Assortment of common research topics in bioengineering, biotechnology, and biomedicine.

(Many of these topics are inter-related)

1. Stem Cell Research

   Laboratory studies of stem cells enables bioengineers and other scientists to learn about the cells' essential properties and what makes them different from specialized cell types. They are already using stem cells in the laboratory to screen new drugs and to develop model systems to study normal growth and identify the causes of birth defects and other existing diseases and conditions. Research on stem cells continues to advance knowledge about how an organism develops from a single cell and how healthy cells replace damaged cells in adult organisms. Stem cell research is one of the most fascinating and promising areas of contemporary biotechnology, bioengineering and biomedicine.

2. Biomaterials, Drug Delivery, and Tissue Engineering

   Research on the design, synthesis, and characterization of advanced biomaterials includes, but is not limited to:

   a) Cancer detection, therapy and prevention.
   b) Biomaterial-cell interactions in applications such as tissue engineering, advanced stem-cell culture, biosensors, and targeted drug delivery via the blood.
   c) Advanced drug delivery, ranging from polymeric aerosols that carry life-saving drugs to cationic polymer/DNA self-assembled nanocomplexes that deliver DNA to specific tissues for in vivo gene therapy.
   d) Genetically-engineered polymers for tissue engineering and drug delivery applications.
   e) Cellular biopolymers and their role in cell migration and cancer metastasis.
   f) Development of biocompatible prostheses, various diagnostic and therapeutic medical devices ranging from clinical equipment to micro-implants, regenerative tissue growth, pharmaceutical drugs and therapeutic biologicals

3. Computational Biology
   *Ranging from functional genomics to cardiac models in drug discovery and development, one of the most challenging problems in this field is to organize and interpret the vast amounts of basic data being generated in the field today from genome sequencing to protein structure determination to the determination of cellular and intercellular processing networks. Research directed to understanding the inherently complex, hierarchical relationships of biological organization is leading many engineers to novel approaches to data assimilation and handling -- approaches that are now establishing new connections between the biological sciences, chemical engineering and medicine.

4. Neural Engineering
   *Existing at the interface between neuroscience and engineering, neural engineering shares the common goal of analyzing the function of the nervous system, developing methods to restore damaged neurological function, and creating artificial neuronal systems by integrating physical, chemical, mathematical, biological and engineering tools.

5. Genome and Protein Engineering
   The field includes, but is not limited to research in quantitative analyses of chaperones, protein- and RNA-based assemblies, motor proteins, enzymes, receptors, ion channels and transport proteins, protein-ligand complexes, and viral-host complexes. Research also includes studies of chromosomes and centrosomes, proteosomes, clathrin-coated vesicles, synaptic vesicles, actin cytoskeleton, and organelle biogenesis.

6. Pharmaceutical Bioengineering
   Research areas include most molecular and cellular biology, drug discovery and design, pharmaceutics, and translational pharmaceutics.