RegMedNet
Spotlight

iPSC expansion and differentiation: current landscapes and future development

What area are you working in?

Area	%
Regenerative medicine or cell therapy	53.8%
Disease modeling	24.5%
Drug discovery or testing	14.3%
Other	4.8%
Clinical medicine	2.7%

What type of transplantation are your projects aimed at?

Type	%
Autologous	36.4%
Allogeneic	41.7%
Xenogeneic	9.9%
NA	11.9%

What starting cells do you use?

Starting cells	%
Liver and stomach cells	2.1%
Keratinocytes	3.6%
Dental tissue	3.6%
Neural cells	4.6%
Epithelial cells	6.2%
Other	7.2%
Dermal fibroblasts	13.3%
Adipose cells	17.4%
Cord blood or other perinatal source	17.9%
Peripheral blood mononuclear cells (PBMCs)	24.1%

At what stage(s) of the translational cell therapy workflow are your current research projects?

Stage	%
Discovery/basic research studies	50.0%
Preclinical	31.1%
Early-phase clinical trial	10.8%
Late-phase clinical trial	4.1%
Marketed product	4.1%

What cells are you generating from your iPSCs?

Cells	%
Neural and progenitor cells	23.9%
Immune and progenitor cells	8.7%
Cardiac and progenitor cells	13.0%
Hepatic and progenitor cell	7.6%
Others, including renal cells, retinal pigment epithelial cells and fibroblasts	30.4%
Keratinocytes and progenitors	4.3%
Osteogenic and progenitor cells	4.3%
A variety of cells	4.3%
Chondrogenic and progenitor cells	3.3%

What method do you use to differentiate your iPSCs?

Method	%
Structural support	13.1%
Growth and differentiation factors	43.1%
Change in culture conditions (e.g. FBS)	20.0%
Hormonal factors	9.4%
Transcription factors	11.3%
Other	3.1%

Which statement best describes how you feel about using off-the-shelf vs. customized iPSCs?

Statement	%
I feel it is critical to have my proprietary GMP iPSC Master cell bank, but I can start from existing, already reprogrammed iPSC cells	21.3%
I feel it is critical to have customized process for proprietary GMP differentiated cells	17.5%
I can use off-the-shelf GMP iPSC master cell bank vials, as my product is the differentiated cells anyway	16.3%
I feel it is critical to have my proprietary GMP iPSC master cell bank, made by reprogramming cells from a donor that matches my selection criteria	37.5%
I can use of-the-shelf GMP differentiated cells as my starting material	7.5%

What process parameters are important for you?

Parameter	%
Lactate	9.2%
Glucose	16.0%
Aggregate size	15.6%
Stirring speed	6.5%
Temperature	18.3%
Dissolved oxygen	14.5%
Other	1.5%
pH	18.3%

Which platform/system do you use for your iPSC cultivation?

Platform	%
Flask	50.5%
Cell stack	18.7%
Roller bottle	6.5%
Bioreactor	18.7%
Other	5.6%

How do you validate iPSC differentiation?

Method	%
Proteomics	0.0%
Epigenetic studies	4.0%
Antigen assessment	4.0%
Other	8.0%
Cell culture phase contrast microscopy	16.0%
Gene expression profiling	20.0%
Immunoflorescence	20.0%
FACS	28.0%

How do you control differentiation?

Method	%
Passaging	57.5%
Factor withdrawal	42.5%

What expansion conditions do you use?

Condition	%
Standard serum	22.8%
Knockout serum replacement	25.3%
Feeder-free media	51.9%

Over what timeframe does your expansion take place? (%) / Over what timeframe does your differentiation take place? (%)

Timeframe	Expansion	Differentiation
1-2 weeks	25.0	19.1
2-4 weeks	47.1	41.2
4-8 weeks	11.8	23.5
8-12 weeks	10.3	8.8
16 weeks or more	5.9	7.4

Which statement about GMP most applies to you?

Statement	%
Our laboratory and protocols are GMP-compliant and have been for >5 years	10.8%
Our laboratory and protocols are GMP-compliant and have been for >1 years	21.5%
Our laboratory and protocols are GMP-compliant and have been for <1 years	4.6%
Our laboratory and protocols are not yet GMP-compliant but method transfer or development has started	44.6%
Our laboratory and protocols are not yet GMP-compliant and we have no plans to change this	18.5%

What are the biggest challenges in iPSC differentiation and expansion?

Challenge	%
Availability of starting cells	9.1%
Low efficiency of differentiation	17.3%
Incomplete differentiation	5.2%
Removal of transgenes	3.5%
Transgene effects	0.9%
Cell density	10.0%
Neoplastic development due to aberrant transcription factor expression	2.6%
Genetic and epigenetic instability	7.4%
Avoiding senescence in expanded cells	5.6%
Lack of skill or knowledge	6.1%
Large scale differentiation	12.1%
Large scale expansion of differentiated cells	10.4%

What is the future for GMP-grade iPSC lines?

"an increasingly crowded market"

"standards will converge until [GMP-grade iPSC cell lines] are a high-quality, uniform commodity"

"usage in allogeneic therapeutics"

"regulated under an FDA Master File"

Should companies invest in generating their own lines, or is there an opportunity for a centralized repository of iPSC lines?

Answer	%
No, investment should be put towards a centralized repository of iPSC lines	57.9%
Yes, companies should invest in their own lines	42.1%

About the respondents

Location (%)

Location	%
N America	40.6%
Europe	34.4%
Asia	18.8%
S America	3.1%
ROW	3.1%

Job title

Job title	%
Scientist	45.3%
Director/CEO/VP	14.1%
Manager/group leader	18.8%
Medical doctor/surgeon/clinician	6.3%
Student	6.3%
Other	9.4%

Scientific area

Scientific area	%
Biotechnology company	26.6%
Medical device company	3.1%
Academic	40.6%
Pharmaceutical company	6.3%
Medical facility or biobank	12.5%
Other	10.9%

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This infographic was created as part of the RegMedNet Spotlight on iPSC expansion and differentiation