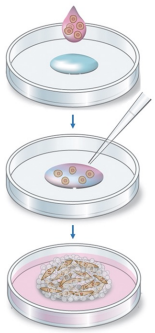
BioLamina

Brain organoid modeling to study neural development and disease

Functional neural 3D cell constructs using Biosilk-Biolaminin scaffold

- Culture organoids without necrotic centers
- Generate reproducible 3D cultures with less variation, both between and within the organoids
- Efficiently differentiate pluripotent stem cells and model tissues in Biosilk
- Easily tune the extracellular matrix with tissue-specific laminin isoforms



Stable long-term culture of homogenously distributed neural cell constructs in 3D

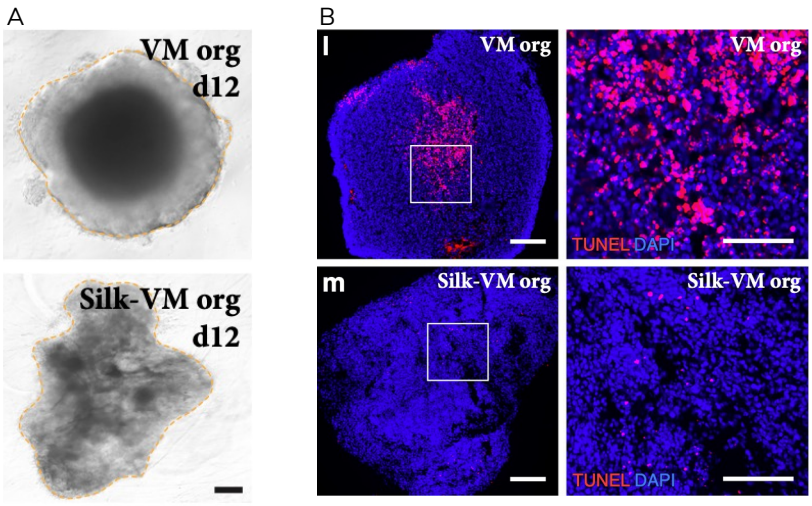
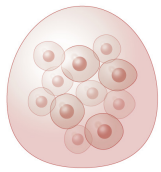
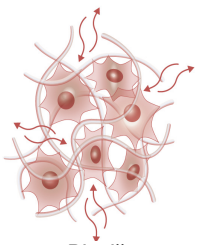


Figure 1. A) Bright-field images of ventral midbrain organoids with Biosilk (silk-VM org) display less distinct outer and innner parts compared to conventional organoids (VM org) at day 12. Scale bar 200 µm. B) Biosilk organoids show no necrotic centers after 6 months of culture in contrast to conventional organoids. TUNEL staining, scale bar 100 µm.



hydrogel



Biosilk

The porous structure of the Biosilk network facilitates the flow of nutrients and oxygen.

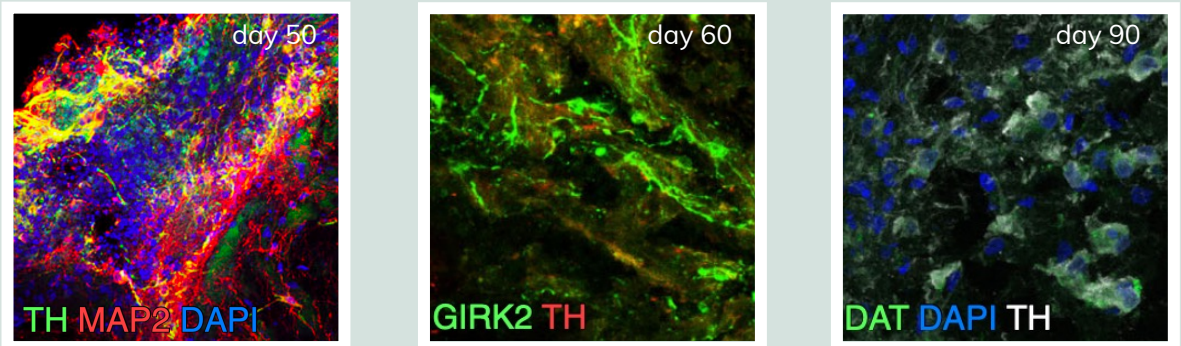


Figure 2. Immunohistochemistry of dopaminergic neuron markers in Biosilk ventral midbrain organoids shows efficient specification and maturation throughout culture period.

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All scientific data from Fiorenzano A. et al. Nature Communications 12, 7302 (2021), figs. 5-8 (CC BY 4.0)

Functional cells – even inside the organoid

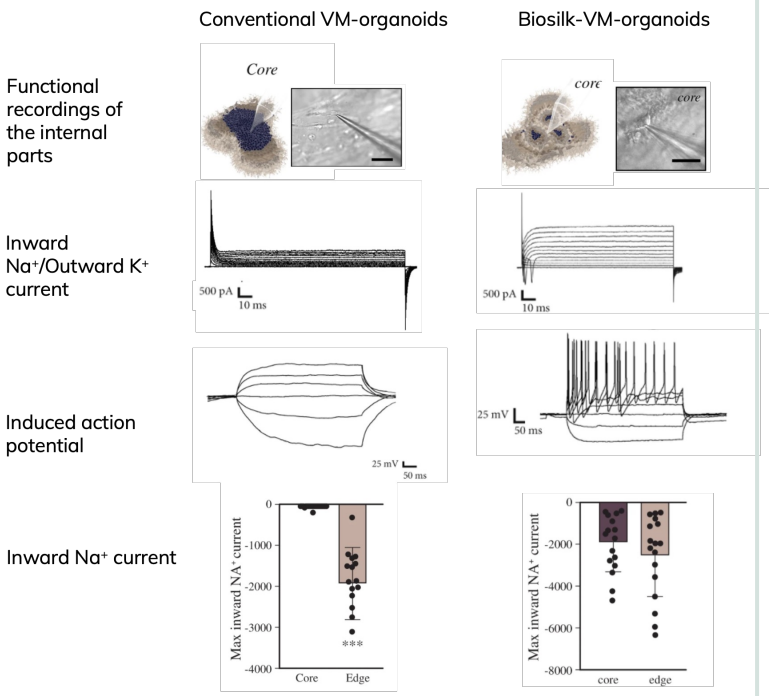

Figure 3. Functional recordings using whole-cell patch-clamp technique at day 90 show functional cells throughout the Biosilk organoids (right) in contrast to the conventional model (left).

Biolaminin 111 for dopaminergic neurons

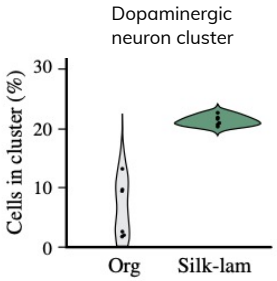

Figure 4. The percentage of cells belonging to dopaminergic neuron cluster at 4 months of organoid culture.

Biolaminin 111, a biologically relevant laminin of the ventral midbrain, significantly increased the proportion and improved the maturity of dopaminergic cells long-term, indicating a precise and reproducible patterning.

Reduce variation – increase reproducibility

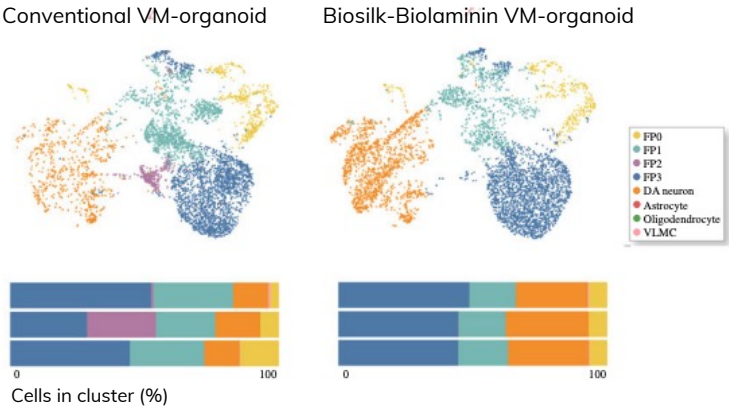

Figure 5. UMAP plots of scRNA-sequencing data and the percentage of cells belonging to each cell type cluster in individual organoids at 1 month of culture. Cell frequency analysis shows significantly lower variability between Biosilk organoids (right) than between conventional organoids (left).

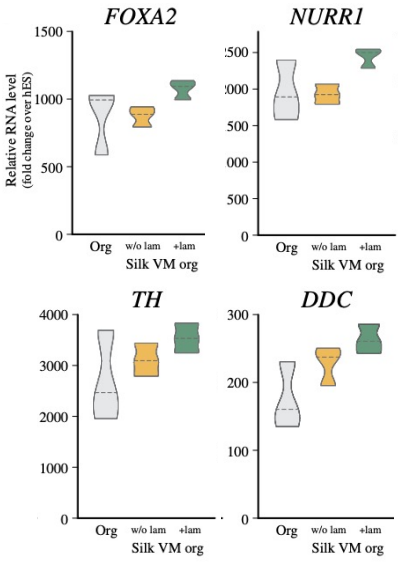

Figure 6. qRT-PCR analysis of early and late dopaminergic neuron markers at 2 months from three independent organoids. Biosilk functionalized with Biolaminin 111 (silk+lam, green) significantly reduced batch variability.

Cell culture plate illustration modified from Johansson & Widhe *et al.* 2019 Scientific Reports (CC BY 4.0)

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