SP6 Summary Report on Community Outreach (SGA2 – D6.5.1)

Figure 1: A hackathon on cerebellum modelling in Pavia, Italy in January 2020.
(Photo: Johannes Hjorth)

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Description in GA:	Summary report of SP6 SGA2 community outreach.
Abstract:	This Deliverable gives a summary of the activity undertaken by SP6 in SGA2 (April 2018-March 2020) in terms of community outreach.
Keywords:	Community outreach, communities, SGA2
Target Users/Readers:	Neuroscience community, computational neuroscience community, systems biology community, scientific community, students, general public

Table of Contents

Table of Tables

Table of Figures

1. Introduction

The goal of the SP6 Brain Simulation Platform (BSP) is to establish brain modelling strategies, provide tools and workflows, and bootstrap data-driven modelling efforts, to support the community in using, improving and building scaffold multi-level models of different brain regions and species. The main target audience is the scientific community, but we also contribute to the Human Brain Project's (HBP) global effort to disseminate its work and inform the general public, such as via the HBP Open Days.

The goals of our community outreach and dissemination efforts with the scientific community are to:

1) involve and harness the community to contribute to the collaborative building of brain models;
2) provide state-of-the-art computational tools to the community;
3) increase the number of users of the Platform; and
4) boost the visibility of the results achieved using the Platform and increase interest in our research.

The scientific community we are targeting is mainly composed of neuroscientists, such as experimentalists, modellers and systems biologists (including undergraduate, graduate and PhD students). The modelling community is small and we are targeting them directly through for example, hands-on training events and our brain circuit communities. Therefore, low numbers of people reached are entirely compatible with a successful engagement programme. The neuroscience community as a whole is much larger: membership of the Society of Neuroscience is around 37,000, whereas membership of the Organization of Computational Neurosciences is around 2,000 and the European Systems Biology Community currently comprises nearly 8,000 researchers. For large communities, the SP6 massive open online courses (MOOCs) have proved very popular, with total registrations to date in SGA2 of around 15,860. SP6 is also reaching out to the medical research, pharma research, neurorobotics, neuromorphic and cognitive research communities, with which we are currently collaborating mainly via the HBP voucher system.

As described in SP6's SGA2 Dissemination Plan (D11.4.1), we use different channels and strategies for informing and engaging with our communities. This Deliverable gives a summary of our community outreach in SGA2, from April 2018 to March 2020. Its structure is based on the different tools we offer and the various activities we carried out in pursuit of our community outreach and dissemination goals.

2. Massive Open Online Courses (MOOCs)

In SGA1 (April 2016-March 2018), we released the first of our three MOOCs on simulation neuroscience (Figure 2). MOOCs are a great tool for engaging various communities at large and our first MOOC was a major success. This MOOC enables users to digitally reconstruct a neuron using the BSP. Currently, more than 11,870 users have enrolled in this MOOC since it was launched in November 2017. We also contributed to another MOOC (The multi-scale brain; Figure 3) which provides an overview of the latest tools and techniques for neuroinformatics, analysis, modelling and simulation to investigate the different levels of the brain. This particular MOOC has had over 3,990 participants since it launched in July 2018.

Both MOOCs (simulation neuroscience and the multi-scale brain) are available on the edX Platform. The MOOCs are free and can be started at any time, and completed at one's own pace.

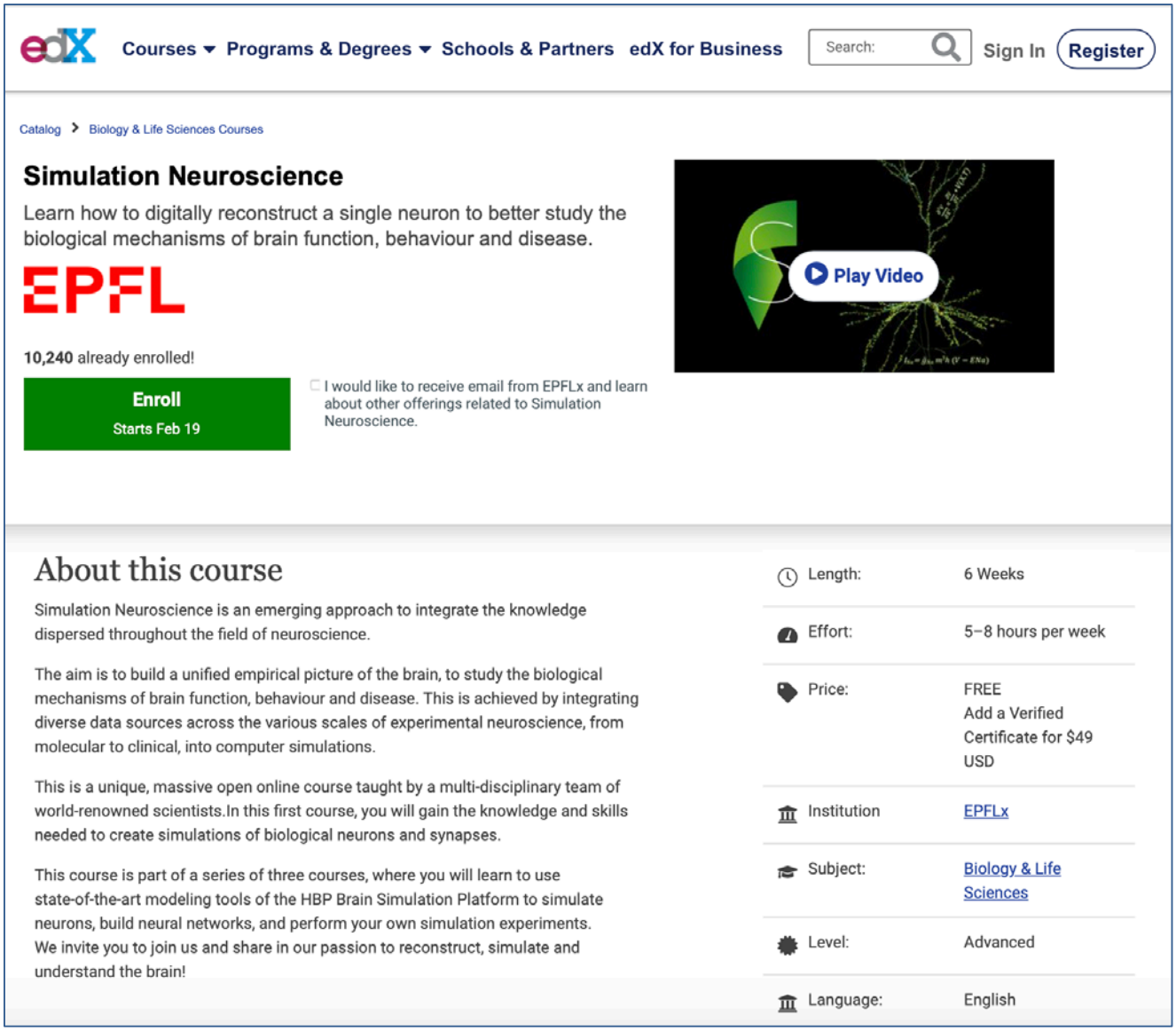

Figure 2: Screenshot of the simulation neuroscience MOOC.

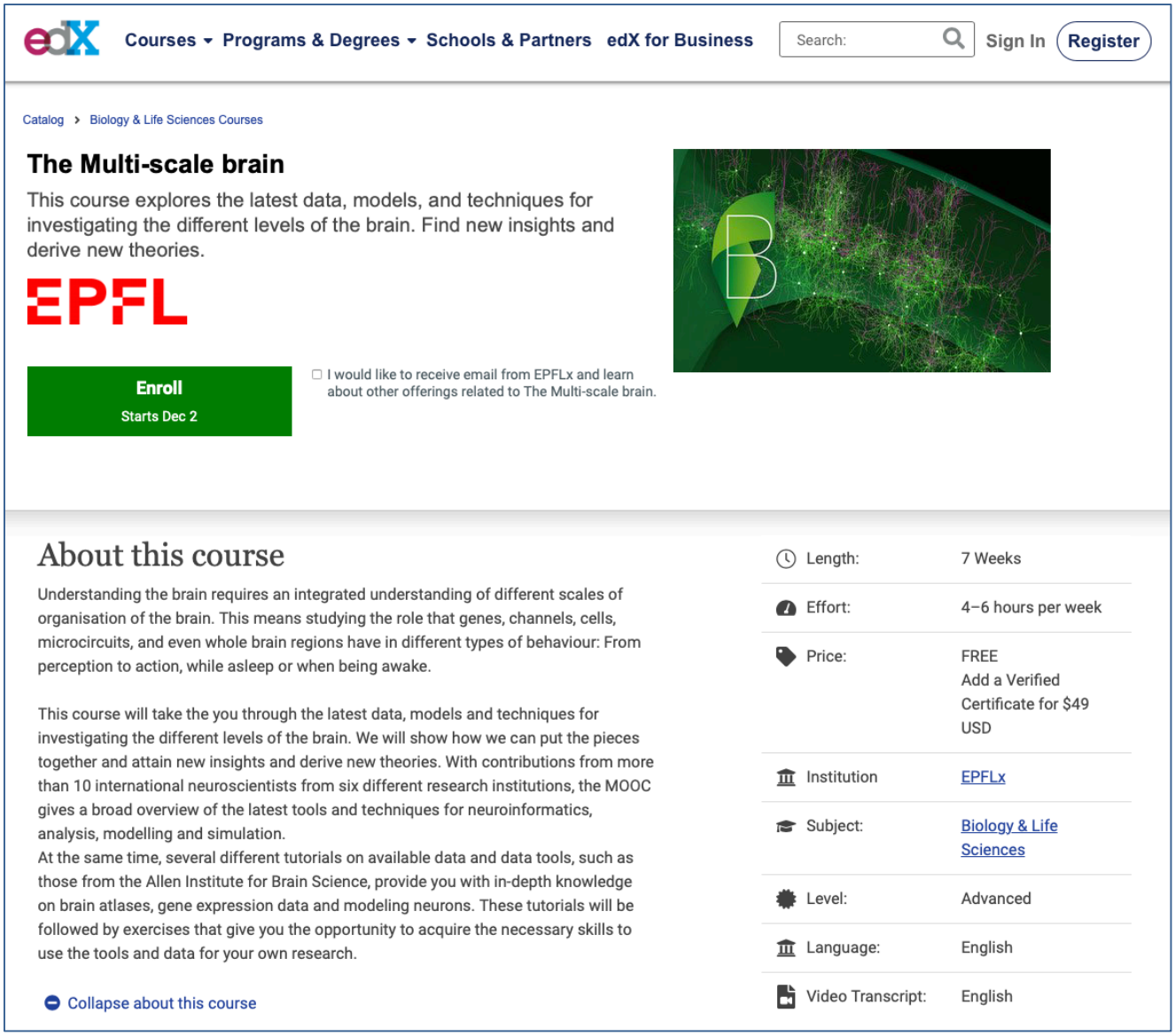

Figure 3: Screenshot of the multi-scale brain MOOC.

We are currently finalising our second MOOC in simulation neuroscience. This will focus on simulation of the hippocampus network using the BSP. The beta launch of this MOOC is planned for spring 2020. As with the other two MOOCs, we expect this to drive significant numbers of users to our Platform.

Communities engaged:

- neuroscience
- computational neuroscience

3. Hands-on training

In contrast to the MOOCs, providing hands-on training via schools and workshops is obviously much more time-consuming and reaches fewer people. However, such training is able to go into greater depth and can provide personalised help and advice. In SGA2, we provided hands-on training as frequently as possible, either as stand-alone events or as a training event tagged onto another activity, such as a conference (Table 1).

We delivered two schools/training courses with organisational support from the HBP Education Programme. These schools/courses were held over 4-5 days and were a mix of presentations and hands-on training. The first HBP School, The Brain Simulation Platform of the Human Brain Project, was filmed and the lectures can be found in the HBP Education Programme's e-library

(https://education.humanbrainproject.eu/web/hbp-school-the-brain-simulation-platform/school-media).

In SGA2, we also organised two courses as part of the School of Brain Cells & Circuits "Camillo Golgi" programme. The international School of Brain Cells & Circuits, dedicated to the Italian Nobel laureate Camillo Golgi, was opened in 2015 by the Ettore Majorana Foundation and Centre for Scientific Culture in Italy. Every year, the School hosts a course tackling the latest topics in neuroscience; it provides learning, fuels discussion and critical thinking in the next generation of neuroscientists. The 2018 course focused on cellular microcircuits to large scale networks and modelling, while the course in 2019 was dedicated to modelling the brain and its pathologies. Both courses consisted of presentations, posters and debates.

A number of workshops tagged onto conferences took place during SGA2; they are listed in Table 1. These varied in length and in structure.

Communities engaged:

- neuroscience
- computational neuroscience
- systems biology

Table 1: Overview of hands-on training events provided during SGA2.

Name of school/workshop	Place of school/workshop	Dates	Number of attendees
HBP Training course on the Brain Simulation Platform of the Human Brain Project	Helsinki, Finland	7-10 Oct 2019	25
Brain Circuit Insight: From brain circuit models to brain circuit insights workshop, Bernstein Conference	Berlin, Germany	17-18 Sep 2019	not recorded
School of Brain Cells & Circuits "Camillo Golgi": Modelling the brain and its pathologies	Erice, Italy	27 Aug-1 Sep 2019	80
Simulating the Brain with the Brain Simulation Platform, INCF Conference	Warsaw, Poland	31 Aug 2019	12
"Computational Modeling in Biology Network" (COMBINE) Workshop	Heidelberg, Germany	15-19 Jul 2019	not recorded
NEST Conference 2019 – A Forum for Users and Developers	Ås, Norway	24-25 Jun 2019	39
School of Brain Cells & Circuits "Camillo Golgi": The Neural Bases of Action – from cellular microcircuits to large-scale networks and modelling	Erice, Italy	11-15 Dec 2018	63
HBP School - The Brain Simulation Platform of the Human Brain Project	Palermo, Italy	17-21 Sep 2018	11
Developing, standardizing and sharing large scale cortical network models, CNS 2018	Seattle, USA	17 Jul 2018	not recorded
Neuroscience for ICT: applications to computation and robotics workshop	Berlin, Germany	4-6 Jul 2018	not recorded
NEST Conference 2018	Ås, Norway	25-26 Jun 2018	41

4. Hackathons/codejams

We have actively organised and participated in hackathons/codejams (Table 2). These have evidently been open to the community and an opportunity to develop and get ideas from those external to the HBP.

Community engaged:

- computational neuroscience

Table 2: Overview of hackathons/codejams held during SGA2.

Name of hackathon	Place of hackathon	Dates	Number of attendees
HBP Hackathon on Cerebellum Modelling	Pavia, Italy	13-15 Jan 2020	63
HBP CodeJam Workshop #10	Heidelberg, Germany	26-28 Nov 2019	61
NEST hackathon	Meßstetten, Germany	21-24 Nov 2019	6
NEST hackathon	Jülich, Germany	9-13 Sep 2019	10
NEST hackathon	Ås, Norway	26-28 Jun 2019	16
NEST hackathon	Meßstetten, Germany	3-7 Jun 2019	7
NEST hackathon	Jülich, Germany	8-12 Apr 2019	9
NEST hackathon	Ås, Norway	4-8 Feb 2019	12
NEST hackathon	Ås, Norway	27-29 Jun 2018	10
HBP CodeJam Workshop #9	Palermo, Italy	26-28 Nov 2018	64

5. Developer communities

5.1 NEST

The NEST community has developed well in the SGA2 phase of the HBP. The NEST Conference has now established itself as the annual forum for this community. Initiated as a user workshop first held in Geneva in 2015 and held annually since, the move to a summer timeslot and the Norwegian University of Life Sciences campus at Ås has helped to turn the conference into a permanent community institution with participants from around the globe. In 2019, we were even able to attract high-level speakers such as Stefan MIHALAS from the Allen Institute for Brain Science. The next conference will be held on 29-30 June 2020, again at Ås.

Post-conference hackathons, including users attending the conference, have allowed close interaction between users and developers. This has enabled developers to learn first-hand about users' needs, while giving users direct access to developer competence. Several additional developer-only hackathons have significantly boosted NEST development, through focused week-long development sprints with members of different teams contributing to NEST development.

Outside the conference and hackathons, NEST developers meet every other Monday for an Open Developer Video Conference to discuss current topics in development and review open pull requests, issues and mailing list requests. Between 25 and 40 developers have contributed code, documentation or examples to recent NEST releases.

5.2 NEURON

To advance NEURON/CoreNEURON features required for the HBP, developers funded by the HBP, met with the members of the wider NEURON development community. This meeting was held on 13-15 November 2019, hosted by Robert McDougal at the Center for Biomedical Data Science, Yale University. Besides the Project Owner and Lead Developer, Michael HINES, various members from Robert McDougal's team, the Blue Brain Project's High-Performance Computing Team (under Felix Schürmann, EPFL), as well as from SUNY Downstate's Neurosimulation Lab (led by Bill LYTTON) attended the meeting. In total, 15 people came together to discuss, learn and code.

The aim of this first meeting was explicitly not only to discuss high-level topics and the future roadmap for NEURON, but to also allow the various contributors to meet in person, work on pending issues and advance code development.

More details on the meeting can be found here: https://www.neuron.yale.edu/neuron/news/first-neuron-core-developers-meeting-new-haven. The next NEURON meeting, a codejam, is planned for April/May 2020.

6. Brain circuit communities

The hippocampus community within SP6 has always collaborated closely with the hippocampus community outside the HBP. This community collaboration was kicked-off during the Ramp-Up Phase of the HBP (October 2013-March 2016) with a workshop on collaborative hippocampal modelling at University College London, United Kingdom (March-April 2015). To follow-up on the success of this first workshop, two others were organised at EITN (Paris, France) in May 2017 (SGA1) and January 2019 (SGA2). A third workshop is planned for after the hippocampus hub is launched, the MOOC on the hippocampus network simulation and analysis is launched, and publication of a journal article on the hippocampus network.

The cerebellum community within SP6 has always engaged the external community, organising many events to disseminate the project's concepts. Among these events were:

1) the HBP Italy Outreach Event (Human Brain Project: the endeavour of neuroscience) with more than 300 registered participants from a broad public including students, scientists, academics, as well as institutional representatives from government and the national Italian research system;
2) the Ettore Majorana Golgi School (since 2015) involving PhD students and scientists from around Europe; and
3) the hackathon on cerebellum modelling (January 2020) was open to external participants. The talks and tutorials from the hackathon are available on the dedicated public Collab (https://collab.humanbrainproject.eu/#/collab/77410/nav/524402).

Communities engaged:

- neuroscience
- computational neuroscience

7. HBP voucher system

In SGA2, the HBP introduced infrastructure vouchers, intended to encourage the external community to use the Platforms, establish collaborations and co-develop engineering solutions of mutual interest and benefit. SP6 actively encouraged external scientists to apply to the voucher call.

The HBP received thirty-two proposals and 15 of these were funded. Of the 15 funded proposals, eight are collaborating with the BSP.

The vouchers have been a helpful tool to establish more in-depth collaborations, connecting the Platform with various communities. Significant outcomes include:

- Mapping Brain Circuits in Spatial Navigation, Voucher n.32 (with University of Rome, Italy)
- Installling an independent software on the BSP, Neuronal Dynamics Library and its integration with CxSystem, Voucher n.23 (with University of Helsinki, Finland)
- Building Alzheimer Disease Neuron Model, Voucher n.28 (with the Institut de Pharmacologie Moléculaire et Cellulaire (IPMC), CNRS, Valbonne, France)
- Multiscale Hippocampal Models for Neuronal Plasticity, Voucher n.41 (with the Neuroscience Institute, Lithuanian University of Health Sciences, Kaunas, Lithuania).

- Neuromorphic hardware simulations of cerebrocortical-cerebellar loop (SpinnCer), voucher n.47 (with University of Pavia, Italy).
- Virtual Mouse CerebNEST (VM-CEREBNEST), voucher n.49 (with Politecnico di Milano, Italy)

In the upcoming SGA3 funding period, 8 of the 13 selected voucher proposals were requests to work with SP6 partners and the BSP. This achievement is a reflection of the success of SP6's voucher-related collaborations in SGA2.

Communities engaged:

- neuroscience
- computational neuroscience
- neuromorphic
- neurorobotics
- medical research

8. Grünenthal

Since 2011, we have had a strong collaboration with Grünenthal, a pharmaceutical company headquartered in Aachen, Germany. This collaboration focuses on the development of painkillers. Several molecules with possible therapeutic beneficial effects have been developed and are now being tested *in vitro* and *in vivo*. The research has been supported by two grants from the German Ministry for Education (BMBF).

Community engaged:

- pharma research

9. Live Papers

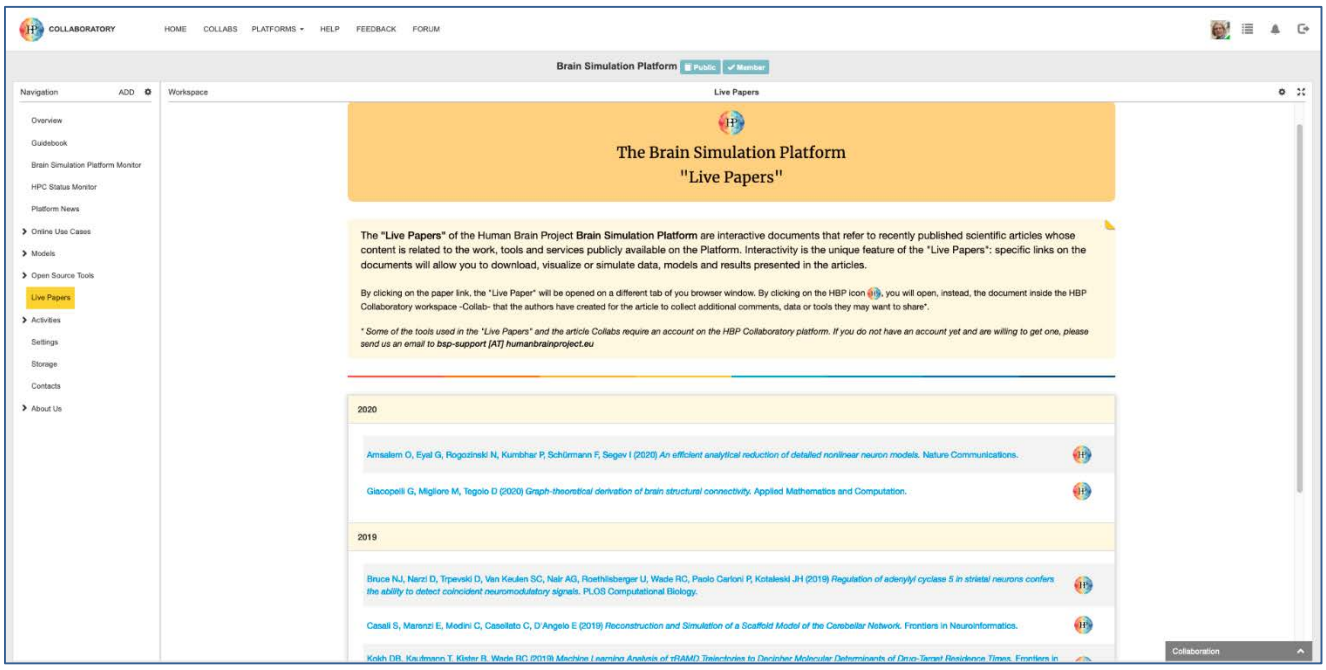

Figure 4: Screenshot of the Live Papers portal in the Brain Simulation Platform.

In SGA2, we started the concept of Live Papers. When a model reaches exploitation phase (as per the SP6 Life Cycle Model for Data-Driven Models) and is published, we endeavour to accompany the publication with a Live Paper. A Live Paper is an interactive document which allows the user to download, visualise or simulate data, models and the results presented in the publication (Figure 4).

The Live Papers can be accessed directly via the Platform, the preferred way to interact with them, as the user can in this way benefit from the full functionality of the Platform. However, for users who do not yet have a Collaboratory account, they can access the Live Papers externally from the Platform, but with a more limited functionality.

Currently, 11 Live Papers are available:

- Amsalem O, Eyal G, Rogozinski N, Gevaert M, Kumbhar P, Schürmann F, Segev I (2020) An efficient analytical reduction of detailed nonlinear neuron models. Nature Communications.
- Giacopelli G, Migliore M, Tegolo D (2020) Graph-theoretical derivation of brain structural connectivity. Applied Mathematics and Computation.
- Bruce NJ, Narzi D, Trpevski D, van Keulen SC, Nair AG, Röthlisberger U, Wade RC, Carloni P, Hellgren Kotaleski J (2019) Regulation of adenylyl cyclase 5 in striatal neurons confers the ability to detect coincident neuromodulatory signals. PLOS Computational Biology. doi: 10.1371/journal.pcbi.1007382
- Casali S, Marenzi E, Medini C, Casellato C, D'Angelo E (2019) Reconstruction and Simulation of a Scaffold Model of the Cerebellar Network. Frontiers in Neuroinformatics. doi: 10.3389/fninf.2019.00037
- Kokh DB, Kaufmann T, Kister B, Wade RC (2019) Machine Learning Analysis of τRAMD Trajectories to Decipher Molecular Determinants of Drug-Target Residence Times. Frontiers in Molecular Biosciences. doi: 10.3389/fninf.2019.00037
- Martinello K, Giacalone E, Migliore M, Brown DA, Shah MM (2019) The subthreshold-active K_V7 current regulates neurotransmission by limiting spike-induced Ca^{2+} influx in hippocampal mossy fiber synaptic terminals. Communications Biology. doi: 10.1038/s42003-019-0408-4
- Masoli S, Tognolina M, Laforenza U, Moccia F, D'Angelo E (2019) Parameter tuning differentiates granule cell subtypes enriching the repertoire of retransmission properties at the cerebellum input stage. bioRxiv. doi: 10.1101/638247
- Solinas SMG, Edelmann E, Leßmann V, Migliore M (2019) A kinetic model for Brain-Derived Neurotrophic Factor mediated spike timing-dependent LTP. PLOS Computational Biology.
- Live Paper covering two publications:
  - Eyal G, Verhoog MB, Testa-Silva G, Deitcher Y, Benavides-Piccione R, DeFelipe J, de Kock CPJ, Mansvelder HD, Segev I (2018) Human Cortical Pyramidal Neurons: From Spines to Spikes via Models. Frontiers in Cellular Neuroscience. doi: 10.3389/fncel.2018.00181
  - Eyal G, Verhoog MB, Testa-Silva G, Deitcher Y, Lodder JC, Benavides-Piccione R, Morales J, DeFelipe J, de Kock CPJ, Mansvelder HD, Segev I (2016) Unique membrane properties and enhanced signal processing in human neocortical neurons. eLIFE. doi: 10.7554/eLife.16553
- Lindroos R, Dorst MC, Du K, Filipović M, Keller D, Ketzef M, Kozlov AK, Kumar A, Lindahl M, Nair AG, Pérez-Fernández J, Grillner S, Silberberg G, Hellgren Kotaleski J (2018) Basal Ganglia Neuromodulation Over Multiple Temporal and Structural Scales—Simulations of Direct Pathway MSNs Investigate the Fast Onset of Dopaminergic Effects and Predict the Role of Kv4.2. Frontiers in Neural Circuits. doi: 10.3389/fncir.2018.00003
- Migliore R, Lupascu CA, Bologna LL, Romani A, Courcol J-D, Antonel S, Van Geit WAH, Thomson AM, Mercer A, Lange S, Falck J, Rössert CA, Shi Y, Hagens O, Pezzoli M, Freund TF, Káli S, Muller EB, Schürmann F, Markram H, Migliore M (2018) The physiological variability of channel density in hippocampal CA1 pyramidal cells and interneurons explored using a unified data-driven modeling workflow. PLOS Computational Biology. doi: 10.1371/journal.pcbi.1006423

We also have one Live Paper created by scientists external to the HBP. They contacted SP6 and were interested to produce a Live Paper to accompany their publication:

- Mandge D, Manchanda R (2018) A biophysically detailed computational model of urinary bladder small DRG neuron soma. PLOS Computational Biology. doi: 10.1371/journal.pcbi.1006293

So far, the Live Papers have been accessed more than 2,800 times as seen in Figure 5.

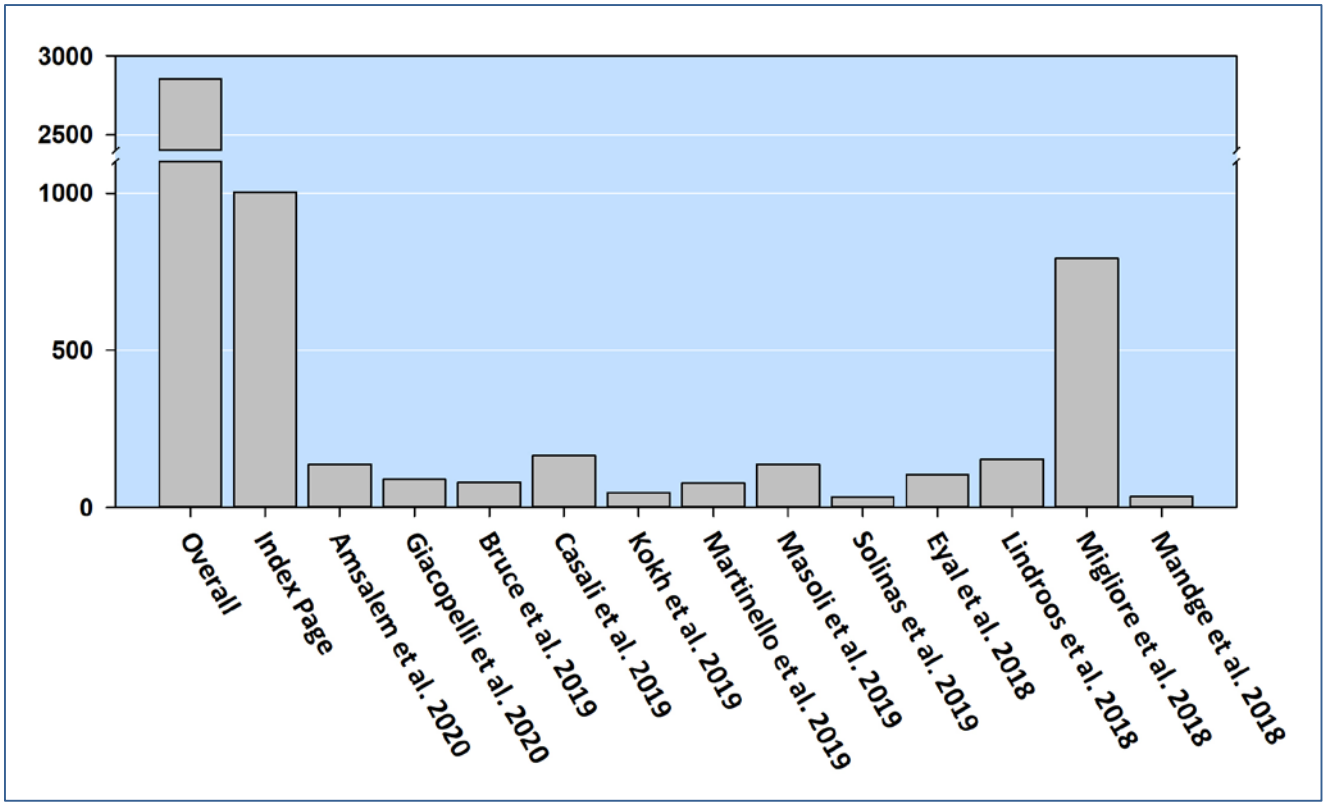

Figure 5: Graphic showing the current views of the different Live Papers.

Communities engaged:

- neuroscience
- computational neuroscience
- systems biology

10. Open Days and conferences

We have participated in HBP Open Days in Florence in 2016, Glasgow in 2017, Maastricht in 2018 and Athens in 2020. These Open Days, which take place prior to the HBP Summits, have attracted schoolchildren, students, journalists and scientists, as well as the general public. At these Open Days, we had a booth with posters and videos, and members of SP6 were present to give more detailed information on the BSP and its functionality.

SP6 has also participated in a number of scientific conferences, with videos, live demos and information leaflets and postcards, made available via the HBP booth. In SGA2, the conferences at which there was an HBP booth and SP6 participation were: the ICT Research & Innovation Event of the EU (Vienna, December 2018), FENS Forum of Neuroscience (Berlin, July 2018), Bernstein Conference (Berlin, September 2019) and SfN Neuroscience 2019 (Chicago, October 2019). The audience at these conferences was obviously mainly neuroscientists and computational neuroscientists, and the medical and pharma research communities.

Communities engaged:

- neuroscience
- computational neuroscience
- systems biology
- medical research
- pharma research

- industry
- European Commission
- schoolchildren
- journalists
- general public

11. Human Brain Project and EBRAINS websites

Our various models and resources are listed per model on the HBP website. For each model, we highlight the work that was carried out and how, list who was involved and detail the benefit to the community (Figure 6).

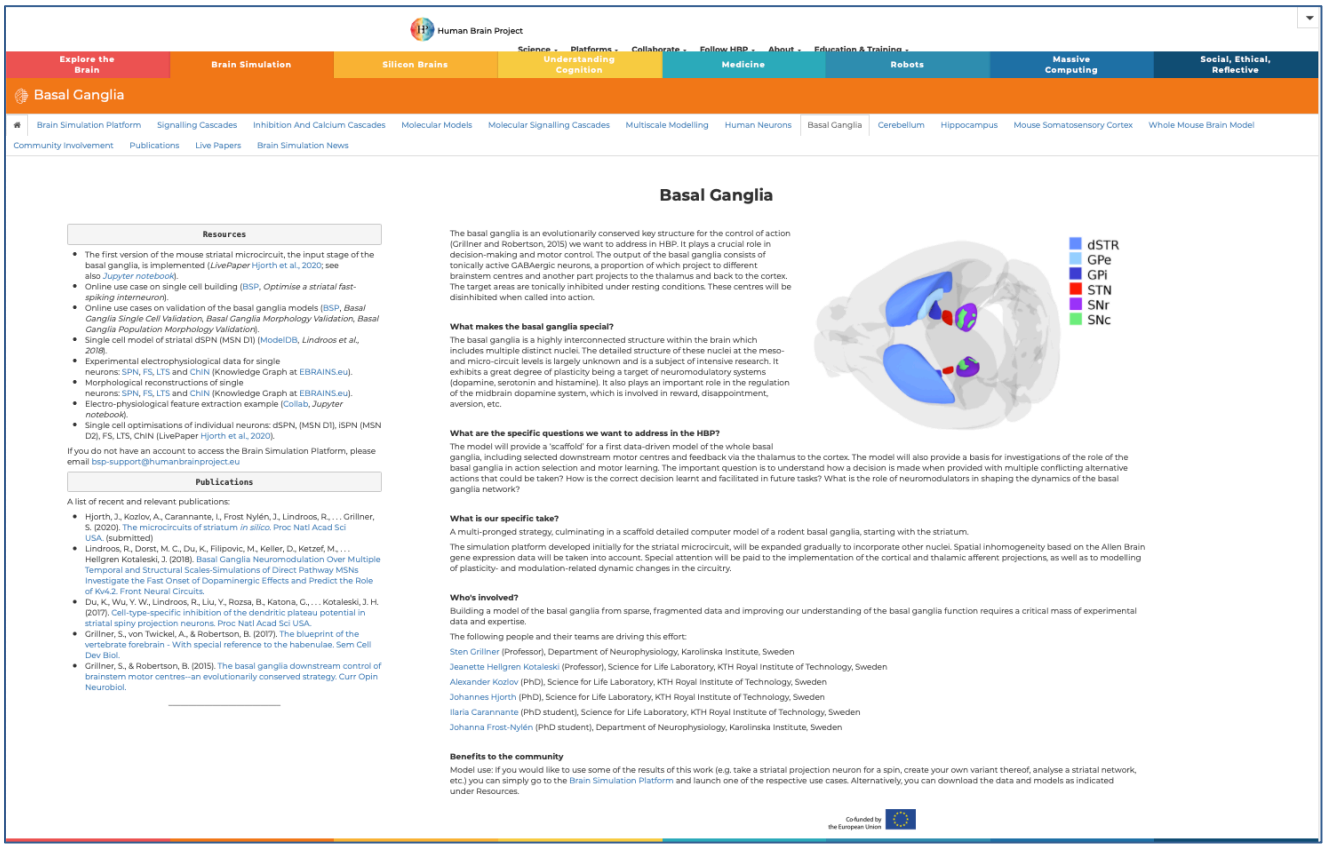

Figure 6: Screenshot of a model page on the Human Brain Project website.

In addition to the model pages, we have another section for community involvement, in which we list, per model, the types of data that the various models will be able to consume in the short-term to near future (Figure 7). In this way, experimentalists with data that would like to contribute to our collaborative model building efforts can directly get in touch with us.

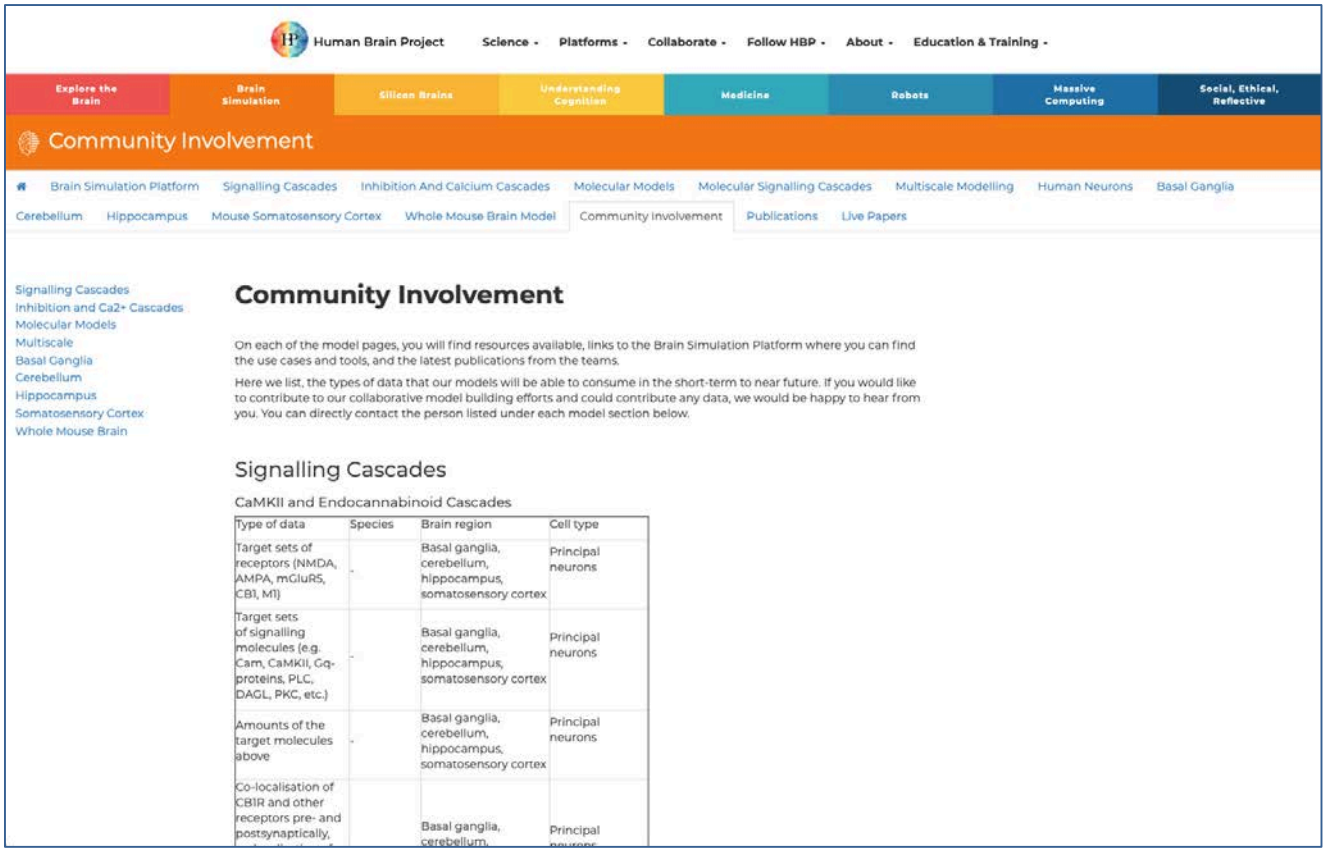

Figure 7: Screenshot of the website section on which data each model will be able to consume.

With the launch of the EBRAINS website/portal in October 2019, SP6 started to advertise various tools and services via this new channel. This activity will be continued in SGA3.

Communities engaged:

- neuroscience
- computational neuroscience
- systems biology
- medical research
- pharma research
- general public

12. Twitter

The Brain Simulation Platform (@HBPBrainSim) and the NEST simulator (@NESTSimulator) both tweet on recent publications and event/conference information and presentations.

Communities engaged:

- neuroscience
- computational neuroscience
- systems biology
- medical research
- pharma research
- general public