
Alleviate pain by manipulating emotions in the brain

A Data Management Plan created using DMPonline.be

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Funder: Fonds voor Wetenschappelijk Onderzoek - Research Foundation Flanders (FWO)

Template: FWO DMP (Flemish Standard DMP)

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Grant number / URL: 12D7523N

ID: 197279

Start date: 01-10-2022

End date: 30-09-2025

Project abstract:

Pain is an essential feature of our bodies that alerts us to danger or injury. Several therapies exist already, but no universal pain reliever has been identified so far. Our goal is to modulate precise brain circuits to relieve pain instantaneously without the need for drugs. We will study pain in head-fixed mice receiving a calibrated nociceptive cold or hot stimulus on the forepaw. We will record simultaneously brain-wide activity using volumetric functional ultrasound imaging (vfUSI) and animal behavior using fast video cameras. The facial expression of pain will also be decoded using artificial intelligence. Our preliminary data show that several brain nuclei, including the basolateral amygdala (BLA), are differentially affected in WT mice versus KO mice not sensitive to pain. We will use multi-electrode arrays to precisely study the role of BLA in thermal nociception. The second aim is to identify which cell types are involved by modulating the electrical activity of the BLA circuit using vfUSI with optogenetics (opto-vfUSI). Here, we will activate and inhibit the same BLA neuronal population alternatively during both hot and cold painful stimuli. We will compare the effects in both the brain imaging data and the behavior/facial expression. These experiments may identify new brain regions involved in nociceptive pain and inspire the development of innovative therapeutical strategies at the neural circuit level.

Last modified: 08-05-2023

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Application DMP

Questionnaire

Describe the datatypes (surveys, sequences, manuscripts, objects ...) the research will collect and/or generate and /or (re)use. (use up to 700 characters)

The imaging data recorded on the fUSI station uses Matlab format (.MAT) containing metadata to describe the parameters of the experiment. Neuropixels recordings are in binary format (.bin). Video camera recordings of the animal (face and eyes/body) are in .h264. Other data available such as those from monitoring the animal (temperature, ambient light, noise) are 8-bit floats timestamped data. Vocalization of the animal are in .mp3. Other file formats will be used, such as Adobe, Microsoft office. Open-source software will be shared in our lab Github repository for reusability. Manuscripts, figures, software, and datasets will be accessible through Open Access and Zenodo repository.

Specify in which way the following provisions are in place in order to preserve the data during and at least 5 years after the end of the research? Motivate your answer. (use up to 700 characters)

The IT manager at NERF is Dr. Giuliano Maggi, responsible for the maintenance of the IT structure. The imaging data generated will comply with the PACS (picture archiving and communication system) to safely store and transmit electronic images and reports. Data will be stored on a dedicated Cloudian Server for a 5-year period. We expect about 40TB of data generated at the end of the project. Cloudian is supporting logical storage policies that can be configured with replication or erasure coding. 10TB will be stored with full on-line access and then archived at the end of each year to a cold-storage solution in a SYNOLOGY DiskStation NAS located at NERF/IMEC.

What's the reason why you wish to deviate from the principle of preservation of data and of the minimum preservation term of 5 years? (max. 700 characters)

I declare no reasons to deviate from the principle of preservation of data.

Are there issues concerning research data indicated in the ethics questionnaire of this application form? Which specific security measures do those data require? (use up to 700 characters)

I declare no issues regarding the ethics questionnaire.

Which other issues related to the data management are relevant to mention? (use up to 700 characters)

I declare no further issues regarding data management. All key aspects are mentioned above.

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FWO DMP (Flemish Standard DMP)

1. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

				Only for digital data	Only for digital data	Only for digital data	Only for physical data
Dataset Name	Description	New or reused	Digital or Physical	Digital Data Type	Digital Data format	Digital data volume (MB/GB/TB)	Physical volume
		Please choose from the following options: <ul style="list-style-type: none"> Generate new data Reuse existing data 	Please choose from the following options: <ul style="list-style-type: none"> Digital Physical 	Please choose from the following options: <ul style="list-style-type: none"> Observational Experimental Compiled/aggregated data Simulation data Software Other NA 	Please choose from the following options: <ul style="list-style-type: none"> .por, .xml, .tab, .cvs, .pdf, .txt, .rtf, .dwg, .gml, ... NA 	Please choose from the following options: <ul style="list-style-type: none"> <100MB <1GB <100GB <1TB <5TB <10TB <50TB >50TB NA 	
vrUSI recordings	Ultrasound imaging of mouse brain	Generate new data	Digital	Experimental	.mat	<10TB	
Neuropixels recordings	Electrophysiological recordings of mouse brain	Generate new data	Digital	Experimental	.bin	<10TB	
Video recordings	Video camera recordings of the animal	Generate new data	Digital	Experimental	.h264	<5TB	
Mouse physiology	Physiological parameters : temperature, ambient light, noise.	Generate new data	Digital	Experimental	8-bit floats timestamped data.	<100GB	
Processed data	Processed data	Generate new data	Digital	Compiled/aggregated data	.cvs, .pdf, .txt, .ai, .doc, .xlsx	<100GB	
Open-source software	Open-source software	Generate new data	Digital	Software	.exe	<100GB	

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

Not applicable

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

- Yes, animal data

The project has been approved by the KU Leuven ethical committee.
Project ECD is 191/2022

Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, ...)? If so, please comment per dataset or data type where appropriate.

- No

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements/ research collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.

- No

Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to

what data they relate and which restrictions will be asserted.

- No

2. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g., in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

For digital data I will maintain a record of the following:

- Experimental design and protocol (.doc file)
- Structure of the data (.doc file)
- Steps involved in data analysis and relevant analysis scripts (R, MATLAB, Python and ImageJ scripts)
- Raw data and metadata (specific file format according to data type)
- Analysed data (specific file format according to data type)
- Index file/read me file (.txt file) for every WP, linking the name, location (folder and subfolder on /server) and description of above-mentioned files.

Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type) which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.

- No

The experiments are unique, but the data will be standardized according to data-type across experiments to make it easier to interpret. The structure for vUSI data will be the NIFTI file format.

3. Data storage & back-up during the research project

Where will the data be stored?

Data will be stored on servers centrally managed by NERF-IMEC using a dedicated Cloudian Server. We expect about 40 TB of data to be stored at the end of the project. 10TB of year data will be stored with full on-line access and then archived at the end of each year to a cold-storage solution in a SYNOLOGY Disk Station NAS located at NERF/imec.

How will the data be backed up?

Cloudian's HyperStore Operating Environment software provides enterprise object storage.

The software has native Amazon S3 support, and data can be tiered to Amazon S3, Amazon Glacier, or S3 endpoints such as tape libraries.

HyperStore supports logical storage policies that can be configured with replication or erasure coding.

The SYNOLOGY Disk Station NAS will save redundant data in RAID 0 mode.

Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely. If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.

- Yes

There is currently sufficient storage at NERF/imec.

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

Data are securely stored on SYNOLOGY Disk Station NAS that requires a 2-factor identification delivered by the group leader.

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

Back-up cost per Tb in the Cloudian = 250€/year/TB

4. Data preservation after the end of the research project

Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

We will retain all data for the expected 5-year period. For most publications we expect that we will make the data publicly available on data repositories.

Where will these data be archived (stored and curated for the long-term)?

The long-term storage will be performed in a cold storage on HDD 10 TB in a SYNOLOGY Disk Station NAS located at NERF/imec.

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

We expect about 2500 EUR/year. These costs will be budgeted at the lab level.

5. Data sharing and reuse

Will the data (or part of the data) be made available for reuse after/during the project? In the comment section please explain per dataset or data type which data will be made available.

- Yes, in an Open Access repository

Published data will be available. Unpublished results will be made available after an embargo period (3 years; exceptionally 5 years after the project)

If access is restricted, please specify who will be able to access the data and under what conditions.

Not Applicable

Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain in the comment section per dataset or data type where appropriate.

- No

Where will the data be made available? If already known, please provide a repository per dataset or data type.

Published data will be available on open-access repository (GitHub, Zenodo)

For data stored locally, on our Cloudian server/SYNOLOGY with access to data on written demand.

When will the data be made available?

The data will be made available after publications via the required link in the publication or upon request and after an embargo period after publication.

Which data usage licenses are you going to provide? If none, please explain why.

Creative Commons Attribution 4.0 International Public License

Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.

- Yes

What are the expected costs for data sharing? How will these costs be covered?

Dependent on the data repository selected. Costs will be covered by project fund and the laboratory.

6. Responsibilities

Who will manage data documentation and metadata during the research project?

Project lead (Clément Brunner) and PI (Alan Urban)

Who will manage data storage and backup during the research project?

Project lead (Clément Brunner), PI (Alan Urban) and the day-to-day manager of the Cloudian Server (Giuliano Maggi Olmedo)

Who will manage data preservation and sharing?

PI (Alan Urban)

Who will update and implement this DMP?

Project lead (Clément Brunner)

