FWO SENIOR POSTDOCTORAL FELLOWSHIP (2021-2024) – Liwang Liu

DMP_FWO 12V4422N

ADMIN DETAILS

Project Name: Integrated photoacoustic and photothermal microscopy: towards non-contact, non-invasive, and multi-parametric assessment of cell mechanics

Grant Identifier: -

Grant Number: 12V4422N

Principal Investigator / Researcher: Dr. Liwang Liu, Prof. Christ Glorieux

Project Data Contact: liwang.liu@kuleuven.be/christ.glorieux@kuleuven.be

Description: Mechanical forces act on us every day. Even the simplest physiological functions, e.g., respiration and circulation, require the generation of forces. Similarly, biological cells as building blocks of life are constantly subjected to mechanical forces, e.g., tension, shear, and compression. They can sense those forces and convert them into biological responses to perform normal functions. In the past decade, studies into the mechanics of cells have rapidly grown with significant implications for biotechnology and human health. For instance, cell and nuclear softening have been associated with DNA damage, cancer invasion, and tumour malignancy. This progress has largely been facilitated by new capabilities for mechanical assessment at the single-cell level. This project envisages pioneering efforts to establish a photoacoustic and photothermal microscopy platform for the non-contact, non-invasive, and multiparametric study of cell mechanics. We envision great potential to advance our current knowledge of cell rheology and its connection with cell structural biology. These breakthroughs will moreover open new paradigms for mechanics-informed disease diagnosis and drug efficacy tests. In that regard, this project also aims at developing lab-on-chip instruments for disease diagnosis by coupling the developed platform with microfluidics technology.

Institution: KU Leuven

1. GENERAL INFORMATION

a. Name applicant

Liwang Liu

b. FWO Project Number & Title

FWO project number: 12V4422N

Title: Integrated photoacoustic and photothermal microscopy: towards non-contact, non-invasive, and multi-parametric assessment of cell mechanics

c. Affiliation

Laboratory for Soft Matter and Biophysics, KU Leuven

2. DATA DESCRIPTION

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

- I will make use of existing data and generate new data, both obtained from my experimental setups by myself partially from my junior postdoctoral fellowship, partially from my ongoing senior postdoctoral fellowship.

b. 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.

Type of Data	Format	Volume	How created
(A) Transient thermoreflectance (TTR) waveforms	.dat/.txt Ascii	200 GB	TTR waveforms are created through automized experiments via NI Labview/Matlab programs, on the standard samples and biological cells, more specifically: • thin solid films: 300 nm-500 nm thin metal layers on top of the glass substrate • microbeads on top of thin metal layers • fixed and living cells that cultured on top of thin metal layers
(B) Transient grating (TG) waveforms	.dat/.txt	200 GB	Transient grating waveforms (TG) of viscoelastic samples: • well-controlled samples, including the water-glycerol mixture • fixed NIH-3T3 fibroblast cells • living NIH-3T3 fibroblast cells treated by routinely used cytoskeletal drugs acting on three specific cytoskeletal components, including nocodazole (microtubules), cytochalasin D (actin filaments), acrylamide (intermediate filaments)
(C) Setup info	.pdf/.docx	5 GB	• pdf/docx files describe the technical details (used components and their functionalities, operation instructions) of the envisaged TTR and TG microscopes. • paper that reports the setups
(D) Optical microscopic images	.tiff	20 GB	Microscopic images of studied samples (cells and microbeads) recorded by • white light microscope • phase-contrast microscope
(E) Analysis scripts and code	.m/.vi/.txt	2 GB	Computer codes including home-made Labview programs and Matlab scripts for: • instrumentation control and data acquisition • TTR and TG theoretical models and processing/fitting

			• additional .txt files explaining how to use the codes
(F) Protocols/Scientific reports/manuscripts	.docx/.pdf/.pptx	20 GB	• sample preparation and experimental configuration • intermediate projects reports • internal and external presentations • publications in open access journals and the KU Leuven LIRIAS repository • a separate folder is created for each publication. Raw data and processing codes associated with each plot are stored in the respective folder

3. LEGAL AND ETHICAL ISSUES

a. 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

b. 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)

- No

c. 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

d. 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

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

- Protocols and details related to sample preparation, data collection (e.g., sampling rate, used laser power, objective lens), and processing are recorded in Word or Excel files by the applicant, Dr. Liwang Liu, and updated to the supervisor of the project, Prof. Christ Glorieux, stored on the ZMB server.
- Data folders containing raw and processed data are hierarchically organized and labeled based on the source of the data, the type of experiment, the date of data generation, and the different experimental conditions analyzed. Additional .txt or docx. file explaining the experimenting protocol and configuration, optical image scale bar, and data storage, are created for each. Data processing codes/instructions are located in the respective folder, which is set as the working directory of the codes.
- Scripts use the comment function to explain each analysis step. Data sets have a clear document name and row/column description; Further metadata (.txt/.docx) is created for a better understanding of the data structure.

All files will be stored on the ZMB server, with sharing possibilities via Box Sync and One Drive.

b. 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

Text documents stored within each experiment folder in the ZMB-server will respectively contain guidelines describing data collection/analysis configurations and methods and all relevant metadata (including experimental conditions, sample information, and laser settings) to ensure the reusability of the data and the reproducibility of any further data generation.

5. DATA STORAGE AND BACKUP DURING THE FWO PROJECT

a. Where will the data be stored?

1. Upon data collection/preprocessing, temporary copies of the data will primarily be stored in the KU Leuven-managed laboratory computer of the applicant (Dr. Liwang Liu). A copy of the data will be immediately uploaded to the ZMB server (managed by the Department IT) for long-term preservation and backup.

b. How is backup of the data provided?

Data stored on the ZMB server is managed, maintained, and backed up by Department IT services. Specifically, mirror copies of the stored data are made immediately upon upload, for safety backup purposes.

c. 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, the Department ZMB server has sufficient storage capacity for the outlined project.

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

We expect that 5 TB will be sufficient to store all data generated as part of the project. The data is stored on ZMB server under Department IT maintenance. These costs (~500 EUR/year) will be covered by the budget of the project supervisor (Prof. Christ Glorieux).

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

Data stored on KU Leuven-managed personal computers are protected via password access to the computers, as set up by the KU Leuven IT Department. Off-site access to ZMB-server data is available from KU Leuven personal computers via the Pulse Secure.

6. DATA PRESERVATION AFTER THE FWO PROJECT

a. 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 raw data will be retained for at least 5 years on the ZMB server. Publication data will be further organized and cataloged on a figure-by-figure basis: meaning an individual folder is created for each figure to store the associated raw data, processing codes, and plotting codes.

b. Where will the data be archived (= stored for the longer term)?
Long-term data archives will be maintained in specific archive folders on the ZMB-server.

c. What are the expected costs for data preservation during the retention period of 5 years? How will the costs be covered?
We expect that 5 TB will be sufficient to store all data generated as part of the project. The data is stored on ZMB server under Department IT maintenance. These costs (~500 EUR/year) will be covered by the budget of the project supervisor (Prof. Christ Glorieux).

7. DATA SHARING AND REUSE

a. 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
All data will be generated and collected within the laboratories of Prof. Christ Glorieux and may be shared externally upon reasonable requests from collaborating scientists, which will be reviewed and approved on a case-by-case basis by the project supervisor (Prof. Christ Glorieux).

b. Which data will be made available after the end of the project?
The major findings of the project and their interpretation will be made available through the publication of journal articles in established, peer-reviewed academic journals. Relevant e-prints will be made publicly available through uploading to well-established open-access data repositories, e.g., https://arxiv.org/, and LIRIAS.

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

- Upon request by mail

All requests and approvals for the reuse of data other than those deposited in open-access repositories will be assessed on a case-by-case basis by the project supervisor (Prof. Christ Glorieux).

d. When will the data be made available?

- Upon publication of the research results

Data will only be made available to other researchers after the publication of the results/methods.

e. Who will be able to access the data and under what conditions?
Only requests via mail will be answered by the project supervisor Prof. Christ Glorieux. Privacy and legal experts will be consulted when sharing data with researchers outside of the research group. A written agreement with the PI is necessary when sharing the data outside of the research groups.

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

Costs for data sharing will be discussed with collaborators on a case-by-case basis.

8. RESPONSIBILITIES

a. Who will be responsible for data documentation & metadata?

The applicant (Dr. Liwang Liu) and the supervisor (Prof. Christ Glorieux) will share the responsibility for data documentation and metadata generation/preservation.

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

The applicant (Dr. Liwang Liu) will be primarily responsible for collecting/generating data, and for correct documentation and uploading it onto the ZMB server storage space. The Department IT department will be responsible for the maintenance and backup of the data storage space.

c. Who will be responsible for ensuring data preservation and reuse?

The applicant (Dr. Liwang Liu) and the supervisor (Prof. Christ Glorieux) will share the responsibility for ensuring data preservation and reuse

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

The applicant (Dr. Liwang Liu) and the supervisor (Prof. Christ Glorieux) will share the responsibility for updating & implementing this DMP.