The Dynamic US Research and Development Ecosystem

PhRMA
RESEARCH • PROGRESS • HOPE

The rapid pace of scientific advances and our growing understanding of the underlying mechanisms of disease are fueling the development of new treatments and cures for patients. At the same time, the costs, time and complexities of biopharmaceutical research have also increased, introducing additional challenges in the research and development (R&D) and manufacturing processes. Despite these dynamics, research-based biopharmaceutical companies are committed to realizing the promise of the pipeline and increasingly collaborating across the dynamic US R&D ecosystem to harness new scientific and technological advances to bring new medicines to patients. With about 7,000 medicines in development globally and about three quarters having the potential to be first-in-class treatments, the future has never been brighter.[1,2]

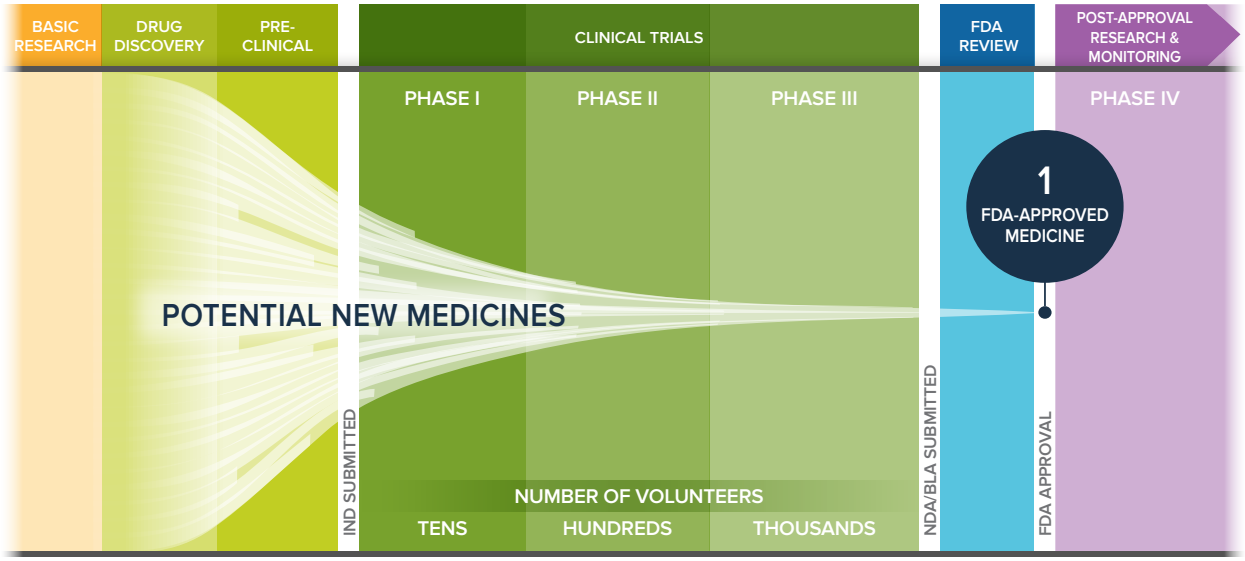
AMERICA'S BIOPHARMACEUTICAL COMPANIES PLAY CENTRAL ROLE IN R&D ECOSYSTEM

US biopharmaceutical companies play a central role in the biomedical research ecosystem. The complex system is marked by collaborations across industry, academic institutions, government agencies, venture capital firms, nonprofit foundations and others. This diverse group of stakeholders works in concert to advance basic science that forms the foundation for research and development of new medicines, which is led by biopharmaceutical companies.

THE COMPLEX BIOPHARMACEUTICAL R&D PROCESS

The drug development process typically begins with the screening of an enormous number of potential medicines. On average it takes 10 to 15 years for a medicine to make its way through the entire R&D process to approval by the US Food and Drug Administration (FDA). And only 12 percent of investigative medicines entering clinical trials are ultimately approved by the FDA.[3]

Figure 1 The Lengthly, Costly and Uncertain Biopharmaceutical Research and Development Process



Key: IND=Investigational New Drug Application, NDA=New Drug Application, BLA=Biologics License Application

*The average R&D cost required to bring a new FDA-approved medicine to patients is estimated to be $2.6 billion over the past decade (in 2013 dollars), including the cost of the many potential medicines that do not make it through to FDA approval.

BIOPHARMACEUTICAL RESEARCH AND DEVELOPMENT PROCESS

Discovery The road to a new medicine begins with selecting a disease target and working to understand the underpinnings of the disease. Researchers search for a candidate medicine that may have activity on the chosen target.

Preclinical Development Researchers run the potential medicine through a battery of lab tests to understand the activity and safety of the medicine before moving to clinical studies.

Clinical Development Before moving to studies in humans the sponsor company submits an Investigational New Drug Application to the FDA outlining the preclinical findings and clinical plans. Clinical trials are stages in 3 phases. Phase I trials test safety in a small group of healthy volunteers, Phase II trials include larger numbers of patient volunteers to assess safety, dosing, and effectiveness, and Phase III trials are in a large group of patient volunteers to generate statistically significant information on the efficacy of the candidate medicine.

FDA Review/FDA Approval If the potential medicine successfully passes through clinical trials the sponsor submits a New Drug Application and Biologics License Application to FDA. FDA reviews all data and determines whether the medicine warrants approval.

Ongoing Study of the Medicine Research continues throughout the life of a medicine to monitor safety and learn more about the best uses of the medicine.

The average cost to develop a new medicine is estimated at $2.6 billion dollars, including the cost of failures. The cost of development has more than doubled over the past decade.[4] Over this same period, the regulatory burdens have steadily increased resulting in more complex clinical trials. For example, one study found that between 2001 and 2018, the total number of endpoints within a typical phase III grew 86 percent and the number of procedures (including routine exams, blood work, and x-rays) grew by 70 percent.[5] Despite these challenges, biopharmaceutical research companies remain committed to bringing new and important new treatment options to patients. PhRMA members alone have invested more than half a trillion dollars in R&D since 2000.[6]

THE EVOLVING R&D PROCESS

Biopharmaceutical researchers are constantly seeking to evolve the R&D process in response to new scientific and technological advances and evolving regulatory requirements. Companies are using the latest tools such as innovative clinical trial designs, real world evidence and biomarkers to make development as efficient as possible as well as incorporating use of patient-reported outcomes measures.

New scientific advances bring greater promise and complexity, as well as a higher degree of scientific and regulatory uncertainty for biopharmaceutical companies. For example, Alzheimer's disease has seen a number of setbacks in recent years: between 1998 and 2014, 128 potential medicines for the treatment of the disease did not make it through clinical trials, with only 4 gaining FDA approval.[7] Despite these challenges, researchers remain committed and are focusing on challenging diseases such as Alzheimer's through public-private partnerships to advance the science and meet the needs of patients.

PROVIDING HOPE TO PATIENTS

By all accounts, we are in the midst of an unprecedented period of medical discovery, one that decades from now will be credited as resulting in new cures for many of our most costly and debilitating diseases and providing treatment options that allow many to live longer healthier lives. However, in many ways, our work is just getting started.

Recognizing the scientific opportunities before us, as well as the risks of not seizing this new era of discovery, it is critical that we have a policy and regulatory environment that fosters innovation. To continue to advance medical discovery, we need to ensure a well-functioning, science-based regulatory system that keeps pace with the latest advances and also ensures the timely review, approval, and introduction of new medicines. This will be critical to not only improving the lives of patients but to maintaining US global leadership in biomedical innovation and sustaining and growing US jobs. We also need to foster the development of a highly trained science-technology-engineering-math (STEM) workforce to support the discovery, development and delivery of new treatments. Finally, it is important that we have robust intellectual property (IP) rights and regulatory incentives to foster investment in R&D and commercialization of new technologies, including robust enforcement of IP protections in the US and abroad.

1 Adis R&D Insight Database. June 2017.
2 G Long, Analysis Group, "The Biopharmaceutical Pipeline: Innovative Therapies in Clinical Development," July 2017.
3 JA DiMasi, HG Grabowski, RW Hansen. Innovation in the pharmaceutical industry: New estimates of R&D costs. J Health Econ. 2016;47:20-33.
4 JA DiMasi , Grabowski, RW Hansen. Innovation in the pharmaceutical industry: New estimates of R&D costs. J Health Econ. 2016;47:20-33.
5 KA Getz, RA Campo. New benchmarks characterizing growth in protocol design complexity. Therapeutic Innovation & Regul Sci. 2017, in press; updated data provided through correspondence with Tufts Center for the Study of Drug Development.
6 PhRMA annual membership survey. Washington, DC: PhRMA.
7 PhRMA. Researching Alzheimer's Disease: Setbacks and Stepping Stones. July 2015. http://phrma-docs.phrma.org/sites/default/files/pdf/alzheimers-setbacks-and-stepping-stones.pdf