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There is nothing more practical than a good theory

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Commentary on
Csermely, Peter, et al., 2013, "Structure and dynamics of molecular networks: a novel paradigm of drug discovery: a comprehensive review", *Pharmacology & Therapeutics* Vol. 138 (3): 333-408.

1.1 To the core of the problem

The title of the commentary is a quotation from the psychologist Kurt Lewin (Lewin, 1952). The 'take home' message is twofold: theorists should provide experimentalists new avenues for solving practical problems; on the other hand, experimentalists should be able to offer theorists a consistent picture catching the essential of their findings.

The readers of Organisms know very well the huge difficulties encountered by the experimentalists to make the theorists to address their mind to the 'core' of their problem so preventing them to 'fly away' into the very respected (but substantially useless) comfort zone of the 'very general principles'.

On the other hand, theorists have a hard time to push their more 'experimentally oriented' colleagues to accept even a minimal level of abstraction from the empirical observation level.

This is why Lewin quotation must by no means be intended as a 'theory pride' but as a warning to embrace a mutual exchange between theory and practice, keeping in mind any fruitful exchange needs a shared language.

The review paper by Peter Csermely and colleagues is an excellent handbook for learning such a language.

The authors suggest (and give a brilliant proof of concept of their claims) that the ideal medium for giving rise to a fruitful exchange of ideas between theory and practice (in all the fields of science, not only in biomedical sciences) is the language of the networks.

In their most basic definition, networks are nothing else than objects made up of nodes linked by edges (in mathematics such structures are called graphs). The nodes are the actors of the play, the edges represent their mutual direct interactions. Thus in a social network the nodes correspond to different persons, and an edge between two A and B nodes tells us that A and B know each other, in a network representation of a protein 3D structure an edge between A and B amino-acid residues indicates that A and B are in put in contact by the protein fold. Similar issues hold for food webs or gene regulation networks.

The unique advantage of network formalization is that network language is 'naturally systemic': the wiring properties of the entire network emerge from the local contacts made by each single node while in the same time the global architecture of the network affects the local properties of each single node. This is not only a philosophical statement but also the operational way in which network descriptors at both global (e.g. average degree, characteristic length) and local (betweenness, closeness) are computed. Moreover, these descriptors are completely intuitive asking for a mathematical sophistication of high school level (the discrete character of the network allows only for arithmetic's) so demolishing the high barriers erected by differences in mathematical skills.

Networks create a 'friendly playground' where experimentalists can show the theorists their preferred players (nodes) so making the problem clear and the theorists can ground the proposed models on the wiring diagram of the network so their plausibility can immediately be evaluated by the experimentalists.

The Csermely et al. review opens a huge repository of theory-practice exchanges mainly (but not only) focused on pharmacological activity that, in my opinion, give many ideas to develop a good (because practical) organism theory.

References

Lewin, K, 1952, *Field theory in social science: Selected theoretical papers by Kurt Lewin*. London, Tavistock.