

## 2016 Annual Report summary

This report summarises activities and achievements from the second year (January-December 2016) of the current funding period of SINAPSE – Scottish Imaging Network: A Platform for Scientific Excellence.

2016 was an eventful year for the Scottish imaging research community, which saw the procurement of state-of-the-art imaging facilities including Scotland's first MR-PET system and Scotland's first 7 Tesla (7T) clinical MRI scanner, the funding and initiation of several major multi-centre imaging studies, and the awarding of SINAPSE Seed Fund support to PhD studentships on imaging-related research projects with joint funding from industry partners. Selected highlights from this year are detailed below.

### Enhanced people capacity

The SINAPSE network has helped to make Scotland a more attractive landscape for imaging researchers to work, reflected in SINAPSE-related posts created and outstanding talent recruited this year. New academic appointments include postdoctoral fellows and project leaders on funded awards, and internationally recognised imaging experts brought into Scotland to fill positions such as Lecturer in Psychology at Stirling (Dr Yee Lee Shing, from Max Planck Institute Berlin) and Chair of Neuroradiology at Edinburgh (Prof Adam Waldman, from Imperial College London).

Additionally, numerous imaging studentship positions were filled this year, which included Seed Fund support from SINAPSE to 5 PhD studentships located across 5 of our partner Universities, and funding contributions to 2 additional PhD studentships. The students appointed to these positions belong to a new SINAPSE cohort and will benefit from our resources, events, and networking. In November, a welcome event was held at the University of Stirling (modelled after annual PhD student induction events held during the first phase of SINAPSE funding) which featured scientific communication skill-building activities and presentations from SINAPSE PhD students and early career researchers recently awarded PECRE funding on their international research exchange experiences.



A welcome event at the University of Stirling brought together PhD students with SINAPSE funding and recent recipients of PECRE funding for international research exchanges

### Improved facilities and infrastructure

Improvements to SINAPSE imaging facilities this year included new scanners at Edinburgh (3T MRI, PET-CT, and the first MR-PET system in Scotland), and at Glasgow (the first 7T clinical MRI scanner in Scotland, installed in the newly built Imaging Centre of Excellence, and a small animal MR-PET system at the Beatson Institute), as well as MRI scanner upgrades at Dundee (with involvement from St Andrews and NHS Tayside) and Edinburgh. Dundee also received a new ultrasound unit, and Stirling invested in new mobile EEG equipment. An Ekert & Zeigler radiochemistry platform was installed in the John Mallard PET Centre at Aberdeen, built to GMP standards. Aberdeen will submit its MHRA application in Spring 2017, and has benefitted from Glasgow and Edinburgh's experience of going through same process for GMP accreditation.

Infrastructure for teaching and training in imaging research also had further development this year, such as new online courses at Edinburgh for MSc Neuroimaging for Research and MSc Imaging, and improvements at Dundee to IMSaT and the Cuschieri Skills Centre. SINAPSE contributed to the formation of new training networks, as well, including involvement from Edinburgh in an MRC Partnership MR-PET grant and a Fondation Leducq Transatlantic Network of Excellence grant, from Dundee in European ITN training partnerships, and from Stirling in an ESRC training programme on latent variable modelling.

Furthermore, SINAPSE participated in research networks and knowledge exchange partnerships this year on national and international levels. Glasgow partnered on the new UK 7T MRI network, and Edinburgh led the development of an international network for multi-centre preclinical PET work.

SINAPSE was represented on two JPND-funded international working groups for harmonisation and alignment in brain imaging methods for neurodegeneration: the HARNESS working group in vascular contributions to neurodegeneration (led by Edinburgh) and the EUFIND ultrahigh-field imaging network (Glasgow and Edinburgh). Additionally, Edinburgh partnered on the IMI-funded AMYPAD initiative to improve diagnosis and management of Alzheimer's disease through amyloid PET imaging. Aberdeen, Glasgow and Edinburgh are also involved in UK-wide and international multi-site clinical trials, and Dundee participates in EU-funded partnerships with sites in Ireland and England. The SINAPSE network itself has been at the centre of a new research partnership between Scotland and Taiwan resulting from an RSE Bilateral Exchange Programme workshop held in late 2015, which was followed by an exchange visit to National Taiwan University in May by SINAPSE researchers from Edinburgh and Aberdeen. Together, the collaborators are now working on a project evaluating analysis methods for diffusion MRI data, and have produced a joint application for access to UK Biobank MRI data in order to develop age-specific atlases of brain white matter tracts.

SINAPSE facilitates collaborative imaging research within Scotland as well as with partners elsewhere in the UK and globally. SINAPSE-SANON meetings link Scottish neuro-oncologists with the imaging research community, and this partnership now involves a multi-centre PET imaging pilot study in glioblastoma.



Arrival of 7T MRI at Imaging Centre of Excellence, Glasgow

### Further funding secured

SINAPSE researchers were responsible for bringing over £16M in research funding to Scotland this year. This amount of direct income to SINAPSE centres includes funding from the Scottish Government (to Edinburgh and Aberdeen for the FutureMS study), from UK research councils (such as ESRC support for Administrative Data Research Centre Scotland at Aberdeen and Edinburgh, and BBSRC grants for staff, facilities, and research activities at St Andrews), and from charities (awards from Alzheimer's Research UK, Wellcome Trust, British Heart Foundation, Stroke Association, Neurosciences Foundation, Royal Society, Leverhulme, and several smaller trusts). Also included is funding from industry partners for SINAPSE Seed Fund studentships at Glasgow (Toshiba Medical), Edinburgh (Optos), Aberdeen (IXICO), and Dundee (Vascular Flow Technologies), and from sportscotland for the Seed Fund studentship at Stirling, plus additional studentships sponsored by Siemens, Mentholatum, and Astra Zeneca, and industry funding for project grants.

SINAPSE researchers also had notable success in attracting international funding this year, including a Leducq Transatlantic Network of Excellence grant (Edinburgh) and three large EU Horizon 2020 grants: SVDs@Target (Edinburgh) for research into cerebral small vessel disease mechanisms, IdentIFY (Aberdeen) for development of Fast Field-Cycling MRI, and PET3D (Aberdeen) for a training network on PET imaging in drug design and development. Adding the full value of these international grants, along with others which SINAPSE researchers were awarded as part of international consortia, to the amount of SINAPSE-related direct income to Scotland brings the total amount of further funding secured to around £33M.

### New products and inventions created

SINAPSE researchers created new products and inventions this year across a range of imaging research applications. Technical products have been developed at Dundee in collaboration with Vascular Flow Technologies, and software products include patented high resolution MR elastography algorithms at Edinburgh. Image analysis is one of the strengths in SINAPSE, and new analysis tools have been developed at Edinburgh, along with the BRAINS (Brain Images of Normal Subjects) databank, the Cerebrovascular

Disease Database, and age-specific atlases of T1 brain MRI. In molecular imaging, novel SPECT and PET tracers have been developed and applied in patients at Aberdeen, Edinburgh and Glasgow. Fast field-cycling MRI is now being tested in clinical pilot studies.

Contributions to clinical imaging guidelines included input from Aberdeen and Edinburgh to British Society of Neuroradiology draft guidelines for imaging in people with dementia, and input from Dundee to European Renal Association best practice guidelines.

SINAPSE researchers at Stirling are at the leading edge of the emerging field of mobile EEG. The potential for impact with this new neuroimaging technique includes applications in sporting behaviour (for talent selection, monitoring and training) and cognitive neuroscience research (allowing the study of spatial navigation in humans during real-world movement). Contributions to mobile EEG hardware and software development at Stirling include EEG compatible infra-red sensors to detect location of and allow precise triggering of mobile EEG equipment, a signalling device to allow mobile eye-tracking equipment to communicate with mobile EEG equipment, and a suite of in-house data processing pipelines for use with mobile EEG.



Development of mobile EEG at Stirling sets an agenda for the use of neuroimaging during real-world activity

### Engagement with external stakeholders

Knowledge transfer from SINAPSE to wider audiences this year took the form of public lectures and public medical imaging exhibitions in Edinburgh (including a display at the National Museum of Scotland), talks given to the Glasgow Neuroscience Society and the Institute of Physics about imaging research and career paths, public events such as Café Scientifique at St Andrews, Science Fayre at Stirling, and Doors Open

Day and reunion of Aberdeen Children of the 1950s at Aberdeen, and a series of 3-minute videos produced by SINAPSE PhD students and early career researchers explaining imaging research in lay language (the impressive results can be seen at [www.youtube.com/channel/UCIMcixMQGbUi0jQG\\_5difgw](http://www.youtube.com/channel/UCIMcixMQGbUi0jQG_5difgw)).

SINAPSE also was frequently engaged with industry partners and other Scottish networks this year. Exhibitors at the 2016 SINAPSE Annual Scientific Meeting were Siemens, Holoxica, Toshiba Medical, Bracco, Bayer, Bartec, GE, Imaging Equipment, Scottish Mental Health Research Network, and NHS Research Scotland (NRS). Relationship building beyond the imaging research community included SINAPSE participation in the SUPA Annual Gathering, the NRS Annual Conference, the CENSIS Engagement Event to engage with industry partners interested in imaging research, and a Scottish Radiological Society meeting to engage with clinicians interested in imaging research. Additionally, new opportunities for contributing SINAPSE imaging expertise and resources to clinical trials were discussed with the Stratified Medicine Scotland Innovation Centre (SMS-IC). Related developments this year have included an amyloid PET imaging project with the NRS Dementia and Neurodegenerative Diseases Clinical Research Network involving multiple SINAPSE centres, and a novel PET tracer development project at Glasgow in partnership with SHIL.

PEER funding awarded this year to support SINAPSE members' engagement in European research included grant writing consultation on an EU funding bid for a project to identify biomarkers for acute brain changes following sub-concussive sport-related head impact (led by Stirling in collaboration with universities in Germany, France, and Belgium), travel to contrast agent manufacturer Guerbet in France through an industry-academia collaboration that will form part of wider EU grant submission in preparation at Dundee, and travel for attending a group meeting in the Netherlands to bring European partners into a preclinical PET imaging research network and to confirm contributions from Edinburgh towards new European guidelines on preclinical PET/CT imaging.

### Other significant achievements

SINAPSE was delighted to congratulate Prof Joanna Wardlaw at Edinburgh on receiving a CBE for services



to neuroimaging and clinical science in the 2016 Queen's New Year's Honours List.

Based at Glasgow, SINAPSE Lead Scientist Dr Kristin Flegal has further developed her research programme – using behavioural and fMRI methods to investigate the mechanisms of cognitive training interventions – by establishing new collaborations with researchers at Stirling and Strathclyde and by submitting funding applications to the Chief Scientist Office, Alzheimer's Research UK, and the Neurosciences Foundation.

As SINAPSE serves as a representative body for imaging researchers across Scotland, further development of the network has continued to be a priority. The SINAPSE website ([www.sinapse.ac.uk](http://www.sinapse.ac.uk)) has been developed as an active online base for the network, with membership growth from 111 member accounts in June 2015, to 284 at the start of this year, to more than 400 by the end of this year. All SINAPSE members receive a monthly e-mail newsletter sharing SINAPSE news and events, SINAPSE JISC mailing lists facilitate communication and collaboration in the subject areas of MRI, Molecular Imaging, and Psychology, and SINAPSE maintains an active social media presence with both Twitter ([@SINAPSECENTRE](https://twitter.com/SINAPSECENTRE)) and LinkedIn accounts to bring members together.

#### Learning and development

SINAPSE ensures access to high quality training and support for students and early career researchers. The 2016 SINAPSE Annual Scientific Meeting held at Stirling in June included a keynote address by cognitive neuroscientist Dr Jon Simons from Cambridge on his fMRI memory work, an invited talk on the developing research collaboration between Scotland and Taiwan on diffusion MRI, and a wide array of proffered talks and poster presentations.

SINAPSE also was proud to host the 2016 UK PET Chemistry Meeting in Edinburgh, following a winning bid in response to a UK-wide call. The programme featured Prof David Newby from Edinburgh and Prof Paul Matthews from Imperial College London as keynote speakers, and presentations on SINAPSE research at Glasgow, Edinburgh, and St Andrews.

PECRE funding awarded this year for international research exchanges supported valuable training and development opportunities for young investigators in the SINAPSE network. The exchange visits established and strengthened institutional collaborations between SINAPSE partner Universities and sites in Italy, Germany, Belgium, the Netherlands, USA, and Canada. Moreover, outcomes of the exchange visits were shared with the wider Scottish imaging research community (including industry partners) at the 2016 SINAPSE Annual Scientific Meeting.



2016 SINAPSE Annual Scientific Meeting, Stirling

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