Functional fabrics: Engineers, designers, and other scholars assigned to develop techniques for 'smart textiles'

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Drexel University opens a new center that its leaders hope will revive one of Philadelphia's oldest industries.

The $7 million, 10,000-square-foot Center for Functional Fabrics at 3101 Market St. replaces a 2,000-square-foot textile lab three blocks west. Engineers, designers, and other scholars are assigned to the Schuylkill Yard development to develop models and mass-production techniques for "smart textiles that emit, transmit, communicate, and actuate" using embedded sensors and other digital tools, says the center's director, Genevieve Dion.

It's a modern mini-factory. "We have a warp knitting machine, flatbed knitting machines, circular knitting machines, a textile welding machine, a 3-D scanner loom, 3-D printers, laser printers. It's an end-to-end facility where we can prototype quickly—and fail quickly—so we can solve the problems quickly, so we can create the textiles of the future, with the tools of the future," said Dion, a 12-year Drexel design veteran, with the lilt of her native Quebec.

Philadelphia was a textile and clothing manufacturing center for most of its history, with block-long factories in North and South Philadelphia, the River Wards, and along wheel-turning creeks in the suburbs, luring workers to the region from across Europe and the Caribbean.

Most of the mills and jobs moved to low-wage countries, leaving converted warehouses, loft apartments, and ruins. "When manufacturing gets thrown over the fence, practical understanding is lost," said Dion. She wants Drexel to be a resource for a new generation of fabric makers.

The new R&D center also constitutes the Pennsylvania Fabric Discovery Center, part of a partnership between Massachusetts Institute of Technology and Drexel that is funneling Department of Defense research money through the nonprofit Advanced Functional Fabrics of America institute. The effort comes with additional support from firms including Apex Mills, the New York company whose North Carolina mills make NASA and military fabrics. The center's funding includes

$1.5 million from the state of Pennsylvania, the remaining $5.5 million from Drexel. The institute has so far added $1.2 million for research.

The goal: to show that U.S. companies can make and sell durable smart textiles that communicate data automatically, at a profit. "We are at the center of (Drexel president) John Fry's vision of bringing industry and academia together," Dion said. Her staff includes fashion designers, material scientists, and mechanical and civil engineers.

Fabric studded with sensors and entire computing systems is a staple of science fiction and tech promotion. But after years of experiments and lab use, there are few such "functional fabric" products in commercial production.

Adidas MiCoach, the biodata-collecting shirt, has been discontinued, though successors are under development. Toronto-based Myant says it's close to deploying health-monitoring systems embedded in clothes. The Department of Defense is also funding smart-fabric research.

And a Drexel team is working on a "smart fabric belly band," with a configurable antenna and RFID system (like the antitheft tags in stores) that can detect breathing and contractions in patients not under the direct supervision of nursing staff.

"You see a lot of proofs-of-concept. But very rarely do we see actual products," Dion said. "There are many challenges that need to be overcome. I have been doing this intensely for 10 years now, and I can say that we are coming closer. I'm hoping in the next five years, we will see some really good reliable products in the defense industry, or in the medical industry."

It's not enough to build a one-of-a-kind gadget for geeks. "We can now do pilot testing of up to 1,000 (items). We can test for validation, scale,

repeatability. Can the product survive general use?"

A handful of doctoral students are based at the center, along with master's candidates and undergraduate interns. Dion hopes to join electrical and materials engineering students, fashion designers, and biomedical specialists to learn "trans-disciplinary teamwork" as well as textile and computing design.

Though few Philadelphians still make cloth or clothes, the region remains a center for companies with deep investments in automated production of both fabrics and the modern digital sensors that must be durably integrated into clothing for "functional fabrics" to reach their promise.

The region is home to $4 billion (yearly sales) fabric innovator Gore-Tex, with several research and production facilities around the Pennsylvania-Delaware-Maryland border; TE Connectivity, the $12 billion electronic connectors and sensors maker; Kynetic, the Conshohocken firm that makes major-league baseball uniforms at Majestic mill in Easton and distributes pro and college gear through Fanatics; Amazon Woot's first printed-clothing plant, near Norristown; BioTelemetry, a pioneering Exton maker of remote medical monitors; and units of many other companies that Dion says can be expected to show interest in functional fabrics as Drexel ramps up mass production techniques.

"Oh, we really need to talk to them" about the new lab, Dion said.