Why do scientific discoveries take long to reach the general public?

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The retinal implant that Prof. Diego Ghezzi's laboratory has been working on since 2015 is now ready for clinical trials. Credit: EPFL's Neuroengineering Laboratory (LNE)

The results of scientific research can often bring considerable societal and economic benefits. But the path from the lab bench to a real-world application can take years, even for projects that are designed from the outset with a concrete use in mind. For instance, it took seven years for

the pipetting robot developed by EPFL spin-off SEED Biosciences to reach the market, which it did in 2020. "Our robot lets scientists dispense cells one by one," says Eric Meurville, a SEED Biosciences co-founder who now works at EPFL's Technology Transfer Office. "The technology isn't really all that complicated, but it still took a long time to turn the idea we came up with in the lab into a commercial product."

New discoveries are often developed in response to a specific problem. "In my field, we first have to identify a concrete need," says Diego Ghezzi, who holds the Medtronic Chair in Neuroengineering at EPFL. "Then we come up with a way to meet that need. My lab typically relies on technological advances to overcome such challenges." Ghezzi and his research group have been working since 2015 on a new kind of retinal implant that can partially restore vision in blind people.

Once scientists have fleshed out an idea in the laboratory, the next step is to develop a tangible application. That usually starts with building and testing a prototype, and then performing different kinds of analyses to measure the prototype's properties and behavior. "There are several rounds of development and characterization before we are able to come up with a device that meets all our specifications and delivers optimal performance," says Ghezzi. "This process can take several years."

For biomedical devices, the testing step also includes biological trials. "We first tested our implants in vitro on animal retina, then in vivo on living organisms. That was of course after obtaining all the necessary approvals from the cantonal agencies," he says.

Reproducing results and getting them peer reviewed

Scientists must repeat their experiments many times to make sure their results are consistent and not just a fluke. An experiment to quantify a device's effectiveness, for example, could be repeated dozens of times.

Exactly how many times depends on statistical criteria and numerous variables.

Peer review is another important milestone on the road to commercialization. As scientists work on a project, they usually publish their findings in journals and present them at industry conferences. This gives them valuable feedback and comments—both positive and negative—that help them orient their research. Most journals require articles to be peer reviewed before they are published. Peer reviewing entails having experts read and comment on a research paper, with the author generally incorporating the reviewers' suggestions.

Market launch

The next step in getting a product to market requires bringing on board experts from outside the scientific community. There are generally two ways researchers can commercialize their discoveries: by selling a license to an established firm, or—if the inventor has an entrepreneurial bent—by creating a startup.

"EPFL offers a range of support in both cases," says Meurville. "There's the enable program, for instance, which provides funding and know-how to help scientists quickly take their products to a level of maturity that could attract interest from companies in Switzerland and abroad. And there's the EPFL Startup Unit, which supplies both coaching and funding."

Scientists generally present their prototypes to potential customers and investors, explaining how their development meets a market need or offers a major competitive advantage over existing products.

Clinical trials

In addition, medical devices must undergo clinical trials to demonstrate they are both safe and effective in humans. But before the trials can even start, scientists have to prove their devices are manufactured to adequate health and safety standards—a level of testing and approval that isn't included in the prototyping step. In Switzerland, this approval is given by Swissmedic, the Swiss regulator for medical products and treatments. The first round of clinical trials usually involves one to five patients in a single hospital. If these trials are successful, further rounds are carried out with more hospitals and several dozen patients.

Next comes market approval. Products sold in the EU must bear the CE marking. In the US, drugs and medical devices must obtain FDA approval. These certifications indicate that a product has been thoroughly tested by its manufacturer and meets all requisite health, safety and environmental standards.

Turning a scientific breakthrough into a product that can enhance our everyday lives is a long process. "The amount of time required depends on how complicated the technology is and what industry it's intended for. New drugs and medical implants obviously take much longer," says Meurville. "But for a product to be successful, it has to hit the market at the right time—and fill a need that hasn't yet been met."

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