

2015 Annual Report for the SINAPSE Network

This report summarises activities and achievements from the first year (January 2015 - December 2015) of the current funding period of SINAPSE – Scottish Imaging Network: A Platform for Scientific Excellence.

The post of Lead Scientist, which is central to the functioning of SINAPSE, was advertised internationally and Dr Kristin Flegal took up the appointment on 1st June. Dr Flegal has a PhD in Psychology with a concentration in Cognitive Neuroscience, and she came to SINAPSE after completing a postdoctoral fellowship at the University of California, Davis. Her post is based at the University of Glasgow, where she is dividing her time between coordinating SINAPSE network activities and continuing her own research programme using behavioural and fMRI methods to investigate the mechanisms of cognitive training and associated changes in patterns of brain activity.

Progress towards key outcomes

Outcome 1: A Scottish medical imaging research base that is internationally competitive and improving its reputation and standing in the world

Drawing on the combined expertise of its six partner Universities, SINAPSE serves as the node for research imaging activity in Scotland by maintaining a strong, dynamic network that pools facilities, resources and skills. SINAPSE links academic and NHS medical imaging research, creates a shared national environment for strategic research, education, and knowledge exchange, and extends its reach beyond the UK by participating in international networks and funding bids. Progress towards this outcome in the first year of the new SINAPSE is detailed below.

Re-engaging with the partner Universities

Since Dr Kristin Flegal took up the post of SINAPSE Lead Scientist, she and Prof David Wyper have visited the partner Universities to discuss the next phase of SINAPSE, promote research collaborations across the network, and increase membership. These visits have ranged from informal gatherings at Aberdeen (prior to the 2015 Annual Scientific Meeting, reported below), Stirling, and St Andrews to official launch events at Edinburgh and Glasgow which included networking sessions and short talks from local SINAPSE researchers.

Further development of the network

In tandem with the centre visits, the SINAPSE website (www.sinapse.ac.uk) has been further developed as an active online base for the network, enabling more topic-specific groups and content editors. The ongoing growth in SINAPSE membership is reflected by more than 280 member accounts. There are now JISC mailing lists for three SINAPSE subject areas: MRI, Molecular Imaging, and

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Psychology. Additionally, a monthly SINAPSE e-mail newsletter has been launched and a SINAPSE Twitter account (@SINAPSECENTRE) is in active use.

Activities within Scotland

In response to an invitation from SFC to identify the one item of capital equipment that would make the greatest collective contribution in our Research Pool, the SINAPSE Executive Committee set up a process for submission and evaluation of proposals from the partner Universities. A great deal of thought and effort went into this exercise, and five bids were put forward which all presented exciting advancements for clinical and research imaging in Scotland. The proposal which emerged as our clear preference and was submitted to SFC requests £4.45M to establish a Scottish National MR Guided Focussed Ultrasound (MRgFUS) Unit. In addition to its impact on leading academic research in Scotland, this facility would be of enormous potential benefit to the NHS in Scotland, leading to clinical trials that would ultimately translate to clinical service delivery. We are hopeful that this will be funded.

About 25% of SINAPSE members are NHS employees. A good example of the links we support between academic and NHS research is the SINAPSE-SANON [Scottish Adult Neuro-Oncology Network] meetings which directly address NHS issues such as better use of PET by the introduction of more selective tracers and harmonising fMRI protocols to inform treatment planning. On 8th October, the annual SINAPSE-SANON Meeting was held in Dundee. One outcome was that, despite there being no evidence that it is the best tracer for detection or staging of brain tumours, current studies around Scotland appear to be focusing on FDG rather than on more selective tracers. At this meeting Dr Sally Pimlott, who Chairs the SINAPSE Molecular Imaging Group, presented data on current activity around the world. Amino acid tracers are showing signs of being much better for patient stratification, but there are several to choose from and the technical challenges of synthesis and delivery around Scotland will have to be addressed. A subgroup has been set up to explore the rationale for a multicentre study across Scotland, probably focusing on 18F-FET or 18F-FACBC. Once this has been prepared it will form the basis of a clinically driven funding application.

Not all SINAPSE partner Universities have medical schools – and in these centres, Psychology is at the heart of the network. One major innovation from Psychology at Stirling has been the emergence of mobile cognition, an entirely new approach to recording brain activity during real-world activity. The recent increase in cognitive neuroscience staff at Stirling (itself due to the influence of SINAPSE) has been partnered with local investment in mobile EEG and eye-tracking technology. As a result, in 2015 researchers in Stirling developed a new centre focused on mobile imaging (www.mobilecognition.org), installed new cutting edge mobile EEG and eye-tracking equipment, and published an influential review on mobile EEG in sports (rated in the top 5% of all papers tracked by Altmedia). Mobile brain imaging looks set to grow – not least because it opens up new areas to of investigation – and SINAPSE is well placed to take an international lead in driving mobile cognition research.

UK activities

In response to a UK-wide call for the 2016 UK PET Chemistry Meeting, an application to hold the event in Edinburgh was drafted by an organising committee led by Dr Pimlott, Prof Edwin van Beek, and Dr Christophe Lucatelli, and submitted by Prof Wyper on behalf of SINAPSE. The bid was successful, and the meeting will be held at the National Museum of Scotland on 4th May 2016,

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featuring keynote presentations from Prof David Newby (University of Edinburgh) and Prof Paul Matthews (Imperial College London).

As part of the MRC Dementias Platform UK (DPUK), Edinburgh led the procurement of five state-of-the-art PET-MRI scanners which will be installed at Edinburgh, Cambridge, Imperial College London, Manchester and Newcastle, to create a national imaging network for dementia research. Prof Joanna Wardlaw at the University of Edinburgh leads the DPUK experimental medicine theme of Vascular Disease Mechanisms.

Imaging expertise in SINAPSE supports several UK multicentre trials. Those led from Glasgow include PISTE (Prof Keith Muir; funded by Stroke Association and NIHR HTA), ATTEST (Prof Keith Muir; funded by Stroke Association and British Heart Foundation), PRACTISE (Prof Keith Muir; funded by NIHR EME) and XILO-FIST (Dr Jesse Dawson; funded by Stroke Association and British Heart Foundation), and those led from Edinburgh include LACI 1 and 2 (Prof Joanna Wardlaw; funded by British Heart Foundation and Alzheimer's Society) and RESTART (Dr Rustam Al-Shahi Salman; funded by British Heart Foundation).

International activities

To help promote and increase participation in EU funding bids, Dr Flegal attended a workshop for the launch of the Horizon 2020 Health, Demographic Change and Wellbeing work programme held at the University of Glasgow on 14th October, and gathered information of interest to SINAPSE members about call topics with a focus on clinical studies and personalised medicine.

Prof Wyper and Dr Flegal were invited to represent SINAPSE at a workshop in Taiwan the first week of November, for the Bilateral Exchange Programme sponsored by the Royal Society of Edinburgh and the Ministry of Science and Technology, Taiwan. With the objective of soliciting interest in collaborative research, they presented SINAPSE neuroimaging research on the topics of clinical applications and development of novel technologies, and applications in psychology research. By using a pooling group in the activity, the work of fifteen leading Scottish academics was presented. In the course of the workshop, Prof Wyper and Dr Flegal identified potential collaborations with Taiwanese researchers working in neuroimaging which could be of value to SINAPSE. To initiate such a collaboration, we have successfully obtained RSE International Exchange Grant funding for Dr Gordon Waiter from Aberdeen and Dr David Dickie from Edinburgh to travel together to Taipei in 2016 for a short exchange visit in the lab of Prof Wen-Yih Tseng from National Taiwan University, who is developing novel techniques for diffusion MRI analysis. The exchange visit would be the first step in a possible long-term partnership eventually expanding to include other mutual research interests across SINAPSE and Prof Tseng's wider network of colleagues in Taiwan.

The annual scientific meeting of the European Society of Magnetic Resonance in Medicine and Biology saw over 1000 international delegates at the Edinburgh International Conference Centre at the start of October. Prof Ian Marshall from the University of Edinburgh served as meeting president, with several other SINAPSE members in the local organising committee. The ESMRMB meeting immediately followed the 7th International Workshop for Pulmonary Functional Imaging, which was held at the University of Edinburgh Playfair Library, with Prof Edwin van Beek as meeting president. This meeting saw 170 delegates from the USA, Canada, South Korea, Japan and around the EU present their latest

research in the field, covering PET, MRI and CT imaging modalities, while 80 internationally renowned faculty presented a background course on the topic. Both meetings were a scientific and commercial success and brought significant revenue to the Scottish economy. Figures provided by the Edinburgh Convention Bureau indicate that the ESMRMB meeting was responsible for more than £1M in economic benefit.

Prof Joanna Wardlaw was the only European invited speaker at the 1st Annual Conference of the Chinese Stroke Association in June, and was also invited as a Barnett Professor to Toronto in October to lecture on small vessel disease.

Prof Wardlaw has been awarded a €6M H2020-PHC-2015 grant "SVDs@target" (Small vessel diseases in a mechanistic perspective: Targets for intervention, affected pathways and mechanistic exploitation for prevention of stroke and dementia) for a multicentre study to understand mechanisms of stroke and dementia. Preparation of the grant application was dependent on PEER funding to Prof Wardlaw, including support for meetings in Europe and workshops.

Prof Matteo Zanda at the University of Aberdeen is Head of Unit in the recently funded H2020-MSCA-ITN-2015 European Joint Doctorates Project "MOGLYNET" (Modulation of glycolytic flux as a new approach for treatment of atherosclerosis and plaque stabilization: a multidisciplinary study), in which Aberdeen will be one of five European universities to take on 12 international PhD students studying new therapies for atherosclerosis and new ways of diagnosing the condition at an earlier stage. The role of Aberdeen in the project is to develop candidate therapeutics and diagnostics (PET and optical imaging).

PEER and PECRE funds from the 2014-15 allocation were merged to support exchange visits for two early career researchers working with Prof Graeme Houston at the University of Dundee, in a collaboration with MRI contrast agent manufacturer Guerbet in Paris, France, which is expected to form part of wider EU grant submission under the Horizon 2020 programme for a call in 2017.

Outcome 2: Value created for the Scottish economy and society

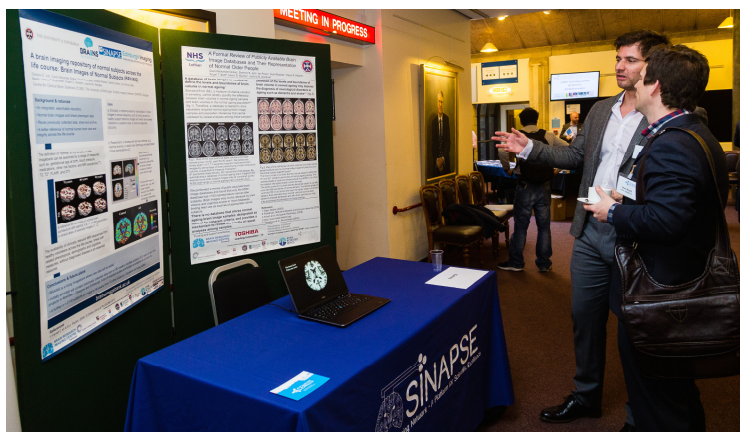
SINAPSE provides direct access to outstanding imaging expertise for the benefit of the pharmaceutical industry, manufacturers of imaging equipment, and academic and clinical researchers, and increases public awareness and understanding of imaging. Progress towards this outcome through KE projects, public engagement activities, and links to other academic and NHS networks, is detailed below.

Engagement with Industry and Innovation Centres

Interactions with industrial/NHS partners have included the University of Glasgow Future of Biomedicine Industry Day and the CENSIS 2nd Technology Summit and Conference reported below, and NHS participation in the SINAPSE launch events in Edinburgh and Glasgow reported above. The 3D holographic image company Holoxica exhibited at the Edinburgh launch event, as well. Industry participation in the 2015 Annual Scientific Meeting held in Aberdeen came from Imaging Equipment Ltd, Siemens, GE Healthcare, Bracco, and Philips Medical. SINAPSE membership is open to industrial partners, and industry members currently include Optos, Holoxica, Toshiba Medical Visualization Systems Europe, and Edinburgh Molecular Imaging.

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Dr David Dickie staffed an exhibition stand showcasing SINAPSE image processing technologies at the CENSIS Technology Summit and Conference on 1st October. *Credit: Angus Forbes Photography*

Despite the fact that Scotland is the country where obstetric ultrasound was first developed and major contributions were made to the development of MRI, there are few Scottish Companies now involved in equipment manufacture. One exception is BCF Technologies in Bellshill. This is a manufacturing company specializing in veterinary ultrasound. Prof Wyper and Prof George Corner, who leads the SINAPSE Ultrasound topic group, visited their factory in February and several potential developments were discussed.

In February, along with the Farr Institute, we took part in a 'brain storming' event set up by Toshiba Medical Visualization Systems Europe to explore new needs in medical imaging.

The SINAPSE Seed Fund provides part-funding for PhD studentships to enhance engagement with industry. SFC approved carrying over £52K in previous unspent funds, increasing the number of seed fund studentships that we are able to support from 3 to 5. Our call for studentship applications was advertised through SINAPSE channels and around industry partners, and encouraging early feedback was received in response to an enquiry circulated to SINAPSE members who previously have been successful with partnership bids or who might be now. The application deadline was 18th December, and eight strong proposals were received. In deciding on release of funds, to strengthen ties with Scottish industry, priority will be given to applications involving companies based in Scotland. The decision on submitted applications will be made in January so that the awarded studentships may be advertised shortly thereafter, for starting dates around August 2016.

Along with SUPA we were successful in obtaining an STFC Grand Challenge Exploration award of £10K to hold a series of workshops on the potential medical imaging application of physics technologies. Those taking part included industry representatives from Anacil, Gas Sensing Solutions, Toshiba Medical Visualization Systems Europe, Chromacity, and Edinburgh Molecular Imaging and CEOs from SHIL, DataLab and CENSIS.

On 24th September, the University of Glasgow Future of Biomedicine Industry Day was held at the new Queen Elizabeth Teaching and Learning Centre at the QUEH campus in Glasgow. Prof Keith Muir spoke during a workshop titled 'Focus on Industry, NHS and Academia' and Dr Flegal represented SINAPSE in a 'College Pod' organized by the College of Medical, Veterinary and Life Sciences. The event

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was successful in promoting SINAPSE research and informing potential academic and industry partners about current KE opportunities including the Seed Fund studentships.

On 1st October, the CENSIS 2nd Technology Summit and Conference was held in Edinburgh. Prof Wyper chaired an Image Processing session and Dr David Dickie exhibited work from a major SINAPSE collaboration project, the Brain Images of Normal Subjects (BRAINS) Bank. Many delegates visited the exhibition stand, and queries and comments were on a wide range of SINAPSE activities – not limited to the BRAINS Bank – including the Seed Fund studentships and opportunities for the technology developed within SINAPSE to be developed commercially and applied in clinical practice.

Public Engagement

Several SINAPSE members have registered as STEM Ambassadors including Dr Chris McCabe from the University of Glasgow, Drs Gordon Waiter and Ourania Varsou from the University of Aberdeen, and SINAPSE PhD students Michael Stringer, Tristan Hollyer, and Filip Zmuda.

Michael Stringer reached the Scottish final of FameLab, an event promoting public awareness of science, with an entertaining presentation on James Clerk Maxwell, the Scottish mathematician and physicist who formulated the classical theory of electromagnetic fields. In connection with participation in FameLab, Michael participated in a short discussion on the University of Aberdeen's science radio show aimed at young people, 'Talking Science', discussing the competition and some of the research carried out in the centre.

Other events in Aberdeen this year include:

- 26th January - a careers event at Ellon Academy. We supported an S5 careers event speaking to small groups about the different job and research opportunities available in imaging to help with subject choices for S6 and further/higher education options.
- 20th March - a Science Week event at Westpark Primary School. We delivered workshops for two classes fitting in with the solar eclipse and relevance of electromagnetic phenomena in different technologies including MRI.
- 12th September - Doors Open Day. We organised and staffed a stand for the Imaging Centre and engaged with members of the general public to explain our current research.

A similar approach to public engagement has been taken by Stirling, with a range of Psychology-based activities including:

- 17th-19th February - a STAMP (Science, Technology, Aquaculture, Maths and Psychology) event showcasing science to children drawn from 18 local authority schools in the Forth Valley region.
- 26th September - a public Science Fayre attended by over 140 school aged children (see www.youtube.com/watch?v=ytZKaz-kzol). Plans are in place for the first Stirling University Science Cabaret in 2016.
- A series of careers events, engaging with groups of future school leavers – allowing them to visit the department, hear about undergraduate degrees, and see research going on in Psychology.

SINAPSE teamed up with the Institute of Physics in Scotland, together with SUPA and SULSA, to take part in an International Year of Light project asking post

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graduate students and early career researchers to send in videos explaining how light is used their research. The broad definition of 'light' is being used – anything in the electromagnetic spectrum including PET, SPECT, MRI and optical imaging. An excellent submission from Dr James Cameron at the University of Edinburgh, in which he discussed his retinal imaging research, was selected as the winning entry from SINAPSE. The runner-up entry from SINAPSE came from University of Glasgow PhD student Tim Morgan, who provided an impressively accessible overview of his PET imaging research. These videos can be viewed at the following links:

- www.sinapse.ac.uk/news/winning-entry-from-sinapse-in-iop-international-year-of-light-video-competition
- www.sinapse.ac.uk/news/runner-up-entry-from-sinapse-in-iop-international-year-of-light-video-competition



Dr Chris McCabe and several colleagues in Glasgow are STEM Ambassadors. They have participated in events such as the recent Science Fair at Williamwood High School on 7th October.

Links with other networks

The NHS has a PET Network. They meet two or three times a year to enable members to share their experiences on the delivery of clinical services. SINAPSE has a Molecular Imaging [PET] Group that focuses on radiopharmaceutical development. There is a degree of overlap as issues such as cyclotron performance and clinical trials that require novel radiopharmaceuticals concern both groups. It is clearly important that we communicate and so we have identified two PET specialists who are members of both groups and in addition we have agreed to share minutes of our respective meetings.

Prof David Wyper was the keynote speaker at a medical image analysis conference at Dundee in March 2015 organised by the Computer Vision and Image Processing Group in conjunction with **SICSA**. Many of those who took part are now part of the SINAPSE Image Processing topic group.

Prof Wyper took part in an **Institute of Physics** Careers event at Dynamic Earth where over 40 undergraduate and postgraduate students from around Scotland were able to discuss medical physics along with several less attractive applications. He also took part in a mock interview event at the University of Glasgow.

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SINAPSE researchers at Stirling have begun collaborations with the sportscotland institute of sport, who oversee training and development of elite athletics professionals across Scotland. Prof David Donaldson attended the opening of the SFC-funded ORIAM Sports Performance Centre at Heriot-Watt University in September 2015, and has forged links with **Sport Scotland**, the national agency for sport. A range of different sports (curling, shooting, archery) are interested in the potential of brain imaging to provide information about high performance, talent selection, training and recovery from fatigue.

Outcome 3: Access to excellent learning experience and support for students and early career researchers

SINAPSE ensures access to high quality training across the wider imaging research community, and encourages and facilitates individuals from different disciplines to be part of a larger imaging collaboration. Progress towards this outcome is detailed below.

The visits to each participating University enabled Dr Flegal and Prof Wyper to promote research collaborations across the network and to publicise its learning and development opportunities. The ongoing growth in SINAPSE membership resulting from these visits includes an increased number of affiliated students: at present, there are 50 post-graduate students within the SINAPSE portfolio.

In November, Dr Flegal was invited to speak to the University of Glasgow undergraduate Neuroscience Society about neuroimaging research and career paths. She discussed the training opportunities available for students through the SINAPSE network, and promoted SINAPSE resources including the online eLearning modules about medical imaging techniques.

The 2015 Annual Scientific Meeting was held in Aberdeen on 12th June, with an excellent keynote address delivered by Prof Bill Jagust from the University of California, Berkeley; the result of a connection developed through a PECRE exchange undertaken by SINAPSE PhD student Dorota Chapko. Prof Jagust is one the world's leading authorities on the role of amyloid and tau in Alzheimer's Disease, and the opportunity for the leading dementia imaging researchers in Scotland to debate with him directly was invaluable. Other highlights from the programme included updates on the VAMPIRE optical imaging collaboration led by Dundee and Edinburgh, talks on treatments for dementia from SINAPSE researchers at Aberdeen and Edinburgh that dovetailed splendidly with Prof Jagust's keynote, and well-attended student poster sessions. Furthermore, the event was used to introduce the new Lead Scientist to the SINAPSE community.

Evidence of future planning for sustainability

Although the new SINAPSE is in an early phase, we have had discussions about future sustainability. It is unlikely that there will be a single route to income generation for our core activities. A ballpark figure of £100K per annum is targeted to enable SINAPSE to function effectively. Several options will be explored over the course of 2016.



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