Precision medicine: Fantasy meets reality

IN THEIR POLICY Forum “Countering imprecision in precision medicine” (29 July, p. 448), S. P. Hey and A. S. Kesselheim discuss the many combinations of biomarkers and treatments that drive precision medicine research. They propose that “funding agencies could award responsibility for specific regions of the [biomarker x treatment] parameter space through their grants.” However, this is an extremely inefficient way to search such a large number of combinations. Researchers should be able to rapidly and adaptively refocus their research efforts as results become available. Bureaucratic funding agencies cannot react quickly enough to facilitate this dynamic process. Electronically connected networks of collaborating scientists can.

Several researchers have proposed, and some have piloted, a Global Cumulative Treatment Analysis (1). In this giant prospective trial, all patients with a given condition who enroll in the trial are tracked and treated based on the best available knowledge, and when there is uncertainty about whether a treatment will be beneficial, the decision algorithm (be it computational, human, or more likely a combination) randomly assigns treatments to patients in real time, integrating response information as soon as it becomes available and updating the decision algorithm immediately.

This strategy would allow biomedicine to operate as a gigantic distributed robotic discovery system (2) or air traffic control system: New hypotheses injected into the system by pharmaceutical companies or researchers would be validated or refuted by being pushed through a huge distributed and rapidly intercommunicating network, which would integrate information nearly instantly. This may seem like a fantasy that would require a giant connected computer system over many sites, but the Veterans Administration has just such a system and is in the process of piloting exactly this idea, in what they call a “Point of Care” trial (3). If Apple, or some other organization, has its way in centralizing medical records for the rest of us (4), that system could operate the same way. Interdisciplinary doctors already meet to discuss the best precision treatment options for patients on panels referred to as “molecular tumor boards.” A centralized system could network the tumor boards of the world.

There are, of course, many complex issues that need to be worked out in creating such a model for treatment, and treatment discovery (5), but something like a Global Cumulative Treatment Analysis is the only way that the increasingly enormous combinatorial space of biomedical parameters can possibly be searched with any efficiency.

Jeff Shrager
Cancer Commons, Los Altos, CA 94022, USA and Symbolic Systems Program (Adjunct), Stanford University, Stanford, CA 94305, USA. Email: jshrager@stanford.edu

REFERENCES
4. N. Swanner, “In iOS 10, you’ll be able to request medical records on an iPhone. Here’s how it works.” The Next Web (2016); http://thenextweb.com/apple/2016/06/15/healthkit-medical-records/.
10.1126/science.aaf8483