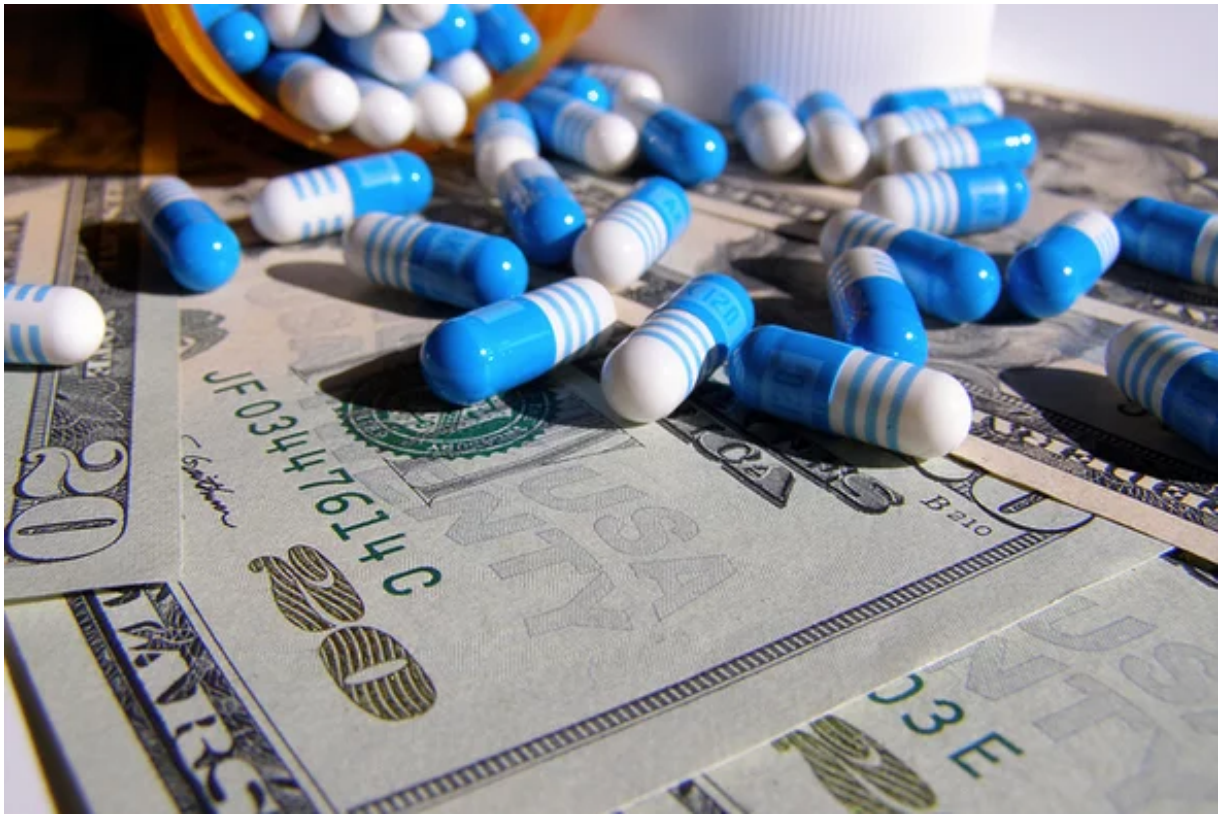
THE SCIENCES

To Cure Cancer, Provide a Profit Motive

Creative investments could fund a huge number of new drug-development projects

By Andrew W. Lo, Roger M. Stein on March 26, 2014



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Translating scientific research into safe and effective drugs takes money—lots of money. Current estimates put the cost of developing a single successful drug at more than $2 billion by the time you include all the dead ends along the way; the out-of-pocket cost for just a single attempt is about $200 million. Drug development usually takes a decade or longer, and the probability of success is low (historically around 5 percent for oncology).

As a result, investors are now shying away from the pharmaceutical industry, investing instead in less risky and more attractive opportunities like big data, social media and e-commerce. Financial engineering techniques can help change that, directing capital from those wishing to invest it to those who need it to develop new drugs.

Our research suggests that it is possible to fund many drug trials simultaneously by structuring investment products that would appeal broadly to big investors like pension funds, insurance companies and sovereign wealth funds rather than traditional biotech investors. Although this idea is still in its early stages, several groups around the world have already begun putting these ideas into practice. When we hosted a conference at Massachusetts Institute of Technology last June on new approaches to financing biomedical innovation (CanceRX.mit.edu), we expected 25 or 30 attendees—some 200 participants showed up. Senior stakeholders from the biotech, pharma, academic and patient advocacy communities presented many different perspectives, but all were united in seeking innovative ways to address the biggest current challenge to drug development: how to pay for it.

For example, instead of investing in one drug development project, what if we invested in 150 projects at once? At $200 million per project, we'd need $30 billion—

a crazy amount of money. But we would also have much lower risk: more “shots on goal” translates into a higher probability of scoring. In fact, assuming a 5 percent success rate for each project, the probability of at least two successes out of 150 independent trials is a stunning 99.59 percent.

A blockbuster drug typically generates $2 billion a year in profits for 10 years before its patent expires, implying a ballpark net present value of $12.3 billion for each successful drug. When you consider those numbers, $30 billion doesn’t seem so crazy, especially with a 99.59 percent chance of earning $24.6 billion or more after 10 years. With those odds, a big piece of that $30 billion could be raised by issuing long-term bonds, which would attract many more investors than stocks or venture capital.

Of course, the real world is not that simple. Can we find and manage 150 projects? What about correlated failures among them? Can this work without discovering “blockbuster” drugs? Would it work on smaller scale? We’ve published several simulation studies that incorporate correlation, clinical phase transitions and other realities of the drug development and approval process. The results are encouraging, both in terms of the investment returns and the number of new drugs developed. By funding many biomedical projects through a single “megafund” and issuing a variety of securities to pay for it, investors can earn attractive rates of return on average. The return is still risky but much less so than with a single shot, and this means more resources would be available for these activities.

In fact, our most recent published simulations of drugs for rare diseases—which are less expensive to develop, have higher success rates, and enjoy faster U.S. Food and Drug Administration approval times—show that much smaller portfolios of only 10 to 20 projects costing a total of just $500 million can generate double-digit returns with reasonable levels of risk. This is particularly relevant given the current trend of precision medicine, in which a disease—breast cancer, for example—has been stratified into several smaller subcategories based on molecular and genetic biomarkers.

We also showed that third-party guarantees on the megafund securities make them even more attractive to an even larger pool of investors. Who would provide such guarantees? Philanthropists, patient advocacy groups and government agencies, all of whom value impact over investment return. In fact, every dollar used as a megafund guarantee can attract several more dollars of investment capital, yielding a much greater impact than if directly applied toward drug development.

Of course, the real test of these ideas will be in their implementation, which will require large-scale and sustained collaborations between biomedical and financial experts. This has never happened before, but several budding initiatives suggest that the first megafunds will emerge in the near future. With the right combination of expertise and motivation, we believe that financial engineering can, in fact, help cure cancer.

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