INVOLVEMENT OF THE SKELETAL STROMAL-VASCULAR UNIT IN CORTICAL BONE STRENGTH AND ANABOLIC OSTEOPOROSIS TREATMENT

A Data Management Plan created using DMPonline.be

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Project abstract:

With ageing our bones become brittle and prone to fractures, known as osteoporosis. Despite widespread use of therapies blocking bone loss, osteoporosis represents a major public health concern. There is a large clinical need for bone-building (osteo-anabolic) treatments that sustainably improve bone mass in patients. Intermittent parathyroid hormone (iPTH), the first-approved osteo-anabolic drug, effectively stimulates bone formation, but suspected side-effects unfortunately limit its use. Understanding the mechanisms of action of iPTH at the cellular-molecular levels could identify strategies for improved therapeutic use of this powerful drug or for developing safer new treatments. We and others previously identified a few selected angiogenic pathways as very important for bone formation during growth and fracture repair. These pathways can jointly mediate activation and expansion of skeletal stem/progenitor cells and blood vessels, both needed for bone formation. Could this stromal-endothelial communication and vascular remodeling also be important for therapeutic bone gain? This question will be tackled here. We will investigate whether selected molecules from these pathways are involved in iPTH-induced bone formation and required for the therapeutic outcome. We will collaborate with Prof Sims (University of Melbourne), a world-renowned expert in PTH, and implement her highly specialized methodologies for cortical bone analysis to extend the study to this important part of the bone: the outer shell that provides most of the bone’s strength. This work can lead to improved or new anabolic treatment approaches for osteoporosis, based on manipulation of the stromal-vascular bone unit.

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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.

Dataset name / ID	Description	New or reuse	Digital or Physical data	Data Type	File format	Data volume	Physical volume
		*Indicate: **N**(ew data) or **E**(xisting data)*	Indicate: **D**(igital) or **P**(hysical)	Indicate: **A**udiovisual **I**mages **S**ound **N**umerical **T**extual **M**odel **SO**ftware Other (specify)		Indicate: <1GB <100GB <1TB <5TB >5TB NA	
MicroCT	Raw and processed microCT scans of mouse bones and their analysis	N or E	D	I and N	various formats including .png, .tif., .jpg, .bmp, .xlsx	<5TB	Mouse bones are processed and stored (fridge) or used further for histological processing and analysis.
Histology samples	Biological samples, including embedded mouse bones and cut tissue sections thereof, for general histology, immunohistochemistry, and other staining procedures.	N or E	P		N/A	N/A	Tissue samples/biopsies, cells and cell lysates/products are stored in dedicated, closed and locked containers at room temperature, 4°C, -20°C, -80°C, or liquid nitrogen (N2).
Histology data	Microscopy images and analysed histomorphometric data of histological samples and sections. Includes raw and processed images, from 2D and 3D microscopy, and numerical data files.	N	D	A, I and N	various formats including .nd2, .vsi, .png, .tif., .jpg, .xlsx	<1TB	N/A
Gene expression samples	Biological samples, including stored or processed biopsies collected from mice (serum, tissues) and cultured cells, and derivates thereof (RNA, DNA, protein), for gene expression analysis during the project or in future research of the lab.	N or E	P		N/A	N/A	Tissue samples/biopsies, cells and cell lysates/products are stored in dedicated, closed and locked containers at room temperature, 4°C, -20°C, -80°C, or liquid nitrogen (N2).
Gene expression data	Molecular biology data, obtained by qRT-PCR, ELISA, western blot, RNA-sequencing, etc.	N	D	mostly N (some I)	various formats, foremost .eds, .xlsx, .nd2	<1TB	N/A
Flow cytometry data	Raw and analysed flow cytometry data	N	D	N	.fcs, .xlsx	<100GB	N/A

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:

Biological samples and data generated in the lab in previous projects under supervision of the PI of the current project (Christa Maes) may be reused.

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, refer to specific datasets or data types when appropriate and provide the relevant ethical approval number.

- Yes, animal data (Provide ECD reference number below)

Preceding and ongoing studies of the nature as applied in this project have been approved under preceding and running ethical dossiers #041/2017, #042/2017, P016/2022.
A new application is being prepared to continue the project; this will be submitted to the KU Leuven Animal Ethics Committee prior to the start of the animal experiments.
Breeding of the mouse lines required for the work has been initiated under Breeding License "000/(GS1/GS2) Breeding-Maes Christa-Breeding non harmfull phenotypes".

Will you process personal data? If so, please refer to specific datasets or data types when appropriate and provide the KU Leuven or UZ Leuven privacy register number (G or S number).

- No

Not applicable. This research project does not involve ethically sensitive data or data from human subjects.

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

No commercial valorisation is anticipated at this early stage. If this changes, it will be declared accordingly.

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material or 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.

- Yes

Material transfer agreements are in place regarding the use of genetically modified mouse strains for the studies in this project.
Research collaboration agreements are established with the University of Melbourne, more specifically with prof Natalie Sims who is our partner on this Global PhD project.

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

Intellectual property rights and ownership are defined in the Material transfer and Research collaboration agreements.

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).

- Metadata will be collected regarding the mice used for experiments (age, strain, genotype, gender, date of sacrifice, tissue storage and purpose, weight and other relevant parameters); .xlsx and .docx files in dedicated folders for each experiment will contain this information. Moreover, a general “log list” will contain a full summary of all the experiments with information from each individual animal, including type of sample, storage location and processing status.
- Protocols (sampling, processing, histology staining, flow cytometry gating and antibody staining, etc…) will be kept in dedicated folders for each experiment and a printed copy in the personal lab book will be stored in the lab. Furthermore, these protocols will be put on the internal shared lab drive (J) drive, so that they are easily accessible to all current and future lab members.
- Metadata regarding data acquisition (e.g. for image acquisition: objective, camera settings,…) will be stored together with the raw data and processed data, both on the personal hard drives as well as the shared KU Leuven drives.

Will a metadata standard be used to make it easier to find and reuse the data?
If so, please specify which metadata standard will be used.

If not, please specify which metadata will be created to make the data easier to find and reuse.

- No

Both on the personal hard drive and on the shared KU Leuven drives, a logical folder organization will be used such that current and future lab members can easily access all raw and processed data. An easy-to-follow hierarchy will be used, and folder names will be descriptive. Main folders are kept for each researcher or project. Subfolders will be used, with broader topics at higher levels. Next, subfolders will be created according to type of data (e.g. histology, flow cytometry, qPCR,)… Within each type of data folder, descriptive subfolders will be created (depending on type of data) in which the raw and processed data will be stored. As mentioned above, mouse sampling log lists, protocols and metadata regarding data acquisition will be stored on the shared drive, such that they are easily accessible for all lab members.

Data Storage & Back-up during the Research Project

Where will the data be stored?

- Shared network drive (J-drive)
- OneDrive (KU Leuven)
- Personal network drive (I-drive)
- Large Volume Storage
- Other (specify below)

Data will be stored on the shared network drives, including the KU Leuven shared Large Volume Storage (L-drive); selected raw datasets will be transferred to the KU Leuven data Archive Repository (K-drive). Additionally, throughout the project the PhD students and other personnel involved in this project will keep a copy of the data on personal external hard drives (backup of computer), which will be handled over to the PI Christa Maes after finalization of the project.

How will the data be backed up?

- Standard back-up provided by KU Leuven ICTS for my storage solution
- Personal back-ups I make (specify below)

Data will be stored on the shared network drives, including the KU Leuven shared Large Volume Storage (L-drive); selected large raw datasets will be transferred to the KU Leuven data Archive Repository (K-drive). Additionally, throughout the project the PhD students and other personnel involved in this project will keep a copy of the data on personal external hard drives (backup of computer), which will be handled over to the PI Christa Maes after finalization of the project.

Is there currently sufficient storage & backup capacity during the project?

If no or insufficient storage or backup capacities are available, explain how this will be taken care of.

- Yes

Currently there is sufficient storage in the Long-term KU Leuven server drive and in the back up external hard drives. Additional server capacity can be reserved at any time, and additional working hard drives and back up hard drives will be purchased when needed.

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

Shared drives KU Leuven: Access is only given to authorized researchers associated to the lab.
Personal hard drives: Hard drives are stored in the lab, which is accessible only to lab members.

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

We expect an approximate 1000 Euro per year for this project for data storage on the KU Leuven servers (electronic files). These costs will be covered by the PI (FWO and KU Leuven grants).
Expenses for temperature-controlled storage of biological samples (fridges, freezers, ultrafreezers -80°C, liquid N2) is limited: purchase of freezers has been done before from preceding grants to the PI; costs for repair are occasional.

Data Preservation after the end of the Research Project

Which data will be retained for 10 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 will be preserved for 10 years according to KU Leuven RDM policy
- Certain data cannot be kept for 10 years (explain below)

All data will be retained for at least the expected 10-year period after finalization of the project. After that, PI Christa Maes will decide on what data will be retained. In principle, all key raw and analyzed data are preserved for >10 years or undetermined time after the project. Data or samples deemed uninformative or of no further value for research purposes (e.g., quality loss from long-term stored biological samples) may be discarded after the 10-year period.

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

- Large Volume Storage (longterm for large volumes)
- KU Leuven RDR
- Shared network drive (J-drive)

Data will be stored on the shared network drives, including the KU Leuven shared Large Volume Storage (L-drive); selected raw datasets will be transferred to the KU Leuven data Archive Repository (K-drive). Additionally, external hard drives containing data backups are stored on campus by the PI Christa Maes after finalization of the project.

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

We expect an approximate 1000 Euro per year for this project for data storage on the KU Leuven servers (electronic files) and expenses for temperature-controlled storage of biological samples (fridges, freezers, ultrafreezers -80°C, liquid N2). These costs will need to be covered by the PI from grant funding.

Data Sharing and Reuse

Will the data (or part of the data) be made available for reuse after/during the project?
Please explain per dataset or data type which data will be made available.

- Yes, as restricted data (upon approval, or institutional access only)
- No (closed access)
- Yes, as open data
- Yes, as embargoed data (temporary restriction)

The principle route of sharing the data is via the publication as peer-reviewed, original research papers. Published results will be available, either as open-access research papers, embargoed data, or restricted data, depending on the journal's specifics. Published papers are also deposited on the KU Leuven Lirias repository.
Datasets that are relevant to the community, such as genome-wide transcriptome profiles of cells or tissues (RNA-Seq datasets), will be shared via public repositories (e.g., ENA (the European Nucleotide Archive, from the European Molecular Biology Laboratory (EMBL)). These can be openly accessed by anyone for reuse.
Remaining samples and datasets that are stored and preserved after the project, can be reused internally, by other or new team members, in consultation with the PI.
Any other reuse of data or samples requested by external parties, will be considered on a case-by-case basis by the PI. In principle, data can be made available upon reasonable request after publishing the key results of the project. Remaining samples from the project that are not critical for the own research, can be made available to others in collaboration. No special licenses or transfer agreements will be required when working in this context with academic partners that have research/educational goals and no commercial interest.

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

Results of the study will be published as research papers, preferentially open-access. Datasets that are relevant to the community, such as genome-wide transcriptome profiles of cells or tissues (RNA-Seq datasets), will be shared via public repositories. Any other data can be made available upon reasonable request after publishing the key results of the project. Uses for research and educational purposes will in principle be allowed, if in line with the further plans and goals of the lab. Commercial reuse will in general be excluded. For all internal use of data and samples, authorized researchers associated to the lab have access to the shared KU Leuven drives, to preceding team members' protocols, data, lab notebooks, and stored samples.

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 per dataset or data type where appropriate.

- Yes, intellectual property rights
- Yes, ethical aspects
- Yes, other

Some samples cannot be shared because of prior material transfer agreements that preclude sharing with third parties (e.g., genetically modified mice and their derivates including tissue samples etc.). Some data and samples would preferably not be shared based on reasons of competition or further plans by the lab for internal reuse and subsequent studies building on the current project. In general, we will consider only uses for research and educational purposes; commercial reuse or any reuse with ethical issues will be excluded.

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)
- Other data repository (specify below)

Results of the study will be published as research papers, preferentially open-access, and deposited via the KU Leuven Lirias repository.
Datasets that are relevant to the community, such as genome-wide transcriptome profiles of cells or tissues (RNA-Seq datasets), will be shared via public repositories (e.g., ENA (the European Nucleotide Archive, from the European Molecular Biology Laboratory (EMBL)).
Any other data can be made available upon reasonable request after publishing the key results of the project.

When will the data be made available?

- Upon publication of research results

After publishing the key data and findings of the study.

Which data usage licenses are you going to provide?

If none, please explain why.

- Other (specify below)

None. Data will be made available only after publishing the key results of the project, either as open data (datasets of broad interest) or upon request by email. When relevant, advice will be sought about appropriate usage licenses.

Do you intend to add a persistent identifier (PID) to your dataset(s), e.g. a DOI or accession number? If already available, please provide it here.

- No

Published research papers will have a PID/DOI.

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

Data sharing is generally not associated with costs. Data are shared either via public repositories (free for depositing and users) or via email or free-of-costs data sharing services (e.g., Belnet, OneDrive).

Responsibilities

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

The researchers who generate the data are responsible for documentation, metadata, storage and backup.
The supervisor of the project has the end responsibility and manages long-term preservation and sharing.

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The researchers who generate the data are responsible for documentation, metadata, storage and backup.

Who will manage data preservation and sharing?

The supervisor of the project, Christa Maes, has the end responsibility and manages data preservation and sharing.

Who will update and implement this DMP?

The PI will update and implement this DMP.