Research News

Taxonomic chauvinism

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Research in ecology and behaviour is dominated by studies on birds and mammals, and scientists who work on less 'popular' organisms (such as amphibians and reptiles) frequently complain that referees are biased against them. Our survey of >1000 recent papers revealed that published studies on ectothermic vertebrates were framed more conceptually than were those on endothermic vertebrates, as predicted by this complaint. Such unconscious biases might substantially affect the publication process.

Scientific journals receive many more manuscripts than they can publish. Although acceptance depends on the merit of the work, does it also depend upon the personal biases and preconceptions of the referees and editors involved? 'Irrelevant' issues, such as a person's status, sex and institutional affiliation, do influence the evaluations of their scientific work [1–5]; however, another potential bias involves the taxonomic identity of the study species. Scientists who study 'unconventional' or 'unpopular' study organisms often complain that their papers are rejected for publication because they are seen as lacking general interest, whereas equally narrow studies on 'popular' or 'model organisms' are accepted. The alleged mechanism generating this bias is a simple one: researchers are most interested in papers on their own study organisms. Thus, papers based on model organisms will be handled more sympathetically during refereeing and editorial decision-making. By contrast, a manuscript describing studies on an unpopular organism will often be judged by people who do not work with that kind of organism, and who will thus see less general interest in the study.

This complaint predicts that, to be accepted for publication, a paper based on unpopular organisms will need to be framed in broader conceptual terms than will a paper based on model organisms. For example, a paper on birds might be accepted even if it defines its aims only in terms of bird biology, whereas a paper on snakes would be rejected as being of too little general interest if it were focused only in terms of snake biology. Thus, papers on unpopular organisms will be judged 'of general interest' only if the work is well embedded in theory – a filter that will apply less strongly to papers on model organisms.

Such a difference should be evident in the introductions to published papers. We surveyed 1171 papers published in 1992, 1996 and 2000 in nine leading journals whose ISI impact factors in 1997 were >1.8, including both American and European publications and spanning the range from behavioural through to evolutionary ecology (Table 1). We selected only articles with a discrete 'introduction'. Displaying our own chauvinism, we arbitrarily restricted the study to papers on vertebrates.

Are some taxonomic groups strongly over represented?

Our null hypothesis was that vertebrate classes that are more species rich should feature more commonly in the papers surveyed. However, although there are more than twice as many ectothermic species (fish, amphibians, squamate reptiles, turtles and crocodilians) as endothermic (avian plus mammalian) species (~31 000 versus 13 000), >71% of the papers analysed dealt only with endotherms.

Birds were highly over-represented ($n = 513$; 44% of papers versus 20% of species), as were mammals ($n = 320$; 27% of papers versus 9% of species). Other groups attracted less attention than was expected given their species richness: fish ($n = 165$; 14% of papers versus 48% of species), reptiles (including lepidosaurs, turtles and crocodilians: $n = 87$; 7% of papers versus 14% of species), amphibians ($n = 85$; 7% of papers versus 9% of species).

How can we measure 'generality' of an introduction?

We scored the length of each introduction (number of printed lines) and the 'line of first mention' of the study organism. That is, how far into the introduction is the study species (or higher lineage) mentioned for the first time? A more conceptually framed introduction will develop ideas before mentioning taxa, thus delaying the first mention of the study organism.

As expected, 'narrow' introductions (those lacking even a single sentence devoted entirely to general concepts) mentioned the study organism sooner than did 'general' ones (ANOVA, $F_{1,1167} = 221.68$, $P < 0.0001$); the line of first mention correlated with the journal's impact factor [i.e. journals with higher ISI impact factors in 1997 exhibited longer 'delays' to first mention of the study organism ($n = 9$, $r = 0.80$, $P = 0.009$); and the line of first mention is typically much later in concept-oriented journals than in taxon-oriented journals]; and the line of first mention has increased over the last decade, as have rejection rates of high-impact journals. These patterns suggest that the line of first mention does reflect the degree to which the introduction is

Table 1. Numbers and proportions of articles dealing with either endothermic or ectothermic vertebrates among the journals sampled[a]

Journal	Number of articles: Endotherms	Number of articles: Ectotherms	Proportion of ectotherms (%)
Animal Behaviour	324	76	19
American Naturalist[b]	35	10	22
Behavioral Ecology[b]	98	36	27
Ecology[b]	102	62	38
Evolution[b]	48	71	60
Functional Ecology	45	23	34
Journal of Animal Ecology	98	12	11
Journal of Evolutionary Biology	26	21	45
Oikos	57	27	32

[a]Data combined for volumes from 1992, 1996 and 2000.
[b]On average, 39% of the studies published in American journals dealt with ectothermic organisms, whereas this was only 22% in European journals.

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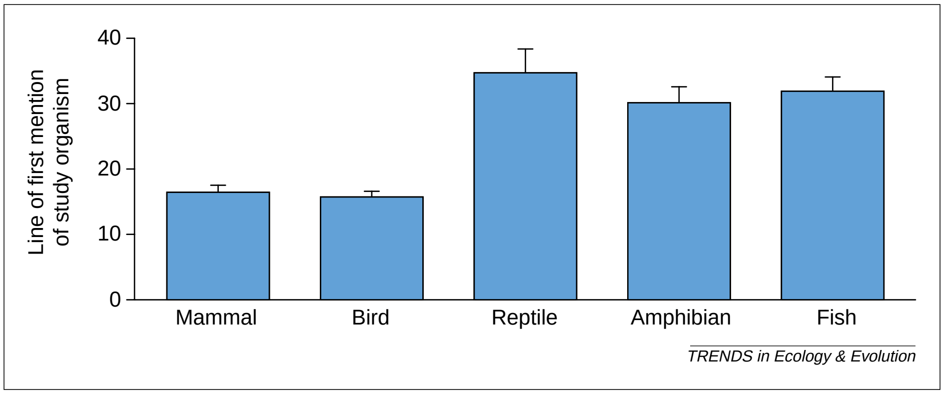

Fig. 1. A comparison of ecological papers published on five vertebrate Classes, in terms of the position within the introduction (number of printed lines after beginning of introduction) at which authors first mentioned the organism on which their study was based. The histograms show mean values and associated standard errors. Sample sizes for the classes are 320, 513, 87, 85 and 165, respectively.

framed in conceptual terms.

Are endothermic study organisms mentioned sooner and more often?

On average, the Class of the study organism was first mentioned at line 16 of the introduction in 833 papers on endotherms (mammals and birds), versus line 32 (on average) in 338 papers on ectotherms (reptiles, amphibians and fish: one-factor ANOVA, $F_{1,1169} = 122.8$, $P < 0.0001$; Fig. 1). Average values for line of first mention did not differ between the two endotherm classes, or among the three ectotherm classes (Fisher's PLSD, $P > 0.18$ in all comparisons). However, the three ectotherms all differed significantly from the two endotherms ($P < 0.0001$; Fig. 1). Thus, organisms from more popular Classes were mentioned earlier (regressing line of first mention versus '% of papers devoted to that Class', $n = 5$, $r = -0.91$, $P < 0.035$), a difference in position that was evident in all surveyed journals. A two-factor ANOVA (with the factors ectotherm/endotherm and journal, and the dependent variable position of mention of study organism) confirmed that study organisms were mentioned earlier in some journals than in others ($F_{8,1152} = 4.15$, $P < 0.0001$) and that endotherms were mentioned much earlier than were ectotherms ($F_{1,1152} = 54.63$, $P < 0.0001$), with no significant interaction term between these factors ($F_{8,1152} = 1.04$, $P = 0.40$). To control for differing lengths of introductions, we also calculated the line of first mention as a proportion of the length of the entire introduction. The result was unchanged.

Endothermic study organisms were cited more often in their relevant introductions than were ectotherms in theirs. The means (adjusted for length of the introduction) were 6.58 mentions for endotherms and 5.44 mentions for ectotherms ($F_{1,1021} = 4.99$; $P < 0.026$).

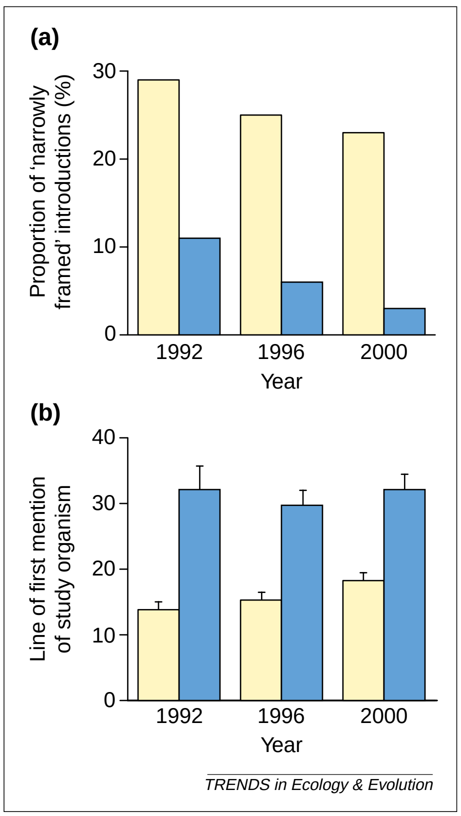

Fig. 2. Changes through time in the proportion of 'narrowly framed' versus 'broadly framed' introductions to scientific papers in nine ecological journals (Table 1). Data were obtained for three years (1992, 1996 and 2000) and sample sizes were: endothermic vertebrates (birds and mammals; yellow bars): 1992, 235; 1996, 293; and 2000, 303; ectothermic vertebrates (fish, amphibians and reptiles; blue bars): 1992, 97; 1996, 119; and 2000, 122. (a) Shows the proportion of introductions in each category for papers based on either endothermic or ectothermic vertebrates. (b) Shows changes through time in the position within the introduction (number of printed lines after beginning of introduction) at which authors first mentioned the organism on which their study was based. The histograms show mean values and associated standard errors.

Are endotherm papers framed less broadly?

We classified 25.2% of the endotherm introductions as focusing exclusively on the study organism; this proportion was only 6.5% for ectotherm studies ($\chi^2 = 52.7$, df = 1, $P < 0.0001$). Therefore, ectotherm papers were focused more broadly than were endotherm papers.

Have these patterns changed through time?

Because we sampled papers from 1992, 1996 and 2000, we could look for any temporal shift in the generality of introductions. No such change was evident. The proportion of narrow introductions has decreased (Fig. 2a), but the taxonomic difference remains (Fig. 2). The proportion of ectotherm-based studies relative to endotherm-based studies has been stable (29% versus 71% in all three years).

Are there alternative interpretations of these patterns?

There are many reasons why research focuses on model organisms [6], and the over-representation of endotherms in ecological and behavioural studies is unsurprising. More worrying is whether this taxonomic bias prejudices the decisions of editors and referees. The publication differences between papers on ectotherms and endotherms are very clear (Fig. 1), so the only plausible challenge to this conclusion involves interpretation. In particular, do attributes of published introductions (line of first mention of study organism, number of times that study organism was mentioned and the presence of conceptual phrases) estimate the degree to which a paper is framed in terms of ideas, versus attributes of the specific study organism? In keeping with our interpretation, the various measures were intercorrelated, and showed patterns that we would expect of a measure of conceptual generality.

Are these differences in generality of approach caused by bias from editors and referees? Alternatively, papers on 'model organisms' may not need to include as much conceptual justification, because the significance of the new data is already well understood. However, this interpretation predicts that introductions to endotherm papers should be briefer (which was not the case) and does not explain why the endotherm papers frequently mention the study organism, and rarely mention any general concepts. Thus, 'taxonomic chauvinism' offers the likeliest explanation for these patterns.

How can we redress this bias?

We doubt that an 'ornithological Mafia' has conspired to suppress other disciplines. Herpetologists are equally passionate about their study animals, and a brave new world in which reptiles replaced birds as model organisms would see a reversal, rather than a disappearance, of the existing biases. The personal interests of ornithologists and mammalogists have influenced the structure of published papers only because their study animals have dominated ecological research, and thus people interested in these organisms have come to dominate the ranks of referees and editors (even those dealing with papers on other kinds of organisms). Similar prejudices probably apply to all researchers.

Most professional scientists acknowledge that their personal proclivities influence their scientific judgements. As fallible humans, we are often unaware of the nature of such prejudices [2,3] (http://buster.cs.yale.edu/implicit/). Our data highlight the need for editors and referees to consider their own biases – including their level of interest in different kinds of organisms – when they evaluate manuscripts during the peer-review process. None of us are immune to such prejudices, but we need to be aware of their influence on processes that we optimistically contend to be 'objective' evaluations of the quality of science. Our study suggests that such decisions (whether they involve publications, grants or promotions) should be made by groups of people that encompass a diversity of taxonomic and conceptual expertise.

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Inference of reticulation in outcrossing allopolyploid taxa: caveats, likelihood and perspectives

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Single- or low-copy nuclear sequences are now widely employed for phylogenetic reconstruction. In a new paper, Ferguson and Sang apply this approach to allotetraploid species of peonies *Paeonia* and document the first case of natural homoploid hybrid speciation between tetraploid taxa. This surprising finding could shed light on the relationship between the two main pathways of hybrid speciation: allopolyploidization and homoploid hybrid speciation. In addition, this work illustrates both the promise and uncertainty associated with the reconstruction of reticulate phylogenies using molecular tools.

The ease with which a sequence can be derived from multiple genes has made it feasible to reconstruct increasingly complex organismal histories. Recently, for example, Ferguson and Sang [1] proposed that the peony *Paeonia officinalis*, an outcrossing allotetraploid species, was derived from hybridization between two other tetraploid species. This article apparently represents the first documented example of homoploid hybrid speciation *in natura* involving polyploid taxa. The complex, reticulate, genealogy of *P. officinalis* was deduced from the classic triptych of molecular markers, including chloroplast DNA (cpDNA; [2]), nuclear ribosomal DNA (nrDNA; [3]) and low-copy nuclear gene sequences. Although the evolutionary fates of these types of sequence have been recently discussed [4] (Box 1), the frequencies of concerted evolution, pseudogene formation, and gene duplication and deletion during the stabilization process following allopolyploidization remain poorly understood. This lack of information hampers the reliability of phylogenetic reconstruction when reticulation is under scrutiny. The recent article by Ferguson and Sang [1] on homoploid hybridization is one of the first to address these issues and it provides some guidelines for studies of the origins of allopolyploid taxa and their hybrid derivatives.

Based on DNA sequence data from the genes encoding alcohol dehydrogenase (*Adh1* and *Adh2*), Ferguson and Sang suggest that *P. officinalis* (section *Paeonia*) arose from homoploid hybridization between its tetraploid congeners, *P. peregrina* (Fig. 1) and *P. arietina* (section *Paeonia*). Six diploid species and five tetraploid species of section *Paeonia* were included in the study, as well as five species of sections *Onoepia* and *Moutan*. Among the tetraploid species, *P. officinalis* and *P. peregrina* were represented by two accessions. More comprehensive molecular descriptions (nrDNA and

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