



OPEN INNOVATION AT ELI LILLY AND COMPANY

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Designing and discovering molecules that might lead to the development of new drug therapies is not easy. To accelerate the process, Eli Lilly created an open innovation community that draws on the contributions of top scientists from around the world for the benefit of scientists and society.

DEFINING THE OPEN INNOVATION CHALLENGE

For US-based pharmaceutical giant Eli Lilly and Company—and for all companies in the industry—designing and finding compounds that could lead to new biotherapies is a crucial part of the drug-discovery process. The process overall is highly complex, and identifying bioactive compounds (compounds having an effect on living organisms or tissues) is just the beginning. Typically, scientists do not know ahead of time what the ideal chemical structure is for a specific pharmaceutical application.

Equally challenging, there is a huge network of scientists and researchers working around the world on molecules for a wide range of applications. To accelerate the discovery process, Eli Lilly wanted to tap into this network of external investigators—and persuade them to share their new chemical designs with its own scientists.

CHOOSING AN OPEN INNOVATION APPROACH

With this purpose in mind, Eli Lilly created an open innovation community in which external investigators from research institutions and academia could collaborate with its own scientists to advance innovation in biomedical science. The decision led to the launch of Eli Lilly's Open Innovation Drug Discovery program.

Outcomes from the program then shaped Eli Lilly's choices about how to collaborate with individual scientists to take the solution to the market. For instance, if an external party lacked the capability to develop a high-potential compound, Eli Lilly might license or acquire the compound. For external scientists who did have the capabilities and desire to make more of a promising compound, Eli Lilly might forge a short-term partnership to get the work done.

Eli Lilly made a decision to adopt a phased approach due to how hidden the knowledge was that the company wanted to find, combined with the level of the complexity of the challenge at hand (see Figure 1). Early in the discovery process, knowledge is hidden deeply in the networks of people that work on scientific problems often without any biological application in mind. As a result, Eli Lilly's initial focus on building an open innovation community stems from the company's interest in tapping into knowledge about truly novel compounds. According to the open innovation manager at Eli Lilly: "...often, there's innovation where you don't think there will be."

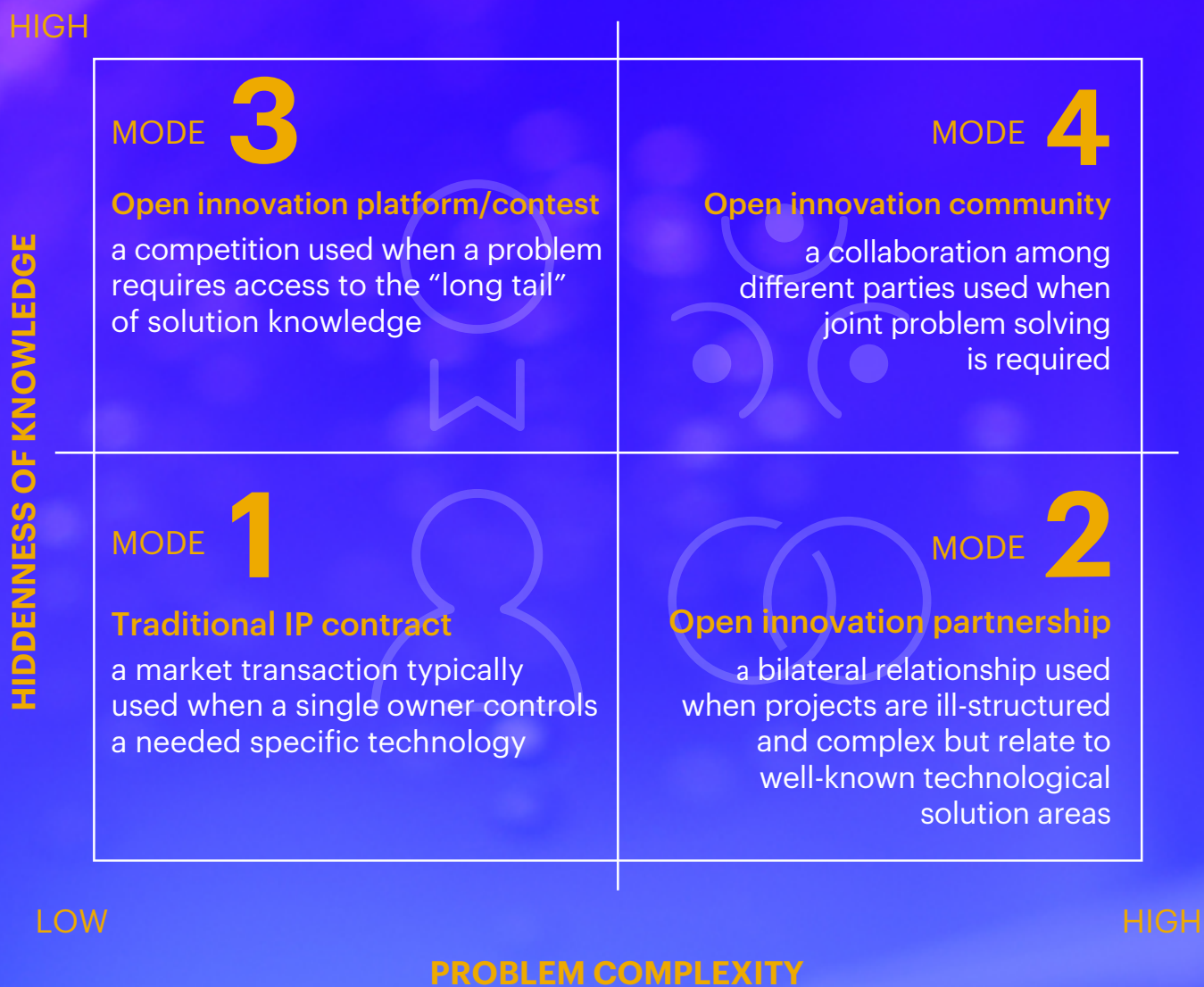
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By accessing an online community of scientists that hold diverse knowledge, are globally distributed, and work in different disciplinary fields, Eli Lilly opens up its potential to access and integrate new compound structures. Later in the process, as the company began building knowledge, it shifted its focus to cultivating the right collaborations with one or several community members to support its strategic goals.

To deploy this sophisticated approach, Eli Lilly made savvy use of digital technologies and found ways to lure the best scientists to its program. It also defined data-sharing rules to secure participants' privacy and reassure them that their intellectual property would be protected. Three steps were critical to this process.



FIGURE 1. FOUR MODES OF OPEN INNOVATION¹



Source: Bagherzadeh, M. and S. Brunswicker (2015). Mix and match: Open Innovation Project Attributes and Optimal Governance Modes. World Open Innovation Conference 2015. Santa Clara, UC Berkeley; accessible via SSRN <https://ssrn.com/abstract=2821203>

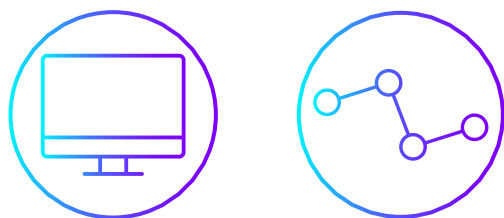
¹ For more detail on the study results read the report: Brunswicker, Sabine; Bagherzadeh, Mehdi; Lamb, Allison; Narsalay, Raghav; Jing, Yu. (2016). Managing open innovation projects with impact. Whitepaper. Research Center for Open Digital Innovation, Purdue University. West Lafayette, Indiana. www.purdue.edu/pendigital.

STEP ONE: BUILD A POWERFUL DIGITAL PLATFORM

Eli Lilly developed a digital platform to collaborate with outside parties, such as academic institutions and individual scientists that may not previously have been accessible. The platform supports experimentation with new chemical structures and compound samples by giving external scientists access to sophisticated chemical informatics tools. Scientists use the tools to analyze and test their proposed structures and generate biological data about them. Eli Lilly uses a computational tool to identify the uniqueness of the compound structure by assessing its similarity with structures that are familiar to them.

The open innovation drug discovery program is highly resource efficient.

The digital platforms enable the testing of a variety of compounds against biological assays that the company is running at the time they receive the samples. As a result, the open innovation drug discovery program is highly resource efficient. Drawing on the insights from this process, external scientists as well as those within Eli Lilly identified chemical compounds that may have the potential to be groundbreaking pharmaceutical applications (see Figure 2).



STEP TWO: ATTRACT THE BEST SCIENTISTS

Placing a high premium on their time, discerning scientists are unlikely to flock to any innovation program. Eli Lilly knew it had to create a program that would attract the scientific community to make the program work. With this aim in mind, the company designed a strong set of incentives to encourage participation, including:

Access to valued resources

The program provides sophisticated tools and a secure workspace in the cloud to enable outside investigators to ask “what if” questions and to test and refine their scientific hypotheses. Free access to Eli Lilly’s automated synthesis lab helps them synthesize compounds.

Partnership opportunities

Eli Lilly uses different approaches for partnering with external investigators—including short-term collaboration agreements, public-private partnerships, compound acquisition and purchase, licensing agreements and academic partnerships. Choices about which approaches to use hinge on criteria such as the quality of a participant’s proposed structure, the uniqueness of the structure, the innovation opportunities from a biological perspective, and the alignment with Eli Lilly’s strategic objectives.

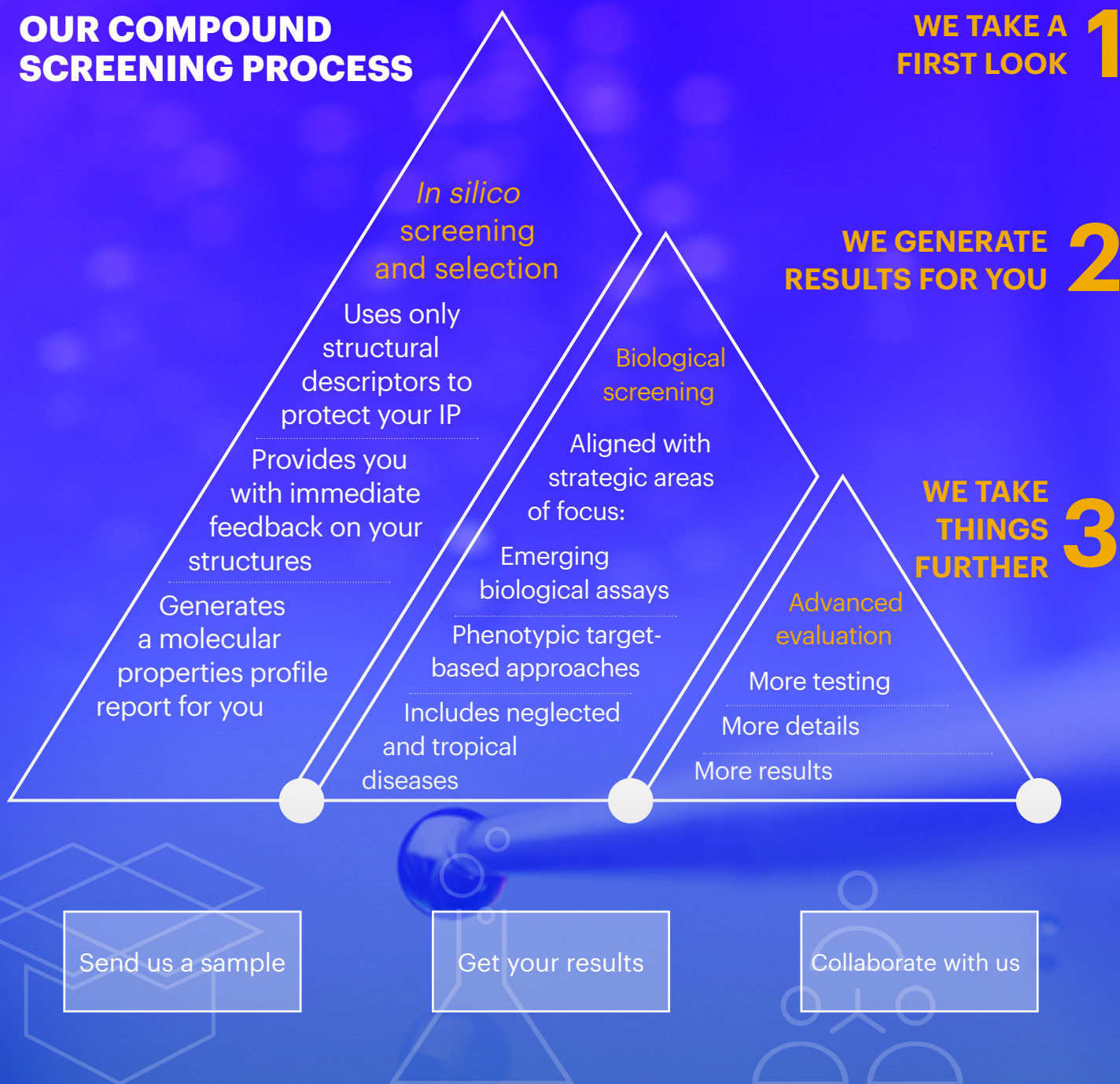
Publication opportunities

Most collaboration agreements prohibit external partners from publishing their research results. But Eli Lilly gives its external investigators permission to publish results from collaborative efforts.

FIGURE 2. COLLABORATING EFFECTIVELY

To stimulate a highly collaborative approach to drug discovery, Eli Lilly created a three-step compound-screening process that is clearly a “win-win” for the company and external scientists.

OUR COMPOUND SCREENING PROCESS



Source: Eli Lilly (2016), <https://openinnovation.lilly.com/dd/what-we-offer/screening.html>, viewed on July 10, 2016.

Reputation building for top contributors

Eli Lilly established awards for external investigators, such as “outstanding collaborator” and “outstanding contribution to compound screening” to provide them with visibility in the community of contributors, and build reputation for their scientific achievements. Such non-financial incentives trigger social processes that may also motivate others to become a top contributor.

STEP THREE: DEFINE THE RULES FOR SHARING DATA

In any open innovation community, participants have to share data to get value from their collaborations. But sharing data also raises concerns about privacy and intellectual property (IP) rights. Eli Lilly defined data-sharing rules that fostered collaboration while also addressing such concerns. It struck this delicate balance through multiple measures:

“Fingerprinting”

External investigators taking part in the program do not share structural data on their compounds with Eli Lilly. Instead, the structures are converted to encoded “fingerprints”—the minimum information Eli Lilly’s automated informatics algorithm needs to determine whether a compound meets important structural criteria. In this way, participants’ IP remains protected. Eli Lilly also shares results of experiments with the external scientists through the digital platform, whose sophisticated features protect this sensitive information.

IT-based privacy and security controls

Each program participant has his or her own platform account that is not accessible by other scientists registered on the community platform, so there is no cross-sharing of information. The biological data that the platform generates on specific structures appears only in the corresponding participant’s account. When Eli Lilly and an external partner need to share more extensive knowledge, the company creates a restricted-access collaboration account (see Figure 3).

Retention of intellectual property

The IP of new chemical structures resides with the external investigators who developed them. However, in its partnership agreements, Eli Lilly generally establishes non-exclusive rights for use of the intellectual property associated with the structures. While this presents Eli Lilly with the opportunity to commercialize the structures in new drugs, it does not preclude the scientist from working with other organizations in the same or other sectors.

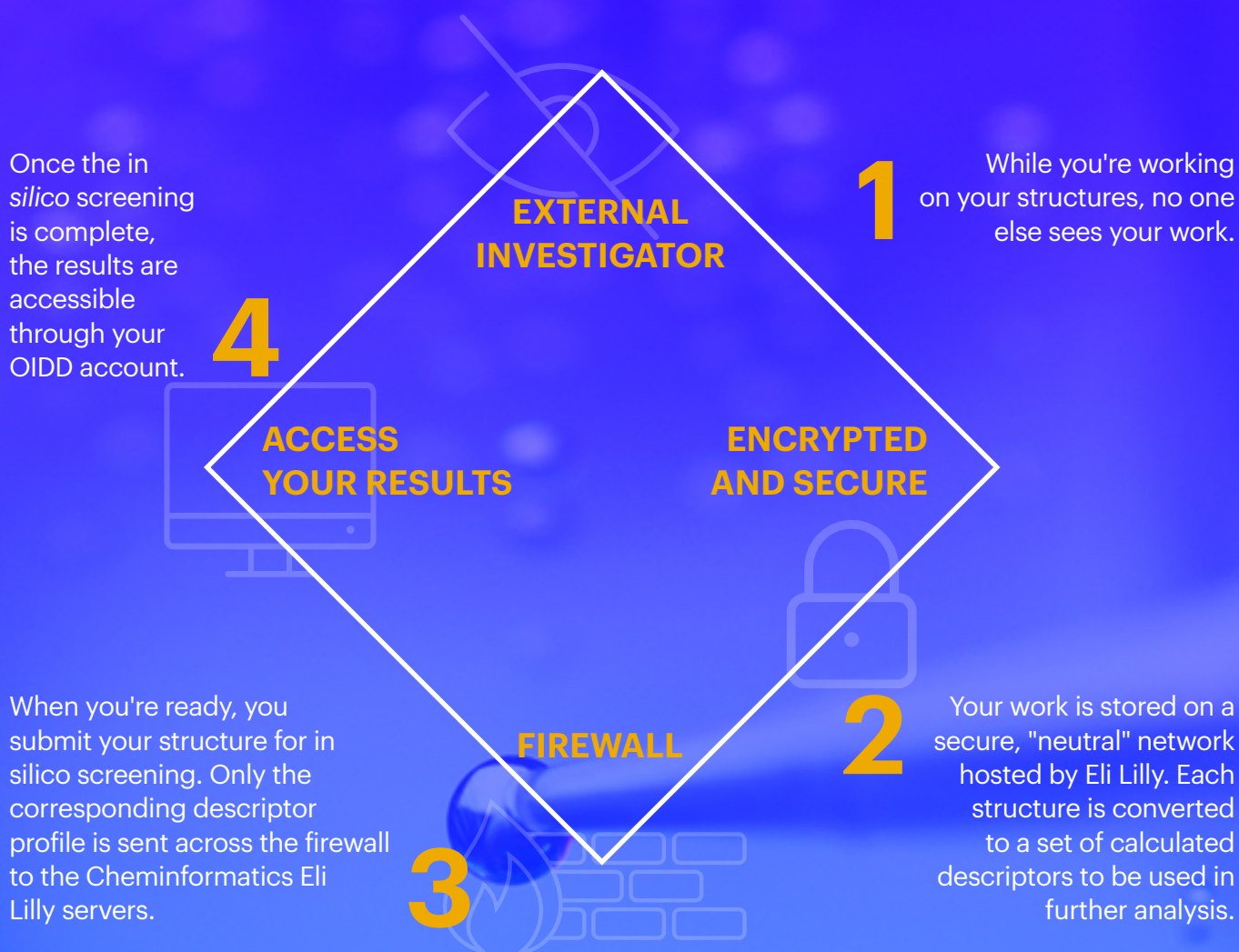


FIGURE 3. SECURE RELATIONSHIPS

Sharing intellectual property and data is an inherently risky proposition, so Eli Lilly created a four-step process to reassure program participants that the open innovation environment was secure.

MAKING SURE YOUR DISCOVERIES STAY YOURS

The Eli Lilly OIDD security provisions ensure a secure environment for you to design and investigate drug-like molecules without compromising the confidentiality of your structures.



The neutral zone, often referred to in the IT industry as a "demilitarized zone," or "DMZ," protects information from access inside or outside Eli Lilly.

Source: Eli Lilly (2016), <https://openinnovation.lilly.com/dd/what-is-oidd/protecting-your-intellectual-property.html>, viewed on July 10, 2016.

SCORING SUCCESSES

Thanks to its thoughtful approach to open innovation, Eli Lilly can test the potential of many chemical structures rapidly and develop a deep pool of know-how, integrating different structures without infringing on privacy or intellectual property rights. New digital technologies and computation techniques make this possible. Further, the process is highly resource efficient. Instead of creating its own physical samples, Eli Lilly works with scientists that have already created their samples. As soon as these samples arrive Eli Lilly can use the digital platform to test them against biological assays, making the open innovation drug discovery program resource efficient and time-bound.

The individual external scientist who is part of the community also benefits by gaining access to valuable resources. If a compound meets the basic structural criteria, assessed through chemical informatics tools, Eli Lilly offers the external scientists access to more tools and even helps them synthesize their new structures. Society wins, too: the digital platform that Eli Lilly built helps connect scientists who have developed promising compounds with nonprofits seeking cures for serious global diseases, such as malaria and tuberculosis.

And because the innovation program is integrated into a scientific function at Eli Lilly, versus being managed by a business unit, it supports ongoing learning—another priority for the company. Executives at Eli Lilly know that few compounds submitted by external participants will end up being new drugs. They understand that the program's purpose instead centers on moving early-stage research forward and identifying previously unknown potential researchers and partners. In this way, they define success not only as the generation of learning opportunities, but also the development of new drugs that can be commercialized.

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