, Dr Fergus McKiddie & Dr Mintu Nath.

Ms Nora Almuqbil commenced her PhD in October 2018 entitled "Radiomic Analysis of PET Hypoxia Markers" and is in her second year. Supervisors - Prof Andy Welch, Dr Fergus McKiddie & Dr Mintu Nath.

Dr Gabriel Cheung graduated in Spring 2019. He then moved to a research fellow position funded by Cancer Research UK from May 2019 on a grant awarded to Dr Jiabao He.

Ms Clarisse de Vries submitted her PhD entitled "Early Life Determinants of Brain Structural and Functional Connectivity and Relationship with Cognitive and Depressive Outcomes" in September 2019, undertaking her VIVA in December 2019. She will formally graduate in June 2020. She was appointed to a research assistant position funded for 3 months from NHSG Endowments to work on development of a graphic user interface (GUI) for resting state entropy in November 2019. Following this she will move to a research fellow position on the iCAIRD project from February 2020. Supervisors – Prof Alison Murray and Dr Roger Staff.

Ms Mina Khezrian is in Year 3 of her PhD entitled "Investigating the Role of Polypharmacy in Brain Ageing, and Cognitive, Physical and Emotional Impairment in Three Well Characterised Cohort Studies in Aberdeen". She is completing her studies off campus due to family reasons but has regular skype calls with her supervisors. Supervisors: Prof Alison Murray, Dr Chris McNeil and Prof Phyo Myint.

Mr Philipp Loske is in Year 2 of his PhD entitled "Using Brain Network Models to Improve Diagnostic Accuracy of Behavioural Variant of Frontotemporal Dementia and Alzheimer's Disease and Predicting Determinants of Treatment Response to LMTM" and is funded by Medical Research Scotland and TauRx. Supervisors: Dr Vesna Vuksanovic, Prof Alison Murray and Dr Gordon Waiter.

Mr Naif Majrashi is in Year 3 of his PhD entitled "Lifespan Model of Photo-Induced Neural Plasticity" and is funded by the Saudi Cultural Bureau. Supervisors: Dr Gordon Waiter, Dr Anca Sandu-Giuraniuc and Dr Trevor Ahearn.

Miss Vasilki Mallokouarti is in Year 4 of her PhD entitled "Development and Translation of Advanced Non-Invasive Metabolite Profiling Methods in Breast Cancer Using Magnetic Resonance Spectroscopy (MRS)" funded

by a Princess Royal Tenovus Scotland Medical Research Scholarship award to Dr He. She is due to submit towards September 2020. Supervisors: Dr Jiabao He and Prof David Lurie.

Dr Rosalind Mitchell-Hay commenced her PhD study in August 2019 on a part-time basis while working as a consultant radiologist, with a title of “Developing Imaging Biomarkers in Rectal Cancer”. Supervisors: Professor Alison Murray, Dr David McLernon and Dr Trevor Ahearn.

Ms Nafessa Nazlee commenced her PhD studies in May 2019 entitled “Brain cortical complexity and its association with cognitive performance and life-course factors across adulthood.” Nafeesa is partly self-funded with a grant from RSAT contributing to her project expenses. Supervisors: Dr Anca Sandu-Giuraniuc and Dr Gordon Waiter.

Mr Nicholas Payne formally graduated in June 2019 and initially worked in Kings College London, before moving to University of Cambridge, working as a medical physicist on the “Breast Screening – Risk Adaptive Imaging for Density” (BRAID) trial headed by Professor Fiona Gilbert.

Mr Nick Senn completed his PhD entitled “Development of Non-invasive Advanced Diffusion Magnetic Resonance Imaging Method for Human Skeletal Muscle”, submitting in September and undertook his VIVA in October. He has moved to a research assistant/fellow post with Prof Lurie in the FFC team until April 2020. He will formally graduate in June 2020. Supervisor – Dr Jiabao He & Prof David Lurie.

Mr Shaun Stone is in the writing up phase of his PhD supported by funding from SINAPSE and IXICO entitled “Prediction Models of Dementia Risk from Brain MR Images and Proxies of Cognitive Reserve”. He was awarded a 6 month extension during 2019 and should submit by end March 2020. Supervisors: Prof Alison Murray, Dr Gordon Waiter and Dr Anca Sandu-Giuraniuc.

Mr Robert Stormont continues his part-time PhD entitled “Radiofrequency coils for Fast Field-Cycling MRI” while working from GE Healthcare in the United States. Supervisor: Prof David Lurie.

Mr Shalendra Tripathi is in Year 3 of his PhD entitled “A study of Machine Learning analysis of brain FDG PET as a predictor of treatment response and progression in patients with Alzheimer’s dementia (AD)” Supervisors: Prof Alison Murray, Dr Bjoern Schelter, Prof Claude Wischik.

Ms Jennifer Waymont is in Year 4 of her PhD entitled “Automated detection of brain lesions in the Aberdeen Children of the 1950s and analysis of lifecourse determinants” funded initially University of Aberdeen Development Trust, then by TauRx. She hopes to submit in Spring 2020. Supervisors: Dr Gordon Waiter, Prof Alison Murray and Dr Chris McNeil.

Over the summer of 2019 the Lilian Sutton Building hosted one University of Aberdeen funded Hotstart student, **Ms Farah Bassem Alabed**, who worked with Mrs Mina Khezrian and Dr Chris McNeil for 6 weeks. Farah worked on this short project entitled “*Medication use and cognitive function in the Aberdeen 1936 Birth Cohort*” about taking medications and their effect on cognitive function using ABC36 data. Farah started her project with literature review around the topic. She then estimated the association between the exposure to different classes of medications including anticholinergics, PPIs and HRTs and subsequent cognitive function in cohort members. Farah applied various statistical and analytical techniques including descriptive analysis to compare the demographics, socioeconomic status and health conditions, data reduction techniques and linear regressions. The preliminary results showed a positive association between taking HRT and cognitive function at age 68 years. In addition, taking PPIs at wave three of the study, age 68 years, was associated with poorer cognition in this population. However, this association was not significant after adjusting for confounders. More analyses are required to further investigate the preliminary results found in this project. ABC36 dataset could be used to test these hypotheses further in the future.

PUBLICATIONS

Lorgen-Ritchie M, **Murray AD**, Ferguson-Smith AC, Richards M, Horgan GW, Phillips LH, Hoad G, Gall I, Harrison K, McNeill G, Ito M & Haggarty P. Imprinting methylation in *SNRPN* and *MEST1* in adult blood predicts cognitive ability. 2019 Feb 1;14(2):e0211799 DOI: 10.1371/journal.pone.0211799. PMID: 30707743.

Johnston M, Butler J, Clark H, Locock L, **Murray A**, Robertson L, **Chapko D**, Hannaford P, Iversen L, Skea Z, Black C. Co-design of data collection with participants of the Aberdeen Children of the 1950s cohort study. *International Journal of Population Data Science* (2019). DOI <https://doi.org/10.23889/ijpds.v4i3.1220>

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Waymont JMJ, Petsa C, **McNeil CJ**, **Murray AD**, **Waiter GD**. Validation and comparison of two automated methods for quantifying brain white matter hyperintensities of presumed vascular origin. *J Int Med Res*. 2019 Oct 15:300060519880053. doi: 10.1177/0300060519880053. [Epub ahead of print]

Clark D, Okada Y, Moore K, Mason D, Pirastu N, Gandin I, **Murray AD** et al. Associations of autozygosity with a broad range of human phenotypes. Accepted by *Nature Communications*. September 2019

Frangou S, Shirali M, Adams M, Howard D, Gibson J, Hall L, Smith B, Padmanabhan S, **Murray A**, Porteous D, Haley C, Deary I, Clarke TK, McIntosh A. Insulin resistance: Genetic associations with depression and cognition in population-based cohorts. *Experimental Neurology*, Vol. 316, 06.2019, p. 20-26.

COGENT-Kidney Consortium; Bentley AR, SungYJ, Brown MR, Winkler TW, Kraja AT, Ntalla J, Schwander K, Chasman DI, Lim E, Deng X, Guo X, Liu J, Lu Y, **Murray AD**, et al. Multi-ancestry genome-wide gene-smoking interaction study of 387,272 individuals identifies novel loci associated with serum lipids. *Nature Genetics*, Vol. 51, No. 4, 04. 2019, p. 636-648.

Kilpeläinen TO, Bentley AR, Noordam R, Sung YJ, Schwander K, Winkler TW, Jakupović H, et al. Multi-ancestry study of blood lipid levels identifies four loci interacting with physical activity. *Study, Lifelines Cohort. Nature Communications*, Vol. 10, No. 1, 376, 22.01.2019.

Hamilton O, Zhang Q, McRae A, Walker R, Morris S, Redmond P, Campbell A, **Murray A**, Porteous D, Evans K, McIntosh A, Deary I, Marioni R. An epigenetic score for BMI based on DNA methylation correlates with poor physical health and major disease in the Lothian Birth Cohort. *International Journal of Obesity*. 2019 Mar 6. doi: 10.1038/s41366-018-0262-3.

Shrine N, Guyatt A, Mesut Erzurumluoglu A, Jackson V, Hobbs B, Melbourne C, Batini C, Fawcett K, **Murray AD** et al. New genetic signals for lung function highlight pathways and chronic obstructive pulmonary disease associations across multiple ancestry. *Nature Genetics*. 2019 March; 51(3): 481–493. doi:10.1038/s41588-018-0321-7.

Zhang Q, Vallerga CL, Walker RM, Lin T, Henders AK, Montgomery GW, **He J**, Fan D, Fowdar J, Kennedy M, Pitcher T, Pearson J, Halliday G, Kwok JB, Hickie I, Lewis S, Anderson T, Silburn PA, Mellick GD, Harris SE, Redmond P, **Murray AD** et al. Improved precision of epigenetic clock estimates across tissues and its implication for biological ageing. *Genome Research* 2019 Aug; 11 Article number: 54 DOIs: 10.1186/s13073-019-0667-1

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Vuksanovic V. Cortical Thickness and Functional Networks Modules by Cortical Lobes. *Neuroscience* 2019. 423: 172-176.

Shiells H, Schelter BO, Baddeley TC, Rubino CM, Ganesan H, Hammel J, **Vuksanovic V**, Staff R, **Murray AD**, Bracoud L, Riedel G, Gauthier S, Jia J, Bentham P, Moebius H, Hardlund J, Kipps CM, Kook K, Storey JMD, Harrington C and Wischik CM. Concentration-dependent activity of hydromethylthionine on clinical decline and brain atrophy in a randomized controlled trial in behavioural variant frontotemporal dementia (bvFTD) *Journal of Alzheimer's Disease* 2020 (in press).

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de Vries CF, Staff RT, **Waiter GD**, Sokunbi MO, **Sandu AL**, **Murray AD**. Motion during Acquisition is Associated with fMRI Brain Entropy. *IEEE J Biomed Health Inform.* Accepted March 2019. DOI: 10.1109/JBHI.2019.2907189. PMID: 30946681. 2020 Feb;24(2):586-593.

Gibson J, Russ TC, Clarke T-K, Howard DM, Hillary RF, Evans KL, Walker RM, Bermingham ML, Morris SW, Campbell A, Hayward C, **Murray AD**, Porteous DJ, Horvath S, Lu AT, McIntosh, AM, Whalley HC & Marioni, RE. A meta-analysis of genome-wide association studies of epigenetic age acceleration. Nov 2019, In : *PLoS Genetics*. 15, 11, e1008104.

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PRESENTATIONS

Johnston M, Butler J, Clark H, Locock L, **Murray AD**, Robertson LM, Chapko D, Hannaford P, Iversent L, Skea Z, Black Ci. Co-design of data collection with participants of the Aberdeen Children of the 1950s cohort study. Administrative Data Research Conference, Cardiff, December 2019.

Khezrian M, Waymond J, McNeil C, Myint P, Staff R, Whalley L, **Murray AD**. Aspirin moderates the association between WMH total lesion volume and processing speed in normal ageing. SINAPSE Annual Scientific Meeting Dundee 21st June 2019.

McNeil C, Waymont J, Sandu-Giuraniuc A, Waiter GD, Murray AD. Life-course factors affecting brain health in older people. SINAPSE Meeting Dundee 21st June 2019.

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MacLeod M-J, Ross JP, Guzman-Gutierrez G, **Lurie DJ, Broche LM,** "Imaging of acute stroke by FFC-MRI: the PUFFINS study", COST Action AC15209 2nd Workshop of Nuclear Magnetic Resonance Relaxometry, Prague, Czech Republic, February 2019.

Davies GR, Broche LM, Gagliardi T, **Lurie DJ, Ross PJ,** "Bilateral breast coil for Fast Field-Cycling relaxometric MRI", ISMRM 27th Annual Meeting, Montreal, Canada, May 2019.

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Ross PJ, Broche LM, MacLeod MJ, Guzman-Gutierrez G, **Murray AD, Lurie DJ,** "Fast Field-Cycling MRI identifies ischaemic stroke at ultra-low magnetic field strength", 11th Conference on Fast Field-Cycling NMR Relaxometry, Pisa, Italy, June 2019.

Broche LM, Ross PJ, Davies GR, MacLeod MJ, Masannat Y, Leslie S, Bhatt P, Berger F, Lahrech H, **Lurie DJ,** "First clinical studies with FFC-MRI: Early results", 11th Conference on Fast Field-Cycling NMR Relaxometry, Pisa, Italy, June 2019.

Kruk D, Masiewicz E, Borowska A, **Broche LM, Lurie DJ.** "What do we know about ¹⁴N quadrupole relaxation enhancement?", 11th Conference on Fast Field-Cycling NMR Relaxometry, Pisa, Italy, June 2019.

Lurie DJ, Broche LM, Davies GR, MacLeod MJ, **Ross PJ.** "MRI basics and research on Fast Field-Cycling MRI", AMPERE NMR School, Zakopane, Poland, June 2019.

Broche LM, Ross PJ, Davies GR, MacLeod MJ, **Lurie DJ,** "Imaging molecular dynamics using Fast Field-Cycling MRI", World Molecular Imaging Congress, Montreal, Canada, September 2019.

Broche LM, Ross PJ, Davies GR, Lurie DJ. "Fast Field-Cycling MRI for molecular dynamics imaging", ESMRMB 36th Annual Meeting, Rotterdam, Netherlands, October 2019.

Ross PJ, Broche LM, MacLeod MJ, **Lurie DJ.** "Fast field-cycling MRI identifies ischaemic stroke at ultra-low magnetic field strength", ESMRMB 36th Annual Meeting, Rotterdam, Netherlands, October 2019.

Mallikourti V, Cheung SM, Gagliardi T, Masannat Y, Heys SD, **He J.** Optimal phased-array signal combination for the measurement of polyunsaturated fatty acids in breast cancer using multiple quantum coherence MR spectroscopy at 3T. BCISMRM (Sheffield, UK) 2019.

Senn N, Masannat Y, Husain E, Siow B, Heys SD, **He J.** Q-space imaging is more sensitive to breast tumour heterogeneity than conventional diffusion MRI. ESMRMB (Rotterdam, Netherlands) 2019.

Cheung SM, Husain E, Masannat Y, Miller ID, Wahle K, Heys SD, **He J.** Non-invasive measurement of lactate concentration in whole human breast tumours using advanced magnetic resonance spectroscopy (MRS). ESMRMB (Rotterdam, Netherlands) 2019.

Cheung SM, Masannat Y, Husain E, **Mallikourti V,** Heys SD, **He J.** Lipid composition of whole breast tumour is associated with lymphovascular invasion (LVI). ESMRMB (Rotterdam, Netherlands) 2019.

Cheung SM, Masannat Y, Husain E, **Mallikourti V,** Heys SD, **He J.** Lipid composition is associated with lymphovascular invasion (LVI) and serotonin turnover in human breast tumours. SINAPSE (Dundee, UK) 2019 (Awarded Image Analysis Best Proffered Talk Prize).

Senn N, Masannat Y, Husain E, Siow B, Heys SD, **He J**. Multiparametric q-space imaging provides sensitive assessment of complex breast tumour heterogeneity. SINAPSE (Dundee, UK) 2019.

Mallikourti V, Cheung SM, Gagliardi T, Masannat Y, Heys SD, **He J**. Optimal multi-channel signal combination for the measurement of polyunsaturated fatty acids in breast cancer using multiple quantum coherence MR spectroscopy. SINAPSE (Dundee, UK) 2019.

Senn N, Masannat Y, Husain E, Siow B, Heys SD, **He J**. Q-space imaging is more sensitive to breast tumour skewness than conventional diffusion MRI. BCISMRM (Sheffield, UK) 2019.

Mallikourti V, Cheung SM, Gagliardi T, **Senn N**, Masannat Y, McGoldrick T, Sharma R, Heys SD, **He J**. Phased-array coil combination for lipid composition quantification using 2D correlation spectroscopy in breast cancer. BCISMRM (Sheffield, UK) 2019.

Mallikourti V, Cheung SM, Masannat Y, Gagliardi T, Heys SD, **He J**. Lactate detection in breast cancer using optimised multiple quantum coherence MR spectroscopy and effective phased-array coil combination. BCISMRM (Sheffield, UK) 2019.

Chan KS, **Cheung SM, Senn N**, Masannat Y, Husain E, Heys SD, **He J**. Lipid composition mapping in whole breast tumour. BCISMRM (Sheffield, UK) 2019.

Cheung SM, Mallikourti V, Masannat Y, Gagliardi T, Heys SD, **He J**. Deregulation of lipid metabolism in postmenopausal patients with breast cancer using double quantum filtered correlation spectroscopy (DQF-COSY). BCISMRM (Sheffield, UK) 2019.

Cheung SM, Husain E, Masannat Y, **Mallikourti V**, Heys SD, **He J**. Lipid composition in whole breast tumours using double quantum filtered (DQF) correlation spectroscopy (COSY) is associated with lymphovascular invasion (LVI). BCISMRM (Sheffield, UK) 2019.

Cheung SM, Husain E, Masannat Y, Wahle K, Heys SD, **He J**. Polyunsaturated fatty acids (PUFA) reduction in high serotonin turnover breast tumour using advanced magnetic resonance spectroscopy (MRS). BCISMRM (Sheffield, UK) 2019.

Cheung SM, Husain E, Masannat Y, Wahle K, Heys SD, **He J**. Non-invasive measurement of lactate concentration in multiple quantum coherence (MQC) magnetic resonance spectroscopy (MRS) is associated with breast cancer grading. BCISMRM (Sheffield, UK) 2019.

Cheung SM, Husain E, Masannat Y, Wahle K, Heys SD, **He J**. Polyunsaturated fatty acids (PUFA) depletion is associated with high serotonin turnover in human whole human breast. ESMRMB (Rotterdam, Netherlands) 2019.

Mallikourti V, Cheung SM, Gagliardi T, Masannat Y, Heys SD, **He J**. Optimal multi-channel signal combination for the measurement of polyunsaturated fatty acids in breast cancer using multiple quantum coherence MR spectroscopy. ESMRMB (Rotterdam, Netherlands) 2019.

Senn N, Masannat Y, Husain E, Siow B, Heys SD, **He J**. Q-space imaging is more sensitive to breast tumour heterogeneity than conventional diffusion MRI. SINAPSE (Dundee, UK) 2019.

Cheung SM, Husain E, Masannat Y, Wahle K, Heys SD, **He J**. Non-invasive measurement of lactate concentration in whole human breast tumours using advanced magnetic resonance spectroscopy (MRS). SINAPSE (Dundee, UK) 2019.

BOOK CHAPTERS

Welch A, Pimlott S, Tavares A & Sutherland A. "*PET and SPECT in Drug Development*" in *Burgers Medicinal Chemistry, Drug Discovery and Development*, 8th Edition In-Press.

INVITED LECTURES

Sandu AL. "Cortical complexity and functional connectivity: potential resilience factors for dementia" presented in "Neuroimaging in diseases that cause dementia" Invited lecture, SINAPSE/EPAD Conference, Aberdeen, August 2019.

Waiter GD. "Neuroimaging in diseases that cause dementia" Invited lecture SINAPSE/EPAD Conference, August 2019.

Waiter GD. "Using population based imaging repositories". NHS Radiology Postgraduate Teaching Seminar, November 2019.

Vuksanovic V. "Organisation of cortical morphometric similarity networks in health and neurodegenerative disorders". Interdisciplinary Seminar Series, Institute for Complex Systems and Mathematical Biology, UoA, November 2019.

PUBLIC ENGAGEMENT

29 January 2019. The History, Physics, Applications and Future of Magnetic Resonance Imaging: talk by David Lurie.

18 April 2019. Stuff Worth Knowing: The Science of Magnetic Resonance Imaging. Professor David Lurie gave an interactive lecture, hosted by the Aberdeen Science Centre.

20 April – 16 June 2019. Immobile Choreography, by Beverley Hood.
Edinburgh based artist Beverley Hood was commissioned by Grampian Hospital Arts Trust to work with The University of Aberdeen team who are leading the research project, IDentIFY.

23 April – 16 June 2019.

From Where Do We See? Craft Skills and Aesthetics in MRI: Public Exhibition by Dr Silvia Casini. Held in the Small Gallery, Aberdeen Royal Infirmary.

Further information about both exhibitions available at <https://www.abdn.ac.uk/news/opinion/the-art-of-mri/>

11 June 2019 - Professor David Lurie gives the IPEM John Mallard Lecture at the UK Imaging and Oncology Congress (UKIO). President Professor Mark Tooley presented Professor David Lurie with his certificate for the John Mallard lecture at [UKIO2019](#)

17 June 2019 - CORDIS coverage of the IDentIFY project, in six languages.

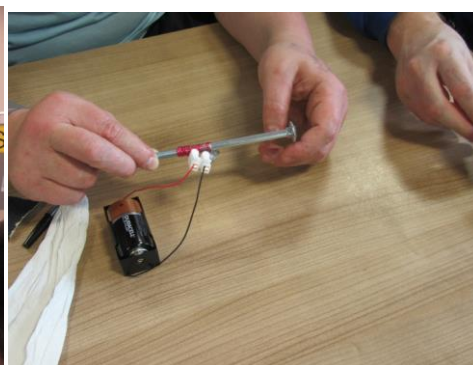
A novel full-body scanner will help revolutionise cancer diagnosis. [View the full article](#)

Un nouveau scanner du corps entier contribuera à révolutionner le diagnostic du cancer

Des scientifiques ont développé un nouveau type de technique d'imagerie par résonance magnétique (IRM) afin de fournir aux médecins plus d'informations fiables sur le cancer du sein.



11 July 2019 - Professor David Lurie and Dr James Ross lead a series of workshops exploring magnetism, MRI and FFC in HMP Grampian, as part of the Cell Block Science programme.



The pair explained the fundamentals of MRI, and of electromagnetism. They helped inmates build their own electromagnets. The engagement was superb and the feedback excellent.

CURRENT GRANTS

Proving the Utility of Fast Field Cycling MRI in stroke and small vessel disease (PUFFINS) Macleod MJ, **Lurie DL, Broche L, Murray AD, Waiter GD**, Levi R, Oren N, Guttzman-Guterriez G. Chief Scientist Office £299,590 (TCS/19/14) April 2020 – March 2023.

Industrial Centre for Artificial Intelligence in Digital Diagnostics (iCAIRD). Universities of Glasgow, **Aberdeen**, Edinburgh, St Andrews, Canon Medical Research Europe, Philips Healthcare. Innovate UK £15,000,000 Jan 2019-Dec 2021.

Does nutritional intervention preconception and during pregnancy result in measurable brain differences in children using brain MRI? **Murray AD, Chapko D**, Black C, Williams J, Waiter G, Fall C, Sahariah S et al. GCRF-IPPF £10,000 Jul 2018-Dec 2019.

Early-life origins of brain resilience to mental illness and cognitive impairment across the life-course. **Murray AD**, Fall C, Kalyanaraman K, Fall C, Bhattacharya S, Williams J, **Waiter G**, Lee A, Wallace C, Coghill G, Hornberger M, Chandak G, Sahariah S, Gandhi M. Medical Research Council, £192,240.40, 2018-2019.

PET Imaging in Drug Design and Development (PET3D). Zanda M, **Morris T, Welch A, Murray AD**, Dall'Angelo. European Commission (675417 PET3D). Euros 1,009,310 approx £746,889, 2016-2020.

Delineating the neural mediators of rheumatoid arthritis related fatigue. Basu N, **Waiter GD**, Ralston S, **Murray AD**, Wardlaw J, Wiseman S, Emsley R. Chief Scientist Office. £278,850 2017-2020. Ref: TCS/17/14.

Prediction models of dementia risk from brain MR images and proxies of cognitive reserve. **Murray AD**, Wardlaw J, Staff RT, Ritchie C, Wolz R. Seed funded PhD studentship SINAPSE and IXICO, £60,000 Sept 2016 – Aug 2019.

Improving diagnosis by fast field-cycling MRI (IDENTIFY). **Lurie DJ, Murray AD**, Heys S, Brittenden J, Ashcroft AP. European Commission (668119 IDentIFY) Euros 6,597,377.50 approx £4,618,164, 2016-2019.

Stratifying Resilience and Depression Longitudinally (STRADL). McIntosh A, Porteus D, Deary I, Evans K, Seckl J, Wardlaw J, **Murray AD**, Lawrie SM, Haley CS. Wellcome Trust Grant no. 104036/Z/14/Z, £4,787,640, 2015-2019.

Scottish Imaging Network: A Platform for Scientific Excellence (SINAPSE) Phase 2. Wyper D, Wardlaw J, **Murray AD**, Muir K, Lerski R, O'Connor A, Donaldson D. Scottish Funding Council, £625,000, 2015-2019.

Brain flexibility: A potential non-invasive biomarker for resilience to dementia. **Vuksanovic V, Staff R, Murray AD**. Roland Sutton Academic Trust, £118,426, 2019-2020.

Role of Polypharmacy in brain ageing: cognitive, clinical and emotional impairment in three well characterised ageing cohorts in Aberdeen. **Murray AD**, Myint P, **Khezrian M**. The Morningfield Association Aberdeen. £15,000, Oct 2018-Sep 2019.

Is cortical complexity a measure of cerebral reserve against dementia? **Sandu Giuraniuc AL, Waiter GD, Murray AD**. Alzheimer's Research UK, junior member small grant, £1,950, Mar 2017-Feb 2019.

A pilot study to identify the earliest brain imaging predictors of cognitive decline. **Sandu Giuraniuc AL, Waiter GD, McNeil C, Habota T, McIntosh A, Murray AD**. TENOVUS Scotland, £11,616, Mar 2018- Feb 2019.

Brain functional connectivity networks and resilience to cognitive decline in late-midlife: The influence of biological and life-course factors." **Sandu-Giuraniuc A, Murray AD, Waiter G**. Roland Sutton Academic Trust. £116,465, Jun 2019-Dec 2021.

Brain cortical complexity: a support package for a self-funded PhD student" **Waiter GD, Sandu-Giuraniuc A**. Roland Sutton Academic Trust, £9,000, May 2019-Apr 2022.

Delineating the neural predictors of fatigue in axial spondyloarthritis (AxSpa). **Waiter GD, Basu N & Murray AD**. NHS Grampian Endowments. £11,966. Apr 2018-Mar 2019.

Using Brain Network modules to improve diagnostic accuracy of behavioural variant of frontotemporal dementia and alzheimer's disease and predicting determinants of treatment response to LMTM. **Waiter GD, Murray AD, Vuksanovic V**. MRS/TauRx funded PhD Studentship – P. Loske. £93,912/£10,000 1/10/2018 to 30/09/2022.

Brain imaging predictors of cognitive ability - a multimodal investigation. **Murray AD, van Beek E, Muir K, Sandu-Giuraniuc AL** and Dickie D. £80,000, EASTBIO BBSRC Doctoral Training Partnership, Oct 2018-Sept 2021.

Identifying Fatigue biomarkers in rheumatoid arthritis using multi-modal neuroimaging. **Waiter GD, Basu N**. £54,199, Roland Sutton Academic Trust. 2018-2019.

Automated Detection and Analysis of Brain White Matter Hyperintensities in Healthy Ageing and in Alzheimer's Disease (PhD Studentship J Waymont) **Waiter GD, Murray AD**. £46,517, TauRx Therapeutics, Jan 2018- Mar 2020.

Template based Automatic Analysis of Age Related White Matter Change. **Waiter GD**. £18,800, Roland Sutton Academic Trust. Jan 2017-Jun 2019.

Altered organisation of cholinergic and default mode brain networks in Alzheimer's disease. **Vuksanovic V, & Staff RT**. £1,800, ARUK (small grant) 2019.

Circulating Retinol binding protein 4 and cognitive health in an ageing cohort from NE Scotland. **McNeil C, McCaffrey P**. £3000, ARUK, 2019.

Non-invasive mapping of lipid and metabolite profiles in breast cancer: translational development of advanced multi-dimensional Magnetic Resonance Spectroscopic Imaging (MRSI) methods. **He J, Wahle K, Masannat Y, Husain E**. Princess Royal Tenovus Scotland Medical Research Scholarship. £80,000, 2016-2020.

Development of quantitative microstructure measurement method using diffusion MRI for the application in human heart and breast cancer. **He J**. BBSRC EastBio Studentship. £80,000. 2015-2019.

Is lipid composition mapping using magnetic resonance imaging an effective early detection tool for breast cancer in high risk populations? **He J, Miedzybrodzka Z, Masannat Y, Gagliardi T**. Cancer Research UK. £72,085, 2019-2020.

Can dietary nitrate halt the aerobic glycolysis (AG) in locally advanced breast cancer? **He J, Gagliardi T, Masannat Y, Husain E, Sharma R**. NHS Grampian Endowments. £11,936, 2019-2020.

Hypoxia PET CT Imaging in Cancer. Laws K, **Fleming IN, Dall'Angelo S**. Friends of Anchor Fellowship £144,403, 2016-2019.

Detection of hypoxia in non small cell lung cancer with 18F FMISO PET/CT. **Fleming IN**, Dall'Angelo S, Samuel L. NHS Grampian Endowments. £11,634. 2017-2019.

Evaluating ability of a novel paclitaxel conjugate to selectively target AVB3 integrin expressing cancer cells and inhibit cell invasion/migration. **Fleming IN**. Friends of Anchor. £9,700. 2017-2019.

Characterisation of cytotoxic T Lymphocyte antigen 4 (CTLA-4) expression and function in tumour cells. Ward FJ, **Fleming IN** & Abu Eid R. Tenovus Scotland £11,990. 2018-2019.

Hypoxia in non small cell lung cancer: Molecular, translational and clinical study. **Fleming IN**. NHS Grampian Endowments. £15,000. 2018-2021.

Hypoxia in Non Small Cell Lung Cancer: Molecular, Translational and Clinical Study (PhD Studentship - A Mohan) **Fleming IN**. NHS Grampian Endowments. £30,000. 2018-2021.

End of Report