2023F_05_CHU

Application Title: **iLEAP: I**nfrastructure for high-throughput chemical and biological analysis **L**aboratory **E**nabled through **A**utomated sample **P**reparation.

Lead contact for RDF Application:

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Key Participating Units (in alphabetical order):

Departments: Biological & Agricultural Engineering (BAEN), Civil & Environmental Engineering (CVEN), Chemical Engineering (CHEN), Electrical and Computer Engineering (ECEN), Environmental & Occupational Health (PHEO), Plant Pathology and Microbiology (PLPM), Oceanography (OCNG), Soil and Crop Sciences (SCSC)

Colleges: Agriculture and Life Sciences, Arts and Sciences, Engineering, Health Science Center, Medicine, National Center for Therapeutics Manufacturing, School of Public Health, Medicine

RDF Amount Requested ($): $1,051,351

Executive Summary

The application is to create a high-throughput chemical and biological analysis shared facility that is enabled through several automated sample preparation instruments and a high-throughput liquid handling robot. This high-throughput laboratory that we named **iLEAP** (**iLEAP: I**nfrastructure for high-throughput chemical and biological analysis **L**aboratory **E**nabled through **A**utomated sample **P**reparation) will be a shared user facility to provide new services to TAMU researchers. The demand for large number of experiments and sample handling is ever-increasing in the broad areas of biotechnology, synthetic biology (SynBio), and environmental engineering and science fields. Despite many analyses instruments being available in TAMU, especially in the area of genomics and single-cell analyses, the capability of conducting sample preparation and complex liquid handling steps, which are some of the most time-consuming, labor-intensive, and throughput limited steps, in an automated way is sorely lacking. The proposed iLEAP facility has the broad vision and goal to dramatically accelerate high-throughput automated experimental capabilities at TAMU.

The **iLEAP** will provide automated and high-throughput experimental capabilities, especially for environmental, SynBio, health, and biotechnology applications by advancing two broad objectives: **(1)** Provide new capabilities to streamline tedious sample preparation steps so that they can be ready for various chemical analyses capabilities already provided by several existing TAMU user facilities equipped with instruments such as GC/MS, LC/MS, and ICP-MS. Depending on sample matrices, streamlining various sample preparation steps will be enabled by one or combination of the following instruments: an **EXTREVA Solvent Extraction and Evaporation** System for soil or semi-solid sample preparation into vials, a **Labconco™ RapidVap™ Vertex™ Dry Evaporator** for accelerating the generation of desired extracts from solid and semi-solid samples, a **Dionex AutoTrace 280** for direct concentration of bulk liquid samples (> 1,000 times) and for extracts cleanup for GC/MS or LC/MS analysis, and a **MPS 320 Microwave digestion system** for reproducible and high quality digestates in preparation for ICP-MS analysis; **(2)** Provide high-throughput liquid and microorganisms handling capabilities through a multifunctional, versatile automated liquid handler system - **TECAN Fluent 780**.

To demonstrate the utility of this new infrastructure, we will initially develop high-throughput workflow and pipelines in three important areas of broad interest, **i)** bioremediation, **ii)** environmental engineering, and **iii)** synthetic biology and biomanufacturing. While **iLEAP**'s capabilities will directly benefit the 21 faculty mentioned in our project description, we anticipate that nearly all current users of our chemical and molecular analytical facilities will harness these advancements, along with those keen on high-throughput experimentation. The research themes this investment unlocks, such as synthetic biology, environmental engineering (bioremediation, bioharvesting/biomining), and biomedical/health applications, align with major federal funding priorities. We also anticipate extensive collaboration with industry stakeholders. Furthermore, automated experiments/analyses have the potential to further broaden the application areas.