Joint JGI-TMF User Call on Critical Minerals and Materials

Overview

The Joint Genome Institute (JGI) and The Molecular Foundry (TMF) announce a collaborative user program focused on innovations in critical minerals and materials (CMM). The program seeks research proposals that integrate genomics with nanoscale science, accelerating discoveries and developing transformative bio-based technologies that address challenges in the sourcing, recovery, and utilization of critical minerals and materials. A list of CMMs and the results of the 2023 DOE Critical Materials Assessment can be found here.

Supported by the Biological and Environmental Research (BER) program, the JGI provides advanced genomic capabilities and access to large-scale data resources. Users can ship samples and/or provide DNA designs to the JGI where expert staff process samples, run instruments and/or workflows, and process data, delivering products to the users, such as fully annotated genome assemblies or protein expression libraries.

Supported by the DOE Office of Basic Energy Sciences (BES), TMF provides researchers worldwide with access to state-of-the-art expertise and instrumentation in a collaborative, multidisciplinary environment. Users and members of their research teams work on-site at TMF alongside facility experts to conduct research beyond the capabilities of individual laboratories. TMF's comprehensive nanoscale science capabilities enable users to expand the scope, technical depth, and impact of their research.

Scope of Research

Research proposals within this program are expected to address one or more of the following areas:

- **Genomics and metagenomics:** Exploring the genetic potential and functional roles of fungi, algae, protists, bacteria, archaea, viruses, plants, microbial communities, and plant-microbe interactions in critical mineral-rich environments.

- **Biogeochemical cycling:** Investigating cellular-, protein-, or chelate-mediated transformations and mobilization of critical elements.
- **Bioleaching and biorecovery:** Developing and optimizing biological processes and bio-based materials with synthetic biology and genetic engineering for the extraction and recovery of critical minerals from various sources.
- **Biomineralization:** Understanding and harnessing biological processes and resulting biominerals at the atomic, molecular, and systems level for the design of new materials.
- **Materials discovery:** Identifying proteins and enzymes involved in the binding, transport, and storage of critical elements, as well as those that utilize these elements in catalysis, to inspire the development of catalysts and materials with improved resource efficiency or functionalities, such as self-healing “smart” materials with capabilities currently only achievable through complex biosystems.

Resources and Facilities

Awarded projects will gain access free-of-charge* to a comprehensive suite of resources and facilities, including:

JGI Capabilities (mail-in services):

The JGI employs both next-generation short-read sequencing platforms and 3rd generation single-molecule/long-read capabilities, along with DNA synthesis and metabolomics. The capabilities available for this call are listed below. More details about JGI products, including expected cycle times, can be found on the JGI Products web page. Proposals should request no more than 3 Tb of sequencing, 500 kb of synthesis. Requests for Pacific Biosciences long-read sequencing are capped at 1 Tb and 50 samples (up to 2,000 samples for bacterial/archaeal isolate genomes). Researchers are encouraged to review JGI’s sample submission guidelines to obtain additional information about the amounts of material that are required for various product types.

Individual proposals may draw from one or more of these capabilities as needed to fulfill project goals:

- Genome and metagenome sequencing to enable the discovery of novel proteins and processes that have evolved to extract, separate, precipitate, transport, store, sense and/or use CMMs in catalysis and other cellular processes.
- Transcriptome analysis including coding transcript annotation and expression profiling.

- Metabolomics-based discovery. Metabolomic technologies at JGI enable users to examine diverse polar and non-polar metabolites from plants, microbes, and environments. In addition, users may request targeted analysis of stable isotope labeling for specific metabolites. Proposals should clearly indicate how the data obtained will advance an understanding of metal capture and transformation, which can include acid production, redoxolysis, biosorption, hyper-accumulation, and precipitation. Users may request up to 50 polar metabolite sample analyses or 150 non-polar metabolite sample analyses.
- Synthesis of genes and pathways for functional characterization and introduction into strains of interest.
- Synthesis of combinatorial pathway libraries to fast-track optimization of CMM recovery design strategies.
- Synthesis of sgRNA genome-wide libraries for high-throughput gene discovery and phenotype optimization in any sequenced organism.

TMF Capabilities (on-site users, some limited remote access):

The Molecular Foundry features world-class scientists with expertise across a broad range of disciplines and state-of-the-art, often one-of-a-kind, instrumentation. An awarded proposal provides one year of access to Foundry facilities and expertise in the Biological Nanostructures Facility, with an option to request support from additional Molecular Foundry Facilities. Proposals must be activated within a year of approval. Access to the Molecular Foundry is free of charge for non-proprietary research; the vast majority of projects fall into this category. Users are responsible for their own living, local transportation, and travel costs. The cost of standard incidentals related to the user project (such as chemicals, basic lab supplies, office supplies) is supported by the Foundry. Potential users are encouraged to explore the wide-range of expertise and instrumentation available at the Molecular Foundry.

Individual proposals may draw from one or more of these capabilities as needed to fulfill project goals:

- Expertise in nanoscale properties of proteins and chelating agents to understand how critical materials are selectively bound, transported, and sequestered
- Expertise in protein-function prediction and assay design for hypothesis-based experimentation inspired by computational genomics studies and/or derived from AI-enabled insights
- Expertise in use of biological systems as living materials platforms for selective extraction or recycling of critical minerals
- Support for integrating nanoscale characterization techniques with synthetic biology to engineer microbes for targeted mineral processing

- Access to laboratory space and equipment, including access to advanced instrumentation for imaging and characterization to support these research topics:
    - Users can perform experiments at TMF and prepare samples to send to JGI and/or analyze samples with various imaging and characterization tools within TMF
    - Users can receive assistance with designing and performing experiments, such as cellular or protein assays, structure- or function-inspired design and redesign, proteins/genome engineering, transport assays, imaging, and barcode-sequencing assays
    - Examples of instrumentation:
        - Cell culture: automated growth monitoring in microplates or flasks; culturing heterotrophic, photosynthetic, or anaerobic microbes
        - Proteins: protein expression/purification, calorimetry, high-throughput surface plasmon resonance, CD spectroscopy, X-ray macromolecular crystallography (MX) and X-ray Footprinting Mass Spectrometry (XFMS)
        - Optical imaging: sub-diffraction fluorescence imaging and localization of elements in organisms that naturally or have been engineered to uptake, transport or hyperaccumulate elements
- Expertise and equipment for cryo-S/TEM is available soon at the Molecular Foundry, but is outside the scope of the current call. For more information about available and upcoming electron microscopy capabilities email Stephanie Ribet (sribet@lbl.gov).
- Scanning/Transmission electron microscopy (S/TEM) equipment for analysis of inorganic materials is available. The TEMs in TMF are capable of imaging, diffraction, and spectroscopy for analysis of morphology and composition of inorganic materials at the nanoscale produced or involved in biological activity. Contact Peter Ercius (percius@lbl.gov) for more information.

Eligibility

Researchers from academic institutions, national laboratories, and industry* are eligible to apply. Collaborative proposals involving researchers from multiple institutions are encouraged but not required.

Potential users are encouraged to refer to the data policies of the JGI and TMF: https://jgi.doe.gov/data-policy-support/data-policy

https://foundry.lbl.gov/user-program/working-at-the-foundry/#data-mgmt

*Companies that plan to conduct non-proprietary research through this call, with an intent to publish in open scientific literature, can work at the Molecular Foundry at no charge. Helpful FAQs related to IP, access, and related topics, can be found here: https://foundry.lbl.gov/become-a-foundry-user/industry-users/

How to Apply

(1) Get started – In order to submit a proposal, you will need to create a user account in the Molecular Foundry User Portal.

Familiarize yourself with the requirements and policies for users:

- TMF User Agreements
- TMF Data Management Policy
- JGI User Agreements
- JGI Data Management Policy

View Proposal Questions and Evaluation Criteria and Review Proposal Tips and Examples

You are strongly encouraged to contact Crysten Blaby-Haas at least two weeks before the submission deadline for assistance with preparing your proposal and for initiating discussions with staff at the Joint Genome Institute and the Molecular Foundry.

(2) Submit a proposal - Create new “Standard proposal” by logging into the Molecular Foundry User Portal. A proposal content guide is available to preview the prompts and guidance in the proposal form.

Proposal Schedule

Stage	Date	Description
Call for Proposals	Mar 1, 2026	Opening of the application portal.
Proposal Submission Deadline	Mar 31, 2026	Final date for submitting research proposals.

Feasibility Review	Apr 1, 2026	Proposals will undergo review by JGI/TMF staff for technical feasibility.
Technical and Scientific Review	Apr 23, 2026	Proposals will undergo peer review by an expert panel.
Mission Review Period	May 2026	Proposals will undergo review by BER PMs for mission relevance of JGI components.
Notification of Awards	Jun 3, 2026	Applicants will be informed of the outcome of their proposals.
Proposal Start Date	Jul 1, 2026 or as soon as user agreements are finalized	Commencement of awarded projects.

Contact Information

Program Coordinator: Crysten Blaby-Haas