Strategic experiments lead to faster innovation

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Is drug discovery research a game of chance, like poker, or a strategic endeavour, like chess? The current paradigm for managing a portfolio of therapeutic development programmes is actually quite similar to poker. Decisions are made to invest heavily in the programmes that appear to have the greatest probability of success. Regardless of the probability of success, the last card can still cause the hand to fail. In contrast, chess has a much smaller component of chance and a greater reliance on the skill and foresight of the player. My vision is that in the next decade, the process of developing a successful new therapeutic drug will have the elegance of a well-played game of chess.

In recent years, the chess community has been upturned by the development of computer programmes that can defeat even the greatest of chess masters. Previously, chess expertise was isolated in a small number of individuals that had devoted numerous years to mastering the art. Today, brute force algorithms that exhaustively explore the universe of potential moves are far superior to the typical chess player[1]. A similar paradigm shift has occurred in the field of life sciences. The scientific method has transitioned from hypothesis-driven research to massively parallel, discovery-based research. High throughput screening, selectivity and safety profiling, combinatorial chemistry and, of course, the human genome project are all examples of the discovery-based research paradigm. Over the next decade, this trend will continue and expand, and will ultimately lead to sophisticated programmes that will substantially improve the success rate of clinical development efforts.

In both drug discovery and chess, the success of a brute force approach requires a sophisticated algorithm that is able to score each position based on the specific rules. The rules for drug discovery are actively being developed and by the end of the decade will be more firmly established. Towards that aim, researchers are conducting substantial secondary screening or profiling programmes to understand the chemical determinants of selectivity and side-effects. As these profiling programmes expand and more voluminous data is collected, scientists will create predictive algorithms to guide future chemistry efforts.

Several experimental factors are necessary to ensure that successful algorithms are generated to increase the rate of innovation[2]. These factors include fidelity of experiments, the iteration time from experimental design to data analysis, the capacity of experiments that can be run in parallel, and the cost of the experiment. As each of these factors are improved, so too are the experimental outcomes that are used to create powerful predictive programmes. At Caliper Life Sciences, our strategy is firmly based on providing the necessary tools and support to enable researchers to achieve this vision[3]. We have partnered with scientists to develop technologies that are high fidelity, cost-effective, high throughput and can be standardised among the therapeutic areas. Microfluidics is an enterprise discovery technology platform that can strategically transform the approach to discovering drugs. This platform can change a company's overall information management to enable a more efficient experimentation process, ultimately leading to faster innovation cycles. The impact of a widespread deployment of microfluidics technologies is that researchers will have access to better data, enabling them to develop more powerful predictive tools, ultimately leading to a algorithm-driven, chess-like approach to drug discovery.

Looking to the future, I foresee a scientific enterprise in which the development of new therapeutic agents will no longer be subjugated to the chances of the last poker card, but rather will be guided by strategic rules, similar to chess. Researchers will utilise algorithms that score experimental datasets and guide the paths of drug discovery. This realisation of this vision will result in substantially improved clinical success rates and more efficient drug discovery. ■

References

1 In 1997, IBM's Deep Blue defeated Garry Kasparov, reigning world champion. http://www.research.ibm.com/deepblue/home/html/b.html.

2 For a discourse on the relationship between experimentation cycles and innovation, see Thomke, Stefan. Experimentation Matters: Unlocking the Potential of New Technologies for Innovation. Boston: Harvard Business School Publishing, 2003.

3 Please read our white paper entitled: 'Microfluidics Enables Faster Innovation Cycles', located at the following URL: http://www.caliperls.com/pdf/Caliper_White_Paper_06242004.pdf.