

**BREAKTHROUGHS****Slimmed-Down Mid-Infrared-Laser Sensor Could Make Waves in Handheld Devices**[Bob Michaels](#)

Mid-infrared lasers have traditionally been large and bulky, making them far too unwieldy for many medical device applications. But if **Daylight Solutions** has anything to say about the matter, the technology will soon find its way into a range of handheld medical devices thanks to the start-up's success in cutting the technology down to size.

Designed to detect and measure chemical vapor, Daylight's external-cavity quantum-cascade laser (ECqCL) technology is based on the quantum-cascade laser (QCL) developed by Bell Labs in 1992. But Daylight's and Bell Labs' techniques differ markedly, insists Eric Takeuchi, Daylight's director of business development. While QCL allows users to obtain laser light in the mid-infrared range, it emits light at one wavelength only. "So if I take a QCL and use it for molecular detection, it's extremely difficult because I don't have the ability to tune the wavelength," he notes. "All I can do is look at one color."

Using a 1 x 3-mm semiconductor chip, ECqCL, on the other hand, enables users to access many different wavelengths across a wide spectrum. Molecules such as ammonia in the breath, for example, absorb colors of light in the mid-infrared range. And because different molecules absorb light in different ways, they have a unique fingerprint. "If you can tune the color of the light in this wavelength regime, you can uniquely identify molecules," Takeuchi explains.

Daylight's ECqCL core technology can do just that. The secret is in the packaging—the sensor's external cavity. "When I take the chip and embed it into an external cavity, I can liberate photons of different colors over a wide range," Takeuchi comments. "That's the enabling factor that allows me to tune color, which allows me to obtain true molecular fingerprint information because I can look at a range of colors with a single chip, or single device."

Having shrunk the sensor from the size of a desk to the size of a fast-food hamburger container, the company is exploring prospects for shrinking medical devices. Breath detection is a nascent field, Takeuchi states, which has potential for diagnosing an array of ailments from diabetes and liver malfunction to lung disease and renal failure. Daylight is also working on monitoring glucose noninvasively. "By looking at the reflections of mid-infrared wavelengths through the skin, you can detect glucose in interstitial fluid because glucose, as a molecule, has an infrared signature that's unique," Takeuchi says.

Replacing surgical laser scalpels with more-compact devices is another possibility that could prove useful for performing field surgery in military environments, according to Takeuchi. Bringing man-portable systems into the field and still being able to do surgical procedures in the mid-infrared wavelength regime is a very interesting area."

**Daylight Solutions**

Poway, CA

[www.daylightsolutions.com](http://www.daylightsolutions.com)

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