

January 28, 2020, National Academies of Sciences, Engineering & Medicine, Washington, DC.

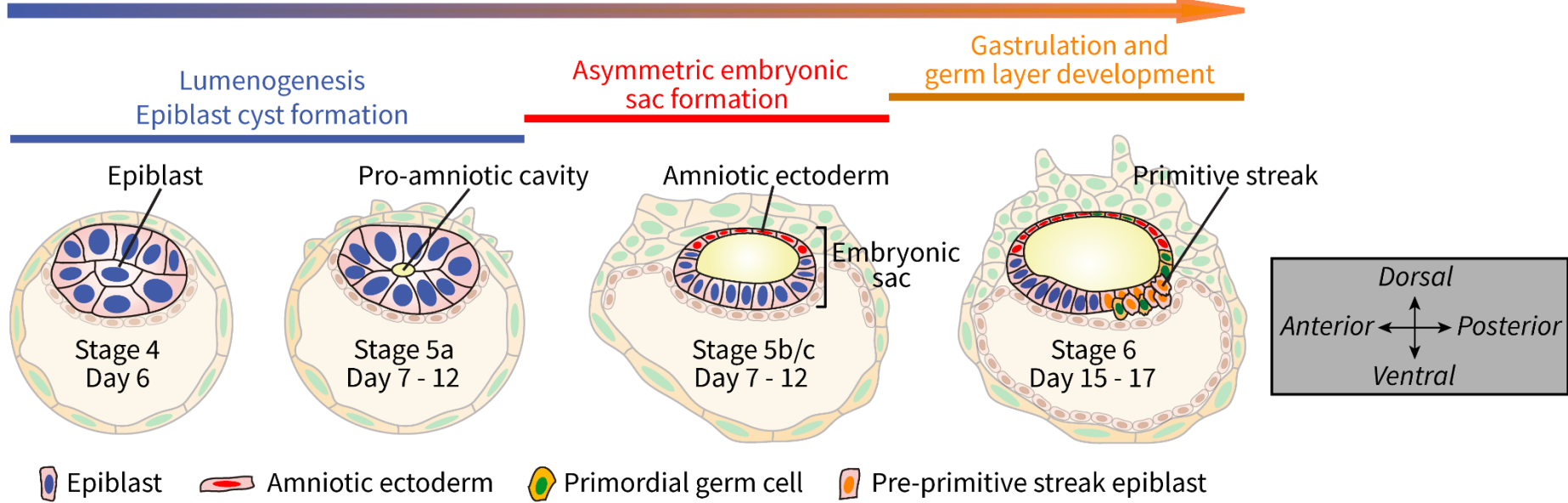
Stem Cell Models of Peri-Implantation Human Development

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Peri-Implantation Human Embryonic Development

Post-implantation human embryonic development (mid-sagittal view)



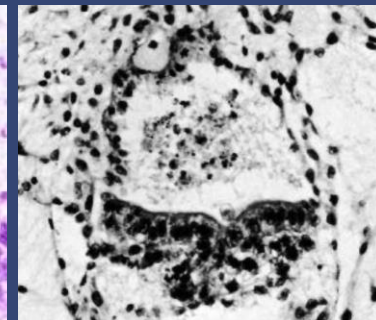
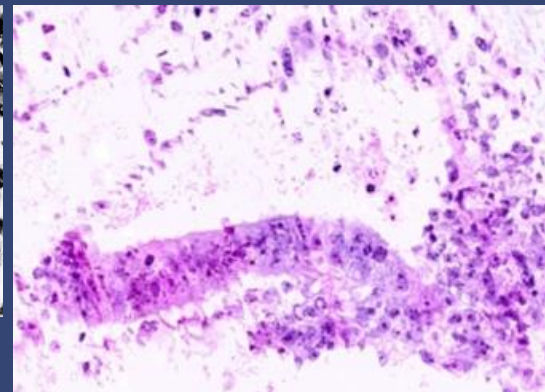
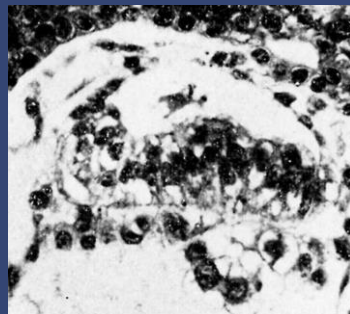
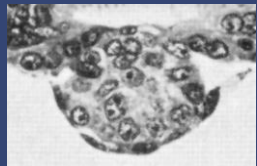
Stage 4

Stage 5a

Stage 5b/c

Stage 6

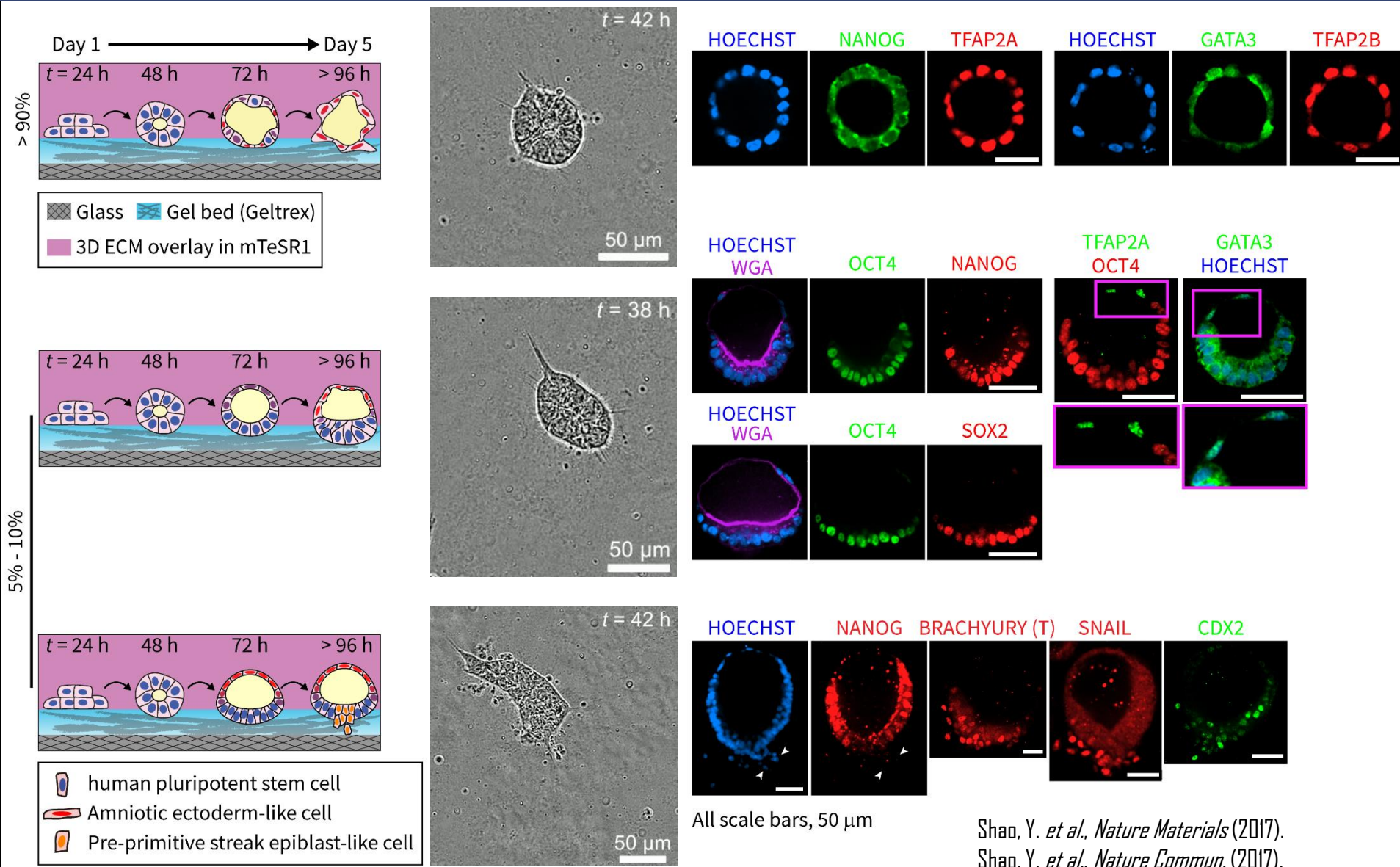
Stage 6



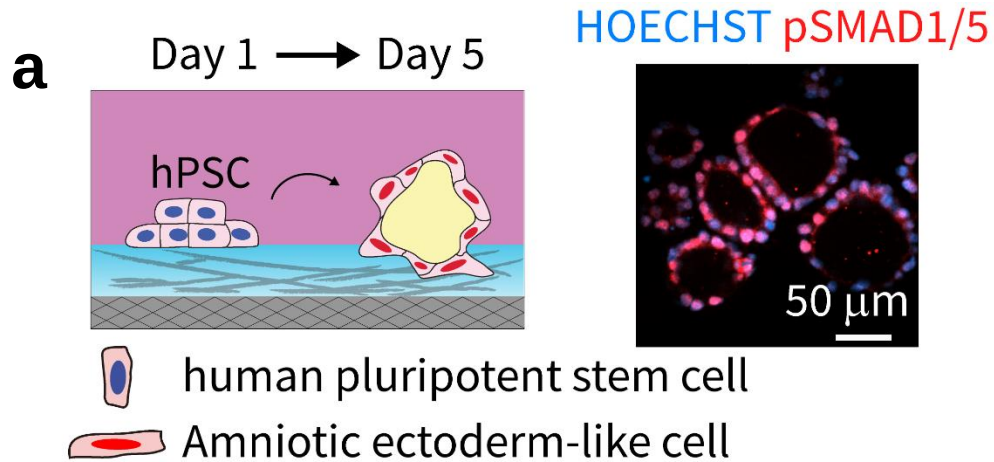
Mid-sagittal plane

Transverse plane
at posterior end

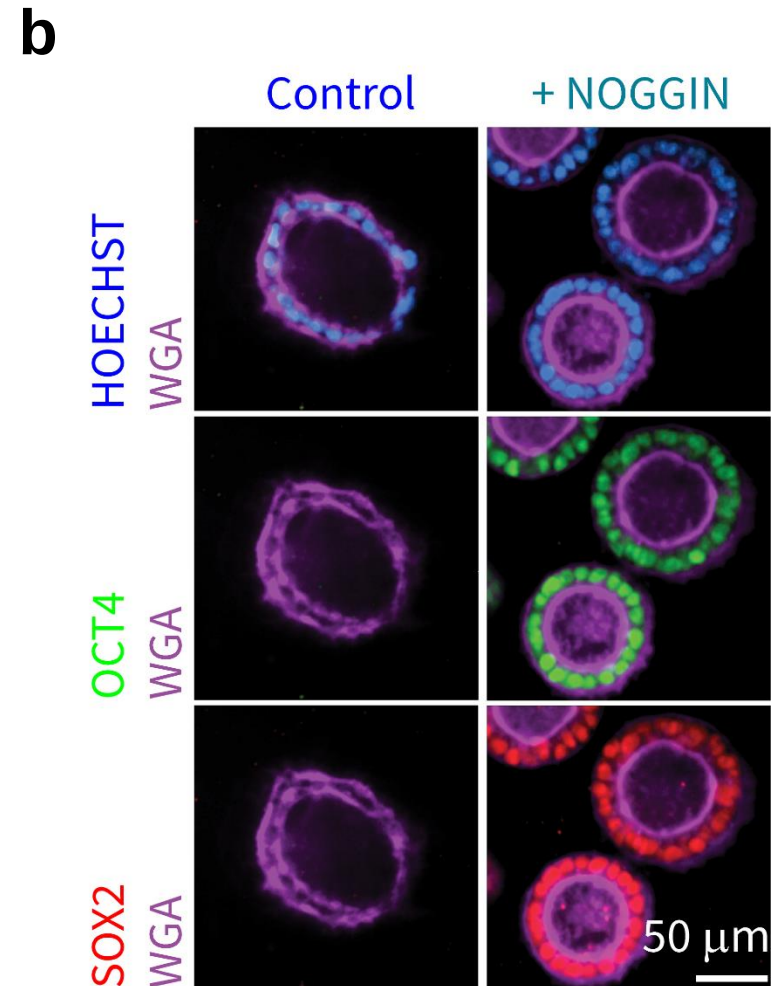
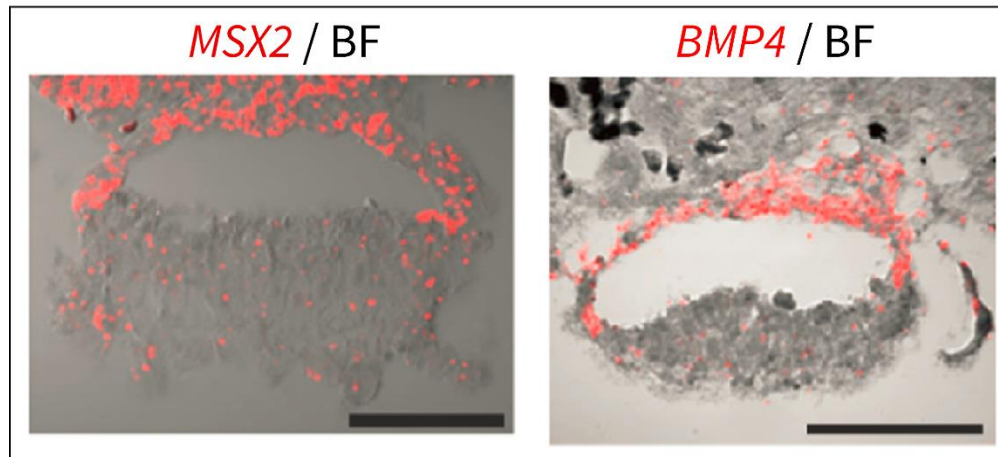
Self-Organized Development of Stem Cell Models of Peri-Implantation Human Development

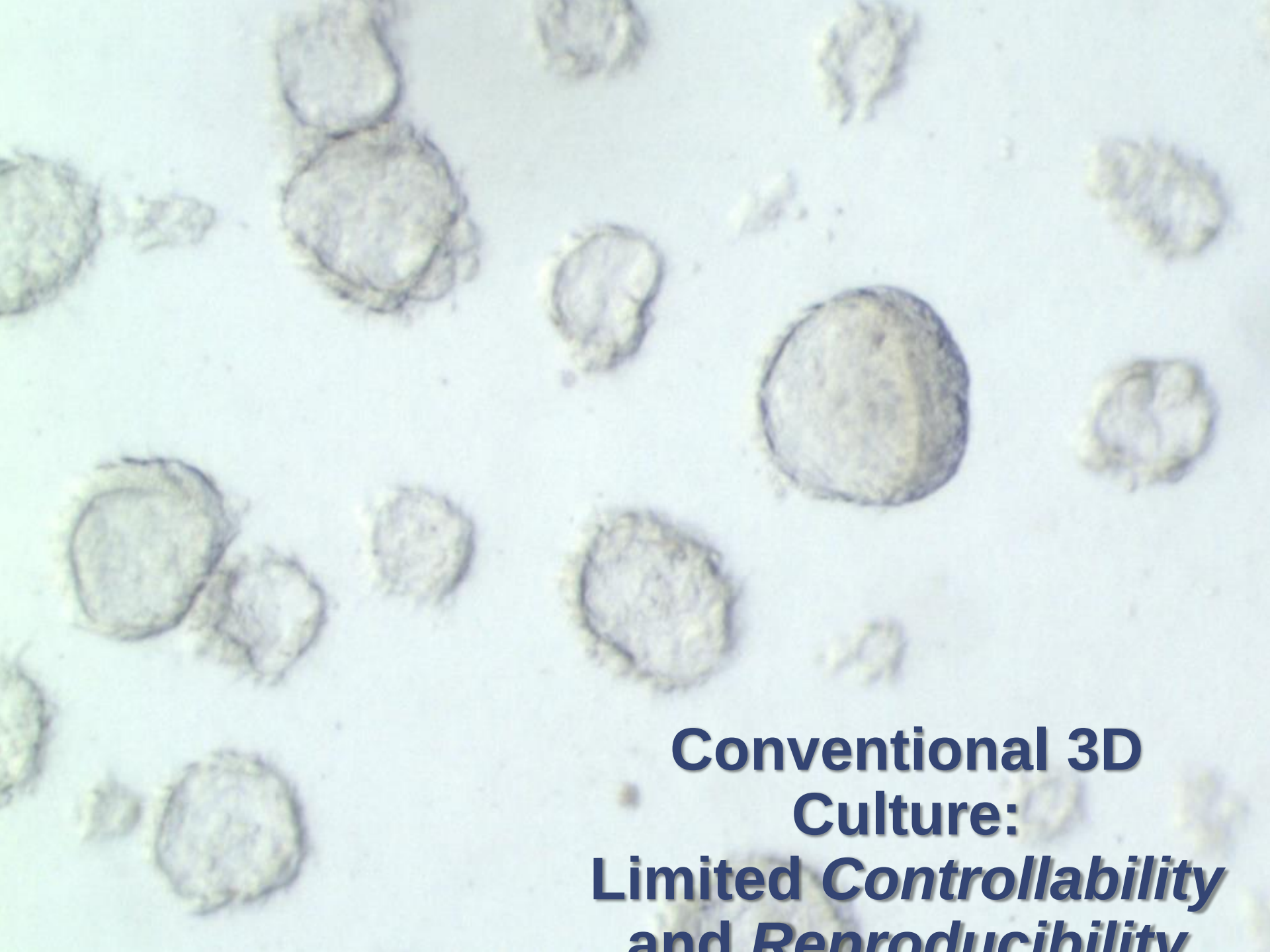


Autonomous BMP Signaling Drives Amniotic Differentiation



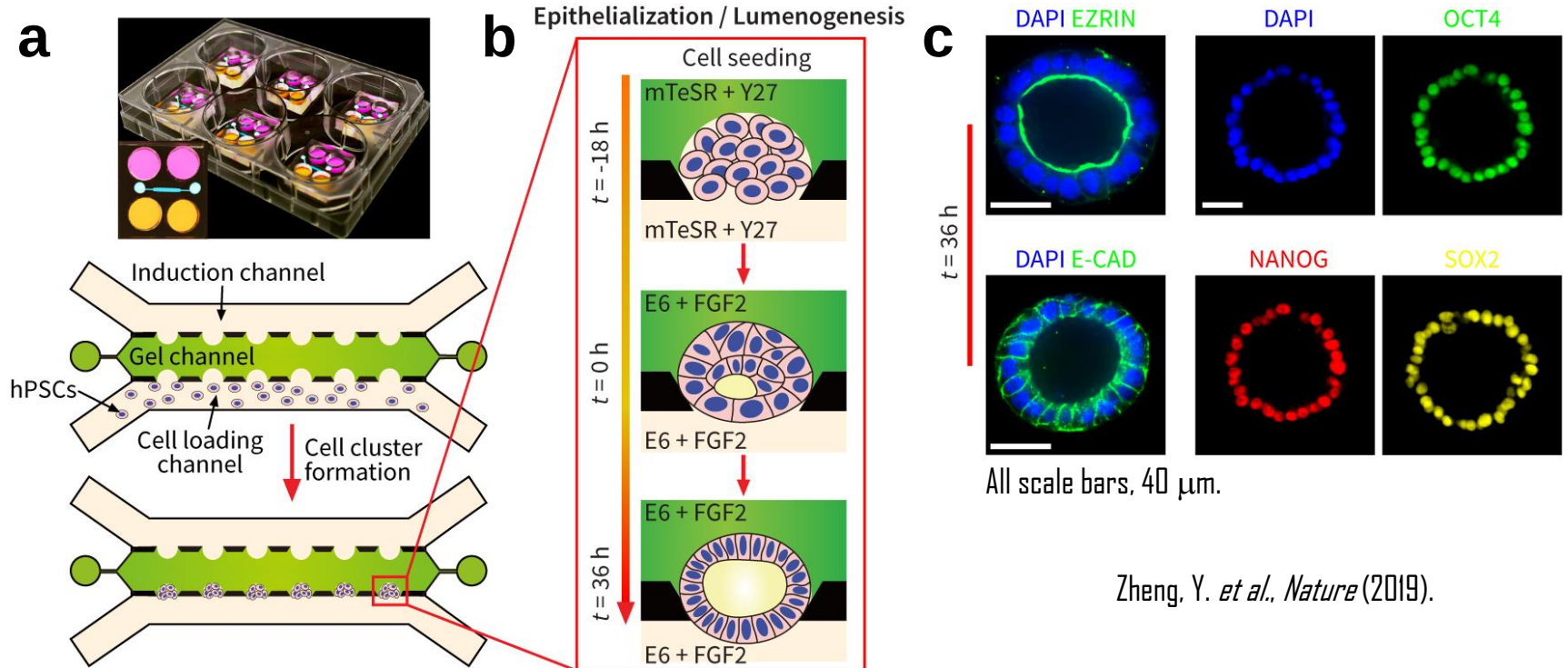
Pre-gastrulation monkey embryonic sac (E11)
(Sasaki, K. *et al.*, *Dev. Cell*, 2016)



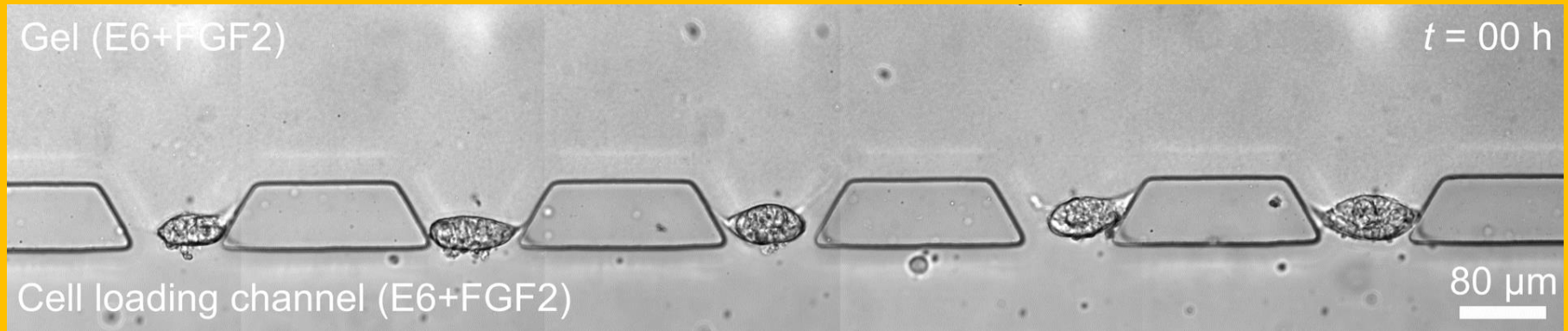


**Conventional 3D
Culture:
Limited *Controllability*
and *Reproducibility***

Controlled Microfluidic Modeling of Human Embryo Development

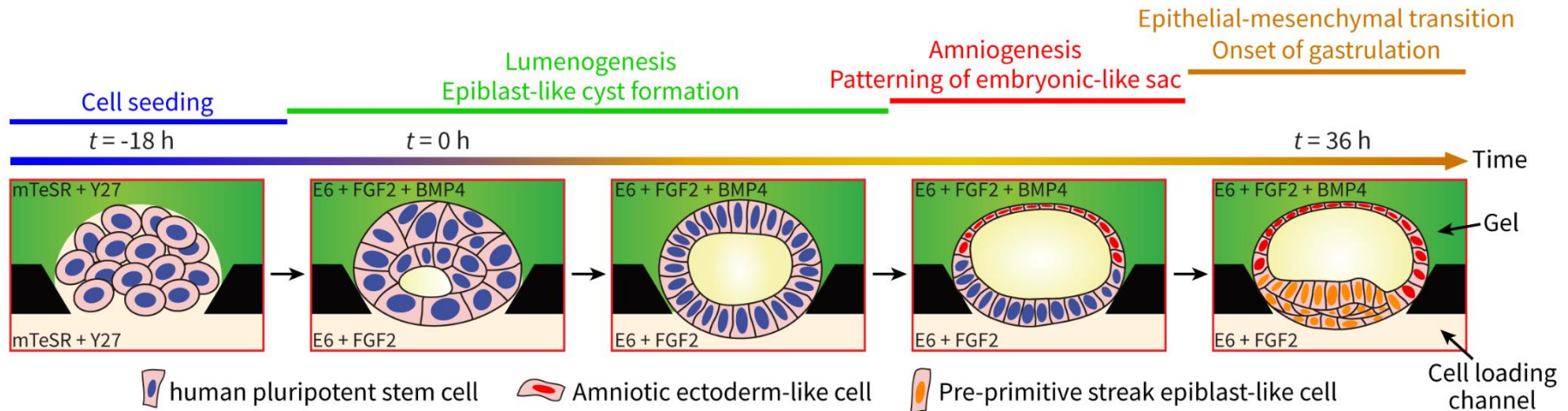


Formation of epiblast-like cyst and its movement into 3D gel

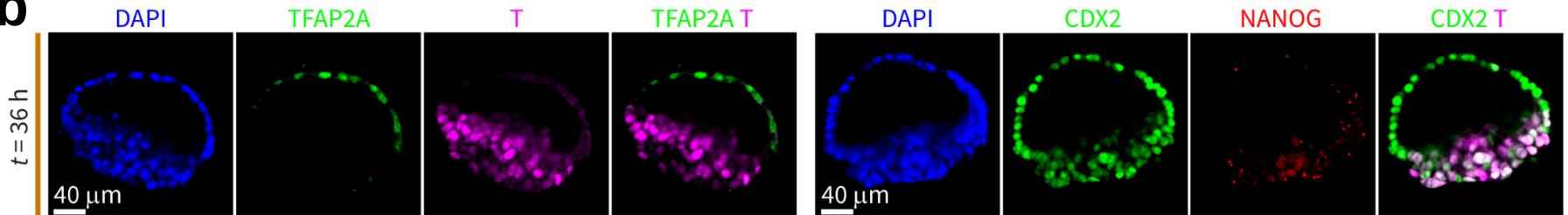


Asymmetric BMP Stimulation Induces Embryonic-Like Sac Formation

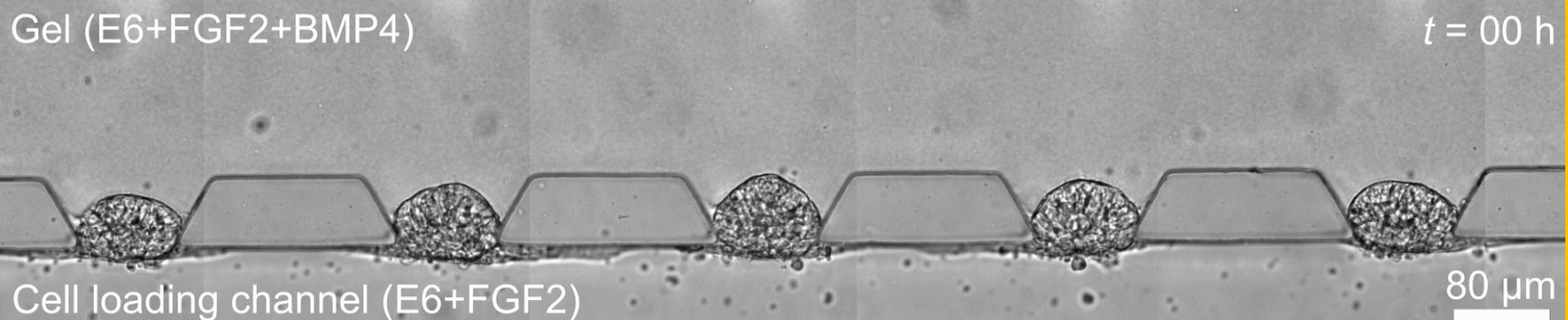
a



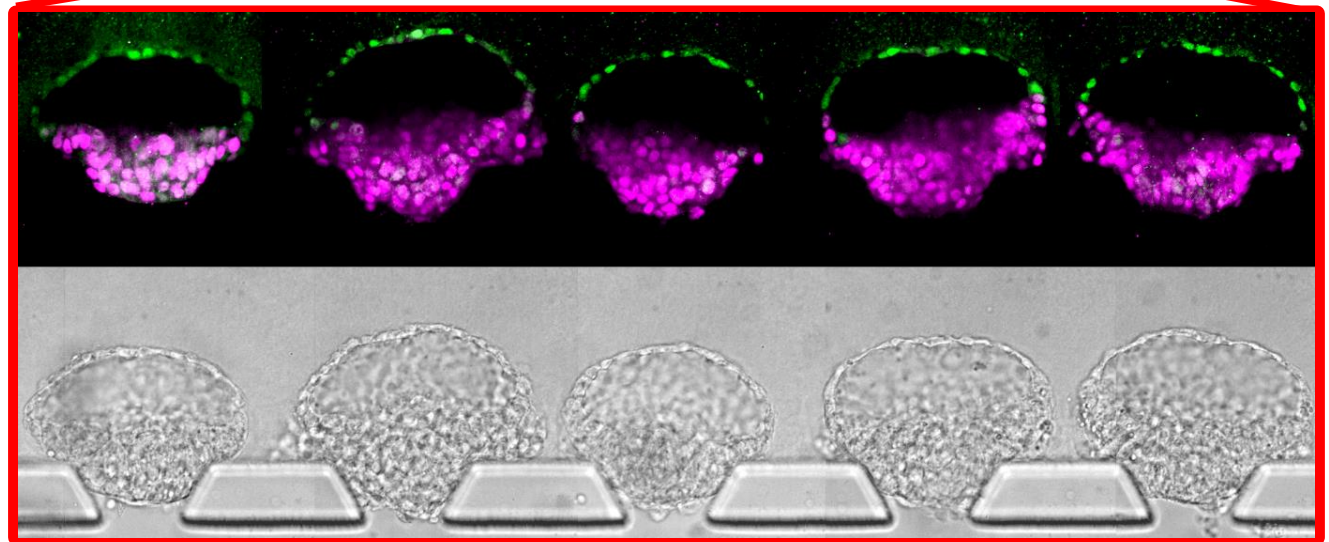
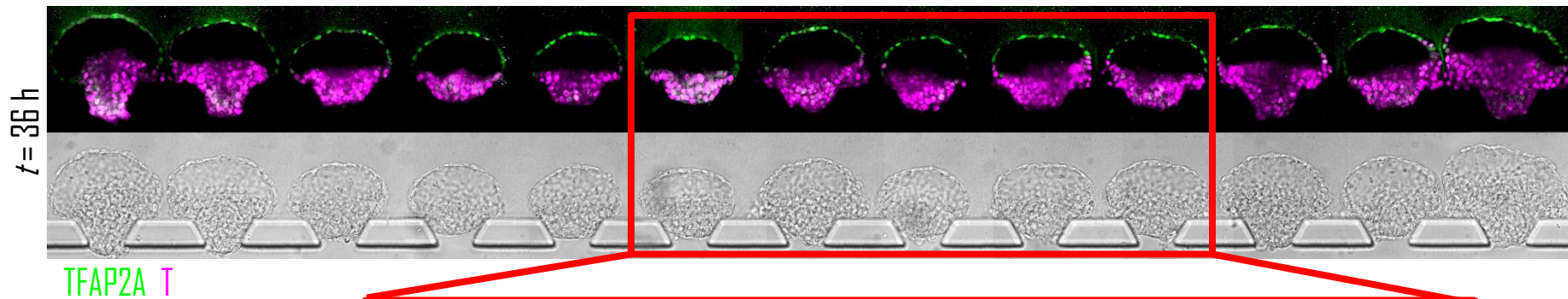
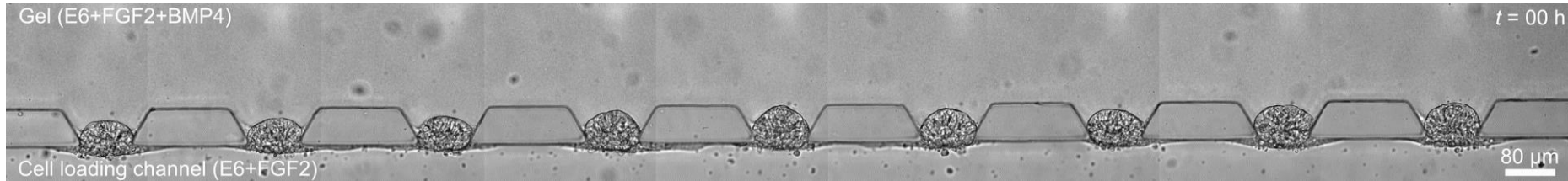
b



Development of embryonic-like sac



Superior Controllability, Reproducibility and Scalability

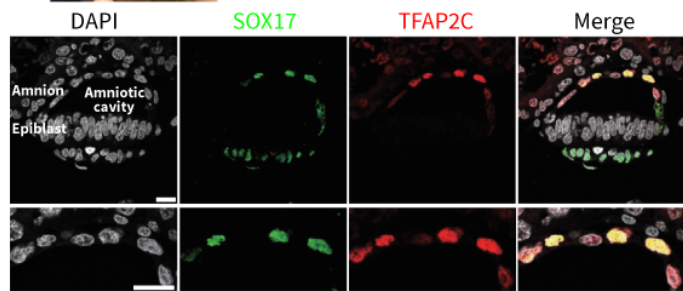


Emergence of Primordial Germ Cell-Like Cells in Embryonic-Like Sac



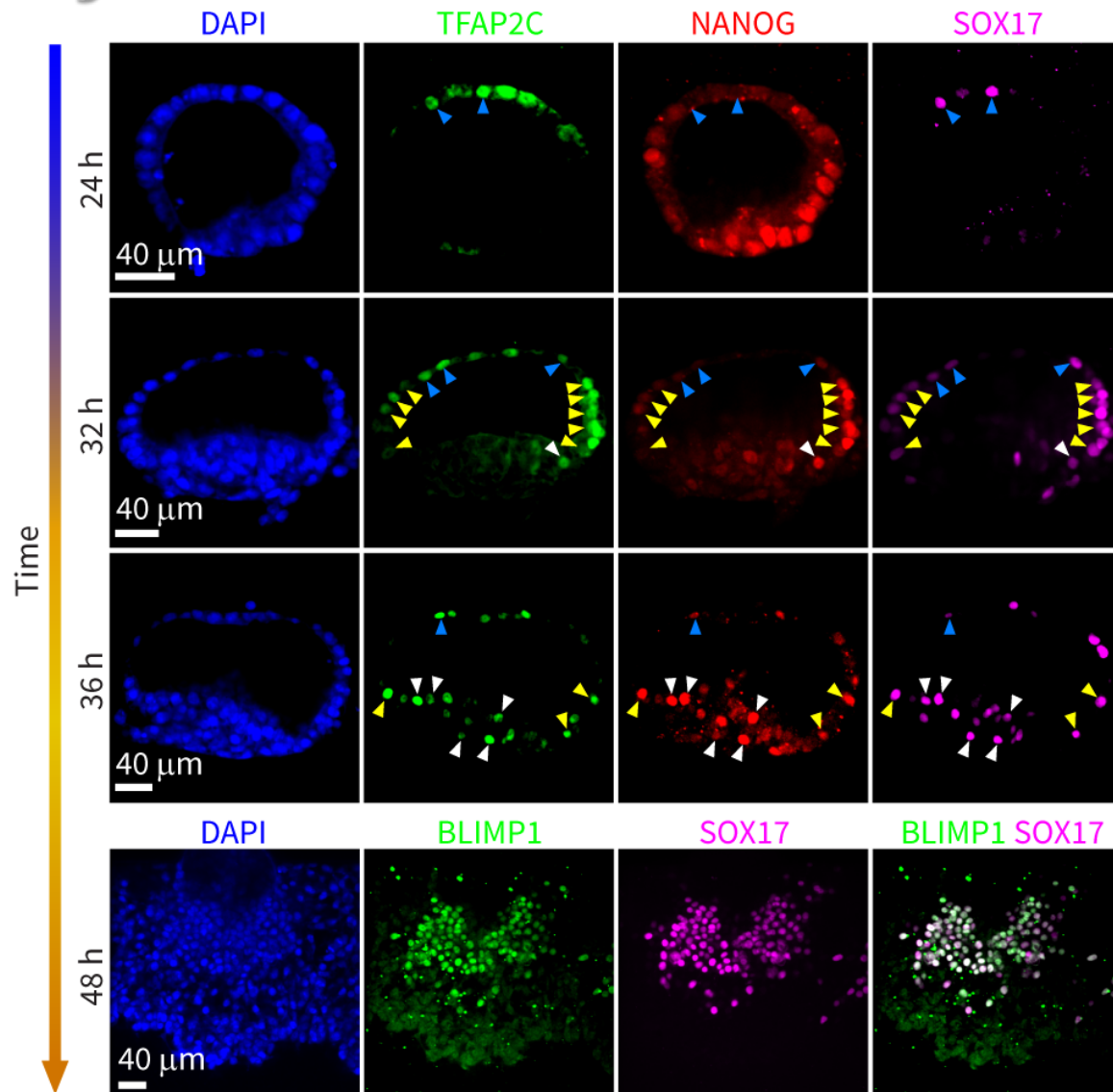
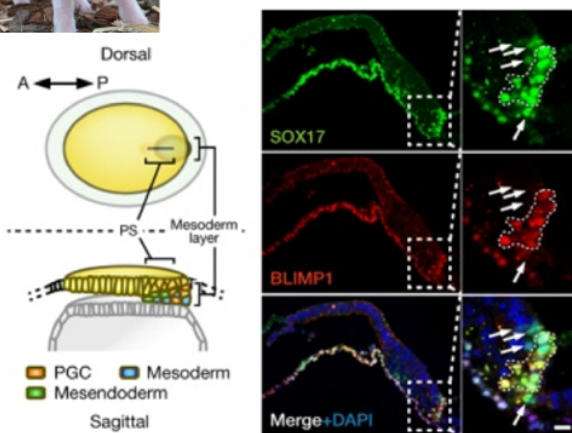
Emergence of PGCs in E11, pre-PS monkey embryo

(Sasaki, K. et al., *Dev. Cell*, 2016)

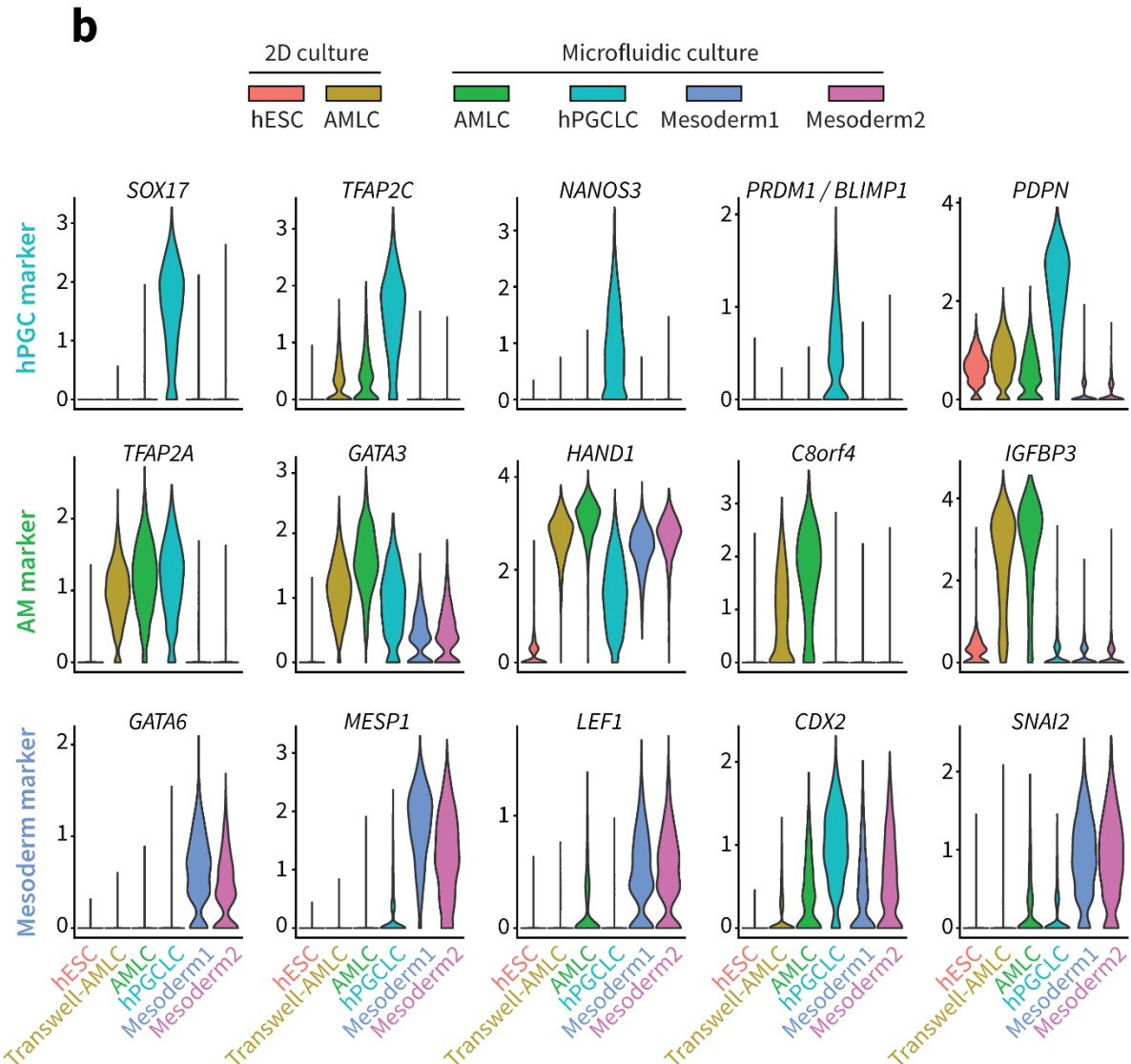
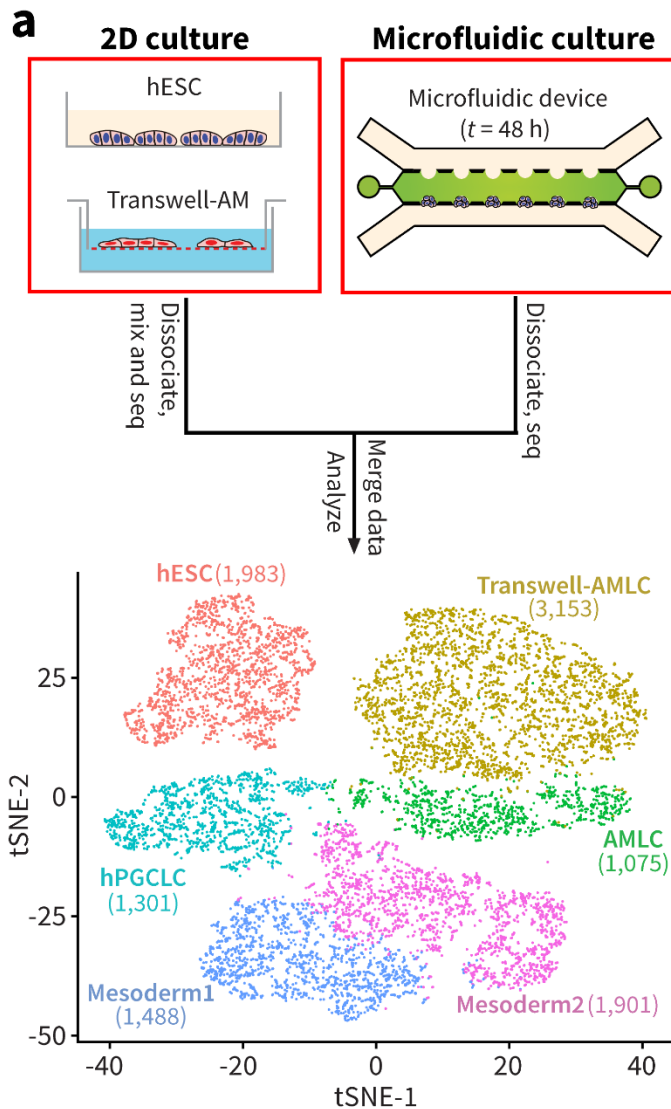


Emergence of PGCs in E11.5-12, early-PS porcine embryo

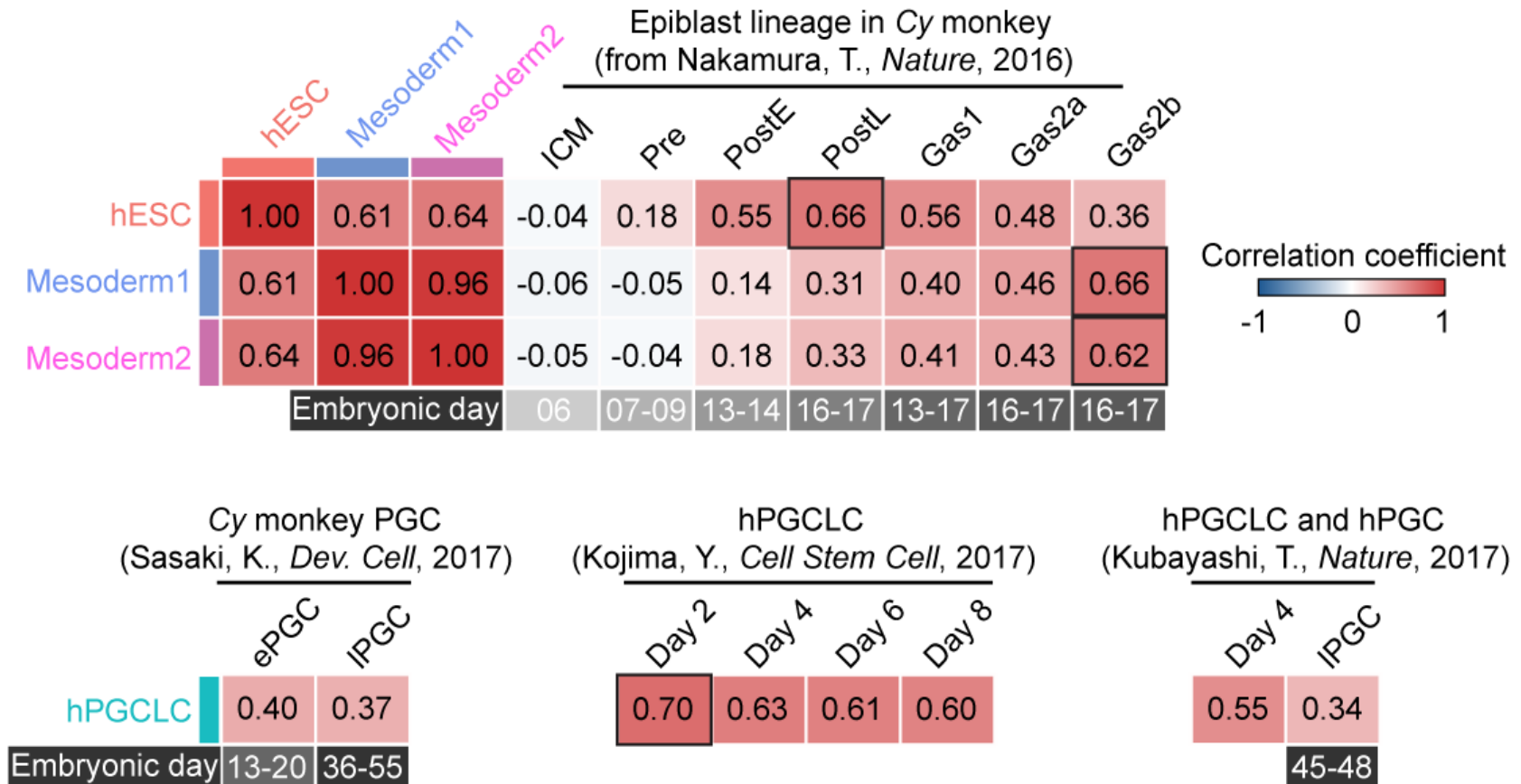
(Kobayashi, T. et al., *Nature*, 2017)



Single-Cell Transcriptome Profiling



Comparative Transcriptome Analysis with Primate Monkey Embryo Data



- Comparisons for "hESC", "Mesoderm1", "Mesoderm2" are based on ontogenic genes identified for *CyEPI* (Nakamura, T. *et al. Nature*, 2016).
- Comparisons for "hPGCLC" are based on ontogenic *CyPGC* genes (Sasaki, K. *et al. Dev. Cell*, 2017).

Thank you!