





<u>SP6 Summary Report on Community Outreach</u> (SGA2 - D6.5.1)



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







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Author(s):	Felix SCHÜRMANN, EPFL (P1 Katrien VAN LOOK, EPFL (P1 Michele MIGLIORE, CNR (P12)				
Compiled by:	Katrien VAN LOOK, EPFL (P1)				
Contributor(s):	James KING, EPFL (P1), Sect Omar AWILE, EPFL (P1), Sec Paolo CARLONI, JUELICH (P2 Markus DIESMANN, JUELICH Dennis TERHORST, JUELICH Anne ELFGEN, JUELICH (P20 Hans Ekkehard PLESSER, NM Egidio D'ANGELO, UNIPV (P70)	tion 5.2 20), Section 8 (P20), Sections 4 & 5.1 (P20), Sections 4 & 5.1), Sections 4 & 5.1 BU (P44), Sections 4 & 5. 20) Sections 6 & 7	1			
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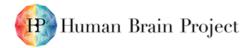




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1. Introduction

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.







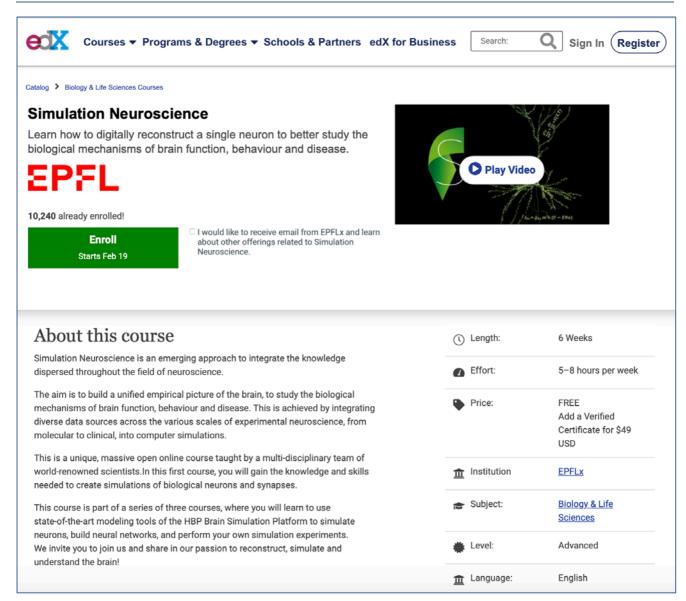
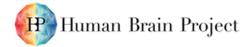


Figure 2: Screenshot of the simulation neuroscience MOOC.







Q edX Courses - Programs & Degrees - Schools & Partners edX for Business Sign In (Register Search Catalog > Biology & Life Sciences Courses The Multi-scale brain This course explores the latest data, models, and techniques for investigating the different levels of the brain. Find new insights and derive new theories. □ I would like to receive email from EPFLx and learn Enroll about other offerings related to The Multi-scale brain Starts Dec 2 About this course C Length: 7 Weeks Understanding the brain requires an integrated understanding of different scales of Effort: 4-6 hours per week organisation of the brain. This means studying the role that genes, channels, cells, microcircuits, and even whole brain regions have in different types of behaviour: From Price: FREE perception to action, while asleep or when being awake. Add a Verified Certificate for \$49 This course will take the you through the latest data, models and techniques for USD investigating the different levels of the brain. We will show how we can put the pieces together and attain new insights and derive new theories. With contributions from more fin Institution **EPFLx** than 10 international neuroscientists from six different research institutions, the MOOC gives a broad overview of the latest tools and techniques for neuroinformatics Subject: **Biology & Life** analysis, modelling and simulation. Sciences At the same time, several different tutorials on available data and data tools, such as those from the Allen Institute for Brain Science, provide you with in-depth knowledge Advanced Level: on brain atlases, gene expression data and modeling neurons. These tutorials will be followed by exercises that give you the opportunity to acquire the necessary skills to f Language: Enalish use the tools and data for your own research. Video Transcript: English Collapse about this course

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.

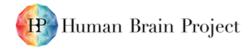
Communities engaged:

- 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







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

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 <u>Ettore Majorana Foundation and Centre for Scientific Culture</u> 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

Developer communities 5.

5.1 NEST

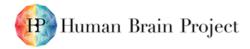
The NEST community has developed well in the SGA2 phase of the HBP. The NEST Conference has now established itself as the annual forum for this community. Initiated as a user workshop first held in Geneva in 2015 and held annually since, the move to a summer timeslot and the Norwegian University of Life Sciences campus at As 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 weeklong 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.

NEURON 5.2

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: <u>https://www.neuron.yale.edu/neuron/news/first-neuron-core-developers-meeting-new-haven</u>. 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:

- 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

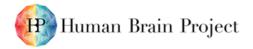
7. HBP voucher system

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)
- Installing 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:

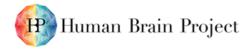
• pharma research

9. Live Papers

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Online Uses The "Live Papers" of the Human Brain Project Brain Simulation Platform are interactive documents that refer to recently published scientific articles whose content is related to the work, tools and services publicly available on the Platform. Interactivity is the unique feature of the "Live Papers"; specific links on the documents will allow you to download, visualize or simulated data, models and results presented in the articles. In Service By cleicing on the paper link the 'Unip Paper' will be general on a different tib dry cursons winders By cleicing on the viels presented in the articles. Actives By cleicing on the paper' will be general on a different tib dry cursons winders By cleicing on the viels presented in the articles. Services "Some of he tools used in the "Live Papers" and the article Collaboratory platform. If you do not have an account yet and are willing to ger one, please enserted or and are one and to age a useral to age-support [AT] humanbraipergeter. Some Collaboratory platform. If you do not have an account yet and are willing to ger one, please enserted to a dispersupport [AT] humanbraipergeter. Some Collaboratory platform. If you do not have an account yet and are willing to ger one, please ensert to age a useral to age-support [AT] humanbraipergeter.	
Amaslem D, Eyal G, Rogasinski N, Kumbhar P, Schörmann F, Seger / (2028) An efficient analytical reduction of detailed nonlinear neuron models. Nature Communications.	
Glacopell G, Migliore M, Tegole D (2020) Graph-theoretical derivation of brain structural connectivity. Applied Mathematics and Computation.	
2019	
Bruce NJ, Herri D, Tynenki D, Van Keslen SC, Nak AD, Rosthildseger LJ, Wade RC, Paslo Certoni P, Kotaleski JH (2019) Regulation of adivgly/ir cyclase 5 in striktel neurons confers the ability to detect coincident neuromodulatory signals. PLOS Computational Biology.	
Catalil S, Materiti E, Medrin C, Casellato C, D'Angelo E (2019) Reconstruction and Simulation of a Scatfold Model of the Casebalar Network. Frontiers in Neuroinformatics.	

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.

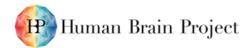
Currently, 11 Live Papers are available:

- Amsalem O, Eyal G, Rogozinski N, Gevaert M, Kumbhar P, Schürmann F, Segev I (2020) <u>An</u> <u>efficient analytical reduction of detailed nonlinear neuron models.</u> Nature Communications.
- Giacopelli G, Migliore M, Tegolo D (2020) <u>Graph-theoretical derivation of brain structural</u> <u>connectivity.</u> 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) <u>Regulation of adenylyl cyclase 5 in striatal neurons confers the ability</u> 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) <u>Reconstruction and Simulation of a Scaffold Model of the Cerebellar Network.</u> Frontiers in Neuroinformatics. doi: 10.3389/fninf.2019.00037
- Kokh DB, Kaufmann T, Kister B, Wade RC (2019) <u>Machine Learning Analysis of τRAMD Trajectories</u> to Decipher Molecular Determinants of Drug-Target Residence Times. Frontiers in Molecular Biosciences. doi: <u>10.3389/fninf.2019.00037</u>
- Martinello K, Giacalone E, Migliore M, Brown DA, Shah MM (2019) <u>The subthreshold-active K_V7</u> current regulates neurotransmission by limiting spike-induced Ca²⁺ influx in hippocampal mossy fiber synaptic terminals. Communications Biology. doi: <u>10.1038/s42003-019-0408-4</u>
- Masoli S, Tognolina M, Laforenza U, Moccia F, D'Angelo E (2019) <u>Parameter tuning differentiates</u> <u>granule cell subtypes enriching the repertoire of retransmission properties at the cerebellum</u> <u>input stage.</u> bioRxiv. doi: <u>10.1101/638247</u>
- Solinas SMG, Edelmann E, Leßmann V, Migliore M (2019) <u>A kinetic model for Brain-Derived</u> <u>Neurotrophic Factor mediated spike timing-dependent LTP.</u> 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) <u>Human Cortical Pyramidal Neurons: From Spines to Spikes</u> via Models. Frontiers in Cellular Neuroscience. doi: <u>10.3389/fncel.2018.00181</u>
 - 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) <u>Unique membrane properties and</u> <u>enhanced signal processing in human neocortical neurons.</u> eLIFE. doi: <u>10.7554/eLife.16553</u>
- 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) <u>Basal Ganglia</u> <u>Neuromodulation Over Multiple Temporal and Structural Scales—Simulations of Direct Pathway</u> <u>MSNs Investigate the Fast Onset of Dopaminergic Effects and Predict the Role of Kv4.2. Frontiers</u> <u>in Neural Circuits.</u> doi: <u>10.3389/fncir.2018.00003</u>
- 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) <u>The physiological variability of channel density</u> in hippocampal CA1 pyramidal cells and interneurons explored using a unified data-driven modeling workflow. PLOS Computational Biology. doi: <u>10.1371/journal.pcbi.1006423</u>

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) <u>A biophysically detailed computational model of urinary bladder</u> <u>small DRG neuron soma.</u> PLOS Computational Biology. doi: <u>10.1371/journal.pcbi.1006293</u>

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





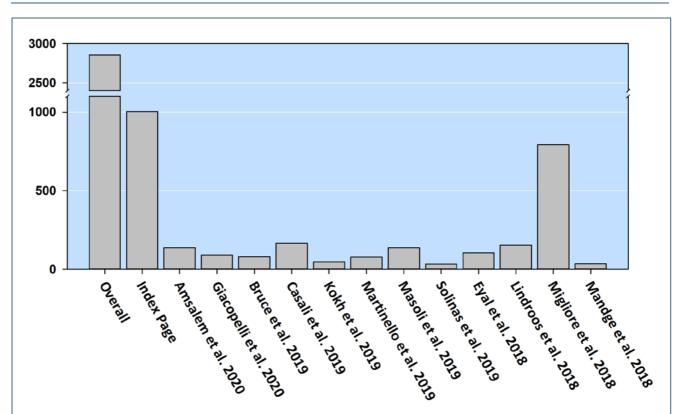


Figure 5: Graphic showing the current views of the different Live Papers.

Communities engaged:

- neuroscience
- computational neuroscience
- systems biology

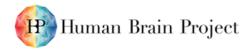
10. Open Days and conferences

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

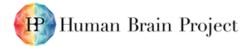
11. Human Brain Project and EBRAINS websites

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).

Explore the		Science - Platforms - Understanding	Collaborate - Follow HBP -			Massive	Social, Ethical,
Brain Brain Simulation		Cognition	Medicir	•	Robots	Computing	Reflective
sal Ganglia							
n Simulation Platform Signalling Cascades Inhibition And Calcium Cascades	s Molecular Models Mi	olecular Signalling Cascades M	fultiscale Modelling Human	Neurons Basal Ganglia	Cerebellum Hippocampus	s Mouse Somatosensory Cortex	Whole Mouse Brain Model
ty Involvement Publications Live Papers Brain Simulation News							
			Decel Con el	•-			
			Basal Gang	la			
Resources		inglia is an evolutionarily conserve Robertson, 2015) we want to add				dSTR	
The first version of the mouse stratulal microcircuit, the input stage of the basil agenitic, is implemented (LVMsper) First) ret al. 2002; see also Juspfer notebook]. Ornine use can enalge cell building (IISP, Optimize a stratal fast-aphility) intermeuron. Gardina Strate cell building (IISP, Optimize a stratal fast-aphility) intermeuron. Gardina Strate Cell building (IISP, Optimize a stratal fast-aphility) intermeuron. Single cell mole of visitial Storp (VMS ID) (Model/R), Lindrose et al., 2008). Experimental electrophysiological data for single mount of stratal Storp (MS ID) (Model/R), Lindrose et al., 2008). Experimental electrophysiological data for single memory. Figure 2014, SL, LL Stard CH, MORNING MA, EBANISeu). meuros: Style, LL Stard CH, MORNING MA, CHARLES, MA, CHARLES, Lindrose et al., 2018. Experimental electrophysiological data for single meuros: Style, LL Stard Storph, EL Stard Strate, LL Stard Storph, LL Storph, LL Storph, LL Stor	decidon-ma tonically act brainstem o The target a disinhibited What make The basal gr includes ma and micro- exhibits a gr (dopamine,	king and motor control. The outputes the GABAregin currons, a proport- entres and another part projects trees are tonically inhibited under when called into action. s the basal ganglia special? unglia is a highly interconnected a thitple distinct nucle. The detailed incut levels is largely unknown an eact degree of plasticity being at the aleo pain dopamire system, which is in a las por an dopamire system, which is in a laster.	ut of the basal ganglia consists ion of which project to different to the thalamus and back to the resting conditions. These centre structure within the brain which structure of these nuclei at the d is a subject of intensive resea rget of neuromodulatory syster lays an important role in the re	of cortex. s will be meso- ch. It ns yulation	40	GPe GPi STN SNr SNr SNc	
 neurons: SPN, FS, LTS and CINIX (Knowledge Graph at EBRAINS.eu). Elector-physiological feature extraction example (Collab, Jupyter notebook). Single cell optimisations of individual neurons: dSPN, (MSN DI), ISPN (MSN D2), FS, LTS, ChIN (LivePaper Hjorth et al., 2020). 	aversion, etc			nt,		B	
If you do not have an account to access the Brain Simulation Platform, please email bsp-support@humanbrainproject.eu	ganglia, incl		or centres and feedback via the	thalamus to the cortex. Th		or investigations of the role of the th multiple conflicting alternative	
Publications		could be taken? How is the correl					
A list of recent and relevant publications:							
 Hjorth, J., Kozlov, A., Carannante, I., Frost Nylén, J., Lindroos, R., Grillner, S. (2020). The microcircuits of striatum in silico. Proc Natl Acad Sci 		specific take? nged strategy, culminating in a sc	affold datailed computer mode	of a redent bacal ganglia	starting with the striptum		
USA (submitted) Lindroos, R. Dorst, M. C., Du, K., Filipovic, M., Keller, D., Ketzef, M., Heligren Kotaleski, J. (2018). Basal Canglia Neuromodulation Over Mutiple Temporal and Structural Scales-Simulations Of Direct Pathway MSNs Investigate the Fact Onset of Dopaminergic Effects and Predict the Role of Kv4.2, Pront Neural Circuits.	The simulat gene expres	on platform developed initially for	r the striatal microcircuit, will be nt. Special attention will be paid	expanded gradually to in	corporate other nuclei. Spatial inh	nomogeneity based on the Allen Brain It projections, as well as to modelling	
 Du, K., Wu, Y. W., Lindroos, R., Liu, Y., Rozsa, B., Katona, G., Kotaleski, J. H. (2017). Cell-type-specific inhibition of the dendritic plateau potential in striatal spiny projection neurons. Proc Natl Acad Sci USA. 	data and ex	nodel of the basal ganglia from sp pertise.		roving our understanding	of the basal ganglia function req	uires a critical mass of experimental	
 Grillner, S., von Twickel, A., & Robertson, B. (2017). The blueprint of the vertebrate forebrain - With special reference to the habenulae. Sem Cell 		g people and their teams are drivi					
 Dev Biol. Grillner, S., & Robertson, B. (2015). The basal ganglia downstream control of 		(Professor), Department of Neuro Ilgren Kotaleski (Professor), Scienc					
brainstem motor centresan evolutionarily conserved strategy. Curr Opin		ozlov (PhD), Science for Life Labor			weden		
Neurobiol.		orth (PhD), Science for Life Labor					
		ante (PhD student), Science for L					
		st-Nylén (PhD student), Departm					
	Model use: I	simply go to the Brain Simulation				t thereof, analyse a striatal network, data and models as indicated	
				Coñur	275		

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.







	Hum	an Brain Proj	ect Science -	Platforms - Coli	laborate - Follow HBP -	About - Education & Train	ning -	
Explore the Brain	Brain Simulation	Silicon I	trains	Inderstanding Cognition	Medicine	Robots	Massive Computing	Sociel, Ethical, Reflective
⑦ Community In	volvement							
 Brain Simulation Platform Cerebellum Hippocampus 	Signalling Cascades Mouse Somatosensory		And Calcium Cascade Iole Mouse Brain Mod			cades Multiscale Modelling Live Papers	Human Neurons	Basal Ganglia
Signalling Cascades Inhibition and Ca2+ Cascades Molecular Models Multiscale Basal Canglia Cerebellum Hippocampus Somatosensory Cortex Whole Mouse Brain	On each of the mo the use cases and t Here we list, the typ to contribute to ou you. You can direct	del pages, you cools, and the l bees of data tha r collaborative ly contact the Cascad	atest publications fro it our models will be a model building effort person listed under e es	allable, links to the Bri m the teams. Ible to consume in the	ain Simulation Platform where e short-term to near future. If y e any data, we would be happ low.	you would like		
	CaMKII and Enc Type of data		Brain region	Cell type				
	Target sets of receptors (NMDA, AMPA, mGluR5, CB1, M1)		Basal ganglia, cerebellum, hippocampus, somatosensory cortex	Principal neurons				
	Target sets of signalling molecules (e.g. Cam, CaMKII, Gq- proteins, PLC, DAGL, PKC, etc.)	- 1	Basal ganglia, cerebellum, hippocampus, somatosensory cortex	Principal neurons				
	Amounts of the target molecules above	- 1	Basal ganglia, cerebellum, hippocampus, somatosensory cortex	Principal neurons				
	Co-localisation of CBIR and other receptors pre- and postsynaptically,		Basal ganglia, cerebellum.	Principal				

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