

# Bio-inspired engineering of a perfusable culture platform for guided three-dimensional nerve cell growth and differentiation†

Zihou Wei,<sup>a,b,‡</sup> Tao Sun,<sup>a,b,‡</sup> Shingo Shimoda,<sup>d</sup> Zhe Chen,<sup>c</sup> Xie Chen,<sup>a,b</sup> Huaping Wang,<sup>a,b</sup> Qiang Huang,<sup>a,b</sup> Toshio Fukuda,<sup>a,b,c</sup> Qing Shi,<sup>\*a,b,c</sup>

† These authors contributed equally to this work.

\* Corresponding author. E-mail: shiqing@bit.edu.cn

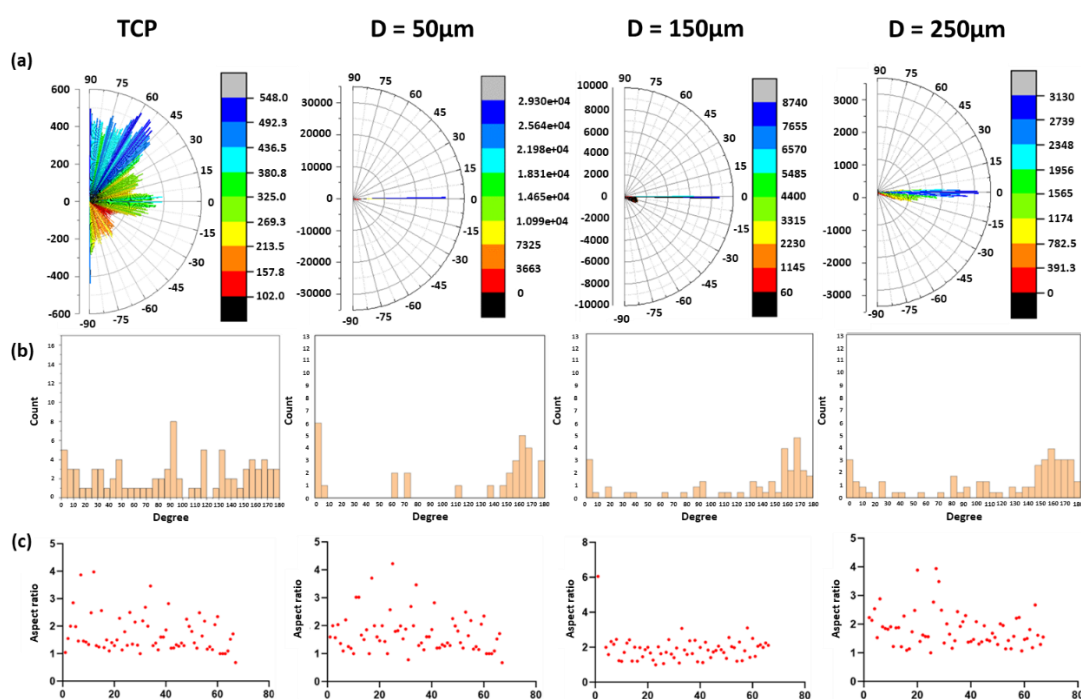


Fig.S1 Evaluation of the extent of orientation about cells 3D cultured in the microtube with different diameters (50µm, 150µm, 250µm), compared with cells 2D cultured on the tissue culture plates (TCP). (a) Polar histogram of the neurites' orientation angles; (b) Histogram of the nucleus orientation angle; (c) Scatter diagram of the nuclear aspect ratio.

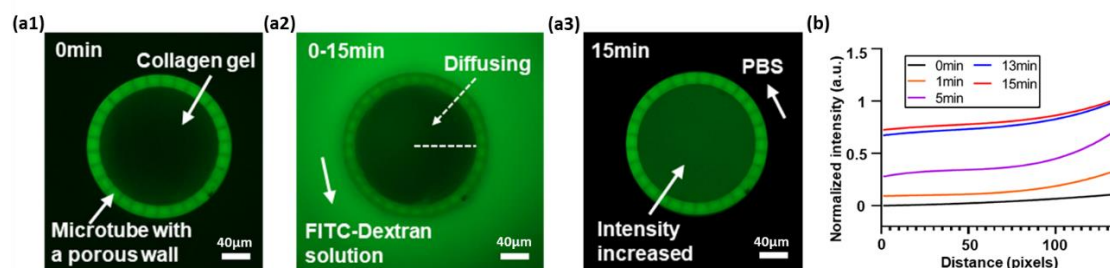


Fig.S2 (a1), (a2), (a3) The process of diffusion experiment; (b) The evolution of the intensity profiles along the dot line (marked in Fig.S2 (a2)).

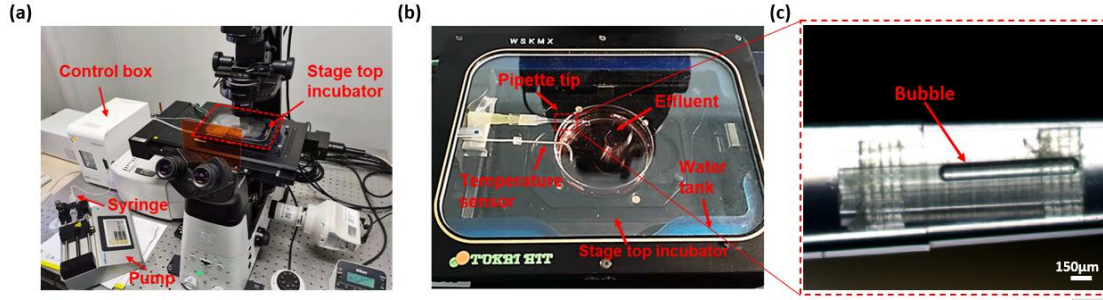


Figure S3. (a) Overview of the perfusion culture platform; (b) The perfusion culture apparatus set-up in the stage top incubator; (c) An image taken during perfusion.

**Table S1. List of the parameters of simulation model**

Symbol	Parameter	Value
$D_g$	Glucose diffusivity	$1.0 \times 10^{-9}$ (m <sup>2</sup> /s)
$R$	Glucose consumption rate	$8 \times 10^{-3}$ (kg/(m <sup>3</sup> ·s))
$C$	Glucose concentration in the culture medium	4.5 (kg/m <sup>3</sup> )
$\varepsilon_c$	Porosity of the collagen gel	90%
$K_c$	Permeability of the collagen gel	$10^{-14}$ (m <sup>2</sup> )
$\rho$	Culture medium density	0.893 (g/cm <sup>3</sup> )
$\mu$	Culture medium viscosity	$8.3 \times 10^{-3}$ (g/(cm·s))
$q$	Volume flow rate of the perfusion medium	$5 \times 10^{-12}$ (m <sup>3</sup> /s)
$\gamma$	Mobility	50 (m·s/kg)
$\varepsilon_i$	Interface thickness	$6.5 \times 10^{-6}$ (m)
$\sigma$	Surface tension coefficient	72.92 (mN/m)
$\vartheta$	Contact angle	10 (°)
$p_0$	Atmospheric pressure	101.325 (kPa)
$g$	Gravity acceleration	9.8 (m/s <sup>2</sup> )
$r$	Radius of the microtube	75 (µm)
$h$	Height of the microtube	2 (mm)
$D_d$	Diffusion coefficient of the gas molecules	$1.8 \times 10^{-9}$ (m <sup>2</sup> /s)
$k_H$	Henry constant	$7.3 \times 10^7$ (Pa·kg/mol)
$M$	Molar mass of the gas	$2.9 \times 10^{-2}$ (kg/mol)
$R$	Universal gas constant	8.314 (J/(mol·K))
$T$	Absolute temperature	298.15 (K)

**Table S2. The statistical results of the cell viability of PC12 cells in the static and perfusable culture condition.**

Day1/static	Day1/perfusable	Day7/static	Day7/perfusable
Live/Dead=1808/287 Cell viability=86.3%	Live/Dead=4104/275 Cell viability=94%	Live/Dead=3415/612 Cell viability=85%	Live/Dead=3484/871 Cell viability=81.6%
Live/Dead=2264/249 Cell viability=90%	Live/Dead=1581/251 Cell viability=86.2%	Live/Dead=1438/604 Cell viability=70.4%	Live/Dead=5190/846 Cell viability=85.2%
Live/Dead=3895/261 Cell viability=93.7%	Live/Dead=2200/242 Cell viability=91%	Live/Dead=1141/609 Cell viability=58.2%	Live/Dead=9827/855 Cell viability=91.7%

Mean±SD=90%±3%	Mean±SD=90%±3%	Mean±SD=71.2%±8%	Mean±SD=86.2%±6%
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