



## Opening Pandora's Molecular Box\*

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*Tell you what they're gonna do  
Started doing it already  
Got to find something new  
Looking for it in genetix*

*Found a new game to play  
Think it's impossible to lose...  
(The Stranglers - Genetix)*

## Introduction

Mooi & Gill (2010) have prised open the cap of the molecular systematics vial and caused a debate to take-off in the ichthyological community. Molecular trees and their supporting evidence are the first two items to leave this Pandora's box, closely followed by DNA barcoding and DNA taxonomy. In short, the debate is fuelled by the nature of molecular data: can nucleotide sequences provide the necessary evidence for relationship? The majority (Wiley et al., 2011) believe that DNA contains informative data; however, in our view, they have failed to ascertain the truth of their claim. Not all data are informative. Data may provide supporting evidence, conflicting evidence, or no evidence at all. Assuming that all data are informative *a priori to analysis* is a theoretical position, not an empirical one. We claim that systematics is, quite the contrary, empirical, and relies on evidence rather than on implicit measurements of data. Consequently, this assertion leads back to the original question of evidence in molecular systematics, namely molecular homology.

Comparatively few authors deal with the comparison of molecular homology and morphological homology. A lack of theory on part of molecular systematists has led to a rather basic understanding of molecular relationship (i.e. similarity between aligned sequences). Similarity as relationship, whether it be 'special similarity' (Farris, 1977) or 'overall similarity' (Sneath & Sokal, 1973), is nothing more than two objects compared in some way. Homology, however, is a three-item relationship in which two homologs are more closely related to each other than they are to a third. This means homology can be defined as 'affinity' or 'sameness', that homologous relationships can be observed and quantified. Similarity is just one increasingly superficial aspect of homology and not, as some claim, part of a 'test' (contra Patterson, 1982 and de Pinna, 1991; but see Rieppel & Kearney, 2002). After all, we do not "test", even with congruence, our initial similarity assessments among different taxa once the characters are deemed to be true homologs. This misunderstanding of the difference between molecular similarity and molecular homology lies at the heart of Mooi & Gill's argument. Without addressing homology in molecular systematists we