Pandorum Technologies
www.pandorum.com

Pandorum
Building blocks of life

Revolutionizing regenerative medicine with engineered biomaterials

As Pandorum Technologies' bioengineered 'liquid cornea', Kuragenx, is about to enter a first-in-human study for vision restoration in patients suffering from corneal blindness, the company is extending its proprietary technology platform to develop advanced exosome-based therapeutics for lung and liver regeneration.

"The cornea is the windshield of the eye," said Ramez Haddadin, assistant professor of ophthalmology at Northwestern University Feinberg School of Medicine in Chicago. Damage to the structure and shape of the cornea is a common cause of blindness. At present, the only treatment to restore vision involves replacing the cornea, or part of it, with corneal tissue from a donor.

The demand for donor corneas vastly outstrips supply. It is estimated that there are over 12 million people waiting for a corneal transplant worldwide[1]. Moreover, the outcome of these transplants is not always perfect, further emphasizing the need for more-effective treatment options.

"Every donated cornea is different; it may not match the shape of the patient's eye leading to other complications, or it could be rejected by the patient's immune system, leaving them back at square one," Haddadin explained.

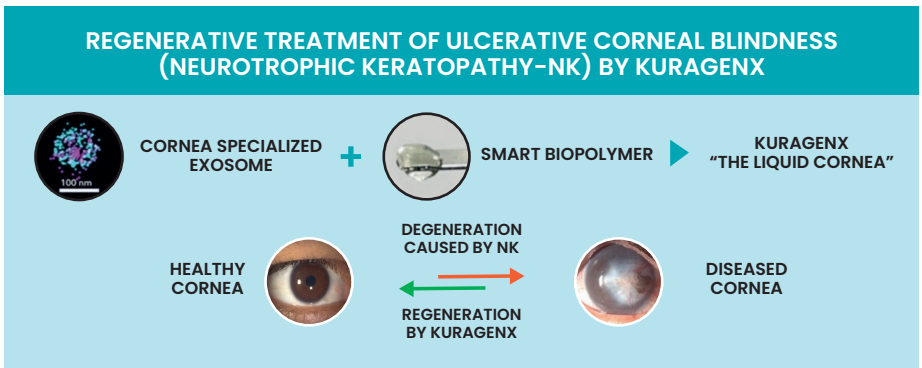
Innovative off-the-shelf solution

Pandorum Technologies is developing a transformative solution to corneal transplants. The company's flagship product, the liquid cornea Kuragenx, has been designed to stimulate the repair and regeneration of damaged corneal tissue.

Kuragenx is a transparent viscous liquid comprising cell-derived vesicles called exosomes with enhanced regenerative properties in a biopolymeric solution that acts as a temporary scaffold supporting epithelial cell growth and sustained exosome release. Kuragenx is administered dropwise to the wound site after a surgeon has removed the diseased tissue. Post-application, the liquid spreads, solidifies within a few minutes under visible light and integrates into the host cornea in a suture-less manner.

Extensive work in New Zealand rabbits with corneal wounds that mimic post-ulcerative corneal scarring in humans[2] showed that Kuragenx could restore corneal health within a few months[3]. Kuragenx stimulated re-epithelialization, re-innervation and stromal regeneration so the structure and physiology of wounded corneas resembled those of normal corneas.

As a result of these promising findings, Pandorum has been working with clinical collaborators in the US and India to pave the way for Kuragenx's first-in-human trials. In India, ophthalmologist and stem cell biologist Virender Sangwan leads the clinical study at Dr Shroff's Charity Eye Hospital, New Delhi.



Kuragenx has been designated as a combination product by the US Food and Drug Administration (FDA)'s Center for Biologics Evaluation and Research and was recently awarded orphan drug designation for the treatment of advanced neurotrophic keratopathy (NK), a severe degenerative corneal disease caused by impairment of corneal sensory innervation. "This treatment could help NK patients in ways that no other therapies can," Haddadin said.

The first-in-human, phase 1/2a study of Kuragenx will take place at Northwestern University Feinberg School of Medicine and Dr Shroff's Charity Eye Hospital from 2024. "We will start by treating a very small pool of patients with very severe disease, but if Kuragenx works as expected, I anticipate many more people will be able to benefit from this therapy," said Haddadin.

Pandorum's tissue-agnostic approach

Pandorum was co-founded in 2011 by Tuhin Bhowmick and Arun Chandru in Bangalore, India. The company and its US arm (Pandorum International Inc.) now include over 40 employees who are using its proprietary technology platform to develop regenerative medicines for diseases associated with tissue inflammation and fibrosis. Pandorum's technology platform can combine therapeutic exosomes with biopolymers that mimic extracellular-matrix materials, representing a unique approach to restore and repair tissues such as the cornea, lung and liver.

Exosomes are natural mediators of cell-to-cell communication. The stability, bioavailability, circulation half-life and low immunogenicity of exosomes make them promising carriers for drug delivery[4]. By optimizing the expression patterns of clinical-grade human stem cells, Pandorum can produce exosomes enriched with specific cargoes that stimulate tissue regeneration. "We can produce exosome variants with anti-fibrotic, anti-inflammatory and neurogenic properties to suit the needs of specific tissues," Bhowmick explained.

In addition, Pandorum has developed a range of biomaterials that can mimic the mechanical and chemical properties of the extracellular environment of target tissues and trigger tissue-specific cellular activity. "The properties of our tissue-mimetic, biopolymer-containing hydrogels, such as transparency, biocompatibility and biodegradability, can be fine-tuned for various applications," said Bhowmick.

Through the effective delivery of exosomes packed with therapeutic factors, Pandorum is building a pipeline of products to heal damaged tissues. "Our goal is to make regenerative medicine a mainstream reality and improve the lives of millions of patients suffering from a wide range of injuries and diseases," Bhowmick concluded.

1. Gain, P. et al. *JAMA Ophthalmol.* **134**, 167–173 (2016). https://doi.org/10.1001/jamaophthalmol.2015.4776
2. Joshi, V. P. et al. *Ocul. Surf.* **18**, 681–688 (2020). https://doi.org/10.1016/j.jtos.2020.07.017
3. Sangwan, V. S. et al. *Invest. Ophthalmol. Vis. Sci.* **64**, 5147 (2023).
4. Tiwari, A. et al. *Front. Pharmacol.* **12**, 684712 (2021). https://doi.org/10.3389/fphar.2021.684712

CONTACT
Tuhin Bhowmick, Co-Founder
Pandorum Technologies
Bangalore, India
Tel: +1-347-277-7715
Email: tuhin@pandorumtechnologies.in