FWO DMP Template - Flemish Standard Data Management Plan

Project supervisors (from application round 2018 onwards) and fellows (from application round 2020 onwards) will, upon being awarded their project or fellowship, be invited to develop their answers to the data management related questions into a DMP. The FWO expects a **completed DMP no later than 6 months after the official start date** of the project or fellowship. The DMP should not be submitted to FWO but to the research co-ordination office of the host institute; FWO may request the DMP in a random check.

At the end of the project, the **final version of the DMP** has to be added to the final report of the project; this should be submitted to FWO by the supervisor-spokesperson through FWO's e-portal. This DMP may of course have been updated since its first version. The DMP is an element in the final evaluation of the project by the relevant expert panel. Both the DMP submitted within the first 6 months after the start date and the final DMP may use this template.

The DMP template used by the Research Foundation Flanders (FWO) corresponds with the Flemish Standard Data Management Plan. This Flemish Standard DMP was developed by the Flemish Research Data Network (FRDN) Task Force DMP which comprises representatives of all Flemish funders and research institutions. This is a standardized DMP template based on the previous FWO template that contains the core requirements for data management planning. To increase understanding and facilitate completion of the DMP, a standardized **glossary** of definitions and abbreviations is available via the following link.

1. General Project Information	
Name Grant Holder & ORCID	**Timo van Leeuwen, ORCID: 0000-0002-1782-022X**
Contributor name(s) (+ ORCID) & roles	
Project number[1] & title	An innovative modelling approach to estimating loading history from bone micro-architecture
Funder(s) GrantID[2]	12B3523N
Affiliation(s)	☒ KU Leuven ☐ Universiteit Antwerpen ☐ Universiteit Gent ☐ Universiteit Hasselt ☐ Vrije Universiteit Brussel ☐ Other: Provide ROR[3] identifier when possible: https://ror.org/05f950310

[1] "Project number" refers to the institutional project number. This question is optional since not every institution has an internal project number different from the GrantID. Applicants can only provide one project number.

[2] Funder(s) GrantID refers to the number of the DMP at the funder(s), here one can specify multiple GrantIDs if multiple funding sources were used.

[3] Research Organization Registry Community. https://ror.org/

Please provide a short project description	Bone is remarkable tissue in that its morphology can inform us about the loading history in which it was developed. The fact that bone adapts in response to habitual mechanical stimuli is of interest to a wide range of research fields. Computational tools, such as Finite Element (FE) modelling and machine learning, have been applied in the clinical and paleo fields to study bone remodelling and its adaptation to function. Yet, with the amount of fossil data available in museum collections, it would be truly impactful to apply concepts of functional bone adaptation to uncover the behaviour of extinct species. In this project we will explore the possibilities of developing an innovative modelling workflow to estimate loading history from bone morphology. The project makes optimal use of a newly established collaboration between KU Leuven, the Auckland Bioengineering Institute (ABI), and Penn State. We have access to a comprehensive dataset of distinct loading cases in the bipedal avian model of guineafowl, unique to the current research at Penn State. These will allow us to validate high fidelity (μ)FE modelling paradigms that are being developed within the world-leading environment for biomechanical research at the ABI. Moreover, the developed workflows will be published Open Source to facilitate data sharing and interdisciplinary collaboration.

2. 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[4].

				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
Guinea Fowl Data set Musculoskeletal model dataset Finite element dataset Open Source integrated modelling	Experimental and medical imaging dataset of the Guinea Fowl Hindlimb + Musculoskeletal Model + Finite element models + Micro finite element models + Integrated pre/post processing and	☐ Generate new data ☒ Reuse existing data	☒ Digital ☐ Physical	☐ Observational ☒ Experimental ☐ Compiled/ aggregated data ☒ Simulation data ☒ Software ☐ Other ☐ NA	☐ .por ☐ .xml ☐ .tab ☐ .csv ☐ .pdf ☐ .txt ☐ .rtf ☐ .dwg ☐ .tab ☐ .gml ☒ other: .dicom .tif .osim .feb ☐ NA	☐ < 100 MB ☐ < 1 GB ☐ < 100 GB ☐ < 1 TB ☒ < 5 TB ☐ < 10 TB ☐ < 50 TB ☐ > 50 TB ☐ NA	NA

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[4] Add rows for each dataset you want to describe.

software suite	modelling workflow						

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.	The data originate from Penn State University. No identifier is available as of yet, these will be included in later versions of the DMP.

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[5] These data are generated by combining multiple existing datasets.

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, please describe these issues further and refer to specific datasets or data types when appropriate.	☐ Yes, human subject data ☒ Yes, animal data ☐ Yes, dual use ☐ No If yes, please describe: The guinea fowl experimental protocols were approved for by the Institutional Animal Care and Use Committee (IACUC) of Penn State University (8/9/2021), assigned to principal investigator prof. Jonas Rubenson. IACUC Protocol number: PRAMS201546435. The current research project only makes use of the medical imaging of available specimens.
Will you process personal data[6]? If so, briefly describe the kind of personal data you will use. Please refer to specific datasets or data types when appropriate. If available, add the reference to your file in your host institution's privacy register.	☐ Yes ☒ No If yes: - Short description of the kind of personal data that will be used: - Privacy Registry Reference:
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 ☒ No If yes, please comment:

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[6] See Glossary Flemish Standard Data Management Plan

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 to what data they relate and what restrictions are in place.	☐ Yes ☒ No If yes, please explain:
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 to what data they relate and which restrictions will be asserted.	☐ Yes ☒ No If yes, please explain:

3. 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 will be stored in a clearly labelled, hierarchical folder format Notebook/README.txt will provide reference to folder contents and data location Open Access data will be made available with proper project and data content descriptions on MorphoSource.org Pre/post processing and modelling workflow scripts, as well as the intended open source software suite deliverable, will be clearly annotated and made available on GitHub repositories. Usability will be a main focus and realized by means of detailed repository descriptions, examples and (video) tutorials.

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. *REPOSITORIES COULD ASK TO DELIVER METADATA IN A CERTAIN FORMAT, WITH SPECIFIED ONTOLOGIES AND VOCABULARIES, I.E. STANDARD LISTS WITH UNIQUE IDENTIFIERS.*	☒ Yes ☐ No If yes, please specify (where appropriate per dataset or data type) which metadata standard will be used: DOI If no, please specify (where appropriate per dataset or data type) which metadata will be created:

4. Data Storage & Back-up during the Research Project
Where will the data be stored?	During the project and 5 years following: data will be stored on password protected university servers, and external drives backed up internally to the cloud daily. We will follow the recommendations of good research data management as outlined by the university (e.g keep logbooks, organization and backup of files). To enable access by other research groups during workflow development, we will share data, models, and scripts on restricted Github, Figshare, and Morphosource repositories. Final source code, software packages and apps will be published on open source versions of these repositories.

How will the data be backed up? *WHAT STORAGE AND BACKUP PROCEDURES WILL BE IN PLACE TO PREVENT DATA LOSS? DESCRIBE THE LOCATIONS, STORAGE MEDIA AND PROCEDURES THAT WILL BE USED FOR STORING AND BACKING UP DIGITAL AND NON-DIGITAL DATA DURING RESEARCH.[7]* *REFER TO INSTITUTION-SPECIFIC POLICIES REGARDING BACKUP PROCEDURES WHEN APPROPRIATE.*	University data servers are automatically backed up daily
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 ☐ No If yes, please specify concisely: If no, please specify:
How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons? *CLEARLY DESCRIBE THE MEASURES (IN TERMS OF PHYSICAL SECURITY, NETWORK SECURITY, AND SECURITY OF COMPUTER SYSTEMS AND FILES) THAT WILL BE TAKEN TO ENSURE THAT STORED AND TRANSFERRED DATA ARE SAFE. [7]*	The data and backups are stored on secured data servers for which specific clearance needs to be attained.

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[7] Source: Ghent University Generic DMP Evaluation Rubric: https://osf.io/2z5g3/

What are the expected costs for data storage and backup during the research project? How will these costs be covered?	Server costs are related to the KU Leuven and Penn State University data storage policies and included in the lab budgets of prof. Vereecke and prof. Rubens. Open Access repositories (GitHub, Morphosource, Figshare) currently include sufficient storage within their free-to-use options.

5. 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...).	CT and micro CT scans Bone morphological parameters Kinematical data Musculoskeletal models Forces and inertial data (µ)FE Models + Visualisations Bone remodelling data e-logbooks Manuscripts Python scripts
Where will these data be archived (stored and curated for the long-term)?	Password protected university drives and, in case of open access data/scripts, GitHub, Morphosource, and Figshare

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?	Server costs are related to the KU Leuven and Penn State University data storage policies and included in the lab budgets of prof. Vereecke and prof. Rubens. Open Access repositories (GitHub, Morphosource, Figshare) currently include sufficient storage within their free-to-use options.

6. 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. *Note that 'available' does not necessarily mean that the data set becomes openly available, conditions for access and use may apply. Availability in this question thus entails both open & restricted access. For more information:* https://wiki.surfnet.nl/display/standards/info-eu-repo/#infoeurepo-AccessRights	☒ Yes, in an Open Access repository ☐ Yes, in a restricted access repository (after approval, institutional access only, …) ☐ No (closed access) ☐ Other, please specify:
If access is restricted, please specify who will be able to access the data and under what conditions.	NA
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, privacy aspects ☐ Yes, intellectual property rights ☐ Yes, ethical aspects ☐ Yes, aspects of dual use ☐ Yes, other ☒ No If yes, please specify:
Where will the data be made available? If already known, please provide a repository per dataset or data type.	GitHub, Morphosource, and Figshare

When will the data be made available? *THIS COULD BE A SPECIFIC DATE (DD/MM/YYYY) OR AN INDICATION SUCH AS 'UPON PUBLICATION OF RESEARCH RESULTS'.*	Upon publication of the related research
Which data usage licenses are you going to provide? If none, please explain why. *A DATA USAGE LICENSE INDICATES WHETHER THE DATA CAN BE REUSED OR NOT AND UNDER WHAT CONDITIONS. IF NO LICENCE IS GRANTED, THE DATA ARE IN A GREY ZONE AND CANNOT BE LEGALLY REUSED. DO NOTE THAT YOU MAY ONLY RELEASE DATA UNDER A LICENCE CHOSEN BY YOURSELF IF IT DOES NOT ALREADY FALL UNDER ANOTHER LICENCE THAT MIGHT PROHIBIT THAT.* *EXAMPLE ANSWER: E.G. "DATA FROM THE PROJECT THAT CAN BE SHARED WILL BE MADE AVAILABLE UNDER A CREATIVE COMMONS ATTRIBUTION LICENSE (CC-BY 4.0), SO THAT USERS HAVE TO GIVE CREDIT TO THE ORIGINAL DATA CREATORS." [8]*	Data licences may depend on the publisher but if possible the data will be made available under a Creative Commons Attribution licence (CC BY 4.0).
Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, please provide it here. *INDICATE WHETHER YOU INTEND TO ADD A PERSISTENT AND UNIQUE IDENTIFIER IN ORDER TO IDENTIFY AND RETRIEVE THE DATA.*	☒ Yes ☐ No If yes: Both Morphosource and Figshare offer options to add such identifiers to data made available. The GitHub repositories are fully open access and will be credited/referred to directly.

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[8] Source: Ghent University Generic DMP Evaluation Rubric: https://osf.io/2z5g3/

7. Responsibilities	
Who will manage data documentation and metadata during the research project?	Timo van Leeuwen
Who will manage data storage and backup during the research project?	Timo van Leeuwen
Who will manage data preservation and sharing?	Timo van Leeuwen
Who will update and implement this DMP?	Timo van Leeuwen