

Phytoplankton
history

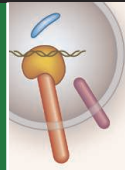
571

Challenges for water
management

573

Handling bones
and bugs

576



LETTERS | BOOKS | POLICY FORUM | EDUCATION FORUM | PERSPECTIVES

LETTERS

edited by Jennifer Sills

Retraction

WE WISH TO RETRACT OUR REPORT “COMPUTATIONAL DESIGN OF A BIOLOGICALLY ACTIVE enzyme” (1), which describes triose phosphate isomerase activity in a computationally redesigned ribose-binding protein (RBP) from *E. coli*. Dr. John P. Richard (Department of Chemistry, Department of Biochemistry, The State University of New York at Buffalo), to whom we provided clones encoding the novoTIM activity, has brought to our attention that the triose phosphate isomerase activity observed in our reported preparations can be attributed to a wild-type TIM impurity—seen in preparations that use a continuous rather than stepwise imidazole gradient (as in the original paper) or that add a second sepharose column. Richard’s reanalysis has now also been confirmed by others in the Hellinga laboratory. The interpretations in the original report were based on lack of observed activity in mutant, engineered enzyme that bound substrate, but lacked catalytic residues. Variations in expression levels of designed proteins relative to the amount of contaminating endogenous protein might account for the pattern of observed activities that led to our erroneous conclusions. The *in vivo* experiments have not been reexamined.

We deeply regret that our report of a designed enzyme activity does not live up to closer scrutiny. Nevertheless, we remain optimistic that the problem of structure-based design of enzyme activity will be solved and that novel catalysts will be produced in conjunction with computationally based methods.

MARY A. DWYER,¹ LOREN L. LOOGER,² HOMME W. HELLINGA³

¹Department of Pharmacology and Cancer Biology, Duke University Medical Center, Durham, NC 27710, USA. ²Howard Hughes Medical Institute, Janelia Farm, Chevy Chase, MD 20815–6789, USA. ³Department of Biochemistry, Duke University Medical Center, Durham, NC 27710, USA.

Reference

1. M. A. Dwyer, L. L. Looger, H. W. Hellinga, *Science* **304**, 1967 (2004).

Comparing Social Skills of Children and Apes

A RECENT RESEARCH ARTICLE BY E. HERRMANN *et al.* (“Humans have evolved specialized skills of social cognition: The cultural intelligence hypothesis,” 7 September 2007, p. 1360) claims that compared with 2-year-old human children, great apes have equivalent technical skills but inferior social skills.

The study features an impressive battery of tests, seemingly administered in the same format to apes and children. However, when a human experimenter provides the social cues, the apes are at a disadvantage (1–3) because they are dealing with a species other than their own. This may not be as relevant for physical or technical problems, which focus on inanimate

objects, but social tasks rely crucially on the relation between experimenter and subject. The reported findings are consistent with the idea that the methodology handicaps apes specifically in the social domain.

The differences between the setups for children and apes in this study appear multi-fold (3). Human children sit on or next to their parent (creating potential “Clever Hans” effects) and receive verbal instructions. They are used to dealing with strangers and are tested by a member of their own species. The apes are alone and confined, receive no verbal instructions, and are tested by a species not their own. We are not suggesting that human experimenters should never be used, but that the social skills that matter most for apes, especially with regards to social learning, are those shown with conspecific models.

In fact, evidence for ape-to-ape social learning is plentiful. Studies of wild chimpanzees in Africa have documented an impressive array of group-specific traditions attributed to social learning (4). Apes tested with a human model they have bonded with (3, 5) or with a familiar member of their species (6–9) have demonstrated social learning that has extended to high-fidelity cultural transmission within and between groups. These findings conflict with the results as well as the central thesis of Herrmann *et al.*



We strongly urge testing of cognition in ecologically valid settings, such as testing social skills with conspecifics. The problem of the human model would be even more severe in relation to Herrmann *et al.*’s proposal to extend their test battery to more distantly related species.

FRANS B. M. DE WAAL,¹ CHRISTOPHE BOESCH,²
VICTORIA HORNER,¹ ANDREW WHITEN,³

¹Living Links, Yerkes National Primate Research Center, Emory University, Atlanta, GA 30322, USA. ²Department of Primatology, Max Planck Institute for Evolutionary Anthropology, Deutscher Platz 6, 04 103, Leipzig, Germany. ³Centre for Social Learning and Cognitive Evolution, School of Psychology, University of St. Andrews, St. Andrews, Fife KY16 9JP, UK.

References

1. F. B. M. de Waal, *Behav. Brain Sci.* **21**, 689 (1998).
2. F. de Waal, *The Ape and the Sushi Master: Cultural Reflections by a Primatologist* (Basic Books, New York, 2001).
3. C. Boesch, *J. Comp. Psychol.* **121**, 227 (2007).
4. A. Whiten *et al.*, *Nature* **399**, 682 (1999).
5. V. Horner, A. Whiten, *Anim. Cognit.* **8**, 164 (2005).
6. A. Whiten, V. Horner, F. B. M. de Waal, *Nature* **437**, 737 (2005).
7. V. Horner, A. Whiten, E. Flynn, F. B. M. de Waal, *Proc. Natl. Acad. Sci. U.S.A.* **103**, 13878 (2006).
8. K. E. Bonnie, V. Horner, A. Whiten, F. B. M. de Waal, *Proc. R. Soc. London Ser. B* **274**, 367 (2007).
9. A. Whiten *et al.*, *Curr. Biol.* **17**, 1038 (2007).

Response

DE WAAL *ET AL.* QUESTION THE VALIDITY OF our finding that while chimpanzees, orangutans, and human children were equally skillful at cognitive tasks in the physical domain, human children were more skillful at cognitive tasks in the social domain. In their critique, there is a single hypothesis that could account for this discrepancy: The social tasks could be especially sensitive to the fact that only the children were tested by conspecifics. (Their other criticisms apply equally to tasks in the physical and social domains and so cannot account for the asymmetry.) We agree that studies with great apes should be conducted with apes interacting with apes whenever possible [e.g., (1–3)], but our Research Article (7 September 2007, p. 1360) is a broad assessment of the cognitive skills of three great ape species and so human experimenters, unfamiliar to all subjects, were necessary.

Recognizing this issue, we selected, whenever possible, cognitive tasks in the social domain that met two criteria: (i) There was previous research demonstrating no substantial difference when apes interacted with humans versus conspecifics; and (ii) apes had demonstrated some success in the past (see table S2 in the Supporting Online Material of

our Research Article for the references). In addition, we measured the comfort level of each individual in our study when confronted with unfamiliar objects and humans. To our surprise, we found the human children to be more shy and less interested in interacting with unfamiliar human experimenters and objects than either of the ape species; moreover, within each species this assessment did not correlate with performance on the social tasks. Finally, in a recent survey by Boesch (4) of great ape cognitive research, it was concluded that across many studies “the use of a human experimenter did not seem to have an influence on the conclusion that humans perform better than chimpanzees.”

Even though we reported on three scales of social cognition (all with similar results), de Waal *et al.* focus exclusively on social learning and the hypothesized effect of a human demonstrator on ape performance. We are great admirers of this team’s studies of social learning using ape demonstrators, but the claim that human demonstrators are harmful for ape performance has no empirical basis: (i) This team’s studies of ape social learning do not compare performance with a human and an ape demonstrator, and so do not address the issue (5–9); (ii) the one existing

study that makes such a comparison finds no difference (10); (iii) the best evidence for action imitation, in a study by Whiten (11), used human demonstrators; and (iv) the best evidence that at least some apes reproduce actions in terms of their underlying intentions also comes from studies with human demonstrators (12). In our study, we do not claim that apes do not learn socially (in fact, they are skilled social learners); our finding is simply that human children prefer to follow the precise means of a demonstrated problem solution more often than do apes (who often prefer to solve it in their own way). This accords with the findings from almost all previous studies that include this comparison (13–15).

ESTHER HERRMANN,¹ JOSEP CALL,¹
MARÍA VICTORIA HERNÁNDEZ-LLOREDA,²
BRIAN HARE,^{1,3} MICHAEL TOMASELLO¹

¹Max Planck Institute for Evolutionary Anthropology, Leipzig D-04103, Germany. ²Departamento de Metodología de las Ciencias del Comportamiento, Universidad Complutense de Madrid, Spain. ³Department of Biological Anthropology and Anatomy, Duke University, Durham, NC 27705, USA.

References

1. B. Hare, J. Call, B. Agnetta, M. Tomasello, *Anim. Behav.* **59**, 771 (2000).
2. A. P. Melis, B. Hare, M. Tomasello, *Science* **311**, 1297 (2006).
3. K. Jensen, J. Call, M. Tomasello, *Science* **318**, 107 (2007).
4. C. Boesch, *J. Comp. Psychol.* **121**, 227 (2007).
5. V. Horner, A. Whiten, *Anim. Cognit.* **8**, 164 (2005).
6. A. Whiten, V. Horner, F. B. M. de Waal, *Nature* **437**, 737 (2005).
7. V. Horner, A. Whiten, E. Flynn, F. B. M. de Waal, *Proc. Natl. Acad. Sci. U.S.A.* **103**, 13878 (2006).
8. K. E. Bonnie, V. Horner, A. Whiten, F. B. M. de Waal, *Proc. R. Soc. London Ser. B* **274**, 367 (2007).
9. A. Whiten *et al.*, *Curr. Biol.* **17**, 1038 (2007).
10. J. Call, M. Tomasello, *J. Comp. Psychol.* **109**, 308 (1995).
11. D. M. Custance, A. Whiten, K.A. Bard, *Behaviour* **132**, 837 (1995).
12. M. Tomasello, M. Carpenter, *The Emergence of Social Cognition in Three Young Chimpanzees* (Monographs of the Society for Research in Child Development, 70, 2005).
13. A. Whiten, D. M. Custance, J.-C. Gomez, P. Teixidor, K. A. Bard, *J. Comp. Psychol.* **110**, 3 (1996).
14. K. Nagell, R. Olguin, M. Tomasello, *J. Comp. Psychol.* **107**, 174 (1993).
15. J. Call, M. Carpenter, M. Tomasello, *Anim. Cognit.* **8**, 151 (2005).

TECHNICAL COMMENT ABSTRACTS**COMMENT ON “Saturation of the Southern Ocean CO₂ Sink Due to Recent Climate Change”**

Rachel M. Law, Richard J. Matear, Roger J. Francey

Unlike Le Quéré *et al.* (Reports, 22 June 2007, p. 1735), we do not find a saturating Southern Ocean carbon sink due to recent climate change. In our ocean model, observed wind forcing causes reduced carbon uptake, but heat and freshwater flux forcing cause increased uptake. Our inversions of atmospheric carbon dioxide show that the Southern Ocean sink trend is dependent on network choice.

Full text at www.sciencemag.org/cgi/content/full/319/5863/570a

COMMENT ON “Saturation of the Southern Ocean CO₂ Sink Due to Recent Climate Change”

Kirsten Zickfeld, John C. Fyfe, Michael Eby, Andrew J. Weaver

We disagree with the conclusion of Le Quéré *et al.* (Reports, 22 June 2007, p. 1735) that poleward intensifying winds could continue to weaken the Southern Ocean sink in the future. We argue that altered winds, along with rising atmospheric carbon dioxide, will likely increase the efficiency of this sink in the 21st century.

Full text at www.sciencemag.org/cgi/content/full/319/5863/570b

RESPONSE TO COMMENTS ON “Saturation of the Southern Ocean CO₂ Sink Due to Recent Climate Change”

Corinne Le Quéré, Christian Rödenbeck, Erik T. Buitenhuis, Thomas J. Conway, Ray Langenfelds, Antony Gomez, Casper Labuschagne, Michel Ramonet, Takakiyo Nakazawa, Nicolas Metzl, Nathan P. Gillett, Martin Heimann

We estimated a weakening of the Southern Ocean carbon dioxide (CO₂) sink since 1981 relative to the trend expected from the large increase in atmospheric CO₂. We agree with Law *et al.* that network choice increases the uncertainty of trend estimates but argue that their network of five locations is too small to be reliable. A future reversal of Southern Ocean CO₂ saturation as suggested by Zickfeld *et al.* is possible, but only at high atmospheric CO₂ concentrations, and the effect would be temporary.

Full text at www.sciencemag.org/cgi/content/full/319/5863/570c

Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the previous 3 months or issues of general interest. They can be submitted through the Web (www.submit2science.org) or by regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged upon receipt, nor are authors generally consulted before publication. Whether published in full or in part, letters are subject to editing for clarity and space.