Hydrogel soft robotics

Seoul National University

Multi-functional Soft Materials Lab

Won Jun Song

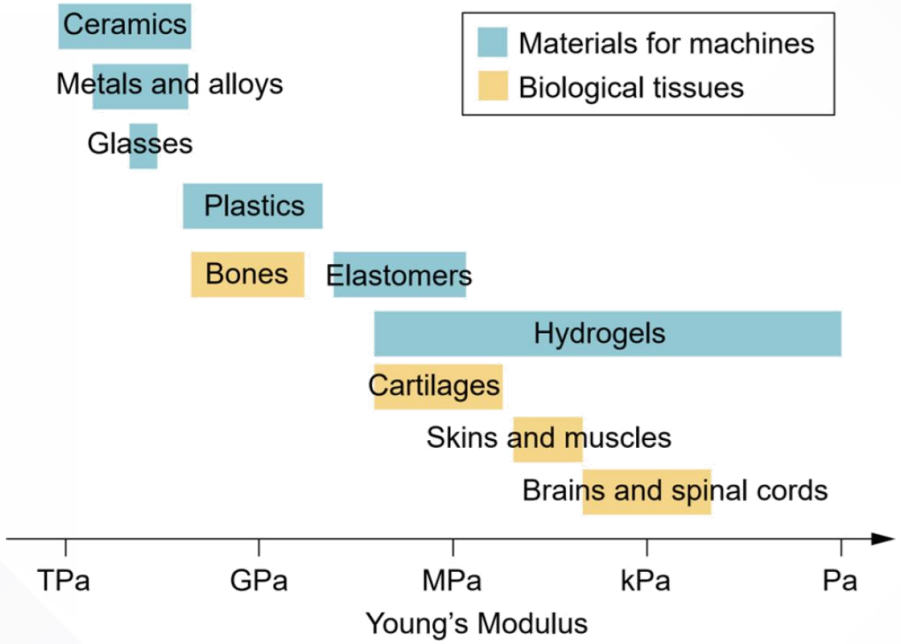
Soft robotics for everyday life

Designed to efficiently carry out
preplanned tasks

Soft robotics for everyday life

Composed of discrete links and joints

Soft robotics for everyday life

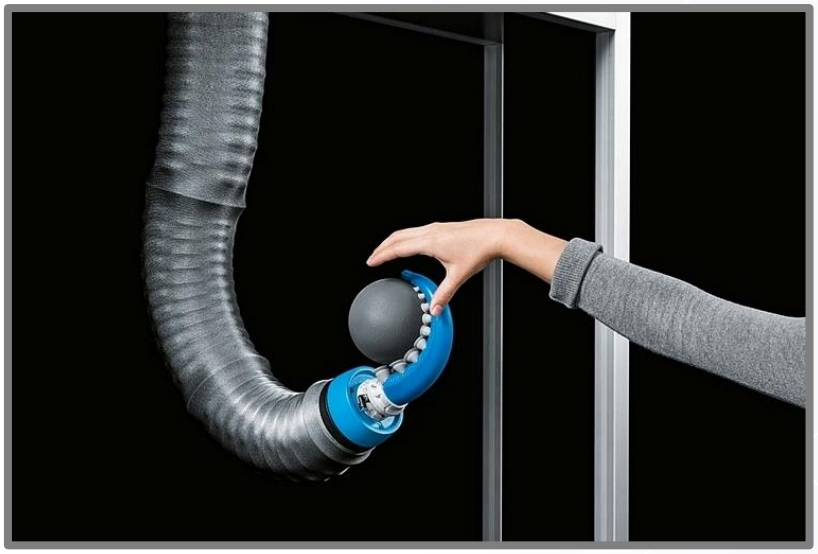


Raise safety concerns

Hydrogel machines, Xinyue Liu, et al. Materials Today, (2020)

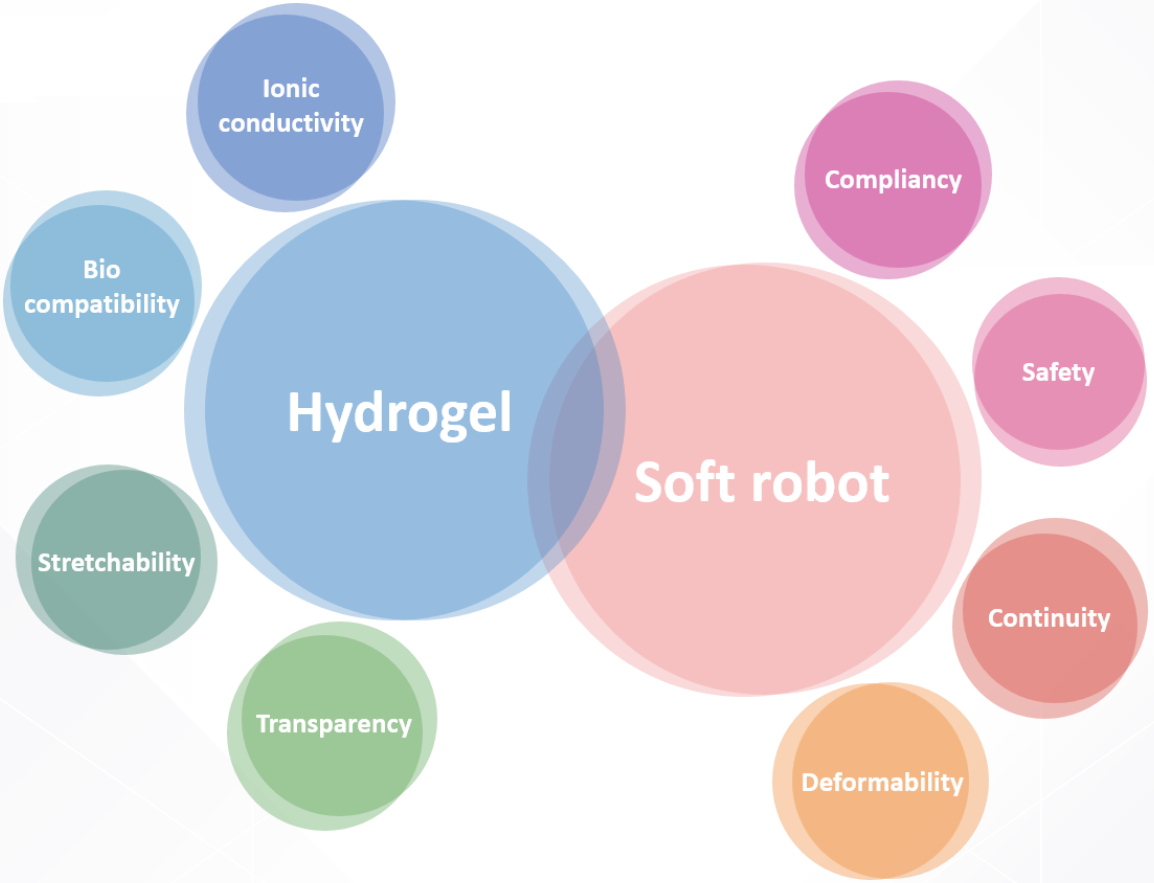
Soft robotics for everyday life

Rigid Robot



Soft Robot

Soft robotics for everyday life



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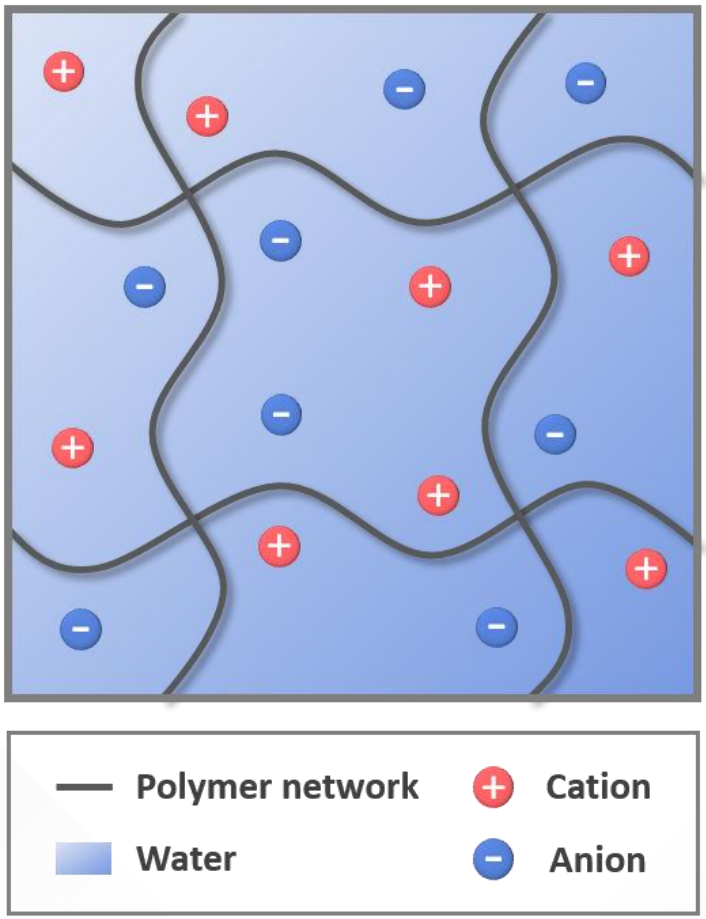
Hydrogels



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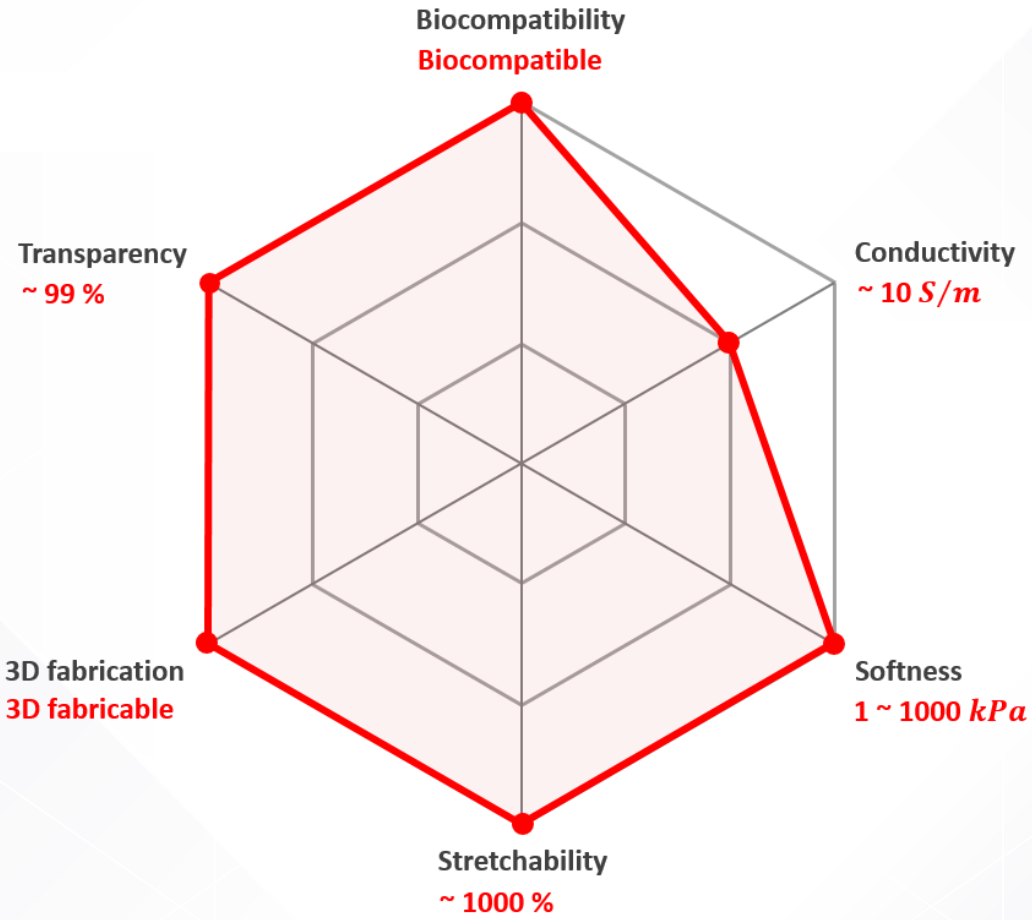

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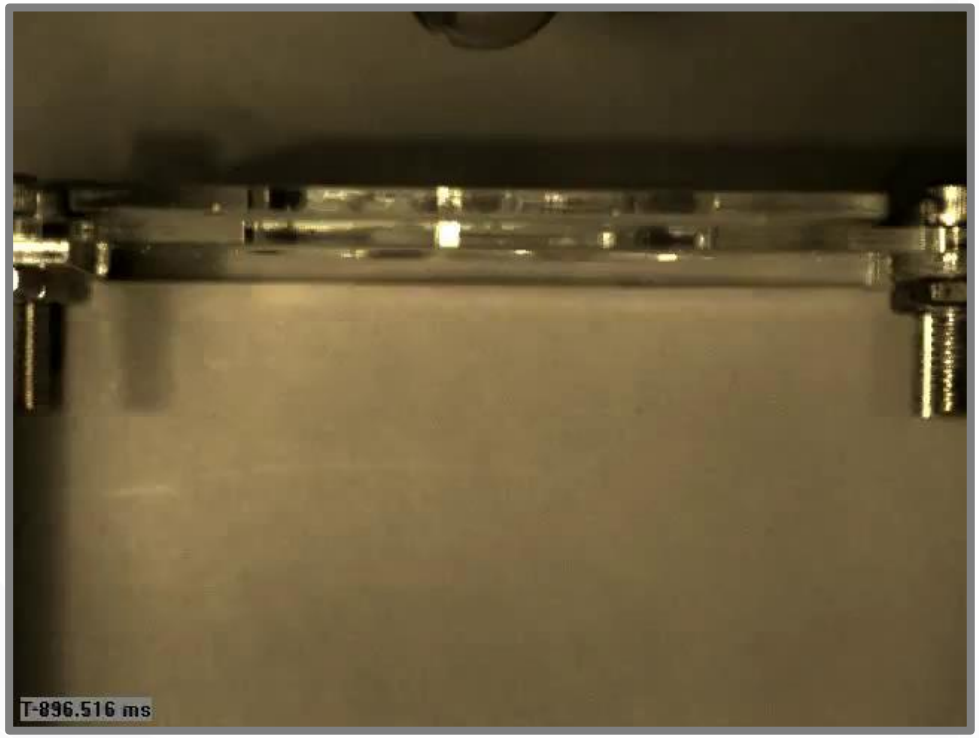
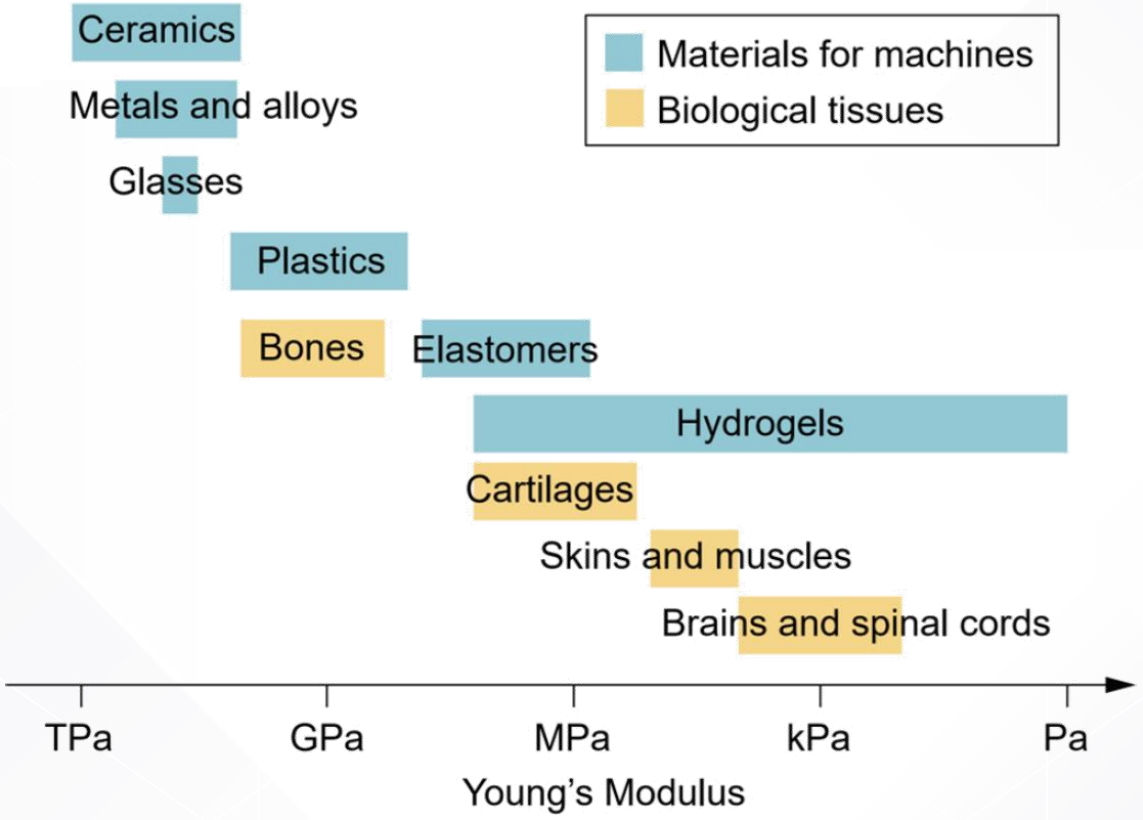


Highly stretchable and tough hydrogel, Jeong-Yun Sun, et al. Nature, (2012)

Hydrogels



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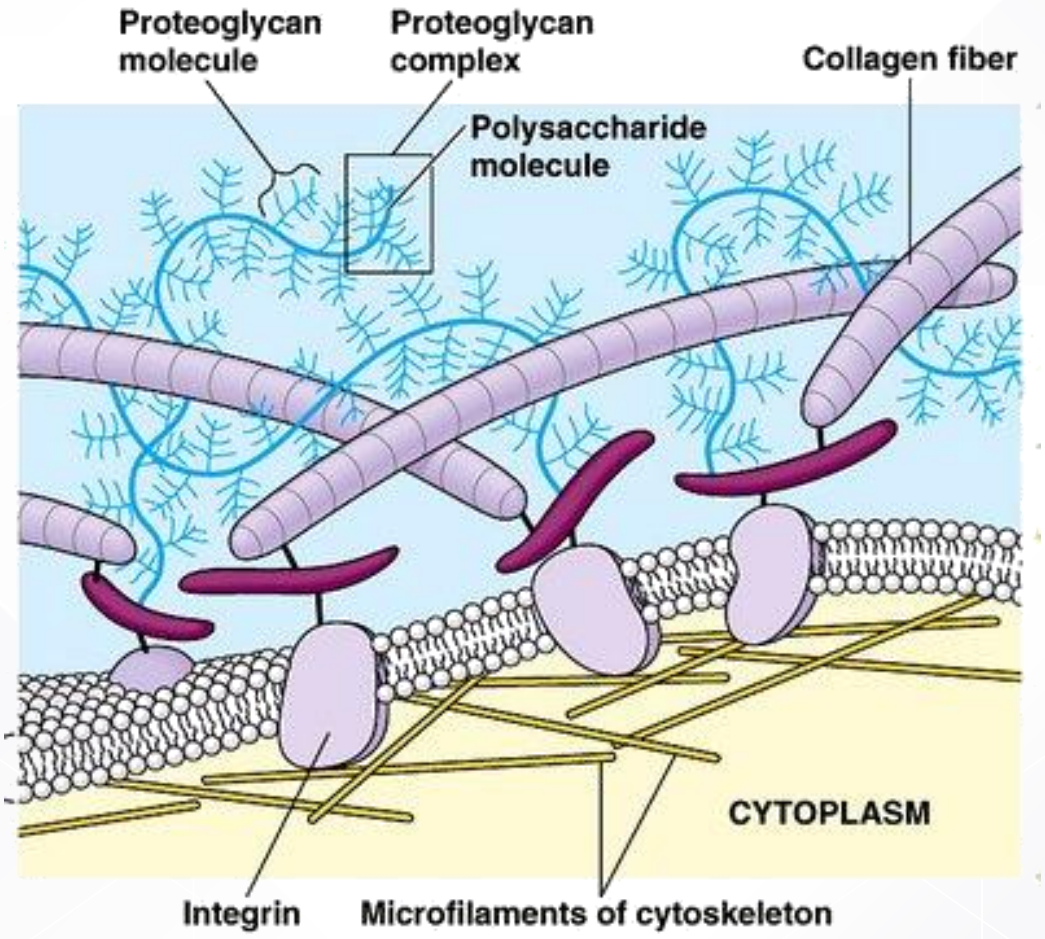

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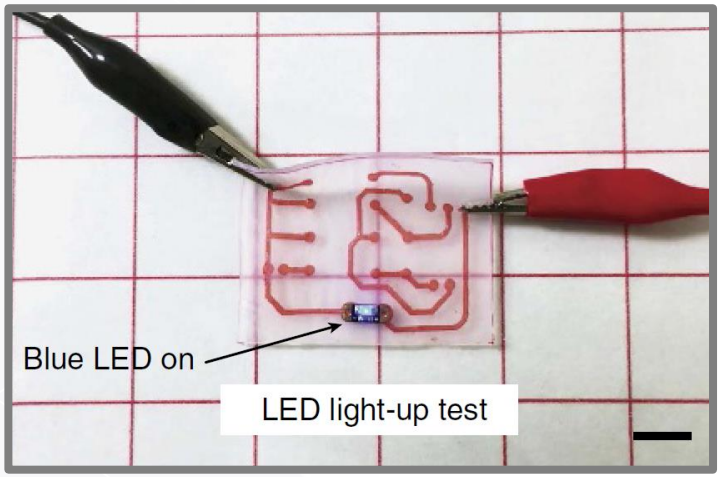

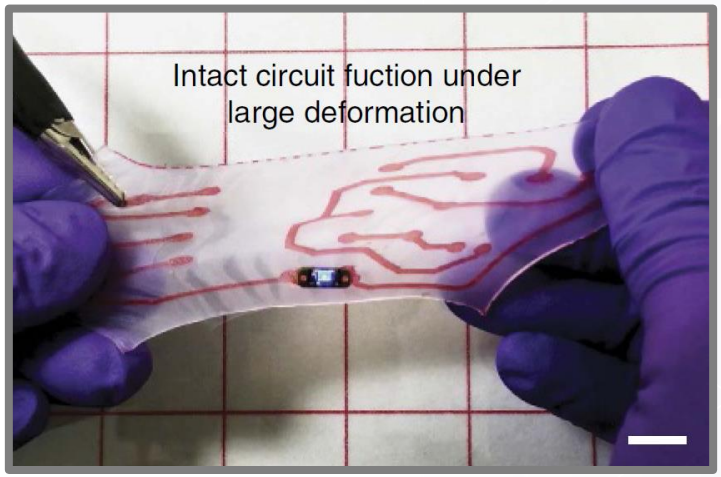

Skin-inspired hydrogel-elastomer hybrids with robust interfaces and functional microstructures, Hyunwoo Yuk, et al. Nature Communications, (2016)

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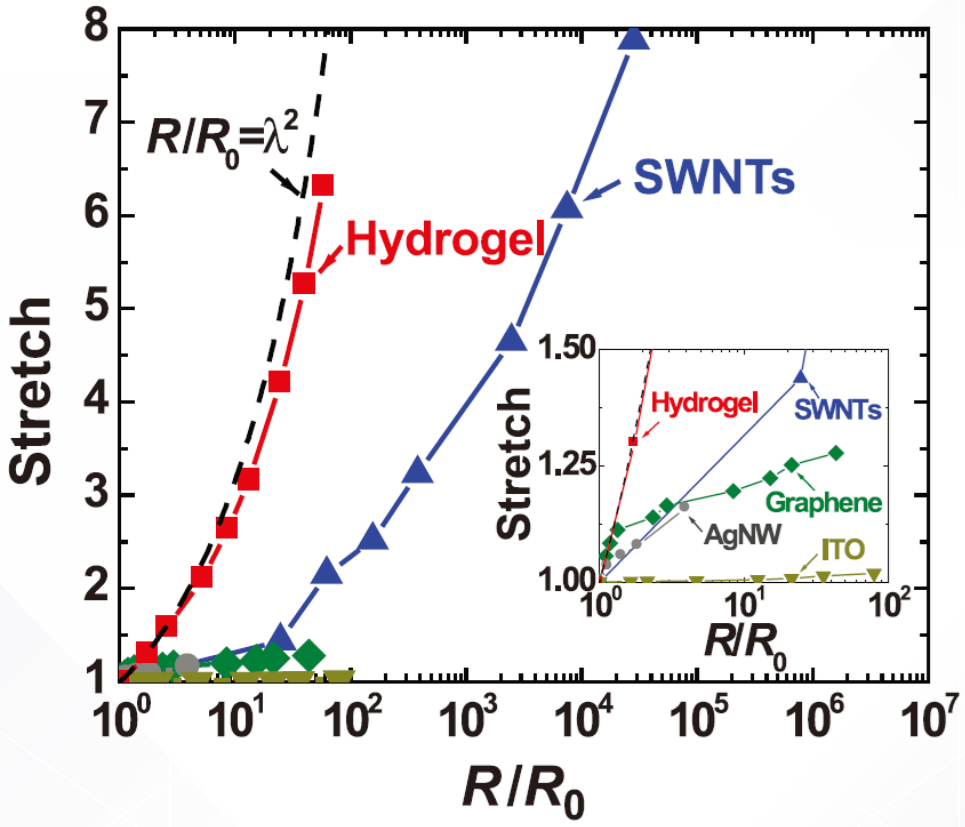

Stretchable, Transparent, Ionic Conductors, Jeong-Yun Sun, et.al. Science, (2013)

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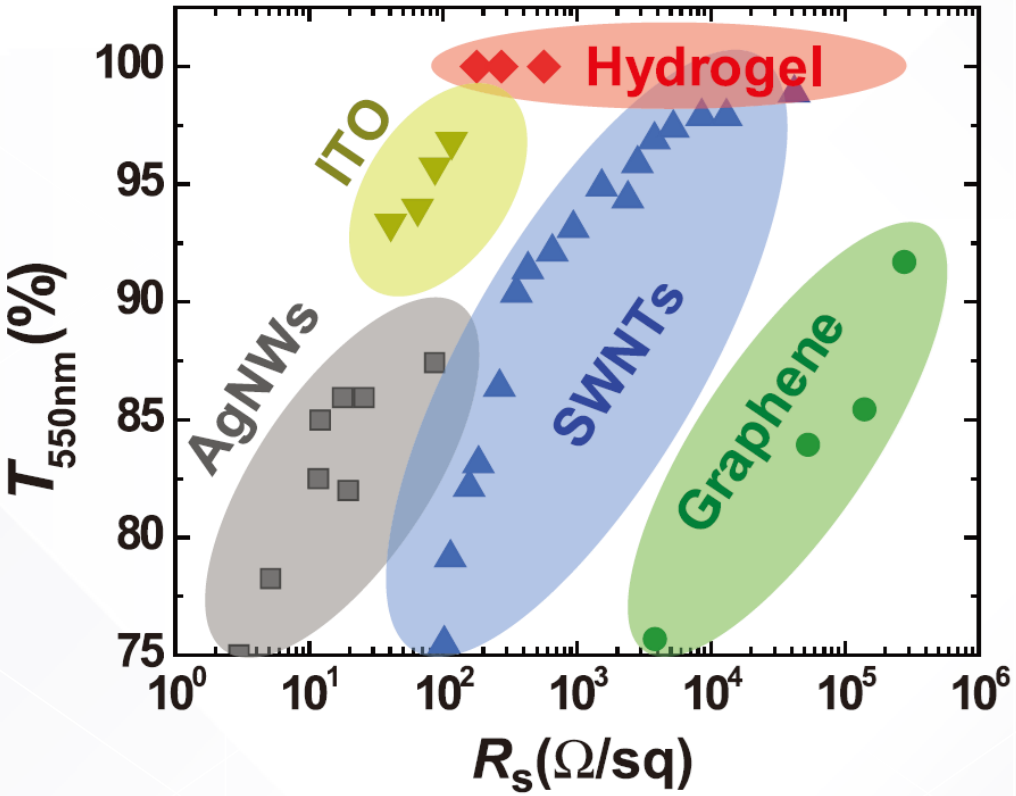

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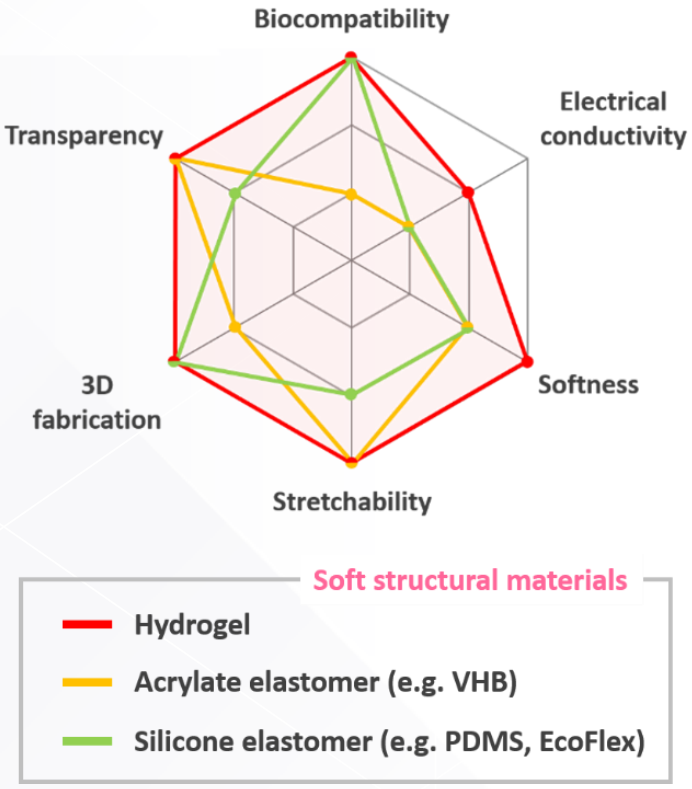

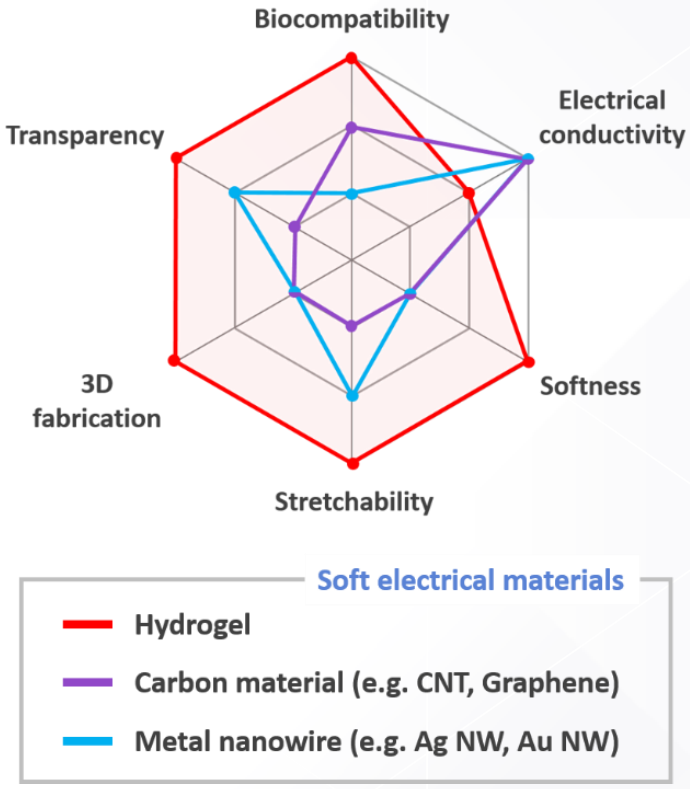

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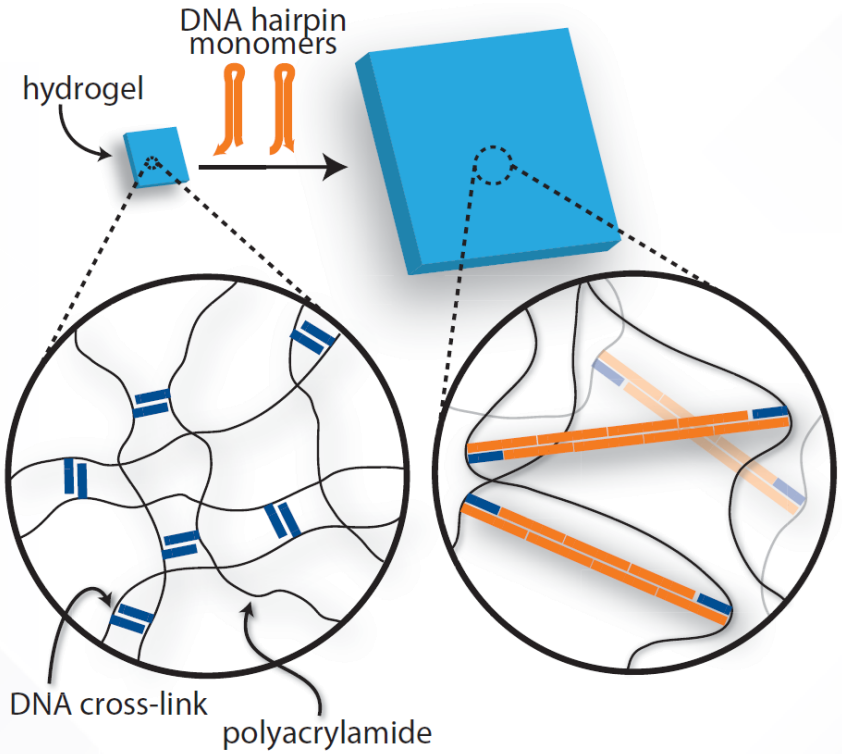
Hydrogel-based soft actuators



DNA sequence-directed shape change of photopatterned hydrogels via high-degree swelling, Angelo Cangialosi, et al. Science (2017)

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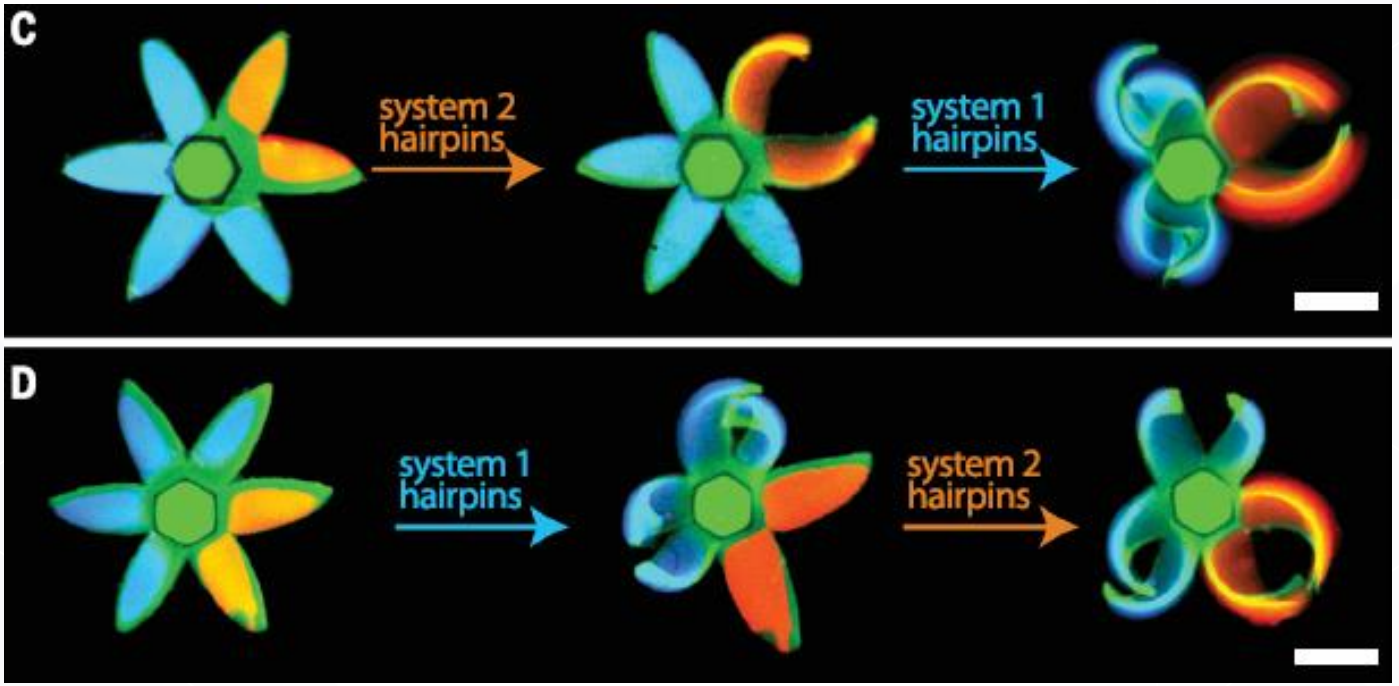

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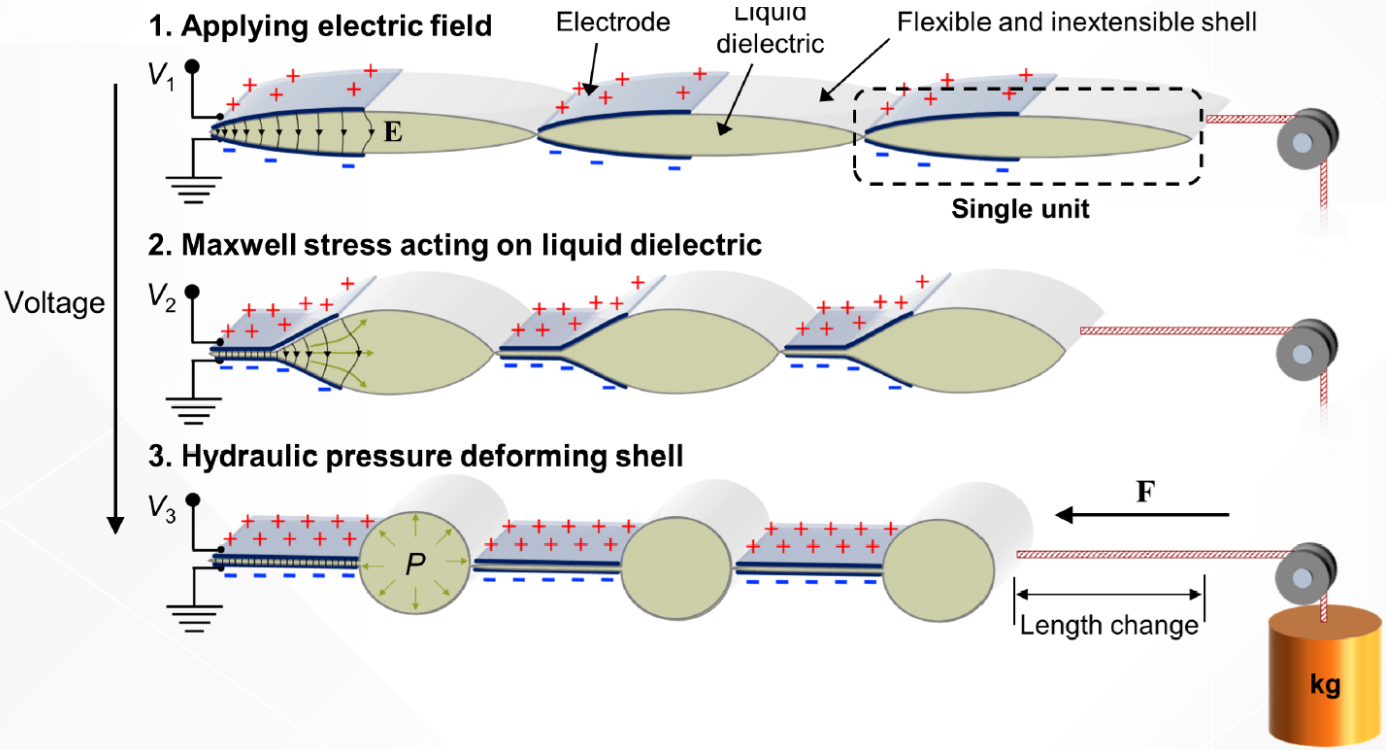

Peano-HASEL actuators: Muscle-mimetic, electrohydraulic transducers that linearly contract on activation, Nicholas Kellaris, et al. Science Robotics (2018)

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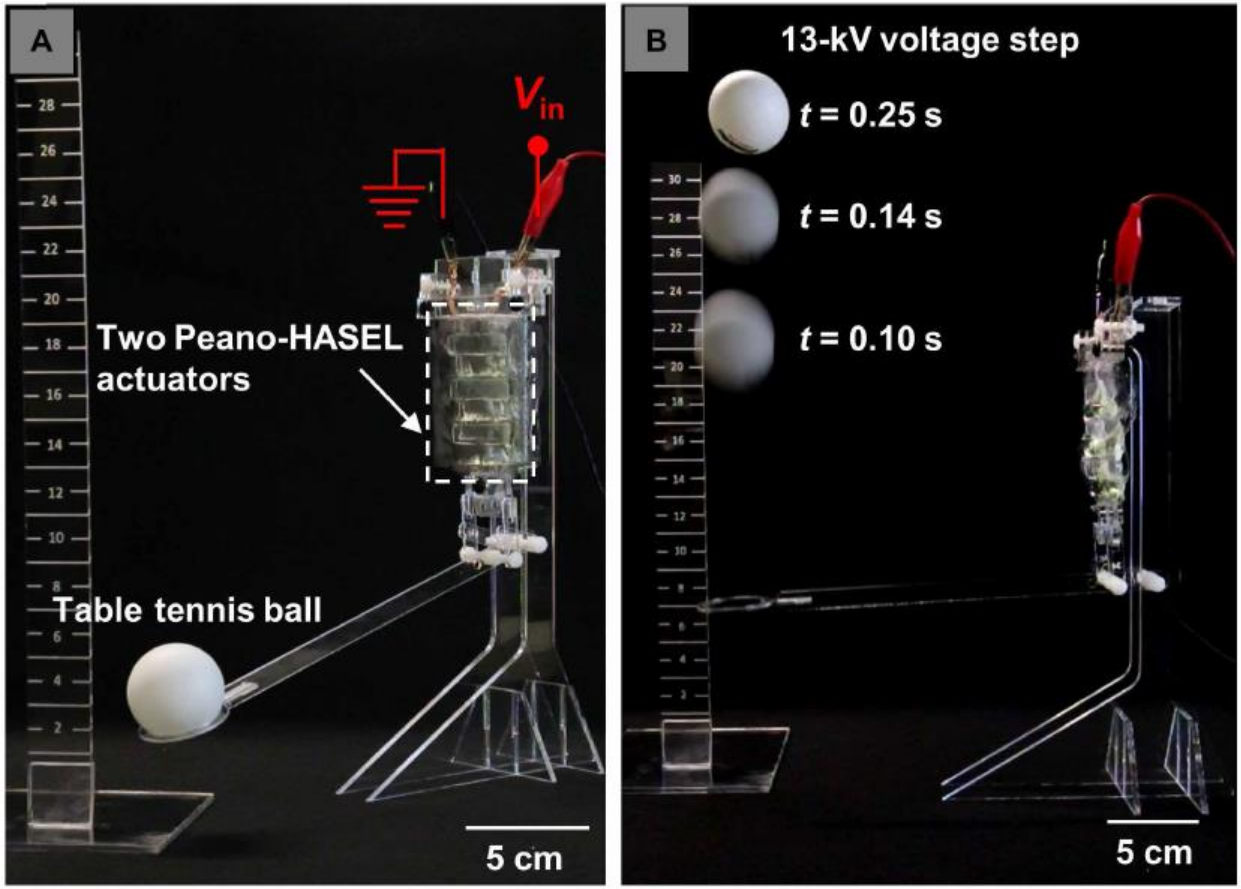

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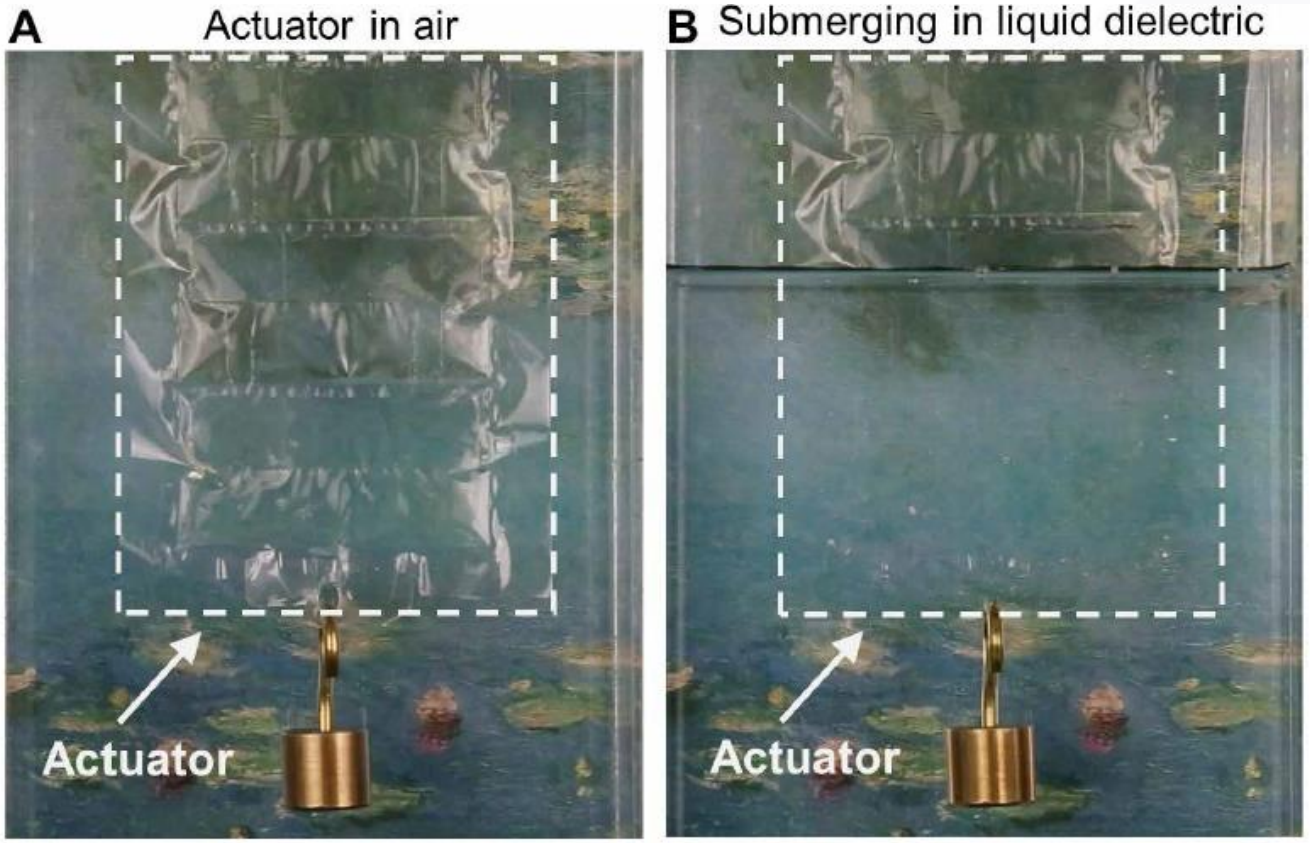

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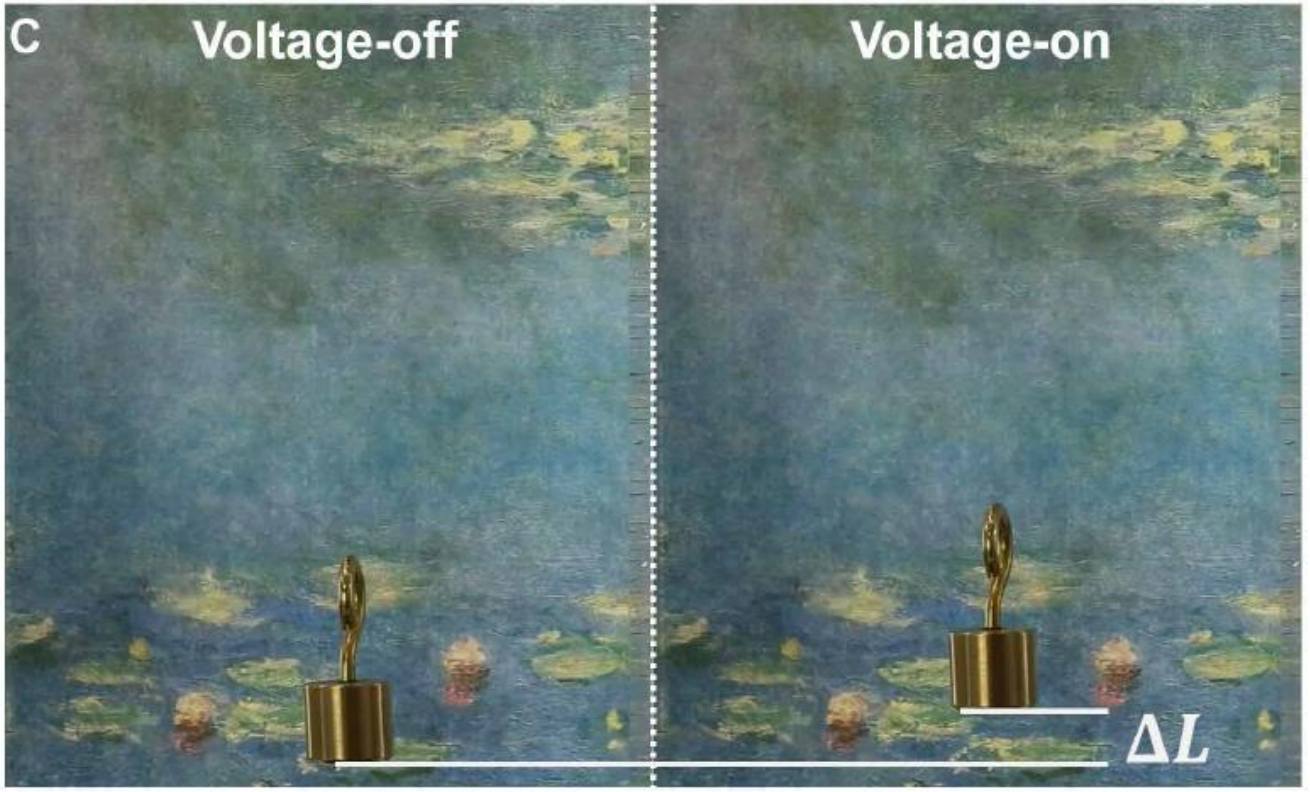

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Hydrogel-based soft sensors

Stretchable living materials and devices with hydrogel-elastomer hybrids hosting programmed cells, Xinyue Liu, et al. PNAS (2017)

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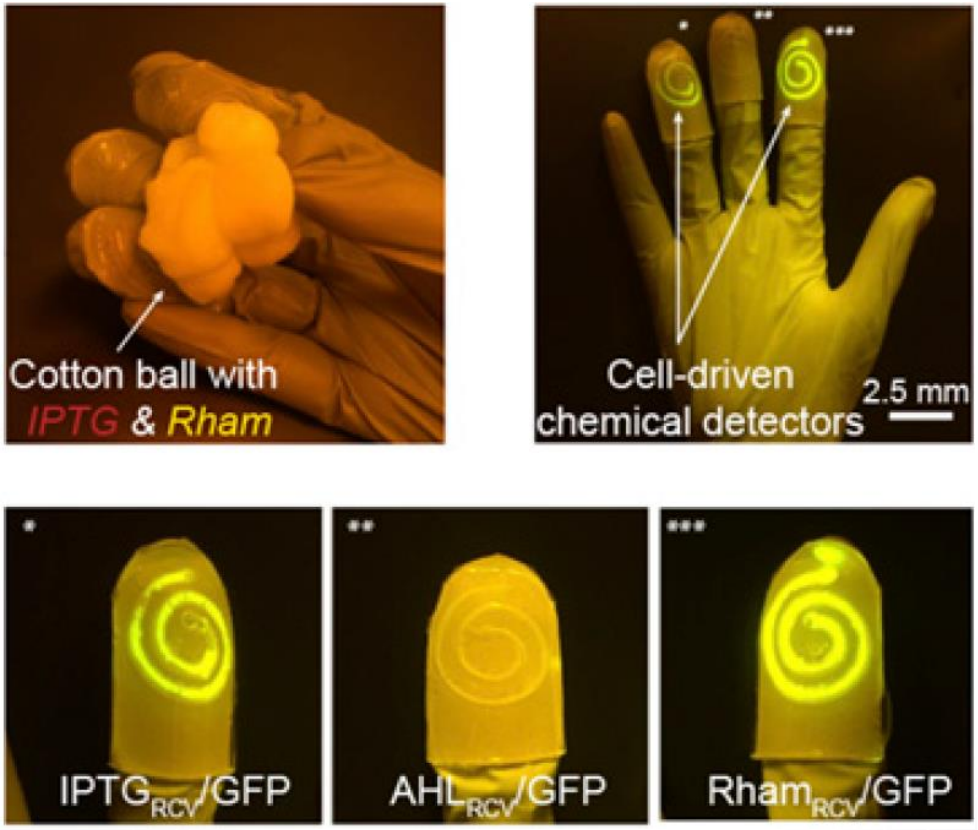

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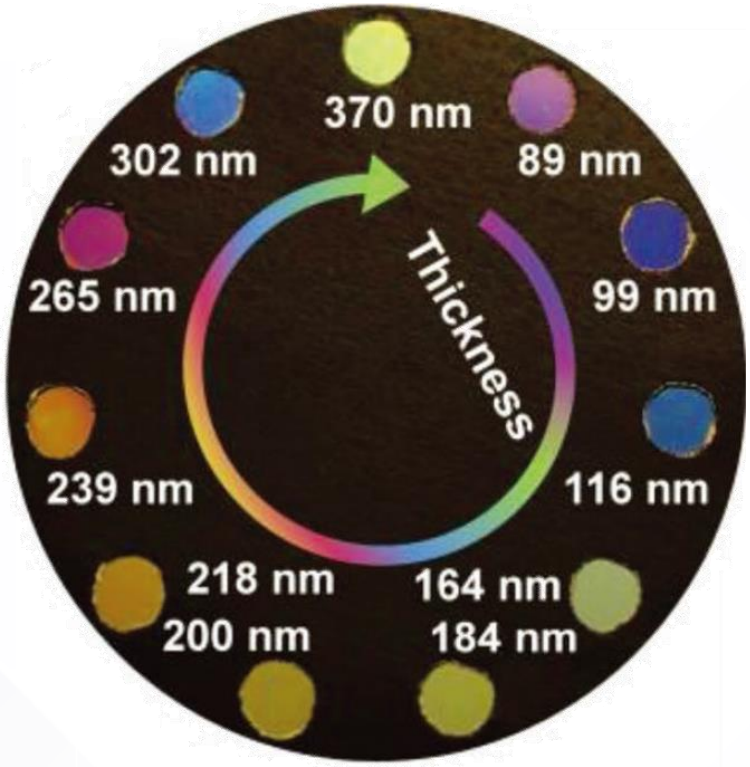

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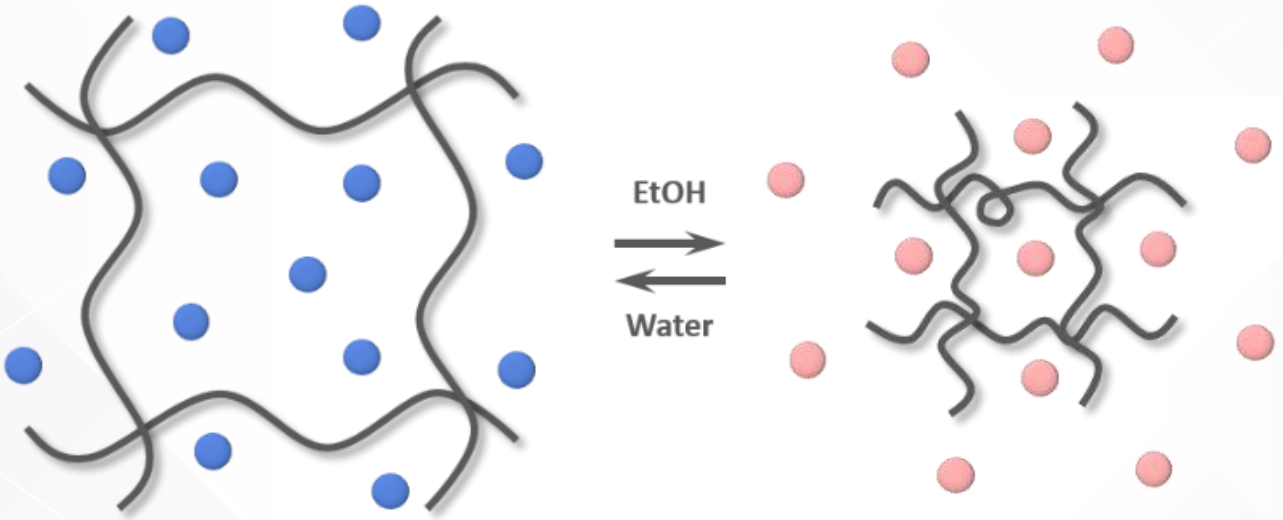

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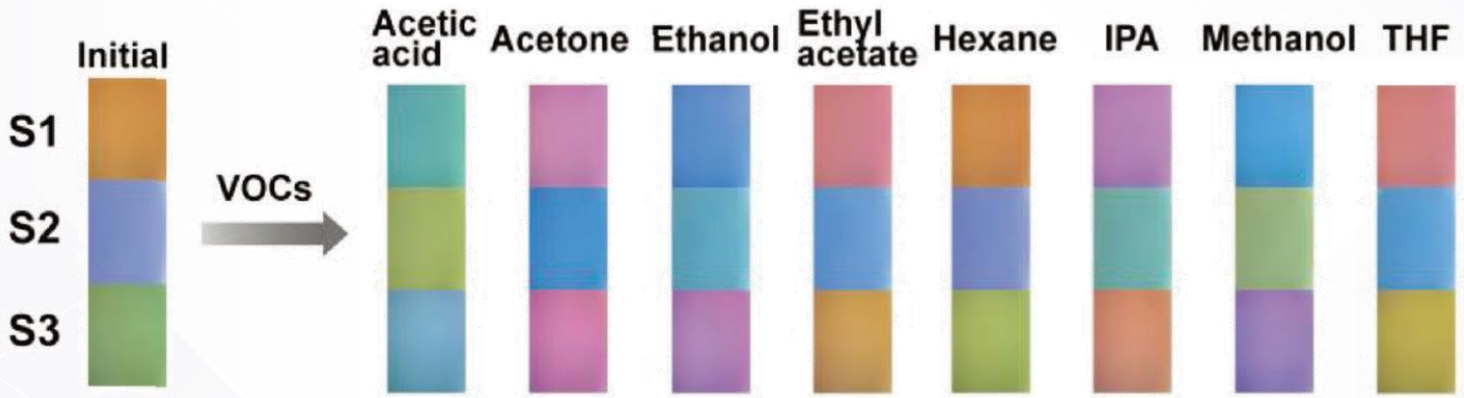

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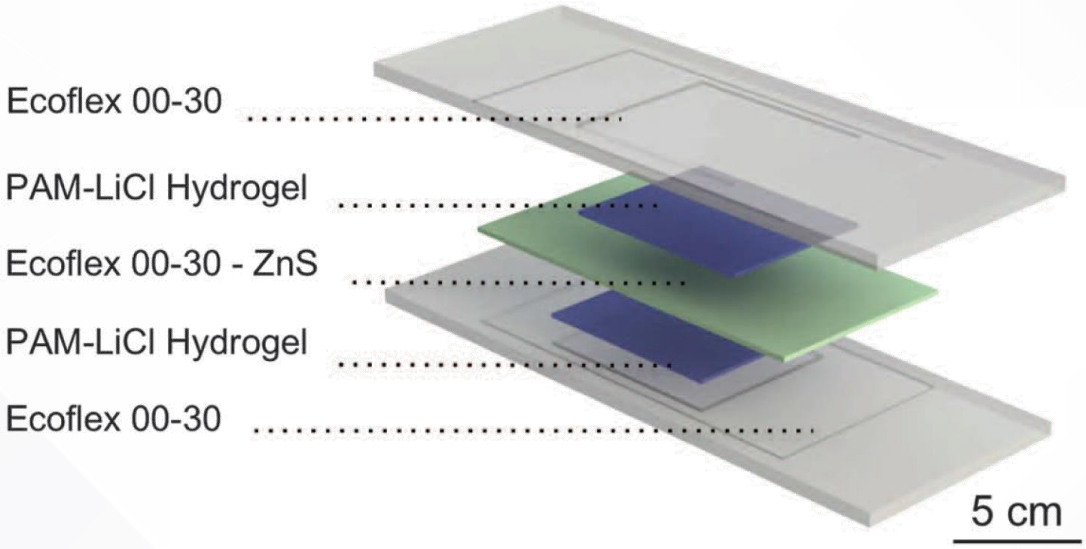

Highly stretchable electroluminescent skin for optical signaling and tactile sensing, C. Larson, et al. Science (2016)

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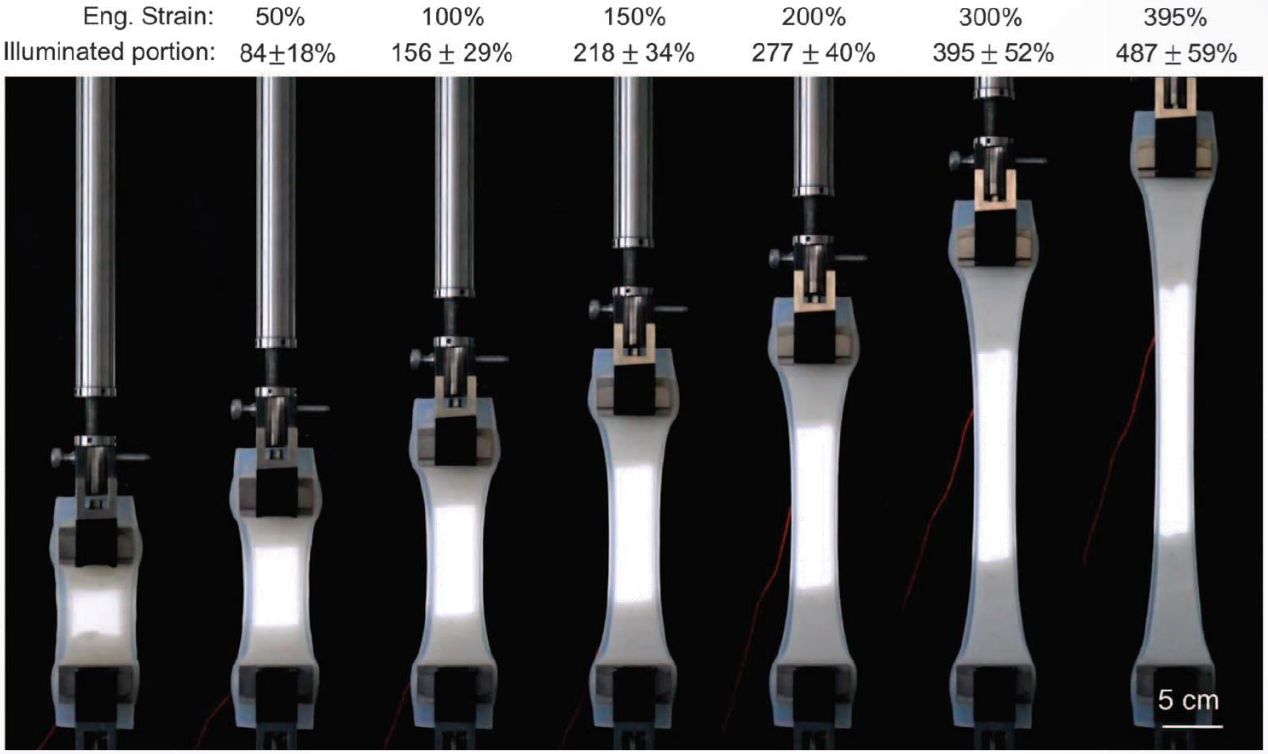

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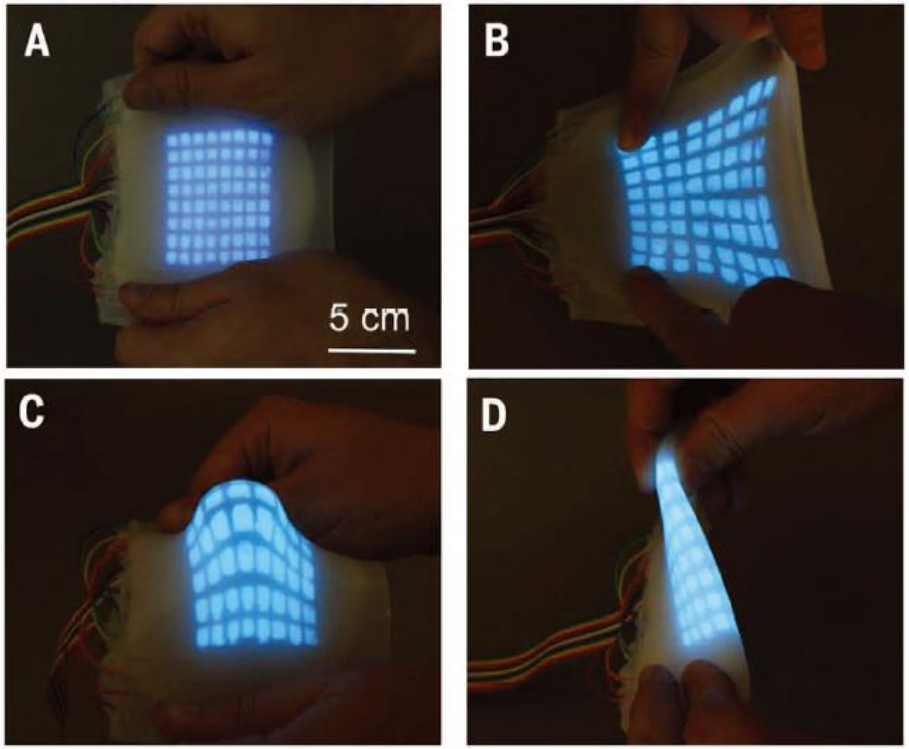

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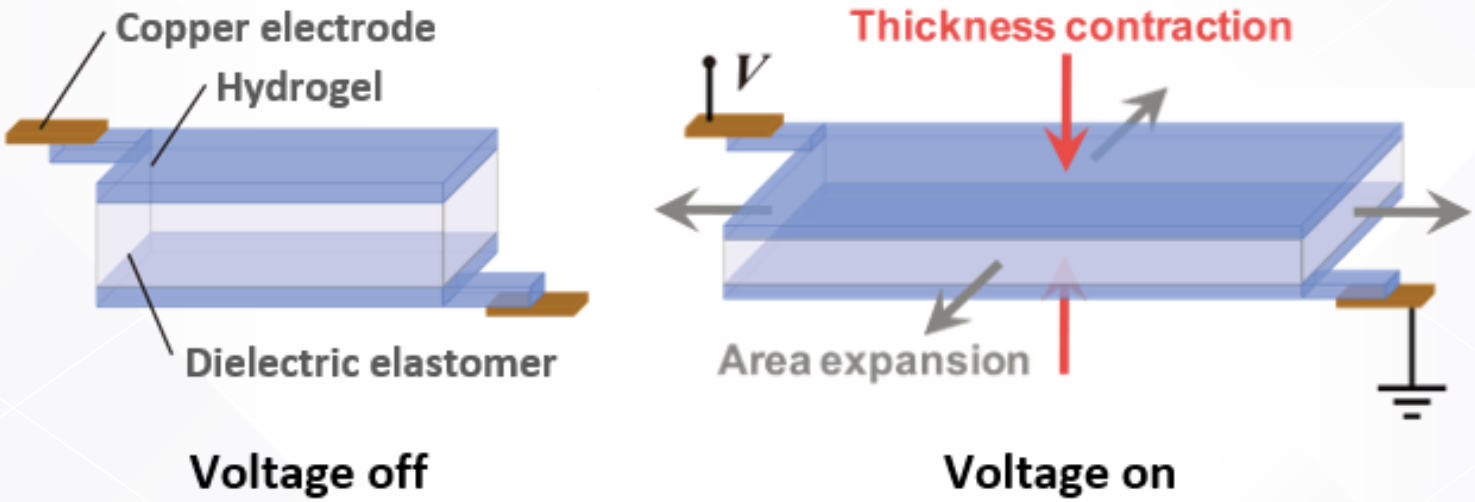

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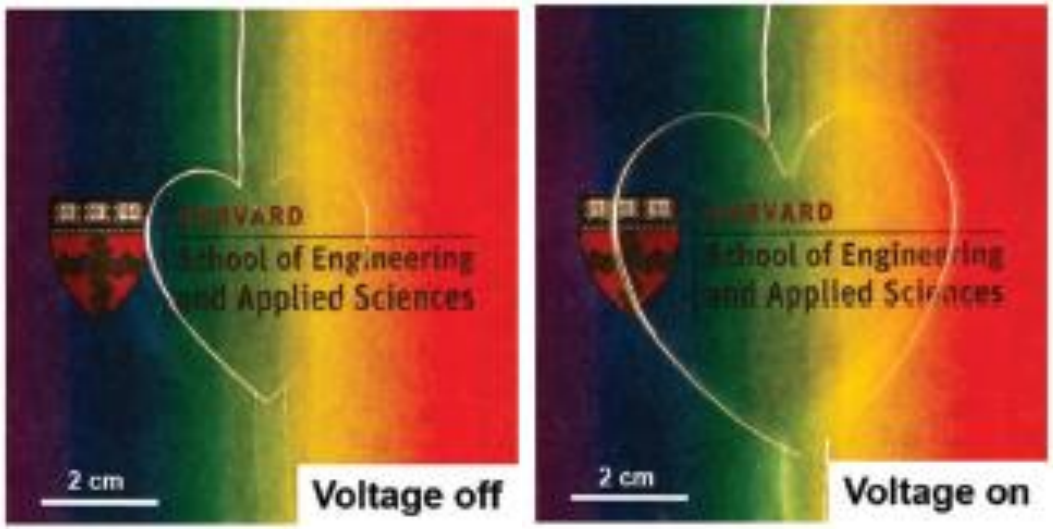

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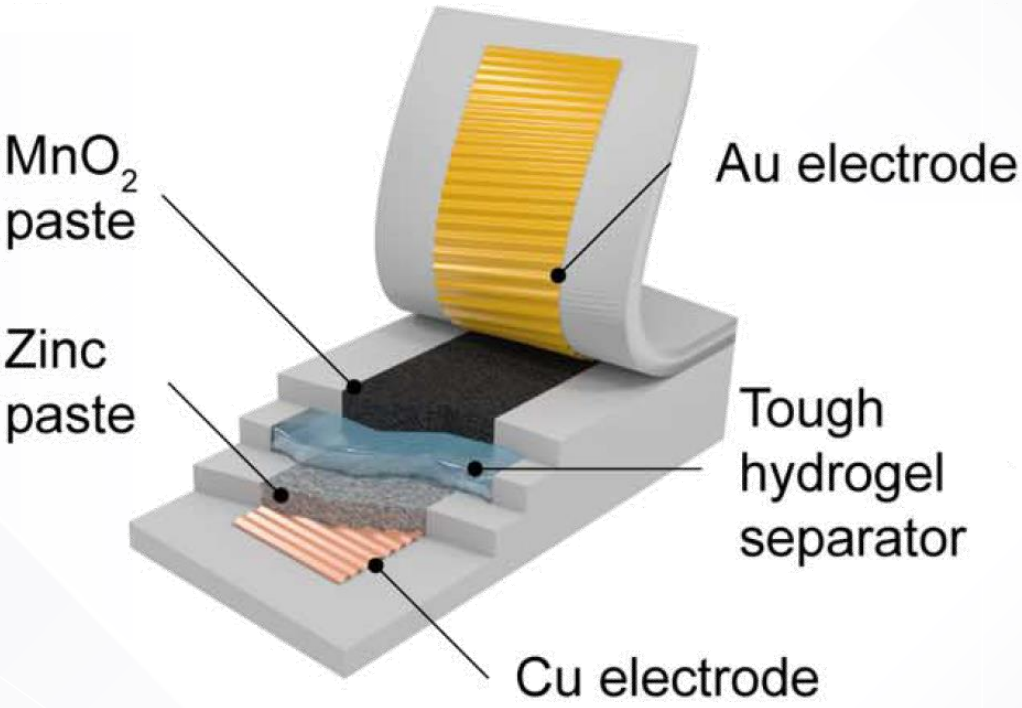
Hydrogel-based soft power source



Instant tough bonding of hydrogels for soft machines and electronics, Daniela Wirthl, et al. Science Advances (2017)

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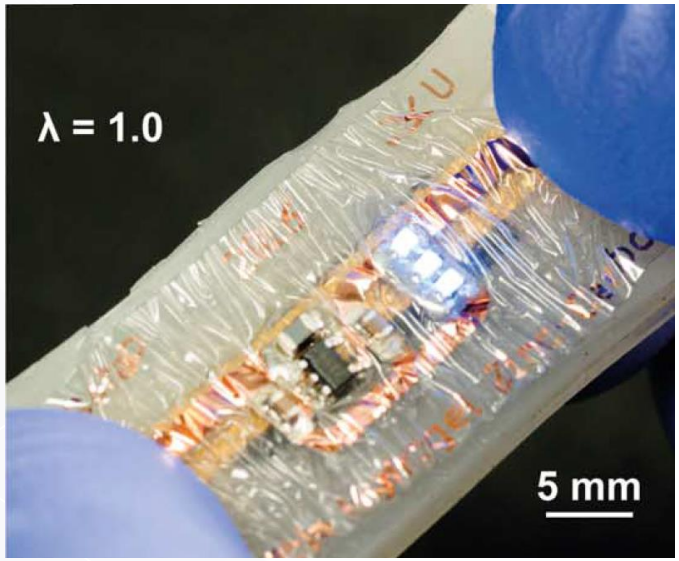

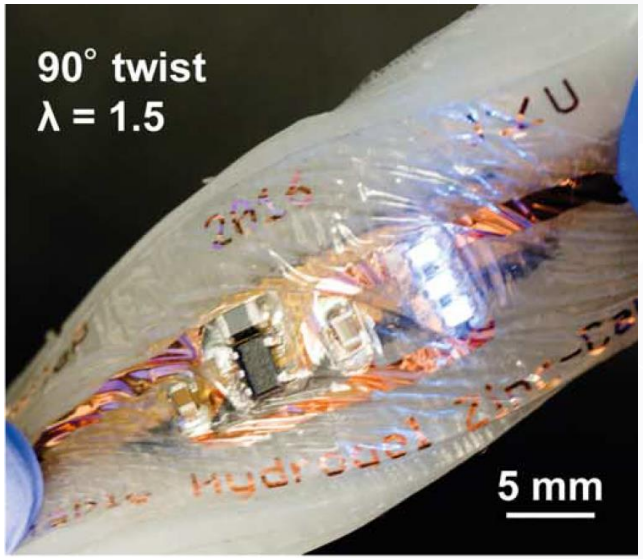

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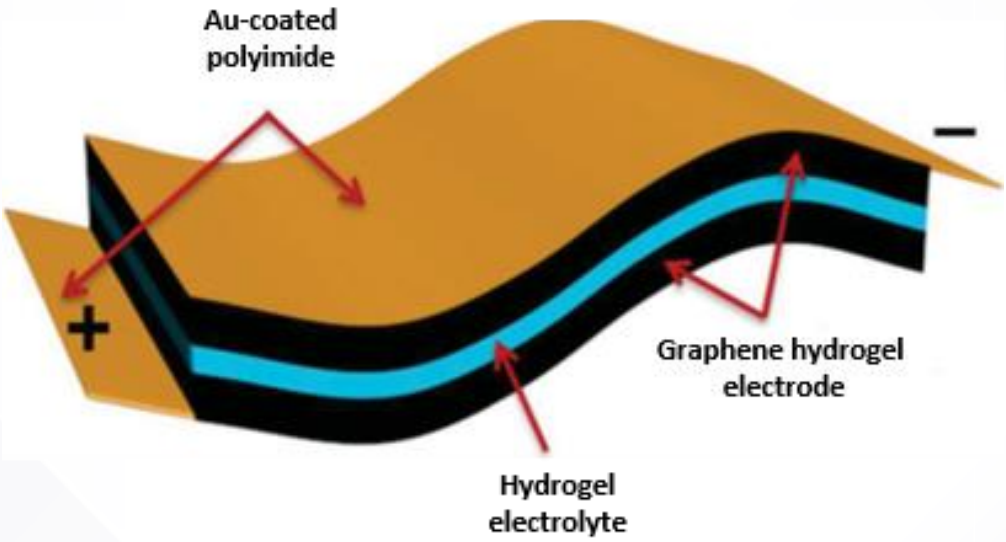

Flexible solid-state supercapacitors based on three-dimensional graphene hydrogel films, Yuxi Xu, et al. ACS Nano (2013)

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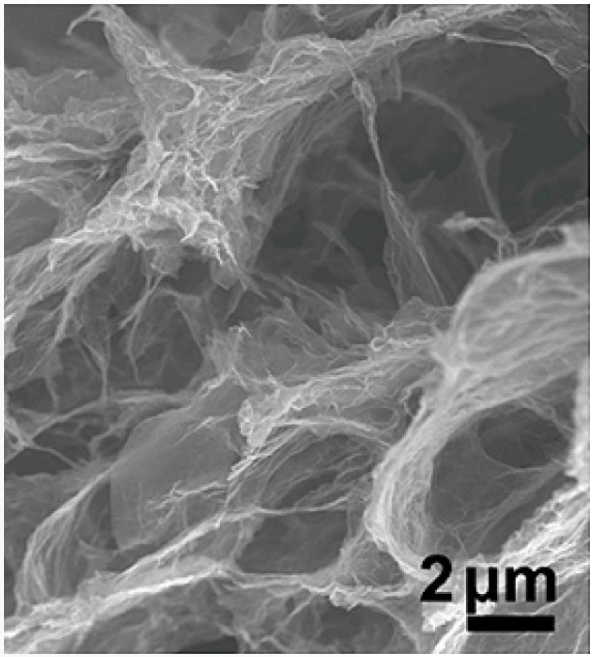

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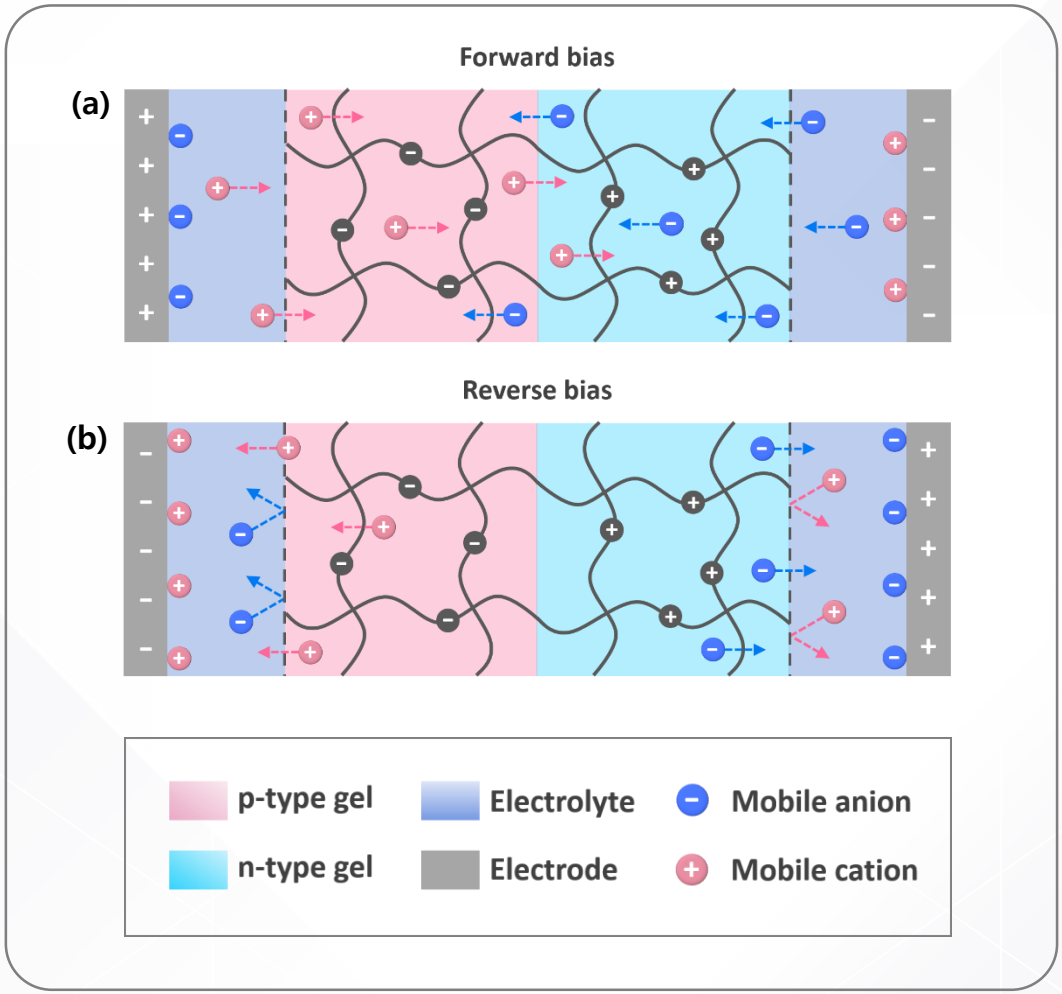

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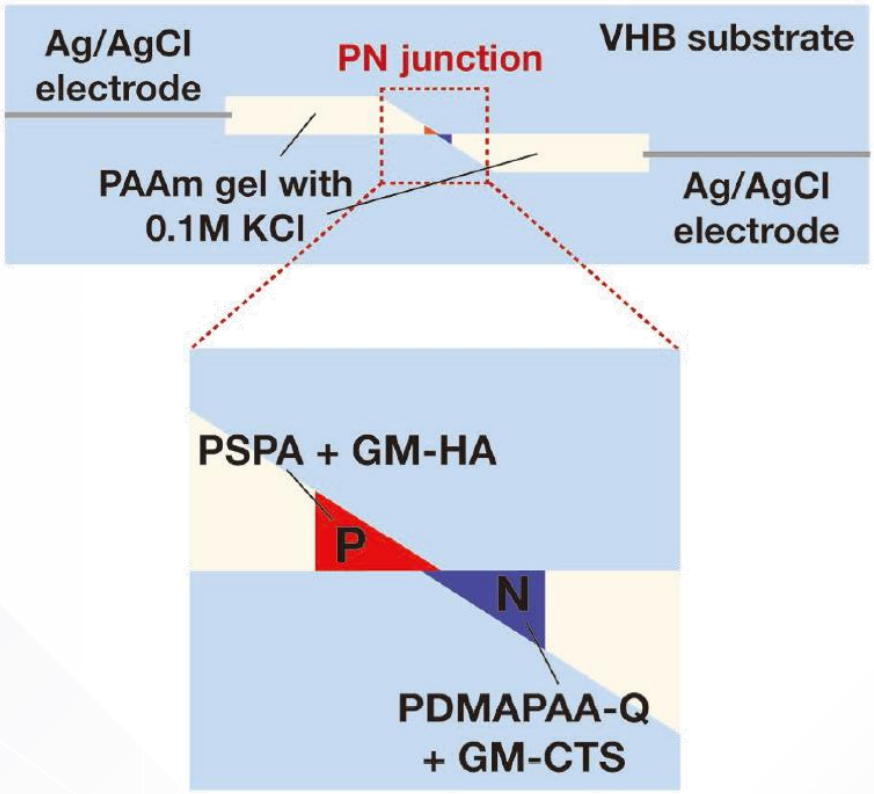

A stretchable ionic diode from copolyelectrolyte hydrogels with methacrylated polysaccharides, Hae-Ryung Lee, et al. Advanced Functional Materials (2019)

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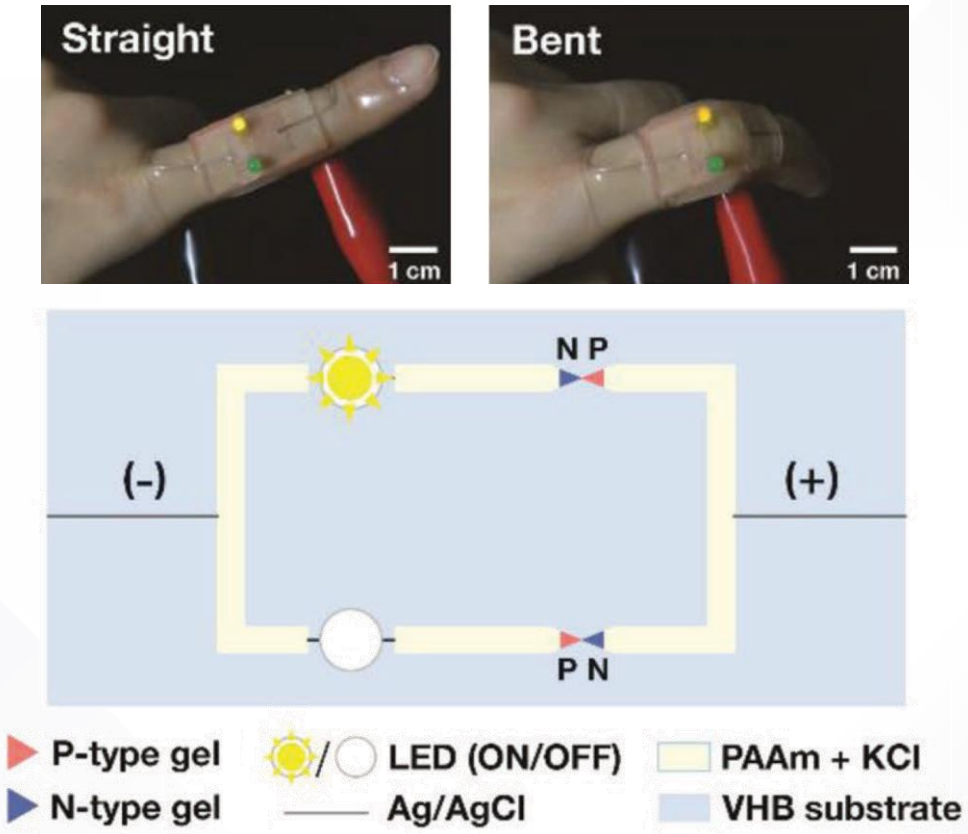

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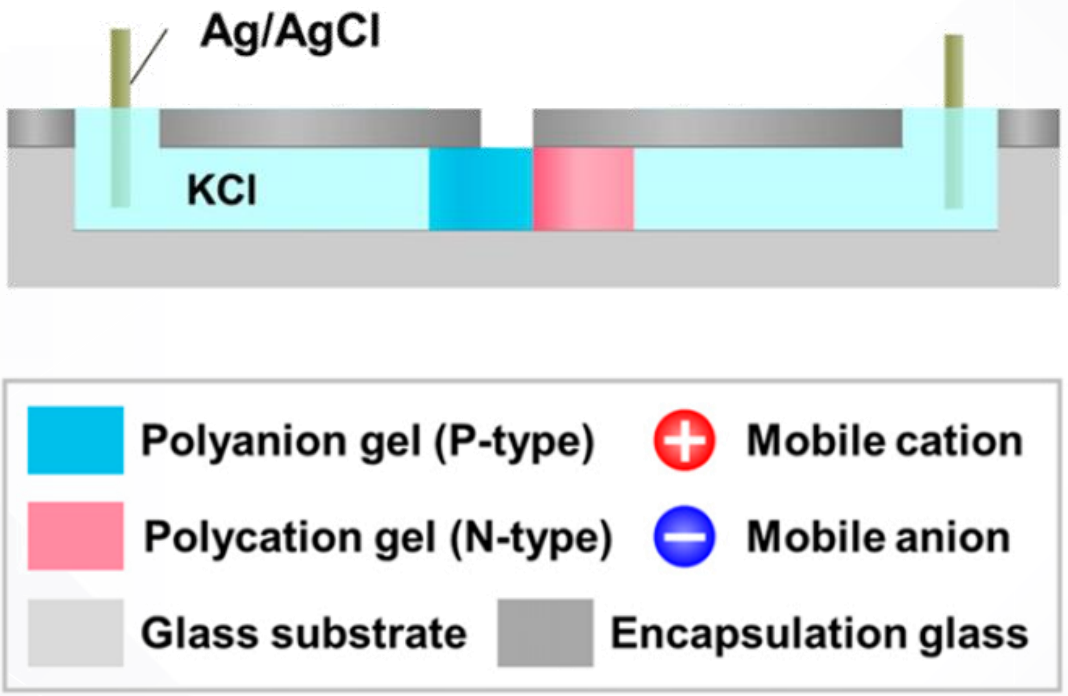

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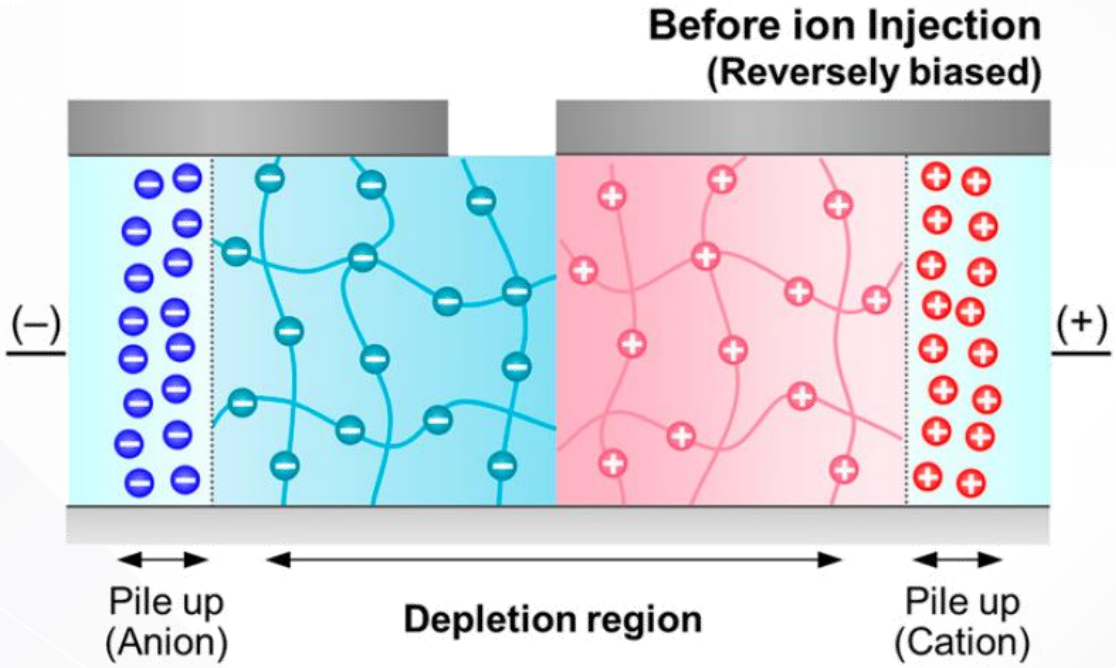

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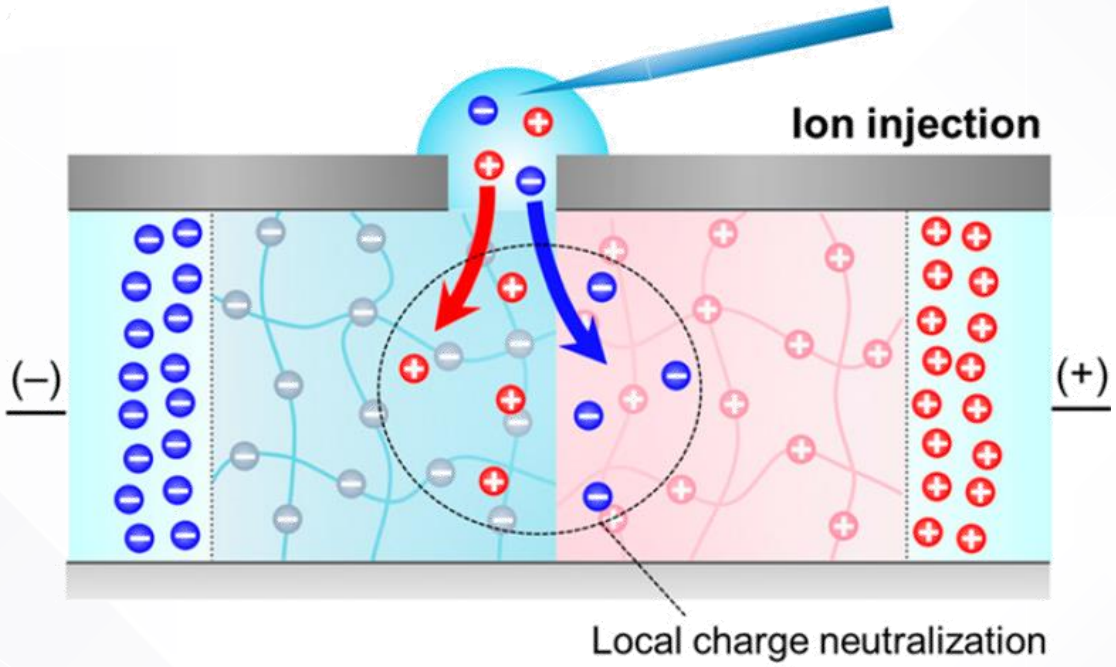

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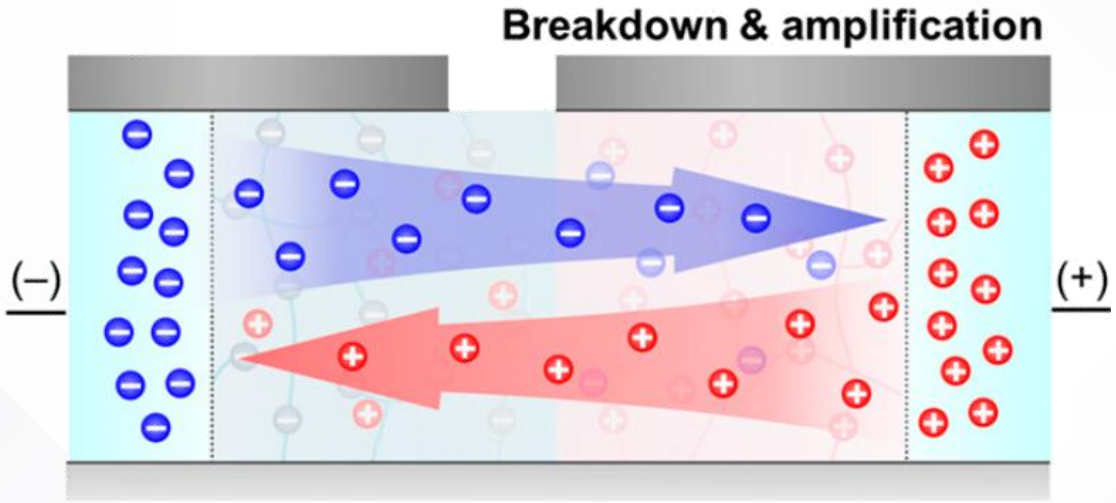

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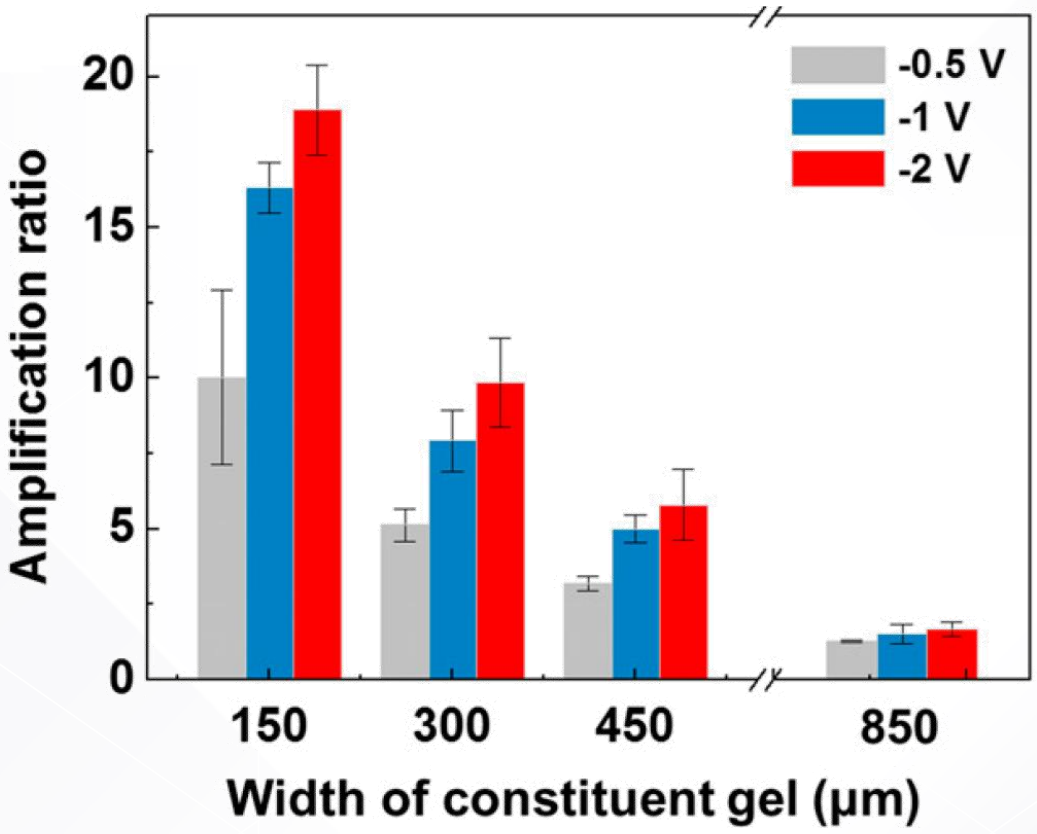

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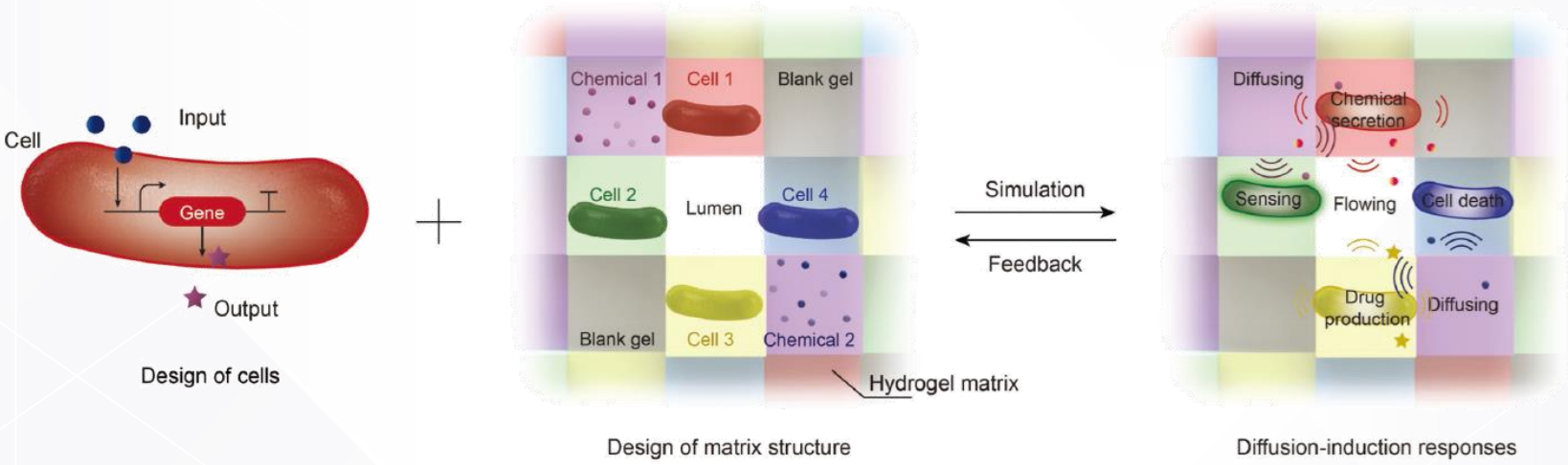

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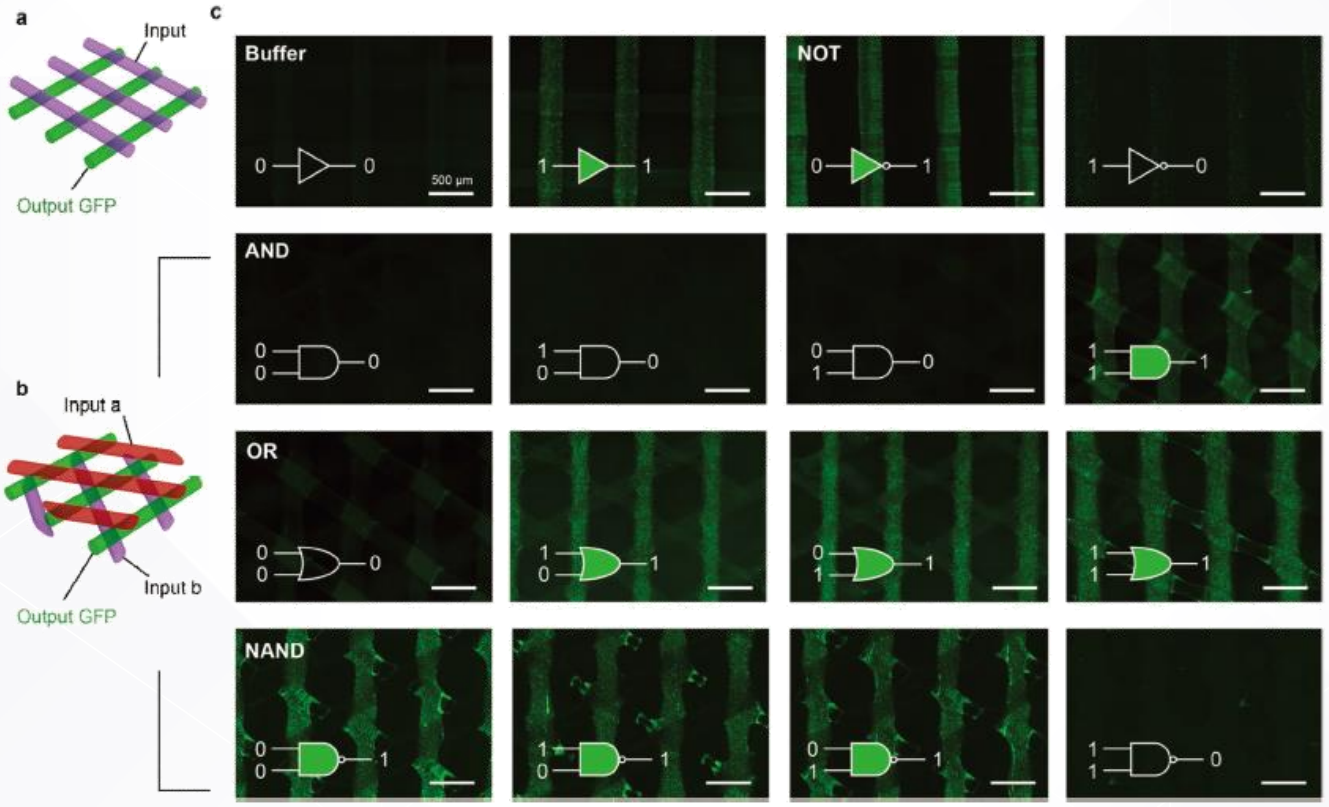

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Future directions for hydrogel soft robots

- Endowing stimuli-selectivity
- Improving durability
- Systemization

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THANK YOU

SNU MSE MFSM 송원준