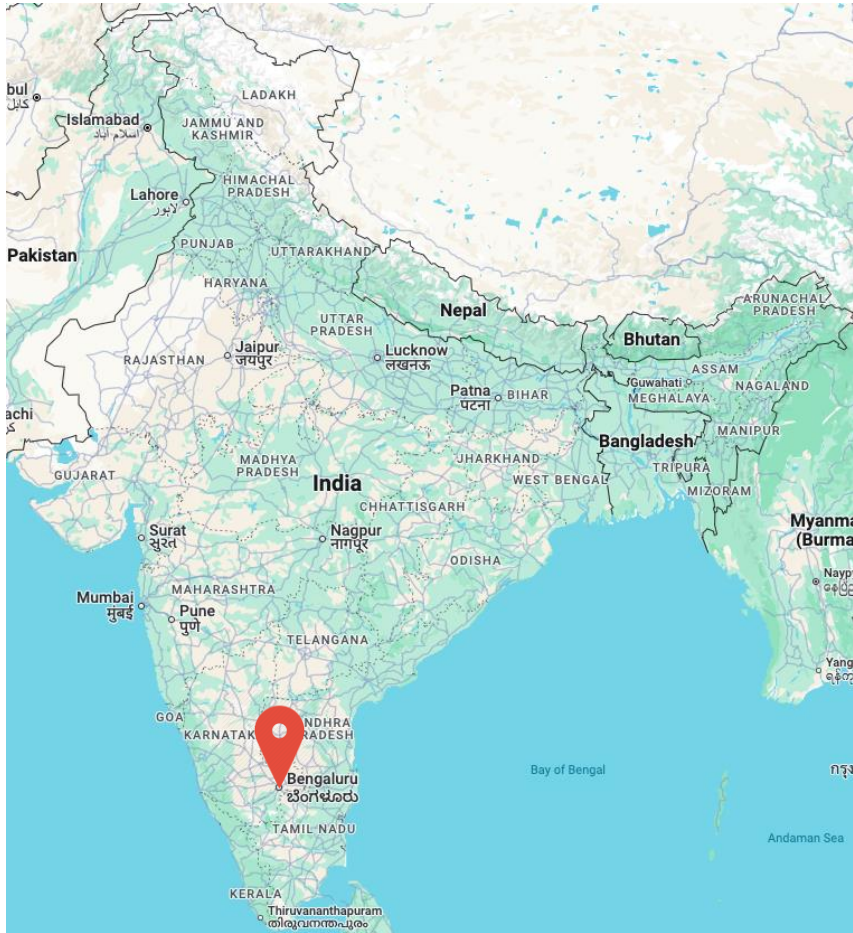


Targeting Axonal Pathways: Advancing Nanoparticle Delivery Strategies for Neuronal Therapeutics

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	Faculty of Pharmacy
	Faculty of Life and Allied Health Sciences
	Faculty of Hospitality Management and Catering Technology
	Faculty of Management & Commerce
	School of Social Sciences
	School of Law
	Ramaiah Institute of Nursing Education and Research
	Ramaiah College of Physiotherapy

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Funding



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DEFENCE



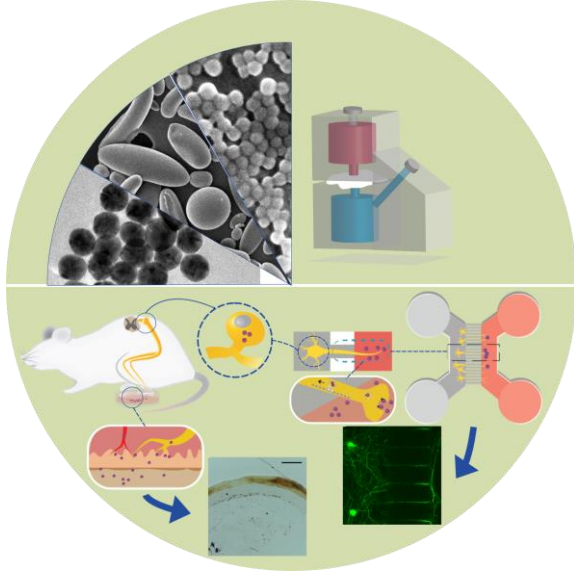
जैवप्रौद्योगिकी विभाग
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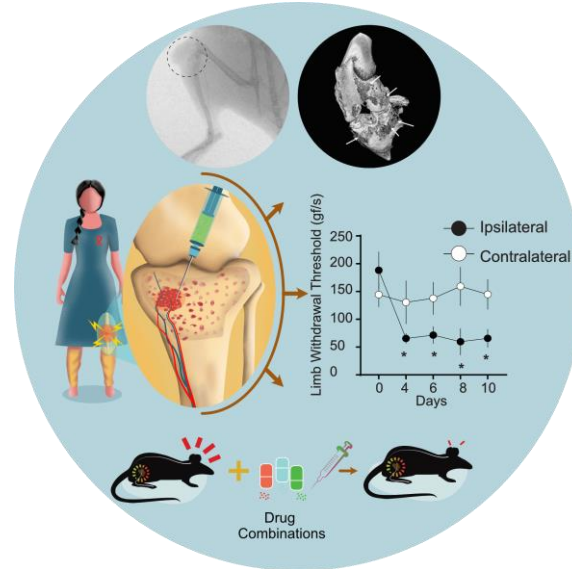
PHILADELPHIA, PA
JULY 13-18, 2025

**NEXT-GENERATION
DELIVERY INNOVATIONS**

Localized delivery systems for the peripheral nervous system

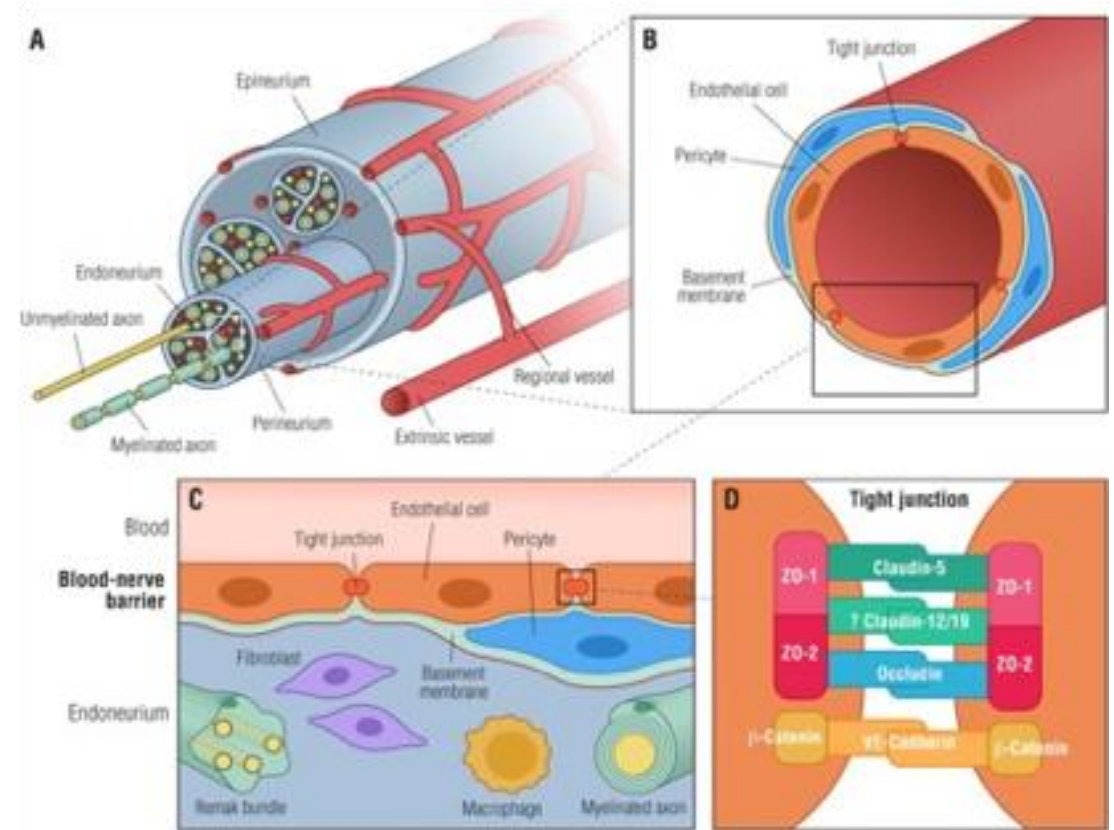
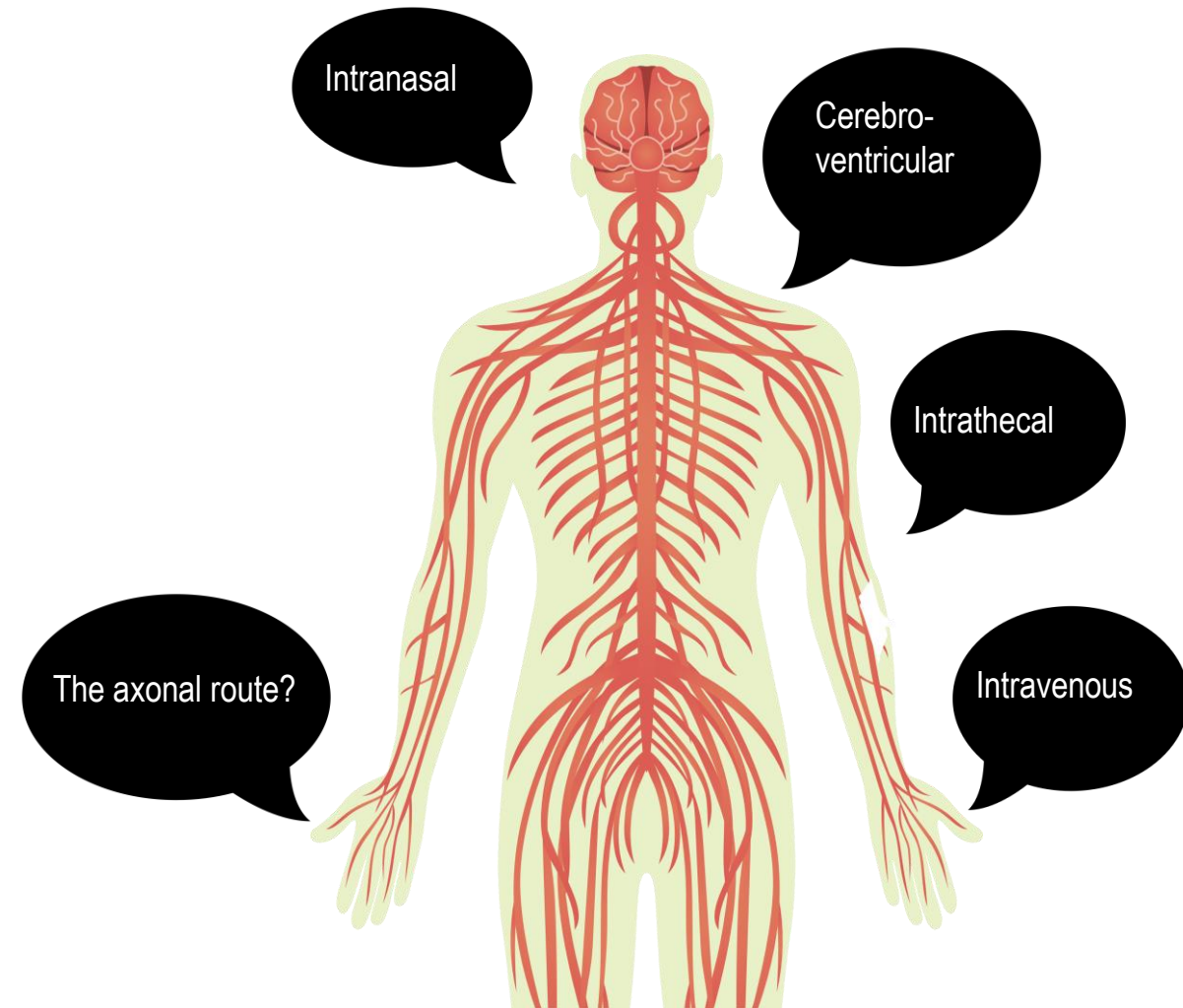


Neuro-behavioral analysis in *C elegans* for diagnostics



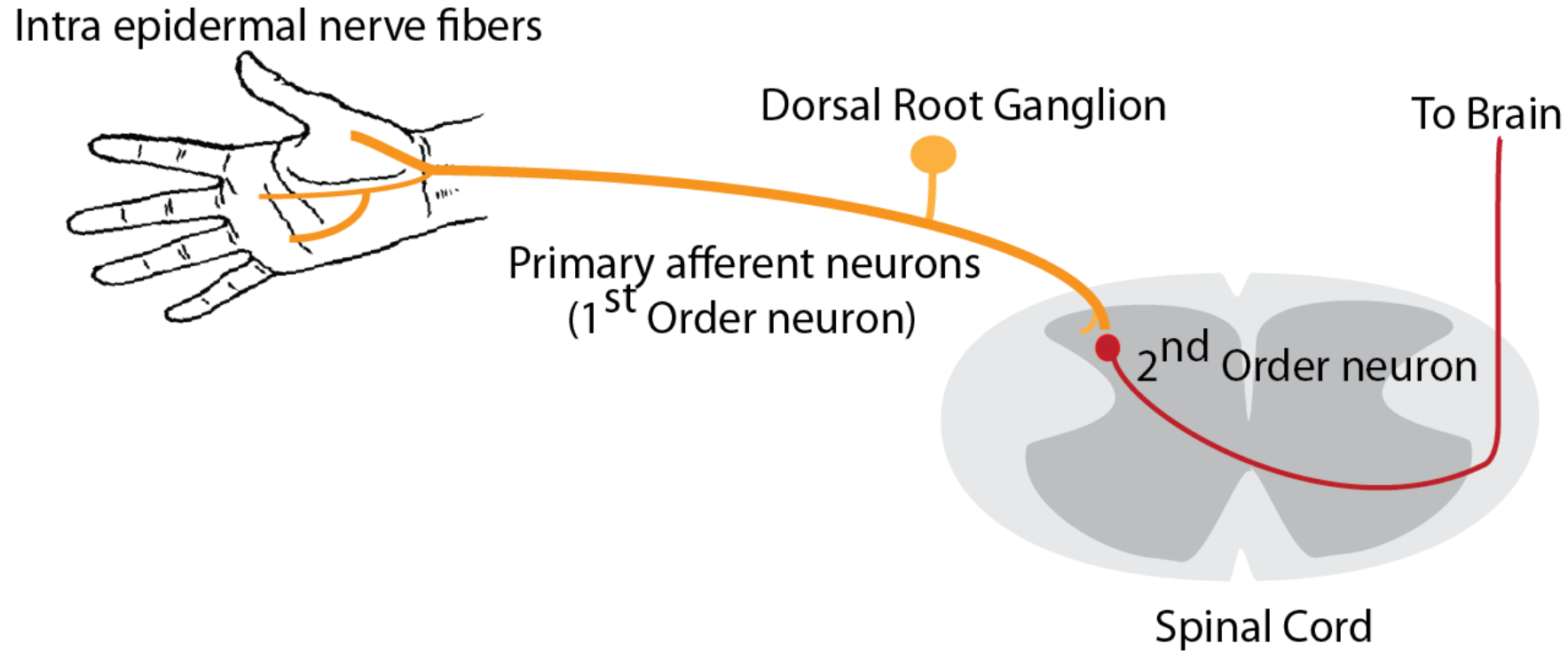
Neural innervation of tissues and tumors :
Is there a role in tissue engineering?

Delivering payloads to the nervous system: A Challenge!

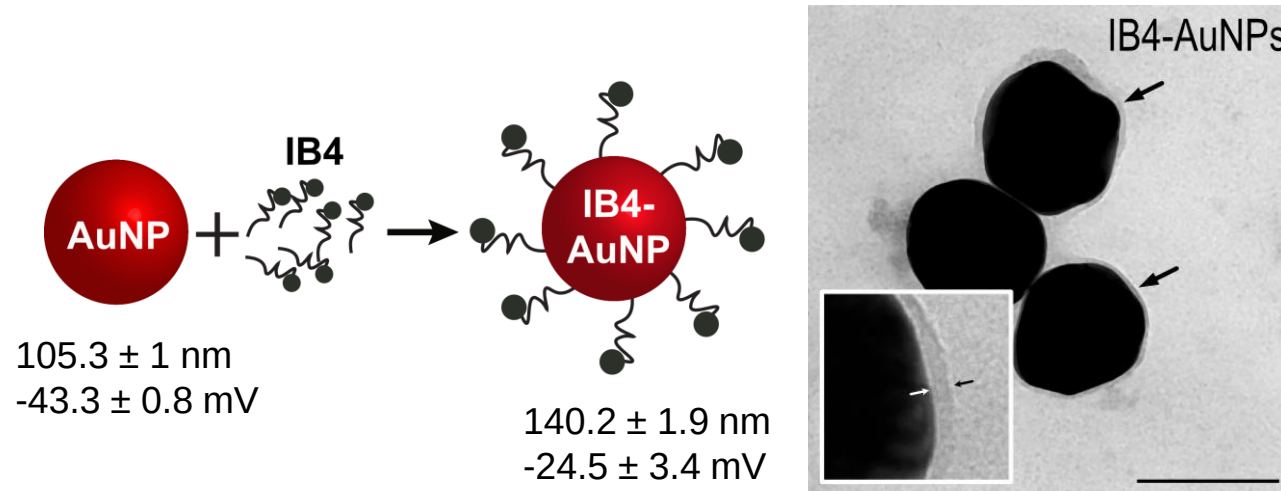


Richner M et al, Front. Neurosci., 14 January 2019

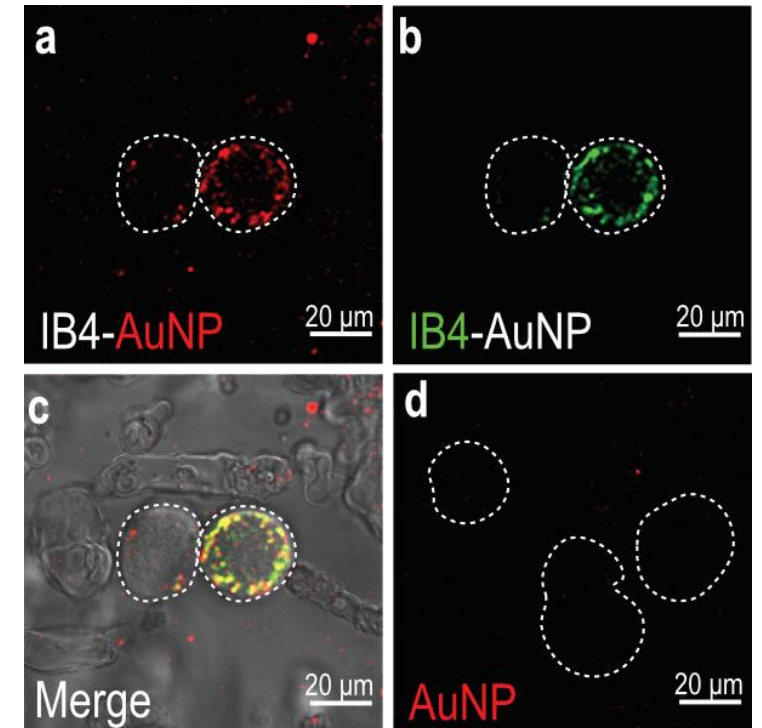
Delivering payloads to the peripheral nerve



Neurotrophic nanoparticles – Isolectin-B4 AuNPs

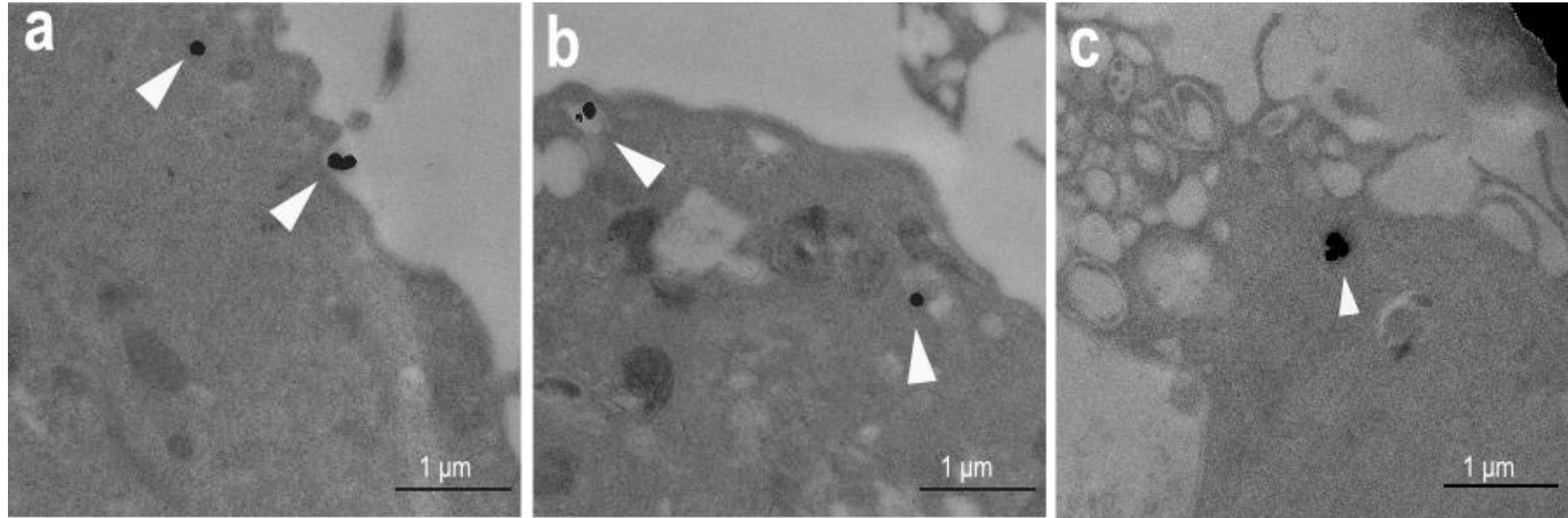


Isolectin B4 (IB4) – Tetrameric lectin (114 kDa glycoprotein) isolated from *Griffonia simplicifolia*



Katiyar et al, Sci Reports, 2021

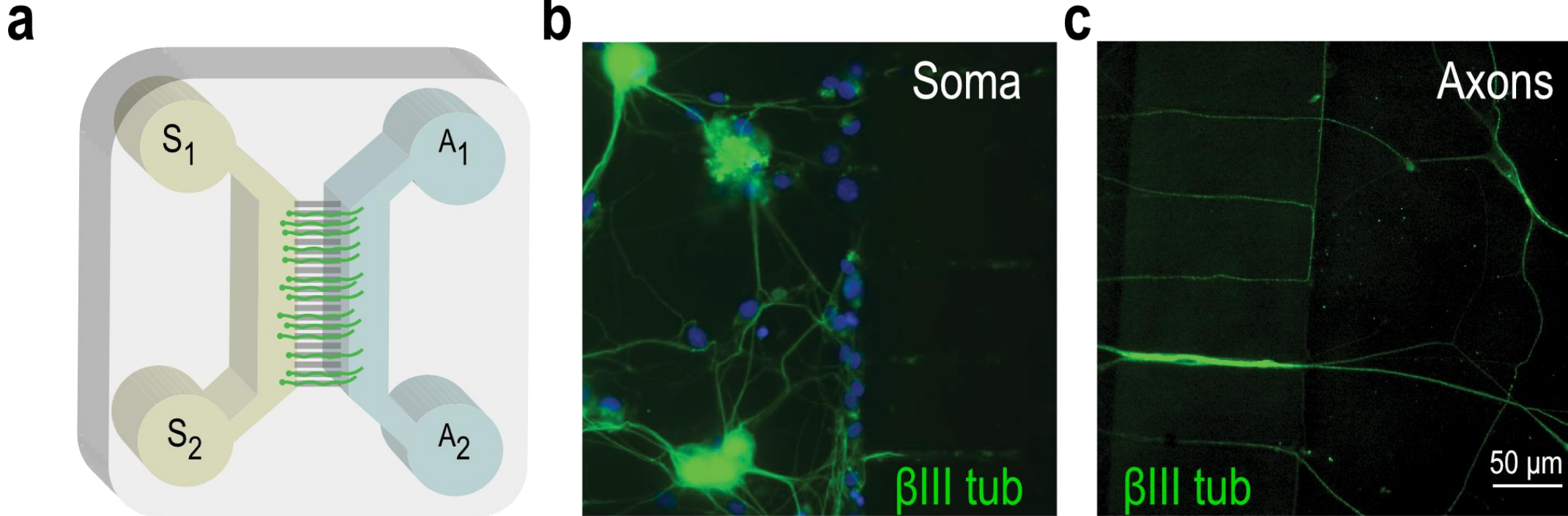
IB4-AuNP binding and uptake in soma of DRG neuron



Katiyar et al, Sci Reports, 2021

IB4-AuNPs bind and internalize into the cell-bodies of cultured DRG neurons

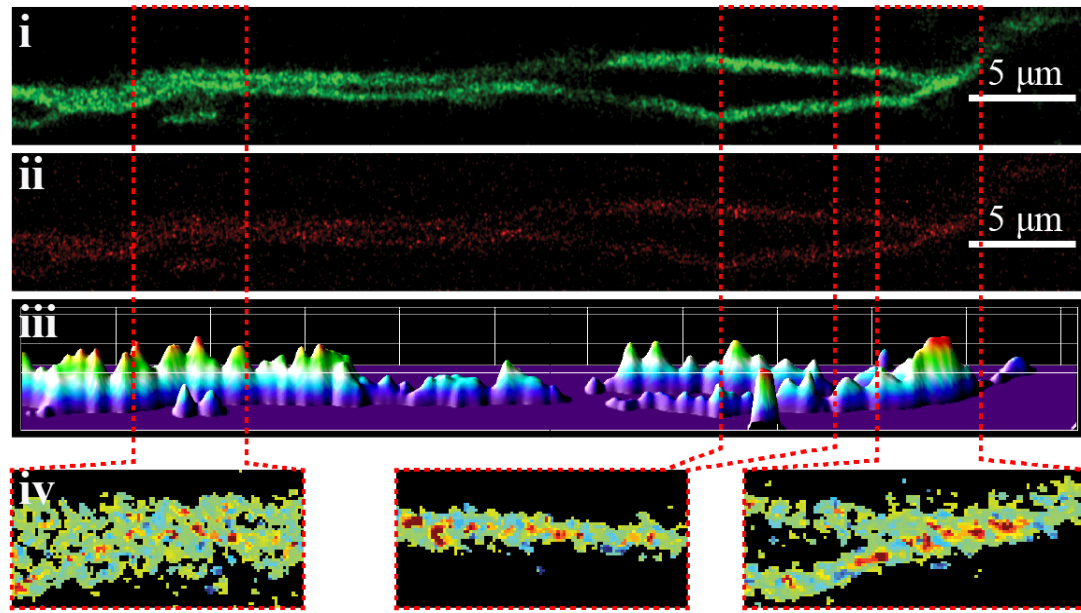
IB4-AuNP binding and uptake in the axons of DRG neurons



DRG neurons cultured in microfluidic devices to attain spatial separation of axons and cell soma, with fluidic isolation

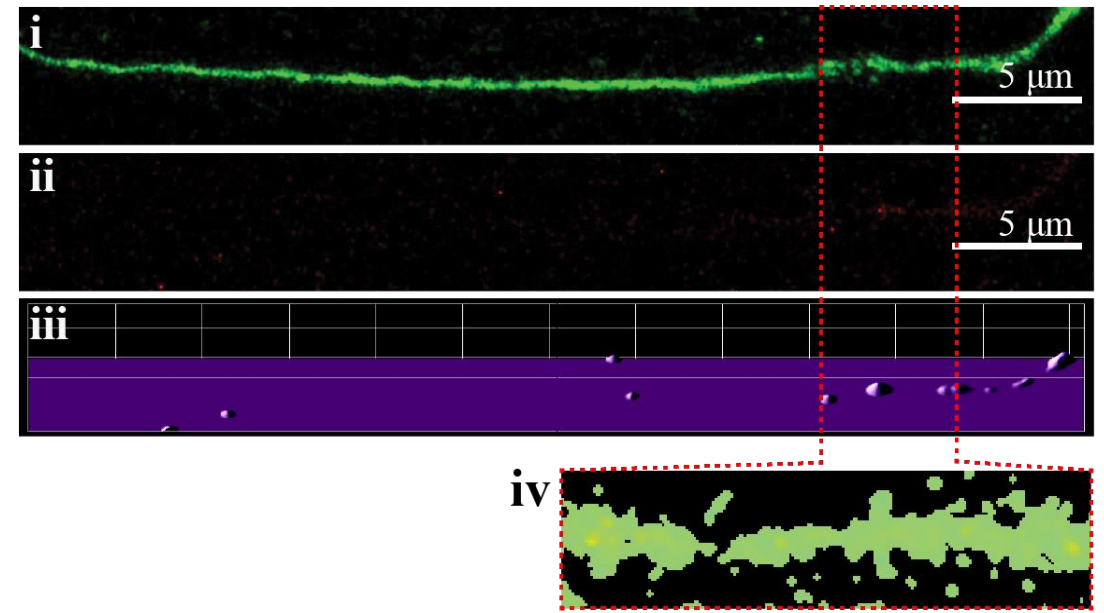
IB4-AuNP binding and uptake in the axons of DRG neurons

IB4-AuNP



Correlation index - 0.51

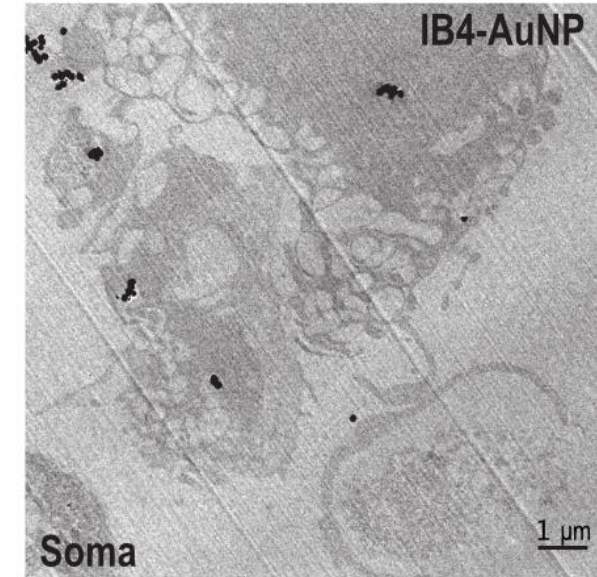
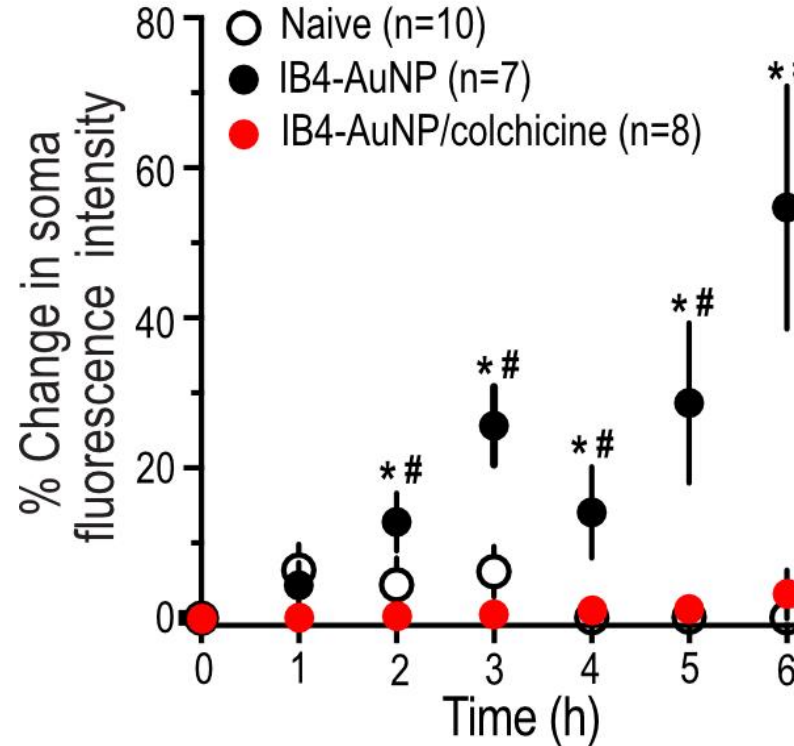
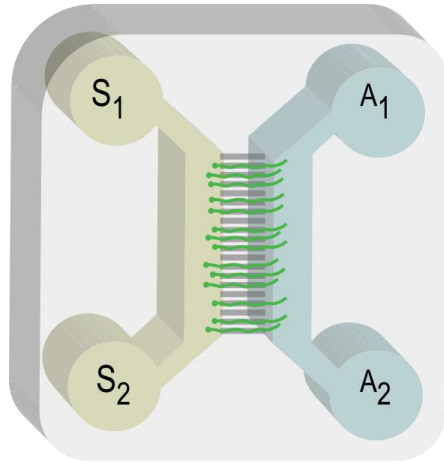
AuNP



Correlation index - 0.13

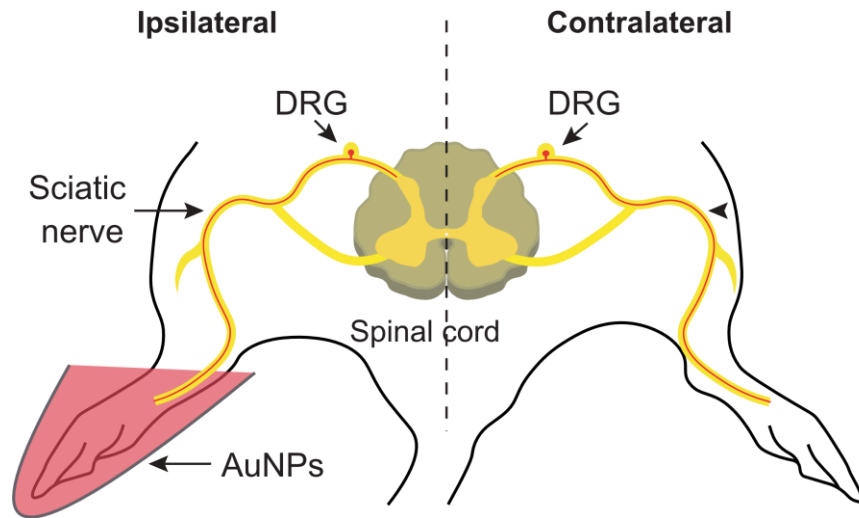
Axons from cultured DRG neurons appeared to show binding and uptake of IB4-AuNP

IB4-AuNP translocation to DRG cell soma via axons

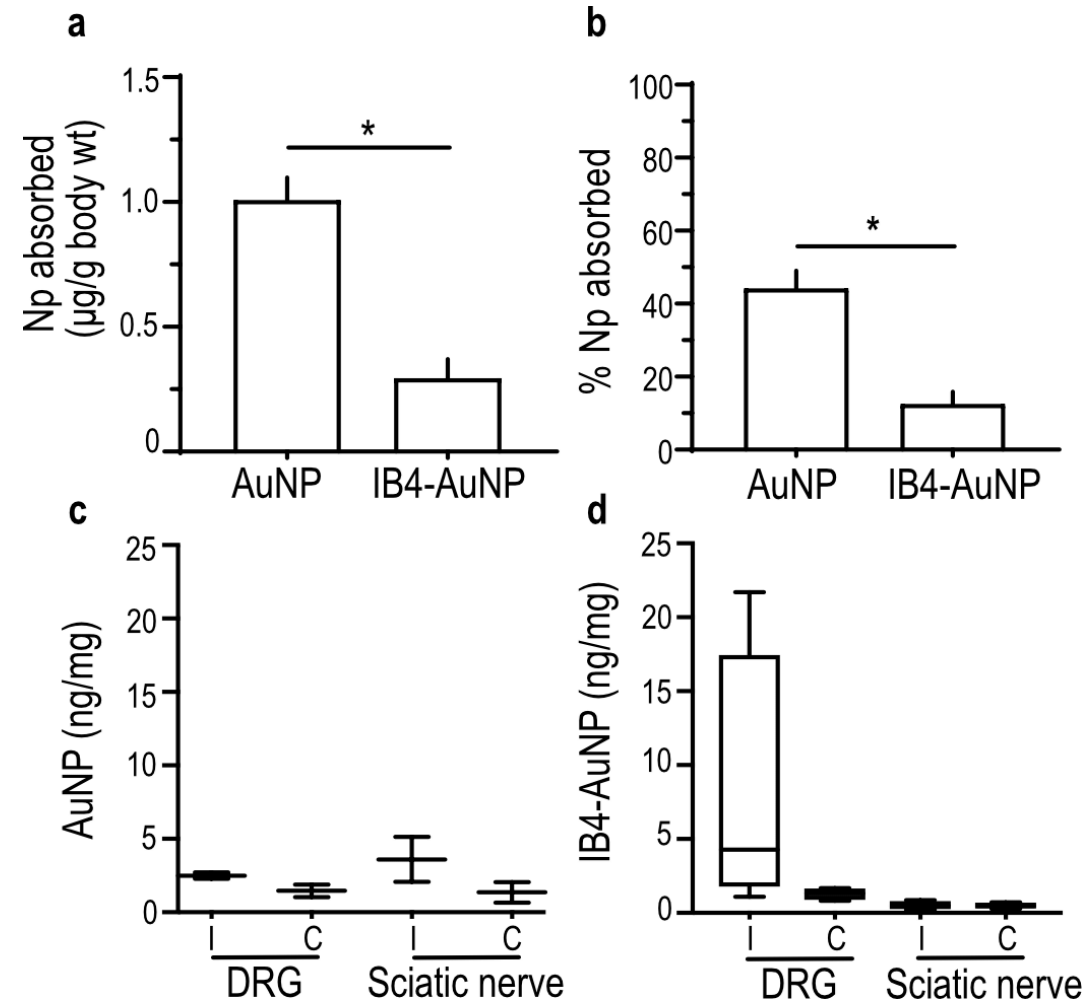


IB4-AuNP undergo retrograde axonal transport and localize in the cell soma of DRG neurons

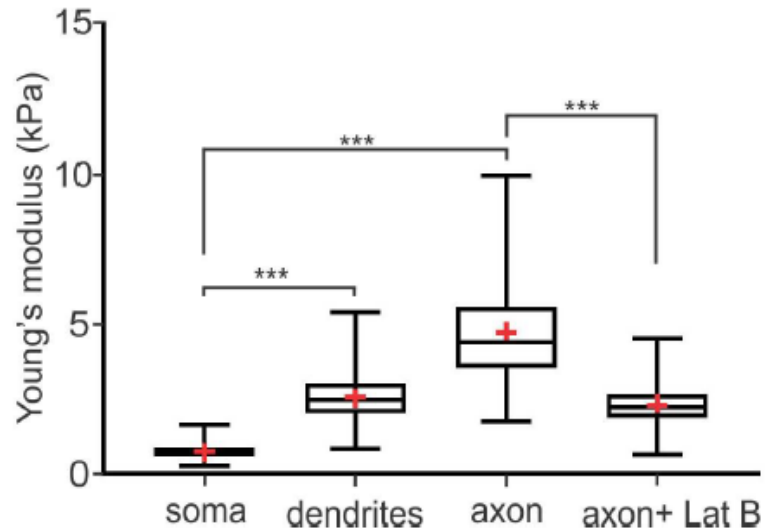
Translocation of topically-applied IB4 AuNP to DRG neurons



Topical application of IB4-AuNP results in their accumulation within the ipsilateral DRG neurons



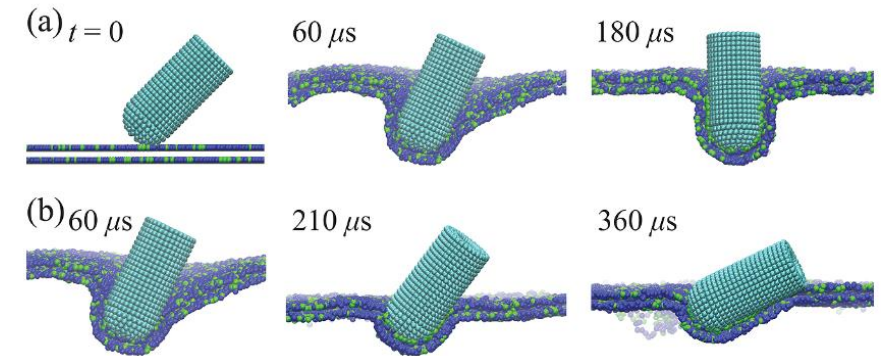
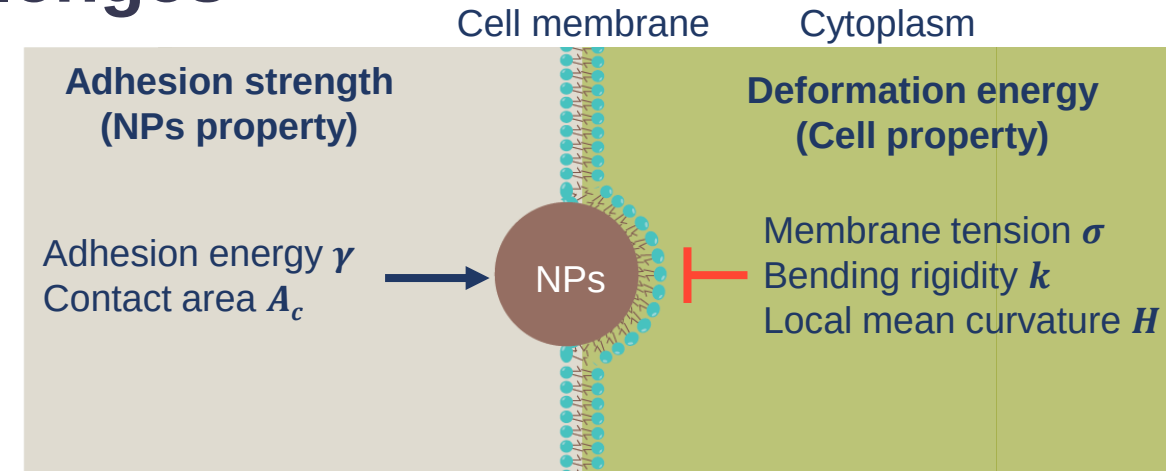
Nanoparticle entry into axons - challenges



Kanda et al., Biophysical Journal, 2017

Canham-Helfrich functional

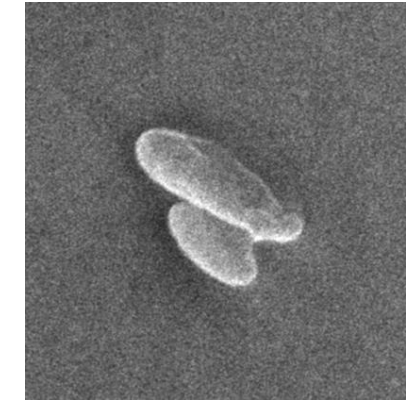
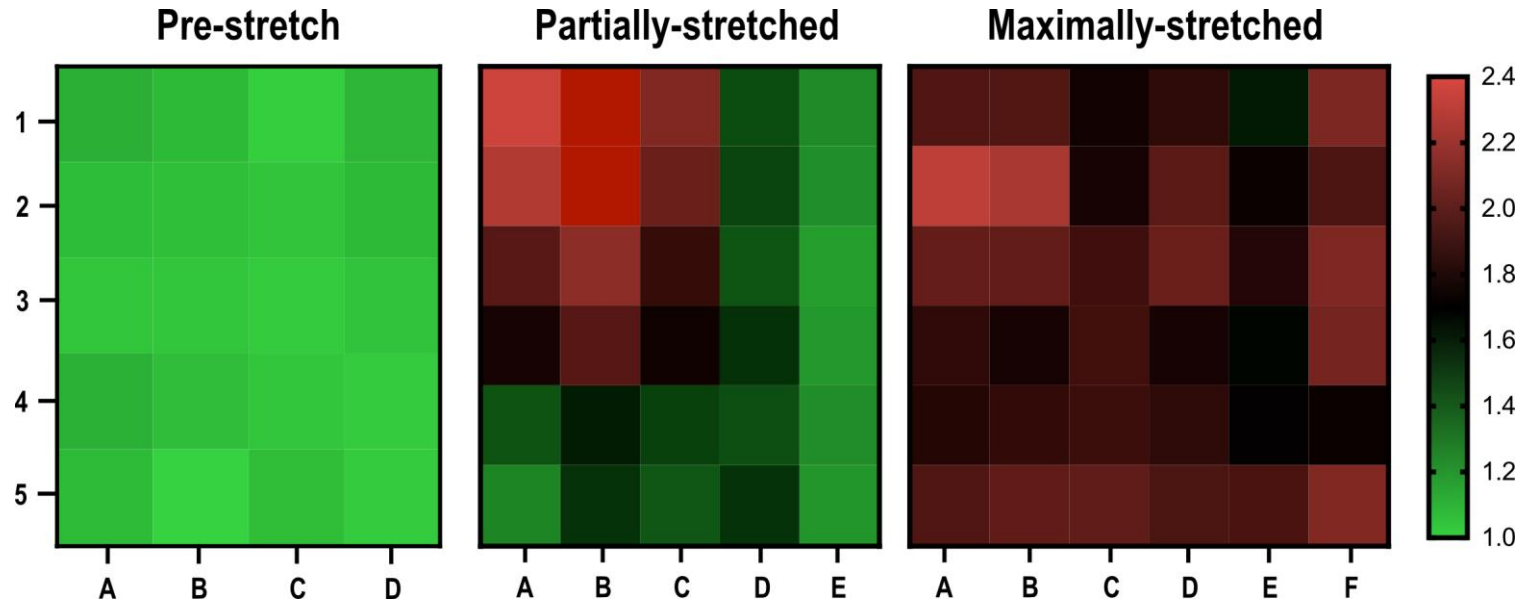
$$E_{tot} = \underbrace{\int 2kH^2 dA + \sigma \Delta A}_{\text{Deformation Energy}} - \underbrace{\gamma A_c}_{\text{Adhesion Energy}}$$



Yi et al., Nano Letters, 2014

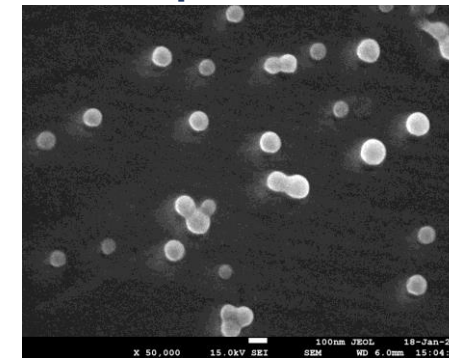
Computational models show adaptable cellular entry of nanotubes under different membrane tensions

Synthesizing Ellipsoid shaped polymeric nanoparticles

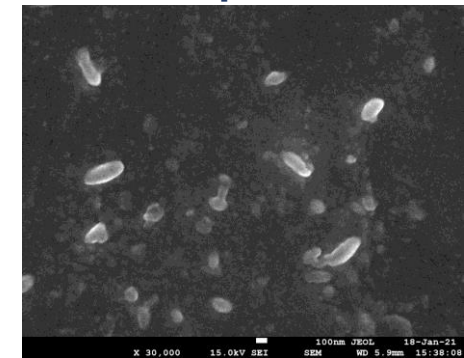


Aspect ratio
 $2.15 \pm 0.5nm$

Spherical



Ellipsoid



$106 \pm 19nm$

Nanoparticle entry in high curvature systems

