**GLOSSARY**

**Markets**

- Medical Devices
- Pharma/Biologics
- Animal Health
- Food
- Renewable Energy
- Renewable Materials

**Enabling Technology Clusters**

- Catalysis
- Synthesis
- Nanotechnology
- Materials Science
- Bioengineering
- Clinical Capabilities
- Bioinformatics
- Systems Biology
- Genomics
- Proteomics
- High Throughput Biology
- Imaging
- Navigation
- Computer Science
- Data Management & Analysis

**Commercialization Catalysts**

- Leadership Talent
- Skilled Workforce
- Funding
- Academic Tech Transfer
- Acceleration/Incubation
- Component & Service Suppliers
- Facilities
- Business Planning
- Others TBD

**Foundational Capabilities**

- Education
- Infrastructure
- Policy

**MARKETS**

**Markets are a clustering of similar products and services based on research and enabling technologies. Markets are where the highest potential for job creation exists.**

**Markets are the domain of the private sector.**

**Medical Devices**

The Medical Device market includes all instruments, apparatuses, implements, contrivances, implants, in vitro reagents, or component parts or accessories which are used to prevent, diagnose, treat, or cure diseases or other conditions in humans or animals.

- **Devices**: are products that are used in the body or to enhance healing or quality of life.
- **Diagnostics:** are anything to detect infections or health conditions and can be used in a hospital, clinical, lab, or in-home. Diagnostic devices can be mechanical, biological, or both.
- **Other:** This category includes all medical-related products that do not fit into the devices or diagnostics categories.

**Pharma/Biologics**

The Pharmaceutical market includes traditional chemical-based drugs for the prevention, diagnosis, treatment, and cure of diseases. Traditional chemical-based pharmaceuticals are often referred to as "small molecule" drugs.

The Biologics/Biopharmaceuticals market includes drugs or other products that are derived from life forms. Biologics are biology-based products used to prevent, diagnose, treat, or cure disease or other conditions in humans and animals. Biologics generally include products such as vaccines, blood, blood components, allergenics, somatic cells, genes, proteins, DNA, tissues, recombinant therapeutic proteins, microorganisms, antibodies, immunoglobins, etc. Biopharmaceuticals are produced using biotechnology and are made from proteins, genes, antibodies, nucleic acids, etc. Biopharmaceuticals are often referred to as "large molecule" drugs.

- **Pharmaceuticals:** are chemical-based drugs, often raftered to as small molecules.
- **Biologics:** a drug, vaccine or antitoxin developed from a living organism used as a diagnostic, preventative or therapeutic agent, often referred to as large molecules.
- **Other:** This category includes all Pharmaceutical or Biologic-related products that do not fit into the pharmaceutical or biologics categories.

**Animal Health**

The animal health market includes any and all products, mechanical, electrical, chemical, software, veterinary, and biological, to prevent, diagnose, treat, or cure diseases that affect animals other than

humans. Animal Health products include feed additives, vaccines, pharmaceuticals, devices, antimicrobials, topical products, imaging, parasiticeds, diagnostics, etc.

- **Feed additives**: are any ingredients to animal food for food animals or companion animals. This includes supplements.
- **Therapies:** are products that treat animal diseases (includes devices and pharma/biologics, antimicrobials/parasiticides).
- **Diagnostics/Testing**: are devices and testing equipment for animals.
- **Vaccines:** a suspension of attenuated or killed microorganisms (such s viruses, bacteria, or rickettsiae), or of antigenic proteins derived from them, administered for prevention, amelioration, or treatment of infectious diseases in animals.
- **Other**: This category includes all Animal Health-related products that do not fit into the feed additive, therapy, diagnostic, or vaccine categories.

**Food**

The intersection of the life sciences and the Food market includes the use of scientific techniques to produce desired traits in plants or animals to enhance the quality, safety, nutritional value and variety of food and increase the efficiency of food production. It also encompasses food ingredients and nutraceuticals.

- **Nutraceuticals/Supplements**: products that are sold not as part of a food product, but as a supplement or a purified compound that claims to have health benefits.
- **Food ingredients/Products**: food ingredients and end products.
- **Seed/Plant Development**: pure agricultural biotech – how do you genetically engineer the plant or engineer the growth environment to produce desired outcomes. This category also includes plant growth.
- **Other**: This category includes all food-related products that do not into the nutraceutical or supplement, food ingredient or product, or seed/plant development technique categories.

**Renewable Energy**

The Renewable Energy market includes the various sources of renewable energy that can be applied to the transportation, electricity, residential, commercial, and industrial sectors. Examples of renewable energy sources include ethanol (corn-based, biomass-based, cellulosic, and other feedstocks), biodiesel, combustible biomass, wind, hydrogen, photovoltatic (solar), geothermal, etc. Bioscience-based energy is typically defined as renewable fuels. This definition includes all renewable energy sources, not just renewable fuels, because all of these sources of energy will become integrated over time.

- **Wind:** energy received from the movement of the wind across the earth.
- **Solar:** solar energy is the energy received by the earth from the sun.
- **Bio-Based Energy:** includes energy from biomass, including biofuels such as ethanol and biodiesel, combustible biomass, pellets, syngas, etc.

- **Energy Efficiency:** encompasses all changes that result in a reduction in the energy used for a given energy service or level of activity.
- **Other:** This category includes all renewable energy-related technologies that do not fit into the wind, solar, bio-based energy categories, such as geothermal, hydro, wave, etc.

**Renewable Materials**

The Renewable Materials market includes materials that are made from biological sources. These can be biofibers, biopolymers, biodegradable plastics, bio-packaging.

- **Chemicals**: industrial or home use chemicals such as industrial cleaners, cosmetics, creams, etc.
- **Polymers:** renewable monomers and polymers that can then be turned into end products.
- **Other**: This category includes all Renewable Materials-related products that do not fit into the chemicals and polymers categories.

# ENABLING KNOWLEDGE CLUSTERS

**Enabling Knowledge Clusters are the basic knowledge and technologies that allow the development of products.**

**Enabling Knowledge Clusters are the domain of academia and corporate R&D.**

## Catalysis

Catalysis is the process in which the rate of a chemical or biological reaction is increased by means of a chemical or biological substance known as a catalyst or an enzyme, respectively.

## Synthesis

Synthesis is a purposeful execution of chemical or biological reactions in order to get a product or several products.

## Bioengineering

Bioengineering is the application of a systematic, quantitative, and integrative way of thinking about and approaching the solutions to problems important in biology, medical research, clinical settings, and population studies. It integrates physical, chemical, or mathematical sciences and engineering principles for the study of biology, medicine, behavior, or health.

## Clinical Capabilities

Clinical capability is the ability to deliver health care in a systematic setting and the ability to conduct research on new diagnostics and therapies in a health care or clinical setting that may involve support from contract research organizations.

## Bioinformatics

Bioinformatics is the research, development, or application of computational tools and approaches for expanding the use of biological, medical, behavioral or health data, including those to acquire, store, organize, archive, analyze, or visualize such data. It is closely related to Computational Biology, which is the development and application of data-analytical and theoretical methods, mathematical modeling and computational simulation techniques to the study of biological, behavioral, and social systems.

## Systems Biology

Systems biology is the study of biological systems to elucidate their components and their dynamic interplay in order to understand the functioning of the system as a whole. Systems biology is the study of an organism, viewed as an integrated and interacting network of genes, proteins and biochemical reactions which give rise to life. Instead of analyzing individual components or aspects of the organism, such as sugar metabolism or a cell nucleus, systems biologists focus on all the components and the interactions among them, all as part of one system.

**Genomics**

Genomics is the study of an organism's entire genome. This includes determining the DNA sequence and genetic mapping.

**Proteomics**

Proteomics is the study of proteins, particularly their structures and functions.

**High Throughput Biology**

High Throughput Biology includes using the techniques from biology, physics, chemistry, mathematics, computer science and engineering to speed research and knowledge creation. It is the basic technology that supports the rapid screening and development of new biologic and chemistry-based products.

**Nanotechnology**

Nanotechnology is the understanding and control of matter at dimensions between approximately 1 and 100 nanometers, where unique phenomena enable novel applications. Encompassing nanoscale science, engineering, and technology, nanotechnology involves imaging, measuring, modeling, and manipulating matter ay this length scale.

**Materials Science**

Materials science is an interdisciplinary field involving the properties of matter and its applications to various areas of science and engineering. The science investigates the relationship between the structure of materials and their properties. It includes elements of applied physics and chemistry, as well as chemical, mechanical, civil, and electrical engineering.

**Imaging**

Imaging science is concerned with the generation, collection, duplication, analysis, modification, and visualization of images. As an evolving field, it includes research from physics, mathematics, electrical engineering, computer vision, computer science, and perceptual psychology, among others.

**Navigation**

Navigation is the integration and registration of medical devices that are used to deliver therapies and create an image to allow for precise delivery of therapies or diagnostic capabilities to identified target locations.

**Computer Science**

Computer science is the study of the theoretical foundations of information and computation and their implementation and application in computer systems. This includes the study of the storage, transformation, and transfer of information. The field encompasses both the theoretical study of

algorithms (including their design, efficiency, and application) and the practical problems involved in implementing them in terms of computer software and hardware.

**Data Management & Analysis**

Data management is the development and execution of architectures, policies, practices, and procedures that properly manage the full data lifecycle needs of an enterprise.

## COMMERCIALIZATION CATALYSTS

**Commercialization Catalysts are generic environmental and infrastructural support to convert knowledge into products. They link and leverage talent to achieve more effective and efficient use of resources, time and leadership.**

**Commercialization Catalysts are the domain of the public, private, and academic sectors**

**Leadership Talent**

- Leadership talent is defined as having access to leaders who are experienced CEOs, executives, and advisors who are willing to help guide and build a structure around the technology to commercialize the product and get it to the marketplace. Leadership has both a strong academic and private sector experience base.

**Skilled Workforce**

- A skilled work force is necessary for achievement in the biosciences. This includes adequate training programs, links between industry and academia, and quality mentorship programs.

**Funding**

- Funding is critical to starting a business. Funding for businesses comes from several different areas, including:
    - Traditional: This includes obtaining loans from banks to start a business.
    - Venture Capital: Venture Capital is a type of private equity capital that is generally held by professional organizations that invest the money businesses in exchange for an equity stake in the company. Venture capital may be invested at any stage of the business development cycle, although it is more likely to be invested in later stages of development.
    - Angel: Angel funders are high-net worth individuals who provide money to start up a business in return for a convertible debt or ownership stake in the company. Often times angel investors pool resources in the form of an angel network.
    - Grants: Grants are "gifts" of money that are provided to businesses for a specific purpose. Grants can be provided by many sources, including non-profit organizations, foundations, government agencies, or other sources.
        - SBIR/STTR

**Academic Tech Transfer**

- Academic tech transfer capabilities are critical to ensuring that the innovative research conducted at academic institutions has an avenue to be further developed and commercialized for the benefit of the public. Tech transfer capabilities include patent support, commercialization support, funding support, management support, licensing, or other assistance in helping discoveries made at the academic institution become a product available to consumers.

**Acceleration/Incubation**

- Incubation is a shared and often subsidized space where companies can locate in their early stages to continue their product development work. Acceleration is space, plus the addition of money, management, technical resources, and other skills that help a business speed up its product development timeline.

**Component & Service Suppliers**

- Component and service suppliers are those companies and organizations that provide needed expertise to help companies commercialize their products. They can be contract research support, manufacturing support, design support, component suppliers, legal counsel, regulatory services, etc.
- Component and Service Suppliers can be broken out into several categories, including product design, regulatory, manufacturing and distribution, operations, and others.

**Product Design:** includes service providers that can design, prototype, and provide small scale manufacturing.

- **Testing & Lab Services:** includes services such as materials testing, process testing, toxicology, etc.
- **Engineering and Design:** product, device or system design.
- **Other:** include any other product design service that does not fit into testing and lab services or engineering and design services.

**Regulatory**

- **Permitting & Sighting**: includes all organizations that can assist in obtaining permits for a life science-related activity and can assist in determining where to place a facility or product installation. Permitting and sighting services are mainly needed in the Renewable Energy, Renewable Materials, Animal Health and Food industries, but can be applicable to all life science industries.
- **Certification**: organizations that can assist companies in obtaining product certification from organizations such as the FDA, USDA, UL, other s.
- **Environmental**: organizations that can assist companies in meeting environmental requirements.
- **Preclinical & Clinical Studies:** organizations that conduct preclinical and/or clinical trials to evaluate the effectiveness and safety of medications or medical devices by monitoring their effects on large groups of people.

- **Reimbursement**: organizations that can help companies in obtaining reimbursement for using specific products or procedures. Reimbursement is mainly an issue for human health-related companies.
- **Compliance**: organizations that can assist companies in quality assurance, quality control, and other regulations regarding quality, good manufacturing practices or good laboratory practices.
- **Other:** any organization that provides some form of regulatory assistance not covered by the above categories.

**Manufacturing & Distribution**

- **Manufacturing**: contract manufacturers to the six bioscience industries.
- **Installation/Maintenance**: contractors that install and provide maintenance of systems.
- **Materials Handling**: a logistics function such as warehousing goods or transporting and storing pellets for Renewable Energy systems.
- **Packaging:** contract packaging companies.
- **Distribution**: logistics and distribution companies.
- **Other:** any organization that provides services in the manufacturing and distribution space that do not fall into any of the above categories.

**Operations**

- **Facilities/Incubators**: assistance with finding or maintaining a facility; accelerators and incubators.
- **Business Planning**: consultants or organizations that help with business plan development or business strategy.
- **Funding:** angel, debt, venture capital, and private equity organizations.
- **Financial**: organizations that can help with accounting, audits, contract financial work, etc.
- **Marketing & Sales**: organizations focused specifically on marketing and sales in the life science industries.
- **Equipment**: suppliers of equipment to a specific industry.
- **Information Systems:** combination of hardware, software, infrastructure and trained personnel organized to facilitate planning, control, coordination, and decision making for businesses and organizations.
- **Legal**: any type of relevant legal services, such as general business counsel, IP, regulatory, M&A Securities and Exchange, etc. to life science companies.
- **Leadership Talent**: organizations that provide C-level talent, including CEO/Executive mentor programs, search agencies, head hunters, etc.
- **Skilled Workforce:** organizations that provide workforce for life science companies, including educational programs and staffing agencies.
- **Other**: any operations-related services that do not fall into the above categories.

**Other**

- Other component and service supplier-related organizations whose work does not fall into the above categories.

# FOUNDATIONAL CAPABILITIES

**Foundational Capabilities are the fundamental building blocks that underlie any life science or business endeavor.**

**Foundational Capabilities are the domain of the Public Sector.**

## Education

A high quality education system from Pre-K, through K-12, and into higher education, with particular strength in math, biology and other sciences are required to support a bioscience economy.

## Infrastructure

Basic infrastructure, such as roads, sewers, buildings, internet/telecommunications capabilities, and other amenities must be in place to support the development of businesses in the community. Infrastructure is of special importance to new industries where no current infrastructure exists to support this new type of technology-based business.

## Policy

There must be sound public policy concerning the regulation of business and sciences to support the bioscience industry sector. In addition, there need to be public policy decisions that help to catalyze innovation and formation of new industries and companies. It is important that catalysts are targeted to encourage and leverage private sector investment.

## Additional Definitions

- **Convergence (Medical Device and Pharma/Biologics):** the merging of distinct technologies, industries, or devices into a unified whole.
- **Biotechnology:** the manipulation (as through genetic engineering) of living organisms or their components to produce useful usually commercial products.
- **Bioscience:** the study of biology wherein all the applicable sciences (physics, chemistry, etc.) are applied.
- **Biobusiness:** economic activity related to the development or commercialization of bioscience or bioscience related technologies, products or services.