Artist's rendering of the planned LPI building in Jena, Germany.

Leibniz Institute of Photonic Technology

PROFILE

Infectious Diseases in the Crosshairs

A new translational-research center being built in Jena, Germany, aims to speed the path from lab to clinic for promising biophotonic technologies.

Stewart Wills

As 2020 drew to a close, news on the COVID-19 front was decidedly mixed. The world was grappling with a second wave—or, in some societies, a third wave—of coronavirus infections, and facing the prospect of a tough 2021 first quarter. Yet the sudden news in November of very promising results in trials of COVID-19 vaccines raised hopes of gradually gaining the upper hand on the virus over the course of the year.

Even if the novel coronavirus is brought under control, it will not be the last pathogen that humanity faces. And in Jena, Germany, a project is underway to put photonics on the case. Backed by €124 million (US$147 million) in funding from the German government, the Leibniz Center for Photonics in Infection Research (LPI) will aim specifically to speed the progress to market of photonic tools to diagnose and treat infectious diseases. For a closer look at the project's goals, OPN talked with its spokesperson, OSA Senior Member Jürgen Popp, the head of the Leibniz Institute of Photonic Technology (IPHT) and a professor at Friedrich Schiller University Jena.

Translation's complex machinery

Popp is no stranger to the goal of marrying photonics and other disciplines in the effort against infectious disease. Among other things, he also has a lead role with InfectoGnostics, a research campus in Jena started in 2012 as a public–private partnership, with the specific aim of "breaking new ground in the diagnosis of infections." That effort involves some 30 partners from science, medicine and industry, putting together expertise on photonics and molecular biology to eliminate some of the barriers to bringing promising diagnostic technologies to market. One recent success coming out of the campus, reported in spring 2020, was a rapid antibody test for SARS-CoV-2, the virus behind the pandemic emergency.

But Popp and his colleagues wanted to make the pathway to commercialization of these technologies even smoother. "The translation from a proof of concept to a marketable product is quite long," he says, "and there are so many obstacles."

Those obstacles, Popp explains, partly stem from the bewildering array of moving parts in the translation machine—feasibility studies, identification of the molecular target, development of assays and readout devices, access to patients for clinical trials, market analysis and testing, and more. As a result, in an ordinary, non-pandemic research environment, lab-to-clinic translation can take many years—and even when a crisis such as the current pandemic puts things on a faster track, progress can seem glacial. "In talking with startup companies," he says, "we found that we were all asking the same question: How can we translate things faster?"

Leibniz Institute of Photonic Technology / Sven Döring

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Building a pipeline

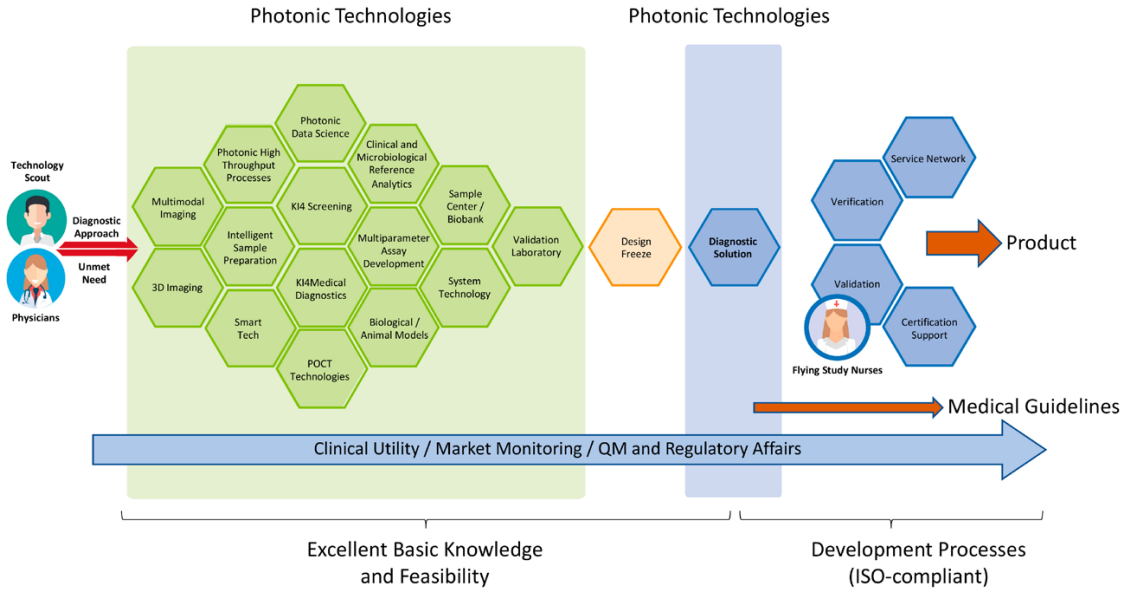
The new LPI aims to speed up the process by more tightly integrating, in a single facility, the diverse resources and infrastructure required to bring biophotonic tools from the lab to the clinic—and by establishing well-defined process "pipelines" within the facility to drive promising diagnostic and therapeutic ideas to marketability.

In the area of diagnostics, for example, Popp envisions an environment in which a scientist with a promising photonic technology can immediately tap an on-site team of physicians, technology scouts and other experts, as well as ready-made supply chains, for sourcing molecules, developing assays, fashioning data-management plans and meeting other needs. The center will also provide resources for market analysis, validation and investigating clinical utility, including a team of "flying study" nurses who will test out the technology in hospital environments. And it will offer assistance for registering the medical products that result. A separate, complementary pipeline is envisioned to speed the development of photonically enabled therapeutics.

As a result, "we can cover the entire workflow within this center—from the sample preparation to the solution, and even the work on developing standard operating procedures," says Popp. "And also—and this makes a difference to a company—we have direct access to the clinical expertise."

Five-year plan

According to Popp, the idea for an integrated facility of this type was hatched around five years ago, long before the scourge of COVID-19. Indeed, one of the original motivations was to battle a different kind of biothreat—the increasing emergence of antibiotic- and drug-resistant pathogens. Popp points out



An example of a lab-to-clinic pipeline, as envisioned for LPI. Courtesy of LPI

that the number of patients that die from multidrug-resistant pathogens, because they do not receive the right antibiotic or receive it too late, is on the increase globally.

The idea blossomed into a joint project of four Jena-based research partners—the Leibniz IPHT, the Leibniz Institute for Natural Product Research and Infection Biology–Hans Knöll Institute, the Jena University hospital and Friedrich Schiller University Jena. In 2015, the consortium rolled the project into a proposal for the national-roadmap funding competition of the German Federal Ministry of Education and Research (BMBF). LPI was one of three projects tapped for funding in the 2019 competition, out of eleven rivals.

The €124 million in BMBF funds will be used over the next several years to develop the institute's building—encompassing some 4,500 m^2 of research and office space—and to acquire or develop the state-of-the-art technology needed to accelerate lab-to-clinic translation. One key element will be ensuring that the new LPI building will meet high-level biosecurity guidelines—"in order to work," Popp says, "with the really nasty guys" like COVID-19. Right now, he points out, COVID research in Jena can take place only at the university hospital, which conforms to biosafety level 3. Baking high-grade biosafety into the LPI design from the outset will, he believes, significantly ease the process of collaborative research on technologies to address some particularly tough microbial prey.

Open user facility

In talking about LPI, its boosters note that the concept leverages the strengths of the Jena area in research and industry, particularly in the photonics, molecular-biology and microbiology spheres. But they stress that the site, once completed, will be open to the entire international community of scientists as a user facility. "If a postdoc at Yale is inventing something great, but she can't really take it further as a medical product, she could bring it to LPI," Popp says. And, while the BMBF funding will serve in the development, construction and start-up of the facility, LPI is expected to be self-funding on an ongoing basis as an increasing number of projects flow through its pipelines.

Realizing that vision, however, will take a few years. Ground is expected to be broken for the LPI facility in 2022, with the building likely to open its doors only in 2025 or 2026. In parallel with that, the LPI team will focus on identifying and acquiring the requisite technologies and equipment, and fleshing out the details of the lab-to-product pipelines that will drive the facility's work.

Meanwhile, Popp and his colleagues haven't dropped the research ball, and continue to wage an ongoing effort for new photonically driven diagnostics, through vehicles such as the InfectoGnostics campus. That campus, he notes, embodies the same philosophy of bringing biophotonic technologies to market faster. The LPI, however, will give it access to substantially greater infrastructure in integration, organization and security, in the direct vicinity of the university hospital.

"We are working intensively on this," says Popp. "And in five to six years, outstanding infrastructure funded by the German research ministry will be ready." OPN

Stewart Wills is OPN's senior editor.