SHAKING UP THE VALUE CHAIN

Data and digitization are creating a growing array of value-creation choices in industries as diverse as pharmaceuticals, mining, and energy.

During the 1980s, McKinsey's Fred Gluck and Harvard Business School professor Michael Porter began writing about the interrelated activities through which companies create value for their customers. Executives have always had choices about how to perform the activities in this "business system" (Gluck's words) or "value chain" (Porter's). In the digital age, as information disrupts the nature of value creation in many industries, the range of choices available to senior business leaders has increased. For example, digital platforms in the pharmaceutical industry now make it possible to aggregate massive amounts of data on diseases—potentially accelerating the discovery and design of new drugs and challenging the industry's legacy processes. In energy production and mining, although companies have long outsourced some functions in efforts to drive down costs, digital requires a new approach. Using data, suppliers can offer incumbents an expanded range of capabilities and productivity gains—alluring possibilities that are accompanied by the risk that sharing too much data could shut off areas of future growth. This type of flux in value chains will only intensify across industries, forcing leaders to grapple with existential questions about core competitive strengths in an environment where destabilizing technologies will be the norm.

WILL DIGITAL PLATFORMS TRANSFORM PHARMACEUTICALS?

Start-up companies are combining genetic information and new therapies to transform drug discovery and development—at greater speed and scale.

by Olivier Leclerc and Jeff Smith

Product innovation is at the heart of the pharmaceutical industry's value chain. Long, capital-intensive development cycles and legacy processes, though, have made it difficult to exploit the full potential of emerging digital technologies to deliver faster, more agile approaches to discover and develop new drugs.

Indeed, McKinsey research shows that the industry's digital maturity lags that of most other industries.

A new current is forming in one area of the industry: start-up companies that are creating biomolecular platforms around cellular, genetic, and other advanced

therapies.[1] The platforms marshal vast amounts of data on the genetics of diseases, such as cancer, and combine that with patients' genetic profiles and related data. They zero in on key points along the information chain—for example, where there are linkages between DNA and proteins, and then cells—to "design" new drugs. Much like software developers, the platforms engineer disease therapies built upon the "code-like" DNA and RNA sequences within cells (Exhibit 1). These techniques have significant implications for the treatment of many life-threatening illnesses that are outside the reach of standard therapeutic approaches. They could also disrupt the industry's value chain as they speed up drug discovery and development, with the potential for a single platform to scale rapidly across a range of diseases (Exhibit 2).

In one example of a biomolecular platform, for a disease that results from a mutation in DNA that codes for a needed enzyme, the platform models the disease from medical and genetic data to arrive at an enzyme "optimized" to correct for the mutation. The platform then designs a sequence of genetic material to treat the disease, as well as a delivery vehicle to get it to the target cells. In another example, for CAR-T[2] therapies, the platform modifies a patient's T cells (an immune-system cell), which are then deployed to attack a cancer.

A new competitive landscape

Optimized biomolecular platforms have the potential to accelerate the early stages of R&D significantly. For example, it can take as little as weeks or months to

go from concept to drug versus what's often many months, if not years, of trial and error under conventional discovery methods. This is achieved by routinizing key steps (such as preparing a drug for preclinical testing) and using common underlying elements in the design of the drug (such as drug-delivery vehicles that are similar). In the past five years or so, a number of start-ups have formulated dozens of drugs that are in clinical trials and, in some cases, drugs that have already been approved. The large information base behind therapies helps identify the right targets for preclinical and clinical trials.

Digital technologies also enable the fast, replicable, and systematic application of a platform's data and analytics capabilities to treat a whole range of related ailments. Initially, a platform organization may discover drugs limited to one or a small number of diseases. Then, if successful in early tests, it can expand the therapies rapidly to a broader range of diseases, building scale economies. Financial valuations of platform companies often swing dramatically on these early readouts and reflect the fact that early-stage platform companies implicitly carry an option to develop a broad pipeline. At the same time, the platforms encourage collaborative drug discovery—and even new pharmaceutical ecosystems—since research institutes and other partners can work together on a therapy concept that can be rapidly translated into a drug.

The road ahead

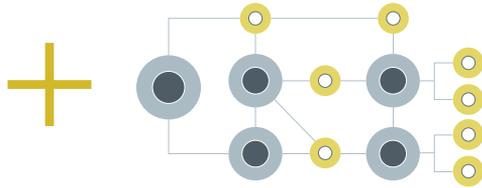Biomolecular platforms face obstacles. They require significant up-front

Exhibit 1

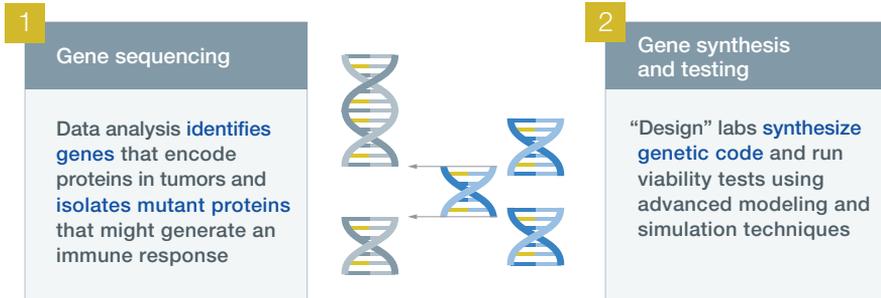## Biomolecular platforms marshal vast amounts of data …

Database

Disease biology ○
Patients' genetics ○
Historical outcomes ○
Genetics of various cancers ○
Similar disease pathways ○

+

Advanced algorithms and analytics

… pinpointing links between DNA, proteins, and cells to design new drugs.

1 Gene sequencing

Data analysis identifies genes that encode proteins in tumors and isolates mutant proteins that might generate an immune response

2 Gene synthesis and testing

"Design" labs synthesize genetic code and run viability tests using advanced modeling and simulation techniques

These digital capabilities speed up preclinical and clinical development …

- **Faster synthesis of initial versions of treatment** for preclinical and clinical trials
- **Accelerated review by Food and Drug Administration (FDA)** and other authorities

… and automate manufacturing, including personalized therapy.

CAR-T therapy example

1 Blood collected from patient

2 Algorithms used to predict effects of mutations identified in patient's cancer

3 Automation used to reengineer genetic material that stimulates patient's immune response to cancer cells

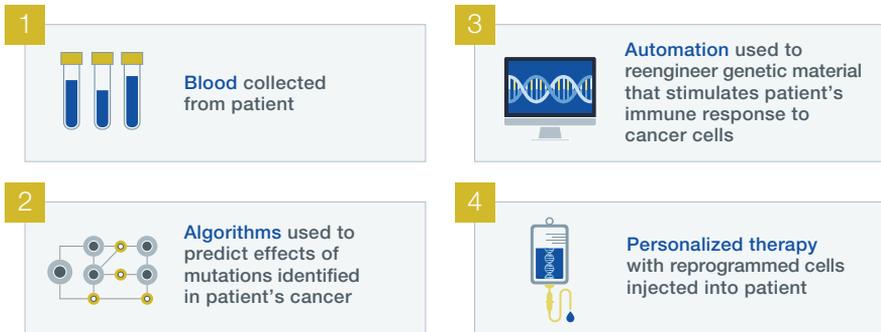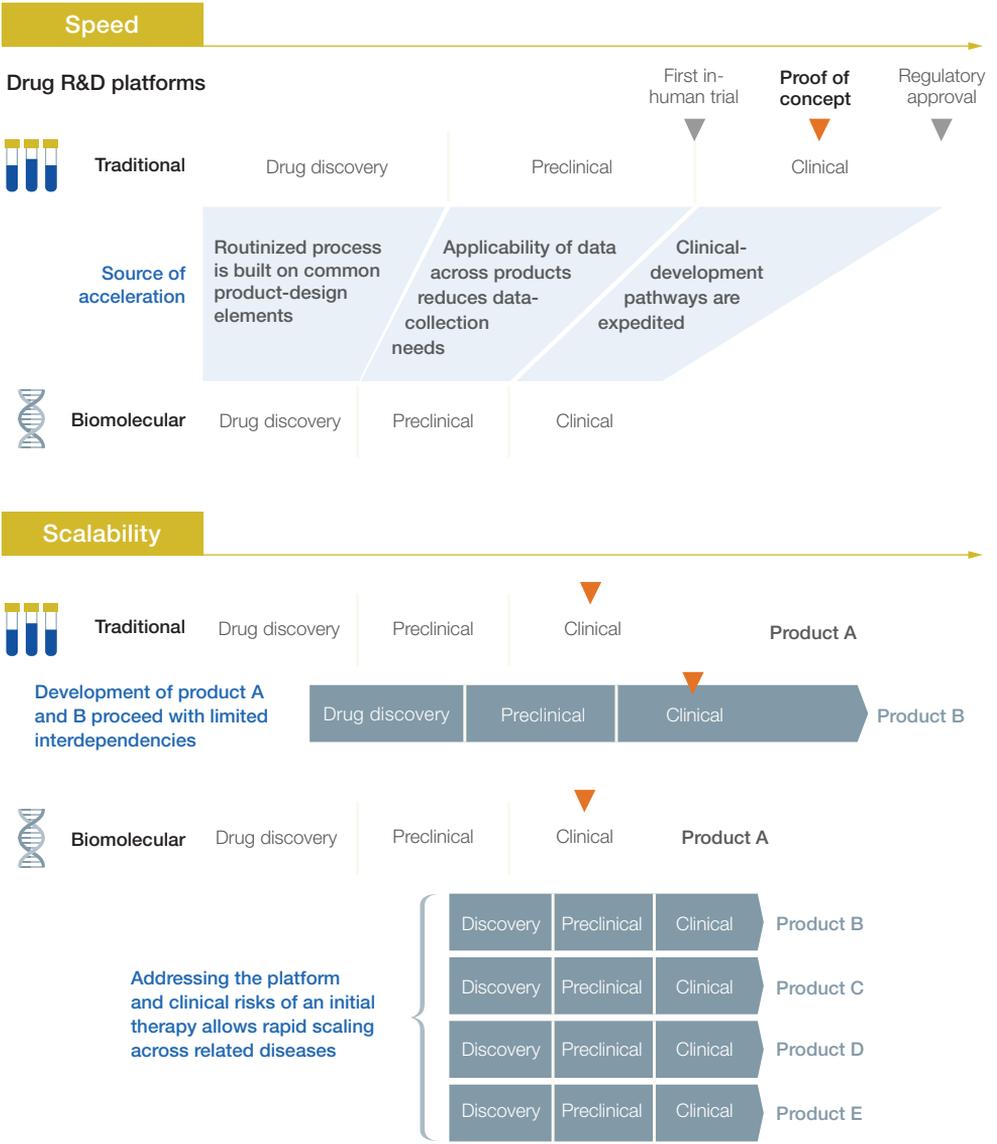**4** Personalized therapy with reprogrammed cells injected into patient

Exhibit 2

Biomolecular platforms have the potential to increase the speed and scalability of drug discovery and development.

Drug-development process: illustrated timelines[1]

Speed

Drug R&D platforms

	First in-human trial	Proof of concept	Regulatory approval

Traditional   Drug discovery   Preclinical   Clinical

Source of acceleration

Routinized process is built on common product-design elements	Applicability of data across products reduces data-collection needs	Clinical-development pathways are expedited

Biomolecular   Drug discovery   Preclinical   Clinical

Scalability

Traditional   Drug discovery   Preclinical   Clinical   **Product A**

Development of product A and B proceed with limited interdependencies

Drug discovery | Preclinical | Clinical   **Product B**

Biomolecular   Drug discovery   Preclinical   Clinical   **Product A**

Addressing the platform and clinical risks of an initial therapy allows rapid scaling across related diseases

Discovery	Preclinical	Clinical	**Product B**
Discovery	Preclinical	Clinical	**Product C**
Discovery	Preclinical	Clinical	**Product D**
Discovery	Preclinical	Clinical	**Product E**

[1] In traditional drug development, discovery typically takes 4 years; preclinical, 1 year; and clinical, 8 years. Timelines shown are not to scale.

investment to build, and the variability and complexity of the diseases they target is staggering, even using high-powered information systems in the discovery process. Yet once platforms are locked in on a design and validated with a therapy (such as a vaccine or an intracellular treatment), their speed and ability to scale rapidly across a range of related diseases make them a potent force. The advances may catalyze new partnerships and M&A activity as larger companies seek to establish their own platform expertise and capabilities. Indeed, as the benefits of digital prove themselves, both biotech pioneers and larger pharma companies are increasingly positioning themselves to harness the potential of biomolecular platforms. That's a recipe for progress and change in an already innovative industry. $\text{\textcircled{Q}}$

[1] These include, for example, DNA- and RNA-based gene therapies, gene editing, microbiome therapies, as well as stem-cell and other cell-based therapies.
[2] Chimeric antigen receptor: a genetically modified receptor that binds to a protein on cancer cells.

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→ For additional insights, see "How new biomolecular platforms and digital technologies are changing R&D," on McKinsey.com.

COULD YOUR SUPPLIER BECOME TOO POWERFUL?

In the digital age, companies must balance the advantage of outsourcing a segment of the value chain to suppliers with the risk of foreclosing their strategic options.

by Calin Buia, Christiaan Heyning, and Fiona Lander

Armed with data and the capabilities to analyze them, suppliers are offering their services in ever greater chunks of the value chains of energy and materials companies. Customers could find the offer tempting given the promise of quick efficiency improvements. But they also risk handing over the keys to the business if they don't tread carefully.

Outsourcing is not new to the sector. Big companies have long outsourced low-value functions such as payroll, but most higher-value ones deemed central to the business, such as exploration and operations, have been kept in-house. Digital, however, is forcing a rethink. In a data-rich world, suppliers might be able to outperform their customers, so why not

harness their capabilities? A fair question in this new, more porous environment, which is requiring companies to re-evaluate which data and digital capabilities are at the heart of their business.

A global manufacturer of turbines, for example, will have more data on their performance than even the largest customer and so could, potentially, maintain them better. It might make sense, therefore, for the customer to outsource their supply and maintenance rather than purchase them. Some mineral companies already use technology specialists to track and improve productivity in their processing plants using the Internet of Things, and a company like Amazon could perhaps transfer its logistical might to the energy industry. In theory, a miner could eventually outsource its entire operations—blasting,

extraction, haulage, processing, freight, and marketing—to contractors who had the data and accompanying expertise to drive down costs and raise productivity and safety.

With technology shifting so quickly and value chains so fragile, it's unwise to predict the future. Ultimately, energy and materials companies may need to redefine what constitutes a core business function (exhibit). But in the meantime, some ground rules will help them capture the short-term gains of outsourcing without limiting future strategic options, or walking away from the many classic truths about supplier management that still apply.

- *Flexibility is more important than ever.* Make sure you can exit a contract or change the terms without fierce

Exhibit

In a data-rich world, even those functions once thought critical to the business might be candidates for outsourcing.

Some examples for energy and materials companies

Criticality to the business
- Importance to strategic objectives
- Competitive advantage

High

Insource, for now
Integrated planning
Reservoir management
Integrated logistics

Potentially outsource
3-D seismic
Marketing
Ore haulage and handling
Subsea drilling and equipment

Potentially outsource
Raw-material transport
Inventory management

Outsource
Back-office functions such as payroll

Low

Low → High

Supplier's performance advantage
- Data and technology
- Digital talent

penalties. Cost reductions might be today's agreed-upon goal in a contract to outsource logistics, for example, but the overnight delivery of spare parts could become more important to you once predictive-maintenance technology is implemented. Or you may decide you only want a stopgap partnership—perhaps to supply and operate a drone to interpret the images, or to leapfrog your radio-frequency-identification capabilities—while you build your own know-how. That's likely to be a wise course, given how logistics could be profoundly disrupted as technologies evolve.

- *Your data are your most valuable asset.* Share them carefully, but don't give them away. You will find it harder to build your own advanced-analytics skills if, for example, the data generated from your machinery are owned by a supplier. And all the while the supplier could be using the data to strengthen its own market position or, worse still, your competitors if the data are used to train models sold to others.

- *Don't cede control of your IT and data architecture.* It can lock you out of new technology solutions offered by other vendors.

- *Maximize competitive tension.* In theory, the more closely a company works with a supplier, the better for both. But some efficiencies, such as the costs saved and lessons learned from deep collaboration with a single supplier, may have to be sacrificed to avoid lock-in. A network of suppliers might be a safer choice.

Make no mistake. Outsourcing more of the business to suppliers could have a big upside thanks to the power of their data-driven insights. And every company will need to participate in the digital eco-systems that are forming around every industry. Still, companies also need to be alert to new wrinkles—value-chain trade-offs beyond the data-rich outsourcing we have described. Location-agnostic robots, for example, hold the promise of markedly reducing labor costs for many industries, allowing incumbents to shift production away from low-cost venues or to bring some activities in-house.

For most companies, keeping the entire value chain intact won't be a winning approach. But outsource with your eyes wide open, avoiding irreversible choices while chasing short-term gains. Q

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