



So, is the process now less dependent on the financial power of the big companies?

The drug-discovery process has become a lot more open. You can be a one-person pharmaceutical company today. You have access to many of the same databases and resources as your colleagues in the pharmaceutical industry. You can also use crowdsourcing platforms to get the input you need at a very attractive price. I know one company that went from creation through to phase II clinical trials with only 6 people and about US\$70 million in cumulative funding. That is a puny amount compared with what it used to cost.

How will the move towards patient-gathered data disrupt the industry?

Biosensing technologies allow patients to be monitored at home, generating vast amounts of high-quality data at very low cost. The impact of these technologies on clinical research will be huge, and the speed at which it is happening is astonishing. These technologies will change the industry. They will reduce the cost of research and erase much of the advantage that scale used to confer on big companies.

What happens when patients take a more active role in the control of their clinical data?

This will be game-changing. Whoever controls data collection and access will ultimately control innovation. Patients realize that they can play a central part there, and are organizing themselves accordingly. This is quite a threat for industry, because patients have different values to pharmaceutical companies. Patients are pushing their values on the clinical research enterprise, and they are values of openness, speed and convenience.

And the value of affordability?

Yes, the cost of innovation is still a big problem. Of the pharmaceutical needs in the United States, 90% are met by generic drugs costing \$70 billion; the remaining 10% cost \$350 billion. That should be concerning to pharmaceutical leaders. Their new drugs often treat only thousands of patients, whereas the old blockbusters treated millions. And how can you grow a \$350-billion revenue base if you have lost millions of customers?

Do drug companies fully understand this crisis?

Most do not produce enough innovation to grow. In fact, half of them are shrinking. They try to mitigate this by escalating prices, which is dangerous. I think industry is misjudging the anger that its practices are creating. The risk of a backlash is real. Policymakers could quickly make changes that may be much less palatable to industry than what could have been achieved by self-policing. ■

INTERVIEW BY ERIC BENDER

This interview has been edited for length and clarity.

Q&A Bernard Munos

Change big pharma

In 2006, pharmaceutical innovation consultant Bernard Munos helped to launch a lively public discussion about how open innovation can bring novel drugs to market with his paper 'Can open-source R&D reinvigorate drug research? He tells Nature how things have changed since then.

How has the research landscape changed over the past decade?

Until ten years ago, innovation was controlled by the big pharmaceutical firms, because they were the only organizations able to afford it. Today, there are all kinds of new players and research models that have spread innovation to all parts of the ecosystem.

Big pharma used to be inward-looking about their research pipelines; overwhelmingly, their ideas came from inside the company. But the number of drugs approved was too low to secure the future of the industry. Companies realized that they needed more, better and cheaper innovation. Now, there is a lot of openness. Some firms have adjusted their research model to effectively tap the global brain. The most successful are willing to contemplate totally new science.

What differentiates the companies that do so?

It comes down to leadership. Take Paul Stoffels, chief scientific officer of pharmaceutical company Johnson & Johnson (J&J). He championed the idea of Janssen Labs, an outreach organization that is run alongside J&J's research. Janssen Labs reaches out to those who do breakthrough science, and lets them know that they can avail themselves of the

scientific, and potentially financial, support that J&J can provide. It hosts these partners in innovation incubators, which nurture dozens of companies with the potential to come up with game-changing therapies. The drug candidates born of these projects have not yet percolated through the J&J pipeline, but when they do, the company's drug output could be multiplied several-fold.

How else is drug innovation changing?

You've got all kinds of groups doing viable research now. Universities are tired of seeing their great ideas languishing on the shelf because they fall outside the comfort zone of big pharma. They want to give those ideas a fair chance, so they are engaging in translational research themselves.

Patient advocacy organizations are taking things into their own hands and launching credible drug research and development (R&D) programmes that run on a shoestring.

Venture philanthropists, who for personal reasons may have an interest in certain diseases, are willing to part with large amounts of money to fund initiatives to help with those diseases. All of this not only enlarges the global pipeline, but also changes the economics of drug R&D.