A contact lens that monitors eye pressure and administers glaucoma drugs when needed

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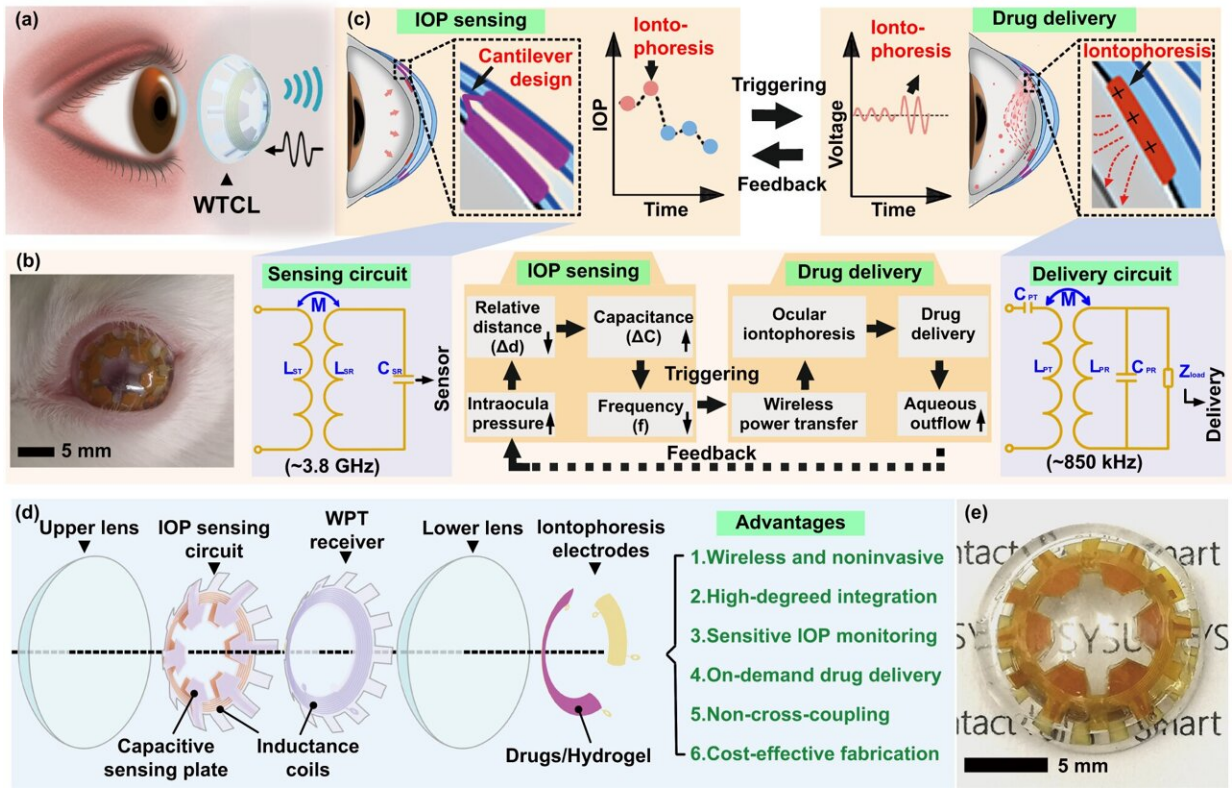

Schematic of the WTCL for real-time and in situ IOP monitoring and drug administration. a Schematic of the WTCL for wireless IOP monitoring and administration. b Photograph of WTCL worn on the eyes of a live rabbit. c Schematic of wireless operation for the purpose of IOP monitoring and on-demand medicines administration in a minimally invasive manner. The soft device, engineered as a double-layer contact lens structure, was integrated with an LCR and a WPT receiver circuit. These modules were wirelessly connected to an external integrated antenna that could record the IOP signal and trigger iontophoresis for drug delivery if needed. Insert figures respectively highlight

critical IOP sensing and drug delivery unit. d Structure of the WTCL in an exploded view. e Optical image of the WTCL. Credit: *Nature Communications* (2022). DOI: 10.1038/s41467-022-29860-x

A team of researchers working at Sun Yat-Sen University in China has developed a contact lens that can be used to monitor eye pressure changes and to administer glaucoma drugs when needed. In their paper published in the journal *Nature Communications*, the group describes developing their lens and its performance in pigs and rabbits.

Glaucoma is pressure within parts of the eye that leads to optic nerve damage, which can result in partial or complete blindness. The disease has historically been difficult to treat due to seemingly random changes in eye pressure—patients cannot feel when the pressure increases, and thus do not know when to apply their eye drops. In this new effort, the researchers developed a contact lens that can continuously monitor pressure in the eye, and when certain thresholds are reached, it can automatically dispense drugs into the anterior chamber across the corneal barrier, providing direct relief and heading off damage.

The lens is double-layered with a pocket of air between layers. The air pocket serves as part of a cantilevered electrical system—pressure from within the eye squeezes the air pocket, alerting the electronic components of the need to administer brimonidine, which is pushed by a small electric current from the underside of the lens across the cornea and into the eye. The outer layer is made with six copper plates that serve as activators arranged in a ring around the pupil.

The design includes tiny modules of brimonidine along its rim, arranged so as not to obstruct vision. The researchers note that the contact lens is minimally invasive and gives the iris of the patient a golden hue. They

also note that it is wireless and battery-free and could conceivably be used to treat a wide variety of eye conditions. It also could be paired with a smartphone app to give patients information regarding the health of their eyes.

The researchers have tested their lens thus far on rabbits and pigs and found it capable of continuously monitoring eye pressure changes and of administering brimonidine when it was needed.

More information: Cheng Yang et al, Intelligent wireless theranostic contact lens for electrical sensing and regulation of intraocular pressure, *Nature Communications* (2022). DOI: 10.1038/s41467-022-29860-x