Recapitulating tissue and inflammed microenvironments through bioengineered platforms and hybrid biomaterials

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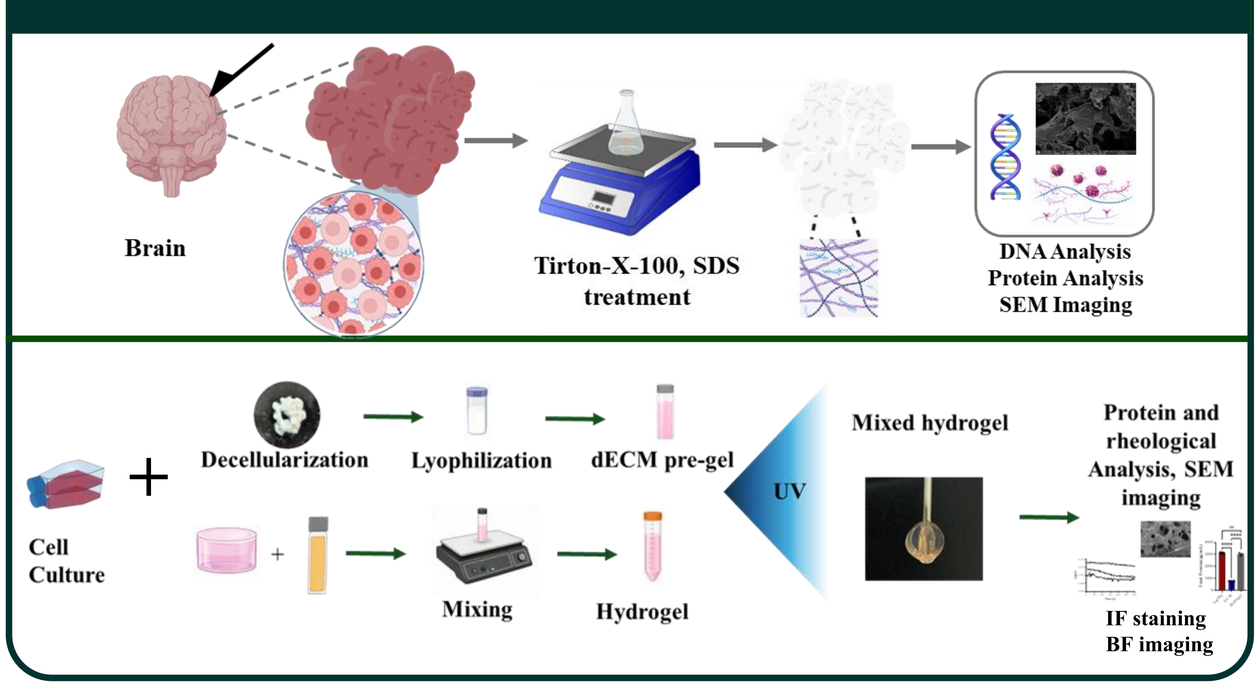
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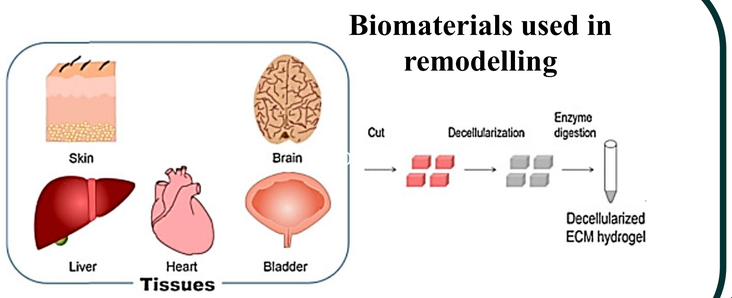
INTRODUCTION

Engineered *in vitro* models that strongly recapitulate native or diseased microenvironments require controlled integration of advanced biomaterials, multicellular assemblies, and physiologically relevant cues. Biomaterials such as tissue-derived, symthetic, natural or semi-synthetic ECM hydrogels and electroactive polymeric interfaces, combined with microfluidic platforms, offer a comprehensive approach to understand the physiology and pathophysiology of replicated tissues.. Such cross-disciplinary platforms faciliate for low-cost, reproducible, and ethically sustainable models for therapeutic approaches.

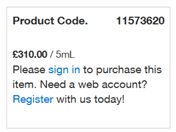
METHODS



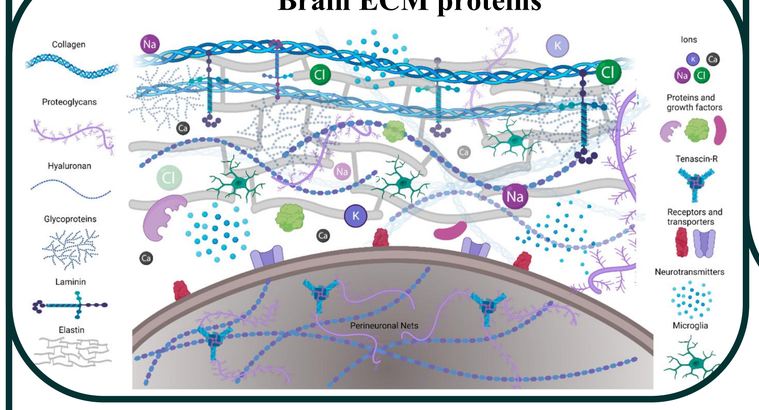
DIFFERENT PERSPECTIVES

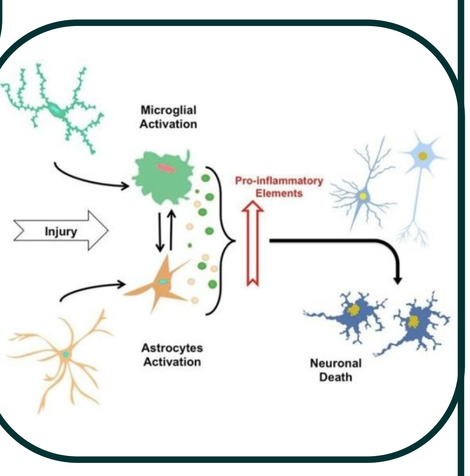






Tumor derived
Expensive
Batch-to-batch variations

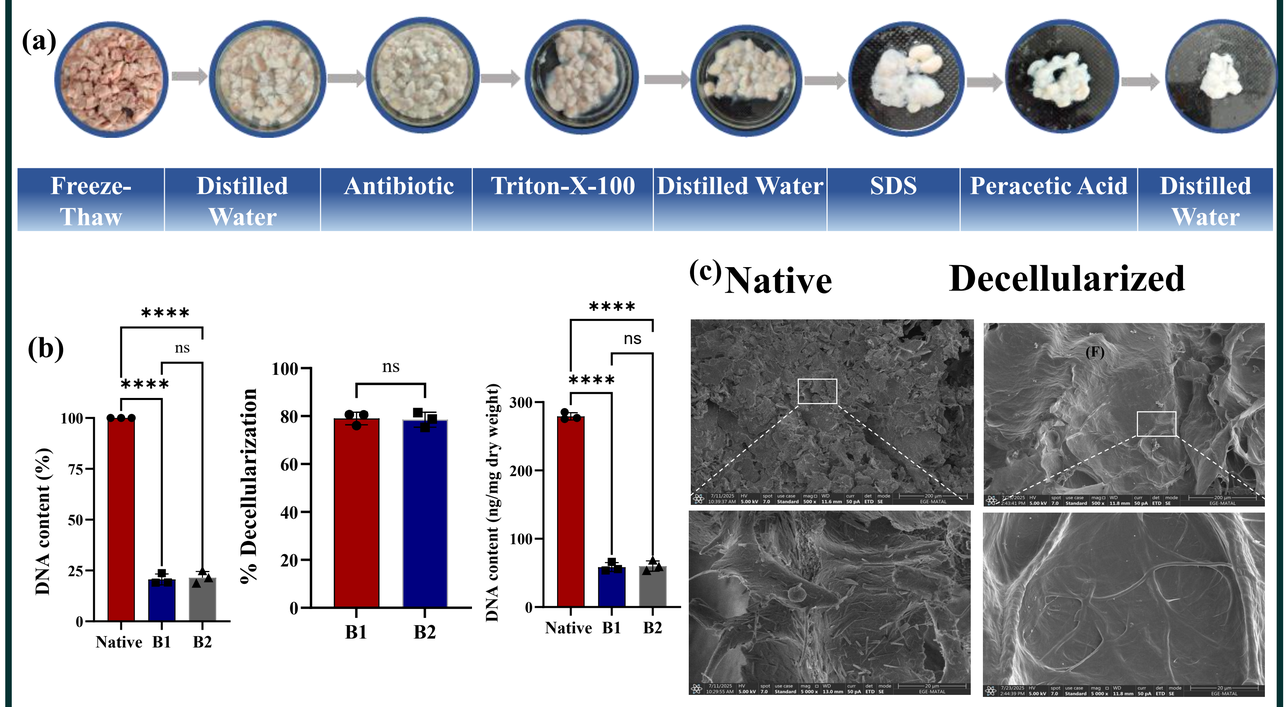




Comparative overview of dbECM sources in relation to the human brain niche

Species	dECM similarity to human brain niche	Protein matrix preservation	References
Human	Native reference; highest biochemical and proteomic fidelity to the human brain niche	~94% overlap of identified ECM proteins with native brain tissue. **352 brain-enriched proteins identified vs. 9 in Matrigel**; low residual DNA content	(Cho et al., 2021)
Porcine	Strong similarity; closest validated non-human model with comparable matrisome composition to human brain ECM	**457 brain tissue-enriched proteins identified**; similar overall protein diversity to human BEM, with compositional differences (↑ glycoproteins, ↓ proteoglycans)	(Cho et al., 2021; Simsa et al., 2021)
Bovine	Moderate similarity; anatomically relevant (gyrencephalic brain) but limited direct proteomic benchmarking against human brain ECM	ECM preservation demonstrated depending on decellularization protocol; structural and functional protein retention reported, but **quantitative comparison of brain-enriched proteins vs. human ECM is not yet established**	(Abdollahi et al., 2023)
Ovine	Potential anatomical similarity; limited evidence for biochemical or proteomic equivalence to human brain niche	ECM preservation reported in decellularized cortical tissue; however, **detailed matrisome profiling and brain-enriched protein quantification remain insufficient**	(Khan et al., 2021)

RESULTS



(**a**)Schematic representation of decellularization process. **(b)**DNA content of native and decellularized tissue**. (%, and ng/mg dry weight, respectively.) (c)** SEM images of native and decellularized tissue (Scale bar 200 um and 20 um).

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REFERENCES

Soles, A., Selimovic, A., Sbrocco, K., Ghannoum, F., Hamel, K., Moncada, E. L., Gilliat, S., & Cvetanovic, M. (2023)……. *International Journal of Molecular Sciences*, *24*(8), 7049.

Pramanik, S., Alhomrani, M., Alamri, A. S., Alsanie, W. F., Nainwal, P., Kimothi, V., ... & Sargsyan, A. S. (2024). …….. *Biomedical Materials*, *19*(4), 042008

Ransohoff R M, Schafer D, Vincent A, *et al*. …….. *Neurotherapeutics*. 2015, 12(4):896-909..

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