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## LETTERS

edited by Jennifer Sills

### Studying Extant Species to Model Our Past

THE COVER CAPTION FOR THE SPECIAL SECTION ON *ARDIPITHECUS RAMIDUS* (2 OCTOBER 2009, p. 60; cover caption, p. 5) echoed a conclusion threaded among the Research Articles: *Ar. ramidus* appears to be so different from *Pan* that “extant great apes are poor models for our last common ancestor.” We are concerned that oversimplistic interpretations of such remarks will devalue exciting progress in synthesizing diverse sources of evidence about our past (1–3). Studies of extant species are yielding important information about behavior and cognition that the fossil record lacks (3–5). Of course, naïvely projecting the chimpanzee into the past would provide an incomplete model of human origins, given that modern chimpanzees are not our ancestors. However, extant species play vital roles in several types of contemporary analyses. One of these methods is strategic modeling (6), in which data on extant species are used to derive general principles. This approach is revealing the sociological or ecological correlates of sexual dimorphism, which are being used to interpret the available fossil evidence. Another overlooked method is cladistic analysis, in which features shared by a family of related taxa, such as the great apes (including humans), are identified and parsimoniously attributed to a common ancestor (7, 8). Furthermore, refined referential models, for both single and multiple species, offer behavioral proxies for long-dead forms (9). It would be tragic and illogical if any departures from “chimpanziness” in *Ar. ramidus* were seen as clashing with the integration of recent findings from primatology and paleoanthropology (1–3).

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#### References

1. M. Haslam *et al.*, *Nature* **460**, 339 (2009).
2. W. C. McGrew, R. Foley, Eds., special issue on *Paleoanthropology Meets Primatology*, *J. Hum. Evol.* **57** (2009).
3. R. Boyd, J. B. Silk, Eds., *How Humans Evolved*, 5th Edition (Norton & Company, London, 2009).
4. A. Whiten, C. P. van Schaik, *Philos. Trans. R. Soc. London Ser. B* **362**, 603 (2007).
5. P. Kappeler, J. Silk, Eds., *Mind the Gap: Tracing the Evolution of Human Universals* (Springer-Verlag, Berlin, 2009).
6. J. Tooby, I. deVore, in *The Evolution of Human Behavior: Primate Models*, W. G. Kinzey, Ed. (SUNY Press, New York, 1987), pp. 183–237.
7. R. W. Wrangham, in *The Evolution of Human Behavior: Primate Models*, W. G. Kinzey, Ed. (SUNY Press, New York, 1987), pp. 51–71.
8. R. W. Byrne, *The Thinking Ape: Evolutionary Origins of Intelligence* (Oxford Univ. Press, Oxford, 1995).
9. J. Moore, in *Great Ape Societies*, W. C. McGrew, L. Marchant, T. Nishida, Eds. (Cambridge Univ. Press, Cambridge, 1996).

### Response

WHITEN *ET AL.* IMPLY THAT WE UNDERVALUED extant species. We find this perplexing. We never stated that studies of extant chimpanzees are unimportant. Our conclusions were based on intensive review of homologous anatomical traits in other primates. Indeed, to understand hominid origins, we must now instead rely on “fundamental evolutionary theory,” which Whiten *et al.* refer to as “strategic modeling.” Increasingly relevant is a vast and still growing knowledge of ecological, locomotor, social, and reproductive interrelationships of not just chimpanzees, but other primates and a wide variety of other vertebrates. In fact, using “data on extant species...to derive general principles” was exactly our approach—the majority of the 108 citations in the final *Ardipithecus* paper referenced such studies. We expressly advocated more intensive reliance on additional living species (beyond *Pan*) because these promise a more comprehensive understanding of social structure in advanced K primates (e.g., *Brachyteles* and other atelines), creation and use of tools (e.g., *Cebus*), and even neuroendocrinology (voles and several primates).

A broad comparative base is equally imperative for accurate phylogenetic analyses, particularly those involving cladistics. The potential of the latter methods to accurately “recover” ancestral phenotypes by parsimony relies on the presence and density of taxa (both extinct and extant) surrounding the nodes of interest. This has been empirically shown with morphological data sets (1) and certainly also applies to behaviors. For example, cladistic analysis of extant species may retrieve the locomotor behavioral trait of knuckle-walking, as the

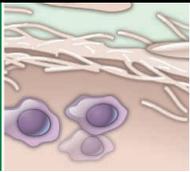


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in tuberculosis

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Australian megafauna

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nodal phenotype for the *Pan/Homo* common ancestor, but the *Ardipithecus* forelimb shows that this inference is simplistic and almost certainly incorrect. Indeed, *Ardipithecus* and other Miocene hominoids establish that extant chimpanzees are poor models for our last common ancestor with chimpanzees. Contrary to Whiten *et al.*'s assertions, this conclusion was informed, and should be further extended, by general principles established from all relevant species. All great ape species merit study and conservation, but despite their genomic proximity, none of them should be interpreted as anatomically or behaviorally “living fossils” or “time machines.”

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#### Reference

1. D. S. Strait, F. E. Grine, *J. Hum. Evol.* **47**, 399 (2004).

## Carbon Accounting a Tricky Business

THE POLICY FORUM “FIXING A CRITICAL CLIMATE accounting error” (23 October 2009, p. 527), in which T. D. Searchinger *et al.* describe the error of assigning biofuel carbon emissions as zero, is long overdue. The heat-trapping potential of carbon dioxide from a

modern carbon source is exactly the same as that from a fossil carbon source. The only way biofuel carbon emissions will have no net effect on the global energy balance is if the modern carbon released during biofuel combustion were removed from the atmosphere and quickly incorporated into a carbon sink. The need to count “changes in emissions from land use when biomass for energy is harvested or grown” is vital, but Searchinger *et al.* minimize the difficulty in determining what those emission changes are.

The land-use changes that may occur due to the widespread use of biofuels such as ethanol are highly variable (1–3). Both forest and abandoned or reclaimed agricultural land have potentially large stores of deep mineral soil carbon. We are just beginning to understand the extent of carbon release associated with conversion to bioenergy cultivation [e.g., (4–6)]. The state of the science related to soil carbon dynamics is not developed enough to allow proper carbon accounting of land-use change.

Furthermore, land-use decisions are a dynamic process based on a variety of factors, many unrelated to biofuels. To fully attribute land-use change emissions to biofuels would require determining what would

have happened in the absence of biofuels. With the complex land-use transitions that may occur—perhaps from cultivation for crops to bioenergy to pasture—it will be exceedingly difficult to ascribe a given land-use history solely to agricultural or bioenergy production. Thus, the science of soil carbon and the difficulty of assigning land use are just two of the many complexities that will further confound adequate carbon accounting—pointing to a need for both further research and careful analysis.

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#### References

1. T. D. Searchinger *et al.*, *Science* **319**, 1238 (2008).
2. M. Wise *et al.*, *Science* **324**, 1183 (2009).
3. K. T. Gillingham *et al.*, *Mitig. Adapt. Strategies Glob. Change* **13**, 675 (2008).
4. S. Fontaine *et al.*, *Nature* **450**, 277 (2007).
5. A. Diochon *et al.*, *For. Ecol. Manag.* **257**, 413 (2009).
6. A. Diochon, L. Kellman, *Geophys. Res. Lett.* **35**, L14402 (2008).

## East German Institutes Stand Tall

THE NEWS FOCUS STORY “AUFBAU OST: MAX PLANCK’S EAST GERMAN EXPERIMENT” (G. Vogel, 6 November 2009, p. 788) claims that “Aufbau Ost” (building up the East) is a project of Max Planck Society. In fact, the term “Aufbau Ost” refers to all government-funded projects to rebuild infrastructure in the former German Democratic Republic. Moreover, our scientific system consists of more than one organization: Others include the Fraunhofer Society, Helmholtz Association, and Leibniz Association. All of these organizations contributed to the scientific “Aufbau Ost.” In fact, in the early years the Max Planck Society indicated that it would not interfere.

The complex process of evaluation and restructuring the East German institutes resulted in more than 40 institutes of the Leibniz Association in the eastern part of Germany employing nearly 7000 people, several large-scale research facilities of the Helmholtz Association, and more than 20 institutes of Fraunhofer Society. None of these was men-

tioned in the story. In nearly all of these institutes, researchers who received their training in East Germany are still working today. These “inherited researchers” have proven to be a crucial support and an important source of innovative ideas for our institutes. They were in no way a burden, as insinuated in the story.

Hans-Peter Hiepe, who administers the German science ministry’s programs for the former East, says in the News Focus story that “[s]cience is really successful when researchers can see their research reflected in the regional economy.” This has already materialized in cases such as Greifswald, Potsdam, Jena, and Berlin-Adlershof.

More astonishing is the quote of Hiepe that the foundation of the research landscape in East Germany “is made of matchsticks.” After nearly 20 years of highly successful work and a number of follow-up evaluations by internationally renowned experts—many with outstanding results—my experience is that we have built our excellent scientific institutions and research infrastructure on a sound basis.

ERNST TH. RIETSCHEL

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