# Research Centers

## Physical Science and Engineering Division (PSE)

The mission of the Physical Science and Engineering Division is to create

knowledge pertaining to matter at all scales (nano, meso, macro) and in all forms (from bulk to divided colloids to fluids) and to seek understanding of the interaction of matter with external stimuli to design new materials/technologies addressing the issues of our times.

Research in the Division includes areas such as theoretical physics and physical chemistry; catalysis and bioengineering; polymers and composites; energy production, storage and conversion; water purification and environmental protection; novel materials, nanodevices and systems; sensors and smart devices for the detection of pollutants and the purification of air, water, and food; earth sciences, mechanics and geomechanics; oil exploration and recovery; and CO2 sequestration.

Research in the PSE Division is driven by independent faculty labs and five Research Centers with which Faculty can affiliate to perform applied, goal-oriented research. Centers affiliated with the Division include:​

### Advanced Membranes and Porous Materials Research Center (AMPMC)

​The Advanced Membranes and Porous Materials Center (AMPMC) at KAUST develops novel materials and cutting-edge process technologies that provide solutions to challenges related to industrial separations with a particular focus on energy and water as well as environmental sustainability. Researchers in AMPMC develop membranes and porous materials for separations in the fields of natural gas and petrochemicals, carbon capture, and the production of potable as well as industrial water.

### Ali I. Al-Naimi Petroleum Engineering Research Center (ANPERC)

ANPERC produces fundamental multidisciplinary research, disruptive technologies, and academic and engineering talent to address the world's pressing energy problems from a geo-engineering perspective. Research at ANPERC focuses on developing methods for increased hydrocarbon recovery with reduced environmental and economic costs related to reservoir access and production.

### Clean Combustion Research Center (CCRC)

The challenges arising from the combustion of fossil fuels, such as pollution, global warming and climate change, are among the main concerns of researchers at KAUST's Clean Combustion Research Center (CCRC). The activities of the Center span both fundamental and goal-oriented research in fuel formulation, fuel diversity and the control of emissions from internal combustion engines to turbines. CCRC utilizes both experimental and computational tools to develop predictive capabilities to design fuels that are more efficient and less polluting. Projects include the development of innovative combustion processes with cleaner-burning fuels coupled to advanced technologies for their sustainable use with emphasis on ease of production, energy efficiency, and abatement of airborne pollution.

### KAUST Catalysis Center (KCC)

The KAUST Catalysis Center follows a multi-disciplinary approach to catalytic technologies. KCC develops new catalytic processes across the chemical, petroleum and new energies industries with the aim of increasing resource and energy utilization while reducing waste and overall environmental footprints.

### KAUST Solar Center (KSC)

The KAUST Solar Center draws together experts in materials science, chemistry and physics to explore innovative solutions for the harvesting and conversion of solar energy. KSC researchers study the fundamental processes involved in the conversion of photons into electricity and exploit their findings to design and develop the state-of-the-art materials used at the core of energy-harvesting photovoltaic panels. In addition, the Center is involved in research and development studies aimed at minimizing the cost of photovoltaic panels while optimizing their performance in the sun-bathed but hot and dusty climatic conditions of the deserts of the Arabian peninsula.

### Computer, Electrical and Mathematical Science and Engineering Division (CEMSE)

Research in the CEMSE Division clusters into four main areas:

* Electrical engineering, including the development of communication networks; CMOS integrated circuits; electronic and optics/photonics devices; micro-electro-mechanical systems (MEMS); various types of sensors, measurement and detection devices; as well as functional- and nano-materials.
* Mathematical analysis, including modeling and simulations with applications to physical, chemical, biological and environmental processes; materials science; oil exploration and reservoir management.
* Computer science and big data, including bioinformatics; and visual and extreme computing.
* Statistics and data science, including climate science, environmental statistics, and biostatistics.

Research in the CEMSE Division is driven by independent faculty labs and three Research Centers with which Faculty can affiliate to perform applied, goal-oriented research. Centers affiliated with the Division include:

### Computational Bioscience Research Center (CBRC)

​Research at KAUST's Computational Bioscience Research Center (CBRC) encompasses computational biology and bioinformatics with applications in the life sciences. Researchers at CBRC develop computationally driven methodologies, tools and resources to speed up the process of biological discovery. By developing methods to store, retrieve, organize and analyze vast amounts of data, the Center contributes to areas such as biotechnology and food, medicine, safety, and environmental protection.

### Extreme Computing Research Center (ECRC)

The Extreme Computing Research Center (ECRC) creates algorithms and develops software to harness the exponentially increasing power of computer hardware for predictive simulation and to understand and exploit the deluge of digital scientific data produced at KAUST and beyond. Researchers at ECRC focus on computational simulation and developing algorithms and applications for emerging computing architectures.

### Visual Computing Center (VCC)

Researchers at KAUST's Visual Computing Center (VCC) use multiscale modeling, multidimensional modeling and simulation techniques to develop methods to sense, model, simulate, process, understand and visualize all forms of visual information. VCC specifically develops novel applications for computational imaging and display, image and video understanding, geometric modeling and design, physical simulation and measurement and scientific visualization.

# Biological and Environmental Science and Engineering Division (BESE)

To accomplish its mission and establish a knowledge and advanced technology platform, the BESE Division organizes its research around six focal areas: environmental systems; epigenetics; functional biology; genomics; imaging/structural biology; and marine science.

These research areas build on interdisciplinary competences that are essential for studying the mechanisms through which living organisms and their environments interact, providing opportunities for new technological developments to optimize such interactions to improve the quality of life.

Researchers in BESE focus on topics relevant to the effects of the environment on organisms, the sustainable production of food, the use of high-salinity or poor-quality water, the optimization of energy used in the production of water and food, and the study and preservation of marine and coastal environments.

In addition, from time to time, the Division undertakes additional exploratory and collaborative research initiatives, with current activity in the following areas: Desert Agriculture; Neuro-Inspired High-Performance Computing; and Nutrition, Metabolism, Adaptation and Epigenetics.​

Research in the BESE Division is driven by independent faculty labs and two Research Centers with which Faculty can affiliate to perform applied, goal-oriented research. Centers affiliated with the Division include:​

### Red Sea Research Center (RSRC)

KAUST's Red Sea Research Center (RSRC) is developing an integrated understanding of the various ecosystems of the Red Sea. In particular, emphasis is placed on coral reef ecosystems and their oceanographic context. Efforts are directed at gaining an understanding of the interplay between physical, chemical, biological, and geological factors as well as the stresses arising from natural and anthropogenic causes such as overfishing, coastal development, and global climate change. A main goal of the RSRC is to develop methods to sustain and conserve coral reef environments along the coast of the Red Sea.

### Water Desalination and Reuse Center (WDRC)

Fresh water supplies across the globe are decreasing while, at the same time, production of potable water in desert and drought-ridden regions is extremely energy intensive. Researchers in the KAUST Water Desalination and Reuse Center (WDRC) focus on the development of new and optimized methods for low-energy water desalination and water reuse. The capabilities of WDRC extend from the laboratory scale to larger pilots with a view to transition the technologies to large-scale water production. While much activity is centered on membrane-based technologies, the goal of WDRC is to extend knowledge to other scalable approaches such as those involving the use of solar or waste heat as an energy source.