

## EDITORIAL

## Precious papers from ‘non-research-intensive’ countries

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Countries vary greatly with respect to total expenditure as well as the fraction of Gross Domestic Product (GDP) they invest in science (Jaffe et al., 2013). Poor countries spend very little because government revenues are small and scientific research tends to be seen as a luxury in comparison with education, health care, infrastructure development, debt repayment and even military spending. Some wealthy countries spend relatively little on science for historical or cultural reasons (Serageldin, 2008). The meagre public funds allocated for scientific research in such ‘non-research-intensive’ (NRI) countries should therefore be regarded as precious – much more so than money spent by research-intensive (RI) countries that invest greater fractions of much larger GDPs. Given this, it has been heart-warming to witness the increasing number of papers from NRI countries published in *The Journal of Experimental Biology* (JEB). However, the number submitted from these countries each year remains relatively low and their acceptance rates fall far below those of submissions from RI countries. Low submission and acceptance rates are seen even among NRI countries that have significantly increased investment in science in recent years. It is not unusual to hear the view expressed that western scientific journals display bias against submissions from NRI countries. Low submission and acceptance rates merit discussion but it is necessary to do this in a broad context.

An empirical question addressed in the social sciences concerns the relationship between research performance and level of economic development. In general, as one goes up, so does the other. But what causal factors drive this relationship? A related set of questions concerns the extent to which greater investment in science might promote economic growth or human well-being (Jaffe et al., 2013). These do not come only from such things as semiconductors, pharmaceuticals and high-yield crops. It has been argued that scientific literacy as well as the development of critical, evidence-based thinking contribute to the strengthening of democratic institutions (Sagan, 1995). Throughout human history, more inclusive, pluralistic political systems have set the stage for economic development and elevated standards of living (Acemoglu and Robinson, 2012). Because it has come to be expected that scientific enterprise should benefit society and that public funds should be well spent, the governments of RI countries implement various means to ensure that only high-quality science gets funded. In addition, scientists are held accountable for the research money that they spend. Given the dearth (and, therefore, great value) of public support for science in NRI countries, it can be argued that such accountability should apply at least equally, if not more so, to their scientists. Whether research is ‘basic’ or ‘applied’, it is in the best interest of people in all countries for high-quality science to be done using public funds.

Over the past century, publication in peer-reviewed journals has become the dominant, internationally accepted means by which scientific findings are presented and scrutinized, and perhaps the most important means by which scientists are held to account for their expenditure of research funds. Admittedly, many aspects of the publication process are far from perfect. The enterprise, now evolved into an industry, is in the midst of rapid change. Although it is clear that there are already too many scientific journals, many more are created each year. Among journals, there is great variation in standards of acceptance; some implement highly rigorous peer review processes while others appear to publish almost anything.

The lack of funding for science in NRI countries results in a wide range of adverse consequences that often include lack of access to scientific journals, inability to attend high-quality scientific meetings, inadequate research infrastructure, lack of actively publishing mentors, excessive red-tape, and working conditions and compensation packages not conducive to good science (Suarez and Lacanilao, 2010). Under these circumstances, scientists who carry out research that merits publication in international, peer-reviewed journals must be truly exceptional. However, these scientists face other challenges when trying to publish their work. One that is seldom discussed involves choosing the ‘right’ journal to submit their work to. Lack of access to much of the vast, expanding universe of journals often leads to lack of awareness of the wide range of acceptance standards and criteria for publication. For example, some journals publish only papers considered to be ‘leading-edge’ in terms of subject matter, techniques employed, novelty of findings or concepts advanced. There are ‘elite’, generalist journals that publish only ‘hot’ papers able to compete for space with the hottest submissions in all other fields of science. Competition for space has required the editors of many journals to make subjective judgments; for example, based on whether submissions are expected to be of interest to the journal’s readers. Some reject a substantial fraction or even majority of submissions without peer review on this basis, and they do this irrespective of national origin. At the other end of the spectrum, and well within the range of reputable, peer-reviewed journals, are those primarily concerned that the methods employed are appropriate, that the data obtained (and manner of analysis) are valid and that the conclusions reached are sound. Some of these journals serve as repositories for good work – even work regarded as ‘dull’ by the current disciplinary mainstream because it may not ask interesting questions or because what is reported does not constitute a significant scientific advance.

Given the increase in the number of manuscript submissions, and therefore the need to increase rejection rates (Hoppeler and Handel, 2013), JEB tends to favour work that is mechanistic, addresses fundamentally important questions, represents a significant scientific advance and is likely to be of broad interest to the community of comparative, ecological and evolutionary physiologists. Biomedical and applied research articles, in general, are considered to belong elsewhere. On the other hand, research articles that put mechanism in the context of behaviour, ecology or evolution are preferred. Clearly, there is much good science done all over the world that does

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not fit these criteria. In addition, the focus of JEB on basic science and mechanism may not coincide with the research agenda of many NRI countries. Nevertheless, JEB goes to great lengths to give research manuscripts from NRI countries a fair chance to get published. Assuming the science is solid, JEB makes an effort, e.g. through extensive in-house copy-editing, to help solve linguistic or other problems to bring submissions to the high standards of the Journal.

There are many other journals – respectable, peer-reviewed and with solid international reputations, in areas covered by JEB – into which good work can find its way. But it is often tempting to avoid submission to such journals, given the many paths available that offer less resistance to publication. Bad work does find its way into the expanding universe of journals. In some countries, obstacles to publication are avoided by the creation of journals with low acceptance standards. However, raising institutional or national publication rates through such shortcuts – while avoiding the time, effort and expense required to build up a credible and effective scientific community – does more harm than good. It is not in any country's interest for bad papers to become the basis for the hiring, tenure and promotion of faculty, the awarding of research grants, the conferring of prestigious awards, and the appointment of unqualified individuals to positions of scientific leadership. Flawed science makes an unsound foundation for paradigm shifts, new technology and public policy. Thus, rigorous review processes benefit both RI

and NRI countries. Journals that maintain high standards perform a valuable service.

The present era is referred to by many as the 'Anthropocene', a time when human activity has become the main driver of rapid and profound changes in the Earth's ecosystems. Many NRI countries are hotspots of great biodiversity and endemism. Many species inhabiting them possess physiological adaptations whose study may yield mechanistic insights into the adaptability and resilience of animals essential to the functioning of various kinds of ecosystems. We encourage scientists in NRI countries to submit work that fits within JEB's areas of focus and fulfils the journal's criteria. In many countries, the journey from funding agency to the laboratory to the pages of JEB can be especially long and arduous. We consider the publication of their precious papers to be worthy of celebration.

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