BioLamina

Dopaminergic neuron differentiation

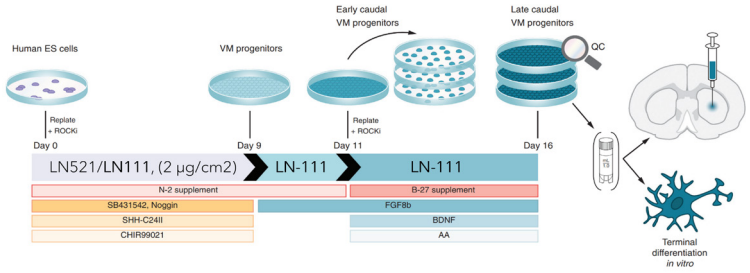
on full-length human recombinant laminin-111 (Biolaminin® 111)

APPLICATION NOTE 013

Biolaminin 111 enables reproducible and high-yield DA neuron differentiation for tissue modeling and clinical translation

Parkinson's disease (PD) remains a major therapeutic challenge, with limited options to halt or reverse disease progression. Human pluripotent stem cell (hPSC)-derived dopaminergic progenitors offer a promising regenerative strategy. However, successful clinical translation requires defined and xeno-free culture systems that maintain cell identity, yield, and function. Here, we demonstrate the use of Biolaminin® 111, the only full-length, recombinant human laminin, to robustly expand and maintain clinical-grade dopaminergic progenitors under GMP-compatible conditions.

FIGURE 1



16-day protocol yielding high-purity ventral midbrain DA progenitors on Biolaminin 111 substrate. By incorporating LN111 into a 16-day differentiation protocol, researchers achieved high-yield DA progenitors (>40-fold increase), reduced batch-to-batch variability, and facilitated clinical translation. Beyond transplantation applications, LN111 also supports functional DA neuron populations in 3D tissue models, enabling long-term disease modelling. (Kirkeby et al. 2017 & Kirkeby et al. 2023)

Benefits

- Efficient DA neuron differentiation
- Consistent and reproducible results
- Enables clinical translation
- Enables long-term tissue modelling

Features

- Full-length human recombinant laminins
- Xeno-free and chemically defined
- Batch-to-batch consistent
- From research to clinical application

Curious about Biolaminin 111? Scan to find out more

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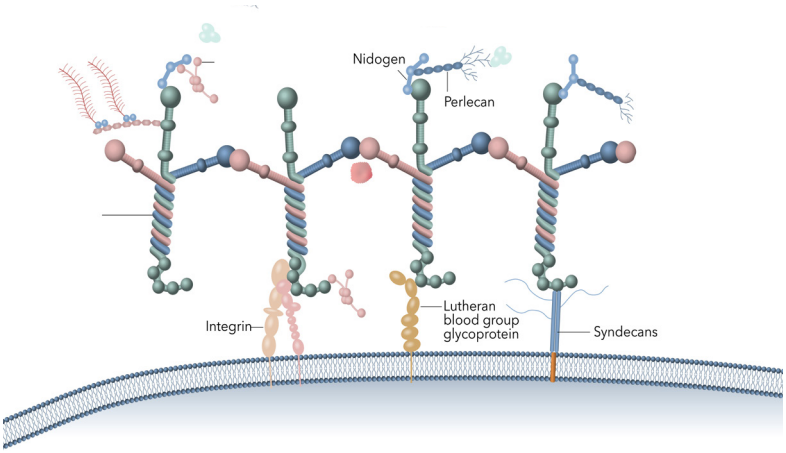
FIGURE 2



Laminins are a conserved ECM protein family with 16 isoforms, essential for development and tissue homeostasis. Their expression is spatially and temporally regulated. Full-length laminin proteins have multiple active sites, required for correct cell binding and signalling, capacity to bind ECM and growth factor reservoir capacity.

Biolaminin® is the only full-length recombinant laminins available, enabling niche-specific cell culture.

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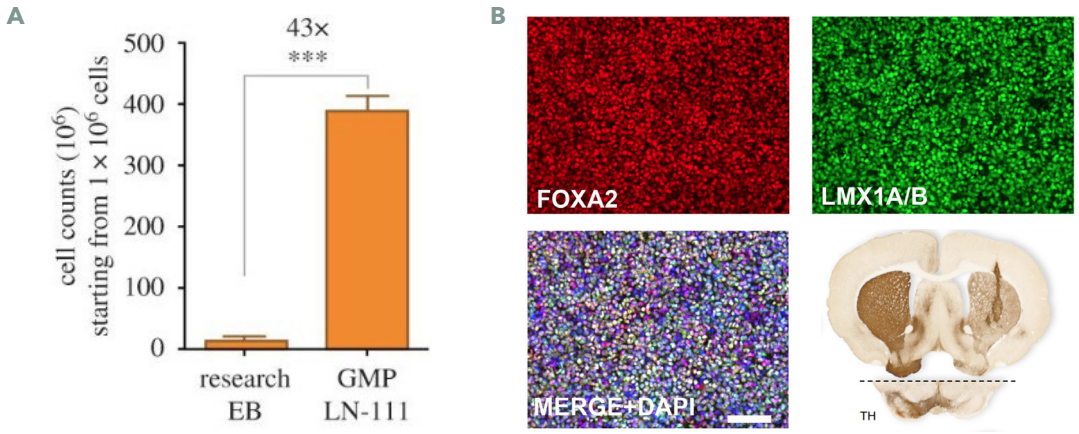
FIGURE 3

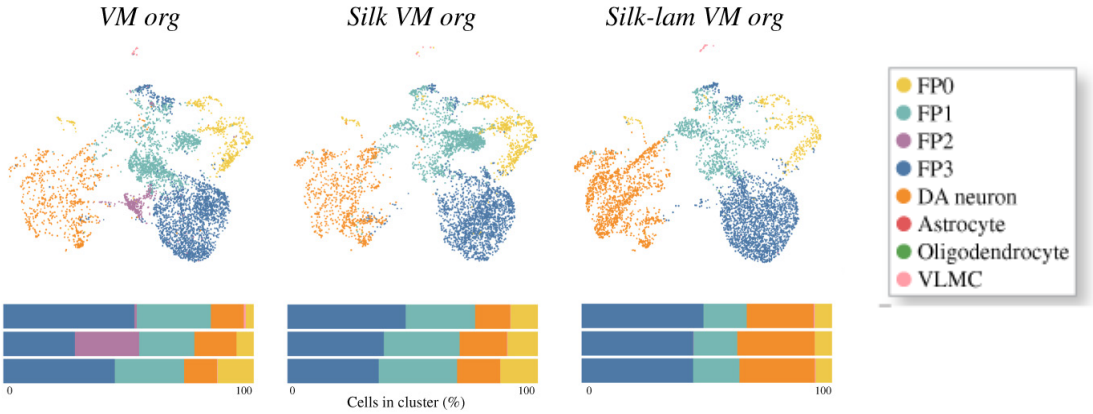
Efficient, reproducible and functional DA progenitor generation on Biolaminin 111



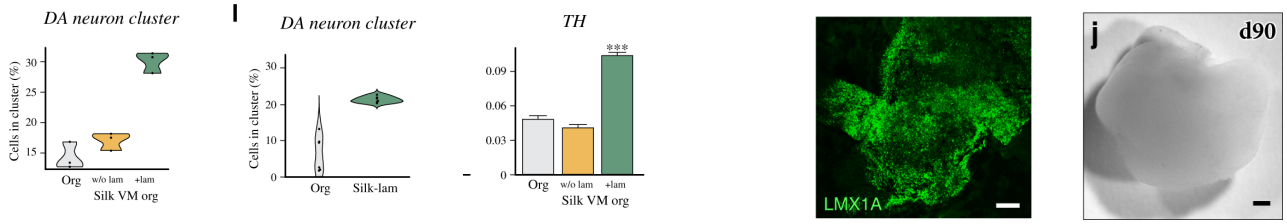
A) Biolaminin 111 in a clinically adaptable protocol delivers a 43-fold higher DA progenitor yield compared to EB-based methods. (Kirkeby et al. 2017) B) ICC images: High co-expression of FoxA2 (red) and Lmx1a (green) confirms purity and predictive marker alignment in differentiated cells. The survival, innervation and differentiation of the generated DA neurons after implantation into 6-OHDA lesioned animals, visualization by graft-derived TH+ fibers. (Kirkeby et al. 2017 & Nolbrant et al. 2017)

FIGURE 4

Efficient, stable and reproducible DA neuron differentiation in long-term organoids using Biolaminin 111-functionalized Biosilk (3D). (Fiorenzano et. al. 2021)



LN111-functionalized Biosilk organoids (Silk-lam VM org), show reproducible and high precence of DA neurons (orange) compared to Biosilk organoids without laminin (Silk VM org) and conventional Matrigel organoids after 1M.



LN111-functionalized Biosilk organoid have high and consistent presence of DA neurons in the organoids 1M (left) and 4M (right), (green bar), compared to Biosilk organoid (yellow) and conventional organoid (grey).

High Expression of VM marker TH at 1M of differentiation in LN111-functionalized Biosilk (green) D) ICC of VM marker, LMX1A (green) at 1M E) Long-term, 90 days, silk-VM organoid culture. Scale bar, 200 µm"

REFERENCES

Nolbrant et. al. Generation of high-purity human ventral midbrain dopaminergic progenitors for in vitro maturation and intracerebral transplantation. *Nat. Protocol* (2017)

Kirkeby et. al. Predictive Markers Guide Differentiation to Improve Graft Outcome in Clinical Translation of hESC-Based Therapy for Parkinson's Disease. *Cell Stem Cell* (2017)

Kirkeby et. al. Preclinical quality, safety, and efficacy of a human embryonic stem cell-derived product for the treatment of Parkinson's disease, STEM-PD. *Cell Stem Cell* (2023)

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