

How to be a tropical scientist

Science seen from childhood: the white male scientist stereotype

History shows that dominant cultures perceive less powerful cultures as inferior. Widely known examples are the classical Greeks with their concept of other peoples as barbarians and the Chinese with their view of westerners as "foreign devils". Today, if I read the newspapers or watch television, I get the impression that all the important scientific achievements are produced in Europe and the USA. In much of the world, tomorrow's scientists, who are children today, learn about what science is like from the Discovery Channel, National Geographic or the BBC, and they cannot fail to notice that most scientists in those programs are English-speaking white males. The women and people of darker skin often appear as field assistants who carry heavy objects in excavations, or as victims of catastrophes and epidemics who are saved by the white scientists.

As adult scientists we are told that Europe produces about 33% of the world's scientific literature, the USA follows closely with 31%, and more distantly the list includes Japan (8.2%), Canada (4.3%), Australia (2%), India (1.6%), China (1.3%), and Israel (1%). Latin American countries have much lower numbers and are led by Brazil with 0.6%, Argentina with 0.3% and Mexico with 0.3% ([Garfield 1984](#) , [Gibbs 1995](#)). As WHO's C.T. Zielinski said, these official numbers are hard to believe because they would mean that 80% of the world's population produces 2% of the scientific output ([Gibbs 1995](#)). If there are about 80 000 specialized journals in the world and some 8400 of them are published in Latin America (José O. Alonso-Gamboa, Latindex, pers. comm. 2002), the numbers do not fit. Furthermore, the Institute for Scientific Information has acknowledged that Latin American science is not properly covered by its indices ([Garfield 1984](#)).

According to [Gibbs \(1995\)](#) , the tropical proportion of science is decreasing even though governments are investing more in science, possibly because they simply tried to implement out-of-context imitations of the National Science Foundation, the American Association for the Advancement of Science and the National Academy of Sciences of the USA. Instead of imitations, tropical nations need original organizations that reflect their scientific and economic reality.

Is there a planned effort to keep the developing countries scientifically behind? A sort of scientific domination? Personally, I believe that the view of "southern" science as insignificant is actually the result of cultural inertia, a closed cycle that needs to be broken. The reason is simple: for historical reasons, the organizations that have the funds needed to globally distribute scientific news, documentaries and journals are located in Europe and the USA. For convenience, they look for scientists in their own countries and when they report abroad, for example, about an archaeological excavation in the Andes or the behavior of pandas in China, they try to find people who speak their language (often British or American scientists) even if local scientists are doing work there. The result is that the work of scientists who are culturally or geographically far from the centers of economic power tends to be ignored by the media. Tropical institutions should bring research of general interest (done by properly trained local scientists with a good command of English) to the attention of science popularization giants. I believe that good work will receive attention independently of who does it.

Scientific predation or cooperation?

Besides significance and productivity, the poor country-rich country science clash is associated with open or undercover stealing of valuable scientific material. Hellenic marbles, Egyptian mummies, Brazilian pteranodons or Argentinean dinosaurs are all well known examples, as are archaeological materials from Latin America. There are two contrasting views on this subject.

The northern view states that valuable scientific material must be extracted by "First World" scientists because only they are properly trained, and that they must be transported to rich countries because otherwise they would not be safe. It has even been publicly stated that in the "Third World", research subjects are old fashioned, techniques poor and literature outdated: J. P. Kassirer, editor of the *New England Journal of Medicine*, practically said that there is no science in poor countries ([Gibbs 1995](#)). This view has a long history: colonial native scientists were seen as poorly trained and unskilled professionals in the 19th century in places such as Brazil ([Sá 1998](#)), a country that now sells training aircraft to the US Army, and Australia ([Newland 1991](#)), now widely respected in the scientific field.

The southern view, backed by UNESCO, is that scientific material should be studied by local scientists and conserved in the corresponding national museums and universities. Who is right?

It is true that generally, scientists have better training and more funding in rich countries, and perhaps many years from now, the politicians who have kept "Third World" science under-budgeted for so many years will be presented in the history books as traitors who opened the doors to the exploitation of scientific heritage by foreign powers. But it is also true that the scientific level is sufficient in many "Third World" regions and that the UNESCO position should be applied whenever possible. The answer to "should the doors be closed to foreign scientists", as done for example a couple of times throughout Brazilian history, has varied greatly according to place and subject. Archaeological techniques are still so crude that in many cases it seems best to let remains wait for a future in which local science will be more developed and techniques more advanced (Chinese authorities have held this view in the case of Emperor Chin's sarcophagus). On the other hand, biodiversity is diminishing so rapidly that all the available hands should be accepted to study what is left. My personal belief is that science is an international activity that should know no borders: I have found cooperative work with foreign scientists to be mutually enriching and multinational teams seem to be a good option in many cases. Where specimens should be deposited is a different issue: they should remain in the country of origin except when that country is not safe for their conservation.

Options for tropical scientists

According to [Mata \(2002\)](#) , a few tropical scientists have found a shortcut to see their names in the top mainstream science journals: they become collectors of tropical samples that are sent to research teams in Europe or the USA in exchange for a coauthorship. This seems acceptable when every coauthor participates in all stages of the work, from protocol to analysis and reporting, but when this is not the case and the tropical counterpart serves as little more than a field collector, it can mean that ethics have been abandoned on the excuse that there are simply not enough funds to do decent research in the tropics (see [Canga-Argüelles 1994](#)).

I have seen too many colleagues return with a Ph.D. from Europe to vegetate based on that excuse, but I have also had teachers who are world authorities and pay for their research from their own pockets. From my experience, I cannot accept that excuse. Furthermore, Latin American laboratories are full of expensive but underused equipment. The only indispensable equipment for good science is a properly trained human brain. Other requirements vary greatly according to the field.

If we confess that financing is not a serious obstacle (except maybe in particle physics and cell and molecular biology), we can consider a more realistic problem. In the tropics, as happens in temperate countries, good research starts with a good question. Tropical literature is full of boring checklists of species that are expensive to produce but cannot find space in leading publications. Often, this money would be better invested in producing an ecological study of any of the species mentioned in the list. Tropical scientists should begin to address more frequently questions of general interest: evolution and ecology are good fields for such questions and the tropics are ideally suited to look for answers.

From my almost 20 years of experience as an editor, I believe that the training of tropical scientists should be reinforced in three basic fields: experimental design, statistical analysis and especially, writing skills. An advanced command of English is an obvious requirement because

a scientist cannot be competent if she or he cannot read the majority of the literature. The use of local languages in science, despite the nationalistic appeal, must be avoided because it hinders communication: the language of science is scientific English, which is no more than a highly modified variant of Latin.

Goals for tropical journals

Rather than language, a more feasible area for some local pride is the diffusion of knowledge. Some of my colleagues dream of having a paper published in *Nature* or *Science*, usually considered the two most influential journals (in that order). However, their chances are low (for example, *Science* accepts 20% of manuscripts from the USA but only 1% of papers from "Third World" countries, Gibbs 1995). According to [Gibbs \(1995\)](#), there is also evidence that some leading journals are prejudiced against papers coming from tropical addresses. In the beginning, tropical scientists had no option because journals only existed in Europe. The oldest paper about tropical nature that I am aware of is *Rerum Medicarum Novae Hispaniae Thesaurus*, a well illustrated paper on the Mexican flora and fauna published in 1651 in the *Atti della Accademia Nazionale dei Lincei* (<http://www.lincei.it>) more than a decade before the Royal Society of London published the first *Philosophical Transactions*.

Today, there are many tropical options. In Latin America alone there are 8400 technical and scientific journals. However, only 800 of these met minimal requirements of the Latindex (latindex.unam.mx) and the Scielo network (www.scielo.br), an innovative international program equivalent of a combined Science Citation Reports, Biological Abstracts and Online Publishing ([Cazaux 2002](#)). This initiative is at an early stage, but if it develops properly, it can solve a basic problem: the impact of tropical science cannot be measured with the Science Citation Index because it covers only 6-7% of the world's journals, and leaves out the majority of tropical journals (which are the journals where citing tropical science is more pertinente).

Citation indices are by no means sufficient indicators of quality or even of impact ([Pérez 1984](#), [Salazar-Vallejo and Carrera-Parra 1998](#)). Rather than a high citation impact, the goals of tropical journals should be quality, availability and usefulness ([Pacheco-Ruiz and Quintanilla-Montoya 2001](#)).

Some publishers of high profile journals have been accused of artificially raising subscription costs ([Buckholtz 2000](#)). In scientific publication, publishers only pay for printing and distribution, while governments cover most of the large costs: infrastructure and brains. The result of disproportionate price increases is that libraries subscribe to fewer journals. With dwindling subscriptions, journals suffer and sometimes disappear, and when this affects tropical journals, tropical scientists are less likely to keep abreast of the work of their colleagues. Several efforts are under way to alleviate this problem. Electronic publishing can circumvent high printing and distribution costs but it can only gain acceptance if electronic journals are peer-reviewed and reliably available (websites can disappear from one day to the next, while printed journals are protected in libraries in many countries). Physics is very advanced in this field ([Buckholtz 2000](#)). Projects to use digital information include BIREME (www.bireme.br) and Infomania, which produces CDs with alternative journals at lower prices for tropical countries (Gibbs 1995), the Scholarly Publishing and Academic Resources Coalition SPARC (www.arl.org/sparc) and BioOne (<http://www.bioone.org>). These initiatives include a network of journals characterized by lower prices and a publication time that has been reduced from 15 months to one month. Quality and prestige will define their future. Atypical cases worthy of mention are the journal *Avicennia* and several publications of the Sociedad Entomológica Aragonesa (both published in Spain), which provide an outlet for Cuban researchers, who are relatively isolated for political reasons.

The concentration of funds in the best tropical journals would allow them to compete with journals from richer countries, but this obvious solution has always been prevented because it affects the interests of those who edit and publish lower quality journals, usually at the expense of the taxpayer.

Tropical authors should strive to produce quality work and to publish it in serious journals, not in the "gray literature", but publishing a paper should not be the end of the story. Tropical faculties ought to have the policy of using tropical literature during student training. However, there are tropical teachers who purposefully ignore the work of their local colleagues and use instead the reprints and textbooks that come from temperate countries. They are joined in this behavior by temperate scientists, who tend to ignore, or worse, use but not cite, the work of tropical researchers, citing instead American or European papers on the same topic ([Gibbs 1995](#)). In the tropics, tropical journals should be used and cited preferentially, a position that could be incorporated in the policies of both journals and faculties.

Tropical scientists have three basic options. They can despair and make no effort to do good science, they can choose to live at the shadow of temperate science, trying to please the interests of temperate journals, readers and citation indices, or they can do what the USA did so successfully after spending many years at the shadow of British science, that is, to develop a local scientific pride based on quality and a good balance between basic and applied science.

When rejected by the international community because of its racist practices, South Africa took the third option and became a nuclear power. Japan and Korea were considered scientifically unfit less than a century ago and now dominate the field of electronics thanks to carefully planned, long term science and technology policies. There is no reason why tropical countries cannot do the same. Human brains are the same in the tropics and in temperate countries, only the cultural and economic contexts differ.

Three millennia ago, Africa and Asia were the leaders of civilization and Europe was a primitive continent. Two millennia ago, the Anglo-Saxons considered Latin culture the pinnacle of development and technology. Today, the situation has reversed, but nobody knows how long it will be before the pendulum swings the other way.

References

- Buckholtz, A. 2000. Electronic genesis: SPARC, BioOne, and the creation of e-journals in the sciences. *Journal Publishing* (Allen Press Newsletter for Journal Publishers) 2000 (1):1-7.
- Canga-Argüelles, M.A. 1994. Ciencia y tecnología en Guatemala, pp. 123-126. In J.A. Vary & G. Violini. *Science and Technology for Central America: Plans and Strategies*. Consejo Nacional de Ciencia y Tecnología, San Salvador, El Salvador.
- Cazaux, D. 2002. Latindex: el índice de las publicaciones científicas latinoamericanas. *Scientific American Latinoamericana* 1: 20-23.
- Garfield, E. 1984. Latin American Research. *Current Contents* 19: 3-8, 20: 3-10.
- Gibbs, W.W. 1995. Lost science in the tropics. *American Scientist* (August): 76-83.
- Mata S., J. 2002. La acrobática académica. *Semanario Universidad de Costa Rica*, 25 enero: 16.
- Newland, E.D. 1991. George Bennett and Sir Richard Owen: A case study of the colonization of early Australian science, pp. 55-74. In R.W. Home & S.G. Kohlstedt (eds.). *International science and national scientific identity*. Kluwer Academic, Dordrecht, Holland.
- Pacheco-Ruiz, I. & A.L. Quintanilla-Montoya. 2001. La revista *Ciencias Marinas* y su factor de impacto mundial. *Ciencias Marinas* 25:121-124.
- Pérez, R. 1984. Patología y la cenicienta. *Patología* 22: 1-6.

Sá, M.R. 1998. James William Helenus Trail: a British naturalist in nineteenth-century Amazonia. *Historia Naturalis* 1: 992-54.

Salazar-Vallejo, S.I & L.E Carrera-Parra. 1998. Taxonomía biológica, factor de impacto y evaluación curricular para el siglo XXI. *Interciencia* 23: 293-298.

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