

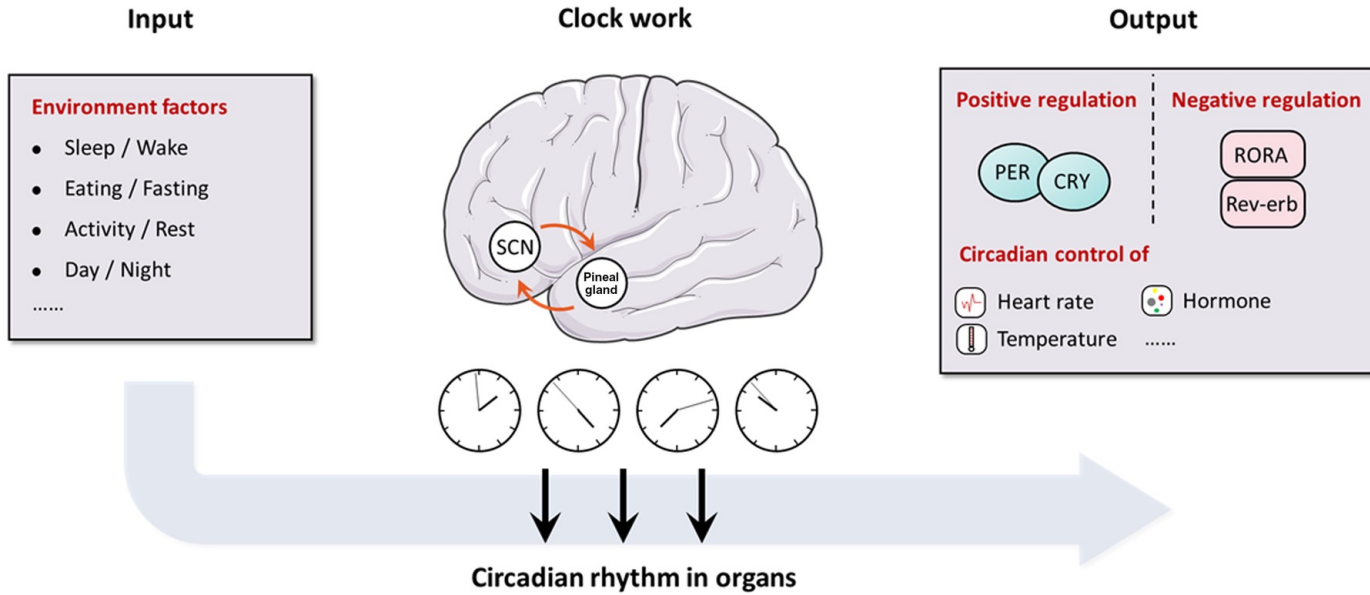
Stem cells display circadian clocks?

By Tran Hong Thuan

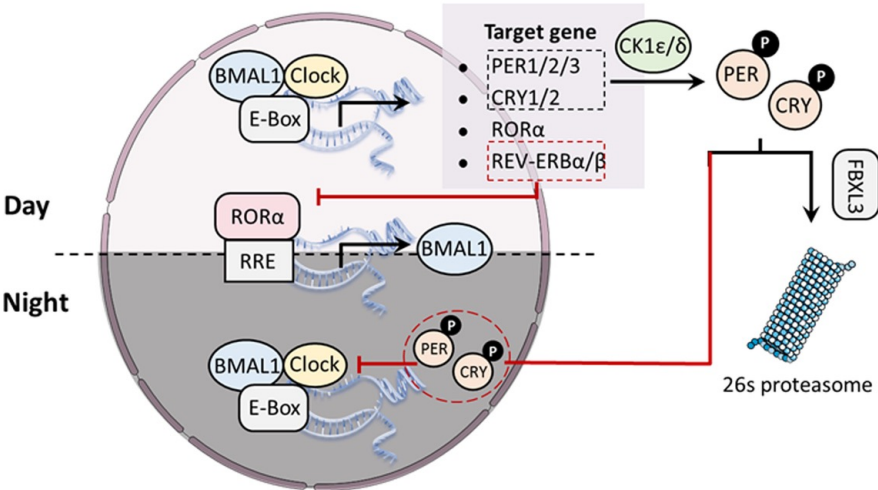


II. Circadian clocks

a

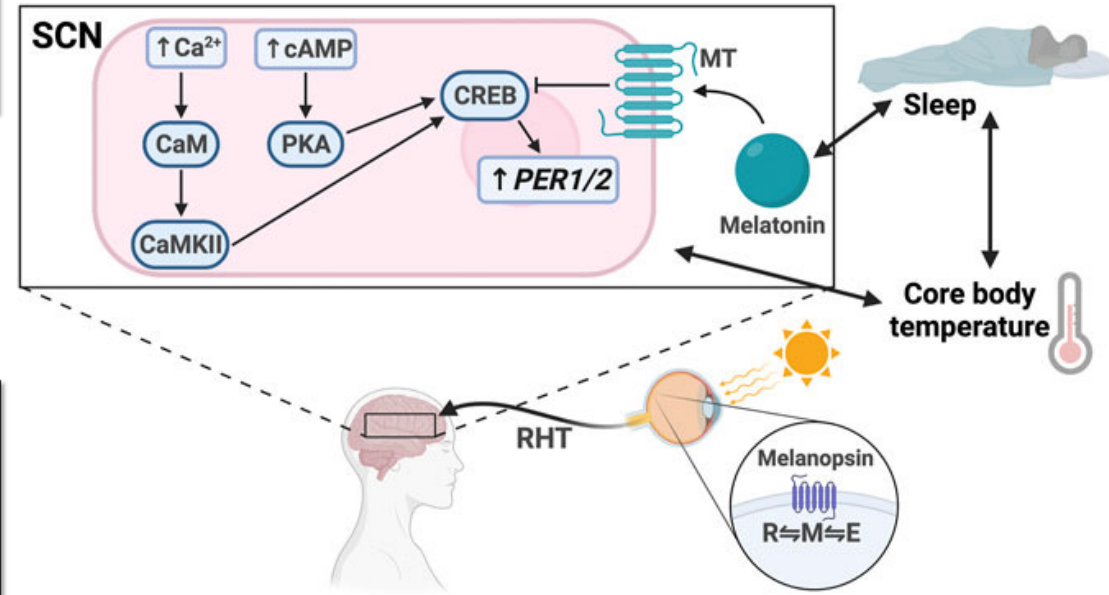
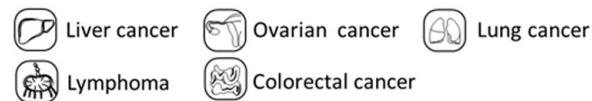
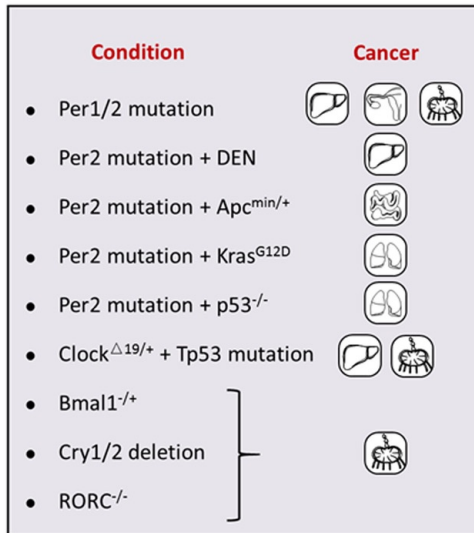


b



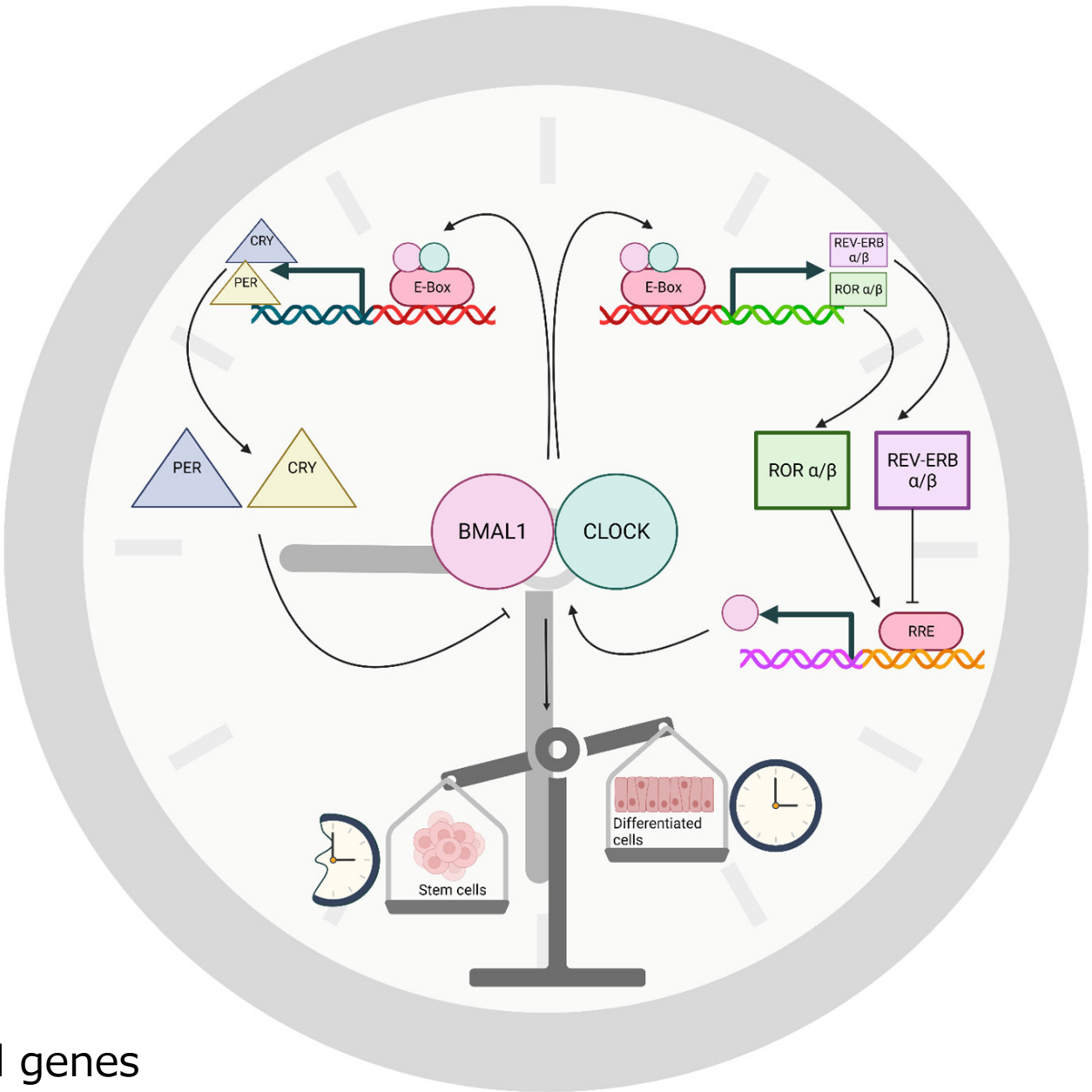
TTFLs

c



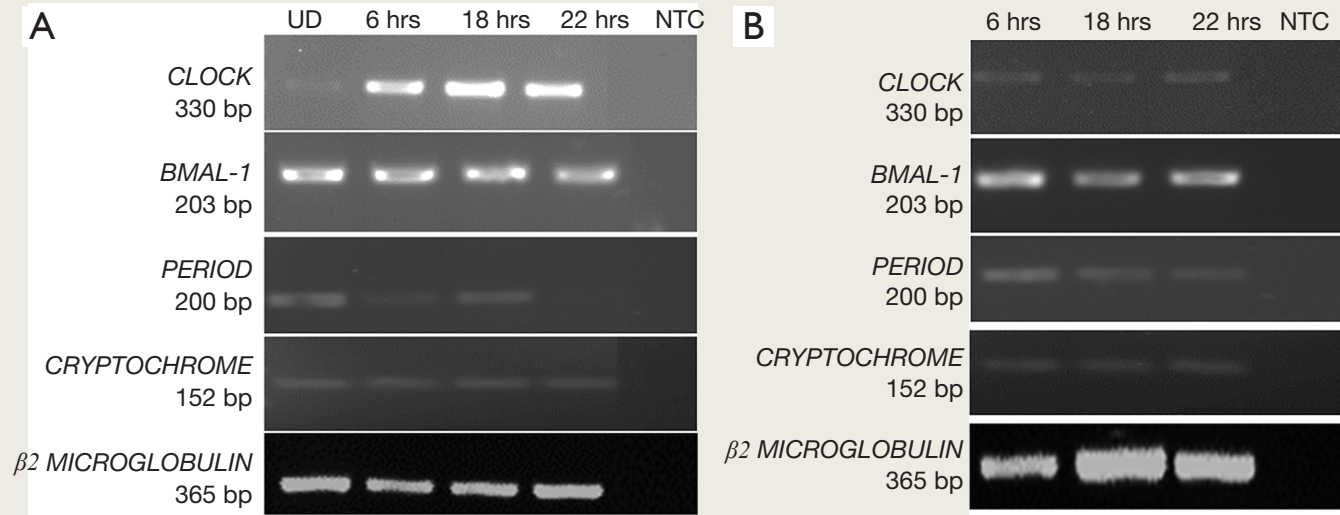
Kelly L. Healy, Andrew R. Morris and Andrew C. Liu, 2021

II. Circadian clocks is presented in SCs?

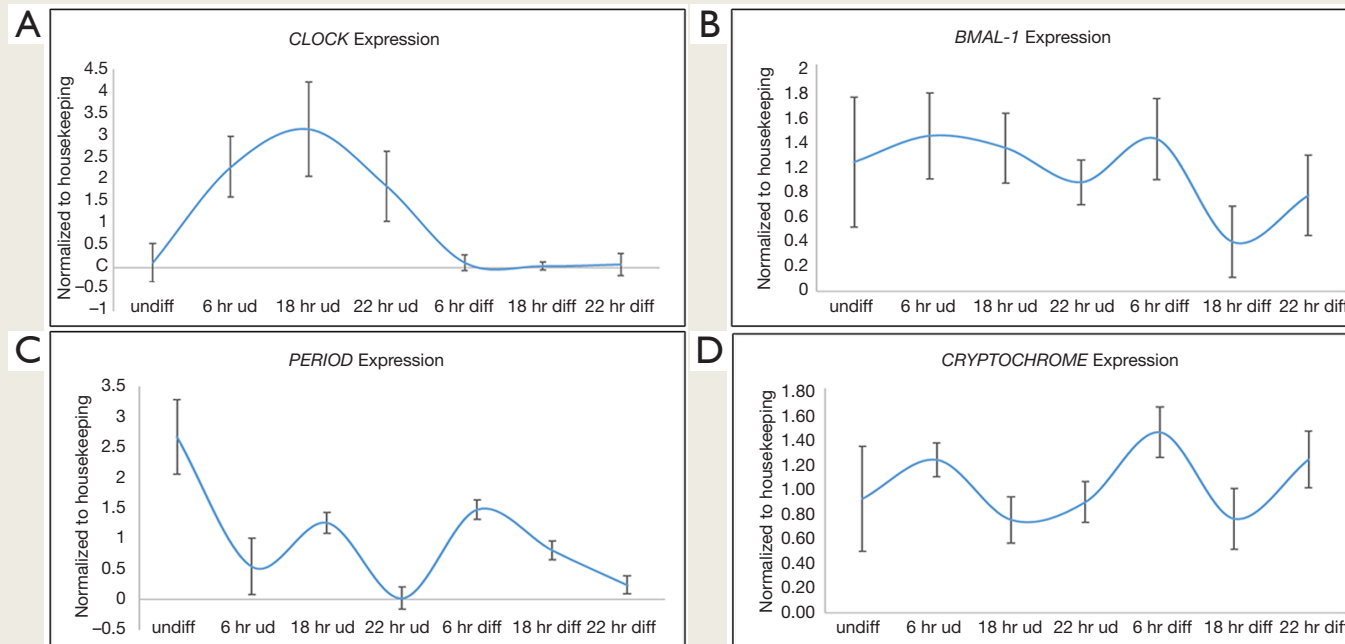


CCGs: clock-controlled genes

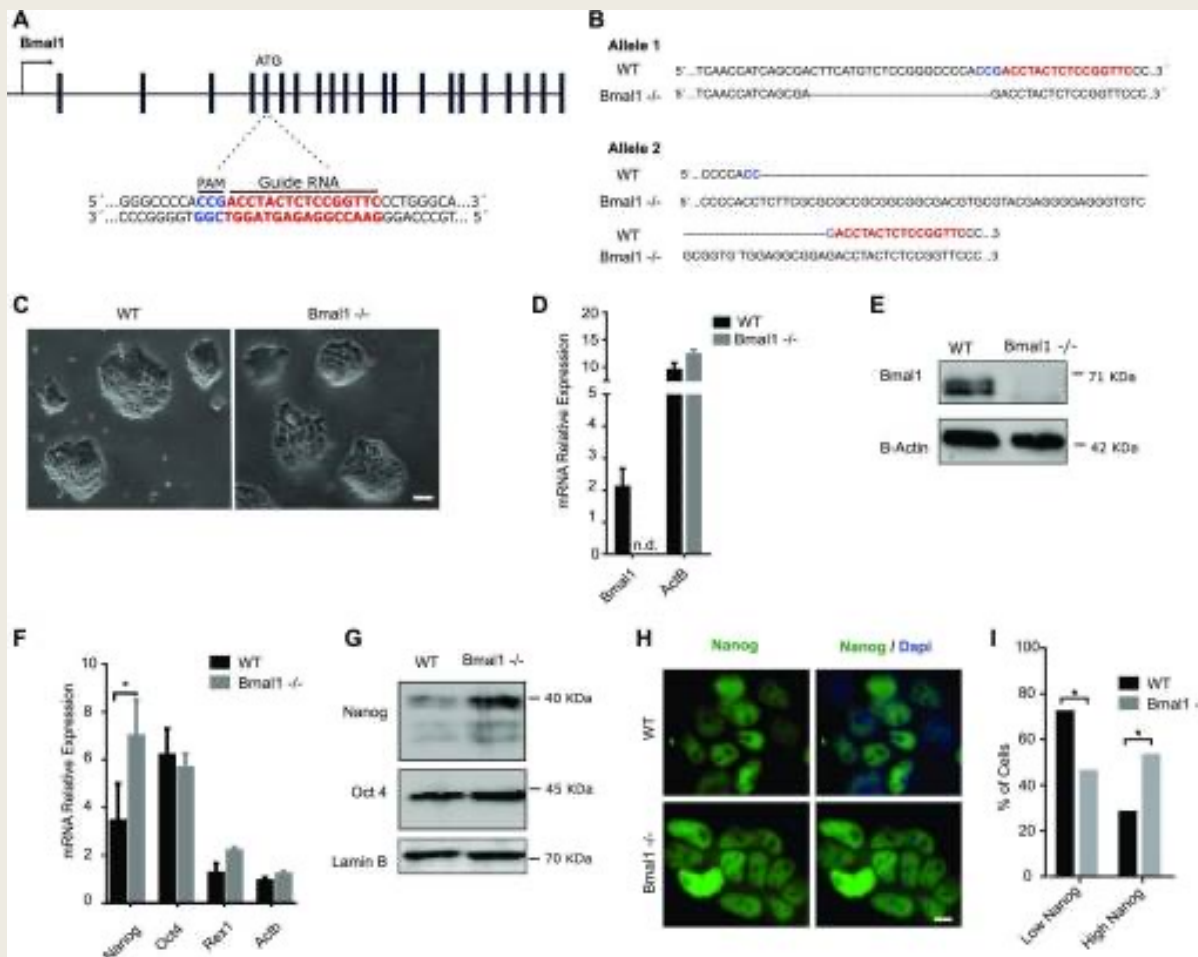
Circadian genes express in stem cells and modulate cell proliferation/differentiation



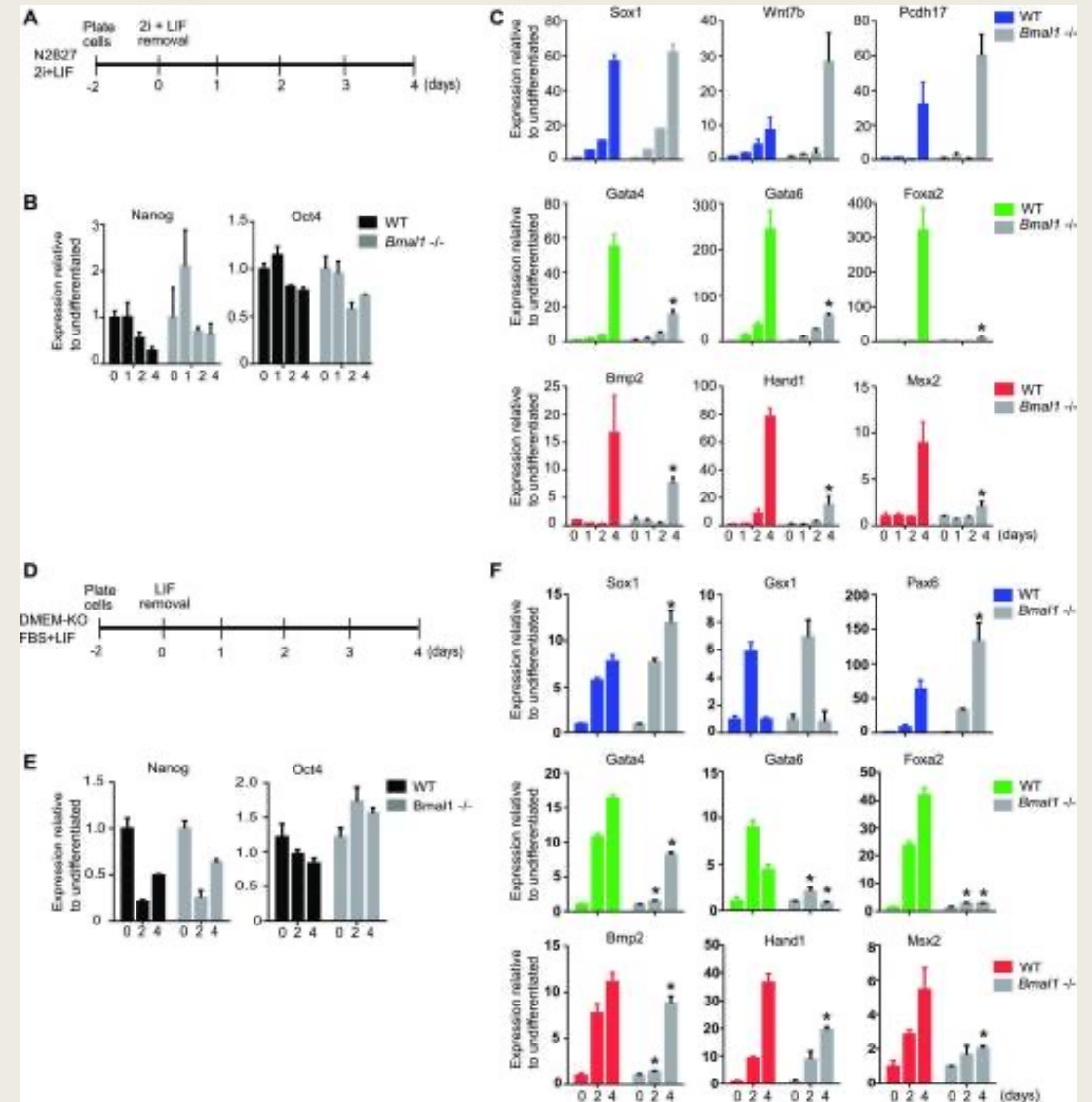
→ Circadian genes expressed in human embryonic stem cells and during differentiation



Circadian genes express in stem cells and modulate cell proliferation/differentiation



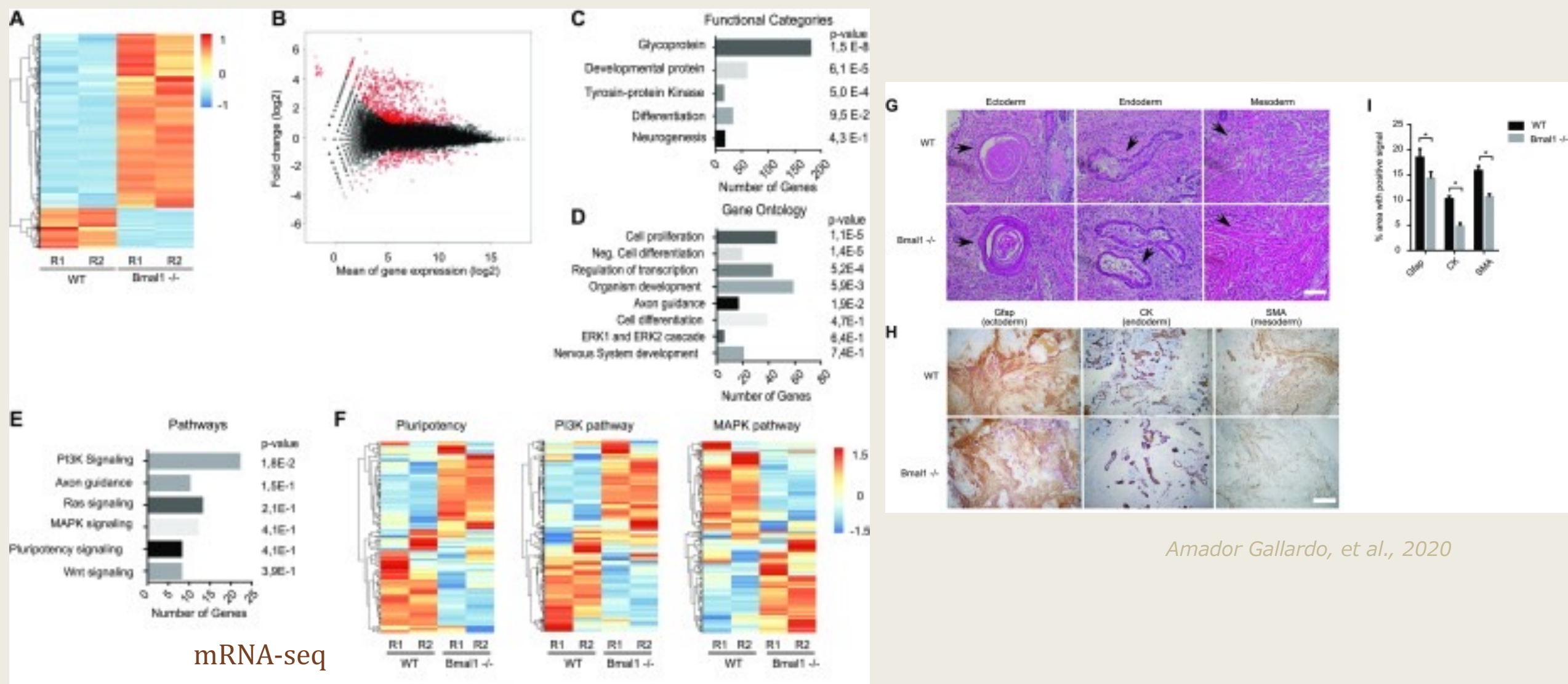
Amador Gallardo, et al., 2020



Amador Gallardo, et al., 2020

Bmal1^{-/-} mouse embryonic stem cells (mESCs) display reduced induction of **ectoderm**, **endoderm**, and **mesoderm** genes during monolayer cell differentiation.

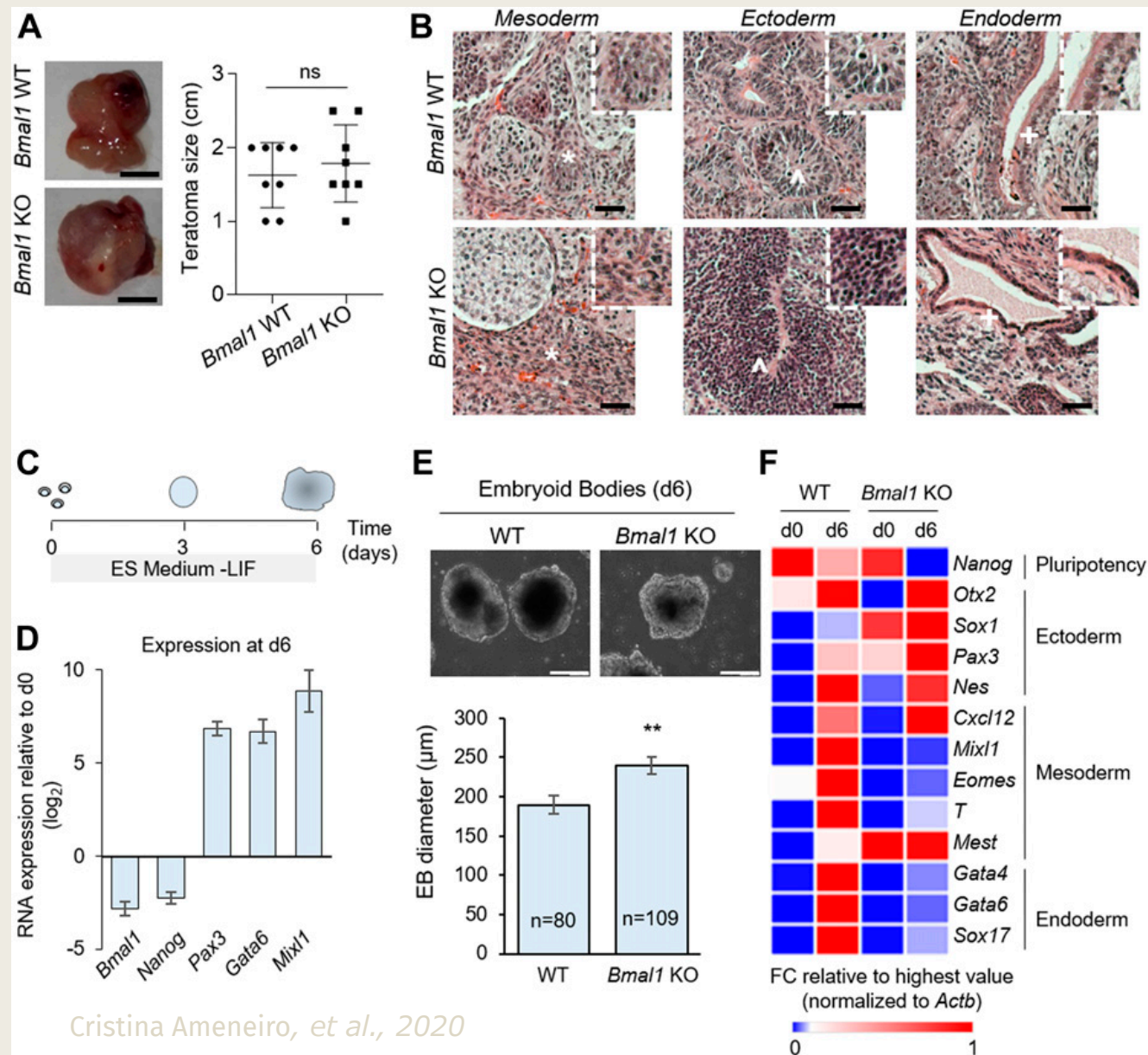
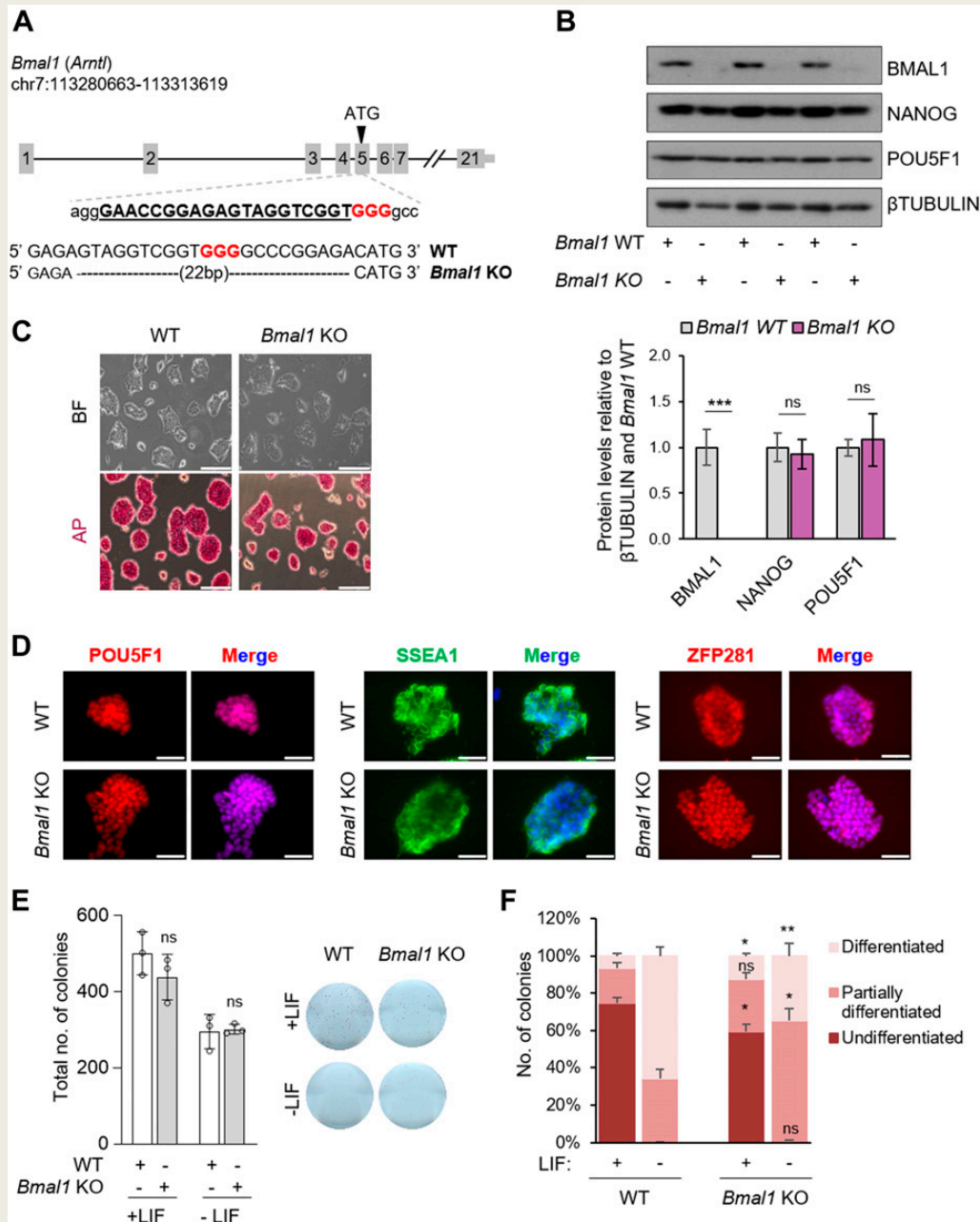
Bmal1^{-/-} mouse embryonic stem cells (mESCs) display altered pluripotency signaling pathways and differentiation potential expression.



mRNA-seq

Amador Gallardo, et al., 2020

BMAL1 coordinates energy metabolism and differentiation of pluripotent stem cells

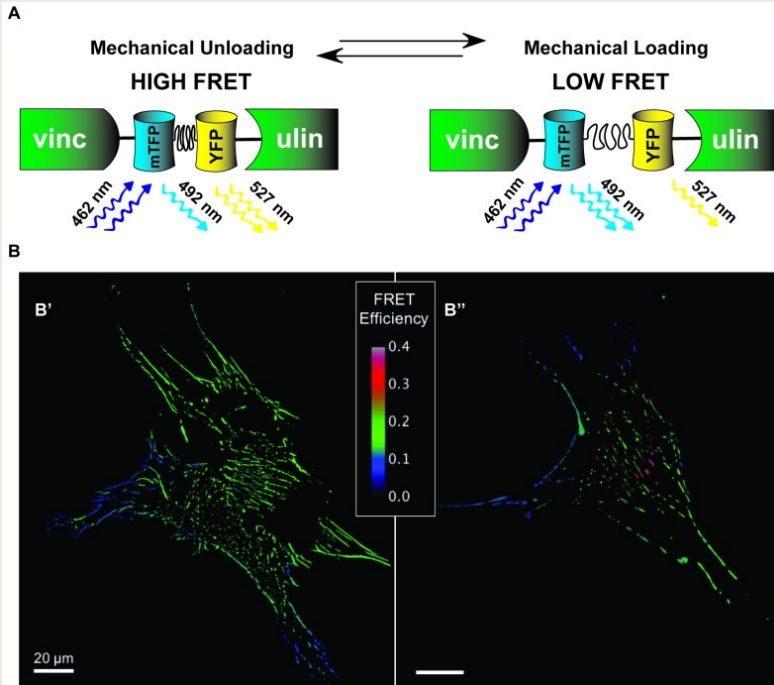


→ the circadian clockworks have detected their expression in several types of stem cells, which may affect stemness, differentiation, and signaling pathway genes

→ No rhythms

- 1) Whether circadian rhythms be established by cyclic 24-hour light/dark periods?**
- 2) Whether circadian clockwork be oscillated in diurnal periods?**
- 3) Whether the cell proliferation is impacted by LD cycles?**

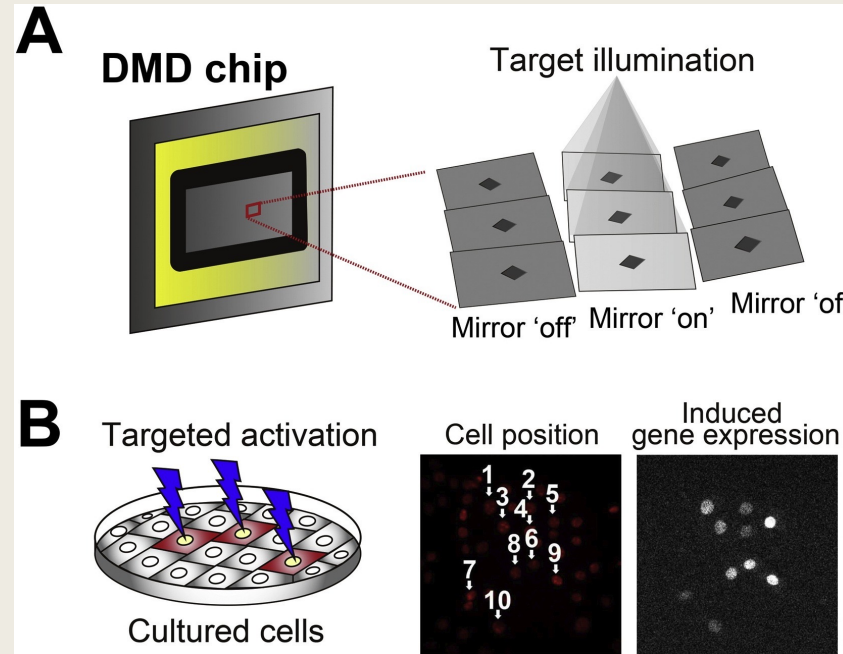
Light-mediated control of Gene expression in cell culture



Jordan E. P., et al. 2017

Distribution of vinculin tension in Mesenchymal Stem Cells

Cell type	Gene(s)
Rod photoreceptors	<i>NR2E3, NRL</i> (wild type cells only), <i>GNGT1, SAG</i>
Cone photoreceptors	<i>PDE6H, ARR3, OPN1MW, OPN1SW, GUCA1C, GNAT2</i>
Bipolar cells	<i>VSX1, VSX2, TMEM215, ISL1</i>
Photoreceptor/Bipolar precursors	<i>CRX, OTX2, PRDM1, VSX1</i>
Amacrine cells	<i>TFAP2A, GAD1, GAD2, CALB2</i>
Horizontal cells	<i>ONECUT1, ONECUT2, TFAP2B, PROX1</i>
Retinal ganglion cells	<i>SLC17A6, GAP43, NEFL, NEFM</i>
Muller glia	<i>SOX2, SOX9, VIM, CLU, DKK3</i>
Mitotic cells	<i>MKI67, TOP2A, NUSAP1, CENPF</i>



Yamada M., et al., 2019

Targeted illumination with a digital mirror device (DMD). (A) Schematic illustration of patterned light generation by DMD. A DMD is a digital imaging chip that reflects light to project and display a certain pattern of the light. It consists of a mirror array of up to 2 million units, each one individually controlled. (B) An example of the targeted cell populations illuminated by patterned light generated by a DMD. The patterned light, indicated by blue lightning symbols, was applied to 10 targeted cells (Cells 1–10) simultaneously, and their light-induced reporter expression was monitored

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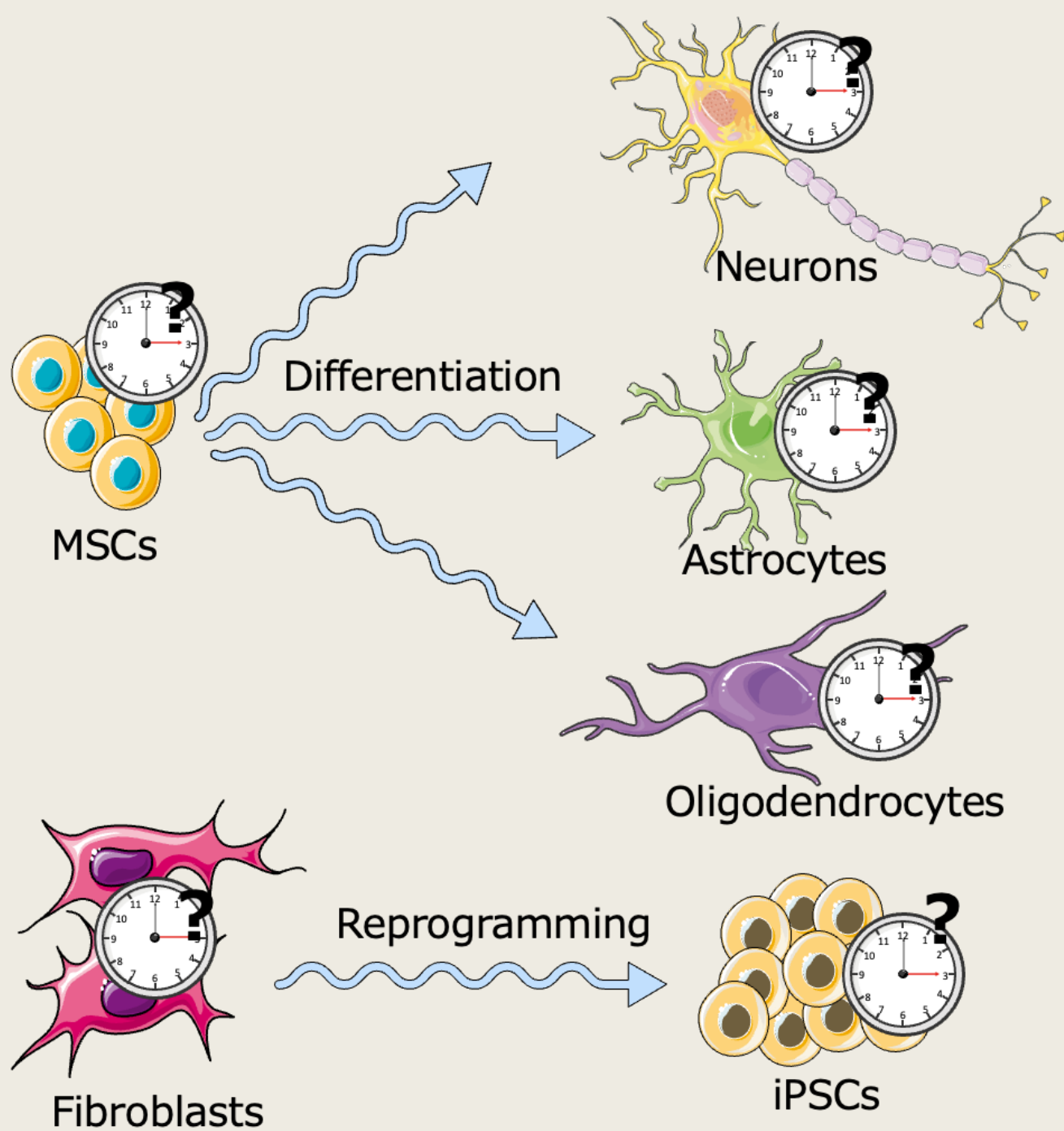
Modeling early retinal development with human embryonic and induced pluripotent stem cells

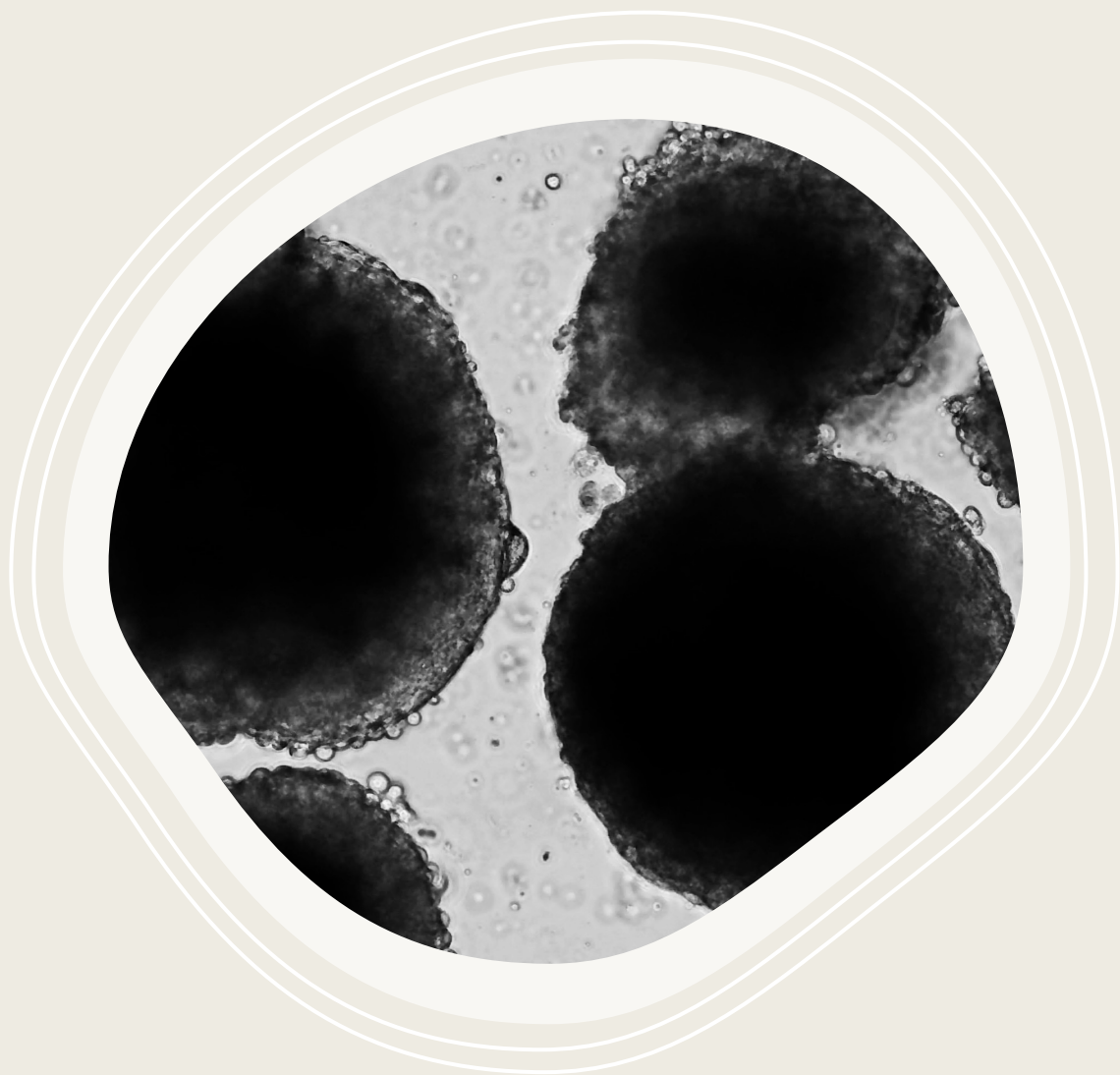
Jason S. Meyer, Rebecca L. Shearer, Elizabeth E. Capowski, , and David M. Gamm [Authors Info & Affiliations](#)

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Differentiation
is driven by
the **circadian**
system?





**THANKS FOR
YOUR
ATTENTION 😊**