

# **Collaborative Research Opportunities in Molecular Chemistry**

## **Introduction**

Molecular chemistry, a sub-discipline of chemistry, focuses on the chemical properties and reactions of molecules. It is a field that has seen significant advancements in recent years, largely due to collaborative efforts among researchers, institutions, and funding bodies. This report delves into the current landscape of collaborative research opportunities in molecular chemistry, highlighting potential partnerships, funding sources, academic conferences, and cutting-edge research topics.

## **Current Collaborative Projects and Partnerships**

### **3D Chemical Tomography for Bladder Cancer Diagnosis and Treatment**

A novel biochemical imaging platform is under development at the Strano laboratory at MIT, aiming to improve the diagnosis and treatment of bladder cancer. This project is a collaborative effort with Dr. Mark Preston and Dr. Daniel Wollin from Brigham and Women's Hospital at Harvard Medical. The research focuses on uncovering and developing cancer biomarkers and examining cellular and tissue-level chemical imaging of tumor efflux in real-time (Source: MIT HST).

### **Glucose Responsive Glucagon Drug Design and Analysis**

Another project at MIT involves the design and analysis of glucose-responsive glucagon drugs. This research could lead to significant advancements in diabetes treatment, showcasing the potential of molecular chemistry to address critical health issues.

### **Human Dynamic Neurochemical Connectome Scanner**

The development of a 7 Tesla MR-compatible PET insert is a project with the goal of building, integrating, and testing hardware and software components for next-generation biochemical imaging. This project is expected to perform proof-of-principle studies in healthy volunteers (Source: MIT HST).

## **PET-MR Imaging of Pulmonary Fibrosis**

This project aims to apply PET-MR imaging to quantify molecular abnormalities in the lungs of idiopathic pulmonary fibrosis patients. The goal is to predict disease progression and response to therapy, which is a collaborative effort with Dr. Ciprian Catana (ccatana [at] mgh.harvard.edu) at Charlestown (Source: MIT HST).

## **Delivery Technologies**

The Chaikof Lab at MIT is working on delivery technologies, which is a broad area that could encompass drug delivery systems, nanotechnology, and other innovative methods for administering therapeutic agents.

## **Creation of Molecular Tools for Next-Generation Neuroimaging**

The development of chemical, nanotechnological, and genetic imaging probes for analysis of molecular and cellular function in living organisms is another collaborative project. This research has applications in both basic neuroscience and translational paths for human brain dynamics studies (Source: MIT HST).

## **Circulating Tumor Cell Chip and 'Suspended Animation' in Living Systems**

The bioengineering and clinical applications of circulating tumor cell chip technology are being explored for early diagnosis and personalized oncology. Additionally, research into achieving 'suspended animation' in living systems is underway, funded by multiple grants (Source: MIT HST).

## **Funding Opportunities and Academic Conferences**

### **UK Research and Innovation (UKRI) Funding**

UKRI offers funding for new investigators in molecular and cellular medicine. This opportunity is ongoing, with application rounds closing every January, May, and September. The typical full economic cost of a project is under £1 million, with MRC funding 80% of this cost (Source: UKRI).

### **Centers for Chemical Innovation (CCI) Program**

The National Science Foundation (NSF) supports the CCI Program, which funds research centers focused on major, long-term chemical research challenges. Phase I CCIs receive significant resources to develop their science and management before requesting Phase II funding. The FY 2024 Phase I competition is open to projects in all fields supported by the Division of Chemistry (Source: NSF).

## **Visiting Faculty Research Partnership at Princeton University**

Princeton University's Department of Chemistry offers a Visiting Faculty Research Partnership for the summer of 2024. This initiative is designed to draw faculty from diverse institutions for collaboration with Princeton faculty. Applications for the summer of 2024 run through December 6, 2023 (Source: Princeton Chemistry).

## **Nature Reviews Materials and Nature Chemical Engineering**

Publications such as Nature Reviews Materials and Nature Chemical Engineering highlight collaborative, multidisciplinary science at the Molecular Foundry and the forefront of chemical engineering research. These journals provide insights into current trends and opportunities in the field (Sources: Nature Reviews Materials, Nature Chemical Engineering).

## **Conclusion**

The field of molecular chemistry is ripe with collaborative research opportunities that span across various sub-disciplines and applications. From the development of novel imaging platforms for cancer diagnosis to the design of responsive drugs for diabetes, the potential for impactful research is vast. Partnerships between academic institutions, hospitals, and funding bodies are crucial in driving these advancements forward.

Researchers and institutions looking to engage in collaborative molecular chemistry projects have a wealth of resources and funding opportunities available to them. Programs like the CCI Program and initiatives such as the Visiting Faculty Research Partnership at Princeton University provide platforms for innovation and collaboration. Academic journals and conferences serve as additional venues for sharing knowledge and fostering partnerships.

As the field continues to evolve, it is essential for researchers to remain informed about the latest developments and opportunities for collaboration. By leveraging the available resources and forging new partnerships, the molecular chemistry community can continue to make significant contributions to science and medicine.

## **References**

- MIT HST. (n.d.). Research Projects Available to HST Students - 2023-2024. Retrieved from <https://hst.mit.edu/faculty-research/research-projects-available-hst-students-2023-2024>
- Nature Reviews Materials. (2023). It's your lab: collaborative, multidisciplinary science at the Molecular Foundry. Retrieved from <https://www.nature.com/articles/s41578-023-00533-5>

- Princeton Chemistry. (n.d.). Visiting Faculty Research Partnership. Retrieved from <https://chemistry.princeton.edu/visiting-faculty-research-partnership/>
- Nature Chemical Engineering. (n.d.). Retrieved from <https://www.nature.com/natchemeng/>
- UK Research and Innovation (UKRI). (2023). Molecular and cellular medicine: responsive mode new investigator. Retrieved from <https://www.ukri.org/opportunity/molecular-and-cellular-medicine-new-investigator/>
- National Science Foundation (NSF). (n.d.). Centers for Chemical Innovation (CCI). Retrieved from <https://new.nsf.gov/funding/opportunities/centers-chemical-innovation-cci>