

unclear. It is very likely, however, that these organizations and arrangements will continue to thrive, as they serve the dual purpose of identifying novel scientific avenues for potential therapeutics and the training of future generations of drug discovery scientists. The pharmaceutical industry needs a constant supply of both in order to continue to thrive and grow.

---

## FUNDING ISSUES

---

Although the scientific hurdles that must be surmounted in order to discover and develop a new drug are substantial, financial issues and the availability of funding can have a significant impact on the translation of interesting science into a commercially successful therapy. In large, well-established pharmaceutical companies, sales of existing products support R&D efforts to design the next generation of products. (Keep in mind, however, that once a patent expires, the profitability of a marketed therapeutic will decrease rapidly as generic versions become available.) Established companies also have access to capital markets (e.g., stock markets, debt securities markets) that can support company endeavors, so long as the investors are sufficiently satisfied with the overall performance of the company. Smaller companies, start-up biotechnology organizations, and academic investigators, however, generally do not have access to these markets, nor do they typically have marketed products bringing in revenue to support ongoing R&D efforts. Instead, these researchers and organizations rely on three main sources of financial support: (1) grant support, (2) angel investors, and (3) venture capital investors.

Grant funding is a major source of funding and support for early stage research, especially when that research is being pursued in an academic environment. Government organizations such as the National Institute of Health (NIH), the National Science Foundation, the European Research Council, and the Indian Council of Medical Research provide grant funding in amounts ranging from a few thousand dollars to several million dollars to successful grant applicants. In many cases, grant funds can only be awarded to not-for-profit organizations, but there are some programs that support small business, such as the NIH's Small Business Innovation Research (SBIR) program and Small Business Technology Transfer Program (STTR). Funding business operations through grant funding typically does not require any transfer of ownership in exchange for funding (it is "non-dilutive" funding), which makes it a very attractive means of launching a biotech start-up company. The success rate of grant applications, however, is low and has been trending lower since the beginning of the twenty-first century. In 2002, just over 30% of NIH grant applications received funding, but by 2013, the success rate had fallen to under 18%.<sup>23</sup>