LETTERS
edited by Jennifer Sills

Finding a Good Research Question, in Theory

NEWTON NEEDED AN APPLE, FRANKLIN A FLASH, GALILEO A telescope, and Archimedes a crown. What do these people have in common? They observed a phenomenon that they could not explain, devoted their lives to investigating it, and in doing so achieved groundbreaking discoveries. From observations to hypotheses, from experiments to potential explanations, they conducted every part of the research required to answer the question they had chosen.

Nowadays, rarely—if ever—can a single scientist start at the beginning of the research process and follow it through all the way to its conclusion. Rather than a marathon, research today resembles a relay race: We focus on a small part of a larger question and then pass the baton to the next scientist. In a system where most advances are incremental, many scientists struggle to pursue original research questions. We identified and evaluated several methods that scientists use to select the subject of their research.

Some scientists approach the task by picking a theory and reading all the papers within its theoretical framework in search of a question not yet asked. However, the mere fact that some aspect has not been explored yet does not necessarily make it interesting. Others create a problem they think they can solve by applying one of the solutions their theories or methodologies have already provided to them. This may be an engaging intellectual exercise, but it usually leads to sterile research questions, unlinked to the real world. These question-generation strategies lead to smart and creative solutions to problems that do not exist—a phenomenon called Type III error: finding the right answer to the wrong question (1). It seems to us that too much research is based on these approaches, especially in behavioral economics and behavioral sciences.

There is another way to generate a research question: Go back to the basics. Observe the world, and when you encounter a phenomenon that intrigues you, investigate it. Theories should not be the only source of research questions or the benchmark against which we define what is right and wrong. Shall we abandon a research question when there is no theory from which we could derive our hypotheses? Should we feel compelled to conform our own results only to the mainstream theoretical framework to be accepted in the field? Should we be more concerned about the theory than about the actual problem under investigation? Research runs the risk of growing too dependent on theories, neglecting real-world problems as a result and constraining perspectives and methodologies. If Newton had been preoccupied with established theories, he might have been too busy in his office to realize how surprisingly interesting an apple falling from a tree could be.

NICOLAI BODEMER* AND AZZURRA RUGGERI
Max Planck Institute for Human Development, 14195, Berlin, Germany.

*To whom correspondence should be addressed. E-mail: bodemer@mpib-berlin.mpg.de

Reference

Science in Nepal Needs Neighborly Aid

COMPAred with its neighbors, nepal remains sluggish in economic development as well as investments in research and development [(1) and “Report notes China’s influence in emerging Asian science zone,” News & Analysis, J. Mervis, 20 January, p. 274)]. While China and India have made substantial progress in science and technology, Nepal, sandwiched between the two countries, lags in basic science and technology infrastructure, high-quality education, retention of talented researchers, and qualified manpower.

China and India support Nepal’s development primarily by providing physical infrastructure. However, military assistance has overshadowed other aid. China has promised to provide military aid of US$7.7 million and to establish a military academy in Nepal. Likewise, India has resumed military assistance and promised to provide more military supplies in the future (2). In contrast, support is dismal for Nepal’s higher education, science and technology, and research and development. Furthermore, scientific cooperation between Nepal and its large neighbors is negligible (3).

Instability, corruption, and lack of technological development, as well as frequent disasters, have undermined economic development in Nepal. Because of the lack of research and development investments, about 40% of Nepalese who have master’s and Ph.D. degrees are teaching instead of conducting their own research (4). Thousands of talented Nepalese emigrated during the

Kathmandu University. Investments in Nepal’s research and development are lagging.
India Lacks Scientific Leadership

P. BAGLA’S INTERVIEW OF C. N. R. RAO (“TOP Indian chemist helps make the case for science windfall,” Newsmakers interview, 13 January, p. 157) lacks some important context. In my experience, the Scientific Advisory Committee to the Prime Minister (SAC-PM) of India, which Rao chairs, has shown neither social responsibility nor genuine commitment to science. For example, in 2001, then-Education Minister Murali Manohar Joshi proposed that astrology be included along with subjects such as chemistry and economics among the first degree courses in India’s universities. A colleague and I filed a petition with the Supreme Court of India against the proposal. Our petition was admitted and heard but eventually dismissed. The support of our science academies and credible scientists such as Rao could have helped our case by countering the judges’ unscientific beliefs about astrology. Rao says, “We have been short of high-level talent for some time.” He lays the blame for this on our bureaucracy. I believe that the true blame lies with India’s scientific leaders. The scientific leadership in the country, with notable exceptions, rewards sycophancy and punishes independence, integrity, courage, effective communication, scientific competence, and credibility.

PUSHPA M. BHARGAVA

Former Vice Chairman, National Knowledge Commission, Government of India; Former Member, National Security Advisory Board, Government of India; Former CSIR Distinguished Fellow; Former and Founder Director, Centre for Cellular and Molecular Biology, Hyderabad, 500 007, Andhra Pradesh, India. E-mail: bhargava.pm@gmail.com

Response

I AGREE WITH BHARGAVA THAT INDIA’S ACADEMIES have not provided leadership to the scientific community, but to say that they are not committed to science is inaccurate.

I do believe that having a critical mass of outstanding young people in various areas of science and engineering is crucial for the future of India. There are many reasons for the talent deficit, such as insufficient funding and an environment that is not conducive to the scientific pursuit. Bureaucracy also plays a part, as it controls everything that happens in

UTTAM BABU SHRESTHA

Department of Biology, University of Massachusetts, Boston, MA 02125, USA. Harvard University Herbaria, Cambridge, MA 02138, USA. E-mail: ubshrestha@yahoo.com

References


India Lacks Scientific Leadership

Conflict and are now reluctant to return home because of limited opportunities.

After a decade-long conflict, Nepal is undergoing peace and a state-restructuring process. Rather than competing to provide military assistance to a country heading toward peace, China and India should foster innovation and economic prosperity by supporting Nepalese science and technology and research and development. An impoverished and uneducated Nepal is a greater threat to its neighbors than a Nepal that is enriched and educated.

ALLE ASHOK RAY

Department of Biology, University of Massachusetts, Boston, MA 02125, USA. Harvard University Herbaria, Cambridge, MA 02138, USA. E-mail: ubshrestha@yahoo.com

References


Published by AAAS
India. Appointments and extensions of senior scientists need to be approved by bureaucrats. Administrative procedures and financial controls are becoming increasingly oppressive.

C. N. R. RAO

National Research Professor and Honorary President and Linus Pauling Research Professor, Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur P.O., Bangalore 560 064, India. E-mail: cnrrao@jncasr.ac.in

TECHNICAL COMMENT ABSTRACTS

Comment on “Productivity Is a Poor Predictor of Plant Species Richness”

Xubin Pan, Fengqiao Liu, Mi Zhang

Adler et al. (Reports, 23 September 2011, p. 1750) analyzed the standardized sampling data from 48 herbaceous-dominated plant communities and concluded that “Productivity is a poor predictor of plant species richness” at fine-scale. However, their method was biased toward site-number-dominated plant communities. They also failed to provide enough data for regional analysis and detailed information for within-site analysis.

Full text at www.sciencemag.org/cgi/content/full/335/6075/1441-a

Comment on “Productivity Is a Poor Predictor of Plant Species Richness”


Adler et al. (Reports, 23 September 2011, p. 1750) reported “weak and variable” relationships between productivity and species richness and disputed the “humped-back” model (HBM) of plant diversity. We show that their analysis lacks sufficient high-productivity sites, ignores litter, and excludes anthropogenic sites. If corrected, the data set of Adler et al would apparently yield strong HBM support.

Full text at www.sciencemag.org/cgi/content/full/335/6075/1441-b

Response to Comments on “Productivity Is a Poor Predictor of Plant Species Richness”


Pan et al. claim that our results actually support a strong linear positive relationship between productivity and richness, whereas Fridley et al. contend that the data support a strong humped relationship. These responses illustrate how preoccupation with bivariate patterns distracts from a deeper understanding of the multivariate mechanisms that control these important ecosystem properties.

Full text at www.sciencemag.org/cgi/content/full/335/6075/1441-c

Letters to the Editor

Letters (~300 words) discuss material published in Science in the past 3 months or matters of general interest. Letters are not acknowledged upon receipt. Whether published in full or in part, Letters are subject to editing for clarity and space. Letters submitted, published, or posted elsewhere, in print or online, will be disqualified. To submit a Letter, go to www.submit2science.org.