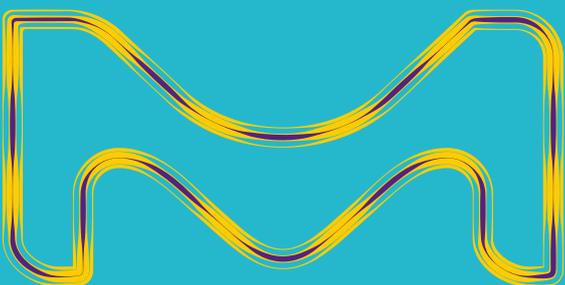


Merck KGaA
Darmstadt, Germany

A clear view

**LicriEye: Breakthrough technology to
restore vision after cataract surgery**





A CLEAR VIEW

Unlocking a spirit of curiosity and inquiry: Innovative strength has always been a firm part of our DNA. The new Innovation Center in Darmstadt offers researchers an ideal environment to work on the products and solutions for tomorrow, for example, the ingenious LicriEye lens.

It's a melting pot of a broad assortment of ideas. At the Innovation Center in Darmstadt, interdisciplinary teams from all three business sectors of our company are passionately pursuing promising developments. In order to intensively work on their discoveries inside the modern, newly constructed light-gray building with its wide window façade, most of the teams were the winners of company-internal competitions. They have thus already cleared the first hurdle on the road to success.

The focal point: Our liquid crystal expertise

The LicriEye project team, which comprises experts from Performance Materials and Healthcare working hand in hand, is pursuing a clear view in two senses. The project, which is still in the early stages of development, is focusing on a novel way of treating cataracts, a widespread eye disorder. A cataract is a clouding of the lens in the eye, which commonly occurs in people over the age of 65. People with cataracts increasingly have problems with blurry and distorted vision and they have trouble seeing contrasts or bright colors. In most cases, this is a process that advances slowly and, if left untreated, could lead to blindness. Cataracts are treated by having them surgically removed in an outpatient procedure that usually takes around 15 minutes. Cataract surgery ranks among the most frequently performed operations worldwide. During surgery, an incision is made to remove the patient's clouded lens, which is then replaced by an intraocular artificial lens. The post-operative result depends on the precision of the implanted lens.



“An improperly measured artificial lens can only be subsequently corrected by surgically replacing the lens. Additional research is definitely required and development potential exists.”

Prof. Dr. Lutz Hesse, Director of the Ophthalmology Clinic, SLK-Kliniken Heilbronn

“If the refractive index of the artificial lens has not been perfectly selected, the currently available intraocular lenses will not offer the patient precise vision after surgery,” said Professor Lutz Hesse, Director of the Ophthalmology Clinic at SLK-Kliniken in Heilbronn, Germany. “An improperly measured artificial lens can only be subsequently corrected by surgically replacing the lens. Additional research is definitely required and development potential exists.” The possible consequences are severe, for instance, poor eyesight with a refractive error of up to three diopters, which currently can only be corrected by eyeglasses.

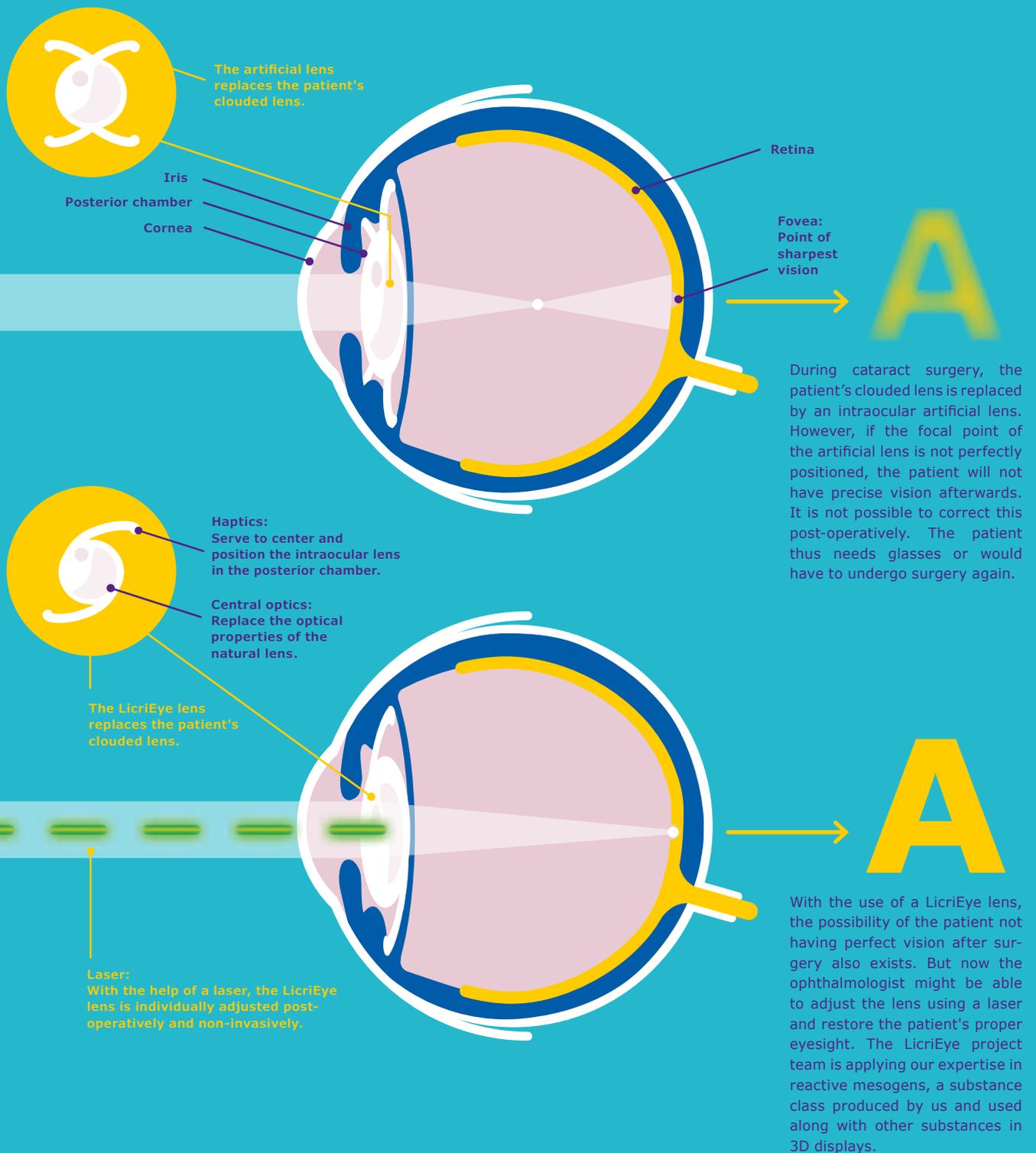
“LicriEye has the potential to restore the vision of patients after cataract surgery.”

Martin Schraub, Head of the LicriEye project

This is where the work of the LicriEye team comes in. The aim is to develop, in collaboration with a partner, an intelligent lens whose focal point(s) can be adjusted to the patient's needs after implantation. “Although lens implants have been standard medical practice for around 60 years now, there has not been very much development on the materials side,” explains project head Martin Schraub. Whereas most manufacturers have been using plexiglass and its derivatives, we are conducting research on an innovative material that is photochemically targeted to the specific requirements and standards of this future medicinal product. It has to be transparent, flexible and biocompatible. Schraub and his colleagues are drawing on our wealth of liquid crystals experience normally used to produce 3D displays. After the lens has been implanted, the ophthalmologist could use a laser to non-invasively rework the material in order to individually adjust the optical properties of the lens, thus obviating the need for eyeglasses. Schraub, who is very optimistic about the market opportunities of the future medicinal product after potential regulatory approval, says, “LicriEye has the potential to restore the proper vision of patients after cataract surgery.” Negotiations on manufacturing and marketing the product with a large partner company have already made very good progress.

What makes LicriEye unique

LicriEye would enable ophthalmologists to change the focus of the artificial lens after cataract surgery non-invasively using a laser, thus correcting potentially poor vision. Our liquid crystals expertise is playing a key role here.



“As a company with a global footprint, international exchanges are especially important to us.”

Michael Gamber, Head of the Innovation Center



Project head
Martin Schraub (left)
talking to members
of his team.

Scope for creativity

For a research-driven company such as ours, innovations are a key success factor. Yet progress is hardly ever the outcome of a process that can be precisely planned. By contrast, in order to allow visionary ideas to become reality, unconventional thinking, courage to take risks, and a pioneering spirit are required. Inaugurated in October 2015, the modular Innovation Center at our headquarters in Darmstadt offers the required scope for creativity. “On the one hand, the center is a springboard for young talent to develop and realize their concepts,” says Michael Gamber, Head of the Innovation Center. “On the other hand, it offers an attractive infrastructure for professional project work, which ideally will lead to future-oriented innovations.” These could be new products or services, as well as new business models or processes. The teams working in the Innovation Center took part in company selection processes, where they were able to convince a jury of experts from all the business sectors. External start-ups also have the opportunity to realize their ideas in the modular Innovation Center and are given a suitable budget to do so. The project teams

receive additional support from our coaches and experienced managers, who serve as mentors and networkers. Not least, the aim is also to test the marketability and competitiveness of their ideas. “As a company with a global footprint, international exchanges are especially important to us,” Gamber emphasizes. Practical training, workshops, lectures, and online tutorials supplement the range of offers for the project teams in the modular Innovation Center.

Being open to new things is the guiding principle of the work in the two-story building, which has a surface area of nearly 4,000 square meters. The welcoming architecture also signals openness. There are no permanent offices, but rather flexible work spaces. The different wings of the building, which have been constructed as modules, are grouped around a spacious courtyard. The building is a trial run for the future Innovation Center, which is scheduled for completion by the end of 2017 and will form the heart of the new global headquarters. It is a key element of the “Fit for 2018” transformation program and is intended to further boost our innovative strength.



Further Innovation Center projects

A simple rapid test for clinical diagnostics

The research work of a further interdisciplinary project team from the Healthcare, Life Science and Performance Materials business sectors of Merck KGaA, Darmstadt, Germany, in the modular Innovation Center is dedicated to a postage stamp-sized test strip for clinical diagnostics and quality assurance. Thanks to its special surface properties, the test strips can be used to investigate multiple parameters in just a few drops of liquid, all at the same time. A further major advantage of this test is its ease of use. It requires neither trained experts nor complex sample preparation or special laboratory equipment. Theoretically, non-experts could also conduct these rapid and uncomplicated diagnostics. The test can be used in a wide variety of healthcare and life science applications. From immunoassays to biochemical assays, several reactions can be adapted to the platform to generate a simple, fast and cost-effective diagnostic test. The project aims to make diagnostics available to everyone, anywhere they're needed.

A high success rate for in vitro fertilization

We are the leading supplier of hormones for fertility treatment. The Fertility Technology team led by Jan Kirsten is aiming to further strengthen our position in this therapeutic area and to improve treatment outcomes. For example, it has in-licensed and further developed new in vitro fertilization (IVF) technologies. The team is currently working on an innovative incubation system that is capable of simultaneously imaging embryonal development using a fully automated embryo and oocyte freezing system along with the Eeva® test. The aim of Eeva® (Early Embryo Viability Assessment) is to provide important information to assess in vitro fertilized embryos for transfer into the uterus. With these new technologies, fertility clinics can make more reliable decisions, for example when selecting the best embryo for transfer or freezing. Clinical trials show that the success rate of IVF treatments can be increased with the support of Eeva® in addition to traditional methods.

Efficient solutions for lab work

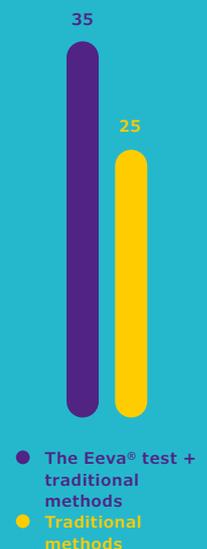
Analytical laboratories are confronted simultaneously by considerably growing numbers of samples and increasing pressure on costs. This situation requires new, rapid and economical forms of active ingredient analysis in many application fields. The Smart TLC project is conducting research in the modular Innovation Center on advanced solutions and methods designed to make laboratory work easier, application-friendlier and more efficient, as well as significantly increasing sample throughput. The objective is to considerably reduce analysis times while improving the quality of results and achieving greater reproducibility.



Realizing ideas:
The Innovation
Center offers young talent
scope for creativity.

IMPLANTATION RATE*

% (2014)



* The Eeva® test used together with traditional methods improves the success of implanting the blastocyst by 10 percentage points, compared to traditional methods alone.^{1,2}

1. Adamson D, et al. Accepted for presentation at the American Society of Reproductive Medicine (ASRM) Annual Conference, (2014).
2. VerMilyea MD, et al. Computer-automated time-lapse analysis test results correlate to clinical pregnancy and embryo implantation: A prospective, blinded, multi-center study. *Reprod BioMed Online*. 2014; 29(6):729-736.

The background features a vibrant yellow field with large, organic, overlapping shapes in cyan and purple. The shapes are rounded and angular, creating a dynamic, abstract composition. The purple shapes are more solid and blocky, while the cyan shapes are more fluid and rounded.

Merck KGaA, Darmstadt, Germany

Frankfurter Strasse 250

64293 Darmstadt

Germany

EMDgroup.com