

## ARTICLES

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### Toward a Postmodern Paleontology?

*Peter Copeland and Keith Parsons*

Over the past twenty-five years, postmodernists, social constructivists, feminists, and others have challenged many basic assumptions about scientific rationality and practice. For instance, such critics have rejected the standard distinction between science fact and science fiction,<sup>1</sup> the distinction between nature and artifact,<sup>2</sup> and the belief that political neutrality is a necessary component of scientific objectivity.<sup>3</sup> If these critics' claims are justified, science as traditionally conceived and practiced is defunct—or at least in need of complete overhaul. Often, though, these critics failed to suggest a way forward by offering a constructive vision of the future of natural inquiry. What would a postmodernist meteorology, a self-consciously social constructivist biochemistry, or a feminist particle physics look like? Would the successors of the traditional disciplines even resemble their predecessors sufficiently still to be called “meteorology,” “biochemistry,” or “particle physics”? What intellectual credentials would such successor disciplines possess?

W. J. T. Mitchell offers very forthright answers to closely related questions in *The Last Dinosaur Book*, published by the University of Chicago Press in 1998.<sup>4</sup> Mitchell is an art historian and literary scholar who holds a chaired professorship in the Department of English Language and Literature and in the Department of Art History at the University of Chicago. It is hard to dismiss Mitchell as a crackpot. His academic qualifications are impeccable and his book was published by a very reputable university press. Moreover, we think that Mitchell's views are not at all atypical of the sorts of opinions about science held in many humanities departments in many of the most prestigious universities. We do not even regard his book as an extreme example of its genre. On the contrary, Mitchell's writing is a model of clarity, coherence, and restraint compared to the effusions of, say, Donna Haraway or Luce Irigaray. Therefore, we do think that Mitchell's views deserve the attention of scientists and philosophers of science, if only to confront, as we must, the vastness of the intellectual chasm that separates us from many of our colleagues in the humanities fields. Here he focuses on dinosaur paleontology to offer a revision-

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ist view of the relationship between science and cultural studies. Though his focus is on paleontology, if Mitchell's analysis is sound, scientists and philosophers of science will have radically to rethink the relations between natural science and the humanities.

Dinosaurs are pop culture icons. Their images are omnipresent; a shopping mall can be a veritable *Jurassic Park*. Yet paleontologists take for granted that they can distinguish between the scientific facts and the fictions of popular culture. Steven Spielberg's *Tyrannosaurus rex* could charge at 35 m.p.h., but many paleontologists think the evidence is decidedly against that possibility.<sup>5</sup>

Mitchell holds that the distinction between scientific fact and cultural image is no longer valid (82, 84). He takes a cue from Bruno Latour who maintains that scientific objects should be regarded neither as purely natural (as scientists conceive them) nor merely as cultural artifacts (as social constructivists view them). Rather, they should be seen as hybrid "quasi-objects," which can be considered as more or less natural or more or less cultural depending on the circumstances.<sup>6</sup> For Mitchell, the demarcation between dinosaurs as scientific objects and as cultural images is no longer possible; the representation and the reality are fused into a hybrid entity. It follows that paleontology, which assumes the defunct demarcation between image and reality, cannot comprehend such entities. What is needed is a hybrid discipline—a fusion of paleontology with Mitchell's own field of cultural studies.

Though he does not explicitly extend his claim to other fields of science, there is no reason why he should not. Many other fields of science encompass subjects of great metaphorical and cultural resonance. For instance, the origin and nature of the universe may hold more fascination for the popular imagination than dinosaurs. Perhaps Mitchell's next project should be *The Last Big Bang Book*. There he could argue that cosmologists should no longer regard the origin and large-scale structure of the universe as their exclusive domain. Rather, they also should accept the aid of academic specialists in the analysis of symbols and images.

Woven throughout *The Last Dinosaur Book* is an implicit epistemology that devalues canons of empirical testability and, instead, would evaluate scientific hypotheses by interpreting their symbolic meaning and cultural significance. In short, hypotheses about dinosaurs are to be interpreted in the ways that literary scholars or historians of art approach their subjects. For instance, for Mitchell, a psychoanalytic explication of the subconscious motivations of paleontologists or museum curators will lead to deeper understanding of dinosaurs than traditional methods of empirical inquiry (150). Mitchell's philosophy is neither original nor contains much formal argument. However, we think it to be a valuable exercise to consider how philosophy, science, or the real world they inhabit, might change if the notion that the sensible world is not the yardstick by which we should measure success in such fields as chemistry, geology, medicine, etc. were to gain widespread currency.

In particular, we here examine and evaluate Mitchell's proposal that practitioners of a new hybrid field—"cultural scientists"—should replace paleontologists as those best qualified to study prehistoric life. While we consider scholarly reflection on dinosaur images and their cultural significance to be an interesting and potentially valuable study, we reject Mitchell's specific proposal. We argue that he fails to show that no legitimate distinction can be made between dinosaur image and dinosaur reality. We also find the nature of his putative successor discipline nebulous, and of dubious value so far as we can understand it. Further, though Mitchell says that he aims more to analyze than to heal C.P. Snow's infamous "two culture" divide (279), it is important to ask whether his proposal will promote *rapprochement* between the humanities and the natural sciences or if it will widen and deepen the schism. We conclude that there is such an enormous disparity between the epistemic standards of Mitchell-style cultural studies and sciences like paleontology, that a fusion of such disciplines is impossible.

Nevertheless, we do not mean to disparage cultural studies in general and do not deny that its findings might aid paleontology. Our claim is specific: Mitchell's particular proposal should be rejected. In principle, there is no reason why various areas of the humanities and the natural sciences cannot be combined to create interdisciplinary fields. Cognitive science, of course, is one such interdisciplinary inquiry, for it draws on contributions from neuroscience, psychology, linguistics, anthropology, and philosophy. Yet progress in an interdisciplinary field surely requires that the participants respect the strengths and limitations of the various specialized components. Such respect demands an accurate grasp of the similarities and differences between disciplines. However, we shall argue that the similarities Mitchell draws between the humanities and the sciences are few and superficial, and his grasp of the differences is even more tenuous.

A case mentioned by Mitchell provides an instance where cultural studies could have made a positive contribution to paleontology. In a 1987 essay, paleontologist Kevin Padian shows how an early representation of pterosaurs with bat-like wings became a fixed image in the minds of Anglo-American researchers and contributed to long-term confusion about these creatures.<sup>7</sup> Padian shows that in some circumstances images can have a powerful effect on paleontology; to make his point, Padian had to become a practitioner of cultural studies by investigating the history and cultural associations of certain images. There is no reason why a scientifically informed professional practitioner of cultural studies could not have done this job and thereby earned the thanks of paleontologists. Unfortunately, Mitchell's attitude resembles that of another of the well-known writers in cultural studies, Andrew Ross, who introduced his book, *Strange Weather*, with the lines, "This book is dedicated to all the science teachers I never had. It could only be written without them."<sup>8</sup> We contend, however,

that the value of the contributions of cultural studies regarding science would be enhanced if its practitioners started by getting the science right.

Much of Mitchell's book is a detailed examination of the dinosaur images that pervade the media and an explication of the various symbolic roles those images play. His conclusion is that dinosaurs have been invested with so much metaphorical and symbolic significance that we can no longer distinguish the totem from the organism. As he puts it: "The truth is that the dinosaur is never really separable from its popular and cultural status" (82). When we try to dig down to factual bedrock about dinosaurs we only uncover new strata of symbolism and metaphor. According to Mitchell, paleontologists' efforts to disclaim the cultural overlay of their dinosaur theories only involve them in deeper entanglement: "Our rational, scientific object, the dinosaur, is in its way an even more deeply superstitious thing than the Indian totem with which it is so often contrasted, if only because our superstitions about it are so constantly disavowed" (164). Not only do scientists fool themselves when they think they've got something right but we can identify their error simply through their declaration of success!

The dismantling of "binarisms"—conceptual polarities that underlie our thinking on many subjects—has been a salient effort of postmodernist writers. One such polarity is the disjunction between image and reality. Leading postmodernist writer Jean Baudrillard contends that in a world permeated by the electronic media, images should no longer be regarded as simulating, representing, or reproducing reality. Instead, we live in a world of deracinated, free-floating images that constitute an autonomous reality—one that cannot be judged by comparison of images with original objects.<sup>9</sup> Latour's view also rejects the standard image/reality dichotomy, and regards these categories not as discrete but as ends of a continuum, and never strictly separable.

Mitchell does not attempt to justify his claim about dinosaurs as hybrids of image and reality with rigorous argument. Rather he illustrates his point by detailing the complexities of the symbolic role that dinosaurs play in our culture:

The dinosaur is the totem animal of modernity. By this I mean, first, that it is a symbolic animal that comes into existence for the first time in the modern era; second, that it epitomizes a modern time sense—both the geological "deep time" of paleontology and the temporal cycles of innovation and obsolescence endemic to modern capitalism; and third, that it functions in a number of rituals that introduce individuals to modern life (77).

So multifarious are the symbolic roles of dinosaurs that Mitchell sees them as the "clan signs" of all sorts of groups, causes, or ideas. Dinosaurs can be gentle giants or demons of boundless rapacity. They can symbolize corporate, civic, and national pride, or they can stand for obsolescence and stupidity. As Mitchell

views them, dinosaurs are omnibus symbol-bearers, prefabricated metaphors suitable for every occasion.

If the dinosaur is thus ineluctably a natural/cultural hybrid, it follows that dinosaur paleontology, as traditionally conceived, cannot adequately address its subject matter. Mitchell concedes that dinosaur scientists' "testimony" is crucial (6), but because they are committed to discovering a mythical trans-cultural, decontextualized truth about "real" dinosaurs, such scientists cannot have the final say. Real understanding can be achieved only when such "testimony" is supplemented by the work of an author who is an outsider and an expert in various fields of the social sciences and humanities:

The author's viewpoint will be like that of an anthropologist interviewing native informants, a cultural historian combing the archives, an art critic poring over an array of images. Neither dinophile nor dino-scientist, the author will approach his subject as an iconologist, an analyst of images—representations, pictures, descriptions, figures, imprints, traces, metaphors—a scientist whose object is not nature but culture, or nature as it is constructed within culture (7).

Mitchell identifies himself as the author who will offer these revolutionary insights (7). Like Bruno Latour, who pioneered the anthropological study of science, Mitchell sees himself as the outsider whose insights are not clouded by the tribe's received mythology.<sup>10</sup>

Dinosaurs are of course employed as symbols in many different contexts, but is everything about dinosaurs so suffused with symbolism that there is no identifiable factual residuum? Mitchell apparently thinks so. For him, *everything* about dinosaur images is simply bursting with symbolic significance; every detail is a vast repository of nuance and a nexus of proliferating tropes. Despite his disavowal (177), when it comes to dinosaurs, a cigar is never just a cigar for Mitchell.

Even if we do concede that every detail of dinosaur imagery is chock-full of symbolic import, Mitchell's conclusion is a non sequitur. Surely the Tlingit artists who created the totem poles could distinguish a carved totem bear from a real bear. The fact that an image has profound symbolic meaning for us does not in general preclude us from knowing many quite literal truths about the object it represents. Naturally, the cross is a potent symbol for Christians, but this does not prevent even devout Christians from viewing it also as the instrument of torture and death it literally was. Mitchell therefore fails to show that paleontologists cannot isolate a scientific object effectively unpolluted by popular culture.

Mitchell himself demonstrates that the conflation of image and reality inevitably leads to confusion. On the one hand, Mitchell admits that, at least for practical purposes, we can distinguish between our images of dinosaurs and what they were really like. He even rushes in where many paleontologists would fear to tread—asserting that our present reconstructions of dinosaurs differ

little from what a Mesozoic eyewitness would have seen (50). Mitchell therefore implies not only that we can distinguish image from reality, but also that we can judge some representations more true to life than others. Still, the text has numerous statements to the effect that “The truth is that the dinosaur is *never* really separable from its popular and cultural status” (82; emphasis added). The specific case of dinosaurs is only an example of Mitchell’s general attitude about investigations of the natural world; he asserts, “Nature *is* culture, science is art. We don’t ever ‘see nature’ in the raw, but always cooked in categories and clothed in the garments of language and representation” (58, emphasis in the original). Such statements only reiterate the alleged futility of attempting to state what dinosaurs were really like, or of trying to know any literal truths about them. Concessions to realism seem to be given with one hand and taken back with the other.

While it is trivially true that concepts are human constructs, we contend that some concepts can reasonably be deemed correct, regardless of their garments of language and representation. Concepts such as gravity seem so well founded that it seems foolish to insist that we have not, in this instance, seen nature in the raw. Moreover, if nature really is culture we would be able to find abundant examples of conclusions, and successful applications of the conclusions, about the natural world made by researchers in different cultures that were strikingly at odds with one another. In other words, the inverse-square law of gravitation could now be considered a quaint notion associated only with seventeenth-century England, not applicable in modern Botswana or Polynesia.

Mitchell’s text is full of enigmatic claims, essential to the understanding of his whole project, and he never makes clear just how we are to take them, nor does he give us any benchmarks by which his assertions might be evaluated. Earlier we quoted Mitchell, saying, “The dinosaur is the totem animal of modernity. By this I mean, first, that it is a symbolic animal that comes into existence for the first time in the modern era” (77). What is it that first comes into existence in the modern era? It is not the animal—unless in Mitchell’s lexicon “modern era” extends back some 200 million years! It is trivial to assert that dinosaur symbols were first employed in the modern era, since Owen first recognized the Dinosauria as a distinctive order of reptiles in the mid-nineteenth century.<sup>11</sup> How then do we take the statement above so that it is not patently false or trivially true? To say that an animal/image hybrid first came into existence in the modern era does not answer the question unless that concept is adequately explicated. Again, what is the dinosaur if it is not just an animal and not just as a symbol, but somehow simultaneously both and neither? We regard such enigmatic passages as symptomatic of the confusion that results when writers conflate concepts that should be kept distinct. Some “binarisms” seem necessary for rational thought.

Since Mitchell’s key concept—the dinosaur as natural/cultural hybrid—is

never sufficiently clarified, the nature of his project remains nebulous. We just do not understand what it means that, “dinosaurs might be thought of . . . as members of a very large and diverse class of depicted animals, some real (lions), some imaginary (unicorns) and some perhaps in between (dinosaurs)” (53). We understand that things theorized but not actually seen, such as quarks or the liquid outer core of the Earth may or may not be real, but we think we would have as much trouble recognizing a partially real, partially imaginary dinosaur as we would in identifying one that was partially dead or partially pregnant.

Mitchell could reply that the problem is not his failure to elucidate, but the wooden literal-mindedness of those, like the two present authors, who insist on a specious “clarity” when puzzle and paradox are needed to break the grip of paralyzing dichotomies. Further, Mitchell could charge that we are holding the sorts of readings and interpretations he does to an inappropriately severe standard of logical and empirical rigor. Curiously, however, Mitchell is at pains to draw (trivial) parallels between what he does as a humanities scholar and the methods of scientists:

Much of what the humanist does is very similar to scientific practice. We gather data, assemble evidence, try to make arguments that are internally consistent and true. We invent technical metalanguages (linguistics, anthropology, narratology, structural poetics, iconologies) to map and describe the field of culture, just as scientists invent names and descriptions for the field of nature (282).

Indeed, he holds that the terms “scientist” and “science” are just as appropriately applied to him and what he does as they are when applied to their usual referents. Thus, he sees Snow’s rift between the “two cultures” as really a division between two sciences:

The two culture split then should really be called a “two science” division, between two distinct traditions of knowledge production, one centered mainly on cause-and-effect explanations of natural phenomena, the other based on something more like reading and interpretation, the analysis of social formations, and archival recovery of the past. Each tradition has its own styles of reasoning, argumentation and proof, and each can learn a great deal from the other about how to proceed (283).

If by “interpretation” Mitchell means that the humanities, unlike the physical sciences, require *Verstehen* in Dilthey’s sense of empathetic understanding, he may have a point. But in a looser sense, “reading and interpretation” are just as much a part of science as other fields. It is a commonplace that data are often ambiguous and that crucial experiments are very rare, so scientists must interpret new findings in the light of accepted theory and background knowledge. Finally, it is ironic, in a book centrally concerned with paleontology, that he should assign “archival recovery of the past” solely to the humanities.

It is difficult to reconcile the juxtaposition of the methods he uses in his book, his description of how science might get better, and his self-identification with scientists in general without concluding that Mitchell doesn't know as much as he should about his chosen subject. Mitchell opines that, "scholars who link science to culture are motivated mainly, I think, not by a desire to discredit science, but to understand it in a new way" (283). It seems impossible for Mitchell to understand science in anything *but* a new way since he does not understand it in the old way. The incongruity between Mitchell's sense of science and the habits and attitudes of most physicists, chemists, etc., is illustrated in the following two passages:

The "two culture split" between science and "the humanities" has often been deplored, but it has an important role to play in serving as a check on the claims of science to an exclusive grip on "the truth" about moral, political, and social issues (203).

The dinosaur may help some children to resist the bone-headed distinctions between "pretending" and "reality", and prolonging their sense of wonder (254).

Now it is rare to find scientists making the claim that their work gives any—let alone exclusive—insights into moral issues, and Mitchell offers no such examples. Further, one need not regard the distinction between pretending and reality as "bone-headed" in order to have a well-developed sense of wonder. The work of science has shown the sensible world to be a fantastic place indeed, but this does not mean one needs to apply fantasy to appreciate or understand it better. Delusion may be more consoling than truth but rarely contains more utility. Moreover, study of the sensible world can be *both* wonderful and instructive, but not if one decides ahead of time that there are no significant differences between the "pretend" and the "real." As Snow noted long ago, we should indeed encourage the two cultures to understand each other better, but, unfortunately, the idea that science has a great deal to teach Mitchell about how to proceed does not seem to have manifested itself in *The Last Dinosaur Book*.

Mitchell regards the ongoing (and worsening) estrangement between the sciences and the humanities as due largely to the polemics of such scientists such as Paul Gross, Norman Levitt, and Alan Sokal.<sup>12</sup> Yet Mitchell's declaration that he is a scientist, and his promotion of "cultural studies" to "cultural science," is likely to exacerbate the split for at least two reasons. First, those who have spent their lives trying better to understand the natural world using hypothesis-testing as a guidebook will recoil from one who wishes to proclaim himself a member of the club while at the same time rejecting the fundamental methods and assumptions of the club. Of course, Mitchell says above that the methods of both disciplines—paleontology and cultural studies—should be used to understand dinosaurs. Yet such a synthesis seems highly implau-



sible given that the methods and practices of paleontology all presuppose the very assumption that Mitchell most emphatically rejects—that science can identify natural objects, distinguish them from their various symbolic representations, and acquire literal, non-metaphorical knowledge about them. It is hard to see what becomes of paleontology—or any science—if such an assumption is surrendered.

The damage done to the relationship between scientists and non-scientists of the sort just described will only come to pass if scientists pay attention to Mitchell, and thus the damage may be expected to be small. However, the second, and much more important, degradation of the relationship between the two groups promulgated by *The Last Dinosaur Book* will come from the reaction of non-scientists, who will likely give it a much wider and more serious hearing. The hearing will be more widespread because, as Mitchell points out, our culture has a strange fascination with dinosaurs. One does not have to be a paleontologist to have an interest in dinosaurs, and many people without an understanding of science will be drawn to a book with “dinosaur” in its title. However, these readers are likely to take away a new—and erroneous—view of what scientists do and the relationship between them and the rest of society after reading the descriptions of this topic offered by Mitchell. Those who have but a slight grasp of the notion of what scientists do and how they view the world will not gain greater purchase on this concept through Mitchell’s descriptions of science.

One of Mitchell’s remarks best illustrates the incompatibility between his approach to dinosaurs and the paleontologist’s. He says that in cultural analysis of the dinosaur, “There is no limit to the stories that can be made up . . . and no limit to the ways of interpreting those stories” (48). Mitchell gives numerous examples of the boundlessness of his storytelling about dinosaurs and their images. Consider his meditation on the green color conventionally given dinosaurs in popular illustrations:

So where does this leave greenness? Is it a symbol of the “colored” racial other, the savage, primitive denizen of the green world? Or is it an emblem of the white man’s burden, the color of the military camouflage required for the Great White Hunter to blend in with the jungle and thus to dominate it? The answer by now should be evident: gray-green is both black and white, both “colored” and no color at all. It designates both sides of the “color line”. . . . The dinosaur can symbolize the dominant “master race” that commands a global empire, the vanished, savage races that lost out in the Darwinian struggle, or an invading horde of aliens who threaten white supremacy (147–149).

Much advancement of our understanding of the cultural history of dinosaurs may be made by telling these (or completely contrary) stories. However, if our goal is to understand *dinosaurs* themselves, our stories cannot simply proliferate. The same thing holds for hypotheses about any natural phenomenon.

Take combustion, for instance. For all we know *a priori*, limitless “stories” could be told about the causes of combustion. Many stories can be *imagined*, but those that invoke phlogiston are simply *wrong*. They are still wrong even if we deliberately infuse our analysis with more “fantasy, unbridled speculation and utopian imagination,” as Mitchell suggests (284).

Science in fact thrives on speculations, and imaginings, but only if we allow such fancies sometimes to founder on the hard rock of empirical reality. Mitchell displays his predilection for ignoring or misunderstanding this most elementary concept:

almost every educated person regards some version of Darwinism as pretty close to the truth, and thinks of science (or scientific method or reasoning) as authoritative. That is the problem. It is exactly this widespread public faith in the institutions of science (and their impressive technological results) that lends credibility and authority to neo-Darwinist and sociobiological pronouncements about human nature (205).

Here again we see Mitchell’s epistemological viewpoint in which the evaluation of science is divorced from our understanding of the tangible world. We suggest the real problem Mitchell ought to be concerned with the next time he boards an airplane on his way to a meeting of the Modern Language Association is whether or not the engineers who designed and built the plane had a clear notion in their minds regarding the difference between fantasy and reality. If they did not, Mitchell may never get another chance to argue that it is bone-headed to hold such distinctions. How can the hypotheses of sociobiology be refuted (if they can be) other than by the evaluation of the predictions associated with such ideas? What authority is there for evaluating empirical claims other than scientific methods or reasoning? The problem is not that scientific analysis gives authority to currently unpopular conclusions, but that anyone thinks that the popularity of a particular hypothesis has anything to do with its truth or falsity.

Can we not easily imagine Pope Urban VIII uttering a pronouncement regarding the heliocentric model of the solar system quite similar to Mitchell’s treatment of Darwinian evolution? This approach did not serve to discredit Galileo and has no chance of doing much damage to Darwin because it completely misses the point.

In general, what results can we expect if unlimited storytelling replaces the effort to understand the physical universe by the rigorous testing of the specific predictions of competing hypotheses? Mitchell’s view of science-as-storytelling has already led to misunderstanding, and if we allow *The Last Dinosaur Book* and others like it to promote the notion that nature is constructed within culture—and not conversely—we should not be surprised when we once again hear of police agencies using public funds to hire a “psychic,” or when another cult advances pseudo-scientific nonsense to achieve a spiritual goal,

such as the sort Heaven's Gate applied to the arrival of the Hale-Bopp comet—again with tragic results. Members of the academy (particularly those in humanities faculties) may have found adoption of the philosophy of relativism—that one idea is just as good as another, that “different ways of knowing” are just as important as what they claim to know—useful for saving one's career but medical doctors in emergency rooms have as yet not found this approach useful for saving lives.

Mitchell echoes Snow as he notes that it is the two-culture split “that prevents scientists and humanists from understanding one another and that makes scientific thinking incomprehensible to ordinary people” (279). Scientific thinking is indeed incomprehensible to many ordinary people and much of the blame for this may lie with instructors of science. Scientists and philosophers of science need to find better ways of explaining what it means to investigate the natural world with reductionism and hypothesis-testing lighting the way, without suggesting that this need be the only way of living one's life while at the same time making clear how much the poorer we would be if everyone chose an approach which rejected it altogether. As Mitchell says, the relationship between the two cultures “clearly cannot thrive by [the two groups'] pillorying each other” (283), but neither can the divide between them be bridged by wishing it away. An attitude of bi-culturalism will serve us well in this regard; an attitude that groups into the same category radically different notions of how to view the tangible world will not.

It is simply impossible to yoke two such epistemically disparate pursuits as paleontology and Mitchell-style cultural science. Our understanding of dinosaurs cannot be enhanced by joining paleontology to a field where the guiding principle seems to be the promotion of any story or interpretation that appeals to the ideological fixations of a professorial clique. We therefore conclude by rejecting Mitchell's recommendation that an interdisciplinary hybrid of traditional paleontology and cultural studies—a postmodern paleontology—replace the disciplines that presently inquire into the life of the deep past. Paleontologists can indeed learn from practitioners of cultural studies, but we think they will be more inclined to listen if they are not told that their discipline is passé and their quest better to understand the life of the past is a sham.

## Notes

1. For example, Donna Jeanne Haraway, *Primate Visions: Gender, Race, and Nature in the World of Modern Science* (New York: Routledge, 1989).
2. For example, Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts*, Second edition (Princeton: Princeton University Press, 1986).
3. For example, Sandra Harding, *Whose Science? Whose Knowledge? Thinking from Women's Lives* (Ithaca, NY: Cornell University Press, 1991).
4. W. J. T. Mitchell, *The Last Dinosaur Book: The Life and Times of a Cultural Icon* (Chicago: University of Chicago Press, 1998). For further references, page numbers will be cited in the text.

5. John R. Horner and Don Lessem, *The Complete T. Rex: How Stunning New Discoveries Are Changing Our Understanding of the World's Most Famous Dinosaur* (New York: Simon & Schuster, 1993). See also R. McNeill Alexander, *Dynamics of Dinosaurs and Other Extinct Giants* (New York: Columbia University Press, 1989).
6. Bruno Latour, "One More Turn After the Social Turn," in *The Social Dimensions of Science*, ed. Ernan McMullin (Notre Dame, IN: University of Notre Dame Press, 1992), 282.
7. Kevan Padian, "The Case of the Bat-Winged Pterosaur" in *Dinosaurs Past and Present*, volume 2, ed. Sylvia J. Czerkas and Everett C. Olson (Los Angeles: Natural History Museum of Los Angeles, 1987), 70.
8. Andrew Ross, *Strange Weather: Culture, Science, and Technology in the Age of Limits* (London & New York: Verso Books, 1991).
9. Jean Baudrillard, "Simulacra and Simulations," trans. Jacques Mourrain, in *Jean Baudrillard: Selected Writings*, ed. Mark Poster (Stanford: Stanford University Press, 1988).
10. Latour and Woolgar, *Laboratory Life*.
11. Hugh Torrens, "Politics and Paleontology: Richard Owen and the Invention of Dinosaurs," in *The Complete Dinosaur*, ed. James O. Farlow and M.K. Brett-Surman (Bloomington: Indiana University Press, 1997), 175–190.
12. For example, see Paul R. Gross and Norman Levitt, *Higher Superstition: The Academic Left and Its Quarrels with Science* (Baltimore, MD: Johns Hopkins University Press, 1994). See also Alan Sokal and Jean Bricmont, *Fashionable Nonsense: Postmodern Intellectuals' Abuse of Science*, (New York: Picador, 1998).

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