Discovering the role of the circadian clock in plant latitudinal adaptation

A Data Management Plan created using DMPonline.be

Creators: Aisha-Alexandra Gerhardt, n.n. n.n.

Affiliation: KU Leuven (KUL)

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Principal Investigator: Aisha-Alexandra Gerhardt

Project Administrator: n.n. n.n.

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Project abstract:

Circadian clocks are conserved across biological kingdoms, and integrate environmental cues such as temperature and light into developmental responses. They are an evolutionary answer to living on a rotating planet with 24-hour cycles, tailoring metabolic processes to the environmental setting. The plant circadian clock consists of an oscillating regulatory loop with transcription factors that can influence around a third of all expressed genes in plants. Adaptation of plants to higher latitudes will be a means to escape rising temperatures caused by anthropogenic climate change but will make adaptation to the differing latitudinal light conditions necessary. Using Arabidopsis thaliana as a plant model organism and focusing on the morning-expressed transcription factors of the circadian clock, LATE ELONGATED HYPOCOTOYL (LHY) and CIRCADIAN CLOCK-ASSOCIATED1 (CCA1), I will generate, and study mutants of these genes showing altered latitudinal response and these plants will be tested under novel in-lab Simulated Latitudinal Light Environments (SLLEs). With this, I want to broaden our understanding on how the plant circadian clock regulates the growth and development of plants at different latitudes, adding twilight length as a variable that has not been considered in the current models of daylength sensing in plants. With my work, I will shine a light on how the circadian clock can drive latitudinal adaptation as an adaptive response to climate change in plants.

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DPIA

DPIA

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

- Not applicable

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GDPR

GDPR

Have you registered personal data processing activities for this project?

- Not applicable

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Application DMP

Questionnaire

Describe the datatypes (surveys, sequences, manuscripts, objects …) the research will collect and/or generate and /or (re)use. (use up to 700 characters)

The research will generate plant and bacterial transgenic material, phenotyping data (data tables and pictures/videos), sequence data (transcriptomics and ChIP-Seq), experimental data analysis outputs (graphs and code), laboratory notebook diaries with images and experimental reports, newly developed and adapted experimental protocols as well as manuscripts to publish. In collaboration, vertical farms will be developed, construction plans and establishment of their running conditions will be catalogued.

Specify in which way the following provisions are in place in order to preserve the data during and at least 5 years after the end of the research? Motivate your answer. (use up to 700 characters)

1. Designation of responsible person: Aisha-Alexandra Gerhardt during the project, Prof. Devang Mehta during and after completion of the project.

2. Storage capacity/repository (Cloud access + sufficient storage space is ensured by the host institution):

- during the research:
  - Live samples are stored in appropriate refrigeration conditions (-80° for live cells in glycerol stocks, 4°C for seed stocks) present in the lab, with associated sample lists in .xlsx format, accessible by every lab member and backed up on the lab servers.
  - Experimental protocols are stored in printed form for in-lab access, and mirrored on the the lab-internal cloud server accessible by every lab member and managed by the PI, backed up on the lab servers.
  - Data is stored in the lab-internal cloud server, accessible by every lab member and managed by the PI, backed up on the lab servers.
  - Personal research data (lab books, logs, and code) is in the lab-internal cloud server, in a personal file, accessible to and managed by the PI, backed up on the lab servers.
  - Published data will be appended with appropriate access to code and raw data, further elucidated below as "after the research".
-
- after the research (in addition to data kept in the cloud storage of the host institution ad described in "during the research":
  - Next generation sequencing data: Will be annotated and archived on the European Nucleotide Archive and made freely available.
  - Phenotyping image data: Raw images will be stored on Figshare, the open access repository for research images.

What’s the reason why you wish to deviate from the principle of preservation of data and of the minimum preservation term of 5 years? (max. 700 characters)

Not applicable.

Are there issues concerning research data indicated in the ethics questionnaire of this application form? Which specific security measures do those data require? (use up to 700 characters)

Not applicable.

Which other issues related to the data management are relevant to mention? (use up to 700 characters)

None.

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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.

Dataset Name	Description	New or reused	Digital or Physical	Digital Data Type	Digital Data format	Digital data volume (MB/GB/TB)	Physical volume
Lab Book Aisha Gerhardt	Lab Notebook	Generate new data	Digital	Observational and Experimental	.one	400 MB	NA

WP1: Generation of novel clock alleles

SNPLatMaps	Analysis of SNPs on genes of interest based on public 1001 Genomes dataset	Reuse existing data	Digital	Compiled/aggregated data	.R, .csv, .xml, .pdf	400MB	NA
Cloning constructs	Plasmids + Glycerolstocks	Generate new data	Physical	Experimental	NA	NA	5x - 80C paper boxes
Arabidopsis mutant seed stock	Seeds	Generate new data	Physical	Experimental	NA	NA	20x paper boxes
Ilumina AmpliSeq	Identification of CRISPR mutants	Generate new data	Physical	Experimental	FASTQ	10 GB	NA

WP2: Phenotypic screening of mutant populations

Vertical Farms	Set-up and building plans of specialized plant growth chambers	Reuse existing data and Generate new data	Digital and Physical	Software and Other	.xml, FORTRAN code, .txt	100 MB	NA
Arabidopsis phenotyping	Images and videos of arabidopsis mutants	Generate new data	Digital	Observational	.jpeg, .xml, .tiff	20 GB	NA

WP3: Functional genomic characterization of lat mutants

Arabidopsis phenotyping	Images and videos of arabidopsis mutants	Generate new data	Digital	Observational	.jpeg, .xml, .tiff	20 GB	NA
RNAseq	Transcriptomics data of arabidopsis mutants	Generate new data	Digital	Experimental	FASTQ	100 GB	NA
ChIPseq	Transcription factor binding site data of arabidopsis mutants	Generate new data	Digital	Experimental	FASTQ	50 GB	NA

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:

- SNP data from the 1001 Genomes project, specifically the Polymorph tool
  - https://tools.1001genomes.org/polymorph/
- Tropospheric Ultraviolet and Visible (TUV) Radiation Model by the Atmospheric Chemistry Observations & Modeling (ACOM) branch of the National Center fro Atmospheric Research (NCAR)
  - https://www2.acom.ucar.edu/modeling/tropospheric-ultraviolet-and-visible-tuv-radiation-model

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.

- No

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.

- No

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).

- Labbook
- Protocols (shared lab folder, .pdf and .docx)
- Manuals (shared lab folder, .pdf)
- General calculation sheets (.xlsx)
- Annotated code (Macros, R, FORTRAN, pearl)
- README files for sequencing data

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.

- Yes

We will follow the metadata standards implemented in the data repositories used to archive our data. This includes the Sequence Read Archive metadata standard and the Figshare metadata standard for sequence and image data respectively.

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

Where will the data be stored?

- OneDrive for Business Cloud Storge - EPSB Lab. This is backed-up by KU Leuven at an additional non-Microsoft server in addition to Microsoft's default versioning.
- Personal External Hard Drive

How will the data be backed up?

- ICTS Service of KU Leuven backup schedule
- Personal backup on external hard drive every 4 months

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

Yes. The lab currently uses 5 GB of storage space for its data, while Microsoft provides 2 TB of storage space for Business accounts, which in turn is extendable to 5 TB.

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

The data can only be accessed by lab members after the admin (PI) grants it. The raw data files will be stored in admin-protected folders, while duplicates of the data will be available to the general lab in the cloud storage environment. Active data is secured via the KU Leuven authentication system and is not accessible to non-authorised users.

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

The data management solutions used are covered by KU Leuven's core services and no additional cost is foreseen. The public data repositories used are free for academic use.

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...).

The data will be retained for at least 5 years according to KU Leuven regulations. Physical samples will be retained under appropriate storage conditions for future projects, if applicable.

- Experimental protocols are stored in printed form for in-lab access, and mirrored on the the lab-internal cloud server accessible by every lab member and managed by the PI, backed up on the lab servers.
- Data is stored in the lab-internal cloud server,
- Personal research data (lab books, logs, and code) in the lab-internal cloud server,
- Published data will be appended with appropriate access to code and raw data
- Next generation sequencing data
- Phenotyping image data:

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

Physical data: Storage facilities within the research institute and available upon request
Digital data: Cloud-based and available upon request
Public data: In the respective public repositories

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

The data management solutions used are covered by KU Leuven's core services and no additional cost is foreseen. The public data repositories used are free for academic use.

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 an Open Access repository

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 in the comment section per dataset or data type where appropriate.

- No

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

- Experimental protocols are stored in printed form for in-lab access, and mirrored on the the lab-internal cloud server accessible by every lab member and managed by the PI, backed up on the lab servers.
- Personal research data (lab books, logs, and code) is in the lab-internal cloud server, in a personal file, accessible to and managed by the PI, backed up on the lab servers.
- Published data will be appended with appropriate access to code and raw data
- Next generation sequencing data: Will be annotated and archived on the European Nucleotide Archive and made freely available.
- Phenotyping image data: Raw images will be stored on Figshare, the open access repository for research images.

When will the data be made available?

Upon publication of research results.

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

Data will be shared under the GNU AFFERO GENERAL PUBLIC LICENSE (AGPL 3.0)

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.

- Yes

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

The data management solutions used are covered by KU Leuven's core services and no additional cost is foreseen. The public data repositories used are free for academic use.

6. Responsibilities

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

Aisha-Alexandra Gerhardt and Dr. Devang Mehta

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

The ICTS Service of KU Leuven, Aisha-Alexandra Gerhardt and Dr. Devang Mehta

Who will manage data preservation and sharing?

Dr. Devang Mehta

Who will update and implement this DMP?

Aisha-Alexandra Gerhardt