Study examines chemists' decision-making processes

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(Phys.org)—Though we may not realize it, our minds spend a lot of time discarding information. More like a big-box store than a box of chocolates, life is constantly throwing us information we don't need. Our job is to prioritize the information and use it to make the right decisions.

In an article recently published in the journal PLOS One, John Coley, an associate professor of psychology at Northeastern, and collaborators at the Novartis Institutes for Biomedical Research explore this process of choice as it pertains to drug discovery. The findings indicate a disconnect between our conscious and subconscious decision-making.

For the study, the team of researchers asked 19 Novartis chemists to each scan eight batches of 500 chemical fragments and identify those that seemed most promising for future drug-development efforts.

Using those data points, the researchers created statistical models to identify the chemical properties that each chemist seemed to rely on most. Though they had dozens of parameters to choose from, the chemists only used one or two in the decision-making process. Like experts from other fields, which Coley has studied previously, educated medicinal chemists throw out most of the information available to them.

The study also asked the chemists to identify the properties they relied on to make their decisions. Interestingly, the properties they subconsciously relied on for choosing promising chemical fragments did not match what they consciously identified as important. For example, while

the model showed that one chemist may have put a lot of subconscious stock in the size of the fragments, she may not have consciously identify size as an important criterion for fragment selection. Even chemists with good track records of successful drug discovery, then, might not be able to explain their achievements.

The models were independently verified using accepted methods, so the inconsistency between a chemist's subconscious and conscious rationale behind decisions suggest an interesting feature of human cognition, according to Coley. "It might be that we're making decisions—and even very complex ones—without having access to the basis for making those decisions," he explained.

This hypothesis is consistent with research from other labs, which, according to the paper's authors, have shown that the "unconscious mind is especially good at making complex decisions and that introspection can actually reduce the quality of decisions."

While the group of chemists converged on a small set of parameters deemed important for fragment selection, they did not seem to agree on how those parameters should be valued.

This lack of consensus, said Peter Kutchukian, a postdoctoral fellow at NIBR and lead author of the study, shows that medicinal chemistry is something like a game of chess. "Just as a master chess player can predict the possible flow of a game, medicinal chemists project how to generate different compounds through several steps or synthetic transformations from a single starting point," Kutchukian said. Different chess masters might look at the same chessboard and see different paths to winning, he added. Likewise, different chemists might look at the same fragment and see different medicinal potential.

The findings—which point to the importance of diversity among

approaches and thought processes—could prove to be a valuable tool for medicinal chemists across industry and academia, "Companies might consider internal education to highlight other valuable starting points and train chemists to be open to options," Kutchukian said.

More information: www.plosone.org/article/metrics/info%3Adoi%2F10.1371%2Fjournal.pone.0048476

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