µForensiCell: Development and validation of a microfluidic device for single cell sorting in forensic casework.

A Data Management Plan created using DMPonline.be

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Project abstract:

The low efficiency of current DNA extraction procedures and the deconvolution of complex DNA profiles required after bulk sequencing, remain major challenges for forensic DNA laboratories and has significant impact on the ability to include or exclude a suspect as a donor. We have recently demonstrated that fluorescence-activated cell sorting has significant potential to increase the sensitivity of forensic DNA analysis. This project aims to build further on these advancements by (1) designing and developing a cell preselection microfluidic device for application in two of the most common samples in forensic investigations (i.e., post-coital swabs and trace contact samples) and (2) validation and accreditation of this new analytical protocol in an ISO17025 accredited laboratory. Miniaturising the process of cell preselection will reduce (1) sample loss, (2) the number of cells required for analysis, (3) cost, (4) turn-around-time and most importantly (5) increase the sensitivity to detect target cells relevant for the investigation. The µForensiCell project will therefore provide an innovative solution for the analysis of the rapidly increasing number of reported sexual crimes associated with the establishment of Sexual Assault Reference Centres.

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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.

Dataset name / ID	Description	New or reuse	Digital or Physical data	Data Type	File format	Data volume	Physical volume
		Indicate: ***N****(ew data) or* ***E****(xisting data)*	Indicate: **D**(igital) or **P**(hysical)	Indicate: **A**udiovisual **I**mages **S**ound **N**umerical **T**extual **M**odel **SO**ftware Other (specify)		Indicate: <1GB <100GB <1TB <5TB >5TB NA	
CAD files	Microfluidic chip design	N	D	I	.svg, .dwg, .dxf, .cif	< 100 GB	
Microfluidic visualization	Visualization of microfluidic chip operations	N	D	I	.mp4, .avi, .png	< 1TB	
Droplet analysis	Image/Video analysis in Matlab	N	D	SO	.m	< 100 GB	
Numerical data	Collection and processing of primary numerical data	N	D	NT	.xlsm, .csv, .MAT, .txt	< 100 GB	
Observational data	Written down in electronic lab notebook (eLABJournal, Bio-ITech)	N	D	NT	.txt, .pdf	< 100 GB	
Scientific publications	Research papers, dissemination materials	N	D	T	.docx, .pdf, .pptx, .png, .jpg	< 100 GB	
Microscopy	Microscopy images	N	D	I	jpeg, gif	<100 GB	
DNA profiles	Electropherograms	N	D	SO	epg	<1 GB	
FCS files	FACS sort data	N	D	SO	.fcs	<1 GB	
MPS sequencing data	Count tables and alignment files	N	D	SO	bam, sam	<100 GB	

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:

NA

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? If so, refer to specific datasets or data types when appropriate and provide the relevant ethical approval number.

- Yes, human subject data (Provide SMEC or EC approval number below)

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Will you process personal data? If so, please refer to specific datasets or data types when appropriate and provide the KU Leuven or UZ Leuven privacy register number (G or S number).

- 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.

- Yes

The µForensiCell project is expected to generate novel IP on the combination of forensic and microfluidics. Although it is difficult to secure IP on purely microfluidic designs, as it is an overcrowded field, we expect that novel approaches for labelling and staining cells and DNA content from swab and contact trace samples will be developed. This combined with the microfluidic technical solutions is expected to lead to patentable matter. We will continuously review if protocols or bioassays should be protected by patent filing or trade secret. The consortium as a whole and in particular the IOF manager Dr. Dal Dosso, will continuously scout for IP opportunities, always in consultation with LRD. In addition, the microfluidics modules developed during the µForensiCell project can be adapted to accommodate multiple types of applications including the detection, sorting and dispensing of single low frequency cells, which is becoming increasingly important in health sciences. This will also further strengthen the IP position of the microfluidics expertise centre at the Biosensors group, that already holds several patents on microfluidics such as a filing (currently at national phase, WO 2020/094848 A1) on a microfluidic chip design used for single cell isolation. When there is concrete potential for tech transfer, the IP related to these research data will be protected, with the support of KU Leuven LRD (e.g. I. Roelants, A. Beckers, who have been following the microfluidic IP portfolio) and the IOF manager supporting this project (Dr. F. Dal Dosso).

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material or 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

There are no 3rd party agreements in place regarding this project.

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.

- Yes

As of today, a preliminary FTO analysis has not shown major IP conflicts (e.g. search by claims keywords like forensic/crime/criminal did not reveal patents which are dedicated to this specific field of application) but this assumption will be continuously checked and revised during the project when a specific method or device is selected or developed. As we are aware of the impact of not having FTO for a service-oriented with licensing options exploitation plan, in the third year, we will apply for a Wellcome Trust-LRD ignite grant to support an in-depth FTO analysis by external IP firm (e.g. DenkIP, as already working with the Biosensors group on another microfluidic file).

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).

- Protocols, the research progress and clear descriptions of obtained data, what they represent and how they were generated, will be collected in the Biosensors group in an electronic notebook (eLABJournal, Bio-ITech). Here, folders will be provided for all subtasks of the project. In each folder, a new file will be made for each experiment, named with the date and subject, and including information on the responsible person (i.e., the person who created the file) as well as version tracking. Each experimental file will contain a section on the objective, protocol, results (a description of results and observations rather than all raw and analyzed data) and conclusions. For each experiment, all raw and analyzed data files will be stored in a folder on the shared server, using the same hierarchical folder structure as the electronic lab notebook. By using the same structure on the server and in the electronic lab notebook, contextual information on the experimentally obtained data can be easily searched and used by a secondary analyst via the electronic notebook.
- Most important (raw) data which lead to publications (e.g. conference proceedings, journal paper) and/or to patents filings, will be stored on the shared folder created on the shared drive (J:\SET-MEBIOS-BIOSENSORS-PROJ-DI0443\C3 µForensiCell). This folder is open to all the consortium members and is secured and backed-up by the ICTS service of KU Leuven. This folder contains also all the administrative items (e.g. project proposal, project reports, update presentations, contracts).

Will a metadata standard be used to make it easier to find and reuse the data?
If so, please specify which metadata standard will be used.

If not, please specify which metadata will be created to make the data easier to find and reuse.

- No

- Being a highly interdisciplinary project, it is not possible to use a standard metadata system.
- The Biosensors group will use the electronic lab notebook in which a number of predetermined topics have to be described for each experiment (Objective, protocol, results, and conclusion). The electronic lab notebook facilitates searching for particular metadata through a search engine. By mimicking the folder structure of the electronic lab notebook in the server-based folder with the experimental data, linking of the metadata to the actual data will be facilitated.
- The electronic lab book software will also be used to manage the sample inventory (coded label, position, date) and track samples in and out of the fridges and freezers.
- For each peer-reviewed article, a separate folder will be made on the server, containing the latest word version and all raw and processed data used in the article. In addition, a separate file will be made in the electronic lab notebook for each article, containing clickable links to all metadata files of data that were used in that particular article, to facilitate tracing back of protocols, results and conclusions.

Data Storage & Back-up during the Research Project

Where will the data be stored?

- Other (specify below)
- OneDrive (KU Leuven)

- A folder on the UZ Leuven secured server only accessible to the researchers. The folder is backed-up by ICTS service of UZ Leuven. The folder is open to the researchers involved with a UZ login.
- The time-stamped digital data will be stored in an already created project folder on the shared drive (J:) of KU Leuven. The time-stamped digital metadata will be stored on the server of the electronic labbook (eLABJournal, Bio-ITech), and .pdf exports will be made on a weekly basis to be saved on the shared drive (J:). The folder is open for the members participating in this KU Leuven C3 project and is secured and backed-up by the ICTS service of KU Leuven. Copies can be made and kept on personal devices.

How will the data be backed up?

- Standard back-up provided by KU Leuven ICTS for my storage solution
- Other (specify below)

Standard back-up provided by UZ Leuven ICTS

Is there currently sufficient storage & backup capacity during the project?

If no or insufficient storage or backup capacities are available, explain how this will be taken care of.

- Yes

KU Leuven provides sufficient storage and back-up capacity during and after the project. A dedicated folder will be made for the project on which the collaborators will work jointly and store data files.

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

The network drive for the project share folder and the large volume storage folder are secured by the ICTS service of KU Leuven with a mirror copy. Only lab members that work on the project, will have access to the shared folder. Confidential data can and will be protected with a password (available only for PI Jeroen Lammertyn). Visitors, MSc thesis students and internship students in the groups as well as other unauthorized persons will not have access to the data on the shared folder. Data storage in the cloud will be avoided, unless for temporary use only, e.g., to transfer large files between the researchers involved in the project.
Data on the UZ Leuven network folder can only be accessed with a personal UZ login and access/edit rights have been restricted to the researchers themselves.

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

Type 1 server back-end storage with mirror backup for the project share folder will cost 519 Euro per Tb per year. Costs will be covered by the project consumables budget.

Data Preservation after the end of the Research Project

Which data will be retained for 10 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 data will be preserved for 10 years according to KU Leuven RDM policy

The data to be retained during 10 years after the project's end are dissemination data (source files of publications and presentations), documentation on measurements set-ups, and the most relevant measurement data.

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

- Other (specify below)

A distinction is made between research data and dissemination data. The research data, namely microscopy images, video recordings and measurement results, will be stored on the archive server (K-drive) of KU Leuven in a folder that is only accessible for the staff of our group. Dissemination data, namely files corresponding to papers and presentations, will be stored on the PI's PC, and back-upped daily on the readily accessible server (J-drive) of KU Leuven for permanent storage.

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

- The volume corresponding to dissemination data is expected to be relatively low (<10 GB), and therefore can be seamlessly embedded in the PI's allocation on the KU Leuven server. The costs (1000 EUR/year) will be covered by other on-going projects at that point in time.
- The research data will be stored on the archive server (K-drive) of KU Leuven. The costs will be (12 EUR/100GB/year) will be covered by other on-going projects at that point in time.

Data Sharing and Reuse

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

- Other (specify below)

Relevant digital data will be published and made available after the end of the project. Data with valuable IP will be protected prior to publication. We will comply with open access regulations of KU Leuven.

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

NA

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 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.

- Other (specify below)
- KU Leuven RDR (Research Data Repository)

NA

When will the data be made available?

- Upon publication of research results
- Upon publication of research results, as soon as the research results have been published, the data can be made available to other researchers.
- Upon request by mail, due to the data volume, access will then be granted to a restricted access repository.

Which data usage licenses are you going to provide?

If none, please explain why.

- Data Transfer Agreement (restricted data)

Do you intend to add a persistent identifier (PID) to your dataset(s), e.g. a DOI or accession number? If already available, please provide it here.

- No

NA

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

A restricted access repository can be implemented through the KU Leuven's Research Data Repository platform, which provides a platform to upload and share research data. This platform is provided by the university and free of charge.

Responsibilities

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

The researchers who will work on this KUL C3 project will be responsible for the data collection, documentation and metadata. They will be trained in data management at the beginning of the project. Supervisors will manage the data storage facilities

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

The lab technician and researchers who will work on this KUL C3 project will be responsible to store the data on the appropriate accommodation provided by KU Leuven. The ICTS service of KU Leuven is responsible for the back-up of the network drives at KU Leuven. The folders will be managed by the supervisors.

Who will manage data preservation and sharing?

The PIs of this project will be responsible for the data preservation and eventual reuse of obtained data.

Who will update and implement this DMP?

The PIs bear the end responsibility of updating and implementing the DMP.