Table of Contents

European Institute for Theoretical Neuroscience

1. Introduction

This document is reflecting the activity of the European Institute of Theoretical Neuroscience (EITN) over the SGA1 M13-M24 period and is complementary to the document HBPSGA1M12Deliverable_D461. References to it may be required for a full understanding of the EITN activities.

1.1 The European Institute for Theoretical Neuroscience

As a reminder and from the DOA "The aim of the EITN is to serve as an incubator of ideas and foster the exchange of ideas between theoreticians and experimentalists, inside and outside the HBP. The institute is located in Paris area and is open to researchers from the field, from all over Europe and the rest of the World, whether they are HBP Partners or not. Besides organising inter-SP internal workshops, the Institute will also organise international workshops open to everyone to promote interactions between neuroscience and other disciplines. To help with this, the EITN will work with analyses of estimates of the different communities involved in the workshops to improve the reaching out accordingly."

1.2 The Aim of this Document

This deliverable describes the activities of the EITN between Month 13 - 24 of the SGA1 phase and concludes on the EITN development during SGA1 funding period.

2. EITN Activities

2.1 Post-doctoral positions & Visiting Scientists programme

2.1.1 Work Conducted by the EITN resident post-docs

2.1.1.1 Introduction

All EITN postdocs were co-supervised by two HBP members as detailed in the table.

Due to the delayed funding of SGA1, we had to hire postdocs mostly in the SGA1 second year. Nevertheless, we could hire several one-year postdocs whose work is detailed below. This work of course represents only one year of work for most of them.

Name	Co-supervision	HBP SP involved	Date of start	End date
Jennifer Goldman	V. Jirsa (AMU) F. Kherif (CHUV) A. Destexhe (UNIC CNRS)	SP4 - SP8	1 April 2017	31 March 2018
Anna Bulanova	A. Grüning (SURREY) S. Furber (UMAN)	SP4 - SP9	1 June 2017	31 March 2018
Tomasz Gorski	H. Mansvelder (VU) Destexhe (UNIC CNRS) T. Bal (UNIC CNRS)	SP4 – SP3	1 Mars 2017	31 March 2018
Cristiano Capone	M. Mattia (ISS) A. Destexhe (UNIC CNRS)	SP4 – SP3	1 September 2017	31 March 2018

2.1.1.2 The post docs in detail

The work of the different postdocs is detailed in Deliverables D4.7.2 of SGA1, and is summarized as follows.

Jennifer Goldman

Jennifer Goldman worked at the interface between network modelling and human data analysis. She discovered that the oscillatory modes in human recordings can be described in a coherent way, defining analogues of energy and entropy from their spectral structure. This work shows that brain states can be understood from such analogy, and she is presently trying to understand epileptic seizures using this formalism (in collaboration with Viktor Jirsa, SP4).

She also participates actively in the EITN workshops and was a tutor at the March 2018 EITN spring school.

Anna Bulanova

Anna Bulanova was co-supervised by Steve Furber (SP9) and Andre Guning (SP4). She participated actively to the CDP5, working at the interface between computational modelling (SP4) and hardware simulations (SP9). She was developing network models implementable on

the SpiNNaker hardware. She participated to the CDP5 meeting held in Bern on January 25-26th.

Anna devoted time on understanding the theoretical neuroscience which is key to understanding the work in SP4 as well as getting in-depth knowledge of the internals of the SpiNNaker neuromorphic platform and becoming embedded into WP9.3's corresponding software engineering team.

We have made good progress with the work including small scale reimplementation of the Brader-Fusi-Senn rule as a demonstration of the type of plasticity rules that are now implementable on SpiNNaker as a consequence of our joint work. We have now all the infrastructure in place to scale up simulation to a larger scale and implement a still greater variety of biologically inspired plasticity rules and explore their computational properties. To carry through this work, an extension of the current EITN cross-SP postdoc post for 2 years in SGA2 will be extremely beneficial to reach SP4 and SP9 goals, and make the SpiNNaker platform the tools of choice for large scale simulations in Theoretical Neuroscience with applications in Machine Learning.

Tomasz Gorksi

Tomasz Gorski works at the interface between human and animal slices (Huib Mansvelder, SP2), and modelling and analysis (Alain Destexhe, SP4). He is studying with imaging techniques the genesis of Up and Down states by mice cortical and entorhinal slices. He is presently studying the possibility of generating Up and Down states from human slices.

Cristiano Capone

Cristiano Capone worked at the interface between cellular models (Alain Destexhe, SP4) and population models (Maurizio Mattia, SP3). He aimed at linking these two scales, between the cellular level (network of spiking neurons) and the population level (mean-field models). His work has led to testable predictions about the genesis of activity states by such networks, bridging not only two scales, but also SP3 and SP4 work.

2.1.2 The EITN visiting scientists programme

In the M13-M24 phase, we had three visitors invited by the EITN in addition to HBP members coming to visit us.

Name	Institution	Date of start	End date
Morgan Taylor	University of Pennsylvania, USA	01/03/2017	14/07/2017
Claude Bédard	Laval University, Quebec	16/06/2017	01/07/2017
Zahara Girones	University of Oregon,USA	13/03/2018	28/03/2018

2.1.3 Conclusions

The feedback on the EITN co-supervised post-docs was that they are essential to facilitate actual collaboration between different SPs that require a true commitment from both sides. Supervising post-docs between SPs greatly improved collaborations between SPs, as well as within SP4, increasing the SPs' mutual scientific understanding also on a detailed technical level especially when both disciplines are constantly developing and not finished set frameworks. A classical collaboration as a result of eg a joint grant application would at this stage not have been feasible due to the blue skies nature of the research with the objectives only emerging as we went along and both parties investing time for explorative work by the Task Leaders initially. This was then complemented by the technical work of the EITN postdocs. In that way, they constitute an important way for developing cross-disciplinary work, such as typically linking scales, or linking between experiments and modelling, modelling and hardware, etc. In all of these cases, having two supervisors appears to be an efficient way to consolidate interactions between partners.

These postdoc also constitute part of the "core" of the scientific animation of the EITN, they participate to workshops and they also take a role in the other events, such as spring school, brainstorm sessions, etc.

Because the EITN has a reduced funding in SGA2 compared to SGA1, we decided to keep the priority on the co-supervised postdocs and on the workshops. The visitor programme is discontinued in SGA2 though we keep the possibility to host scientists in our offices when visiting their co-supervised post-doc or joining us for a workshop or a specific collaboration.

2.2 EITN attendance

Please refer to HBPSGA1M12Deliverable_D461 for statistics covering SGA1 M1-M12.

2.3 Workshops Organised by the EITN

During SGA1 M13-M24 period, 18 events were held. Oral feedback from our audience and speakers is very positive. They enjoy the atmosphere that comes out of our events with the possibility of reaching out to famous names as well as discovering unknown scientists to their knowledge. The diversity of the themes brings us people from a large variety of background and helps deepen discussions happening after talks are during breaks. EITN also gives them an opportunity to enlarge their professional network and we fairly often hear of collaboration to-become at the end of the event. We also have the chance to welcome participants several times in the year, given us faith that our workshops are very much appreciated.

2.3.1 Workshop attendance

At the EITN we have been thinking a lot about gender balance, and even more when reviewers from the previous deliverable, pointed out that this was an important issue to them. We have organized consultation with the scientists in our offices as well as during some of our workshop in a purpose to seize the feeling and ideas they had in regards to that matter.

**Gender distribution
M13-M24 SGA1**
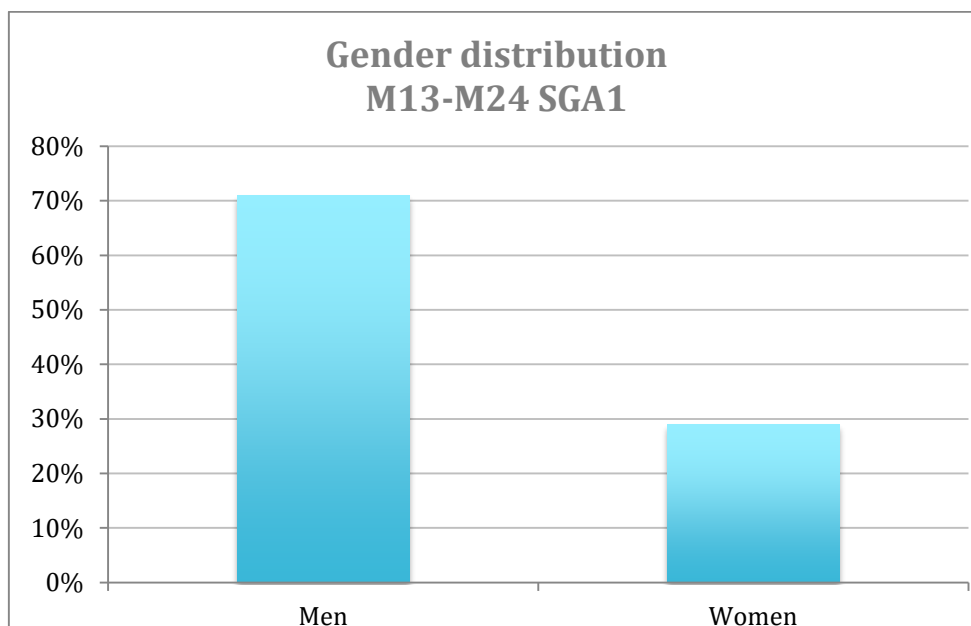
Gender distribution of EITN participants during SGA1 P2

From the various discussions we encountered, several points were noticeable:

- this subjects brings confronting ideas

- women do not want to be pointed out as victims though they have the feeling that career progression and recognition from peers might be easier for men

- women tend to have an important lack of confidence compared to men

- a majority of men and young women do not feel concerned by this issue

To guide towards a concrete set of ideas we limited the consultation to one single question: "How to improve gender balance in EITN activities?", with the given facts of *20 events for ≈ 300 participants*, *16% were women* . We were able to summarize the feedback of this consultation as follow.

At an organisation level:

- for one man speaker invited, invite a women (and vice-versa)

- increase intergenerational equality in speakers

- identify one or two contact persons to help find speakers fitting the event theme. This will also help increase organiser's network gender balance.

Sacha Van Albada and Mavi Sanchez-Vices accepted to help us on that matter, and all SP4 members are very supportive in these actions.

At an HBP level:

- with the help of the Education team, create extension programs of science dissemination in schools to encourage girls join science and more precisely in STEM (Science, Technology, Engineering and Mathematics) fields.

- with Ethics and Education, organise workshops on the topic as well as mentoring sessions.

In regards to those conclusions, we have been in touch with EAF Berlin, SP11 gender balance team and Ethics & Society team to share with them our conclusions and see if further actions could be brought together. Discussions are still going on to that day as we are seeking for a complementary approach to what is already being made in the HBP task dedicated to gender balance and diversity.

We now make sure that there is a right gender balance in our events even though we know that currently only 16% of women are in Theoretical Neuroscience.

Gender participants distribution
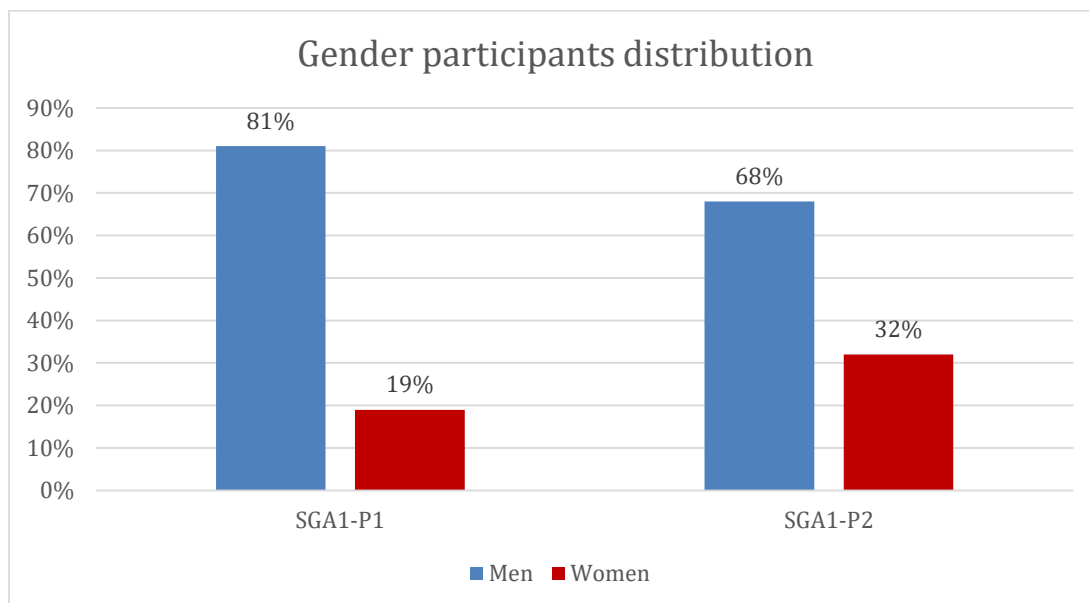
Comparison of gender distribution of participants SGA1 P1 vs P 2

Though the Cortical Code workshop was presented for its scientific topic and not for being a 100% women speaker event, speakers themselves could not prevent from noticing this fact. This situation is contrasting with the past, where some HBP workshops were unintentionally 100% men speaker. Fortunately, this past is now revolved, with women participating as speakers to all of our workshops, and the audience tends to be balanced.

Also, disseminating the event on large-scale mailing lists, made the cortical code event end up on Biaswatchneuro.com, increasing the awareness on the gender ratio and maybe loosing sight of the science being presented. Scientific content was of high quality and ended-up in foreseeing a follow-up in the coming years.

Gender distribution during Ramp-up

- Men - Women
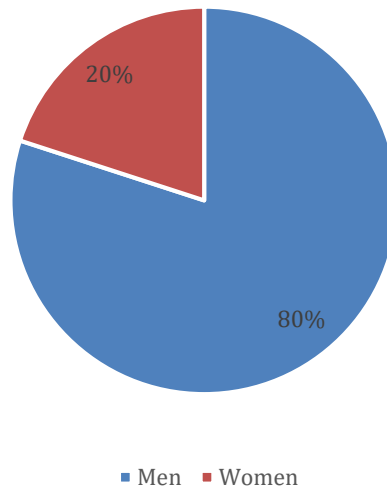
Gender distribution during SGA 1

- Men - Women
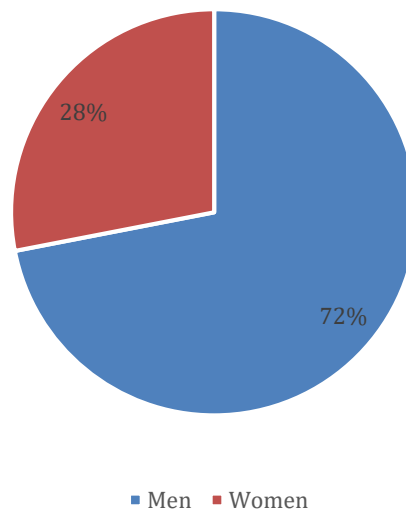
comparison of gender distribution of participants to EITN events RUP vs SGA1

We can conclude that our efforts in raising awareness of gender balance to the events organizers are useful as the gap is reducing. We will continue our support to gender balance issues and will try to keep improving as much as possible.

It is also interesting for our activity to note what communities are interested in our event. As we can see on the following graphs, a majority of our attendants come from Europe but also from Northern America. This confirms the links SP4 has with researchers from the Brain Initiative and other American labs.

Participants repartition M13-M24 SGA1
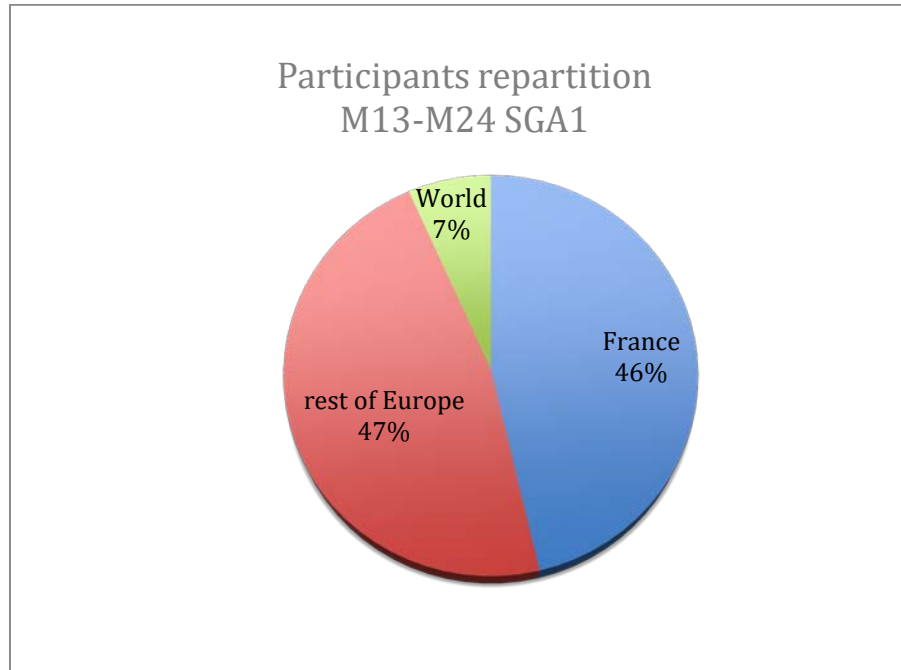
geographical repartition of EITN events attendees
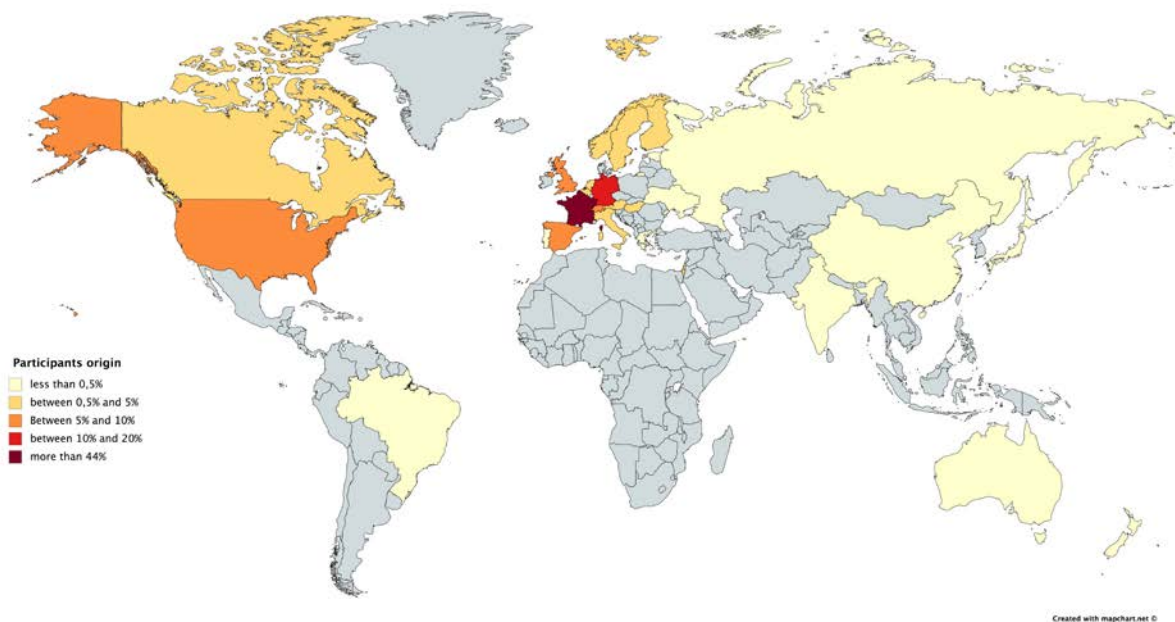
map of geographical repartition of EITN events attendees

We will also notice that a bit more than the majority are non-HBP members. This allows us to think that we are at a right balance, opening to communities outside of HBP but also involving HBP member. This later is pertinent as EITN workshops help reinforce on-going collaboration as well as develop some new ones.

HBP participants over the M13-M24 SGA1

HBP
43%

Non-HBP
57%

comparison of HBP vs non-HBP attendants to EITN events for SGA1 P2

HBP participants distribution

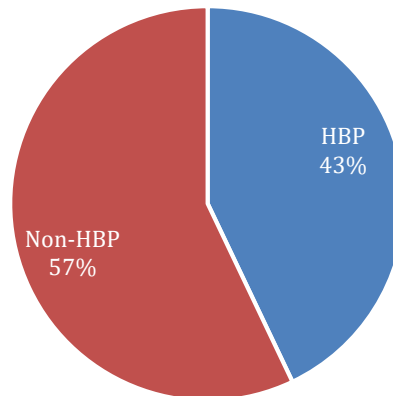|	Ramp-up	SGA 1
HBP	46%	41%
Non-HPB	54%	59%

◼ HBP   ◼ Non-HPB
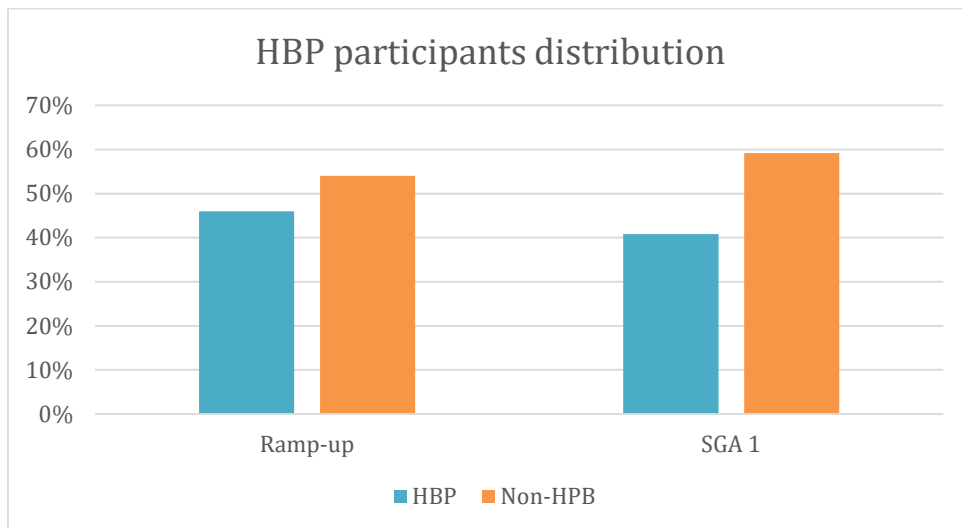
comparison of HBP vs non-HBP attendants to EITN events for RUP and SGA1

2.3.2 Workshop virtual participation

Videoconference talks have been held at the workshop "Cortical Codes", on February 5th-6th 2018 because three of the speakers could not attend in person. The videoconference system allowed their virtual presence.

For the workshop "Dendritic integration and computation with active dendrites", one speaker participated remotely as well.

Making that option possible allowed us to fulfil the organizers will to include speakers that could not have participated otherwise and have our audience benefit from presentations. We noticed that these "virtual" moments of exchange were highly appreciated as interaction through question and answers were of high level and a silent and focused atmosphere was noticed during the remote talks.
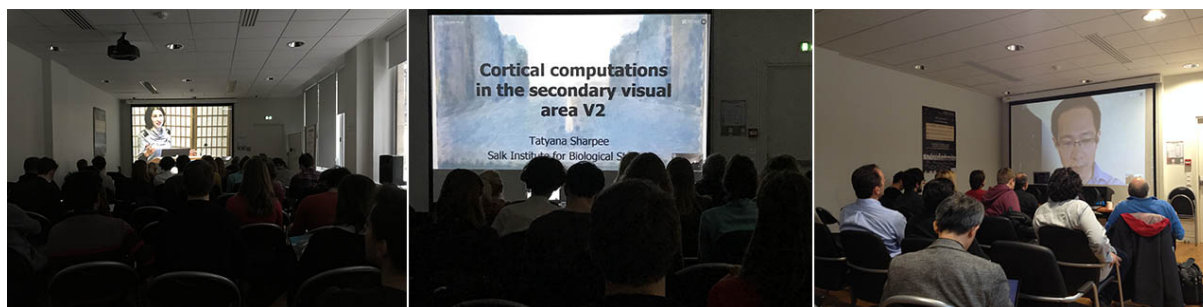
Tatyana Sharpee (left and middle) at Cortical Codes EITN workshop; Weinan Sun (right) at Dendritic Integration and Computation with active dendrites EITN workshop.

2.3.3 Strategy for improvements of the EITN attendance statistical analysis

To improve the statistical analysis of EITN attendance, the registration form has been readjusted. When possible, we try to propose answers as a bullet list to avoid as much as possible free alphabetical entries. Indeed those are hard to handle, as any difference would appear as an additional entry. Additional information is now requested to allow us a better identification of the EITN community. The collected data is ensured to be respecting the data governance and ethics rules.

Sciencesconf, the platform we are currently using for the events, now prevents creating additional account if registering with an already existing e-mail. Even if a single participant can still possess several accounts by using different email addresses, this change eased the identification of recurring visitors.

On a longer term, possibilities to further develop our current website to better answer our needs of data gathering in a statistical analysis purpose will be studied.

2.4 EITN communication activities

2.4.1 EITN conferences follow-up

Following the success of the EITN workshop « Consciousness in humans, animals & robots I: concepts, theories, and neural mechanisms » held on March 9-10, 2017, Marcello Massimini, Mavi Sanchez-Vives and Giulio Tononi and the HBP decided to organize an international conference « Understanding consciousness – a scientific quest for the 21st century » to be held on 21-22 June 2018 in Barcelona.

https://www.humanbrainproject.eu/en/follow-hbp/events/understanding-consciousness-scientific-quest-21st-century/

2.4.2 SP4 at CNS 2017

The EITN has helped SP4 in the organization and promotion of a workshop held during CNS2017. The workshop was co-organized by our partner Michele Giugliano (UA) and was held on July 19th. CNS2017 is an international conference held by the Organization for Computational Neurosciences. This conference hosted from July 15 to 20th in Antwerpen, Belgium welcomed 157 faculty, 125 postdoc, 178 PhD students.

The workshop has been promoted on the EITN website, the EITN twitter account and on the Human Brain Project website. A website dedicated to the event has been set up by the EITN to present the event and its programme (https://eitnconf-190717.sciencesconf.org/).

Thirteen SP4 members participated as speakers:

- Andrej Bicanski, University College London

- Neil Burgess, University College London

- Marc De Kamps, University of Leeds

- Alain Destexhe, EITN CNRS UNIC

- Gaute Einevoll, NMBU

- Olivier Faugeras, INRIA

- Michele Giugliano, University of Antwerpen

- Sonja Grün, FZ Jülich

- Moritz Helias, FZ Jülich

- Viktor Jirsa, Aix Marseille University

- Marja-Leena Linne,Tampère University of Technology

- Sacha van Albada, FZ Jülich

- Gorka Zamora-López, UPF

An average of 45-50 people attended the SP4 workshop.

For the main meeting 36 countries were represented: United States of America, Canada, Mexico, Brazil, Chile, United-Kingdom, France, Belgium, Switzerland, Sweden, Denmark, Finland, Netherlands, Norway, Russia, Czech Republic, Germany, Poland, Macedonia, Greece, Romania, Italy, Spain, Morocco, Ghana, Israel, Turkey, Iran, India, China, Singapore, Korea, Taïwan, Japan, and Australia

Overall, this event can be seen as another way of reaching out to neuroscientists and was very much appreciated by the participants. SP4 is looking forward to continuing these kind of events.

2.4.3 Website updates

The move of EITN offices from Paris to Gif-sur-Yvette gave us the opportunity to enlarge our room selection for our events and the website has been updated accordingly. We created a tab for the different venues available for the organization of events (https://www.eitn.org/index.php/general-information/our-venues). On a daily basis, we ensure at best the update of the website content and work on creating more various feeds.

We are also working on increasing the kind of content available to disseminate even more EITN and SP4 activities.

2.4.4 EITN events promotion – The posters

Once the new EITN team was in place, we decided to create dedicated artistic posters for some of the EITN events — this in a purpose of extending the life of the event as well as to add content for the announcement of the workshop. Not all organizers wish to go that way yet, but we strongly recommend it.

These posters are presented in the Annexe C.

2.4.5 social media statistical analysis

2.4.5.1 The EITN main website

Annual visitor number : 3772

Annual visits number : 4650

Average visits/day : 13,3

EITN website visitor's language
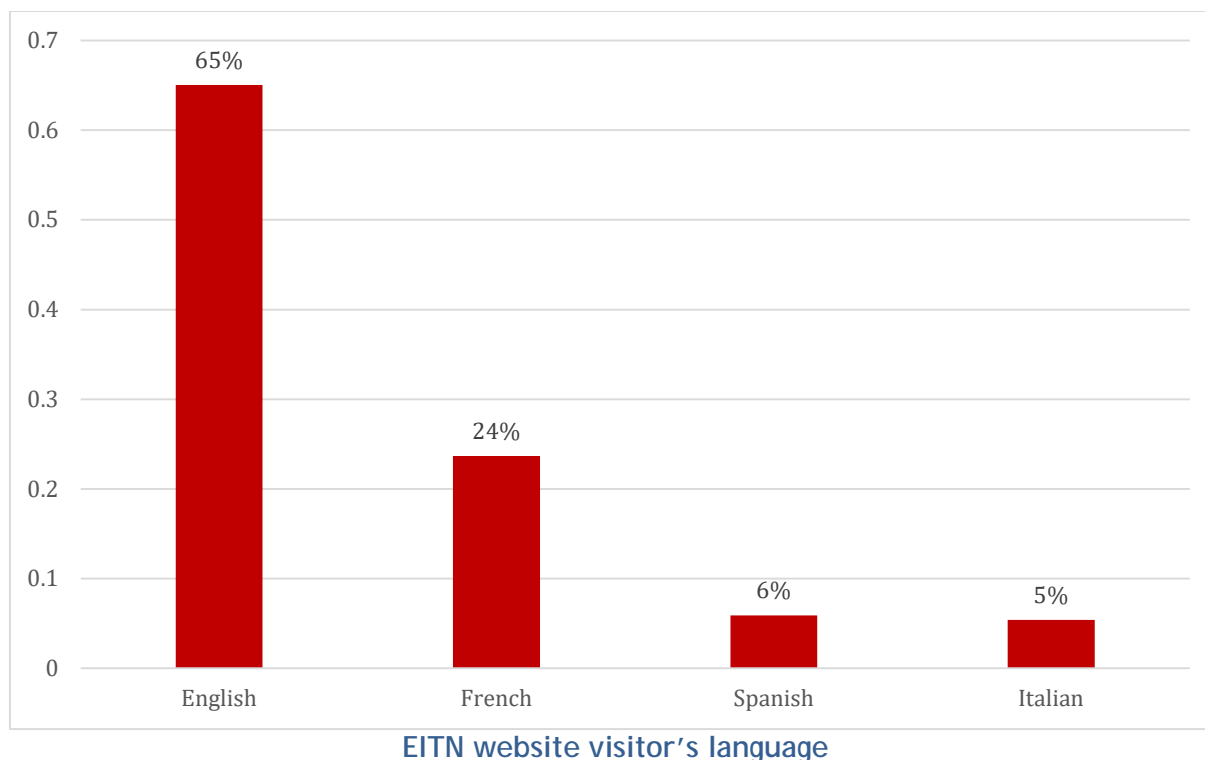
2.4.5.2 Tweets statistical analysis

The EITN twitter account: @EITN_Paris

The twitter account @EITN_Paris has now reached 509 followers and is steadily increasing since its creation. In comparison, CNRS Ile-de-France has 1175, which is much higher, but they are covering a wide range of disciplines. It has to be noted that only a few of the French laboratories dedicated to theoretical neuroscience are on twitter and for those who are present on twitter, it mainly originates from a personal researcher initiative (e.g. personal accounts of Viktor Jirsa, Etienne Tanré, Spase Petkovski). Their numbers of followers are below or about the same order as the EITN's one.
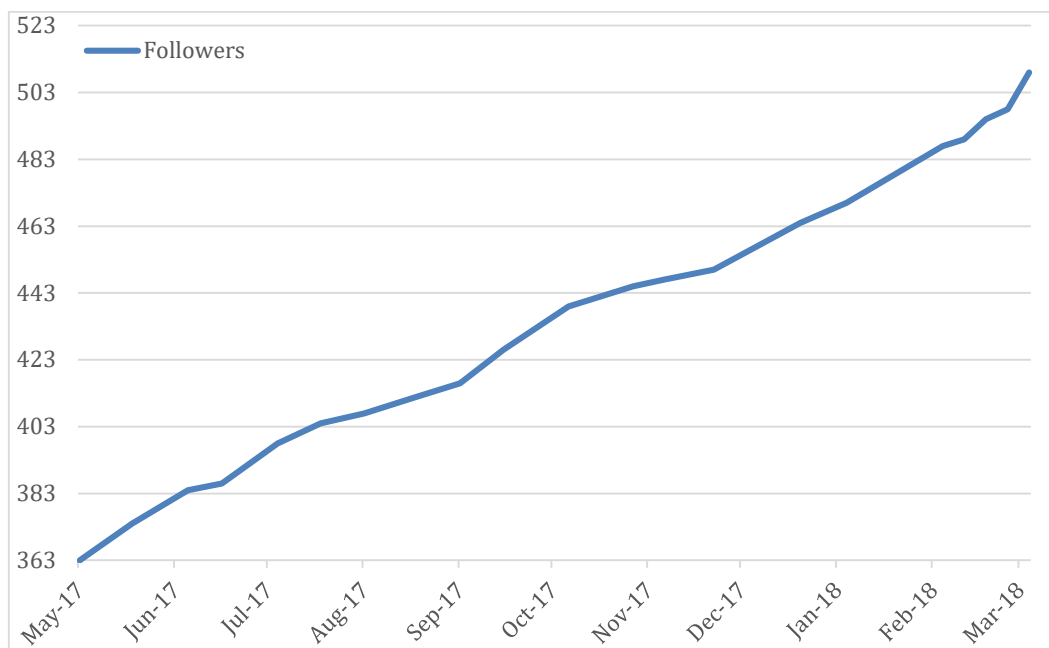
curve of progress for the number of EITN followers on Twitter over SGA1 P2
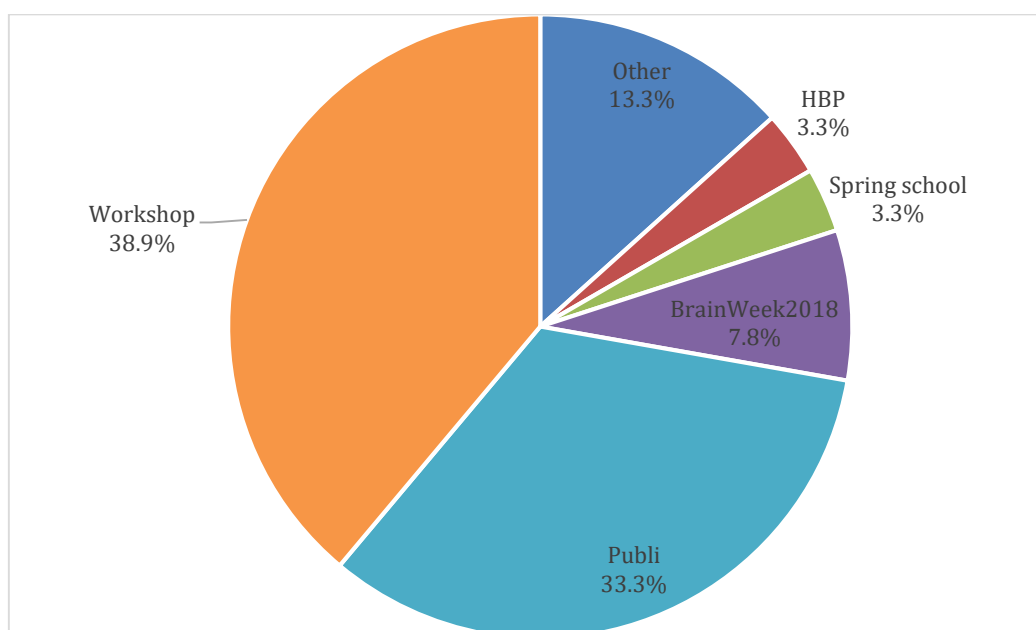
content type of EITN tweets over SGA1 P2
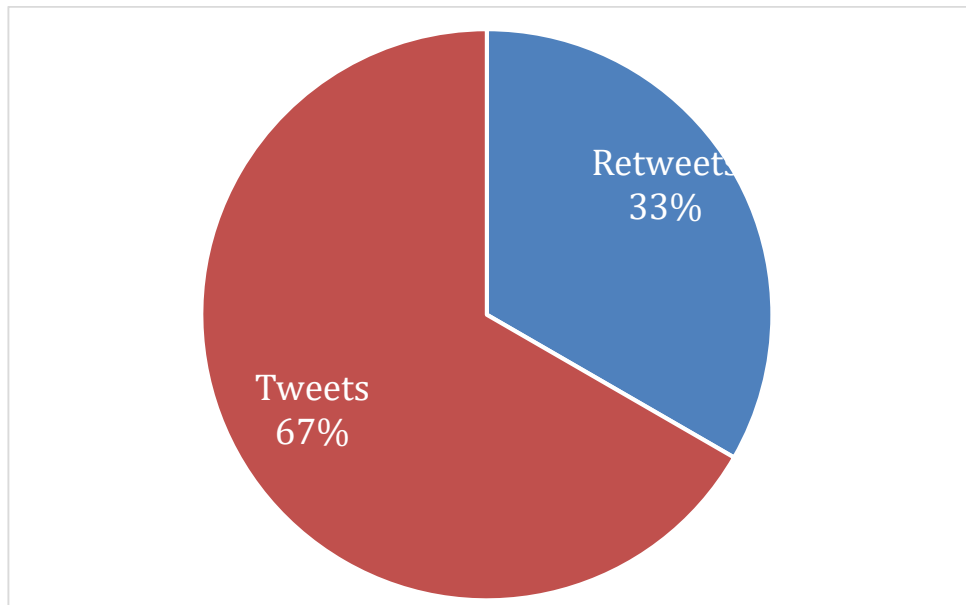
types of EITN tweets over SGA1 P2

Our analysis tools do not allow us yet to identify the impact that our tweets have in raising awareness of our activity. So far as our events are always at full capacity and that the number of followers keeps increasing we do not feel the need to expand the EITN communication but we wish to put in place a more in-depth data analysis process to be able to evaluate if a more strategic twitting experience would happen to be beneficial.

2.4.6 EITN Goodies

Until recently the goodies for communication of the EITN were limited to personalized pads and pens.

In October 2017, we designed mouse pads, part of them were distributed at the HBP Science Market SP4 booth held during the Open day of the HBP Summit in Glasgow, UK. We then developed a range of various goodies.

Goodies are thought to match our travelling-public constrains as well as to answer our values at best.

a set of EITN goodies developed during SGA1 M13-M24 period

It is too early to be able to estimate the impact the EITN goodies have though it is nowadays highly proven that giving away goodies is an efficient action to develop a brand or spread a message. With these we hope to reach out to a larger audience, to raise awareness of our existence worldwide as our visitors come from all over the world. We also hope to engage the current public in talking about our activity as some of their colleagues or friends might engage conversation on our subject by seeing one of the goodies in our visitor's hands. Also, from the smile and comments we get from the crowd, we may say goodies help people feel considered and even better enjoy their first experience in visiting us.

2.4.7 Dissemination

To reach out to non-specialists and to a larger public, we took the opportunity of the Science Market in Glasgow to design a poster popularizing the meaning of models for Theoretical Neuroscientists of our HBP subproject as well as short movie presenting some of our SP4 partners work.

This was seen as a success as this eased up conversation during the forum. This poster is now available in EITN Paris and a copy of it in Gif-sur-Yvette offices.

Theoretical Neuroscience

SP4

Each SP4 member has his own specificty and they all work on a different scale but they all produce models. A model is a simplifie description of a phenomenon, sufficent to under st and the fundamental functioning of this phenomenon.
The model allows the experimentalist to verify a prediction or an identifie phenomenon and can then be used in softwares, platforms, etc.

Models can have different forms

An Algorithm or an Equation

Scientists identify the most appropiate mathematical principle to use in order to model the phenomenon being studied. This is possible on different scales.

$$\dot{c}_v(t) = -c_v(t) + \sum_w \tilde{J}_{vw} \cdot S_w \cdot g(c_w(t)) + \tilde{\xi}_v(t)$$

model from published article in Frontiers «NeuralNetwork Model of Memory Retrieval»;
authors: Stefano Recanatesi, Mikhail Kat kov, Sandro Romani and Misha Tsodyks

A Simplifie Repr esentation of a Neuron

A. The experimentalist reveals the neuron with a dye under the microscope

B. From that data, the scientist is able to reconstruct virtually in a complex way the neuron

C. Because taking into account all the details of the complex neuron structure would lead to very complex models, the scientist models the neuron in a simplifie representation without altering its properties
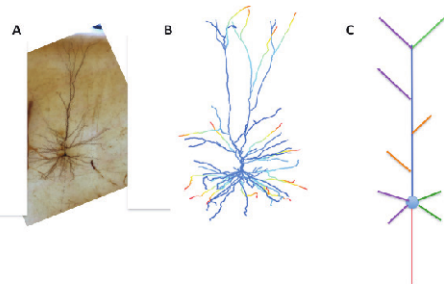
Steps in reducing 3D reconstructed and physiologically characterized
nonlinear dendritic tree idto a simplifie mo del ("Ne ur on_reduce").
author: Idan Segev, photo: Javier deFelipe's team

The quality of this reduction compared to the performance of the full
model is under examination.

Mapping of Activity

From simplifie r epresentation of neurons, scientists can also take into account the surrounding context of the neurons. This is possible on different scales.
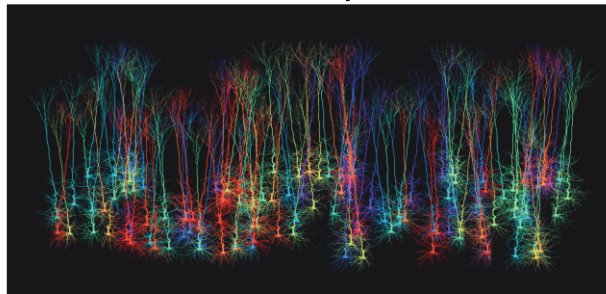
Interaction within network of neurons. author: Torbjorn Ness
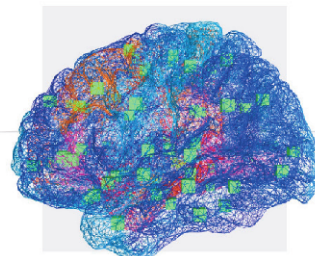
Mapping of brain activity. author: AMU/INSERM Viktor Jirsa (INS)

With the opportunity of the Human Brain Project (HBP), the European Institute for Theoretical Neuroscience (EITN) has been set up in Paris. It is meant to serve as an incubator of ideas for SP4 and also for the whole HBP.

eITN
European Institute for Theoretical Neuroscience

EITN poster: types of models SP4 is developping

We wish to continue with science popularization as we foresee that better understanding of our speciality from other disciplines can emerge from this path. Actions in that domain will be depending on the resources available and activities that will be implemented during the next funding period.

2.5 Continuing the EITN work in the operational phase

2.5.1 Improvements and difficulties encountered

On June 26th & 27th, offices of the EITN were moved from Paris to Gif-sur-Yvette, on the CNRS campus. This allowed more proximity between the EITN postdocs and the CNRS researchers.

After our IT assistant left in December 2016 and our secretary left in February 2017, the EITN was left with neither secretary nor IT services. Contributions from other positions were necessary to ensure EITN's minimum functioning, reducing their availabilities for their initial duties, as recruitment for these positions was difficult given the nature of the contract compared to the qualification requested such as bilingualism. Also, to best ensure the period filled with difficulties, the EITN activity had been reduced the time being.

The situation improved in May 2017 with the welcoming of Tammy Crewe Bodin as the new secretary. The IT position was filled shortly after when Rémi Girard joined our team. The two new comers were able to adapt rapidly and helped us go back on a cruise mode. This improvement allowed us, among other things, to develop part of our communication activities that had been put on hold previously.

3. Conclusion

3.1 M13-M24 conclusion

This second period of SGA1 was rich in events and activity despite unexpected recruitment difficulties.

EITN name seems to be spreading far and well. During the last HBP summit, different SPs cited our workshops or venue as a place where ideas are shared and scientific approaches may evolve.

3.2 SGA1 general conclusion

SGA1 M1-M12 funding period was more difficult than foresee due to late signature of the grant agreement and M13-M24 funding period has been more difficult than expected due to Human Resources issues. Great efforts from the different EITN team members made it possible to continue along and still propose a various range of workshops as well as to develop communication actions. We hope to continue down this road though the start of a new funding period, we are sure, will bring us lots of interesting challenges to be shared along the way.

EITN plays an important role to link the HBP with the community outside of the project, both through visitors, and through the invited speakers of the workshops. It is also to be noted that the excellent response (*nearly all invited speakers accept our invitation*) suggests that the EITN is now acquiring a good reputation in the field. We plan to continue this workshop program in the future.

EITN also plays a role in linking different partners in HBP, within its funding possibilities. The co-supervised postdocs appear to be an efficient way to consolidate inter-SP links, but also to advance inter-disciplinary fields where a co-supervision is necessary. This asset for HBP will be continued in the SGA2 period.

4. Annex A: EITN events agenda M12-M24

2018:

March 19-23

[EITN Spring school](#)

Organized by Idan Segev (Hebrew University of Jerusalem), Markus Diesmann (FZ Jülich), Viktor Jirsa (Aix-Marseille University), Sonja Grün (FZ Jülich), Gaute Einevoll (NMBU), Alain Destexhe (CNRS and EITN) and Gustavo Deco (University Pompeu Fabra).

March 12-13

Workshop "[From Neuroscience to Machine Learning](#)"

Organized by André Grüning (University of Surrey) and the EITN

March 1-2

Workshop "[Brain States : Models and Experiments](#)"

Organized by Maria Sanchez-Vives (ICREA-IDIBAPS), Marcello Massimini (University of Milan), Alain Destexhe (CNRS UNIC EITN), HBP – SP3 ,HBP –SP4, and SlowDyn

February 8-9

Workshop "[Dendritic integration and computation with active dendrites](#)"

Organized by Karlheinz Meier (University of Heidelberg), Idan Segev (HUJI) and Alain Destexhe (CNRS UNIC EITN)

February 5-6

Workshop "[Cortical Codes](#)"

Organized by Sacha van Albada (FZ Jülich) and the EITN

January 12

HBP SP4 annual meeting

January 10-11

Workshop "[Mean-field approaches to the dynamics of neuronal networks](#)"

Organized by Alain Destexhe (CNRS UNIC EITN), Gorka Zamora-López (UPF), Marc de Kamps (ULEEDS), Viktor Jirsa (AMU), Sacha van Albada (FZ Jülich), Moritz Helias (FZ Jülich)

2017:

December 21

[Journée d'information Horizon H2020](#)

Organisée par le MESRI et le PCN FET et accueillie par l'Institut Européen des Neurosciences Théoriques (EITN).

December 11-12

Seminar "Data governance and informed consent"

Organized by The Danish Board of Technology Foundation, led by director Lars Klüver; HBP Ethics Management Group at De Montfort University, led by Prof. Bernd Stahl, both being part of the Subproject 12 (SP12) Ethics and Society of the HBP; European Institute for Theoretical Neuroscience (EITN).

November 7

Brainstorm on modelling sleep
Organized by Mathieu Galtier (Rythm) and Alain Destexhe (CNRS UNIC EITN).

October 5-6

Workshop"Dendritic Spines: Morphology, Function and Modelling"

Organized by Javier DeFelipe (CSIC), Ruth Benavides-Piccione (CSIC), Idan Segev (HUJI), Alain Destexhe (CNRS UNIC EITN).

September 22

3rd SlowDyn « Meeting Experimental and Theoretical Analysis of Cortical,Dynamics » Organized by Stefano Panzeri (IIT Genova) and Tommaso Fellin (IIT Genova) in Rovereto, Italy.

July 19

Theoretical Neuroscience in the Human Brain Project : a CNS 2017 workshop

Organized by Michele Giugliano, Alain Destexhe, Viktor Jirsa in Antwerpen, Belgium

June 21-23

HBP Education ICT workshop

Organized by Andrew Davison (CNRS UNIC), David Lester (University of Manchester), Elisabeth Wintersteller (Medical University of Innsbruck), Lisa-Marie Leichter (Medical University of Innsbruck), Katherine Frégnac (CNRS UNIC EITN).

May 29-30

Workshop "Modelling the auditory system: theory and experiments"

Organized by Brice Bathellier (CNRS UNIC), Romain Brette (IdV), Srdjan Ostojic (ENS) & Alain Destexhe (CNRS UNIC EITN).

May 23-24

Workshop " HBP Hippocamp 2017: Collaborative and Integrative modeling of Hippocampus"

Organized by Eilif Muller (EPFL), Alain Destexhe (UNIC EITN CNRS), Szabolcs Káli (Institute of Experimental Medicine), Audrey Mercer (UCL), Michele Migliore (CNR-IBF), Armando Romani (EPFL), Katrien Van Look (EPFL)

May 2

Neuromathematics seminar : Peter Neri from ENS Paris, presents :"The basic facts of human vision are inconsistent with theoretically-driven accounts"

April 6-7

Workshop "[Feed-forward and feedback processing: anatomy, function and physiology](#)"

Organized by Robert Sachdev (Humboldt University), Guy Doron (Humboldt University), Pieter Roelfsema (Netherlands institute for Neuroscience), Matthew Larkum (Humboldt University), Alain Destexhe (CNRS UNIC EITN).

5. ANNEXE B _ EITN event Reports M12-M24

5.1 "Feed-forward and feedback processing: anatomy, function and physiology"

EITN, Paris 2017 April 6 & 7

Organized by Robert Sachdev (Humboldt University), Guy Doron (Humboldt University), Pieter Roelfsema (Netherlands institute for Neuroscience), Matthew Larkum (Humboldt University), Alain Destexhe (CNRS UNIC EITN, SP4).

The labs of Matthew Larkum, Pieter Roelfsema and Alain Destexhe organized a very successful workshop at the EITN. The organizers included EITN members Katherine Fregnac, and Morgane Bourdonnais, as well as Guy Doron and Robert Sachdev from Matthew Larkum's laboratory. The meeting brought together members of the Human Brain Project, with eminent neuroscientists (from a variety of countries) who are not members of the HBP to discuss the role of feedback and feed-forward processing on cortical function. The abstract of the meeting is below:

"Cortical function relies on feed-forward connections that propagate information from lower to higher brain regions and define the tuning of cortical neurons. The role of feedback connections, which are at least equally numerous as feed-forward connections, but propagate information in the opposite direction, from higher to lower brain regions, has remained largely enigmatic. How and when these connections modulate feed-forward input, their role in perception, cognition, and learning are the focus of investigation in various sensory systems and in a variety of species, including human beings. Here we bring together experimentalists, theoreticians and computational neuroscientists working on feed-forward and feedback processing in cortex to discuss unifying themes, alternative hypothesis and the way forward."

The talks spanned 1) human fMRI, unit recording, and anatomical reconstruction; 2) non-human primate behavior and recording; and 3) rodent anatomical, physiological and calcium imaging (of neurons, axons and dendrites). There was general agreement that in human beings, non-human primates and rodents, long range feedback connections between the different cortical areas can modify feed-forward connections, but the exact circuits, and neurons that provide feedback still need to be understood.

There were 21 speakers, 9 of whom were not in HBP including: Clay Reid (Allen Brain Institute, Seattle, USA), Murray Sherman (U. Chicago, USA), Charles Gilbert (Rockefeller U, NY, USA), Jianing Yu (Svoboda Lab, Janelia, USA), Leopoldo Petreanu (Champalimaud, Lisbon Portugal), Andreas Burkhalter (U. Wash, St Louis, USA), Anthony Holtmaat (U. Geneva Switzerland), Henry Kennedy (U. Lyon, France), Masanori Murayama (Riken, Tokyo, Japan). For all of the external speakers, this was their first interaction with any HBP event.

This was the first meeting on Feedback and feedforward cortical circuits. It plants a seed for the future meetings on the same topic – with at least some of the same speakers in two years. The meeting has fostered new discussions, and at least one or two potential collaborations that we know of so far.

5.2 "Modelling the auditory system: theory and experiments"

EITN, Paris 2017 May 29-30

Organized by Brice Bathellier (CNRS UNIC), Romain Brette (IdV), Srdjan Ostojic (ENS) & Alain Destexhe (CNRS UNIC EITN).

Context. Hearing is a fundamental sensory ability for many animals and is involved in various contexts such as communication, identification of distant events, spatial orientation, or even in purely hedonic behaviours such as listening to music. But, despite continuous advance in the neurophysiology of hearing, the principles by which the brain performs auditory perception are still unclear and many complex questions are still waiting for being solved beyond simple examples. What sound features need to be recognized to discriminate biologically relevant acoustic sources? How are these features computed and organized across the auditory system? What are the circuit principles that underlie these computations? How are these computations modulated by behavioural context? To address all this complexity hand-in-hand work between theory and experiments seems to be an unavoidable path.

Conclusions and perspectives. With this workshop, we brought together a large panel of international scientists working on auditory processing at the theoretical and/or experimental level. The public was, even though at full capacity with more than 50 participants from various institutions in Paris (ENS, UNIC, Pasteur, Vision Institute), very good and interacted well. We could recognize that the interplay between theory and experiment is still vivid in the field of audition, with novel ideas emerging about sound processing. Several speakers demonstrated the power of linear receptive field model for coding the frequency content of sound at different levels of the auditory system and showed new avenues to improve these models, in particular, models using mixtures of primitive functions. Also, an interesting emphasis was put on the coding of temporal features of sounds (onset, offset and amplitude modulations), which are also important for sound recognition. Here, multi-layered or more precise cortical circuits models were proposed to capture well the observed responses of cortical neurons. Thus an interesting perspective is the fusion of these "temporal" models with "spectral" ones, and experiments to challenge those.

Two other interesting avenues were discussed. The processing of sound location in a natural context, beyond simple comparison of time difference cues, and the modulation of cortical circuits during auditory behaviours and learning. The theoretical exploration of these topics is still to come, but this came up clearly as new interesting fields in this workshop.

Altogether the meeting was very lively and successful in summarizing novel ideas in auditory coding and proposed new avenues for modelling the auditory system. The speakers and the audience were also interested in eventually having further editions of this workshop to reinforce the modelling in auditory science and keep the community informed and connected.

5.3 "Dendritic Spines: Morphology, Function and Modelling"

EITN, Paris 2017 October 5-6

Organized by Javier DeFelipe (CSIC), Ruth Benavides-Piccione (CSIC), Idan Segev (HUJI), Alain Destexhe (CNRS UNIC EITN).

Purpose: This workshop aimed to discuss relevant findings regarding dendritic spines to better understand their role in neuronal circuits and to simulate these structures in the different species. For this purpose scientists of different research fields (neuroanatomy, electrophysiology, computational science), were gathered.

Speakers: Roberto Araya, Université de Montréal; Erik Bloss, Janelia Research Campus; Hermann Cuntz, ESI; Albert Gidon, Humboldt University; Anthony Holtmaat, Unige; Valentin Nägerl, IINS, Bordeaux 2; Menahem Segal, Weizmann Institute; Ruth Benavides-Piccione, CSIC; Javier DeFelipe, CSIC, Alain Destexhe, CNRS UNIC EITN; Jeanette Hellgren Kotaleski, KTH; Michele Migliore, CNR; Srikanth Ramaswamy, EPFL; Idan Segev, HUJI.

Outcomes:

This event provided the opportunity to discuss and identify existing data, critical data and missing information with the aim to simulate dendritic spines in cortical circuits.

Also, it was discussed the possible significance of the differences in the structure and function of dendritic spines that exist in different cortical areas and species in order to correctly model cortical circuits.

It also permitted to draw up plans to fill the gap between the existing data and the missing information required by the modelers.

Finally, collaborative work plans have been established in order to exchange data/ information between neurobiologists and modelers.

5.4 "Opening up the discussion on data governance and informed consent in the Human Brain Project"

EITN, Paris 2017 December 11-12

Organized by The Danish Board of Technology Foundation, led by director Lars Klüver; HBP Ethics Management Group at De Montfort University, led by Prof. Bernd Stahl, both being part of the Subproject 12 (SP12) Ethics and Society of the HBP; European Institute for Theoretical Neuroscience (EITN).

Data on patients and research participants, stored in hospitals around the world, provide a valuable resource for research. The Human Brain Project (HBP) hopes to use these valuable health databases for its research on providing more accurate diagnoses and personalized medicine for brain diseases. With the incoming General Data Protection Regulation (GDPR), such research raises questions on appropriate data governance and informed consent, but also about trust and societal values.

During a two day seminar at EITN, HBP researchers joined with leading neurologists, personal data managers, bioethicists, legal advisers and patient representatives to discuss the ethical and legal challenges setting up and participating in data driven research.

Prof. Jo Samanta, keynote speaker at the seminar, emphasised that there is a growing tension between privacy rights and the benefits to society. How HBP should address this tension through the GDPR regulations and ethical data stewardship was discussed throughout the seminar. The main conclusion from the seminar is that HBP should go beyond the legal requirements for personal data governance and base its data governance on several personal and societal values that include data privacy but also include data control, reciprocity, reliability, engagement, societal utility and trust.

Key points:

- The HBP must ensure that research activities comply with the GDPR in order to balance the competing interests of privacy and innovation;
- The tension between privacy and societal interests require that data utility and social utility are carefully considered case by case;
- All data should be treated as personal with sufficient anonymization as a back-up;
- An ethical framework in data sharing platforms should be based on a web of trust and be developed by engaging with key data stakeholders;
- Research participants should as far as possible have something in return: if not results, then a vision;
- The HBP should uphold its credibility by ensuring that people are *informed* about the risks and benefits of participating in HBP research.

More information about the seminar can be found at www.hbp.tekno.dk

5.5 "Cortical Codes"

EITN, Paris 2018 February 5-6

Organized by Sacha van Albada (FZ Jülich), Katherine Frégnac (CNRS), and the EITN.

Context

The cerebral cortex plays a key role in high-level brain functions including sensory processing, memory, attention, planning, and the internal modeling of the external world. To make sense of the wealth of experimental data available on cortical anatomy and physiology, and the relation of its activity to behavior, theoretical approaches are essential. A variety of tools are used for this purpose: bottom-up modeling starting from biological knowledge, top-down including normative approaches, investigations of the coding properties at the single-neuron and neuronal population levels, analytical work and simulations, and comparisons between healthy and disease conditions. This workshop brought together a cross-section of these theoretical approaches toward unravelling the mechanisms used by the cerebral cortex for achieving its functionality, with the goal of facilitating mutual fertilization between the various approaches.

Conclusions and perspectives

The workshop featured talks on the dynamical substrate underlying cortical computations, different hypotheses on cortical coding (attractor dynamics in neural fields; time series encoding at the spiking level; coding via spike synchrony), and specific cortical regions (visual,

auditory, somatosensory, and motor). Both experimental results and theoretical studies were represented. The workshop was well attended with 35 participants on the first day and 30 participants on the second day. There was a lively interaction among and between the participants and speakers.

New theoretical work on the development of auditory receptive fields was presented, on which the speaker received valuable feedback from the audience.

Experimental data on figure-ground segregation were shown that suggested a dominant influence of feedforward and horizontal processing. This provided an interesting contrast with recent accounts in which feedback is responsible for the filling-in process. The workshop brought together attendees working from the two different points of view, which had not previously collaborated but plan to keep in touch in relation to this topic.

A talk on optimal encoding of time series by individual spiking neurons in a regime with precise balance and consequently asynchronous activity had parallels with a talk on sequence memory in the subsequent EITN workshop on "Dendritic integration and computation with active dendrites", and raised the question whether aspects of these point-neuron and compartmental-neuron network architectures can be mapped to each other.

At the end of the workshop, it was discussed how different perspectives on cortical coding can be reconciled, for instance population attractor dynamics and models of temporal processing by sequences of individual neurons. A possible partial resolution was offered in terms of sequences of attractors activated according to specific temporal patterns, i.e., cortical networks not being activated according to arbitrary time series but specific ones representing, for instance, predictions, constraint satisfaction, motor planning, and motor execution. Another discussion topic was whether different cortical areas use unified coding strategies. While it is currently impossible to reach definite conclusions on these issues, the workshop functioned as an incubator of ideas and inspired participants to develop further ideas from these starting points. There were several requests for a follow-up workshop next year.

6. ANNEXE C _ EITN event Posters M12-M24

Poster for the workshop "Feed-forward and feedback processing: anatomy, function and physiology"

Poster for the workshop "Modelling the auditory system: Theory and Experiments"

Poster for the workshop "Dendritic Spines: Morphology, Function and Modelling"

Dendritic Spines:
Morphology, Function and Modelling

*An EITN workshop organized by Ruth Benavides-Piccione,
Javier DeFelipe, Idan Segev, and Alain Destexhe*
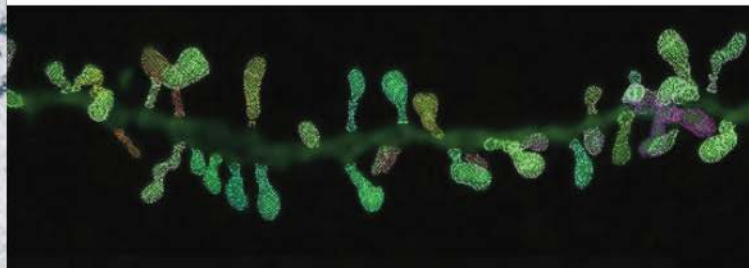
October 5 & 6, 2017
EITN, Paris

Speakers
Roberto Araya, Université de Montréal,
Erik Bloss, Janelia Research Campus,
Hermann Cuntz, ESI,
Albert Gidon, Humboldt University,
Anthony Holtmaat, Unige,
Valentin Nägerl , IINS, Bordeaux 2,
Menahem Segal, Weizmann Institute,
Ruth Benavides-Piccione, CSIC,
Javier DeFelipe,CSIC,
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Michele Migliore, CNR,
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Idan Segev, HUJI.

Programme & registration
https://eitnconf-051017.sciencesconf.org/