Appel à postulation pour une résidence au sein d'un laboratoire de recherche

Introduction

Le programme de résidence Embassy of Foreign Artists s'associe au Campus Biotech et au Flux Laboratory pour la mise au concours de résidences de recherches et de production pour un projet en lien avec les travaux de recherche de trois laboratoires actifs au sein du Campus Biotech (cf p.4 à 8).

1 Projet

Le projet vise à offrir des résidences à des artistes professionnels de tous les domaines artistiques (arts plastiques, danse, théâtre, musique, écriture, bande dessinée, cinéma, etc.) dont le projet s'inspire des recherches de pointe menées par les laboratoires partenaires actifs au sein du Campus Biotech.

Ces résidences ont pour but de favoriser les échanges et les croisements entre pratiques scientifiques et pratiques artistiques. Elles sont destinées à favoriser l'émergence de nouvelles manières de formuler, percevoir et utiliser les recherches, autant scientifiques qu'artistiques. Elles permettront par les connections de deux domaines une meilleure compréhension de leurs champs de recherches respectifs.

Les réflexions et les échanges mèneront à la réalisation de nouvelles œuvres ou à l'adaptation d'œuvres préexistantes qui pourront s'intégrer, s'adapter et/ou compléter les expériences menées dans les laboratoires. Les résultats de chaque résidence seront présentés lors d'un événement public au sein du Campus Biotech ou dans une institution partenaire. Ils pourront faire l'objet d'une publication dans des journaux scientifiques spécialisés.

2 Les partenaires

Le Campus Biotech

Avec ses 40'000 mètres carrés de talents, d'équipements, de compétences et de collaborations scientifiques implantés au cœur de Genève, Campus Biotech a fait de la région lémanique l'un des premiers pôles de recherche au monde dans le domaine des neurosciences et de la santé digitale et globale.
Plus de mille spécialistes s'y côtoient, privilégiant les approches pluridisciplinaires et élargissant le champ des connaissances humaines. La recherche sur le génome peut désormais s'appuyer sur la première plateforme de séquençage de l'ADN à haut débit de Suisse. Et dans les sciences cognitives, notre compréhension des émotions a été bouleversée par les travaux du pôle de recherche national (PRN) en sciences affectives.
De nombreux partenaires académiques et industriels participent au succès de Campus Biotech, parmi lesquels des équipes de l'Université de Genève (UNIGE), de l'Ecole Polytechnique Fédérale de Lausanne (EPFL), des Hôpitaux universitaires de Genève (HUG), du Centre Wyss de Bio- et Neuro-ingénierie, du Human Brain Project (HBP), de l'Institut suisse de bioinformatique (SIB) ou encore de la Haute école du paysage, d'ingénierie et d'architecture (HEPIA). Avec un objectif partagé : mettre la science au service de progrès concrets qui auront un impact positif sur la société et sur le monde.

https://www.campusbiotech.ch/

Embassy of Foreign Artists

Embassy of Foreign Artists est un programme de résidence fondé et administré par L'association Laps en collaboration avec l'Office cantonal de la culture et du sport. Notre organisation a pour but d'accueillir des artistes, des acteurs culturels, citoyens engagés et chercheurs, de manière individuelle ou collective et de leur offrir un soutien logistique et financier pour le développement de leurs activités. Nous mettons à profit notre réseau afin de favoriser la diffusion de leurs pratiques et de leurs projets. Nos espaces accueillent les différentes étapes du processus créatif, des premiers tâtonnements et réflexions à sa présentation dans une forme aboutie.

www.eofa.ch

Le Flux Laboratory

Le Flux Laboratory espaces artistiques pluridisciplinaires et outil de production de la Fondation Fluxum. La Fondation Fluxum a pour but et pour mission de soutenir les arts vivants, la danse étant le mode d'expression privilégié. Le Flux Laboratory est un incubateur artistique en Suisse et à l'étranger, qui a comme finalité d'encourager des dynamiques collaboratives innovantes par le biais de projets artistiques expérimentaux et transdisciplinaires.

www.fluxumfoundation.org.
www.fluxlaboratory.com

3 Calendrier de conception et de réalisation

1er juin fin du délai pour les candidatures
15 juillet annonce des lauréats

4 Budget

4’200.00 CHF de per-diem réparti en trois bourses mensuelles de 1'400 CHF / mois
2'000.00 CHF de budget de production

5 Composition du dossier

Document 1 : Le formulaire dûment compléter avec adobe Acrobat

Document 2 : Votre dossier de candidature en un seul document PDF contenant :

- Une lettre de motivation expliquant la démarche artistique et le lien avec le sujet de l’appel.
- Un descriptif le plus détaillé possible du projet qui sera développé au cours de la résidence
- Un dossier de travaux récents
- Un curriculum vitae à jour
- Une copie d’une pièce d’identité en cours de validité

6 Personnes de référence

Pour la résidence : Richard Le Quellec, residence@eofa.ch
Pour le Campus Biotech : Carole Varone, Carole.Varone@unige.ch

7 Les laboratoires

Charting emotion components and dynamics in the human brain using naturalistic movies

Project Aim

We are currently working on a large-scale project to chart emotion components and dynamics in the human brain. The goal of the project is to demonstrate and chart the complex and dynamic phenomena in the brain that constitute the subjective experience of emotion. To this end, we will use functional Magnetic Resonance Imaging (fMRI) of the brain and state-of the art analysis techniques on the level of overlapping dynamic functional networks in the brain.

About MIP:Lab

The Medical Image Processing Lab (MIP:Lab) is headed by Prof. Dimitri Van De Ville. The lab is jointly between the EPFL and the University of Geneva. At MIP:Lab, we pursue the development and integration of innovative data-processing tools at various stages of the acquisition, analysis, and interpretation pipeline of neuroimaging data, in particular, using (functional) magnetic resonance imaging, electroencephalography, and optical techniques. We aim at obtaining new insights into *brain function & dysfunction* by approaches that are based on modeling the brain as a *network* and as a *dynamical* system. (from our website https://miplab.epfl.ch)

The members of MIP:Lab have a wide range of scientific backgrounds, which creates an environment of interdisciplinarity and reciprocal learning. However, we also closely collaborate with other research groups. In the context of the project outlined below we are joining efforts with LABNIC, headed by Patrik Vuilleumier.

About the Project

Emotions are complex and multifaceted phenomena affecting both the mind and body, promoting adaptive behavior in response to challenging events. We will be using naturalistic movies to elicit emotions and investigate the neural response to these emotional stimuli. Parallelly, LABNIC will be using virtual reality and video games with the same overall goal to understand the representation of emotion in the brain.

This research is informed by a Component Process Model of emotion postulated by Klaus Scherer[1]. The Component Process Model predicts, that emotions are elicited by the cognitive appraisal of a given situation along a number of components as well as the integration of this appraisal with other elements of the situation (e.g. physiology, subjective feeling). This model of emotion addresses the shortcomings of approaches that consider emotions as discrete entities by accounting for the myriad of emotional experiences with distinct yet sometimes overlapping aspects. However, there is yet no comprehensive demonstration of the Component Process Model on a neural level.

fMRI is a non-invasive tool to probe whole-brain activity and enables the study of sophisticated processes that involve functional integration and segregation of different brain areas over time. We will use naturalistic stimuli (i.e., movies) to elicit emotions in participants while brain activity is recorded with fMRI, in principle similar to a previous study[2]. However, our research exceeds the scope of any previous work in the quality and volume of data acquisition as well as analysis. Participants will be watching 3.5 hours of full movies, covering a wide range of emotional

[1] K. R. Scherer, “Emotions are emergent processes: they require a dynamic computational architecture,” Philosophical Transactions of the Royal Society B: Biological Sciences, vol. 364, no. 1535, pp. 3459–3474, 2009.
[2] G. Mohammadi, K. Lin, and P. Vuilleumier, “Towards understanding emotional experience in a com- ponential framework,” in 2019 8th International Conference on Affective Computing and Intelligent Interaction (ACII), pp. 123–129, IEEE, 2019.

experience. These movies will have been continuously annotated with discrete emotions as well as aspects of the Component Process Model.

We will perform a number of analyses on the acquired data, to replicate previous work and to contribute novel insights on the neural representation of emotions. Data analysis and the interpretation of results are the main pillars of our work. We will try to replicate the results of a previous study that represented the semantic organization of the brain[3] and then apply the same analysis principle to emotion. Furthermore, we will apply sophisticated analyses that capture dynamic intersubject functional connectivity, as these are more appropriate to the study of dynamic phenomena like emotions.

Ultimately, our goal is to achieve a comprehensive understanding of how emotion is represented in the brain that is informed by state-of the art technology and a progressive understanding of how the brain works as a system of interdependent networks.

https://www.epfl.ch/research/domains/bioengineering/

[3] A. G. Huth, S. Nishimoto, A. T. Vu, and J. L. Gallant, "A continuous semantic space describes the representation of thousands of object and action categories across the human brain," Neuron, vol. 76, no. 6, pp. 1210–1224, 2012.

Medtronic Chair in Neuroengineering EPFL

The Medtronic Chair in Neuroengineering is a multidisciplinary environment promoting cross-fertilization among a variety of expertise. We bring materials science, computer science, engineering, life science, and medicine together by the convergence of physicists, engineers, neuroscientists, and ophthalmologists cooperating to accomplish innovative projects. Our mission is the development of application-driven solutions based on compliant, minimally invasive, and replaceable neuroprosthetic devices. Ultimately, we aim at translating our research findings into clinical practice.

Currently, our research program is organized in two research lines:

POLYRETINA: Injectable, self-opening, wide-field, photovoltaic epi-retinal prosthesis. Retinal prostheses were developed to fight blindness in people affected by outer retinal layer dystrophies. To date, few hundred patients have received a retinal implant. However, several challenges remain open, such as the improvement of visual acuity and the enlargement of the visual field above the thresholds of blindness. An agreed upon strategy to improve visual acuity is to increase the electrode density, while a large visual field could be attained by enlarging the retinal coverage with a larger prosthesis.

Inspired by intraocular lenses, we have designed a foldable and photovoltaic wide-field epiretinal prosthesis capable of stimulating wireless the retinal ganglion cells. Within a visual angle of 46.3 degrees, it embeds more than 10,000 stimulating pixels, it is foldable to allow implantation through a small scleral incision, and it has a hemispherical shape to match the curvature of the eye.

We demonstrate that it is not cytotoxic and respects optical and thermal safety standards; accelerated ageing shows a lifetime of at least 2 years (**Ferlauto et al., *Nature Communications* 2018**). Experiments with explanted blind retinas showed that POLYRETINA can achieve high focal stimulation of the retinal ganglion cell layer, because of the efficient recruitment of the lateral inhibition provided by Amacrine cells (**Chenais et al., *Journal of Neural Engineering* 2019**). In preparation to the first-in-men clinical trial, we further developed POLYRETINA to be sensitive to near-infrared illumination (**Airaghi Leccardi et al, *in Review*;doi:10.1101/2020.01.27.920819**). This is necessary to provide a better comfort to the implanted patients. Currently, our unpublished results show that POLYRETINA has high stimulation selectivity down to single retinal ganglion cell resolution.

The preclinical trails in blind minipigs shows that POLYRETINA can be safely injected and placed into the eye, is tolerated upon long term implantation, and restorers light sensitivity. Our research is a significant progress towards the improvement of both visual acuity and visual field with the same device, a current challenging issue in the field. In particular, POLYRETINA is the first (and still the only) retinal prosthesis able to restore a wide visual field (46.3). In the past year, we have developed a set of virtual and augmented reality scenarios to demonstrate in healthy subjects (under simulated prosthetic vision) the benefit provided by POLYRETINA during common daily activities. In particular, our unpublished results confirmed that the wide visual field provided by POLYRETINA is the key element to enable an efficient performance in common daily experience, like object finding and recognition, locomotion, general orientation, obstacle avoidance etc.

OPTICSELINE: Intraneural electrode array for optic nerve stimulation. Retinal prostheses were developed to restore a functional form of vision in patients affected by outer retinal layer dystrophies. In particular, retinal prostheses addressed patients affected by retinitis pigmentosa, a set of genetic diseases leading to blindness due to the death of retinal photoreceptors. In various clinical trials, retinal prostheses demonstrated the capability to restore a functional form of vision. However, only a small fraction of the profound blind patients affected by retinitis pigmentosa (approximately 12 % or less) is eligible for retinal prostheses due to exclusion criteria. Small eye size, retinal detachment, trauma, and severe strabismus are in fact among the contraindications for an epi-retinal prosthesis (e.g. Argus® II). Therefore, optic nerve stimulation is an attractive strategy since it bypasses the eye and, at the same time, still takes advantage of the high-level information processing occurring downstream in the visual pathway. Thus, optic nerve stimulation is a strategy to overcome issues

related to selection criteria and address a larger population of blind patients which currently has no medical solution.

Accordingly, we developed an innovative intraneural stimulator for the optic nerve (**Gaillet et al., *Nature Biomedical Engineering* 2019**). Our preclinical results showed that optic nerve stimulation can induce selective cortical activation patterns depending on the stimulating electrode used. In preparation to the first-in-men clinical trial, we are further refining the OPTICSELINE with three-dimensional concentric bipolar electrodes which allow for a more selective activation of the optic nerve fibres (unpublished results). These three- dimensional electrodes are based on a fabrication method previously developed in our laboratory (**Airaghi Leccardi et al, *Journal of Neural Engineering* 2019**).

Blindness is a widespread global public health issue affecting more than 39 million people worldwide (World Health Organization), and it represents a significant personal and societal burden, both in terms of reduced quality of life as well as costs. Our research goal is to reduce this burden by reverting blindness in a large fraction of affected people. To do so, we combined materials science, engineering, and neuroscience to develop and validate innovative neuroprosthetic devices going well- beyond the state-of-the-art of the research in the field. We are simultaneously innovating in neurostimulation technology for vision restoration, and translating our research findings towards clinical use.

https://www.epfl.ch/labs/lne/

Sleep and Cognition Neuroimaging Laboratory UNIGE

The Sleep and Cognition Lab is headed by Prof. Sophie Schwartz. The Lab is in the Department of Neuroscience, Faculty of Medicine at the University of Geneva.

Our team investigates the mechanisms of brain plasticity that underlie learning and memory in humans. In particular, our research focuses on the role of emotion and sleep in memory processes. We also study the content of dream reports, as an important source of information about what our brain and mind do while we sleep.

Our experimental approach includes the development of novel behavioral tasks, in combination with simultaneous measures of brain activity such as functional magnetic resonance imaging (fMRI) and high-density electroencephalography (EEG).

For specific details about our work, feel free to browse through our publications:

https://www.unige.ch/medecine/neuf/en/research/grecherche/sophie-schwartz/

We would be delighted to welcome an artist in our lab. We will share knowledge, present our experimental tools, explain our goals and results, etc. The artist will be invited to our lab meetings, and s.he might also attend (and possibly participate) to actual experiments. We are looking forwards to lively discussions between our lab and the artist.

A selection of recent media coverage:

In French: http://avisdexperts.ch/videos/view/10775/46306
https://avisdexperts.ch/videos/view/9335

In English: https://www.bbc.com/news/education-50563835
https://www.nytimes.com/2019/02/10/opinion/sleep-neuroscience.html