Basic, Clinical and Translational Research: What’s the Difference?

Together, they form a continuous research loop that transforms ideas into action.

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“Research” is a broad stroke of a word, the verbal equivalent of painting a wall instead of a masterpiece. There are important distinctions among the three principal types of medical research—basic, clinical and translational.

Whereas basic research is looking at questions related to how nature works, translational research aims to take what’s learned in basic research and apply that in the development of solutions to medical problems. Clinical research, then, takes those solutions and studies them in clinical trials. Together, they form a continuous research loop that transforms ideas into action in the form of new treatments and tests, and advances cutting-edge developments from the lab bench to the patient’s bedside and back again.

Basic Research

When it comes to science, the “basic” in basic research describes something that’s an essential starting point. “If you think of it in terms of construction, you can’t put up a beautiful, elegant house without first putting in a foundation,” says David Frank, MD, Associate Professor of Medicine, Medical Oncology, at Dana-Farber Cancer Institute. “In science, if you don’t first understand the basic research, then you can’t move on to advanced applications.”

Basic medical research is usually conducted by scientists with a PhD in such fields as biology and chemistry, among many others. They study the core building blocks of life—DNA, cells, proteins, molecules, etc.—to answer fundamental questions about their structures and how they work.

For example, oncologists now know that mutations in DNA enable the unchecked growth of cells in cancer. A scientist conducting basic research might ask: How does DNA work in a healthy cell? How do mutations occur? Where along the DNA sequence do mutations happen? And why?

“Basic research is fundamentally curiosity-driven research,” says Milka Kostic, Program Director, Chemical Biology at Dana-Farber Cancer Institute. “Think of that moment when an apple fell on Isaac Newton’s head. He thought to himself, ‘Why did that happen?’ and then went on to try to
find the answer. That's basic research.”

**Clinical Research**

Clinical research explores whether new treatments, medications and diagnostic techniques are safe and effective in patients. Physicians administer these to patients in rigorously controlled clinical trials, so that they can accurately and precisely monitor patients’ progress and evaluate the treatment’s efficacy, or measurable benefit.

“In clinical research, we’re trying to define the best treatment for a patient with a given condition,” Frank says. “We’re asking such questions as: Will this new treatment extend the life of a patient with a given type of cancer? Could this supportive medication diminish nausea, diarrhea or other side effects? Could this diagnostic test help physicians detect cancer earlier or distinguish between fast- and slow-growing cancers?”

Successful clinical researchers must draw on not only their medical training but also their knowledge of such areas as statistics, controls and regulatory compliance.

**Translational Research**

It’s neither practical nor safe to transition directly from studying individual cells to testing on patients. Translational research provides that crucial pivot point. It bridges the gap between basic and clinical research by bringing together a number of specialists to refine and advance the application of a discovery. “Biomedical science is so complex, and there’s so much knowledge available.” Frank says. “It’s through collaboration that advances are made.”

For example, let’s say a basic researcher has identified a gene that looks like a promising candidate for targeted therapy. Translational researchers would then evaluate thousands, if not millions, of potential compounds for the ideal combination that could be developed into a medicine to achieve the desired effect. They’d refine and test the compound on intermediate models, in laboratory and animal models. Then they would analyze those test results to determine proper dosage, side effects and other safety considerations before moving to first-in-human clinical trials. It’s the complex interplay of chemistry, biology, oncology, biostatistics, genomics, pharmacology and other specialties that makes such a translational study a success.

Collaboration and technology have been the twin drivers of recent quantum leaps in the quality and quantity of translational research. “Now, using modern molecular techniques,” Frank says, “we can learn so much from a tissue sample from a patient that we couldn’t before.”

Translational research provides a crucial pivot point after clinical trials as well. Investigators explore how the trial’s resulting treatment or guidelines can be implemented by physicians in their practice. And the clinical outcomes might also motivate basic researchers to reevaluate their
original assumptions.

“Translational research is a two-way street,” Kostic says. “There is always conversation flowing in both directions. It’s a loop, a continuous cycle, with one research result inspiring another.”

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