

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

Males and females of the Eclectus parrot, *Eclectus roratus*, have such different coloration that for many years they were thought to be separate species (the male is green). The fact that the two sexes have the same coloration in most parrot species makes this an even more striking example of the widespread problem of synonymy — the existence of two or more names for the same species.

how many have yet to be revealed. Using the gamma distribution (a flexible two-parameter distribution) as their model of the amount of time it takes to reveal a synonym, Solow *et al.* employ likelihood techniques to estimate that the true proportion of synonyms is around 39%, about double the observed rate. They also estimate that, on average, it takes 43 years to identify a synonym.

As a problem in statistical estimation, this particular example belongs to a large class which includes such diverse questions as estimating the size of an author's vocabulary from observed samples of writing, or the true number of executions in South Vietnam from official records¹. When placed in such company, the analysis of Solow *et al.* stands out as particularly simple in its detail. Their method may, in fact, be the simplest possible likelihood model for problems of this kind. We thought that an even simpler approach might be to use the one-parameter exponential distribution, instead of the two-parameter gamma, to model the time to detection. But the constraints on the database (in particular, the curve of observed synonymies against time is necessarily 'anchored' to zero in the last time period of the study) are such that this approach turns out to be excessively simple, producing a nonsensical answer: with this one-parameter distribution, we are led to the conclusion that all names are synonyms, and that it will take more than 200 years to discover the fact. The exercise, however, serves to underline the technical difficulties that can arise when trying to estimate true synonymy rates.

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In fact, such questions of how many words Shakespeare knew (akin to the true synonymy rate, and thus the true total number of recorded species) turn out to be more difficult to answer than questions of how many new words might be expected in a newly discovered sonnet by Shakespeare⁷ (akin to the observed synonymy rate). The latter is, in principle, a testable prediction. We hope it will be possible to test the implicit predictions of Solow and colleagues' model by noting how many synonyms will be discovered in, say, the next two years. The outcome of such tests will tell us more about the many issues that naturally arise from their pioneering paper.

Apart from the statistically technical questions about drawing conclusions from the available data for one group, such as thrips, there are other questions about how representative thrip synonyms may be. Rates of synonymy are lower among the more charismatic groups, such as birds and mammals, which have always received more attention than most invertebrates (but see illustration). And among invertebrates, we can be fairly sure that butterflies, and even thrips, have been more favoured by taxonomists than, say, nematodes. Suppose, however, that Solow and colleagues' upward revision from an observed synonymy rate among thrip names of around 20%, to a true synonymy rate of around 40%, does indeed prove to be generally representative. The implication would be that the true global total of named and recorded species could be around one million.

The total number of species alive today is, of course, even more uncertain, with estimates ranging from 3 million to 30 million or more. Many, though by no means all, of these estimates are based on the number of distinct species currently named and recorded. So any downward revision in this number, as a result of better understanding of synonymy rates, will at the same time tend to lower estimates of the global species total. □

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Recolonization

DELHI belly, Montezuma's revenge, gippy tummy and so on, are all jocular terms for traveller's diarrhoea. It is often blamed on poor foreign hygiene, but this is unfair; travellers to the most sanitary countries can get it. The traveller's gut organisms, carried from his home region, find themselves challenged by the local varieties. These are better adapted to local conditions (which is why they are established there in the first place). They displace the traveller's own organisms, stirring up in the process a volcanic intestinal immune response. When it dies down, the traveller is as immune to the locals as he was to his previous inhabitants.

Daedalus is now at work on the obvious countermeasure — immunization. DREADCO biologists are collecting samples of indigenous gut organisms from all over the world, and are drawing up a global map of their distribution. The samples are being dried, irradiated and so on, to produce enfeebled and attenuated forms which cannot multiply, but still put the immune system on guard against them. When the system has been perfected, a traveller will simply tell DREADCO where he plans to go, and will receive a capsule of attenuated gut organisms from that region. He will take it about ten days before his flight. As with many immunizations, he may experience brief mild discomfort, but nothing dramatic. When he reaches his destination, the local organisms will recolonize his colon quietly and without trouble. He will be immune to them already.

If he stays a month or longer, he may suffer when he gets back; his immune system will have forgotten its defences against his home organisms. He will be well advised to take a DREADCO 'safe return pill' ten days before his homeward journey. It will immunize him against his old indigenous inhabitants.

DREADCO's growing world map of intestinal organisms has an interest of its own. Why do particular strains dominate certain regions? They must be best adapted to the local conditions, which from their point of view means the local food. Daedalus expects their distribution to conform closely to the map of culinary traditions. Rice, olive oil, yams, wheat, all must encourage their own gut organisms. Those insular British travellers who take a fortnight's supply of sandwiches with them are shrewdly preventing foreign bugs from penetrating their defences. Conversely, when in due course hamburgers and Coca-Cola have conquered the world, and the same diet prevails over the entire planet, traveller's diarrhoea will fade away. David Jones