Amgen's PCSK9 patents upheld

The market share fight for the newest class of cardiovascular drugs saw Thousand Oaks, California–based Amgen win a legal skirmish in March when a US District Court jury upheld two of its patents covering monoclonal antibodies against PCSK9. Defendants Regeneron Pharmaceuticals and partner Sanofi admitted that their cholesterol drug Praluent (alirocumab) infringed claims in both patents, but argued that the patents were invalid. Regeneron, of Tarrytown, New York, and Paris-based Sanofi plan to appeal the decision to the US Court of Appeals for the Federal Circuit. In a statement, Sanofi and Regeneron said, "This decision is the first step in this ongoing litigation and does not impact Praluent or our ability to deliver it to physicians and patients at this time." Amgen markets its own PCSK9 drug, Repatha (evolocumab), which was approved by the Food and Drug Administration in August 2015, one month after Praluent. However, instead of damages or royalties, Amgen has requested a permanent injunction on sales of Praluent, which would leave Repatha as the sole PCSK9 drug on the market—for the time being. Last month, Pfizer's PCSK9 inhibitor cleared its second phase 3 trial, setting up a possible regulatory filing in the coming months. If it reaches the market, bococizumab could compete with Repatha and Praluent.

J&J incubators open in Belgium and Texas

Johnson & Johnson Innovation has set its sights on European biomedical innovation by opening a bioincubator to identify early-stage companies and nurture them at its Janssen campus in Beerse, Belgium. The initiative, called JLINX, launched in March with undisclosed venture funding from the company's J&J Innovation-JJDC venture arm. JLINX will host startups and provide entrepreneurs with access to J&J's scientific, technical, and business expertise, as well as an opportunity to share ideas and collaborate. J&J will make venture investments in the companies but will not hold rights to any products they commercialize. J&J said it hopes to bring in external investors for JLINX companies. Bioqube Ventures, the incubator's independent management arm, will manage the investment portfolio, work with external investors, and help choose new companies for the incubator. J&J said JLINX will have a particular focus on human microbiome research. It is accepting applications from startups and will be fully operational this summer. J&J's other regional innovation centers include Boston, California, London, and Shanghai.

In March, J&J also unveiled the JLABS incubator in Houston. The facility is housed within the Texas Medical Center (TMC) Innovation Institute. J&J said the incubator, dubbed JLABS @ TMC, will initially house 21 companies and can accommodate up to 50. Several resident biotechs will focus on oncology and immuno-oncology. TMC JLAB joins a network of J&J Innovation life science incubators in Boston, San Diego, and the San Francisco Bay Area and a planned incubator in Toronto.

Citizen science lures gamers into Sweden's Human Protein Atlas

Since its launch in March, more than 40,000 people have joined Project Discovery, an effort by the Human Protein Atlas (HPA) that aims to map protein expression throughout the body. The citizen science initiative entices gamers to help analyze around 250,000 images of stained tissue samples by embedding the scientific data within EVE Online, a futuristic role-playing game with around half a million subscribers that has been running for more than a decade.

Gamers have to pinpoint fluorescently labeled proteins within cells, and if their analysis is good enough, they win in-game credits to spend on cyber-goodies. Players have already made more than 4.5 million individual protein location annotations. "It's mind-blowing," says Emma Lundberg, director of the HPA's subcellular protein atlas and leader of Project Discovery, who is based at the SciLifeLab in Stockholm. "Interest in the game has been much higher than we expected."

It's not the first time that gamers have been enlisted to help analyze data through citizen science projects. FoldIt, for example, allows players to tinker with protein models to find the most stable conformations, or redesign them to boost their catalytic activity (*Nat. Biotechnol.* **30**, 190–192, 2012).

But citizen science games have generally been home-grown affairs designed around the data and developed from scratch. "Project Discovery is the first time that a citizen science task has been put into a triple-A computer game," says Lundberg.

"It's the most innovative thing I've seen yet in citizen science," agrees Amy Robinson, executive director of EyeWire, a neuron-mapping game based at Princeton University, in New Jersey. Project Discovery also illustrates how much citizen science has changed over the past decade.

In the past, most citizen science projects simply asked ordinary members of the public to collate data, perhaps counting birds or butterflies for ecology surveys. But internet access allowed them to participate in other ways: donating idle computer time, or directly analyzing data. To make the analysis process more interesting—and keep volunteers coming back for more—some projects turn the task into a game (a tactic known as 'gamification'). A growing number of tools and platforms make it easier than ever to set up a project.

For the Human Protein Atlas, Lundberg hopes the gaming approach will help to unblock a major data bottleneck. Her team has used semi-automated sample preparation and microscopy to build up a stash of 13 million images showing the locations of different proteins in various tissues. Computers can interpret simple features in those images, but with 30 cell lines and 29 different proteins in the mix, it has been difficult for machines to read more complex distribution patterns. "Humans are very good at recognizing those patterns," she says.

Project Discovery could not have happened without a close partnership with CCP Games, in Reykjavik, the company behind EVE Online, which also covered most of the set-up costs. But it also involved a crucial third partner, a startup called Massively Multiplayer Online Science (MMOS), in Monthey, Switzerland, that has developed a set of software tools that make it much easier to integrate scientific data problems into games. "It lowers the barrier to entry," says Attila Szantner, co-founder of MMOS.

Szantner hopes that linking research problems with established games like EVE Online will give citizen scientists a stronger incentive to keep playing. "Keeping up long-term engagement is the major problem," he says. "Gamification is usually a little spice on the top, but here it's the core mechanism." EyeWire currently has 219,000 players signed up, with roughly 1,000 of them active per week. But Robinson says fewer than 10% of the participants do most of the work, and she is eager to capture a broader demographic.

Lundberg is optimistic that players will stay with Project Discovery, but she adds that it remains to be seen whether the data they produce are good enough. "The community will not believe anything until we've proven it," she says. The group is continuing to tweak the game mechanics in order to improve the quality of players' annotations, and Lundberg hopes to have enough data to analyze their success rates by summer.

Joanna Reynolds, director of research communications and engagement at Cancer Research UK (CRUK), says that she has seen a big change in researchers' attitudes to citizen science in recent years. When CRUK produced its first citizen science project, Cell Slider, in 2012, "citizen science still felt very unproven," she says. But after demonstrating that it could produce useful results (*EBioMedicine* **2**, 681–689, 2015), CRUK now has more than a dozen research groups working with the citizen science team and has developed a series of other projects,

CCP Games

EVE Online is one of Iceland's biggest exports. The game combines space exploration, political intrigue, and now, an opportunity to spot proteins inside cells and collaborate with Sweden's Protein Atlas.

including the world's first mobile game dedicated to crowdsourcing cancer research. "It isn't appropriate for everything," she cautions. "But the more we bring scientists together with people in gaming and technology, the more they'll be able to identify the places where we really can develop projects that accelerate research in an entirely new way."

Overcoming scientists' skepticism has been one of the field's biggest successes, says Darlene Cavalier, founder of SciStarter, a nonprofit that connects volunteers to citizen science projects. "I spend far less time defending citizen science than ever before," she says. SciStarter has a searchable database of about 1,400 citizen science projects, along with tools for training contributors, and Cavalier says that health and medicine has been one of the fastest growing themes in recent years.

Meanwhile, the US government released a toolkit in September 2015 to enable researchers to tap into ready-made citizen science platforms such as Zooniverse or CitSci.org rather than building them from scratch. "You don't have to be a pioneer in developing crowd-based methods to have your own citizen science project; you don't even need to be a programmer," says Pietro Michelucci, director of the Human Computation Institute in Fairfax, Virginia.

These resources, along with organizations like MMOS, mean that "it's a lot easier to start a project now than it was a couple of years ago," says Robinson. She is also keen to make EyeWire more 'gamey', and has just won a grant from the US National Institutes of Health to produce a smartphone version.

So far, the pharmaceutical and biotech industries have not embraced crowdsourced analysis, perhaps due to concerns over intellectual property. But they are interested in tapping into the citizen science boom to gather data. "Pharma companies are really, really interested in this area," says Reynolds. PatientsLikeMe, for example, is a Massachusetts-based startup that allows patients to submit details about their health conditions, including symptoms and which therapies they find effective. Its 350,000 users can then look at others' experiences to guide their own treatment.

Companies can also pay to access these valuable patient data, potentially allowing researchers to find useful leads in the information. "Is it the canonical methodology for a clinical study? No. Can you get useful information out of it? Maybe," says Michelucci. In 2011, for example, PatientsLikeMe used its network to evaluate the use of lithium carbonate to treat amyotrophic lateral sclerosis (ALS) (*Nat. Biotechnol.* **5**, 411–414, 2011).

As more and more games compete for citizen scientists' time, Michelucci says that an integrated approach could benefit the whole field. For example, the US National Science Foundation last year awarded SciStarter $300,000 to develop a 'dashboard' system that will allow citizen scientists to use a single registration to participate in multiple projects, and track their contributions. The system is now in testing and should be live in October.

Michelucci is also involved in WeCureALZ.org, which goes live in June and will ask participants to analyze brain sample images from mouse models of Alzheimer's disease. The system relies on elements drawn from EyeWire and stardust@home, a project to identify interstellar dust particles in samples from a space mission. Whereas lab technicians might take a year to analyze the data from just one experiment, "we did some napkin math and realized we could get it down to a couple of weeks," he says.

Citizen science will likely evolve beyond 'microtasking'—where people repeatedly perform a single operation—toward cooperative discovery. FoldIt, for example, is using one person's output as another's input, as a way to refine a solution to a problem.

And in the future, advances in artificial intelligence may alter the way that humans contribute to these projects. "I think it will be relatively easy to design programs that outperform humans on most specific tasks, but almost all programs could also benefit in one way or another from collaboration with humans," says Jérôme Waldispühl of McGill University, in Montreal, who helped to create Phylo, a game that aligns DNA sequences shared by different species. "The key thing is understanding what humans are good at, and putting them where you need in the system."

Studying how to make the most of human-machine collaborations (*Science* **351**, 32–33, 2016) could open up many more opportunities in citizen science, says Michelucci: "We're just in the infancy of using humans as information processors."

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