1S70723N Combined transcriptomic and electrophysiological spatiotemporal profiling of neural circuits with a high-density multi-electrode array chip

A Data Management Plan created using DMPonline.be

Creator: Lukas Fan

Affiliation: KU Leuven (KUL)

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Project abstract:

Studying cellular networks such as neural circuits on a single cell level is essential in understanding
complex disorders such as neurodegenerative diseases. Since the dawn of next-generation sequencing technologies and the power of stem cell engineering, it is now feasible to reveal the transcriptomic profile of thousands of cells from patients with poorly understood conditions. On the
other hand, neural circuits, even in (simplified) cultured conditions, demonstrate convoluted and ultrafast communications. High-density electrode arrays and extensive data processing are being
used to identify disease phenotypes from these in vitro circuits. We foresee the possibility to consolidate electrophysiological recordings from neurons with its transcriptomics. Imec's high-density
microelectrode array (HD-MEA) platform is a powerful instrument to study cellular networks at single
cell resolution. With more than 16k electrodes and an electrode pitch of 15um, the nanochip enables
to study cellular processes at unprecedented level. It features several modalities such as electrical
stimulation, voltage recording and impedance spectroscopy to study a variety of cell types and assays. we will exploit its stimulation capabilities to develop an integrative single cell analysis method based on electroporation and multiplexed barcoding to investigate both transcriptomic and
electrophysiological behavior of in vitro neural circuit with spatiotemporal specificity.

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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
Cell Culture microscopy	Microscopy image collected on cell-cultures that are being experimented on	Generate New Data	Digital	Experimental	.jpg, .tiff, .czi, .lsm	<5TB	
Cell Culture Electrical Recordings and Impedance Measurements	Electrical Recordings and Impedance Measurements of cells taken from MEAs	Generate New Data	Digital	Experimental	.sparrowh5, .csv, .bin	<10TB	
Fluidics Models	3D CAD models of fluidic used for solution delivery on MEA	Generate New Data	Digital	Compiled/aggregated data	.stl, .step, .igs, .sldprt, .sldasm	<100GB	
3D print/CAM instructions	Instructions used by 3d-printer, or g-code for controlling CNC	Generate New Data	Digital	Compiled/aggregated data	.form	<100GB	
Engineering Drawings	Engineering drawings of models designed/used in the project	Generate New Data	Digital	Compiled/aggregated data	.slddrw, .pdf	<100GB	
Fluidics Simulation	Simulation of fluidics models in CFD	Generate New Data	Digital	Simulation data	.csv, .wbpj, .cfx, .def, .dat	<1TB	
Cytometry	Cytometry for sensing fluorescently-tagged cells	Generate New Data	Digital	Experimental	.xitm, .xit, .fcs, .xml	<100GB	
qPCR Data	Output from qPCR of DNA barcodes	Generate New Data	Digital	Experimental	.csv	<100GB	
FACS Data	Cell sorting data	Generate New Data	Digital	Experimental	.fcs, .xml, .pdf	<100GB	
Barcode design	DNA sequences used for generating barcodes	Generate New Data	Digital	Compiled/aggregated data	.xlsx	<1GB	
Sequencing Data	RNA-Seq data from Sequencing technologies like 10x Chromium	Generate New Data	Digital	Experimental	.csv, .pdf, .bam, .bai, .fasta, fastq	<5TB	
RNA-Seq Analysis Data	Data generated from analyzing raw sequencing data	Generate New Data	Digital	Compiled/aggregated data	.csv, .xlsx, .fasta, .vcf, .jpg, .png, .pdf	<5TB	
Software	Software for controlling MEA, microfluidics, analysis data and generating software configurations	Generate New Data	Digital	Software	.cs, .m, .sln, .xaml, .config, .csproj, .exe, .py, .ipynb, .env	<100GB	
Other characterisation	Data generated as according to challenges. Usually manually inputted from measurements observed in machines	Generate New Data	Digital	Experimental	.csv, .opju, .xlsx	<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:

None

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.

- No

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).

1. File names and folder structures are made to reflect the time, date, nature and sometimes purpose of the data stored
2. Microscopy images have settings and configuration information stored in metadata
3. Software have comments/README and/or commit messages that explain the code. These information are stored locally and on IMEC git server
4. Models are named with consistent versioning to reflect iterations. Engineering drawings are provided for fabricated parts.
5. Simulation data are stored in simulation software's native format, which allows retrieval of simulation settings, configuration, mesh, boundary conditions etc. using the software
6. Dataset manually compiled will have headings in the file that explains the data collected, and folder structure that reflects their purpose
7. Sequencing data are stored with labels that reflects their content
8. Onenote is used to store key information explaining conditions and other information about experimental data that are not reflected in the data itself.

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

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

Where will the data be stored?

Simulation data and large dataset generated from software-automated analysis will be saved in imec's central servers.
Metadata, selected important data, and reports of experiments are saved in clouds (SharePoint and OneDrive).

How will the data be backed up?

Carried out by imec and cloud service provider (Microsoft)

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

Central servers and clouds are shared and have large and extensible capacity.

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

Access to the central servers is only possible for specific users after approval by imec. Data on the group's SharePoint is only accessible by people in the research group, with the exception of specific files shared with collaborators. OneDrive access is by default restricted to individual user (i.e. myself) only.

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

Costs are covered by IMEC.

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...).

All the data will be retained for 5 years following the end of the project.

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

The data will be left where it is currently saved (imec's central servers and clouds) as capacity is sufficient.

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

Costs are covered by imec.

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
- Yes, in a restricted access repository (after approval, institutional access only, …)

Relevant summarized data will be published in journals or reported in the PhD thesis.

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

If journal cannot provide open access, only paid users can access the data.
Data can be accessed by relevant collaborators or other parties upon request.
All data can be shared with FWO and KU Leuven

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.

Upon request by mail.
Procedure to be defined depending on parties involved.

When will the data be made available?

Upon publication of the research results

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

Software will be published in GPL or MIT license depending on whether the software will be also deployed in commercial environment by IMEC.

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

DOI for published paper, accession number for novel RNA sequences found in experiments.

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

Open-access costs will be covered by bench fee

6. Responsibilities

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

The PI will the responsible for the data documentation and metadata under the supervision of the PI's advisors (Dr. Dries Braeken and Prof. Liesbet Lagae) .

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

The PI will the responsible for the data storage and backup. Additional back ups of important dataare carried out by the PI's advisors (Dr. Dries Braeken and Prof. Liesbet Lagae)

Who will manage data preservation and sharing?

The PI's advisors (Dr. Dries Braeken and Prof. Liesbet Lagae) and other research group members will be responsible for data preservation and reuse.

Who will update and implement this DMP?

The PI bears the end responsibility of updating & implementing this DMP.