Microfluidics for biomarker-free microwave dielectric sensing and retrieval of cancer cells

A Data Management Plan created using DMPonline.be

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Project abstract:

According to the World Health Organization, cancer is the second leading cause of death globally. Crucial for reducing cancer mortality is the field of cancer diagnostics, especially the early recognition and treatment of cases. However, state-of-the-art early detection strategies still rely on identifying and detecting biomarkers (such as those carried by cancerous cells) using matching bioreceptors, which significantly hampers progress in cancer diagnostics and research. To circumvent this necessity, microwave dielectric sensing (MDS) has emerged as a biomarker-free method for cell detection. Nevertheless, the MDS technology is still at an early stage in the application field with many MDS systems being designed in a non-optimal way. Therefore, this project aims to develop a next-generation microwave-microfluidic technology platform capable of high-throughput biomarker/label-free detection and retrieval of individual cancer cells. Innovative microfluidic solutions, such as microwell arrays and heat-responsive hydrogels will be implemented together with MDS technology to create a fully integrated platform for differentiating cancerous from healthy cells and retrieval of those cells of interest. The results of this project will challenge existing concepts in the way individual cells are being analyzed and as such will have a significant impact on cancer research next to many other fields.

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Microfluidics for biomarker-free microwave dielectric sensing and retrieval of cancer cells DPIA

DPIA

Have you performed a DPIA for the personal data processing activities for this project?

- Not applicable

Microfluidics for biomarker-free microwave dielectric sensing and retrieval of cancer cells GDPR

GDPR

Have you registered personal data processing activities for this project?

- Not applicable

Microfluidics for biomarker-free microwave dielectric sensing and retrieval of cancer cells 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 following data will be produced during this research: microfluidic chip design files from Inkscape (.svg) or AutoCAD (.dwg) as well as microscopy images (.jpg, .TIF), videos (.mp4) and microwave data (.s2p, .prn, .csv). Data analysis and visualization data will be performed using Excel (.xlsx), Matlab (.mat, .mlapp, .fig) and JMP (.jmp). Notes will be kept primarily via Obsidian and paper notebooks.
Protocols, experiments and observations will be managed through eLABJournal, enabling transparency and accessibility for the research group, including supervisors and collaborators.
Scientific output will be kept in the form of papers, posters, presentations, seminars and a PhD manuscript.

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)

Prof. J. Lammertyn, head of the MeBioS-Biosensors group at KU Leuven, ensures that the research data management plan is in accordance with the general guidelines of the KU Leuven and with FWO requirements. The applicant is responsible for the correct usage of the data management protocols. All obtained research data is stored on a KU Leuven shared drive (J: Drive), which is accessible to the supervisor and promotor. The J: Drive is backed up daily to OneDrive, which ensures remote access. After publication, the research data will be transferred to the long-term storage server (K: Drive) for at least 5 years. The KU Leuven ICT service is responsible for maintaining all these servers.

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)

There is no intention 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)

Three types of human samples will be used: (i) Two human cell lines (MCF7 and MCF10A), and (ii) Patient cancer tissue samples. The ethical approval for the human cell lines is granted (EC UZ Leuven, S66605). The ethical aproval for the patient samples will be obtained the latest by the fourth year of the FWO-SB project.

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

There are no 3rd party agreements in place regarding this project.
Regular meetings with KU Leuven LRD will be held to evaluate and protect possible IP generated during the project that could lead to valorization actions. If deemed necessary, data that fall under IP will either not be shared, put under embargo, or a suitable license will be applied to the data when published (e.g. Creative Commons License).

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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: • Generate new data • Reuse existing data	*Please choose from the following options:* • Digital • Physical	*Please choose from the following options:* • Observational • Experimental • Compiled/aggregated data • Simulation data • Software • Other • NA	*Please choose from the following options:* • .por, .xml, .tab, .csv,.pdf, .txt, .rtf, .dwg, .gml, … • NA	*Please choose from the following options:* • <100MB • <1GB • <100GB • <1TB • <5TB • <10TB • <50TB • >50TB • NA	
Microscopy images/movies	Raw and processed data	New data	Digital	Experimental	.nd2, .jpg, .png, .tiff, .avi, .mp4	<1TB	
Microfluidic chip designs	Design files	New data	Digital	Experimental	.dwg, .dxf, .svg, .pdf, .cad	<1GB	
Software data acquisition	Arduino scripts	New data	Digital	Software	.ino	<1GB	
Data analysis	Files for data analysis	New data	Digital	Software	.xlsx, .csv, .jmp, .m, .mat, .mlapp	<1GB	
Observational data	Obsidian files for note taking	New data	Digital	Observational	.md	<1GB	
Cell lines	Cryovials stored in liquid nitrogen	New data	Physical	Other			20 cell line cryovials have been generated and will be used throughout the project. Stored in a box of roughly 1000 cm^3

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)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

- Yes, human subject data

Three types of human samples will be used: (i) Two human cell lines (MCF7 and MCF10A), and (ii) Patient cancer tissue samples. The ethical approval for the human cell lines is granted (EC UZ Leuven, S66605). The ethical aproval for the patient samples will be obtained the latest by the fourth year of the FWO-SB project.

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.

- Yes

If research data have potential for patent filing, scientific staff working on this project will discuss this with the IOF manager in the group (Dr.
Francesco Dal Dosso) and LRD to make sure that data are protected prior publications.

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.

- Yes

Due to the generation of IP, restrictions in data sharing might potentially be implemented. This will be followed up through regular meetings with KU Leuven LRD, who will evaluate and protect potential IP generated during the project that could lead to valorization actions. In this case, IP will (i) not be shared, (ii) put under embargo, or (iii) a suitable license will be applied to the data when published (e.g. Creative Commons License).

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).

The Biosensors group uses 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.
As a general rule, datasets will be made openly accessible, whenever possible via existing platforms that support FAIR data sharing (www.fairsharing.org). When depositing data in a local or public repository, the final dataset will be accompanied by this information in a README.txt document, following the Dublin Core Metadata standard if no other meta- tandard is available yet. This file will be located in the top-level directory of the dataset and will also list the contents of the other files and outline the file-naming convention used. This will allow the data to be understood by other members of the laboratory and add contextual value to the dataset for future reuse.
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.

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.

- Yes

To guarantee reusable aspect of data, sufficient documentation and methods information will be provided, whereas CC-BY license will be attached to data through data repositories.

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

Where will the data be stored?

The time-stamped digital data will be stored on OneDrive and is backed up to both the shared network drive (J-drive) of the KU Leuven and Sharepoint. Large data is stored in the large volume storage K-drive of the KU Leuven. The time-stamped digital metadata will be stored on the server of the electronic labbook (eLABJournal, Bio-ITech). Physical samples will be stored in fridges and freezers located in the respective laboratories or liquid nitrogen tanks managed at the departmental level. All samples will be tracked using electronic lab notebook (Biosensors group).

How will the data be backed up?

Standard back-up provided by KU Leuven ICTS for my storage solution.

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

During, as well as after the project, KU Leuven can provide sufficient storage and backup capacity. A dedicated folder is made for the project to 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 shared folder and the large volume storage folder are secured by the ICTS service of KU Leuven with a mirror copy. 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.

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 shared folder will be used. Using the shared network drive (J-drive) and large volume storage (K-drive) cost respectively 503.66 Euro per TB per year and 104.42 Euro per TB per year. Costs will first be covered by the project consumables budget.

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...).

The following data will be preserved for 10 years according to KU Leuven RDM policy:
Dissemination data (source files of publications and presentations) and the most relevant measurement data.

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

On the shared networks drive (J-drive), Large volume storage (K-drive) and KU Leuven RDR.

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 (<100 GB), and therefore can be seamlessly embedded on the (K:) drive of KU Leuven. The costs (1000 EUR/year) will be covered by other on-going projects at that point in time.
- For research data, at current archiving costs of 10 Euro/(TB*year), we estimate a cost of 2000 Euro/year. These costs will be covered by funding acquired by the project PIs in the context of other research projects.

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

Only researchers participating in the project will be able to access the data for the duration of the project. As soon as the article associated with the data is ready for publication, the data will be made open through the institutional repositories mentioned in 2.1. The data will be deposited in the institutional repositories: (KU Leuven: Research Data Repository (RDR) Research Data Repository (RDR) - RDR - Research Data Repository (kuleuven.be). Data will be assigned with DOIs to create trustworthy and persistent links for online content.

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 in the comment section per dataset or data type where appropriate.

- Yes, Intellectual Property Rights

Before making data and other research output from the project (e.g. journal articles, book chapters and conference proceedings) openly available, they will be aligned with the project IP strategy to avoid premature disclosure, which can compromise the patent filing application(s).

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

KU Leuven RDR (Research Data Repository)

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.

Data from the project that can be shared will be made available under a creative commons attribution license (cc-by 4.0), so that users have to give credit to the original data creators.

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

Data will be assigned with DOIs to create trustworthy and persistent links for online content.
ORCID will be included in all publications and other dissemination material for all the researchers involved in the project.

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

A restricted access repository can be implemented on a free tool, such as OneDrive, up to a certain volume. If this volume does not suffice, time-limited storage will be considered, thus limited to the time needed to download the data. The costs associated with data storage will be covered by the budget foreseen in the project agreement.

6. Responsibilities

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

Emiel De Rieck

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

Emiel De Rieck

Who will manage data preservation and sharing?

Jeroen Lammertyn

Who will update and implement this DMP?

Emiel De Rieck, Jeroen Lammertyn