Plan Overview

A Data Management Plan created using DMPonline

Title: Heading green for SMART bio-plasters for effective healing of acute wounds

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Funder: Netherlands Organisation for Scientific Research (NWO)

Template: LUMC data management plan

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Project abstract:

Chronic and deep wounds are difficult to heal, causing a significant global public health burden. We propose to fabricate by microfluidic bioprinting a bio-plaster, incorporating chlorophyllin (a derivative of the natural green dye chlorophyll), with its anti-inflammatory properties. The bioprinting allows for printing skin-specific compositions, including customizable mixing of chlorophyllin with other components. The bio-plaster will be tested in wounded full thickness human skin models, by quantifying effects on wound-healing, inflammation and skin regeneration.
By combining chlorophyllin with the customizable/high-precision bioprinting, we aim to develop a novel class of SMART bio-plasters. These defined as bio-integrated (made of skin cells, hydrogel and chlorophyllin) plasters, should exhibit higher performance (adaptive to patient needs), than commercial synthetic ones, in healing deep and chronic wounds.

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Heading green for SMART bio-plasters for effective healing of acute wounds

A. Project information

A.1 Name of person filling out the DMP

Dr. Abdoel El Ghalbzouri

A.2 Department of person filling out the DMP (list in Dutch)

- Huidziekten

A.3 ORCID of person filling out the DMP

0000-0001-8351-7715

A.4 Supervisor(s) or main responsible researcher(s) of project, if other than in A.1. Please mention name and e-mail.

Dr. Abdoel El Ghalbzouri, PI, LUMC and Dr. Malgorzata Wlodarczyk-Biegun, co-PI, RUG

A.5 I have read the SOP Data Life Cycle (link in Guidance) and will adhere to it in my research project.

- Yes

A.6 I use personal data (including pseudonomyzed or coded data and human materials), and have filled out the AVG tab in PaNaMa for WMO research or the Data processing registry form (Verwerkingsregister, link in Guidance) for other types of research.

- Not applicable

Not applicable, we will use commercially available cell lines that we have in house such as the keratinocyte cell line NTERT

A.7 I create scripts, code or other research software (see Guidance).

- No

A.8 Refer to a document or pre-registration containing information about the research process (at least one):

WMO protocol nr:	not applicable
Non-WMO protocol nr:	not applicable
Research protocol (pre)registration number (e.g. OMON or clinicaltrials.gov):	not applicable
PaNaMa number:	138421
Grant application (funder + nr + link to document):	NWO TTW 23469
Project part of a larger application or project (specify):	not applicable

B. About this DMP

B.1 Date of first DMP version

2026-10-08

B.2 Consulted LUMC data stewardship expert(s)

Paula	Paula Ramos-Silva
Function/role	Senior Data steward
Department/group	Biomedical Data Sciences
E-mail address	p.silva@lumc.nl
Date of consultation (dd/mm/yyyy)	20-10-2026

B.3 Changes made to an earlier version of this DMP

Part of DMP	Date of change (in dd/mm/yyyy)	Question number(s)	Adaptation(s) made
A. Project information			
B. About this DMP	06-10-2026		After the consult, it became clear that I have used the NWO template (send by NWO to my e-mail), so now I'm re-writing this LUMC template DMP
1. Data description			
2. During the project			
3. Archiving within LUMC			
4. Publishing			
5. Costs			

1. Data description

1.1 How will you acquire the data (including samples) in this study?

- Create new data

All data are generated in the laboratories of LUMC and RUG. Bio(ink) preparation, bioprinting and material characterisation take place at RUG; cell isolation, skin models and wound healing tests take place at LUMC. Following the four milestones of the proposal, we expect the following data:

- **Bioink and hydrogel characterisation (M1).** Rheology, stiffness and printability measurements of gelatin-based bioinks with Cu-, Zn- and Fe-chlorophyllin at two concentrations. Numeric data in spreadsheets (.xlsx, exported to .csv) and instrument output files in their native format.
- **Bioprinting (M2, M3).** Print designs (CAD files; .stl in ASCII format, or .svg), G-code files generated for printing (.gcode), and printer settings (geometry per skin layer, flow rates, pressures, printing speed) stored in the printer software format and exported as a parameter table (.csv or .pdf). Photographs and microscopy images of printed constructs (.tif), or video files.
- **Cell-based data (M3).** Cell viability, metabolic activity and proliferation of the skin layer-specific cells in the printed constructs. Plate reader output (.xlsx/.csv), fluorescence and confocal images, including chlorophyllin autofluorescence (native microscope format, converted to .tif or OME-TIFF).
- **Wound healing data (M4).** Microscopy images of the scratch assay (image stacks as .tif;), histology and immunohistochemistry of wounded full-thickness skin models (brightfield and fluorescence images, .tif), quantification of wound closure and re-epithelialisation, and cytokine measurements in culture medium (.xlsx/.csv).
- **Documentation.** Protocols, SOPs, data analyses files, video files (MP3/MP4), reports and presentations (.docx, xls, pptx, archived as .pdf/A).

For long-term storage and sharing, files will be converted to open, preferred formats where possible (.csv, .tif, .txt, .pdf, zip).

1.2 What data will be created? Specify in the additional information field. See guidance for examples.

- Experimental data (lab)
- Images
- Audio and/or video recordings

In this project we will generate skin mimicking scaffolds with chlorophyllin, using Bioinks (RUG), and testing them in 2D and 3D wounded *in vitro* cultures. We will mostly generate images (IHC and IF using microscopy); visualization of the research data will also be created and presented in the format of a video file.

- 3D printing designs: CAD files; format: ASCII or SVG
- digital raw and analyzed data:
- successful printing conditions: textual; format: doc
- microscopy pictures of the samples: images; format: jpeg, tiff
- data from material testing; format: doc, xls, pdf
- videos of the samples: mkv, avi
- statistics; format: txt
- Samples: printed scaffolds;
- Experimental procedures: hand-written lab-books and digital; format: txt, doc, pdf

1.4 What will you need to acquire and use the data in your research project? Describe in the additional information field what you need, for what data and how you will make sure the project's needs are met.

- Materials or equipment
- Large storage (>2 Gb)

For this project we have everything in place. We make use of the Imaging Facility, with an ongoing contract, where we use several microscopes. Our technicians have already been trained for using the various microscopes. At our own department we have the right materials and equipment needed to execute this project. Depending on the number of microscopic images (.tif) and/or video files, we need more than 2 Gb of storage, which will be stored on the I-drive of our department I-schijf (folder **OpenMind_D**); we

can always extend to the Long Term Storage (LTS), if we require more space to store files

2. During the project

2.1 Will you only use the standard LUMC storage facilities that are backed up sufficiently as described in the Storage of Research data Albinusnet page (link in Guidance)?

- Yes

2.3 What measures will you take to ensure data quality? Refer to the quality plan or other descriptions of quality measures if applicable.

- Standard Operating Procedures (SOPs) for research processes
- Measurement tool calibration (e.g. pipets, blood pressure device, scales, microscopic measurements)

We have for every step in culturing 2D or 3D cultures SOPs, that will be followed. In addition, the equipment and material (e.g. pipettes, pH-meter, incubators etc.) are calibrated

2.4 In scientific research the Principle Investigator (PI) is responsible for managing data. How is this arranged in your project?

- The PI is responsible

Both the PI at the LUMC and co-PI at the RuG are responsible for managing the data at their affiliated organizations. At the LUMC the PI and at the RuG the co-PI both are responsible to grant access to members of the project to data folder (**OpenMind_D**) on the I-drive. The PI contact the ACP of our department and instruct who can have access to the data files. The **Contributor**, will be allowed to have access to all obtained project data to: 1) support project/data management; and 2) use all obtained project data responsibly in order to prepare one workshop to promote the commercialization of the bio-plaster (as included/described in the Open Mind grant proposal).

3. Archiving within LUMC

3.1 What metadata and documentation will accompany the data at the end of the project? Note: key files and other documents that contain personal data need to be stored in a safe location and separate from the data.

- Contracts and agreements
- SOPs
- Research protocol or project description
- Data Management Plan (DMP)
- Publications resulting from the study
- Laboratory notebook (ELN)
- README file describing the files and structure
- Data dictionary describing all variables created manually
- Data dictionary describing all variables exported from Castor or other systems

Each experiment is recorded in the electronic lab notebook (ELN) at LUMC or in the lab notebook in use at RUG. Entries are labelled with the project number and refer to the location of the data files on the network drive.

Protocols for bioink preparation, bioprinting, generation and wounding of the full-thickness skin models, and all read-outs will be written as SOPs. Changes to a protocol get a new version number.

For each spreadsheet we will keep a short data dictionary that describes variables and units, for example chlorophyllin type (Cu, Zn, Fe), chlorophyllin and gelatin concentration, skin layer, cell line, donor code, time point and read-out.

Files and folders are named in a fixed way: yyyymmdd_[type]_[description]_[initials]_[version], where type is raw, processed, analysis, SOP or documentation. Folders follow the four milestones (M1 to M4), each with subfolders for raw data, processed data, analysis and documentation. Raw data files are set to read-only after transfer from the instrument.

At the end of the project a readme.txt file will list all files, describe their content and name the software (with version) needed to open them.

At the end, depending if IP is generated, we will have contracts between LUMC and RUG directed by both TTO offices.

3.2 Will you archive any data formats that are not listed in either the preferred or the non-preferred formats list? (link in Guidance)

- Yes (specify format(s) in additional information field)

At the RUG, they will use high-precision microfluidic bioprinting with three chlorophyllins types (Cu, Zn, Fe), and here different software is needed. The data will be collected at the RUG and transformed in a format (image, video, PDF) that we can use.

3.3 Describe how you will ensure that data can be reused.

- Other (describe)

We will share all data that underpin publications and the results presented at TEKNOWLOGY 2027, together with the SOPs, data dictionaries and readme file. This includes processed data, quantifications and representative raw images (keeping all image info). Data that are part of a patent application or a later agreement with industry may be shared under restricted access. We follow the principle of 'as open as possible, as closed as necessary'

3.4 Will parts of your data be excluded from archiving, i.e. destructed?

- No

All generated data will be archived.

3.5 Will you follow your department’s SOP Data Stewardship for archiving processes?

- No (describe process in next question)

We follow the guideline as stated in the general LUMC SOP Data Life Cycle
Link: SOP Data Life Cycle - DS02 (GRP/DS) (Versie 6)

3.6 What will you do to ensure data and metadata findability, availability and accessibility within LUMC for the long term?

- I will archive the data on the I-drive (specify path and governance in additional information)

- Other (describe)

Each team will archive the data on their I-drive or their institutional intern drive. Where we will have the OpenMind folder
We will share data using Office365 SharePoint:

3.7 How long do your data need to be preserved in the archive?

- 10 years (non-human data)

Given the limited volume, we will keep all raw data, processed data, analysis files, printer settings, SOPs and the readme file, so that every result can be traced back to the original measurements. At the end of the project the data are archived on the LUMC and at RUG. network drive following the LUMC guideline for research data. For research with human material LUMC applies a retention period of 15 years, which is longer than the minimum of 10 years required by NWO. RUG will archive its part of the data according to its own policy, for at least 10 years.

4. Publishing

4.1 Are there restrictions to data sharing or reasons for an embargo? Describe in the additional information field. See guidance for examples.

- Intellectual Property rights (IP; like a patent or trade secret)

There are no privacy-related restrictions. The only reason for restriction is possible IP on the bioink compositions and printing conditions. Where a patent application is considered, sharing of these specific data may be postponed until the application has been filed. We will plan the filing before submission of the manuscript, so that the data underlying a publication can still be shared when the article appears. Data that remain restricted will have public metadata and can be requested from the applicants.

4.2 Will you publish data with open or restricted access?

- Open access

All data generated in this project are published with open access. The project uses established cell lines (N/TERT) rather than primary donor material, so no privacy or consent restrictions apply to data sharing.
Datasets underlying publications, including model characterisation data, imaging data, video files, analysis output, protocols and analysis scripts, are deposited in a public repository with a persistent identifier. Data are released under a CC BY licence and scripts under an open licence such as MIT, so that others can access, reuse and build on the results without restriction

4.3 What data will you publish?

- Raw data used in publication + documentation
- Other (describe)

We will publish all data underpinning our publications, together with the SOPs, data dictionaries and a readme file. This includes processed data, quantifications and representative raw images. Research software and analysis scripts are published alongside the data. We follow the FAIR principles.

4.4 Which license for open access will you attach to the open access data?

- Creative Commons license (describe)

Open data will be published under a CC BY 4.0 licence. Research software and analysis scripts will be published under the MIT licence, since Creative Commons licences are not suitable for code. Accession numbers and DOIs will be cited in the related publications.

4.7 Where will you publish your (meta)data? Describe in the additional information field.

- Repository or catalogue

Microscopy and time-lapse images that underpin publications will be deposited in the BioImage Archive (EMBL-EBI, https://www.ebi.ac.uk/bioimage-archive/), a field-specific repository for biological images. Each submission receives a unique accession number, and a DOI can be assigned on request. We will assign a CC BY 4.0 licence on deposition.

All other data (bioink characterisation, printing parameters, quantifications, SOPs and documentation) will be deposited in the DANS Data Station Life Sciences, a CoreTrustSeal certified repository that assigns a DOI to each dataset. If the data stewards advise another certified repository, for example DataverseNL or 4TU.ResearchData, we will follow that advice.

4.8 Enter the persistent identifier(s) here at the end of the research project.

Dataset DOIs: to be completed at the end of the project.

5. Costs

5.1 How will costs be covered? Keep in mind the needs you identified in question 1.4.

	Costs expected? Yes/no	**Covered in the project or grant application budget?** Yes/no	**If not in budget, how are costs covered?** (e.g. project overhead, internal budget)
Storage and data management tools during the project	Yes	No	Departmental budget. Storage on the departmental I-drive is covered by existing infrastructure; if Long Term Storage is required, this is funded from departmental overhead.
Personnel, training and support	No	No	Technicians are already trained for the imaging equipment; no additional training or data stewardship costs are foreseen.
Other research facilities	No	No	Use of the Imaging Facility is covered by an existing contract
Archiving within the LUMC, incl. preparation	Yes	No	Departmental budget. Preparation time is part of the regular research activities of the project staff.
Publishing and sharing of data and metadata after the project, incl. preparation	Yes	Yes	Included in the project budget.
Other	No	No	

Planned Research Outputs

Journal article - "Development and in vitro testing of a chlorophyllin-based bio-plaster"

Open access article reporting the development of the bioprinted bio-plaster and its testing in wounded full-thickness human skin models.

Dataset - "Wound healing data of chlorophyllin bio-plasters in full-thickness skin models"

Viability, scratch assay, histology and imaging data of bioprinted bio-plasters tested in wounded full-thickness human skin models.

Dataset - "Characterisation and printing parameters of chlorophyllin bioinks"

Rheology, stiffness and printability data of gelatin-based bioinks with Cu-, Zn- and Fe-chlorophyllin, and the printing parameters per skin layer. Access may be restricted until a decision on patent protection has been made.

Planned research output details

Title	DOI	Type	Release date	Access level	Repository(ies)	File size	License	Metadata standard(s)	May contain sensitive data?	May contain PII?
Development and in vitro testing of a chlorophylli ...		Journal article	2028-04-03	Open	None specified		Creative Commons Attribution 4.0 International	None specified	No	No
Wound healing data of chlorophyllin bio-plasters i ...		Dataset	2028-04-03	Open	BioImage Archive DANS Data Station Life Sciences	50 GB	Creative Commons Attribution 4.0 International	DataCite Metadata Schema	No	No
Characterisation and printing parameters of chloro ...		Dataset	2028-07-31	Restricted	DANS Data Station Life Sciences	50 GB	Creative Commons Attribution 4.0 International	DataCite Metadata Schema	Yes	No