DMP FWO Rocio Castro Vinuelas 6 months

Project Name My plan (FWO DMP) - DMP FWO Rocio Castro Vinuelas 6 months

Project Identifier 12Y7422N

Principal Investigator / Researcher Rocio Castro Vinuelas

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Description Mechanical signals are key factors that contribute to homeostasis in the joint but also involved in the development of osteoarthritis (OA), the most common chronic joint disease affecting millions worldwide. Tissue loading and unloading cycles represent mechanical stimuli essential for the cells to maintain cartilage integrity by mechanotransduction. However, in early stages of OA this protective effect of physiological loading appears compromised, and chondrocytes shift their anabolism-catabolism balance. The mechanisms underlying this impaired response to loading remain elusive, hampering the development of strategies that delay or reverse disease progression. In this FWO project I will address a fundamental knowledge gap: why is the protective effect of loading compromised in early OA? I hypothesize that the protective response to loading depends on the chondrocytes mechanical memory, which is inadequately tuned in the altered mechanical environment of early OA, yet can be retrained through optimizing mechanotransduction pathways. To test this hypothesis, I will outline the mechanisms of mechanical memory in chondrocytes, elucidate the impact of mechanical environment in the early OA and test the potential of biomechanical modulation of these parameters as a therapy to withstand the phenotypic molecular shift of early OA chondrocytes. If successful, the mechano-biological optimization of cartilage homeostasis could be a game-changer for treatment of OA.

Institution KU Leuven

1. General Information

Name applicant

Rocio Castro Vinuelas

FWO Project Number & Title

Application number: 12Y7422N

Title research proposal: Mechano-biology optimized cellular exercise for early OA regenerative therapy

Affiliation

- KU Leuven

2. Data description

Will you generate/collect new data and/or make use of existing data?

- Generate new data

Describe in detail the origin, type and format of the data (per dataset) and its (estimated) volume. This may be easiest in a table (see example) or as a data flow and per WP or objective of the project. If you reuse existing data, specify the source of these data. Distinguish data types (the kind of content) from data formats (the technical format).

This FWO postdoctoral research project will generate different datatypes (Table 1): **(i)** quantitative measurements from in vitro experiments (gene expression and protein levels, quantification of colorimetric reactions, bioreactor experiments), **(ii)** histological images of the hydrogel constructs (e.g. slides with the samples, digital image files and quantification), and **(iii)** images and datasets from 3D Traction Force Microscopy measurements (processed with type-specific software).

Table 1. Data description

Type of data	Format	Volume	How created
Primary Physical Data. Cartilage samples	Cartilage explants and cells	-	Harvested from animal model of early OA.
Microscopy images	.vsi and .tiff	200-300GB	Transmitted-light microscopy of early OA cells both in 2D culture and 3D (hydrogels).
Microscopy images	.vsi and .tiff	100-200GB	Images of histological analysis of cartilage samples.
Histological analysis	.xls and .pzfx	50MB	Quantification of histological analysis of cartilage samples.
Microscopy images	.lif	200-300GB	Fluorescence-confocal images of the hydrogels for the 3D Traction Force experiments.
Processed data from the 3D Traction Force experiments (Traction recovery)	.mat	1GB	Analysis of the images taken during the 3D traction force microscopy experiments.
Western blot results	.tiff and .jpeg	1GB	Images of the developed membranes.
Quantitaive data. Colorimetric reactions.	.xls	2MB	Quantification of colorimetric reactions based on absorbances
Gene expression levels	.eds and .xls	10GB	Molecular analysis by quantitative real time PCR.
Applied loading in bioreactor	.csv and .xls	500 MB	Recordings of the applied loads during mechanical stimulation of cartilage explants and cell-seeded hydrogels in bioreactor.

3. Legal and ethical issues

Will you use personal data? If so, shortly describe the kind of personal data you will use. Add the reference to your file in KU Leuven's Register of Data Processing for Research and Public Service Purposes (PRET application). Be aware that registering the fact that you process personal data is a legal obligation.

- No

Privacy Registry Reference:
Short description of the kind of personal data that will be used:

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, add the reference to the formal approval by the relevant ethical review committee(s)

- Yes

The healthy and early OA chondrocytes used for this project will be harvested from a dedicated rodent model, which is already well established in the host laboratory as a synergy with ongoing project granted to Prof. Jonkers in collaboration with Prof. Lories. The data for the ethical committee approval are:

License number Department: LA1210189
Responsible PI: Rik Lories
Project number: P134/2018
Title of the project: De rol van mechanische belasting in kraakbeen homeostase, degeneratie en herstel: een multi-schaal aanpak

Does your work possibly result in research data with potential for tech transfer and

valorisation? Will IP restrictions be claimed for the data you created? If so, for what data and which restrictions will be asserted?

- No

Do existing 3rd party agreements restrict dissemination or exploitation of the data you (re)use? If so, to what data do they relate and what restrictions are in place?

- No

4. Documentation and metadata

What documentation will be provided to enable reuse of the data collected/generated in this project?

The following documentation will be provided: (1) a table of content (excel file and csv) with all project-related experiments including experiment number, date of implementation and name of the researcher who stored the experiment, (2) a brief description of the goal of the experiment and related work package (word and txt file), (3) a detailed protocol or link to an existing standard protocol (SOP) which will enable other researcher to repeat the experiment, (4) all data or link to another file with the (raw) data, (5) samples that are generated during the experiments will be stored and listed in an excel file, (6) if appropriate, illustrations of the data with legends and statistical analysis. In case that documentation is written or available in notebooks or stored on other files, a link will be provided. With the help of these documentations every authorized researcher will be able to look up all the information of the performed experiments and to repeat the experiment in exactly the same way.

All data will be coded. This will consist of:

- Experimental protocols: description how the data are collected and generated (software, materials, set-up, settings (.docx) and how data are processed (software, protocol, guidelines, ...) (.docx, read.me text files). For the biological experiments, detailed protocols or link to existing standard protocols (SOPs) will be provided, which will enable other researcher to repeat the experiments.
- Raw experimental data: storage of original physical data and folders with original digital data in software-specific files.
- Processed data: folder with digital data in the software-specific files, spreadsheets with results (.CSV, .xls)

Will a metadata standard be used? If so, describe in detail which standard will be used. If no, state in detail which metadata will be created to make the data easy/easier to find and reuse.

- No

For the majority of that data, metadata will be provided as readme, word or excel files, containing all settings and technical descriptions of the experiment and data. More specifically:

- Raw experimental data (from the mechanical stimulation in the bioreactor) are managed on a software specific data management plaform. Readme files and logbooks will be generated to describe the different steps taken in the processing workflow.
- For imaging data (i.e. histologycal analysis and 3D Traction Force Microscopy), a large part of the metadata is included in the header files of the original images. These files contain information regarding the acquisition settings (e.g. dimensions, image type, bit-depth, pixel sizes and microscope settings).

5. Data storage and backup during the FWO project

Where will the data be stored?

1. Cells, cartilage tissue samples and the analysed samples will be kept for 5 years postproject in freezers (temperature ranging from -20° till -150°, depending on the sample type), at the Laboratory of Tissue Homeostasis and Disease. Paper lab notebooks on biological experiments will be stored here as well.

2. During the entire postdoctoral research project, raw and processed data will be stored on servers centrally managed by ICTS KU Leuven and with back-up capacities (KU Leuven enterprise box, Large volume-storage Jand L-drive). Data collected will be structured in files and formats during the research project to optimise data sharing and access to data for at least 5 years after the end of the postdoctoral research project.

3. Since we will collaborate with researchers from other research units and groups, we will use OneDrive for active use of the data during the project.

How is backup of the data provided?

The data will be stored on the university's central servers with automatic daily back-up 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

Sufficient storage and backup capacity are available at KU Leuven.

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

Terabyte (Tb) storage is anticipated and it will be covered by the grant (approx 520€/terabyte/year).

Data security: how will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

All data will be stored in a protected environment. Research data can only be accessed by a login following KU Leuven's policy for identifier and with pasword. The digital, pseudonymised, data (i.e. coded and containing no personal information).

6. Data preservation after the FWO project

Which data will be retained for the expected 5 year period after the end of the project? In case only a selection of the data can/will be preserved, clearly state the reasons for this (legal or contractual restrictions, physical preservation issues, ...).

All data will be kept for at least 5 years after the end of the postdoctoral research project.

Where will the data be archived (= stored for the longer term)?

1. Digital data will be archived on the secured university’s network drive, described in part 5 of this DMP. Additionally, data will be stored offline on two external hard drives when the project is finished.
2. Hard copies (e.g. paper lab notebooks) are kept in locked cabinets in the lab of the PI concerned.
3. The physical cartilage samples will be stored for a long term in freezers (temperature ranging from -20° till -150°, depending on the sample type), at the Laboratory for Tissue Homeostasis and Disease.

What are the expected costs for data preservation during the retention period of 5 years? How will the costs be covered?

For this project data storage of 5Tb is anticipated, resulting in a cost of 1520 euro per year, that can be covered by the grant and beyond.

7. Data sharing and reuse

Are there any factors restricting or preventing the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)?

- No

Which data will be made available after the end of the project?

All data will be made available after publication of the data and upon request with the PI. During the project as well as after the end of the project, the published data will be available via an open access repository (e.g. figshare) and upon request by email to the PI. These published data contain the results of processed coded data presented in tables.

Where/how will the data be made available for reuse?

1. The main output of the project will be original scientific research papers. These will adhere to KU Leuven's and FWO's Open Accesss policy.
2. In the context of Open and accessible science, original datasets will be made available with publication, either as supplementary files or using a datasharing platforms such as figshare or Znodo using a CC-BY licence.
3. Upon reasonable and specific request, any data subset and analysis can be made available.
4. For data transfer filesharing via KU Leuven Box or Belnet transfer (secure) will be
5. used.

When will the data be made available?

- Upon publication of the research results

Who will be able to access the data and under what conditions?

In principle any researcher upon reasonable request or through the data repositories.
During the post-project trajectory, data remains available for involved researches and will be made available to external users upon request, with contact via LRD, with a CC-BY licence.

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

No costs are expected. If any occur, they will be covered by the requesting parties.

8. Responsibilities

Who will be responsible for data documentation & metadata?

Prof. Ilse Jonkes, Prof Rik Lories and I will be responsible for data documentation and metadata.

Who will be responsible for data storage & back up during the project?

Prof. Ilse Jonkes, Prof Rik Lories and I will be responsible for data storage and back up during the project.

Who will be responsible for ensuring data preservation and reuse ?

Prof. Ilse Jonkes and Prof Rik Lories will be responsible for ensuring data preservation and reuse.

Who bears the end responsibility for updating & implementing this DMP?

The PIs bear the end responsibility of updating & implementing this DMP.