
Biofabrication of organ-specific functional micro- and macrovasculature

A Data Management Plan created using DMPonline.be

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Project abstract:

The biofabrication of 3D biomimetic tissue analogs, which accurately mimic the properties of native tissue, have an enormous potential in biomedical applications (drug discovery, cancer research, regenerative medicine,...). A basic prerequisite for the survival, maturation and function of 3D engineered tissues is the establishment of blood vessels. The most critical challenge in complex tissue engineering is the integration of an organ-specific hierarchical vascular network. This project will integrate biomimetic approaches with bioprinting by combining self-organizing multicellular spheroids with cell-instructive-biomaterials for guiding organ-specific endothelial cell differentiation and generating vascularized tissues. Spheroids are composed of endothelial and/or mural cells (pericytes, smooth muscle cells) allowing the engineering of micro- and macrovasculature embedded in a tissue-environment. To enhance the maturation state of the tissue, electroactive hydrogels will be applied. By incorporating the vascularized tissue in a bioreactor, we will strive to an organ-on-a-chip system with a higher physiologically relevance than current models. With this model, the response to microenvironmental stimuli (mechanical and biological factors comprising flow, tissue/extracellular matrix stiffness, mural cell interactions) of endothelial cell differentiation towards an organ-specific behaviour will be elucidated.

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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 project will generate new research data.

Experimental data will be collected with various devices and recorded in different file formats, including microscopical images (.zvi, .jpeg, .tiff, .gif, .png), printing parameters (G-code, .STM), tables (.xls), gene expressing data (.fastq), ...

Manuscripts will be stored as .pdf with respective DOI.

Custom-made objects (bioreactor, electromechanical device,) will be stored in the lab and filed. Files will be assigned a unique identifier: Project_WPs_Document type_Researcher name_Date. We estimate that the total volume of data of 1 PhD student will be in the range of TB.

All necessary measures will be taken to archive all biological data according to good scientific practices.

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)

1. Designation of responsible person
H. Declercq and L. Gifre-Renom/E. Jones are responsible for the data management.
2. Storage capacity/repository
 - during the research
During the project, imaging will be stored on a server of the respective (core) facilities, where automatic backups are in place. Other data (tables, doc,...) will be stored at the server of KU Leuven, which is daily backed up. PhDs make use of online notebooks.
 - after the research
At the end of the research, lab notebooks will be stored in the archives of KU Leuven. A preservation plan will be made to ensure the data will be stored for 5 years after the project. Suitable repositories will be analyzed for publishing the data.

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)

Not applicable

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)

Not applicable

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

Not applicable

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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
		<i>Please choose from the following options:</i> <ul style="list-style-type: none"> Generate new data Reuse existing data 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> Digital Physical 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> Observational Experimental Compiled/aggregated data Simulation data Software Other NA 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> .por, .xml, .tab, .cvs, .pdf, .txt, .rtf, .dwg, .gml, ... NA 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> <100MB <1GB <100GB <1TB <5TB <10TB <50TB >50TB NA 	
Lab notebooks	Experimental set-up	New	Digital	Observational, experimental		<10GB	
Spheroids and 3D printed cells' derived RNA and protein lysate		New	Physical	Experimental			500 samples
Embedded spheroids and printed tissues and derived microscopy slices	Embedded, fixated and/or stained microscopy slices	New	Physical	Experimental			500 samples
Microscopy images (phase-contrast microscopy and fluorescence)		New	Digital	Observational, experimental	.jpeg/.png/.pdf	<1TB	
Microscopy images of (immuno)histological stainings	Embedded, fixated and/or stained microscopy slices	New	Digital	Observational, experimental	.jpeg/.png/.pdf	<1TB	
Quantifications of (immuno)histological parameters (raw data)		New	Digital	Observational, experimental	.txt/.slsx/.cvs	<1 GB	
Printing parameters	Design and printing procedures	New	Digital	Software	G-code,.STM	<1 GB	
Bioreactor parameters	Design and parameters for external stimuli	New	Digital	Software, experimental	.xlsx	<1 GB	
Metadata		New	Digital	Observational, experimental	.txt/.xlsx	<1GB	

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:

No reuse of existing data.

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).

All experiments will be documented in an electronic laboratory notebook using the online tool Benchling. The notes will include the experimental setup and protocols used, information on the biological samples used, the raw data obtained from the experiment, location of samples generated during the experiment and possible remarks by the researcher.

Every authorized researcher can access the detailed information of the performed experiments in Benchling and should be able to accurately repeat them.

ManGo will be used to classify images from microscopes.

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

Metadata will be created manually, by including readme, Word or Excel files containing the experimental setup and technical descriptions. Moreover, by using Benchling as an electronic documentation system, it is possible to search for specific items and keep all experiments organized.

ManGo will be used to classify images from microscopes.

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

Where will the data be stored?

Raw data will be stored on the shared drives by KU Leuven which can be accessed by each researcher involved in the project, with local copies on the personal I-drive of the researcher. Processed data in the electronic notebook (Benchling) are stored on the Benchling server and will be periodically exported to the share drives provided by KU Leuven. eg. Data will be stored on the One Drive-KU Leuven, personal homedrive (I:), shared folders (J:) and the archive (K:).

How will the data be backed up?

The data stored in Benchling is backed-up weekly by the system and is accessible at any time. Moreover, the version history of the electronic notebook is saved as well and periodical exports are saved on KU Leuven drives. The research data will be backed up on the homedrive (I:), shared folders (J:) and the archive (K:).

The data stored on the university's central servers (I- and J-drive) is backed-up daily according to university procedures.

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

The J-drive will contain the datasets of each PhD student. The K-drive will be used for classified research. We will use ManGo for large image datasets from microscopes.

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

The data stores in Benchling and on the university's servers are password controlled and can only be accessed when granted permission.

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

Monthly, 1 hour is needed for extra working hours to make sure that back-ups, storage and access control are appropriate. Expected costs for data storage and back-up are 165 euro/TB/year and will be covered by the project.

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 data can be retained for 5 years, both in Benchling which remains accessible by the principal investigator as well as on the university's servers.

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

The data will be stored on the university's central servers (with automatic back-up procedures) for at least 5 years.

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

We expect to store a maximum of 1TB data on the university's servers, which has a cost of 165 Euro/TB/year and will be covered by the lab of the PI's.

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 a restricted access repository (after approval, institutional access only, ...)

Processed data will be made available by publishing Open Access Articles in relevant journals in the field.

Unpublished data will be made available to internal and external collaborators via file sharing upon request and after agreement of the principal investigators.

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

Access will be granted after request to the PI's.

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.

Processed data will be made available by publishing Open Access articles in relevant journals in the field.

When will the data be made available?

Upon publication of research results.

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

Published data are open for as long as it is used for non-commercial purposes.

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

The published research articles and their supplementary material will get a DOI accession number.

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

No costs are expected for data sharing since small datasets on the repository is free of charge.

6. Responsibilities

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

All researchers generating data for this project are responsible for its documentation and metadata (PhD students, 2 PI's). The PI/supervisor, Heidi Declercq and Laia Gifre-Renom/Elizabeth Jones bear the responsibility for the data documentation and metadata.

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

The PI's and the researchers involved in the project.

Who will manage data preservation and sharing?

The corresponding author of the published data will be responsible for sharing the data appropriately. This will be Heidi Declercq and/or Elizabeth Jones/Laia Gifre-Renom.

Who will update and implement this DMP?

The PI's of the project, Heidi Declercq and Laia Gifre-Renom/Elizabeth Jones.

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GDPR

GDPR

Have you registered personal data processing activities for this project?

- Not applicable

Biofabrication of organ-specific functional micro- and macrovasculature DPIA

DPIA

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

- Not applicable