

Patient's are not Schroedinger's cats

All of us know the experiment and its implications: Schrödinger's cat is a paradoxical thought experiment devised by Erwin Schrödinger that attempts to illustrate the incompleteness of the theory of quantum mechanics when going from subatomic to macroscopic systems.

Medicine is not quantum mechanics where we cannot predict when an event will occur.



In Schrödinger's 1935 study, a cat is penned up in a steel chamber, along with the following diabolical device (which must be secured against direct interference by the cat): in a Geiger counter there is a tiny bit of radioactive substance, so small that perhaps in the course of one hour one of the atoms decays, but also, with equal probability, perhaps none; if it happens, the counter tube discharges and through a relay releases a hammer which shatters a small flask of hydrocyanic acid. If one has left this entire system to itself for an hour, one would say that the cat still lives if meanwhile no atom has decayed. The first atomic decay would have poisoned it. The wave function for the entire system would express this by having in it the living cat and the dead cat mixed or smeared out in equal parts.

Keeping the cat alive

But when dealing with pharmacological and biological systems, we should and can avoid this paradox, because we want the cat to be alive at the end of the experiment, that is, we want the patient to be safe (and cured), at the end of the treatment. Medicine is not quantum mechanics where we cannot predict when an event will occur (in the example, when an atom disintegrates). We can and must predict the behaviour of the human molecular and physiological system, no matter how complex it is, when a drug is administered to this system. We should be able to predict the occurrence of adverse events and we should be able to identify those patients at risk by means of using biomarkers, genetic signals, or by differentiation of the personal biological network among individuals. We cannot conform with the idea “it is difficult to know, it’s complex, we are sorry,” because unfortunately patients suffer and eventually can die.

Modern research

Today, tools have been developed to allow us to deal with the sheer complexity of the human biological networks. Systems biology approaches focused in building and modelling the complex interaction networks of the biological systems are starting to shed light to the, too many times still unknown, mechanisms of action of drugs. They provide a novel way of approaching drug discovery by developing models that consider the global physiological environment of protein targets, and the effects of modifying them. Systems biology offers real examples today on how drug discovery can be enhanced by predicting the therapeutic performance of drugs (i.e., their safety and efficacy). As Sears et. al state in their article “Mechanisms of Human Insulin Resistance and Thiazolidinedione- Mediated Insulin Sensitization,” even in those cases where adverse events still occur, this technology can help to identify patients at risk, and minimize the undesired effects. Following the quantum mechanics analogy, and according to the Heisenberg Uncertainty Principle, one cannot know at the same time the speed and a position of a particle, but particles do have a precise speed and position. Or as somebody else put it, although not predicted by quantum theories, things happen. Let’s not give up and let’s keep on pursuing the knowledge.

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