

## EDITORIAL COMMENT

# The Basic Science That Is Epidemiology\*

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A few weeks ago Alberts et al. (1) published a Perspective in the *Proceedings of the National Academy of Sciences of the United States of America* with the attention-grabbing title, “Rescuing US Biomedical Research From Its Systematic Flaws.” The authors noted that we suffer from “a severe imbalance between the dollars available for research and the still growing scientific community in United States.” At the National Institutes of Health (NIH), we are painfully aware of this because, over the past 10 years, we have seen a steady decline in purchasing power while the number of grant applications has increased and success rates have decreased. In 2000, while the NIH doubling was still underway, 32% of R01 grant applications were funded; in 2013, that proportion had fallen to 17% (2).

Alberts et al. (1) ascribe the current dilemma to “a long-standing assumption that the biomedical research system in United States will expand indefinitely at a substantial rate. We are now faced with the stark realization that this is not the case.” Other thought leaders have made similar statements (3), with 1 even going so far as to say that the biomedical research enterprise suffers from “an addiction to rampant expansionism” (4). In any case, whatever the underlying cause, 1 of the clear consequences of the imbalance between research supply and demand is an environment of “hypercompetition,” which Alberts et al. (1) fear

“suppresses the creativity, cooperation, risk taking, and original thinking required to make fundamental discoveries.” In other words, hypercompetition has led to an inappropriately increased emphasis on translational and applied research, along with a potentially dangerous neglect of basic research.

At about the same time that Alberts et al. (1) published their paper, Story Landis (5), director of the National Institute of Neurologic Diseases and Stroke (NINDS), posted a fascinating blog on secular changes in the nature of research supported by her Institute. Dr. Landis’ colleagues at NINDS went through the painstaking task of coding thousands of grants that were funded over a 15-year time span according to a continuum of basic and applied research. Noting that official definitions of basic and applied research were not helpful, the NINDS staff defined basic research as “an understanding of the structure and function of the nervous system,” whereas applied research was “aimed at developing and testing diagnostics, therapeutic agents, or preventive interventions.” They sub-classified basic research into “basic/basic,” which “focused on understanding the normal nervous system,” and “basic/disease-focused,” which “focused on understanding disease mechanisms.” The NINDS found a marked decline in support for basic research (from 87% to 71% of expenditures), accompanied by a marked increase (from 13% to 29%) in applied research; the decrease in basic research was primarily fueled by a decline in basic/basic work (from 52% to 27%). The analysts are now exploring the causes behind the decline in basic/basic research; it appears that a substantial component may stem from fewer applications, perhaps because investigators think that the NINDS is simply not interested.

I was fortunate to have the opportunity to meet with the NINDS team that performed these analyses and used the chance to explore with them where population-based epidemiology fits in. About 25 years ago, I did my research training at the Framingham Heart Study in Massachusetts by working

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on a project on the associations in healthy people of left ventricular mass with blood pressure and body mass index (6). By the NINDS definitions, my work would have been classified as basic/basic. As we discussed this, I was reminded that epidemiology has been characterized as “the basic science of public health.”

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In this issue of *JACC*, Lieb et al. (7) present a careful analysis of the natural history of left ventricular geometry in the Framingham Heart Study cohort. The investigators followed 2,604 unique and mostly healthy participants who underwent 4,492 echocardiographic examinations. They found that approximately one-third of individuals with normal geometry at baseline developed abnormal geometric patterns, including concentric remodeling, concentric hypertrophy, and/or eccentric hypertrophy. One of the more common temporal changes was a transition from concentric to eccentric hypertrophy. The most important correlates of adverse changes in geometry were older age, male sex, higher blood pressure, and greater body mass index. These findings are remarkable because the population studied was relatively young (mean age in the early to mid-50s) and had normal levels of blood pressure at baseline; only a minority smoked, received drugs for blood pressure, had diabetes, or was obese. The potential importance of these findings may stem from the additional observation that development of abnormal left ventricular geometry predicted a higher risk of cardiovascular disease events. In their appropriately cautious discussion, the authors note that their findings are consistent with earlier animal research and with what limited human data exist.

The work of Lieb et al. (7) represents a solid piece of population-based epidemiology, one that in the context of the overall literature may lend important insights into the dynamic nature of left ventricular geometry in human health and disease. It also exemplifies the role of epidemiology as one of many disciplines of basic science, science whose

fundamental discoveries can be expected to lead to improvements in human health, although in ways that are impossible to predict. Moreover, just as NINDS basic science support is waning in an environment of hypercompetition, epidemiology has not been immune to budget cuts that threaten the well-being of all areas of cardiovascular science (8). This is particularly unfortunate because healthcare reform and the information technology revolution present extraordinary opportunities for transformation in epidemiology (9).

Alberts et al. (1) offered a number of recommendations for improving the biomedical research environment, including planning for stable funding, changing structures to balance supply and demand, reforming the process of grant-making, addressing policies that create perverse incentives, and “evaluating programs, policies, and implementation.” The National Heart, Lung, and Blood Institute is now engaged in extensive evaluations of its programs and business models, including its support of epidemiology. Through a dynamic blog page launched more than 2 years ago, we have enjoyed an extensive dialogue with the epidemiology community (10). With the help of internationally recognized experts who sit on our Advisory Council and our Board of Extramural Experts, we are in the process of developing intermediate and long-term strategic approaches to strengthening population-based epidemiology within the constraints of a fiscally austere environment. Other NIH institutes, such as the National Cancer Institute, have engaged in similar exercises and have even published preliminary findings (11). We look forward to ongoing conversations about the direction, in an era of bigger data and smaller budgets, of population-based epidemiology, a basic science that we are proud to support.

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