Transdisciplinary Systems Biology

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Abstract

Systems Biology is currently exploding as a result of the post-genomic era. In its current incarnation, Systems Biology seems to be confused somewhat with integrated use of post-genomic data for creating or testing models and hypotheses. However, its foundations are in the systems science thinking initiated decades ago by Wiener, von Bertalanffy, Ashby and van Foerster founded the domain through a series of interdisciplinary meetings. The fundamental concept behind systems science is that however complex and diverse the world might be, there will always be concepts and principles that are domain-independent. Uncovering such general laws would allow us to analyze and solve problems in any domain, providing economies of scope. In terms of biology, systems scientists from those times talked about focusing on complex, adaptive, and self-regulating systems, which they called 'cybernetic'.

Transdisciplinarity is the next evolution along the supradisciplinary line that starts with multidisciplinary, goes to interdisciplinary and reaches transdisciplinary. These different supradisciplinary terms are not synonymous, as many seem to think. They represent a continuum in which transdisciplinarity is characterized largely by the generation of a shared conceptual framework that is developed outside of any discipline (*transcends* disciplines) and that is then used to solve a common problem. Many elements of this shared conceptual framework are similar to the elements required for systems science as defined in the 1940s and 1950s. And both conceptualizations allow for the possibility of economies of scope. I will expose these concepts, show a few examples and argue that modern systems biology requires transdisciplinarity and should be rooted in the concepts developed last century rather than be seen as integration of –omics data.