

**REQUEST FOR PROPOSALS: ARNOLD AND MABEL BECKMAN FOUNDATION INSTRUMENTATION GRANT FOR
ADVANCED LIGHT-SHEET MICROSCOPY AND DATA SCIENCE**

Advanced microscopy, enabled by recent advances in physics, chemistry, engineering, computer science, and biology, is opening new windows into the anatomy and behavior of cells and tissues. While established modalities such as confocal, two-photon and super-resolution microscopies have contributed greatly to experimental investigations in many fields, the tradeoffs in speed, photo-damage, and resolution often limit our ability to capture complex cellular processes. Emerging light-sheet microscopy tools, however, are enabling rapid three-dimensional (3D) imaging of single molecules, living cells, organs, and even whole animals over time with minimal toxicity. The impact of technological breakthroughs using advanced light-sheet microscopy instrumentation and accompanying methods have the potential to create an unprecedented understanding of the intricate dynamics of cells and their components within living specimens.

Institutions that have made investments in advanced light sheet microscopy have observed that the size and complexity of the data obtained with these new 3D imaging capabilities have created a bottleneck to the advancement and wide-scale adoption of these technologies. There is a critical need for new strategies to address data collection, storage, image registration and organization, and subsequent image quantification and interpretation. This need will only be addressed through the close integration of data processing and analysis personnel together with imaging specialists and biologists to maximize the impact of these promising new technologies and will be central to future biological discoveries.

The Arnold and Mabel Beckman Foundation's mission is to provide funding for promising technologies, particularly in cutting edge instrumentation and interfaces between disciplines. In support of this mission, the Foundation is requesting proposals for a one-time grant opportunity for the procurement and potential further development of groundbreaking advanced light-sheet instrumentation capabilities, including establishment of robust multidisciplinary science/technology teams involving data scientist collaborations within the research group. The Foundation will provide support of up to \$1.2 million per site, which can be used for instrumentation acquisition, development, and maintenance; support for data science collaborations within the research teams; and costs for the proposed research programs. Applicant institution(s) must demonstrate their commitment for additional funding beyond the \$1.2 million support from the Arnold and Mabel Beckman Foundation, if necessary to complete the objectives of the program described below. Additional information on the institutional support requirements can be found in the template in the online application portal.

The Foundation will use a two-stage submission process, starting with an open call for Pre-Proposals followed by a request for Full Proposals from invited institutions.

PROGRAM OBJECTIVES

Proposals should be centered around core biological problems and a research program that is enabled by the dynamic, 3D, and long-term imaging capabilities of advanced light-sheet microscopy. Proposals shall include one-page descriptions of up to 3 distinct research project(s) to which the light-sheet capability will be applied that will represent significant advances within this larger research program. Additional consideration will be given to proposals that include other imaging, sensing, or analysis technologies as an integral part of one or more of the proposed research project(s).

Applicants should propose light-sheet microscope modalities that are both necessary and appropriate for their specific proposed research program, including, but not limited to, super-resolution light-sheet, lattice light-sheet, Airy beam light-sheet, single-optic light-sheet, and multi-photon imaging. Proposals for procurement of commercial systems, instrument build or development, and/or significant

adaptation or improvement of existing light-sheet microscopy capabilities will be considered. If any instrumentation development work is proposed, then the proposal must also address the engineering approach and plans to complete the technology development, and how these developments will further the specific biological aims. The Foundation recognizes that these development approaches may be higher risk, and so Full Proposals shall also address alternative strategies that will be pursued should one or more aspects of the new technological developments fail to achieve their proposed performance metrics. Applicants shall identify the configuration of microscope or components and detectors that will be purchased in the proposal and justify why that level of capability is necessary and appropriate for the proposed research program. The Foundation also recognizes that there are rapid advancements being made in the field of light-sheet microscopy, and updates to the exact configuration of the proposed microscope modality will be allowed at the Full Proposal stage and will be considered at the award stage. All equipment purchases and installation must be complete within two years of the program awards, currently anticipated in January 2021.

Successful proposals must also include a detailed plan on how data scientists will be incorporated into the research teams to analyze the magnitude of data generated by the microscope systems, and how such analysis will further the specific biological aims. Applicants are encouraged to explore creative solutions to this challenge, including, but not limited to, collaborations with existing resources at the institution(s), collaborations with other academic or research institutions or National Laboratories, hiring of new faculty, and/or project plans with corporate partners. Proposals shall also include plans for how any new analysis techniques, along with representative data sets to demonstrate these techniques, will be shared with the broader research community. All costs for incorporating the data analysis expertise and data storage infrastructure in the proposed program must be included in the budget for the overall program, with institutional commitment to support the proposed plan.

The proposed program team for this effort can include up to 3 co-PIs, with at least one of the co-PIs having demonstrated experience in successfully managing multi-disciplinary teams. The other optional co-PIs should also have significant roles within the program team, for example, in the research, engineering, or data analysis tasks. Inclusion and support of junior faculty and scientists is also a priority for the Arnold and Mabel Beckman Foundation, and successful proposals shall include interdisciplinary teams that include junior faculty and junior scientists, such as staff scientists, postdoctoral fellows, and graduate students, as integral components of the team. A training plan shall also be developed that specifically addresses how junior scientists will benefit from new training opportunities, especially training programs that will extend beyond the individual Institution or consortium.

The Foundation will consider proposals from individual institutions or from consortia of institutions whose combined resources will address the program requirements. For any consortium application, there must be a “Lead Institution”, defined as the institute that will maintain the purchased equipment on their property and will accept the entire grant award on behalf of the consortium.

ELIGIBILITY CRITERIA

The Lead Institution submitting the proposal must be a nonprofit US university or research institution. Questions regarding eligibility can be directed to Anne Hultgren at InstrumentGrants@beckman-foundation.org.

TIMELINE

Pre-Proposal Submission Deadline: March 6, 2020 by 5 pm Pacific/8 pm Eastern.

Requests for Full Proposals will be distributed following review of all submitted Pre-Proposals, anticipated in June 2020.

APPLICATION OVERVIEW

Please note that incomplete applications will not be considered. Multiple Pre-Proposals from a single institution are allowed. An individual investigator may be a co-PI on only one Pre-Proposal, but can be a supporting team member on other submitted Pre-Proposals.

THE PRE-PROPOSAL MATERIALS MUST INCLUDE:

1. **Coversheet** (template provided in online portal)
 - a. Identification of the institution(s) in the proposal.
 - b. Name and contact information of up to 3 co-PIs who will lead the project.
 - c. Description of existing institutional resources for advanced microscopy and any centers, collaborations or consortia that will contribute to and/or benefit from the addition of the light-sheet microscope.
2. **Research Program** (up to 3 pages)
 - a. One-page descriptions of up to 3 compelling independent research project(s) within a larger research program requiring dynamic imaging capabilities made possible by the light-sheet microscopy technology. Each project may include multiple investigators beyond the 3 co-PIs of the overall project.
 - b. For each project, include discussion of why the proposed light-sheet microscope configuration is necessary and appropriate for the proposed research and why it cannot be accomplished with other existing techniques.
 - c. If instrumentation development is proposed, include additional discussion on the engineering plans and why the development is key to project goals (additional 1 page allowed).
3. **Data Science Collaboration** (1 page)
 - a. Plan on how data scientists will be incorporated into the research teams to collect, store, and analyze the magnitude of data generated by the microscope systems.
 - b. Discussion of how new techniques and data will be shared with the broader research community.
4. **Program Team** (1 page)
 - a. Description of the full program team, to include up to 3 co-PIs, other faculty/researchers and partnerships, specifically including junior faculty and scientists.
5. **Draft Budget** (1 page)
 - a. Anticipated costs for instrumentation acquisition and/or development, required facility upgrades, data science collaborations, data storage, any planned new faculty, staff scientist, postdoctoral, and/or student hires specifically for this program, research costs for the proposed project(s), and 5-years of projected direct operational expenses.
 - b. Clearly delineate between the funding received from this award, and additional required funding received from, for example, but not limited to, direct Institutional support, other funding agencies, or matching funding sources.
6. **Institutional Endorsements** (2 pages per letter, on letterhead)
 - a. Letters of support from institutional officials with authority (e.g., department heads, deans, provosts) to make the financial, space, and operational commitments described in the proposal. Letters must specifically reference the data science collaboration plans.
 - b. Pre-proposals must include letters from each institution in the consortium that is providing support to meet the program requirements.
7. **Biosketches**. NIH-formatted biosketches of up to 3 co-PIs.

The Full Proposal request will allow for short descriptions of additional individual research projects and biosketches of additional research team members.

APPLICATION SUBMISSION

Online submission portal: <https://beckman-foundation.smapply.io/>

One co-PI must be identified as the Lead PI for the team to create an account on the submission portal and submit the final Pre-Proposal on behalf of the full team. The submission portal allows for the addition of collaborators to access and upload documents into the account. Instructions are provided in the submission portal.

Pre-Proposal Submission deadline: March 6, 2020 at 5 pm Pacific/8 pm Eastern.

Any questions regarding application submission can be directed to Anne Hultgren at InstrumentGrants@beckman-foundation.org.

SELECTION & REVIEW PROCESS

Applications will be reviewed by a scientific review committee appointed by the Foundation. The Foundation reserves the right to use a review panel composed of internal and external reviewers, subject to a non-disclosure agreement and without conflicts of interest.

Due to the administrative requirements involved, the Arnold and Mabel Beckman Foundation is unable to provide critical commentary on unsuccessful proposals.