# What is Needed to Promote Translational Research and How Do We Get it?

*Deborah R. Zucker, PhD, MD*

**Key Words:** translational research, innovation, interdisciplinary research, diffusion of innovation, series introduction

(*J Investig Med* 2009;57: 468–470)

To introduce this series on *Strategies for Innovation and Interdisciplinary Translational Research*, I want briefly to frame some of the issues we will be exploring. To do that, it is helpful first to define some of the terms in our series' title, namely translational research, innovation and interdisciplinary research and to consider their connections.

## TRANSLATIONAL RESEARCH

The term "translational research" is now being used to describe many things-both types of research as well as research processes.[1] According to an National Institutes for Health (NIH) Office for Translational Research (http://www.niehs.nih.gov/about/od/otr/), the definition of translational research differs even among NIH institutes. However, common to these definitions is the concept of using research to realize tangible benefits for individual and population health. This concept is clearly not new and is a basic underpinning of public support for biomedical research. Read most NIH grant applications, and you will find an outlining of how the proposed specific aims, even when basic and circumscribed, will help to realize better health. However, interest in demonstrating the "translational" nature and the connections of research to tangible beneficial goals has been reinvigorated by the explicit attention to "translational research" in the NIH roadmap initiatives and its priority for funding these types of projects.[2]

Often cited when describing translational research, particularly for clinical investigation, is a model put forth in a report from the Institute of Medicine's Clinical Research Roundtable on *Challenges facing the Clinical Research Enterprise*.[3] It depicts the clinical research continuum progressing from "basic biomedical research" to "clinical science and knowledge" to "improved health" and identifies the potential barriers to progress along this continuum as "translational blocks." Impediments to activities involved in transforming basic laboratory research findings into clinical sciences and human subjects' applications (historically also termed *development* research—as in product development) are called the T1 or first translational blocks. Hindrances in the processes that "translate research into practice"[4] and transfer new clinical and human studies knowledge into clinical decisions and practices are termed the T2 or second translational blocks.

Although this clinical research continuum model depicts 3 anchoring steps with these 2 "translational" transitions (T1 and T2), in actuality it is a multitude of steps and transitions that span the continuum and also form circles (Fig. 1). Research ideas often originate from observations in clinical practice and from looking to address public health and policy concerns. Thus, these clinical and real-world observations in addition to the results from prior research all form the basis for designing new research projects. The latter steps then become the first steps in new circles of investigation.

Because the word to "translate" is being used both in its meaning—*to transform* and *to transfer*[5]—it can describe almost any forward motion in a research to health pathway. The question to address is then how, from wherever you are focused along the continuum, can the forward motion toward your identified (intermediate and ultimate) goals be accelerated? Analogous to biochemical pathways, one way to increase output from the research pipeline might be to infuse more bright ideas—novel concepts to develop (substrates) and new ways to improve the pace of the development and implementation processes (catalysts). Bright new ideas then bring us to *innovation.*

## INNOVATION

Innovation connotes something novel, original, visionary, and, hopefully, improved. It can be a new idea or method or a new use for or way of using something that has been around for a while. Innovation also suggests both novelty and the introduction (envisioned or an actual application) of something new.[5] To my knowledge, there is no single formula for scientific innovation, and there are many theories about how innovation comes about and might be fostered. Critical thinking is thought to be integral to scientific research for evaluating the designs, the logic, and the validity of conclusions drawn—"analysis, judgment and argument."[6] However, for innovation, one needs to generate new ideas and hypotheses. This creative process requires proactive thinking, also termed lateral thinking, and a mechanism thought to promote lateral thinking is to induce changes to the usual way a person thinks about problems and solutions.[7] Conceptual creativity might thus result from bringing things together in a novel way, looking at things from a different vantage point, or thinking about something you have not thought about before. Many landmark advances in science have resulted from people who crossed into new fields to introduce techniques or ways of looking at problems from one discipline into another—which brings us to *interdisciplinary research*.

## INTERDISCIPLINARY RESEARCH

The terms interdisciplinary, multidisciplinary, cross-disciplinary or transdisciplinary are being used to describe the bringing together of different disciplines in and for research.

From the Institute for Clinical Research and Health Policy Studies Tufts Medical Center, Boston, MA.
Received December 7, 2008.
Accepted for publication December 9, 2008.
Reprints: Deborah R. Zucker, PhD, MD, Institute for Clinical Research and Health Policy Studies Tufts Medical Center, 800 Washington St, Box #63 Boston, MA 02111 (e-mail: dzucker@tuftsmedicalcenter.org).
Funding: The workshop was supported by a grant from the National Center for Research Resources (5R13RR023236-02) and its contents are solely the responsibility of the presenters/authors and do not represent the official views of either the NIH/NCRR or the AFMR.

ISSN: 1081-5589
DOI: 10.231/JIM.0b013e31819824d8

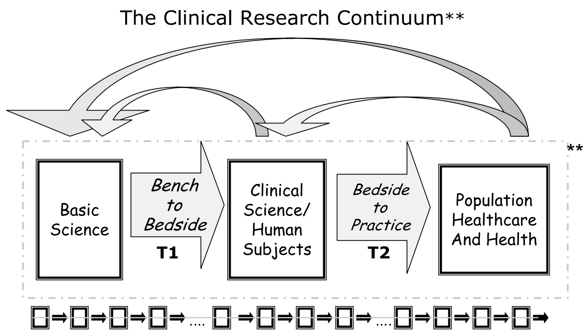


**FIGURE 1.** Model of the Clinical Research Continuum adapted from the model of the Institute of Medicine's Clinical Research Roundtable: Sung et al JAMA 289(10):1279.

Multidisciplinary has often been used when representatives from varied fields come together to each contribute their respective expertise to a project.[8] Interdisciplinary is often focused on the outcome from a meshing of understandings and methods from different fields into a new synthesized outcome or approach and in some cases, a new discipline. Consider bioengineering, an interdisciplinary blending of engineering and biology, in contrast to a multidisciplinary team in which an engineer and a biologist each provide their individual specialized knowledge to a project. In practice, distinctions between these terms are not well demarcated because they, too, likely represent points on a continuum where there is an increasing degree of integration of the fields' theories and practices. Importantly, although interdisciplinary research might help in promoting creative thinking to generate innovations, multidisciplinary implementation is often needed to make use of the idea in practice and attain the intended goal.

## Diffusion of Innovation

The anchors presented in the clinical research continuum model[3] highlight some additional complexities in thinking about translational research, the clinical research continuum and how to accelerate progress. The 3 anchoring steps combine types/arenas of research (basic biomedical science in step 1 and clinical science in step 2) together with goals of research (clinical knowledge in step 2 and improved health in step 3). The respective translations then include evolutions in theory and practice and in idea product generation and their implementation and use. In this big picture model, the T2 activities are those which focus on the dissemination of the research results (knowledge or products/interventions) into clinical practice to attain the outcome (improved health). But no matter where you focus along the continuum your anchors or goals (Fig. 2)– for example, molecule to cell to tissue, mouse to monkey to man, individual to group to population, evidence to policy to practice, knowledge to product to treatment, intervention to implementation to outcome—the diffusion of innovation is required for progress along the continuum. Researchers of all types need to convince others (and each other) of their findings and conclusions—just as clinicians, patients, and policy makers need to be convinced by researchers and each other about usefulness in practice. Rogers[9] in his landmark book, outlined key steps for the Diffusion of Innovations: knowledge, persuasion, decision, implementation, and confirmation (Fig. 2). These basic steps are essentially the same whether the innovation is a new theory, product, or process. Knowledge is the new understanding, idea, or innovation (eg, a new compound envisioned and developed based on a research result). Persuasion is informing (convincing) others—researchers, funders, clinicians, insurers, and so on—of that knowledge. Once informed, they decide whether to accept the knowledge and its consequent action (ie, the actions that follow from that knowledge). Implementation is action on that decision, and then confirmation is the assessment of whether the outcomes align with what was initially envisioned and anticipated. This is an iterative process (Fig. 2), and central to advancement along the innovation, development, and implementation continua. It is a multistep and a multilevel process, that includes (research-based) innovation, the diffusion of innovation, and research on the diffusion of innovation.

## Getting There From Here

Recognizing these complexities, what is really needed to optimally attain our clinical research goals–and what are the blocks? Many research projects look to investigate something new—but how many projects are really paradigm shifting breakthroughs of the type described by Kuhn[10] that revolutionize scientific thinking and investigation? Thomas Edison reportedly said "Genius is 1% inspiration and 99% perspiration."[11] Is it a lack of new ideas that is slowing the pace of our output? Or rather, is it how we pick among the many ideas, the processes by which ideas are developed into new interventions, how new products/processes are implemented and used in practice, or perhaps the ways we choose what and how we research and which results we believe? How much of what is needed is inspiration versus perspiration—and facilitation (eg, funding)?

The answer likely is not an either/or response but calls for attention to all these aspects. In this series, we chose to start by focusing on innovation and what might promote it. One approach might be stimulating lateral thinking through interdisciplinary research (bringing together common things in a novel way, taking ideas from one field and applying them to another or perhaps switching one's approach from testing favorite hypotheses to accounting for unexpected findings).[12] Water coolers may still be discussion facilitators, but other mechanisms are now needed to bring together people from different locations and fields for productive discussions. We can physically bring people together, but how does that result in interdisciplinary research and then innovation?

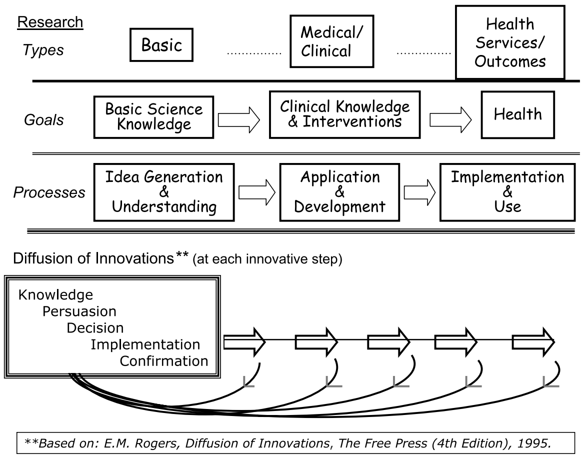


**FIGURE 2.** Anchors in the clinical research continuum and the diffusion of innovation.

One possibility is to identify where interests intersect. For some, this connector may be a similar topic of interest—a common research question being studied in a variety of different ways (eg, the many research approaches to preventing obesity). Alternatively, a method or technique might provide a common language even when applied to a lot of different questions (eg, techniques to study associations between many different conditions and genetic loci). For these approaches to succeed, the people involved need intersecting interests and appropriate training to enable productive interaction. Training includes methods techniques and the capability to integrate a "breadth of interest with disciplinary depth and skills"[6] for critical thinking, problem solving, hypothesis generation, innovation, and conflict resolution.

Like translational research, promoting interdisciplinary research is not a new concept. Although there has long been talk about promoting translational and interdisciplinary research, current systems may not promote (figuratively or literally) this work and the faculty doing it. Studies have looked to identify the factors influencing interdisciplinary research success.[6] One such study, funded by the National Science Foundation, examined the influence of extrinsic (funders, etc), intrinsic (researchers, students, etc), and institutional factors.[8] Their results suggested that systemic factors and specifically physical infrastructure and rewards structuring might favor mono-disciplinary rather than interdisciplinary work. In addition, there may be "tension between the scientific promise of the interdisciplinary path and the academic prospect of the tenure track."[13] These assessments were done several years ago and since then there have been new developments including the implementation of NIH roadmap initiatives.

This series of manuscripts presents some of the newer models and approaches being taken to promote innovation and interdisciplinary translational research and to consider the following: (1) what promotes medical research creativity and innovation, (2) how we might bridge research across disciplines and from bench to bedside to practice, and (3) how this impacts career and research program development. The articles describe some new infrastructure innovations and reflect on whether they are steering us in the right direction, what else might be needed, and how we might get there from here.

## REFERENCES

1. Woolf SH. The meaning of translational research and why it matters. *JAMA*. 2008;299(2):211–213.
2. NIH roadmap Initiative. [NIH Website] Available at: *http://nihroadmap.nih.gov/initiatives.asp.* Accessed October 12, 2008.
3. Sung NS, Crowley WF Jr, Genel M, et al. Central challenges facing the national clinical research enterprise. *JAMA*. 2003;289(10): 1278–1287.
4. Translating Research Into Practice (TRIP) – II. [AHRQ Website] March, 2001; Available at: http://www.ahrq.gov/research/trip2fac.htm#Initiative. Accessed November 3,2008.
5. *Merriam-Webster's Collegiate Dictionary.* Springfield, MA: C&G Merriam Company; 1977.
6. The National Academies. *Facilitating Interdisciplinary Research*. Washington, DC: The National Academies Press; 2005.
7. DeBono E. *De Bono's Thinking Course*. Revised ed. New York, NY: Facts on File, Inc; 1994.
8. Rhoten D. Interdisciplinary research: Trend or transition. *Social Science Research Council*. 2004;5(1-2):6–11. Available at: http://publications.ssrc.org/items/items_5.1-2/interdisciplinary_research.pdf. Accessed November 21, 2008.
9. Rogers EM. *Diffusion of Innovations*. 4th ed. New York,NY: The Free Press; 1995.
10. Kuhn TS. *Thel Structure of Scientific Revolutions*. 2nd ed. Chicago, IL: University of Chicago Press; 1970.
11. *The Columbia World of Quotations*. New York: Columbia University Press, New York; 1996 Available at:*www.bartleby.com/66/.* [accessed November 12, 2008].
12. Dunbar K. Concept discovery in a scientific domain. *Cogn Sci*. 1993;17:397–434.
13. Rhoten D, Parker A. Education. Risks and rewards of an interdisciplinary research path. *Science*. 2004;306(5704):2046.