SINAPSE

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Evidence for the Independent Review of SFC's Research Pooling Initiative

SINAPSE (Scottish Imaging Network: A Platform for Scientific Excellence) is the pooling group for **medical imaging** research, comprising seven universities (Aberdeen, Dundee, Edinburgh, Glasgow, St Andrews, Stirling, and Strathclyde) and NHS Scotland as its partner institutions. SINAPSE is unique as the only pooling group that directly involves the NHS.

Section 1: Initial research pooling initiative

Q1a. What has been the impact of the initial research pooling initiative?

Across 11 years of developing and strengthening partnerships in the Scottish medical imaging community, SINAPSE has supported the sharing of expertise and best practice between centres, and the building of capacity through collaborations between NHS, academia, and industry.

- **Collaborative work**: SINAPSE Founding Director, Prof Joanna Wardlaw, attests that "*prior to SINAPSE, there were disparate fragmented medical imaging research facilities but few research imaging staff, few PhDs or industry collaborations, and few major grants attracted to Scotland that involved medical imaging research. Scotland is now seen internationally as a 'go to' place for medical imaging research*."

  The difference the research pooling initiative caused was for major Scottish universities—those with imaging facilities and with users of imaging—to pull together into a cohesive group, creating a national research imaging 'engine'. This enabled Scotland to attract and retain, in the first two years of SINAPSE, more than 30 senior (chair) and midlevel research imaging staff across several relevant disciplines, establishing a vibrant collaborative network with a clear focus on high quality impactful medical imaging research and career development. That momentum has continued, and SINAPSE now hosts the largest group of senior academic imaging researchers in the UK.

  SINAPSE has been effective at fostering collaborative work because its founders instilled a highly collaborative approach and put in place strategies for minimizing institutional effects – e.g., meetings rotated between centres, extensive use of videoconferencing, and insistence on PhD student supervision at more than one institution. Additionally, as specialised research imaging infrastructure is available only within a small number of centres, supporting collaborative work in turn leverages broadly distributed expertise and maximises outputs. Selected examples generated through SINAPSE include:

  - **SCOT-HEART**: a multicentre trial which showed a benefit of cardiac CT imaging in patients with chest pain (Newby et al., *Lancet*, 2015), leading to an update of

the relevant NICE guidelines. As demonstrated by this project, strong working relationships between SINAPSE imaging centres put Scotland at an advantage for multicentre studies.

- **Dementias Platform UK MR-PET Partnership**: an MRC-funded consortium for which University of Edinburgh was chosen to lead procurement of 5 state-of-the-art MR-PET scanners, to create a UK-wide dementia research imaging network. As demonstrated by this position of leadership, experience with multicentre purchases and cross-institutional collaborations through SINAPSE is noticed and valued by colleagues from different settings.

- **Training**: The SINAPSE Graduate School between the original six partner universities was established with financial support for 24 PhD studentships, a number eventually increased to 45 through match funding arrangements and subsequent funding bid success (SPIRIT and others). Scottish pools form the ideal vehicle for PhD training and were a forerunner of the current UKRI CDT/DTP model. The legacy of strategic investment in doctoral training through SINAPSE is evident in outcomes from its Graduate School studentships.

  - Several SINAPSE doctoral graduates stayed in Scotland and have since taken up advanced posts in imaging research within both academia and industry:
    Dr Adriana Tavares is now Head of the Preclinical PET/CT Laboratory at University of Edinburgh and supervisor of 5 PhD students.
    Dr David Dickie is now a Stroke Association Research Fellow at University of Glasgow carrying out the first clinical patient study on Scotland's first 7T clinical MRI scanner.
    Dr Shadia Mikhael is now a Clinical Researcher in the AI Research Team at Canon Medical Research Europe in Edinburgh.

  - A number of other SINAPSE doctoral graduates have expanded the impact of imaging research training in Scotland to a global scale:
    Dr Victoria Gradin is now in the process of establishing Uruguay's first fMRI centre at Universidad de la República.
    Dr Abdul Mumuni is now a Lecturer of Medical Physics and Biostatistics at University for Development Studies, Ghana, where he has developed a new undergraduate programme in Medical Imaging and was awarded the IUPAP Young Scientist Award in Medical Physics for 2017.

  In addition to coordinating formal postgraduate training in imaging-related disciplines, SINAPSE has helped to increase public awareness and understanding of imaging. Ten eLearning modules developed across SINAPSE centres, now freely available on the SINAPSE website, explain in non-technical ways how medical imaging techniques work and what they can be used for. Accounts to access these learning materials have been established to date by users from 22 countries worldwide.

  SINAPSE also provided PhD students with opportunities to develop strong scientific communication skills, producing doctoral graduates with an enduring commitment to public engagement. This was the case for STEM Ambassadors **Dr Ourania Varsou** and **Dr Michael Stringer,** two more exemplars whose training in the SINAPSE Graduate School has found them staying in Scotland for careers involving imaging research.

- **<u>Influencing policy and practice</u>**: SINAPSE organised a series of three seminars in 2010 on the topic of '*Brain Imaging and its Impact on Society*', through which a community for debate including academics, government, legal professions, ethicists and the lay public was developed, in order to understand how sections of society perceive and react to the implications arising from advances in neuroimaging. Several topics of general relevance were debated, including the use of brain scans for marketing, for recruitment of staff, or for legal purposes. This work was presented to MSPs at Holyrood, established links with key international groups working on similar topics, and produced several publications which have been widely cited.

  SINAPSE also initiated and led a UK-wide exercise to improve management of incidental findings detected during research imaging, involving 1) a workshop in 2010 supported by the Wellcome Trust, attended by imaging researchers from across the UK, ethicists, patient groups, professional, regulatory and funding bodies, and interested parties from other European countries, and 2) publication of a report by SINAPSE and the Royal College of Radiologists and a guidance document for use by Ethics Committees.

  Furthermore, SINAPSE has been instrumental in leading the development of UK and European clinical guidelines, such as Imaging in patients with dementia (British Society of Neuroradiology) and STandards for ReportIng Vascular changes on nEuroimaging (STRIVE; EC Joint Programme for Neurodegenerative Diseases research).

Q1b. What lessons can be learnt from the research pooling initiative?

- **<u>Interdisciplinarity</u>**: Although SINAPSE is not among the largest of Scotland's research pools, it leverages particular strengths in interdisciplinarity which benefit the wide medical imaging community across Scotland. Knowledge exchange activity in SINAPSE brings together researchers with backgrounds ranging across medicine, physics, psychology, chemistry, and computer science, and SINAPSE translates and disseminates key imaging excellence for the benefit of the NHS and Scottish industry. This strength also has facilitated partnership working between SINAPSE and fellow research pools, such as the cross-pool initiative on optical imaging in Scotland on which SINAPSE, SUPA, and SULSA are currently collaborating.
- The main problem encountered is that SINAPSE is not a legal entity, therefore any grant application, agreement or potential commercialization, has to be done through one of the partner institutions – this dampens the collaborative and sharing element.

<u>Section 2: Pooling now and in the future</u>

Q2a. In the current research landscape, what is the perception of, and role for, the pools?

- The research pooling model has been successful in raising the international profile of world-class research in Scotland, allowing for perception (and appreciation) by different research communities. For example, by serving as a representative body for medical imaging in Scotland, SINAPSE is well positioned to communicate research expertise which is distributed across the network. In 2015, the SINAPSE Director and Lead Scientist attended an RSE workshop in Taiwan to present work from 15 SINAPSE researchers, out of which a novel collaboration on diffusion MRI was developed with **Prof Wen-Yih Isaac Tseng** at National Taiwan University. Although the delegation from

Scotland also included several individual researchers, only the pooling group representation (covering more than a dozen areas for potential collaboration) resulted in a lasting relationship with researchers from Taiwan; this has led to further funding, exchange visits by researchers from two SINAPSE partner universities, and joint publications now in preparation.

SINAPSE has been involved in attracting large international scientific events to Scotland, including the 2015 ESMRMB meeting (which brought more than 1000 international delegates to Edinburgh), the 2017 Annual Conference on Medical Image Understanding and Analysis in Edinburgh, the 2018 Society for Magnetic Resonance Angiography conference in Glasgow, and the forthcoming 2019 European Molecular Imaging Meeting in Glasgow. High quality international speakers have readily accepted invitations to deliver keynote addresses at the SINAPSE Annual Scientific Meetings.

- As the node for research imaging activity across Scotland, SINAPSE enables access to national resources to enhance international competitiveness. The model of pooled resources is highly effective for medical imaging research; it would be grossly inefficient to set up advanced imaging facilities at multiple institutions in a country the size of Scotland. Through pooling, the investments at individual centres (e.g., 7T clinical MRI at Glasgow, PET-MR at Edinburgh, fast field-cycling MRI at Aberdeen, ultrasound at Dundee, mobile EEG at Stirling) have been made available to researchers across Scotland and are more effectively used as national resources.
- The perception of research pools is demonstrably positive in funding bodies. When competitive funding applications are focused around a pooling group, reviewers have confidence that the proposed collaborations will work, because the framework is already in place. This is true for UK-based funders (see below for the recent example of iCAIRD) but also ports to an international setting in applications proposing consortia of research institutions crossing borders (examples with SINAPSE leadership include the multi-million Euro **IDentIFY**, **PET3D**, and **SVDs@Target** Horizon 2020 projects).

Q2b. Should research pools have a continuing role in the Scottish research base?

- **<u>Attracting investment</u>**: Just the first two years of funding for Continued Development of the SINAPSE Network (2015-2016) saw a total of over £76M secured – a more than ten-fold increase from the original investment of £7.2M by SFC, CSO and the participating universities in 2007. The subsequent investments comprise not only direct grant income to Scottish universities (over £21M) as part of single centre and the Scottish component of international collaborative project awards, but also significant investment in imaging infrastructure (over £54M), which has brought new world-class facilities to Scotland including its first 7T clinical MRI scanner in Glasgow and its first MR PET system in Edinburgh, and the world's first fast field-cycling MRI scanner in Aberdeen. While some of this investment may have happened anyway, the existence of a strong collaborative community of imaging researchers has undoubtedly helped and continues to make Scotland highly attractive to funders.

  The track record of SINAPSE most recently contributed to the successful UKRI bid for a £15.8M Industrial Centre for Artificial Intelligence Research in Digital Diagnostics (**iCAIRD**), with four SINAPSE partner universities as the founding academic partners

and central involvement from Canon Medical Research Europe, a long-standing Scottish industry partner for SINAPSE. Demonstrating a cohesive imaging community was instrumental in securing this investment. SINAPSE also has supported multiple Scottish bids which were successful in a recent EPSRC CDT call (funding announcements under embargo until 4 Feb 2019).

- **Developing future generations of researchers in Scotland**: The SINAPSE Graduate School could easily have appointed and supervised double the number of trainees. Students have a disproportionate strategic effect on cementing collaborations by making supervisors work together and representing the shared interests of institutions; we feel that studentships should form a core of future SFC support for research pooling.

  Industrial partnership has proven to be a viable model for supporting doctoral training on a limited budget, as in 2016 SINAPSE was able to leverage its £152,373 Seed Fund to bring in £260,000 in external funding for joint-funded PhD projects, resulting in support for a total of 7 studentships (5 joint-funded and 2 with smaller SINAPSE contributions for project costs) with a total value of over £410,000. Regarding pooling in the future, renewed SFC investment in studentship support would attract additional funding from industry partners and enable the delivery of interdisciplinary PhD training to additional researchers furthering Scotland's global reputation for medical imaging innovation.

- **Scenarios of future SINAPSE funding**:
  - An SFC contribution of £65,000 per annum, plus institutional match funding, would allow SINAPSE to maintain the status quo.
  - Adding part-funding for PhD studentships, totalling an SFC contribution of £215,000 per annum, would support a SINAPSE Graduate School with 12 PhD studentships having match funding from external organisations.
  - Adding further funding for a long-term strategy to embed imaging excellence in Scotland's higher education system, totaling an SFC contribution of £565,000 per annum, would support three new chairs in multimodal imaging (to ensure exploitation of national facilities), artificial intelligence for image analysis (to maximise opportunities in iCAIRD for Scottish SMEs) and advanced imaging for our ageing population (to target SINAPSE activities on pressing societal needs).

Yours sincerely,

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