

▶ A New Frontier in Eye Care

Jeff George, Global Head of Alcon, talks about the company's agreement with Google to develop a smart contact lens, which has the potential to transform eye care.



Jeff George

In July, Novartis announced that its eye care division Alcon entered into an agreement with a division of Google to in-license its "smart lens" technology. Google [x] and Alcon are to collaborate to develop a smart lens that has the potential to address ocular conditions. The smart lens technology involves non-invasive sensors, microchips, and other miniaturized electronics, which are embedded within contact lenses.

Google [x] is Google's research and special projects division, the team devoted to finding new solutions to global problems. It is the division that launched Google Glass and is currently working on driverless cars and drone-based delivery systems.

Jeff George, global head of Alcon, says the two companies are a good match.

"Google has the ability to prototype products more rapidly than anything I've seen," he says. "They have strong research and technical problem-solving capabilities within the Google[x] group. We bring the capability in technical and clinical development, high-volume, high-quality manufacturing, and commercialization. We're looking to capitalize upon our strengths and leverage Alcon's long innovation heritage in eye care. While we spend \$1 billion a year in R&D, we don't believe that we can invent everything in-house. We are agnostic about where innovative ideas come from. The smart lens technology is a promising idea and we felt it was a great match."

The company currently manufactures a broad range of contact and intraocular lenses, and Mr. George says that Alcon plans to leverage this and Google's technology for future development of accommodative intraocular lenses.

Alcon has licensed the smart lens technology for all ocular uses, Mr. George says, and the company's first area of interest will be to develop autofocus capabilities for contact lenses to correct presbyopia. The second application will be for a lens that monitors glucose levels via tear fluid. Mr. George says there is also potential for developing this technology for monitoring intraocular pressure in glaucoma patients.

Mr. George says the smart lens is currently in

the early stages of development and additional clinical studies will be initiated in the near future

as part of Google's and Alcon's joint development efforts. The lens is still several years away from reaching the market.

The first application is helping people living with presbyopia who can no longer read without glasses. The smart lens has the potential to provide accommodative vision correction to help restore the eye's natural autofocus on near objects in the form of an accommodative contact lens or intraocular lens. The lens prototype has a built-in sensor that transmits the signal of the eye's gaze to the optical part of the lens through an integrated circuit thereby allowing the lens to accommodate distance and close-up vision. The sensor, integrated circuit, and optical components of the lens are powered by a miniaturized battery.

Mr. George says this is a big market opportunity for the company. About 1.7 billion people have presbyopia around the world, and the company projects that by 2020, about 2 billion people will have presbyopia.

"There is an aging population, as well as an increase of economic means to buy healthcare in the United States and emerging markets," he says.

A second application is in helping diabetic patients manage their disease by providing a continuous, minimally invasive measurement of the body's glucose levels via a smart contact lens, which is designed to measure tear fluid in the eye and connects wirelessly with a mobile device.

About 29.1 million Americans, or 9.3% of the population, have diabetes, according to the Centers for Disease Control. According to the World Health Organization, 347 million people worldwide have diabetes.

Managing diabetes can be challenging because of fluctuations in glucose levels. Although many patients wear monitors with glucose sensors embedded under their skin, they must still prick their finger and test their blood glucose throughout the day.

"Compliance is challenging in diabetes because regular measurement is often invasive—from finger-pricking, blood tests to subcutaneous devices that can be awkward and even painful," Mr. George says. "As a result, people can end up with kidney fail-

Alcon is developing a smart lens technology that includes sensors, microchips, and other miniaturized electronics embedded within contact lenses.



ure or even become blind because they are not monitoring their glucose on a continuous basis. The lens would, through the tear fluid, measure the amount of glucose through a sensor. Then it would wirelessly communicate glucose levels to the patient's smartphone to let the patient know whether he or she would need insulin."

Mr. George says one question clinical trials will aim to answer is how well correlated tear glucose levels are to blood glucose to ensure that measurement is well matched. **PV**

Google's Interest in Healthcare

Google is beginning to make a mark in healthcare. In addition to the development of the smart lens, the company is working on the following projects:

- » In July 2014, Google [x] announced a new project to better understand the human body. Known as the Baseline Study, this will organize data from accumulated genetic profiles. Google will initially collect genetic data from 175 people, followed by thousands more. The group is collecting data from blood, saliva, tissue samples, heart rates, and oxygen levels. The study is being conducted with assistance from Stanford and Duke.
- » Google has released a test version of Google Genomics, a cloud-based system to store, process, and share DNA sequences using standards developed by the Global Alliance for Genomics and Health.
- » In September 2013, Google launched Calico, a company that focuses on health and well-being, in particular the challenge of aging and associated diseases. Arthur D. Levinson, former CEO and chairman of Genentech and chairman of Apple, is CEO and a founding investor.
- » In September 2014, Calico and AbbVie announced an R&D collaboration intended to help the two companies discover, develop, and bring to market new therapies for patients with age-related diseases, including neurodegeneration and cancer. AbbVie and Calico will each initially provide up to \$250 million to fund the collaboration with the potential for both sides to contribute an additional \$500 million.