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One Company Sold, Second Company To Go Public, New Research Breakthrough May Support Third: The Story of a Faculty Entrepreneur

Santa Barbara, Calif.-- Larry Coldren, newly named to the Fred Kavli Chair in Optoelectronics and Sensors at the University of California at Santa Barbara (UCSB), has a curious knack for doing the right research ahead of its time.

Twice, with the tunable laser and with the short wavelength (0.85µm) Vertical-Cavity Surface-Emitting Laser (VCSEL), the research group Coldren heads, has achieved breakthroughs whose usefulness was not at first readily apparent. But in both cases the devices eventually led to business ventures: the tunable laser to the Goleta-based Agility Communications, likely to go public in the year to come, and the short-wavelength VCSEL to Optical Concepts, sold in the mid-'90s to Gore Photonics based in Lompoc.

And a string of recent developments in Coldren's research group (See "Research Breakthrough for Fiber Optic Communications") has led to another round of submitted papers and patents on the long wavelength (1.55µm) V CSEL.

Unlike the two previous inventions, this one's commercial viability was immediately evident to the more than 100 industry, academic and government representatives who gathered mid-summer at the UCSB Optoelectronics Technology Center, which Coldren directs and where his students first presented his group's findings on the long-wavelength VCSEL.

Asked if he is en route to business number three, Coldren shrugs. He just doesn't know the answer. Maybe, he wonders aloud, the University of California, which has a stake in the patents, will steer the long-wavelength VCSEL to non-exclusive licensing agreements with more than one corporation, thereby making it difficult for a start-up to capitalize on the technology. It's just too soon to tell what's to become of his group's latest inventions.

Coldren really likes to make things that will in turn make good business, but he's "not so sure about making businesses."

Take the tunable laser. Some venture capitalists from the Bay area visited Coldren's labs in the mid '90s. Having heard about his novel approach to tuning a laser by using a Vernier scale approach, "They wanted to know," recalled Coldren, "what the problem was. In their world if you have a winning idea, you start a company. I told them I already had the job I really wanted."

Eventually Coldren's graduate students Greg Fish and Beck Mason decided to found the start-up. Fish, who earned his Ph.D. in electrical and computer engineering from UCSB in 1999, is still with Agility. Mason, whose Ph.D. in electrical and computer engineering was conferred in 1999, now works for Lucent Technologies.

Another key player is Ron Nelson, who quit his job as a vice president at Motorola to run Agility. Its 85 employees now occupy 50,000 sq. ft. of space on Pine Avenue in Goleta and some 30,000 sq. ft. in Allentown, Pa., where a highly automated packaging facility is being constructed. One of the key moves Nelson made early on in his tenure at Agility was to acquire an exclusive license for the tunable-laser patent as well as licenses for other associated patents that Coldren and others had filed before the usefulness of the device became apparent.

Coldren is Agility's chairman and chief technology officer. "Being the chief scientist is what I like to do," said Coldren, who is taking a six-month leave from his UCSB faculty position to shepherd Agility through the pre-public stages, including demonstration of a prototype tunable laser.

What is a tunable laser?

Light waves reflected between two mirrors move towards coherency. In other words, light oscillates at one wavelength or frequency which is characteristic of the optical laser's path length. Normally, generating light at more than one wavelength or frequency requires more than one laser. This can get very expensive and cumbersome for today's wavelength diffusion multiplexing (WDM) optical communications systems, which may utilize over a hundred different wavelength channels. The promise of the tunable laser is the ability to program a single device to emit at one frequency then re-program it to emit at another by electronically changing the effective optical length of its cavity. So in effect one device would do what it now takes more than 100 separate devices to do.

Back in 1988 Coldren figured out a way of making lasers tunable over a wider range by employing the concept of a Vernier scale used by machinists. The idea is to put two different gratings at each end of

the laser cavity and misalign them in a precise way by changing their index of refraction to tune differentially the two mirrors and thereby create other frequencies of light.

How did the world react to the revelation of this clever trick? "Nobody cared," said Coldren. "People in industry would say to me, 'Why do you want to make a widely tunable laser? What we want is a laser with a nice fixed single frequency.'"

Of course the rapid evolution of fiber optic communications soon changed the climate for tunable lasers because they are the key to sending more than one channel (i.e., color or frequency of light) down a fiber. Another frequency of light down a fiber is like adding another fiber. And 100 frequencies are like adding 100 fibers.

Coldren comes by his penchant for inventions naturally. He acquired the knack from his dad who ran a general farm in central Pennsylvania.

"My dad was into building things," Coldren recalls. We had an automated farm. I learned all about mechanics at an early age by building real stuff. Dad really liked equipment. We had the finest of corn pickers and bailers and combines. We had a complete hammer mill that he used to make all our own feed -- and most of our neighbors' too -- from the raw grains."

Coldren figures that he majored in electrical engineering at Bucknell in Lewisburg, Pa., because it was the one branch of engineering that he thought he didn't know firsthand from farm life. And he stayed at Bucknell an extra year to complete the course of study for two undergraduate degrees, a B.S. in engineering and a B.A. in physics. He said, "I realized I needed a more liberal education than is normally afforded by a four-year engineering program."

Coldren did his graduate work at Stanford because his first employer after college, Bell Labs, thought that's where he should go despite an acceptance with scholarship support at MIT. He worked at Bell Labs from 1968 to 1984 (including the four years at Stanford), when he joined the UCSB faculty.

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