

CliniMACS Prodigy® Adherent Cell Culture System

Differentiation of human pluripotent stem cells into mesencephalic dopaminergic progenitor cells

Application

The CliniMACS Prodigy® Adherent Cell Culture System facilitates highly specific and efficient differentiation of human pluripotent stem cells (PSCs) into mesencephalic dopaminergic (mesDA) progenitor cells in large scale. This application sheet gives an overview of the entire process and quality control assays, and provides information about the required materials. In addition, it elucidates the setup of the tubing set CliniMACS Prodigy TS 730 and the performance data.

Specifications

Process capacity:	scalable
Number of PSCs for initial expansion:	1×10 ⁶ cells
Number of PSCs for differentiation:	approx. 5×10 ⁷ cells
Number of final mesDA progenitor cells:	approx. 3.8×10 ⁹ cells
Total process time:	21 days (5 days of expansion and 16 days of differentiation)
Total hands-on time:	approx. 12 h

Products

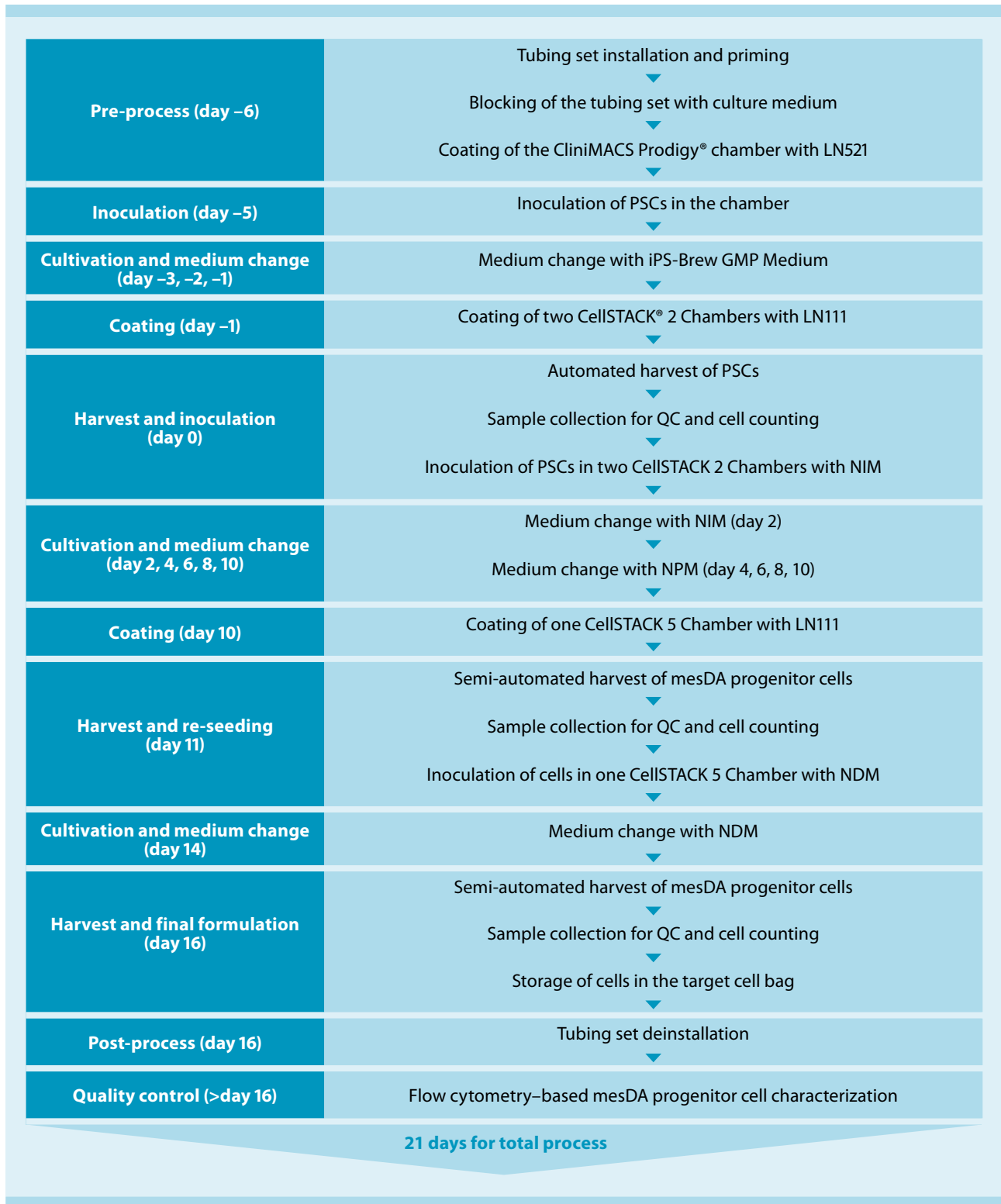
Consumables	Amount required
CliniMACS Prodigy® Instrument	1 piece
CliniMACS Prodigy TS 730	1 set
iPS-Brew GMP Medium	500 mL
MACS GMP Recombinant Human TGF-β1 (5 µg)	1 vial
CliniMACS® PBS/EDTA Buffer (700–29)	3 L
1 m Tube Extension	1 piece
3-way Tube Adapter	1 piece

Differentiation media ^{1,2}	Amount required
Neural induction medium (NIM) Containing: MACS® NeuroBrew®-21 w/o Vitamin A, N-2 Supplement, SB431542, human Noggin, human SHH (C24II), CHIR99021, Purmorphamine	1.5 L
Neural proliferation medium (NPM) Containing: MACS NeuroBrew-21 w/o Vitamin A, N-2 Supplement, SB431542, human Noggin, human SHH (C24II), CHIR99021, Purmorphamine	4 L
Neural differentiation medium (NDM) Containing: MACS NeuroBrew-21 w/o Vitamin A, Human FGF-8b, Human BDNF, L-Ascorbic acid 2-phosphate	3 L

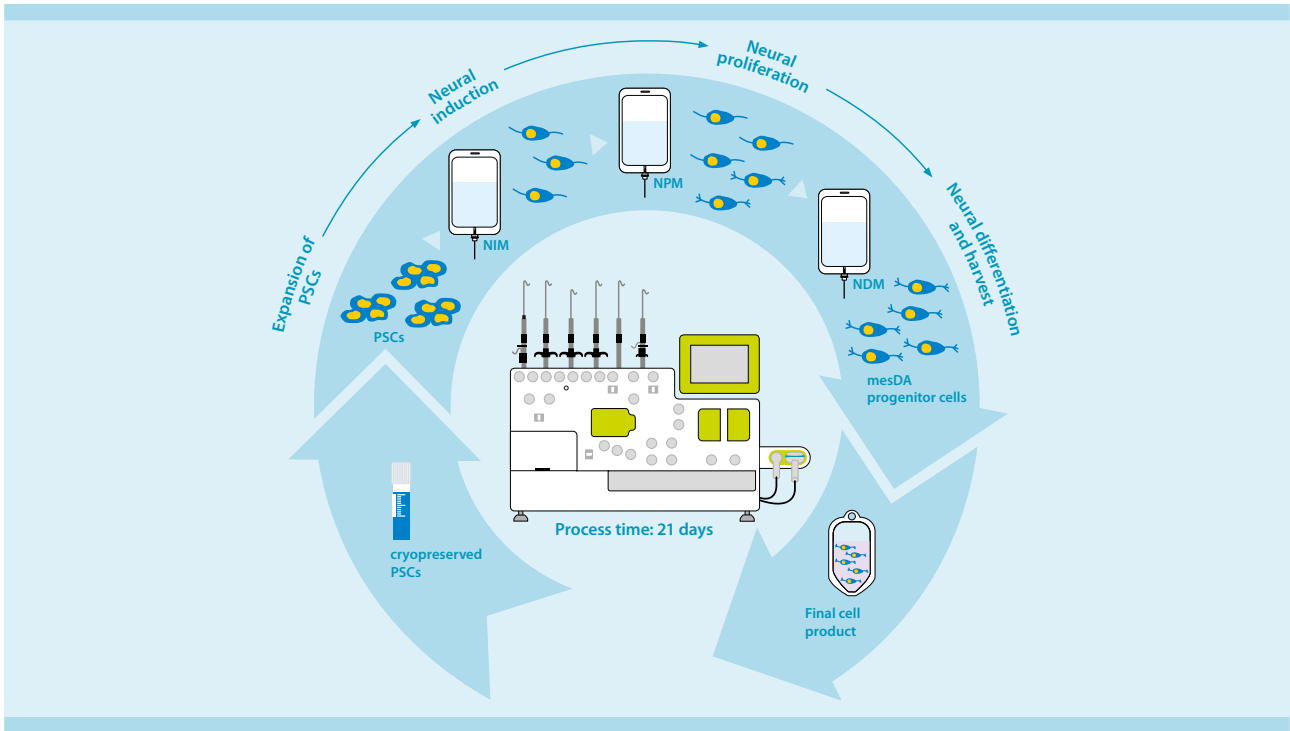
Additional materials	Amount required
Corning® CellSTACK® accessories, fill cap, 3.2 mm I.D. tubing, female Luer Lock with male Luer plug	3 pieces
Corning CellSTACK 5 Chamber	1 piece
Corning CellSTACK 2 Chamber	2 pieces
Corning 1000 mL Easy Grip Polystyrene Storage Bottles with Dip Tube, with 0.2 µm MLL/FLL Filter*	10 pieces
Flexboy® Bag 50 mL, Inlet: Luer Lock male + cap, Outlet: Luer Lock female + cap, Sartorius	3 pieces
Flexboy Bag 500 mL, Inlet: Luer Lock male + cap, Outlet: Luer Lock female + cap, Sartorius	3 pieces
CTS™ TrypLE™ Select Enzyme, 100 mL, Thermo Fisher	500 mL
Defined Trypsin Inhibitor, 100 mL, Thermo Fisher	300 mL
Biolaminin 521 LN (LN521), 100 µg, BioLamina	2 vials
Biolaminin 111 LN (LN111), 500 µg, BioLamina	12 vials

*Used as alternative vessels for iPS-Brew GMP Medium and differentiation medium

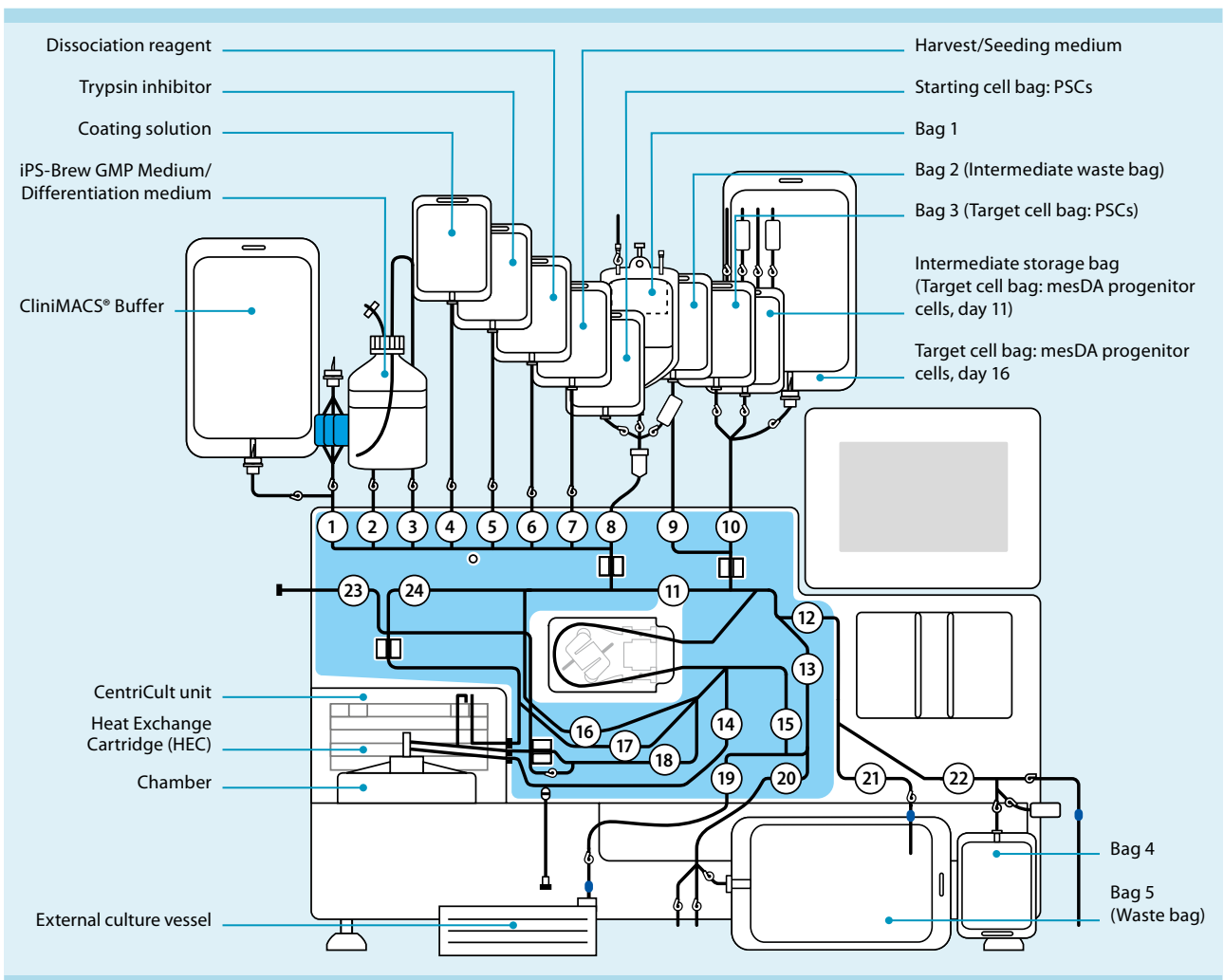
Process overview for mesDA progenitor cell differentiation



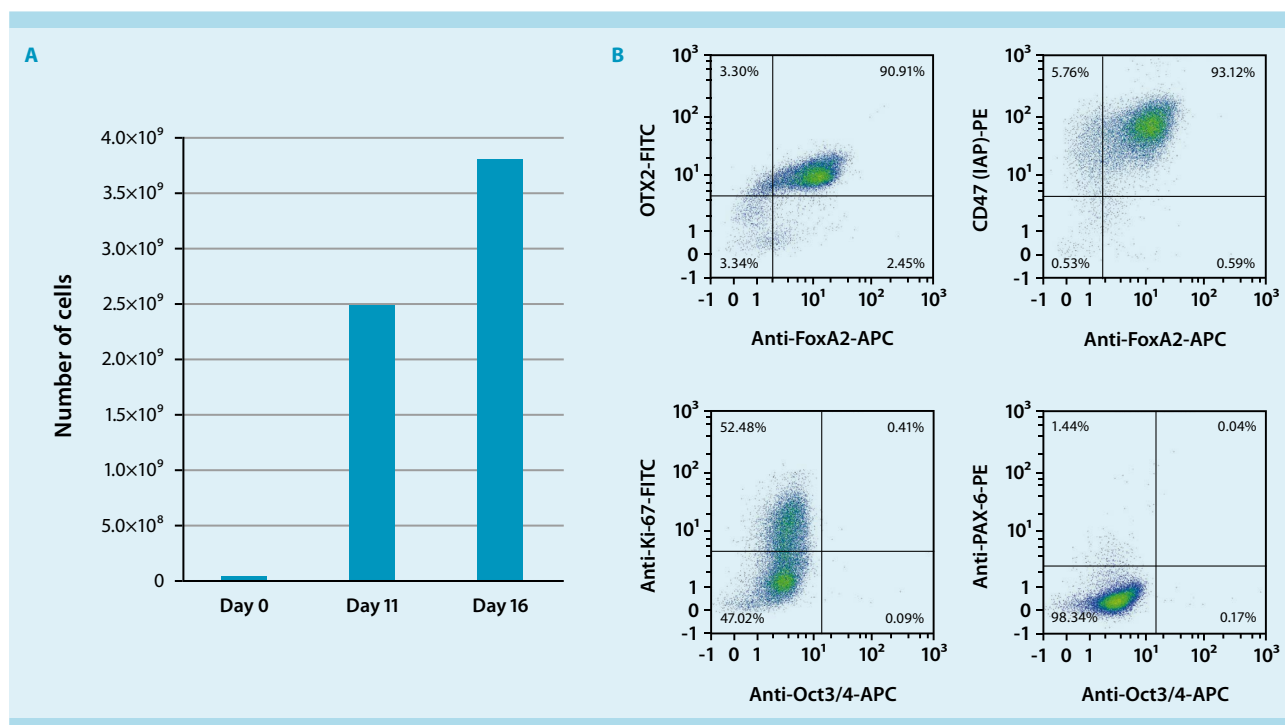
Principle of the mesDA progenitor cell differentiation process using the CliniMACS Prodigy®



CliniMACS Prodigy TS 730 setup for mesDA progenitor cell differentiation



Performance data



1×10⁶ human PSCs were expanded in the CliniMACS Prodigy® chamber for 5 days in iPS-Brew GMP Medium. Differentiation into mesDA progenitor cells took place in two Corning® CellSTACK® 2 Chambers from day 0 to day 11 (in NIM from day 0 to day 4, and in NPM from day 4 to day 11), and in one Corning CellSTACK 5 Chamber in NDM from day 11 to day 16 using the CliniMACS Prodigy Adherent Cell Culture System. (A) Approx. 5×10⁷ PSCs were used for the differentiation into mesDA progenitor cells (day 0). After 16 days of differentiation, approx. 3.8×10⁹ mesDA progenitor cells could be harvested. (B) Flow cytometry–based quality control analysis demonstrated that over 90% of the processed cells expressed markers specific for mesDA progenitor cells (FoxA2, OTX2, and CD47). In contrast, cells positive for the dorsal brain marker PAX-6 and the PSC marker Oct3/4 were lacking. The number of cells expressing the proliferation marker Ki-67 was also reduced.

References

1. Kirkeby, A. *et al.* (2017) Predictive Markers Guide Differentiation to Improve Graft Outcome in Clinical Translation of hESC-Based Therapy for Parkinson's Disease. *Cell Stem Cell* 20: 135–148.
2. Lehnen, D. *et al.* (2017) IAP-Based Cell Sorting Results in Homogeneous Transplantable Dopaminergic Precursor Cells Derived from Human Pluripotent Stem Cells. *Stem Cell Reports* 9: 1207–1220.



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In the EU, the CliniMACS System components are available as CE-marked medical devices for their respective intended use, unless otherwise stated. The CliniMACS Reagents and Biotin Conjugates are intended for *in vitro* use only and are not designated for therapeutic use or direct infusion into patients. The CliniMACS Reagents in combination with the CliniMACS System are intended to separate human cells. Miltenyi Biotec as the manufacturer of the CliniMACS System does not give any recommendations regarding the use of separated cells for therapeutic purposes and does not make any claims regarding a clinical benefit. For the manufacturing and use of target cells in humans the national legislation and regulations – e.g. for the EU the Directive 2004/23/EC ("human tissues and cells"), or the Directive 2002/98/EC ("human blood and blood components") – must be followed. Thus, any clinical application of the target cells is exclusively within the responsibility of the user of a CliniMACS System.

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