

LETTERS

edited by Jennifer Sills

Recognizing Scientists
and Technologists

ON 17 NOVEMBER 2010, PRESIDENT OBAMA PRESENTED THE National Medals of Science and the National Medals of Technology and Innovation. These medals are the highest honor that the nation can bestow in science and technology, yet they are rarely mentioned by the popular media. Because Congress does not appropriate funds to implement the “outreach” of these medals, for many years the only national recognition was a private award ceremony with the President.

In 1991, George Rathmann, one of the founders of the biotech industry, facilitated the formation of what is now the National Science and Technology Medals Foundation. The mission of the Foundation is to promote the National Medal Laureates as role models for students and thereby encourage interest in science and math. To accomplish this goal, the Foundation hosts a banquet in conjunction with the White House ceremony. This banquet features videos highlighting the technical accomplishments of the Laureates, which then become the basis for stories that appear throughout the country.

Over the years, the Foundation has accumulated a wealth of electronic material on the Laureates, including biographies, interviews, and descriptions of their accomplishments (1). This recognition not only is a way to recognize the Laureates’ enormous efforts, but also serves to focus our attention on the seminal ideas in science, mathematics, and engineering. The stories behind these accomplishments often provide inspiration to others, which is essential to promote further achievements.

ROBERT M. WHITE

Materials Science and Engineering, Stanford University, Stanford, CA 94305, USA. E-mail: RMWhite@stanford.edu

Reference

1. National Science and Technology Medals Foundation (www.nationalmedals.org).

Genetics-Based Field
Studies Prioritize Safety

M. ENSERINK’S NEWS OF THE WEEK STORY ON the open release trials of genetically modified mosquitoes in the Cayman Islands (“GM mosquito trial alarms opponents, strains ties in Gates-funded project,” 19 November 2010, p. 1030) highlights the growing pains associated with bringing new technologies out of the laboratory into the field. Unlike for vaccines, drugs, and insecticides, no industry-wide standards are yet in place to guide either public or private efforts in the development

of these technologies. However, it is important for the public to know that the scientists working on these new technologies are aggressively supporting the formulation of best practices for their safe, efficient, ethical, and regulated application, and are reaching out to experts from a range of relevant disciplines for advice and counsel. A series of publications document the evolution of this process (1–5). Indeed, efforts are currently under way to develop a guidance framework for quality standards to assess safety and efficacy and to address regulatory, legal, social, and cultural issues, as recommended by an international consultation held at the World



Health Organization in 2009 (5). Thus, although we have not achieved harmonized international standards, as has taken decades for other technologies, we are much closer than most people realize. We recognize the need to ensure that our enthusiasm for the promise of these approaches as powerful public health tools does not outstrip our responsibility to apply scientifically validated and socially acceptable product development practices. The tragedy would be if this important but complex birthing process were to stifle creativity in the development of not only genetics-based solutions, but all truly novel approaches that seek to reduce the serious health threat of diseases such as malaria and dengue fever. We hope that debates over specific circumstances do not cloud the urgent need for the development and deployment of new tools to mitigate these disease scourges.

ANTHONY A. JAMES

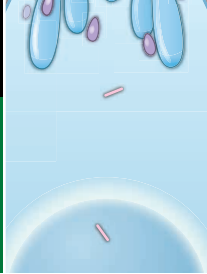
Departments of Microbiology and Molecular Genetics, and Molecular Biology and Biochemistry, University of California, Irvine, CA 92697–3900, USA. E-mail: aajames@uci.edu

References

1. M. Benedict *et al.*, *Vector-Borne Zoonotic Dis.* **8**, 127 (2008).
2. J. V. Lavery, L. C. Harrington, T. W. Scott, *Am. J. Trop. Med. Hyg.* **79**, 312 (2008).
3. J. V. Lavery *et al.*, *Trends Parasitol.* **26**, 279 (2010).
4. J. Mumford, *Asian Pac. J. Mol. Biol. Biotechnol.* **17**, 91 (2009).
5. WHO/TDR, “Progress and prospects for the use of genetically-modified mosquitoes to inhibit disease transmission,” Report on planning meeting 1: Technical consultation on current status and planning for future development of genetically-modified mosquitoes for malaria and dengue control (WHO/TDR publications 10.2471/TDR.10.978-924-1599238, 2010).

Origins of Biodiversity

THE ORIGIN OF THE HIGH NEOTROPICAL BIODIVERSITY has been a controversial topic since Darwin. The debate has focused on the relative influences of the climate changes during the Pleistocene (the past



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~2.6 million years) and the tectonic and geographical reorganizations that occurred before the Pleistocene (1). In their Review “Amazonia through time: Andean uplift, climate change, landscape evolution, and biodiversity” (12 November 2010, p. 927), C. Hoorn *et al.* conclude that the biodiversity patterns of the Amazon basin were largely shaped before the Pleistocene, facilitated by the Andean uplift. The authors dismiss Pleistocene diversification by arguing that, in the Neotropics, the refuge hypothesis (proposing that species diversified in isolated forests during glacial periods) has already been abandoned, and that fossils and molecular phylogenetics support mostly pre-Pleistocene diversification.

However, Pleistocene diversification could have resulted from a variety of mechanisms other than isolated forest remnants (2–4). Furthermore, Hoorn *et al.* cite my meta-analysis (5) in support of the pre-Pleistocene diversification, yet the conclusions I drew from that study contradict those of Hoorn *et al.*'s Review. I concluded that about half of the dated extant neotropical species originated during the Pleistocene and the other half before it, and that speciation proceeded in a continuous fashion with no evident bursts (5). In addition, phylogenetic evidence provided by Hoorn *et al.* is based on the dating of complexes of extant species (the crown clades) that in fact records the age of the oldest species within each group (6) but not necessarily the age of all the extant species, which should be necessarily younger. This overestimates pre-Pleistocene diversification. Earth's biodiversity gradients are the result of a long and complex history of evolutionary trends, mediated by ecological processes and governed by external forces, in which not only speciation but also extinction should be considered, especially in extra-tropical areas (7).

The topic requires the synergy of many disciplines, in a wide range of spatial and temporal scales. Pleistocene speciation is one more element and should not be neglected; after all, we ourselves are a Pleistocene species barely 200,000 years old.

VALENTÍ RULL

Palynology and Paleoecology Laboratory, Botanical Institute of Barcelona (CSIC-ICUB), 08038 Barcelona, Spain. E-mail: vrull@ibb.csic.es

References

1. M. B. Bush, H. Hooghiemstra, in *Climate Change and Biodiversity*, T. E. Lovejoy, L. Hannah, Eds. (Yale Univ. Press, New Haven, CT, 2005), pp. 125–137.
2. M. B. Bush, *J. Biogeogr.* **21**, 5 (1994).
3. B. P. Noonan, P. Gaucher, *Mol. Ecol.* **14**, 3017 (2005).
4. V. Rull, *J. Biogeogr.* **31**, 1 (2005).
5. V. Rull, *Mol. Ecol.* **17**, 2722 (2008).
6. M. J. Benton, *Biol. Rev.* **75**, 633 (2000).
7. M. S. McGlone, *Glob. Ecol. Biogeogr. Lett.* **5**, 309 (1996).

Response

IN OUR REVIEW, WE LINK THE OUTSTANDING species richness in northern South America to the cataclysmic changes induced by Andean mountain building. Evidence for this is the correlation between sedimentary records, the paleontological record, dated molecular phylogenies, and present species distributions. Our conclusions contradict the hypothesis that has dominated for more than 40 years: that the outstanding levels of Neotropical species richness and current distribution patterns were mainly produced by Quaternary climatic fluctuations (1, 2), i.e., in the past 2.6 million years. All evidence in our meta-analysis points toward an older origin of Amazonian biodiversity.

Rull argues that we ignore Quaternary evidence on speciation, in part by erroneously referring to his previous meta-analysis (3) as evidence for pre-Quaternary diversification. Rull's finding that about half of all extant species analyzed originated during Quaternary times (3) is not surprising. Assuming the average species longevity is some 100,000 to a couple of million years (3–5), at any point in time we would expect to find that most species originated in the past few million years. Rull's evidence that extant species originated recently does not contradict the idea that the total

number of species was just as high (and for most organism groups higher) before the Quaternary, even if the species that existed then have since become extinct. Moreover, if Pleistocene glaciations had indeed produced most of the species richness observed today—as implied in the original formulation of the “refuge theory” (1)—this would unrealistically imply that all previous diversity was produced by entirely different mechanisms. This realization severely undermines the role of glaciation dynamics in accounting for Neotropical species richness.

Rull's suggestion that we overestimated pre-Quaternary diversification by using genera instead of species as taxonomic units in our meta-analysis is misleading. Extinction is more likely to affect older lineages than younger ones—simply because species that have arisen recently have had less time to go extinct (6)—meaning that Pre-Quaternary speciation events were probably underestimated in Rull's meta-analysis (3). Stochastic diversification models (6) can correct for the effect of background extinction in diversification rate estimates, but these models have proven unrealistic because of their oversimplified assumptions (7) and sensitivity to incomplete taxon sampling (8), a common feature in Neotropical phylogenies. Estimates of crown ages of genera are, arguably, less sensitive to incomplete taxon sampling, because in most species-level phylogenies, sampling is aimed to cover the geographic and morphological variation within a genus. This should lead to more robust age estimation of deeper nodes even when many species are missing.



Angel Falls, Venezuela.

Debate continues about when and where neotropical biodiversity developed.

The data we assembled show that the blueprint of present Amazonia was laid out in pre-Quaternary times, but they also have the potential to provide us clues on how the rainforest may react to future global warming. It is also clear that Amazonian biota withstood large geodynamic (9) and climatic fluctuations but that humans, the young product of Quaternary evolution, pose the biggest threat to this wealth of biodiversity.

C. HOORN,¹ F. P. WESSELINGH,² H. TER STEEGE,³
M. A. BERMUDEZ,⁴ A. MORA,⁵ J. SEVINK,¹
I. SANMARTÍN,⁶ A. SANCHEZ-MESEGUER,⁶
C. L. ANDERSON,⁶ J. P. FIGUEIREDO,⁷
C. JARAMILLO,⁸ D. RIFF,⁹ F. R. NEGRI,¹⁰
H. HOOGHIEMSTRA,¹ J. LUNDBERG,¹¹ T. STADLER,¹²
T. SÄRKINEN,¹³ A. ANTONELLI^{14,15*}

Letters to the Editor

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¹Paleoecology and Landscape Ecology, Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, 1098 XH Amsterdam, Netherlands. ²Nederlands Centrum voor Biodiversiteit Naturalis, 2300 RA Leiden, Netherlands. ³Institute of Environmental Biology, Department of Biology, Faculty of Science, Utrecht University, 3584 CH Utrecht, Netherlands. ⁴Laboratorios de Termocronología y Geomatemáticas, Escuela de Geología, Minas y Geofísica, Facultad de Ingeniería, Universidad Central de Venezuela, 1053, Caracas, Venezuela. ⁵ECOPETROL, Instituto Colombiano del Petróleo, Piedecuesta, Santander, Colombia. ⁶Real Jardín Botánico, CSIC, 28014 Madrid, Spain. ⁷Petroleo Brasileiro SA (Petrobras), CEP 20.031-170, Rio de Janeiro, Brazil. ⁸Smithsonian Tropical Research Institute, Balboa, Republic of Panama. ⁹Instituto de Biología, Universidade Federal de Uberlândia, Campus Umuarama, Bairro Umuarama, Uberlândia, CEP 38400-902, Minas Gerais, Brazil. ¹⁰Laboratório de Paleontologia, Campus Floresta, Universidade Federal do Acre, Estrada do Canela Fina, Cruzeiro do Sul, Acre, CEP 69980-000, AC, Brazil. ¹¹Department of Ichthyology, Academy of Natural Sciences, Philadelphia, PA 19103, USA. ¹²Institute of Integrative Biology, ETH Zürich, 8092 Zürich, Switzerland. ¹³Department of Plant Sciences, University of Oxford, Oxford OX1 3RB, UK. ¹⁴Gothenburg Botanical Garden, Carl Skottsbergs Gata 22A, 413 19 Göteborg, Sweden. ¹⁵Department of Plant and Environmental Sciences, University of Gothenburg, Carl Skottsbergs Gata 22B, 413 19 Göteborg, Sweden.

*To whom correspondence should be addressed. E-mail: alexandre.antonelli@vregion.se

References

1. J. Haffer, *Science* **165**, 131 (1969).
2. V. Rull, *J. Biogeogr.* **32**, 921 (2005).
3. V. Rull, *Mol. Ecol.* **17**, 2722 (2008).
4. M. Foote, D. M. Raup, *Paleobiology* **22**, 121 (1996).
5. R. T. Pennington *et al.*, *Proc. Natl. Acad. Sci. U.S.A.* **107**, 13783 (2010).

6. S. Nee *et al.*, *Philos. Trans. R. Soc. London B* **344**, 77 (1994).
7. D. L. Rabosky, *Evolution* **64**, 1816 (2010).
8. N. Cusimano, S. S. Renner, *Syst. Biol.* **59**, 458 (2010).
9. G. E. Shephard *et al.*, *Nat. Geosci.* **3**, 870 (2010).

CORRECTIONS AND CLARIFICATIONS

Perspectives: "The feeding habits of ammonites" by K. Tanabe (7 January, p. 37). The legend should read as follows with corrected genus names: "(Top) *Polyptychoceras* sp. with Baculites-like lower and upper jaws... (Bottom) *Anagaudryceras limatum* (a lycoceratid) with a nautilus-like lower jaw."

Policy Forum: "Boosting CITES" by J. Phelps *et al.* (24 December 2010, p. 1752). The heading for the fourth potential solution was missing. "A Peer-Review Process" should have appeared before the paragraph on the second page that begins, "CITES shortcomings may be overlooked because the convention lacks internal and external checks and balances." The header has been added in the HTML version online.

News Focus: "Will homebody researchers turn Japan into a scientific backwater?" by D. Normile (10 December 2010, p. 1475). There is a shift in the increments on the vertical axis of the graph indicating the number of individuals making overseas visits. From 0 up to 10,000 individuals, the graph uses increments of 2000; above 20,000, it uses increments of 20,000.

News of the Week: "U.N. biodiversity summit yields welcome and unexpected progress" by D. Normile (5 November 2010, p. 742). The name of Alison Stattersfield, head of science for BirdLife International, was misspelled.

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