***Scientific Colonialism and Safari Science***

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***Scientific***[***Colonialism***](http://ps.ucdavis.edu/classes/ire001/cult/colonial.htm)

In the 17-19th century England as well as other countries established vast colonial empires. In the 20th century, the United States also began to dominate the affairs of weaker countries under the rubric of [Imperialism](http://www.smplanet.com/imperialism/toc.html). Today there are currently marked scientific disparities between rich and poor countries (1) part of which we would suggest is the result of a colonial/imperialistic mentality in science with wealthier and stronger nations dominating weaker countries. Here we examine several issues related to scientific colonialism including access to information, opportunities for publication and safari research. We argue that much of the inherent inequities between scientists in poor and rich countries are due to differential access to information and lack of communication. We suggest that this in part can be rectified with the Internet.

**Access to Information.**

During the past three decades, the number and costs of journals have skyrocketed. This has placed an enormous burden on all countries with many serials being dropped in libraries. It is much worse in developing countries. It is impossible to compete if the previous literature is not available.

To subscribe to the Science costs $295.00/year, however in many countries, the per capita income is $300.00. Moreover, even if one does subscribe, Science arrives in India, China and Latin America three or four weeks after publication. This is frequently long after the call for abstracts, grants, papers, and too late to respond to articles with letters to the editors. The cost of journals has driven all but the richest scientists away. Scientists have little access, where there is access it is exceedingly slow. For example, a medical library in the United States subscribes to about 3000 journals, whereas the Nairobi Medical School Library, receives only 20 journals. A decade ago the number was 300 (2).

The only solution is electronic. The Internet breaks down the access and speed barriers. It is as the Economist said "[the Death of Distance](http://www.deathofdistance.com/)". Everyone across the world can have access to the same information, at the same time. Scientific articles can be multilingual and distributed for free in different languages. In addition, this need not cost the journals revenues, as a [limited access server](http://www.bmj.com/archive/7085l1.htm) can be established. This server would permit access for free to say Nature and Science to Kenya, Peru, and Vietnam, but not London, Boston, or Rome(3).Some journals are beginning to put full text articles on the web, which is most welcome for developing countries. However, there is the fear that these will not be economically viable. By limited access to the poorest countries few subscriptions would be affected. This may in fact be a way to stimulate an emerging scientific market.

A second approach will be new forms of delivering of scientific information. A primary means by which all scientists obtain information is through review articles. The phrase ***current review article*** is an oxymoron as by the time a review is published it is 12-18 months out of date due to publication delays. However, on the Internet reviews can be updated the day an original article is published (4). There is considerable incentive for the reviewer to maintain that review. The first is that there would be little burden, as the home pages / summary would be submitted by the scientists on the net. Thus the reviewer’s role shifts from "writer" to gatekeeper. Secondly, it will be prestigious to be the gatekeeper for a discipline, such as diabetes epidemiology, as the field must go through you. These gatekeepers will be more powerful than editors, but with less work. Thus in developing countries it may be impossible to have either the original articles or e-versions of the original articles. However, ongoing Internet based reviews would provide almost as much information as the articles themselves for a fraction of the cost. There would be a potential market for "pay for view" for reviews, where inexpensive access by large numbers of scientists could maintain a viable scientific market economy, for benefit of all of countries.

A third approach is that in the near future biomedical scientists will move away from the journals and directly put their research on the Internet as in Physics. In physics scientists in developing and developed countries have equal access to the research, as it is freely available on the web (http://xxx.lanl.gov). E bio-med, PubMed, and the BMJ Netprints server are examples for health topics.

Clearly the Internet can be a partial solution of one of the most vexing problems of science, that of differential access to the world's scientific literature. One example is the initiative of the Member States of the European Union and the European Commission (EC): Scientists for Health and Research for Development (SHARED. A meeting place on the Internet has been established for scientists from developing and developed countries(http://www.shared.de). The SHARED program is excellent but may not capture the realities of the economics of medical publishing. To improve access to the medical literature, the system must be able to reach into developing countries, it has to be virtual, inexpensive, and it must not affect the sales of journals. It is our belief that the Internet is the means by which this can occur.

**Publishing from Developing Countries**

Almost 25% of the world's scientists live in developing countries. However, these scientists publish <3% of the world's papers(3). A recent article in Science talked about the Scientific Wealth of nations (6).The top 7 cited countries were those with the 7 largest economies. Clearly, scientists from developing countries are publishing much less than those from developed countries, but why?

Publication involves two major components, the first is submission of papers. The second is the judgement as to whether the article should be accepted based in part on peer review. It is not clear if the reason for the low number of publications from developing countries is that there are reduced number submitted, or a higher rejection rate.

In order to examine the submission and acceptance rates for developing countries in two medical journals, the British Medical Journal and Annals of Internal Medicine kindly made their results available to us. For the present paper, we defined developing countries according to the classification by the World Health Organization (5).

For the British Medical Journal (8) in the period 1989-1998 there were only 2550 articles submitted from Developing countries (6%) with a mean of 255 per year. Whereas investigators from Developed countries submitted 42,140 per year.

In other words, researchers from developed countries submitted 17 times the papers than authors from developing countries. If 75% of the scientists live in developed and 25% from developing countries then it would appear that scientists from developed countries should submitting only 3 times more papers. Thus a scientist from a developed country is over 5 times more likely to submit to the BMJ than from a developing country.

The acceptance rate for the period 1989-1998 was 7.9 for developing and 16.7% for developed countries (*x*2=137.4, p<.001). In other words, articles from developed countries were 2.1 (95% CI 1.8-2.4) times as likely to have their articles accepted. These are clearly substantial differences, which also are seen, in an American Journal.

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| --- | --- | --- |
| **Country** | **% of all submissions** | **Acceptance rate (%)** |
| **US** | **69%** | **20%** |
| **Canada** | **4%** | **14%** |
| **Europe** | **18%** | **8%** |
| **Israel** | **3%** | **8%** |
| **Japan** | **3%** | **5%** |
| **Australia/NZ** | **1%** | **17%** |
| **Latin America** | **1%** | **0%** |
| **Other** | **2%** | **6%** |

The table shows data for the Annals of Internal Medicine in 1995(9), in general the same pattern appeared. Five percent of submitted papers were from developing countries, and the rest (95%) from developed countries. The mean acceptance rate was 4.7% for developing and 12.8% for developed countries respectively.

Clearly both the submission rate and acceptance rate for developing countries are considerably lower that what is expected. It is not clear exactly why this is occurring. One possibility is the lack of representation of developing country scientists on the editorial boards and reviewers.

As can be seen below, the only editorial board having major input from developing countries is the BMJ. The Lancet and Science have only one editor each from a developing country. Editors from developing countries can indicate the importance of articles from these countries. They also can "coach" the submitters to help improve the quality of the papers. In addition, having editors from developing countries on the masthead clearly signifies the interest in that journal in third world health issues.

|  |  |  |  |
| --- | --- | --- | --- |
|  | ***BMJ*** | ***Lancet*** | ***Science*** |
| ***Total Editors*** | **34** | **24** | **96** |
| ***Developing*** | **6** | **1** | **1** |
| ***% from Developing*** | **18%** | **4%** | **1%** |

Once again, the Internet has a pivotal role to play in bolstering submissions of articles. Scientific disciplines can begin to establish a dialogue through the Internet such that scientists in developed countries have established with meetings and telephone calls with members of their disciplines. Through this dialogue scientists in developed countries could serve as advisors and collaborators, authorship and scientific partnerships and friendships are enabled in the Internet to a degree never thought possible.

Journals can establish a "mentor" program, which link young scientists from developing countries with scientists from developed ones which could help. Also, there is the perception that adding an established researcher to an authorship will help articles be published. For those in the US and UK, there will be the opportunity for additional publications, samples, and friends, which would not be available locally in the US and UK. The Internet can act as glue to tie together the scientists of the world.

Tony Delamothe from the BMJ recently indicated that the Internet will "grow" research from the very early formulation to the completed publication. This would aid both submission and acceptance rate. In the very early stages of work for developing and developed countries alike there will be interactions that will foster new initiatives and quality work(10).

The end result could be a global research communication forum for posting scientific results on the Internet, and an interchange of research communications.

        The famous American President, Teddy Roosevelt went several times to Africa and "bagged" African biologic trophies to exhibit at the White House for the world to see. He paid for this effort, and he planned the kill, which he thought gave him the right to take these trophies out of Africa. But is this right?

Fiona Godlee of the BMJ coined the term Safari Research(11).It is defined as English or US scientists traveling to artifacts to the Smithsonian. Now it is taking the DNA and Sera from developing countries to the laboratories of developed countries.

        We searched Safari Science in Medline for the period 1993-1997. Acharacteristic example of Safari Science would be: Smith (CDC), JonesCDC), Brown (CDC), Mbumic (MOH Uganda) and Green (CDC), The Spread of HIV in Uganda, Journal of HIV, 1998;14:7-10. Clearly the samples came from Uganda, but few people in Uganda receive credit.

        We classified articles published between 1993 to 98 into those whose biologic research materials came from developing countries. This was accomplished by searching Medline for mention of the individual developing country, e.g. Mexico, Brazil, China, etc. The affiliation of the first author was determined. If the first author was from a developed country, this was classified as Safari Research.

The BMJ had 59 publications related to developing countries for this period of these 59, in only 34 (57.6%) was the first author from developing countries. In other words, for one article in two from developing countries the lead author was from a developed country. Scientists from the United States and United Kingdom were the countries with highest frequency of first authorship.

In the Lancet, there were only 82 of which 56.6% had the first author from developing countries, the same pattern seen in BMJ. Most of the lead authors were from the US. The most extreme example was the premier global journal cutting across all of the research areas, Science. In Science, there were only 6 biomedical research papers where samples came from developing countries. What is amazing is that there were no first authors from developing countries on the six Science papers What is even more surprising in that for none of the articles from developing countries was there even an author from a developing countries, this is classic Imperialism.

This is a thorny issue. Most US and UK scientists would not think they are exploiting developing countries as they set up the research design and pay for the research. However, it does not seem right that a scientist from one country "buys" the natural scientific resources of another country. It smacks of the scientific looting of the tombs of Egypt, or the burial lands of Native Americans or Australians Aborigines or Teddy Roosevelt having elephant heads in the While House. Biologic material is a natural scientific resource for developing countries, yet it is being exploited. The difficulty is that typically the scientists from developed countries bring in the money to do the research, they set up the designs, analyze the data, and write the papers. Therefore according the most agreed upon rules of authorship, they should receive the credit. Colleagues in developing countries "only" provide samples and therefore receive at most "token" recognition. However, the biologic materials from developing countries are in some sense being stolen.

Again, this can be aided with the Internet. This can in part be avoided by closer communication between developed and developing countries. Perhaps researchers from the US and UK should be required to give something back, through the transfer of technology and training. If developed countries scientists advise and teach scientists from developing countries then all scientists who participate in the study could receive authorship and other credits. Internet permits a rapid translation of scientific technology and knowledge. This is being developed through systems such as the supercourse ([www.pitt.edu/~super1)](http://www.pitt.edu/~super)).

The scientists in developing countries need not lose track of the safari scientist. The possibility of easier communication that the Internet brings about, it would also have a favorable impact in developing countries because researchers and health care personnel could be in direct contact before and after starting a study. Journals such as BMJ should question any paper from a developing country where the lead author is an American, the second another person from the United States, the third and fourth from Africa and the last an American. Secondly, on the Internet there need not be the problem of first author, but rather one can list the contributions of each author. This is like that of movie credits, which is easy to on the web, and more equitable to scientists in developed and developing countries, alike.

**Conclusions**

Scientific colonialism and safari research exists. There is clear evidence that developing countries have much less access to medical journals, fewer articles are submitted from developing countries, and the articles are twice as likely to be rejected. In addition a large percentage of the articles from developing countries are authored by researchers from the US and UK. This is the nature of "paper" articles.

Most certainly economics provides a critical role into dividing up science. However, researchers in developing countries have unique biologic resources, their "economic" power, is in fact "biologic resources". Perhaps there should be a "Bill of Rights" for scientists in developing countries when collaborating with developed countries. Potentially this Bill of Rights should evolve from international organizations. In addition, as part of NIH Institutional Review Boards, one should examine not only the rights of the patients, but also that of the collaborators. This is truly an ethical issue that should be reviewed consistently by ethics boards for all researchers.

A charter or a Bill of Rights should be developed which protects the rights of all investigators, and samples. This could be developed by major international agencies such as the UN or WHO.

The Internet is a tool to achieve an equal access to information where every user of the web has the same importance and equal right to register or retrieve information. Developing countries have a different pattern of morbidity than developed countries. Therefore the research made in those countries is addressed to solve problems of health that have already been controlled in developed countries. However, we have to recognize the potential impact of diseases such as tuberculosis, cholera, dengue, malaria, etc., is a worldwide threat. Also, we have to recall that health is a right, so researchers and medical staff of developing countries should have access to biomedical journals in the Internet to establish appropriate measures to prevent and control the most important diseases in their countries (1). At the same time we need to recognize the right of the journals as well. It is also important that people discard the concept that science is a luxury for developing countries. Science may be the only way to create national health solutions. Many editors believe the low representation of papers from developing countries is because of the poor quality of science in poor countries. However, Bill Hyde, the journal's former editor of Forest Science, says that the acceptance rate of papers depends of the editor's views, "I learned to treat scientists in developing countries as I would treat my next-door neighbor." But not all editors have the same opinion, Jerome P. Kassirer, former editor in chief of the New England Journal of Medicine, suggests that developing countries should receive guidance on nutrition and immunizations before getting advice on medical editing. Kassirer says, " very poor countries have much more to worry about than doing high-quality research, there is no science there" (5).

It is not sufficient that research just generates data and knowledge, the scientists have to be aware of the importance of sharing and communicating their findings in the major biomedical journals. Currently we know that science is a productive activity for nations; therefore, there are many benefits to the economy and to society. Some authors have reported that the annual social rate of return from fundamental scientific research is between twenty and fifty percent (12). However, scientists from developing countries are not participating. This paper itself can illustrate the dilemma. It was submitted to Science with a list of scientists from developing countries who have published in a major journal, and the editors were asked to have it reviewed by scientists in developing countries. Instead it was turned down at the editorial level which represents scientists who were 99% from developed countries.

Clearly scientists from developing countries play little role on editorial boards, and probably very little as reviewers. The Internet can once again change this as editors now can communicate with the board through the Internet. In addition reviews can be done half a world a way by posting the articles on limited access servers. It is only through these means that submissions from developing countries can truly have peer review.

We would argue that there be an annual audit for journals as to the submission rates, acceptance rates for articles from developing countries. Also, journals should indicate how many editors and reviewers come from developing countries. It is impossible to have a global science and health journal with representation from just the US and UK. An audit will keep authors to decide if they want to submit to specific journals.

The Internet represents a unique opportunity whereby science in developed and developing countries alike can leapfrog forward together. The scientific crevasse between developed and developing countries can be reduced to a hairline crack with the Internet.

The Internet can break the walls separating scientists in developed and developing countries. Bringing science to the Internet could be of enormous benefit for the health of the world.

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