What is Basic Biomedical Research?

What do you think of when you hear the term "basic research?" Does a picture of a scientist in a white lab coat working feverishly with test tubes, bacterial cultures and beakers of boiling chemicals come to mind? How about a scientist sitting in front of a computer working on complicated mathematical calculations that could explain the action of certain physiological processes? What about a field researcher observing the behavior of wild animals as they try to survive in nature? If you pictured any one of these or something similar, you were on the right track. All of these are examples of basic research.

Basic research is research conducted to increase fundamental knowledge and understanding of the physical, chemical and functional mechanisms of life processes and disease. It is not directed to solving any particular biomedical problem in humans or animals. This type of research often involves observing, describing, measuring and manipulating natural systems. It provides the building blocks upon which other types of research are based.

Basic research is often the hardest type of research to define because it is an area of science seeking to answer fundamental questions that are not necessarily focused on any specific disease or disorder. In most cases basic scientists are seeking to add to the primary storehouse of knowledge by explaining how processes in living organisms develop and function. If we don't know how a life process functions normally, we won't know how to recognize and treat it when it functions abnormally. Results from basic research add pieces to the immensely complex puzzle of life.

A researcher often cannot predict exactly how his or her work will contribute to the solution of a particular medical advance. In a study of the top 10 developments in cardiovascular and pulmonary medicine, Comroe and Dripps found that over 40 percent of the research needed to realize a particular advancement was conducted by a scientist whose goal at the time was unrelated to the medical advancement.\(^1\)

\(^1\) Comroe, Jr., J.H. and Dripps, R.D. (1976). Scientific basis for the support of biomedical science, Science, 192, 105-111.

(Information for this section is used with permission from Science for Life: Exploring Animal Models in Biomedical Research, ©1993, Florida State University.)
What is Applied Research?

Applied research is directed toward specific objectives such as the development of a new drug, treatment or surgical procedure. It involves the application of existing knowledge, much of which is obtained through basic research, to a specific biomedical problem. Applied research can be conducted with animals, humans or with nonanimal methods such as with computer models or tissue cultures.

Behind most every health advance exists years of applied research. The next time you hear of a new medical advance, write it down. Then ask yourself, “What would I have to know before I could achieve this advancement?” All of the items you list are most likely examples of applied research.

In the area of cancer research, the primary aim is to provide results that are intended to be applicable to the prevention, diagnosis or treatment of human cancer, or to the rehabilitation of the cancer patient. These types of research are not yet ready for application in humans.

Examples of applied cancer research include:

- the synthesis of new anti-cancer drugs
- studies of human growth factors leading both to diagnostic and therapeutic applications
- the production of monoclonal antibodies for potential use in the diagnosis and treatment of human cancer
What is Clinical Research?

Information gained through basic and applied research often leads to potential treatments to prevent or cure disease. Once all other forms of study and testing have taken place, scientists look to clinical research to test potential drugs and treatments in humans. This research builds upon that done in the basic and applied research stages. However, clinical research is not always the end of the process. Often, it leads back to the lab, where further research is done. It is this interdependence that at times makes science seem so complex.

Clinical research takes place in a hospital or other clinical setting for health care and directly applies to the prevention, diagnosis or treatment of a specific disease in an individual or group of individuals, or to the rehabilitation of the patient. Clinical research includes a broad variety of activities, and there are many areas of study. These areas include human clinical trials, psychosocial and behavioral research and disease-control research.

Scientists and other biomedical researchers are continually striving to improve human health care, and the success of new surgical techniques and other therapies to reduce human pain and suffering capture media and public attention.

In the area of cancer research, basic and applied research findings have led the way to clinical research focused on prevention and/or early detection such as:

- Pap test: Dr. George Papanicolaou’s studies showed that a sample of cells from a patient’s cervix could detect the early stages of cancer. The Pap test has helped to produce a 70 percent reduction in the number of deaths due to cervical cancer.

- Smoking: Research findings that showed lung cancer is significantly associated with smoking and that smokers die more often of heart attacks formed the basis of the American Cancer Society’s smoking control programs.

(Information for this section is used with permission from Science for Life: Exploring Animal Models in Biomedical Research, 1993, Florida State University.)