Chemistry of Life Sciences Complex (CLSC)

TEXAS A&M UNIVERSITY
Science

The Endeavor:

To build a multi-disciplinary center for collaborative research, discovery, and innovation in strategic areas of the chemical and biological sciences.

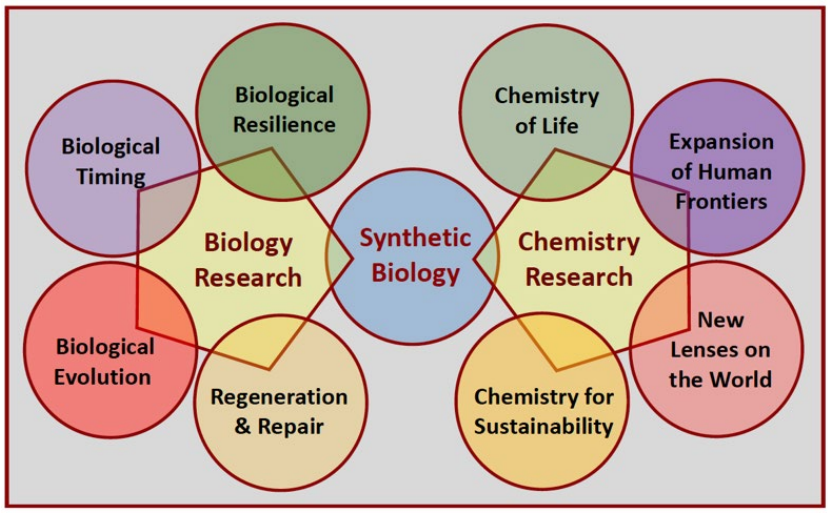
Why Texas A&M:

The sciences have long been a traditional research strength of the university, as well as a key pillar of undergraduate education. Texas A&M recently became the first Texas university to exceed $1 billion in research grants in a single year, primarily from research grants supporting the life sciences. Through strategic faculty recruitment, Texas A&M has preeminent scholars performing groundbreaking research into the basic mechanisms of life, including life sustainability, aging, tissue regeneration and repair, cancer, and immunology. Without modern laboratory facilities, however, the full potential of these scientists will not be realized. With them, $2 billion of annual research funding is just over the horizon.

Texas A&M is among the largest universities in the world. It is uniquely equipped to support this undertaking, both foundationally and logistically, with abundant land, a regional airport, and extraordinary existing resources all located within a thriving local economy.

The Research:

During the past several years, Texas A&M has implemented a strategic plan to attract, recruit, and retain some of the world's leading scientists. Not only has this plan increased the quality and quantity of research being performed, it also focused on the expansion of its research enterprise. The schematic below illustrates the focus research areas that will be housed within the CLSC.



10Y Science Research Plans:
The Biology and Chemistry departments aim to focus their faculty hiring and research initiatives over the next decade on nine areas of scientific innovation. Although each of these areas are truly multi-disciplinary, one shared focus is on **Synthetic Biology,** a new collaboration to build novel translational products designed to withstand pestilence, toxins, injury, pathogens, and drought.

Biological Resilience – Emerging area of biology spanning the sustainability of ecosystems, disease resistance in plants and animals, immunity, aging, and cancer. No university has a primary focus on resilience.

Biological Timing – Explores how organisms regulate their life and respond to external and internal changes. Irregular biological timing leads to sleep disorders, immune system dysfunction, obesity, diabetes, heart disease, and cancer. This research has implications for improving and prolonging human life.

Biological Evolution – Involves studies of genetic changes within populations and how these changes impact life. Computational research in bioinformatics and genetic modeling are the focus of quantitative, multi-disciplinary discovery into the origins of life.

Regeneration and Repair – Understanding how tissues and cells respond to injury is critical to recovery. Discoveries in cell and tissue regeneration pertaining to spinal cord injury, stem cells, aging, inflammation, infection, embryonic, and cancer are the focus of efforts in recovery of function.

Expansion of Human Frontiers – Explores extreme environments ranging from the ocean depths to the reaches of space, where the chemistry is away from equilibrium. This research pioneers the fundamental science of human exploration and habitation in extreme atmospheres, conditions, and milieus.

Chemistry of Life – Understanding the chemistry of biological processes for the design novel drugs, imaging agents, and biomaterials to combat disease. Synthetic and enzymatic chemistry to novel molecular probes will enhance our understanding of the biochemical basis life and its evolution.

Chemistry for Sustainability – Develops the chemical processes to promote new energy sources, the creation of materials that store energy, and the reclamation of recycled products, including the design of purification and remediation chemistry.

New Lenses on the World – Enables chemical technologies on ultrafast time scales, in non-equilibrium systems, across life, and interstellar spaces through the development of next-generation chemistry.

The Impact:

The CLSC advances our understanding of the universe and humanity's place in it by deciphering life's origins, decoding the complexities of human-planet interactions, and intervening in pandemics, disorders, and diseases to improve quality of human life and its sustainability on earth. Still, the excellent Texas A&M's faculty researcher must be matched with equally excellent research facilities. Continued successful recruitment and retention of top researchers will only happen if such facilities exist.

The greatest synergy among our research strategic plans lies at the interface of molecular biology and genetics and organic and inorganic synthesis, converging at the nascent field of synthetic biology. Thus, the CLSC will house the cutting-edge instrumentation and core facilities that best serve these interdisciplinary sciences and the faculty, research staff, and students who rely on them.

Genome Editing Facility (GEF): Gene editing is a type of genetic engineering where DNA is modified in an organism using "molecular scissor," TALEN, or CRISPR techniques. The GEF will be a repository of techniques and expertise for manipulating genomes in any organism.

Molecular Phenotyping Core (MPC): Molecular phenotyping uses techniques that define and quantify biological pathways, including metabolic and signaling pathways, using chemical reporters. The MPC will generate chemical profiles of pathway activities and outcomes and house state-of-the-art screening assays for mRNA expression and fusion protein abundance in organisms that have been modified through genome editing. The MPC also will conduct phenotype validation of the biological relevance of experimental products — for example, compounds generated in drug development studies.

BioInformatics Core (BIC): Bioinformatics is an interdisciplinary field that develops and utilizes tools for understanding biological data — in particular, large, complex data sets. Bioinformatic approaches promote chemical and biological research using mathematical and statistical techniques to query the complement of genes expressed by an organism. The BIC will aid in sequencing and annotating genomes and in the simulation and modeling of biomolecular interactions.

Resonance Spectroscopy Facility (RSF): The RSF will house the latest advances in NMR (nuclear magnetic resonance) analytics, including refrigerated magnet and x-ray scattering technologies. NMR spectroscopy is used to determine the structure of organic molecules, as well as in approaches in medical imaging. NMR analytics determine chemical structures and identify compounds. The RSF will also house EPR (electron paramagnetic resonance) spectroscopy for the study of organometallic structures or biological agents, such as the confirmation of novel viruses or the discovery of new signaling molecules.

Mass Spectrometry Facility (**MSF**): Mass spectrometry is an analytical technique used to measure and determine the elemental signature of a chemical or biological sample. The very high sensitivity of mass spectrometry is the future of alternative approaches to biological research, such as reimagining animal experimentation or monitoring aspects of human metabolism. The MSF will be an essential tool for metabolomic research in the CLSC.

Drug Discovery Core (DDC): In the fields of medicine, chemistry and biological science, drug discovery is the process by which new candidate medications are discovered. The DDC will house chemical libraries of synthetic small molecules that can be screened in cells or organisms to identify new therapeutics. The DDC will also create the advances in technology and the understanding of biological systems that will aid industry in the lengthy and expensive process of drug development, with the goal of generating cost-effective, novel treatment options for infectious diseases, metabolic disorders, and cancer.

Summary:

The CLSC will serve as a premier incubator for scientific research, discovery, and education. Now is the time to invest in Texas A&M's life sciences research and the training of the next generation of American scientists. Construction of the CLSC, at a cost of **$220 million for the research building** and **$30 million for the associated core technology**, will provide the physical resources to fully leverage the potential of Texas A&M scientists, bringing together the best minds and modern laboratory facilities to establish a collaborative community for interdisciplinary science and discovery.