

**The design of vascular grafts through the combination of 3D X-ray based histology and melt electrowriting**  
**Application DMP**

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**Questionnaire**

**The questions in this section should only be answered if you are currently applying for FWO funding.  
Are you preparing an application for funding?**

- No

**The design of vascular grafts through the combination of 3D X-ray based histology and melt electrowriting**

**DPIA**

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DPIA

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

- No

## The design of vascular grafts through the combination of 3D X-ray based histology and melt electrowriting

### GDPR

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#### GDPR

Have you registered personal data processing activities for this project?

- No

The design of vascular grafts through the combination of 3D X-ray based histology and melt electrowriting  
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"> <li>• Generate new data</li> <li>• Reuse existing data</li> </ul>	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> <li>• Digital</li> <li>• Physical</li> </ul>	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> <li>• Observational</li> <li>• Experimental</li> <li>• Compiled/aggregated data</li> <li>• Simulation data</li> <li>• Software</li> <li>• Other</li> <li>• NA</li> </ul>	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> <li>• .por, .xml, .tab, .csv, .pdf, .txt, .rtf, .dwg, .gml, ...</li> <li>• NA</li> </ul>	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> <li>• &lt;100MB</li> <li>• &lt;1GB</li> <li>• &lt;100GB</li> <li>• &lt;1TB</li> <li>• &lt;5TB</li> <li>• &lt;10TB</li> <li>• &lt;50TB</li> <li>• &gt;50TB</li> <li>• NA</li> </ul>	
Dataset 1.1 - Tissue samples (WP1)	Tissue samples : human and animal arteries (porcine). Animal arteries come from the slaughterhouse or from clinical experiment at Cliniques universitaires Saint-Luc. Human arteries come from the biobank or from the clinics (with ethical approval)	Generate new data	Physical	Experimental			Stored in freezer at -80°C
Dataset 1.2 - Statistics from health (WP1)	Statistics from health found in the literature	Reuse existing data	Digital	Other	.xlsx	<20Mo	

Dataset 1.3 - Imaging data (WP1)	Grey-scale images from the Nanotom MicroCT. RGB images from 2D classical histology.	Generate new data	Digital	Experimental	.tiff, .czi, .mrxs	<50TB	
Dataset 1.4 - Tissue samples Mechanical tests (WP1)	Tissue samples Mechanical tests : raw data of the mechanical tests	Generate new data	Digital	Experimental	.mat, .csv, .text	<1TB	
Dataset 1.5 - Protocol (image analysis & sample preparation) (WP1)	Protocols on how to prepare sample, postprocess and analyze the images. Python, matlab codes to process the images.	Generate new data and Reuse existing data	Digital	Software and other	.txt, .csv, .pdf, .xlsx, .docx, .ipynb, .py	<1GB	
Dataset 2.1 - parametric code (WP2)	python code generating microstructural representative volume elements	Generate new data	Digital	Software	.py, .ipynb	<1GB	
Dataset 2.2 - simulation (WP2)	Codes to mesh the RVEs and perform virtual mechanical tests	Generate new data	Digital	Software	.ansa, .inp, .for, .f, .m	<10GB	
Dataset 2.3 - materials parameters (WP2)	Resulting materials parameters of simulation	Generate new data	Digital	Simulation data	.csv	<100MB	
Dataset 3.1 - MEW literature data	Melt electrowriting (MEW) data coming from the literature	Reuse existing data	Digital	Other	.csv	<100 ko	
Dataset 3.2 - DOE	DOE to predict fibre thickness based on the MEW machine parameters	Generate new data	Digital	Other	.csv	<100 ko	
Dataset 3.4 - Motion perfect printing code	Printing code of MEW structures	Generate new data	Digital	Software	.bas, .prg, .bal	< 1Mo	

Dataset 3.5 - Mechanical tests of printed MEW structures (WP1)	Printed structures Mechanical tests : raw data of the mechanical tests	Generate new data	Digital	Simulation data	.mat, .csv, .text	<1TB	
Dataset 3.6 - Printed MEW samples	All samples printed by MEW	Generate new data	Physical	Experimental			
Dataset 4	articles	Generate new data	Digital	Other	.pdf	< 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:**

Dataset 1.2 : statistics from health got from :

Données de la banque RHM, Service Data et Information stratégique,  
SPF Santé publique, Sécurité de la Chaîne alimentaire et Environnement, Belgique.

Dataset 1.5 - Protocols:

Protocols from my ContrastsTeam research group

Dataset 3.1 : a lot of data were taken from the literature, DOI of all articles are kept in zotero.

**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
- Yes, animal data

Porcine arterial tissues will be used coming from the slaughterhouse for which no ethical approval is needed. They will be used for all technical optimisations. Additionally, I have already collected and will continue to collect porcine tissues from Landrace pigs from unused material of a study conducted at the CHEX department (UCLouvain), approved by local authorities (Faculty ethics committee for animal experimentation, 2024/UCL/MD/61), and performed in accordance with the Guide for the Care and Use of Laboratory Animals, published by the US National Institutes of Health (NIH Publication, revised 2011), or from the slaughterhouse.

Human tissues will be employed for validation purposes and final design of the grafts. The collection process of the human tissues will be carried out by our collaborator Prof. Valérie Lacroix at UCLouvain rather than myself. She has submitted and received the necessary ethical clearance for this purpose. In the event that additional biological materials are required beyond the scope of current ethical approvals, a new application will be submitted by my copromotor prof. Kerckhofs.

**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 applicable, IP protection will be investigated in collaboration between the Louvain Transfer office of the UCLouvain and the KU Leuven LRD office.

**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).**

- **Data from all experiments**

The documentation of the experiments consists of:

- Ethical approval documents: CTC documents, communication with ethical committees, etc.
- Test protocols: SOPs and specific protocols of the performed mechanical test, samples and tissues imaging, MEW printing, etc.
- Manuals: manuals for operating the testing devices, performing the scans, etc
- Elabjournal containing all the data from experiments (MEW, imaging, mechanical tests).

- **Data from software development**

All software development will be well annotated. Readme.txt files will explain how to use the developed softwares

- **Data from simulations**

All generated models and subroutines are accompanied with a readme.txt file and contain a header to describe their content.

- **Articles from literature** : All articles are stored on zotero

**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

- **Data from all experiments**

Data related to identification of the tested tissue animal/patient.

- For our biological samples, metadata are created and saved in our electronic labbook (elabjournal)
- For the imaging experiments, all information (acquisition & processing parameters) are stored in elabjournal as well as in the properties of the acquisition file and image dataset. The resulting images are stored in our large volume storage (LVS) backed-up by UCLouvain.
- Specific protocol that was used to perform the mechanical test on a certain tissue.
- For our testing protocols, a template will be used, which will be stored in our elabjournal labbook.

- **Data from simulations**

- Data related to identification of the animal/patient.

- Abaqus automatically generate metadata for every simulation, according to its own standards.
- Any in-house developed code is properly annotated.
- **General computing code**  
Any in-house developed code is properly annotated and accompanied by a readme.txt file.

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

#### Where will the data be stored?

- Personal network drive (I-drive)
- OneDrive (UCLouvain)
- Sharepoint online
- Large Volume Storage
- Shared network drive (J-drive)

Apart from non-sensitive raw images, data will be stored on facilities of the research unit or university. This includes:

- Mechanical data, hosted on the LVS for temporary storage during data processing, backed-up by UCLouvain.
- Storage for archiving of non-sensitive raw images (stored on the LVS)
- Gitlab repository of UCLouvain for code development and thesis text writing
- OneDrive for office files.
- Personal drives for office files.
- Large Volume Storage (LVS) for storing imaging datasets backed-up by UCLouvain.
- Elabjournal containing all the experimental protocols.

#### How will the data be backed up?

All data are stored on the university's central servers (I-drive, J-drive, Kdrive, UCLouvain gitlab space, LVS by UCLouvain) with automatic daily back-up procedures. If not located in one of the above drives, all research-related documents are stored in a folder on the researcher's pc that is synced with OneDrive for Business cloud storage, or a copy of the image datasets stored on physical hard drive.

**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

Sufficient space is available on the university's central servers (J-drive, K-drive, UCLouvain gitlab space, UCLouvain LVS). Moreover, for the UCLouvain LVS, it is possible to increase the storage and backup capacities by paying more. The storage LVS is double backing up.

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

All data is securely stored on KU Leuven and UCLouvain servers and only accessible by members of the research unit through authentication.

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

UCLouvain charges a fixed price per TB for the LVS storage (150€/TB per year). We expect to collect a total of 50 TB of data on the LVS at the end of the project, and 500 GB on the J- and K-drive and gitlab. The overall costs are expected to be less than €2000/yr, financed in part by the current FWO project for the duration of the project and by other project grants from the promoters.



#### 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 datasets will be retained for 5 years after the end of the project (and for publications, until 5 years after the work has been published). Biological samples are destroyed after mechanical testing.

The biological sample used for imaging purposes only and used in a publication will be retained for 5 years in the freezer of UCLouvain, at IREC Morf departement.

Human samples used for imaging purposes only and used in a publication will be retained for 5 years in the freezer of UCLouvain, at IREC Morf departement.

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

All data in the J-drive and on gitlab will be moved to archival storage (KU Leuven's K-drive).

All the imaging datasets used for publications will be archived for 5 years in the large volume storage (LVS) at UCLouvain.

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

The costs will be around €3500 per year and will be covered by the budget of the supervisors.

#### 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, ...)
- Other, please specify:

For each outcome of the PhD project (models, imaging datasets, new techniques, etc), IP rights will be ad hoc discussed with the partners involved in the project and the Tech Transfer Office of the UCLouvain and the KU Leuven. Trade off between patenting and open access will be considered. Once IP is protected, the outcome will be made available via Open Access repositories or upon request after publication.

Especially for the imaging datasets, which are very large (>50GB/dataset), the data will be made available upon request and can be send via BelNet Filesender or via transvol (UCLouvain).

For the mechanical data and the models, they will be made available upon request, via scientific papers and 'data papers' if supported by the journals, via data repositories, such as for example Zenodo, or other repositories upon request, etc.

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

The restriction of the imaging datasets comes mainly due to the large size of the datasets, and the related cost for long term storage in open access repositories. Therefore, the datasets will be made available upon request, and can be send via BelNet FileSender or transvol (UCLouvain).

Once IP is secured and once the related results, datasets are published, everyone should be able to obtain access to the imaging datasets upon request.

For the smaller datasets (i.e. models, protocols, mechanical data), once published, the datasets should be accessible via open access repository.

Members of the research unit will be able to access the data via the shared drives.

The scientific community will have access to the data under the following conditions of use: CC BY, in which appropriate credit must be given to the author and indication of changes must be made, and CC BY-NC, which adds a non-commercial term to the CC BY license.

**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, Other

My PhD is a joint-PhD between the university of KU Leuven and UCLouvain. Therefore, a joint-PhD agreement will be signed, which states that the property, publication, use and protection of the results of the research is common to the two host institutions and are required to be in conformity both with the specific procedures in each of the two communities as well as the relevant internal regulations of each institution. Any cases of potential conflict in the provisions will form the subject of arbitration between the KU Leuven and the UCLouvain. This can restrict or prevent the sharing of my data.

Furthermore, the large size of the imaging datasets and the cost related to long term storage in open access repositories, can also be a restriction to sharing in open access such datasets. In this case, the imaging datasets will be made available upon request.

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

For the publications, it will be made available on DIAL and LIRIAS, the universities repositories for papers and conference abstracts. For the datasets smaller than 50GB, it can be made available on zenodo (<https://zenodo.org/>) and can be linked to the ORCID number and the DOI.

**When will the data be made available?**

When IP is secured for both universities (UCLouvain, KU Leuven) and upon publications of the results, then the data will be made available.

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

Providing usage licences or not will be ad hoc discussed for each type of datasets with the partners involved in the project.

**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.**

- No

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

Our large datasets are stored on LVS where university members can have access to the data upon request. The cost is about 150€ per TB per year. This is for storage, but we can give access to the datasets upon request. Cost will be covered on other grants than the FWO mandate budget (bench fee), from both supervisors.

## 6. Responsibilities

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

The PhD researcher is responsible for data documentation and metadata.

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

The PhD researcher is responsible for data storage and back up during the project.

**Who will manage data preservation and sharing?**

The PhD researcher is responsible for ensuring data preservation and sharing via the shared storage drive during the PhD project. After the PhD project, the supervisor will be in charge of this.

**Who will update and implement this DMP?**

The PhD researcher is responsible for updating & implementing this DMP during the project. After the PhD project, the supervisor will bear the end responsibility of updating & implementing this DMP.