Biomedical Research Methods

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Research Methods

- **Biomedical research** is the broad area of science devoted to the study of the processes of life, the prevention and treatment of disease, and the genetic and environmental factors related to disease and health. It involves the investigation of biological processes and the causes of disease in humans and animals through careful experimentation, observation, analysis, laboratory work, and testing. Biomedical researchers look for ways to prevent, treat, and cure diseases that cause illness and death in people and animals.

Basic Research

- This research is done to increase our fundamental knowledge of how the processes in living organisms function and develop. This research provides the building block upon which other types of biomedical research (applied and clinical) are based.

Applied Research

- This research is directed towards specific objectives and discoveries, such as the development of a new drug, therapy, medical device, or surgical procedure. It involves using existing knowledge (obtained from basic research) and applying it to a specific biomedical problem. This research can be done with animals, non-animal alternatives (computers, cell/tissue cultures), or with humans.

- **In vitro research**- (Latin for “in the glass") is research done with bacteria, cell, tissue, and organ cultures done in laboratories.
- **Ex vivo research**- (Latin for “out of the living") is research done in or on living cells or tissues from an organism and cultured in a laboratory, outside of the living organism. The cultures can serve as models of the entire organism, helping to reduce the need for in vivo research.
- **In vivo research**- (Latin for “in the living") is research done in a whole organism. Pre-clinical trials and clinical trials are examples of this research.

Translational Research

- The scope of translational research is relatively new so definitions of the term tend to vary. Translational research- between basic science and clinical trials- involves transforming laboratory findings into new ways to diagnose and treat patients that can be used clinically or brought to the market for commercialization. The first application for the National Institutes of Health's Clinical and Translational Science Awards (CTSAs) defined translational research as:

- *Translational research includes two areas of translation. One is the process of applying discoveries generated during research in the laboratory, and in preclinical studies, to the development of trials and studies in humans. The second area of translation concerns research aimed at enhancing the adoption of best practices in the community.*

- The key to translational research is to make sure the advances and discoveries made in the laboratory and in preclinical studies find their way into the clinic and into the lives of the patients for whom they are intended and that the treatments are properly implemented. This refers to the “bench-to-bedside" approach that involves taking knowledge from basic science research to produce new drugs, devices, and treatments for patients.