

Fellowship ID : BR230201

年 月 日

2024/04/02

独立行政法人日本学術振興会理事長 殿

To: President, Japan Society for the Promotion of Science

## 研究活動報告書 Research Report

### 1. 受入研究者/ Host researcher

受入研究機関・部局・職

Name of Host Institution, Department and Title

東京大学・生産技術研究所・教授

受入研究者氏名

Host Researcher's Name

河野 崇

### 2. 外国人招へい研究者/ Fellow

所属研究機関・部局・職

Name of Institution, Department and Title

ボルドー大学・iMS Laboratory・教授

外国人招へい研究者氏名

Fellow's Name

Timothee LEVI

### 3. 採用期間/ Fellowship Period

2024年 2月 26日

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2024年 3月 25日

### 4. 研究課題/ Research Theme

FPGA を用いたニューロモルフィックロボット

5. 研究活動報告/ Research Report

(1) 研究活動の概要・成果/ Summary of Research Results

1) Collaboration with Pr Kohno

During my stay, I work with Pr Kohno on three subjects. First, on the supervision of Dinger Cheng, Master student, who works on the emulation of hippocampus region. Second, on a joint project with Xiaoming Qiang, PhD student, on the communication between different neuromorphic hardware systems. As I am the advisor of a Kakenhi project of Pr Kohno, we discussed about it and I talked to Pr Yamamoto from Tohoku University too.

2) Collaboration with Pr Ikeuchi

With Pr Ikeuchi, we are working on biohybrid experiments including artificial neural network (my expertise) and brain organoid culture (Pr Ikeuchi expertise). We would like to create a device that provides key features to recapitulate physiological cell-cell interactions.

During the first week, I attend and give two talks in workshops, one at IIS at Design lab and one at Shibuya scramble building.

One PhD student I supervise, Jérémy Cheslet, is at Ikeuchi lab from February 2024 to December 2024. During my stay, I have several talks and meeting with him to discuss about his research.

With Pr Ikeuchi, we also organize several meetings to discuss about the perspectives of our research and about the revision of two manuscripts. One was published on April 10<sup>th</sup> in Nature Communications.

<https://www.nature.com/articles/s41467-024-46787-7>

3) Collaboration with Pr Tixier-Mita

With Pr Tixier-Mita, we are planning to collaborate on real time cardiac stimulation on in vitro cardiomyocytes. Dr Tixier-Mita is expert on cardiomyocytes in vitro culture and recording/stimulation platform. I bring my real-time biomimetic stimulation expertise to create an innovative platform. We organize several meetings to discuss about cardiomyocyte experiments. One PhD student we co-supervise, Pierre-Marie Faure is currently at Tixier-Mita lab from February to October 2024. We talked to him, organize experiments and prepare the writing of his manuscript and one journal paper.

4) Collaboration with Design Lab

I organized several meetings with the director of the Design lab at the University of Tokyo, Professor Pennington. We were able to discuss joint projects as well as the sending of 4 interns from the University of Bordeaux to the Design lab in April.

5) Collaboration between University of Tokyo and University of Bordeaux

I took advantage of this stay to discuss with Professor Fujii, president of the University of Tokyo, and Professor Kohno. We are going to organize a workshop in Bordeaux between the LIMMS laboratory, the University of Bordeaux and the University of Tokyo. This workshop will showcase common collaborations and promote new research for participants.

6) Discussion with other University

I was able to meet Professor Yamamoto from Tohoku University as well as Professor Hirata from Chubu University and Professor Okuno from the Osaka Institute of Technology. These three meetings allowed me to discover their research. I was also able to present my research work. We are in discussions for visits to the University of Bordeaux as well as for student mobility.

(2) 主な研究発表 (雑誌論文、学会、集会、知的財産権等) / Main Research Publications

4 journal papers (1 published, 1 in revision, 2 submitted)

Osaki, T., Duenki, T., Chow, S.Y.A. et al. Complex activity and short-term plasticity of human cerebral organoids reciprocally connected with axons. *Nat Commun* 15, 2945 (2024). <https://doi.org/10.1038/s41467-024-46787-7>

Beaubois, R., Cheslet, J., Duenki, T., Khoystatee, F., Branchereau, P., Ikeuchi, Y., & Levi, T. (2023). BioemuS: A new tool for neurological disorders studies through real-time emulation and hybridization using biomimetic Spiking Neural Network. *Nat Commun*, in revision

Faure P-M., Tixier-Mita A., Levi T., A digital hardware system for real-time biorealistic stimulation on in vitro cardiomyocytes, *Journal Artificial Life and Robotics*, submitted

Cheslet, J., Beaubois R., Khoystatee F., Kohno T., Ikeuchi Y., Levi T., Biomimetic snake locomotion using Central Pattern Generators network and bio-hybrid robot perspective, *Journal Artificial Life and Robotics*, submitted

(3) その他/Remarks

This stay was quite perfect, I could keep on my research, strengthen my collaborations, obtain results and publish in high-impact journals. I was also able to meet new Professors with whom I am starting to collaborate. I would like to thank the JSPS.