How should we argue about scientific realism?
by Dean Peters

Most proponents of scientific realism now advocate some form of 'partial realism', which I define as any attempt to justify a 'realist attitude' towards limited parts of scientific theories. I include in this category Worrall's (1989a, 2007) "structural realism", Kitcher's (1993) "working posits" idea, and Psillos' (1999) "divide et impera" strategy. I identify a core *epistemic* commitment that these approaches share, regardless of any further *metaphysical* commitments they may have:

$\Box\exists x$ (Px & Ex → Sx) (PR)

where:

Px: the theory with feature x makes novel predictions
Ex: x is essential for those predictions
Sx: x will be found in successor theories

This claim is not intended as an *a priori* truth, but as a *falsifiable* claim about the history of science, which I hope can form the basis for a more focused debate between partial realists and their opponents. However, each of the terms in (PR) requires fuller elucidation.

In defining predictive success (Px), I assume for simplicity that a theory functions as a deductive system along the lines of the covering-law model (Hempel 1965), although my argument is compatible with other accounts. I now follow Worrall (1989b) in arguing that novel prediction is defined not by temporal novelty, but in opposition to "mere accommodation". When a theory is established, its propositions are arranged so that it entails ("explains") some set of observations. A theory makes novel predictions when it entails phenomena not in this 'training set'.

In identifying essential elements of a theory (Ex), it is useful to imagine a scientific theory as a 'tree' of propositions, arranged hierarchically according to entailment relations (Fig. 1). Following the "no-miracles argument" (Putnam 1975), our judgement of what is essential should 'flow upwards' from predictions made at the observational level to more abstract theory. I advocate a version of structural realism arguing that we should consider as essential that minimal set of elements which is sufficient to 'connect' (by entailing both) the 'training set', and *all* those observations that the theory correctly predicts, including those unknown when the theory was in use. I contrast this approach with Cartwright's (1999, 2009) "phenomenological realism" and Kitcher and Psillos' views.

A partial realist claims that an essential element of a theory will be found in a successor theory (Sx) modulo some "generalized correspondence principle" (Post 1971). I argue that we can point to correspondence in cases where theories agree on (1) the numerical value of some empirical variable; (2) some phenomenological law or tendency; (3) a piece of formalism, provided it has the same empirical interpretation in each case; or (4) the relationship between two variables, although that relationship is mediated by a third variable in the successor theory.

Finally, I discuss the development of the miasma theory of disease in the 19th century. I argue that this fails as a putative counterexample to (PR), but this failure nevertheless offers some guidance to those seeking falsification of (PR).

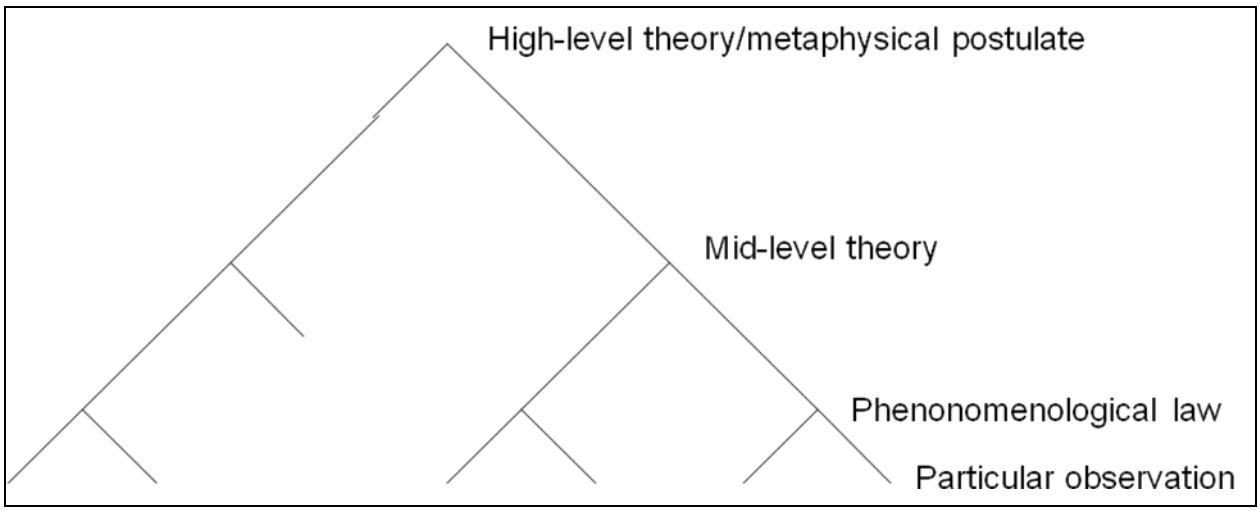

Fig 1. A tree diagram of a generalised theory