動物生命科学 第13回

幹細胞:
個体発生と組織再生

農学部 動物資源生命科学コース
高谷 智英

2019年12月19日

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Stem Cells and Development

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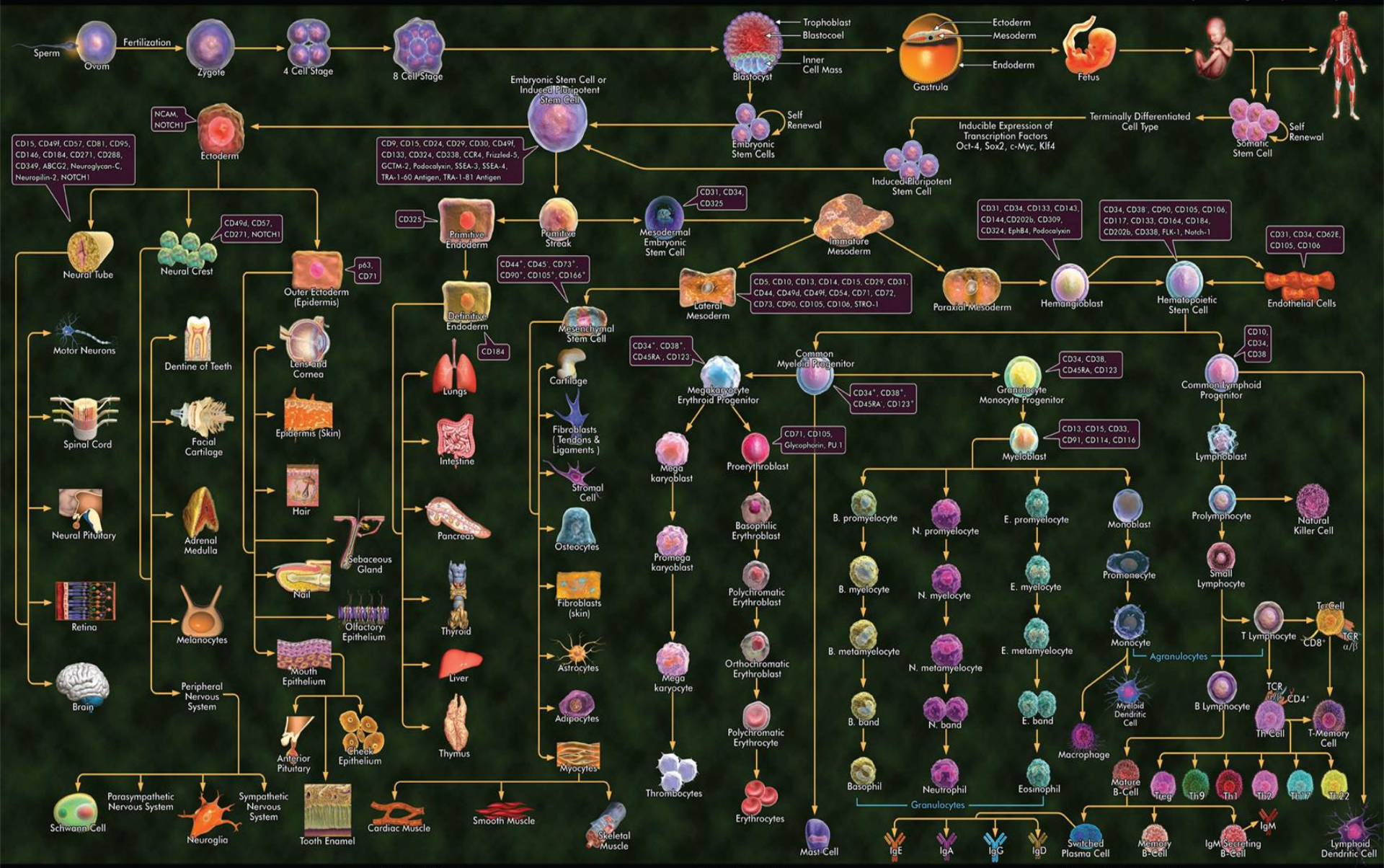

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We would like to thank **Dr. Brile Chung** of the University of California, Los Angeles & **Dr. Chintan Parekh** of the University of California, Los Angeles for their contributions to this poster.

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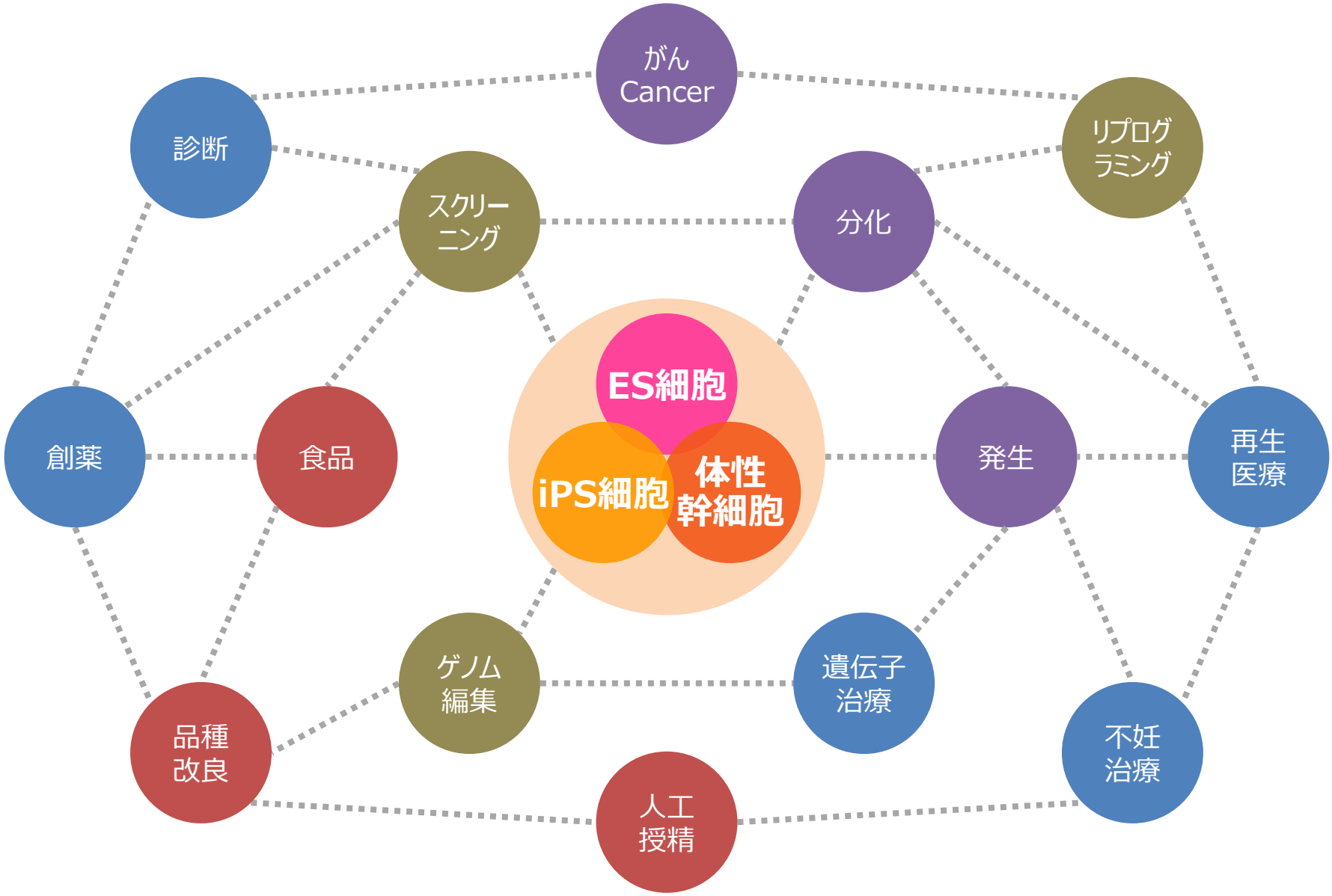
幹細胞 – Stem cells



受精 – Fertilization

from wiseGEEK

発生 – Development

接合子
Zygote

1種,
1個
1 type,
1 cell

発生 Development

成体
Adult

外胚葉 Ectoderm　中胚葉 Mesoderm　内胚葉 Endoderm

200種,
40兆個
200 types,
40T cells

細胞分化 – Cell differentiation

接合子
Zygote

1種,
1個
1 type,
1 cell

分化 Differentiation
細胞の質的な変化

成体
Adult

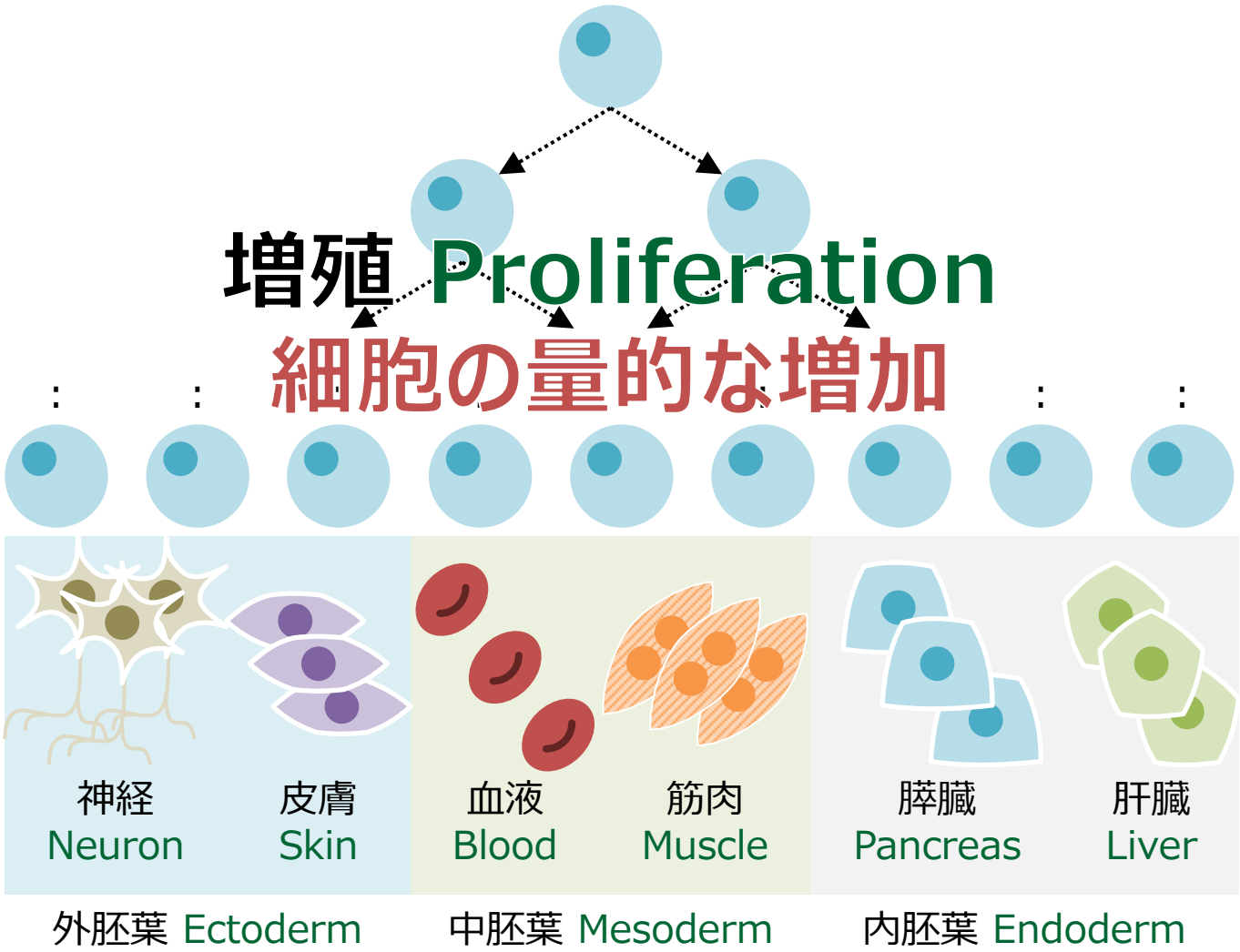
外胚葉 Ectoderm　中胚葉 Mesoderm　内胚葉 Endoderm

200種,
40兆個
200 types,
40T cells

細胞増殖 – Cell proliferation

接合子
Zygote

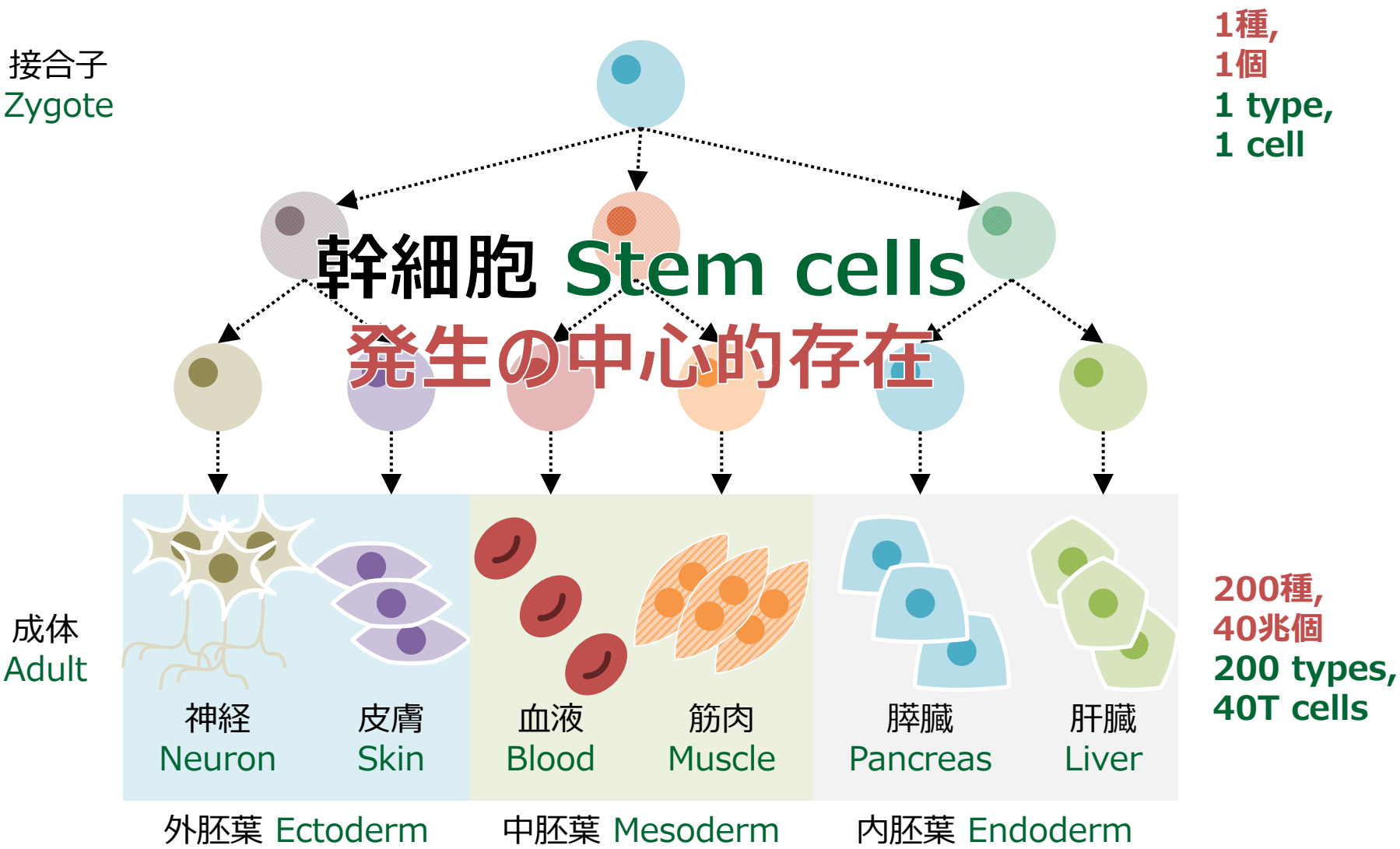
1種,
1個
1 type,
1 cell



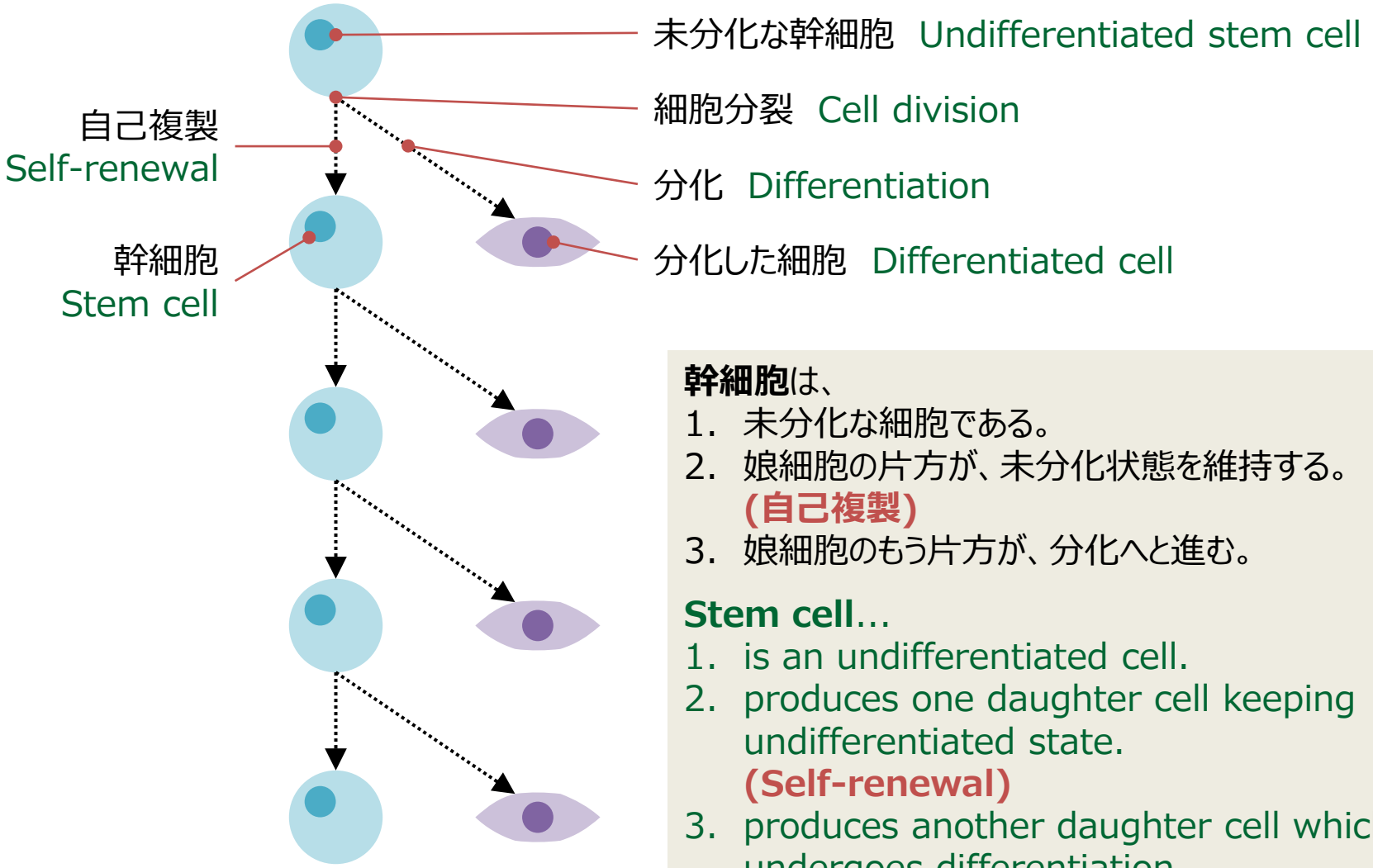
成体
Adult

200種,
40兆個
200 types,
40T cells

幹細胞と発生 – Stem cells and development



幹細胞の定義 – Definition of stem cells



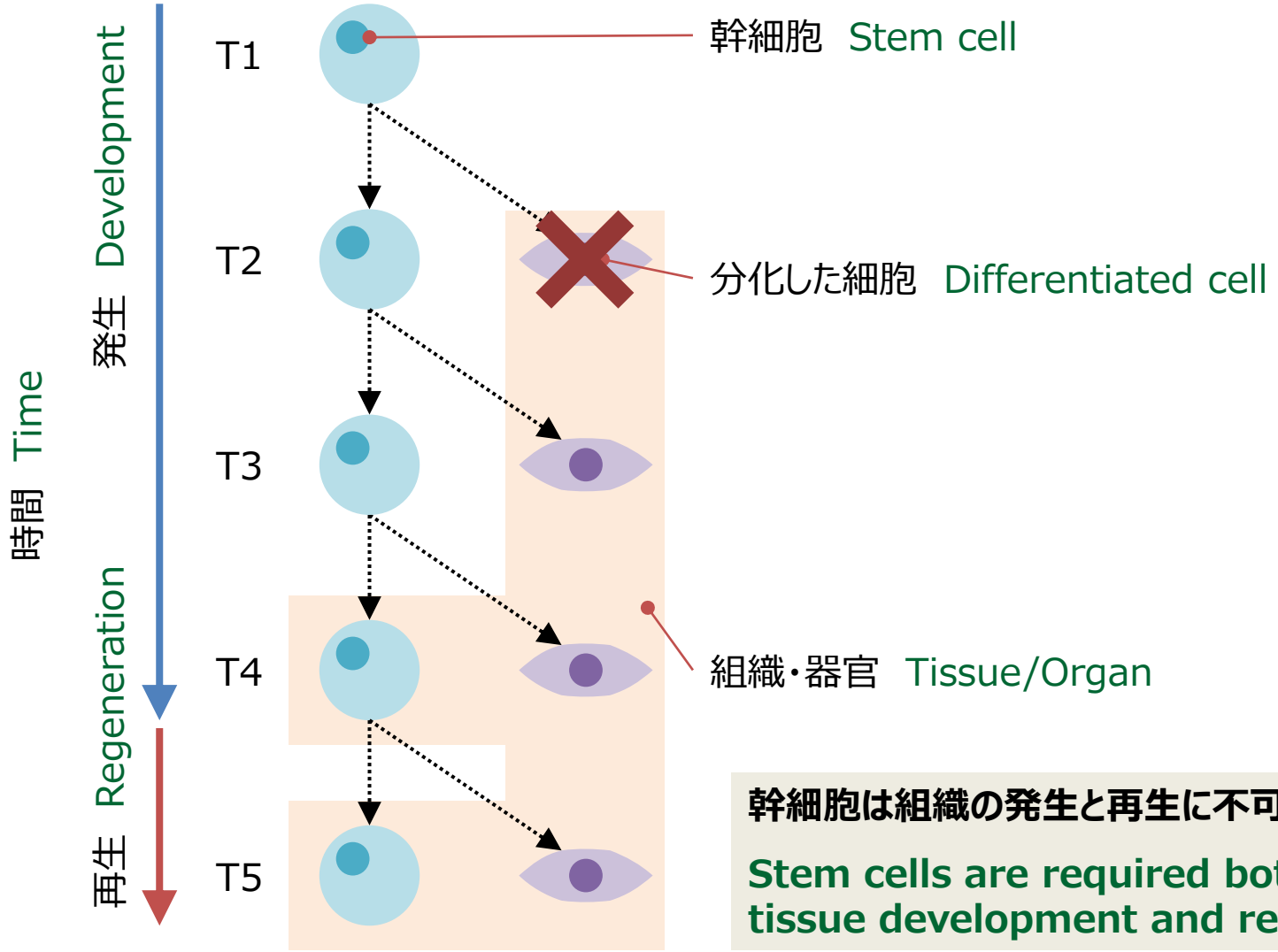
幹細胞は、

1. 未分化な細胞である。
2. 娘細胞の片方が、未分化状態を維持する。
   (自己複製)
3. 娘細胞のもう片方が、分化へと進む。

Stem cell…

1. is an undifferentiated cell.
2. produces one daughter cell keeping undifferentiated state.
   (Self-renewal)
3. produces another daughter cell which undergoes differentiation.

幹細胞と再生 – Stem cells and regeneration



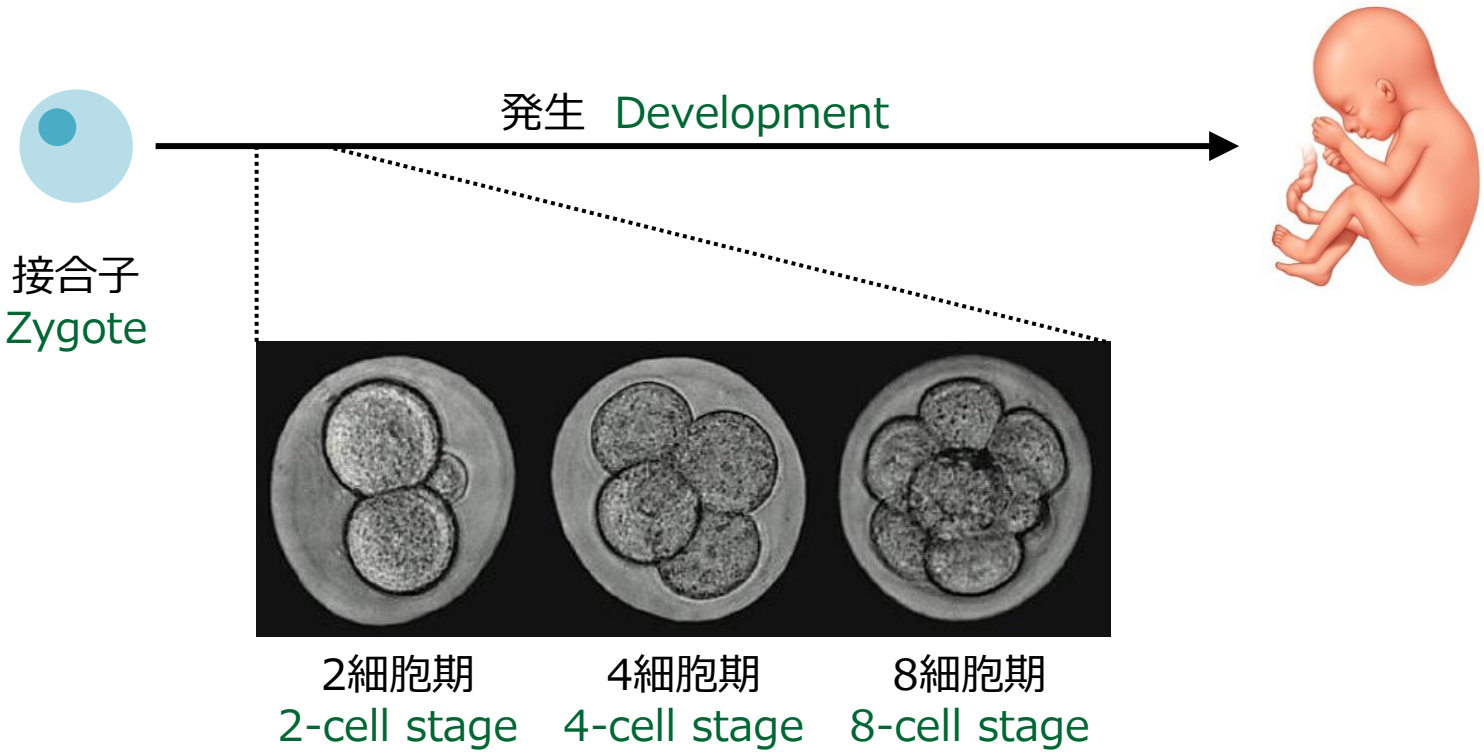
幹細胞は組織の発生と再生に不可欠である。

Stem cells are required both for tissue development and regeneration.

幹細胞の多様性

Diversity of Stem Cells

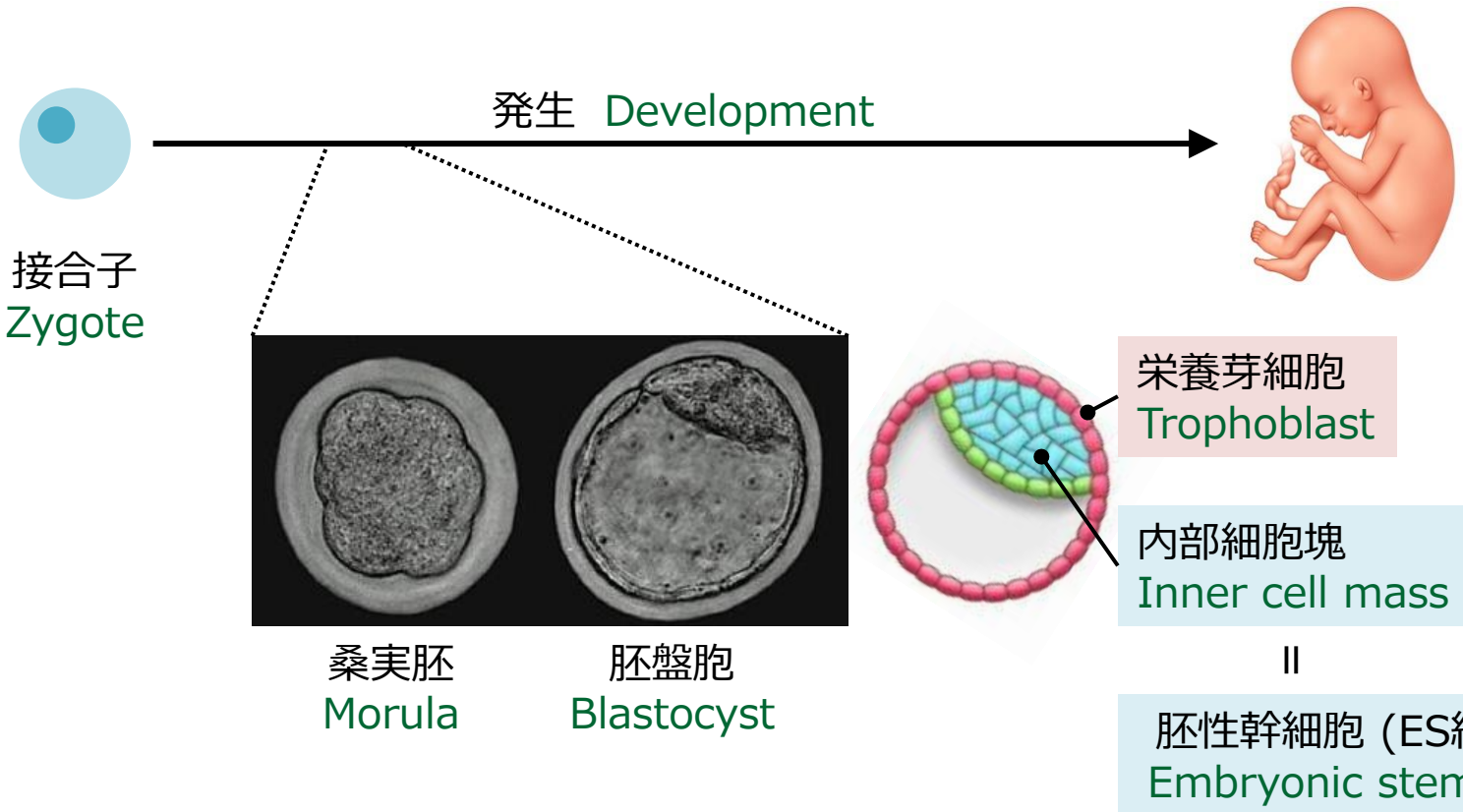
全能性細胞 – Totipotent cells



全能性細胞は、胎盤の栄養芽細胞を含む、全ての細胞に分化する能力を持つ。
（全能性）

Totipotent cells can differentiate into all cells including trophoblast.
(Totipotency)

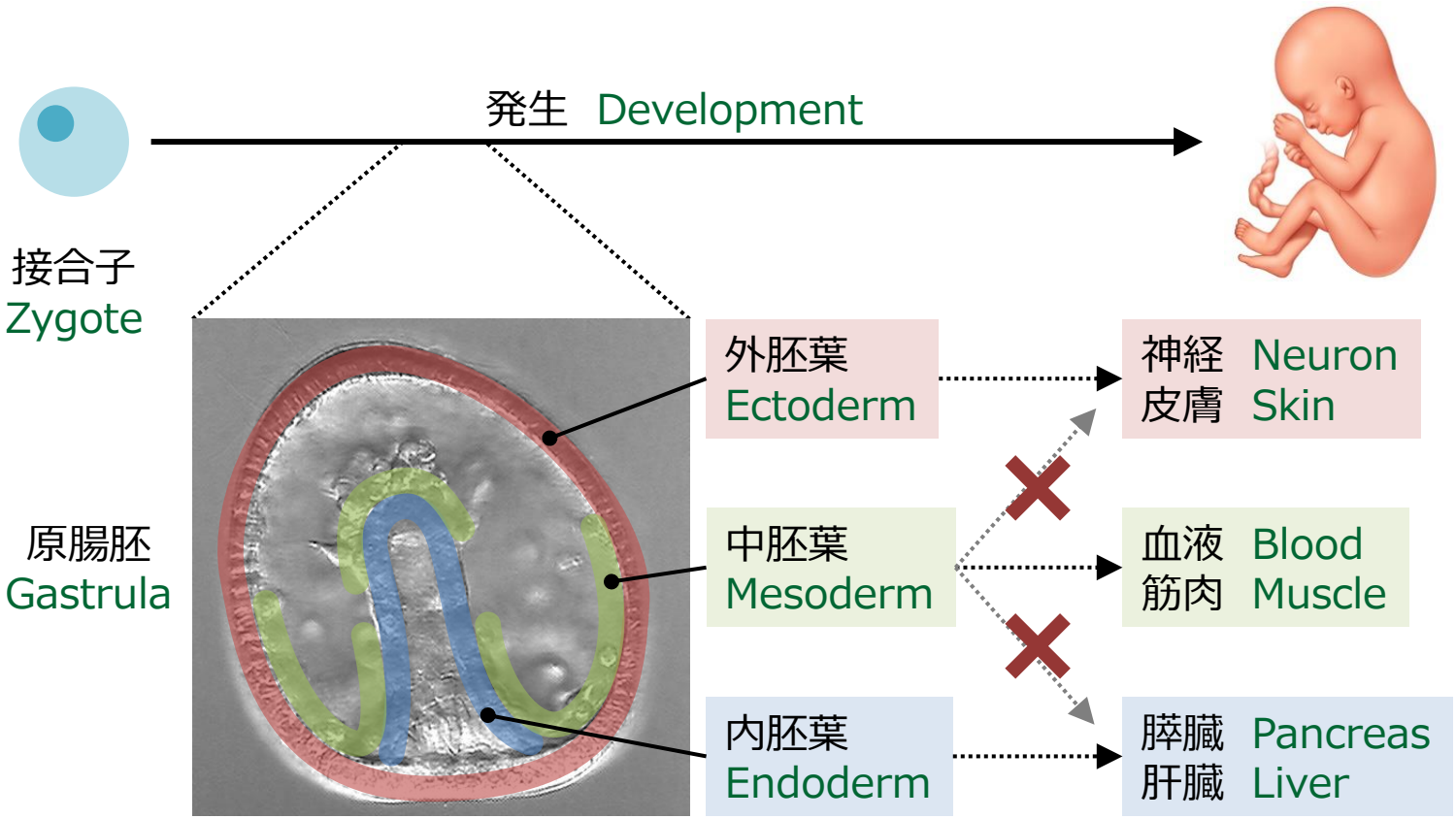
多能性幹細胞 – Pluripotent stem cells



多能性幹細胞は、栄養芽細胞以外の、全ての細胞に分化する能力を持つ。**（多能性）**

Pluripotent stem cells can differentiate into all cells but not trophoblast. **(Pluripotency)**

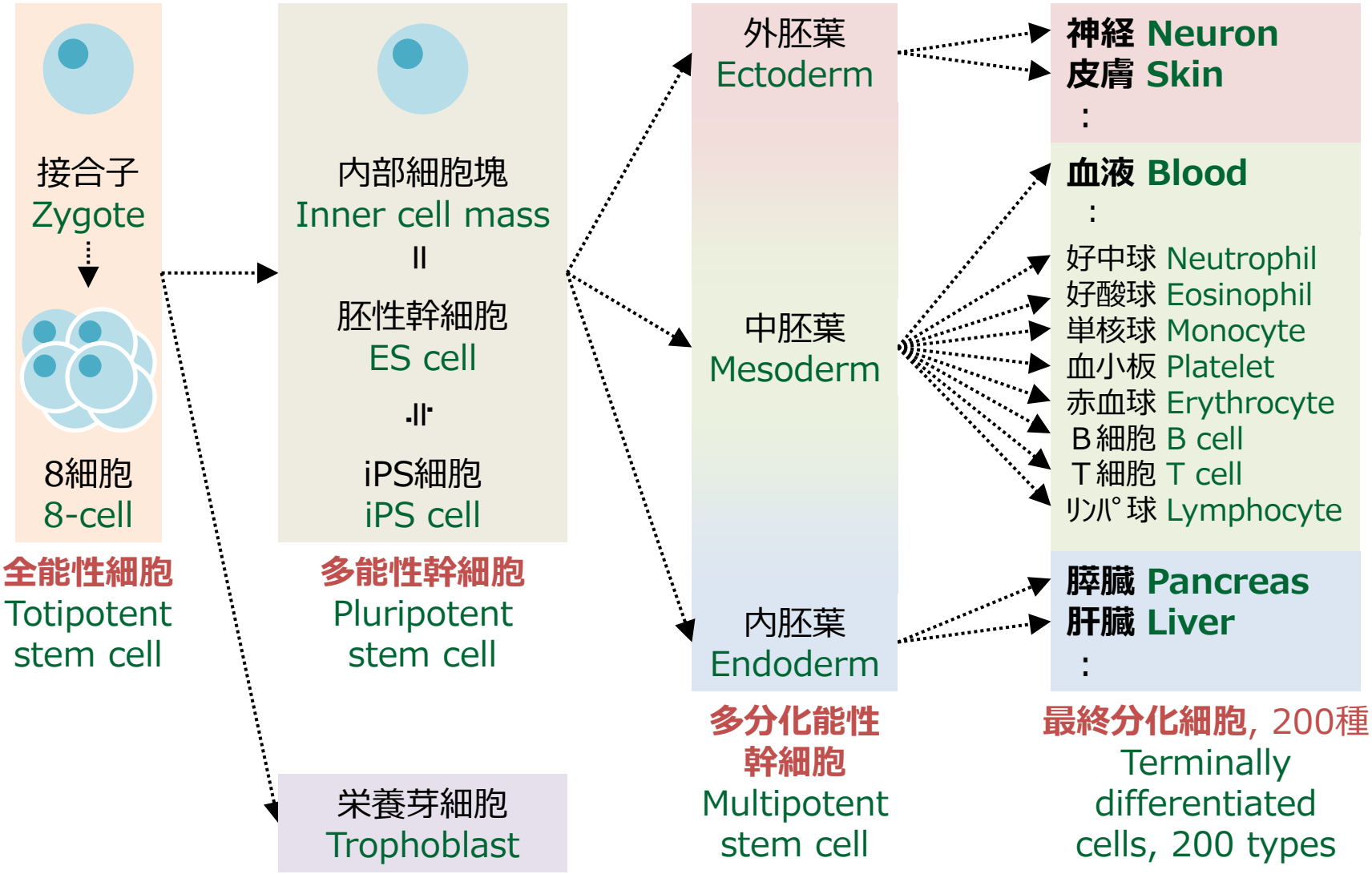
多分化能性幹細胞 – Multipotent stem cells



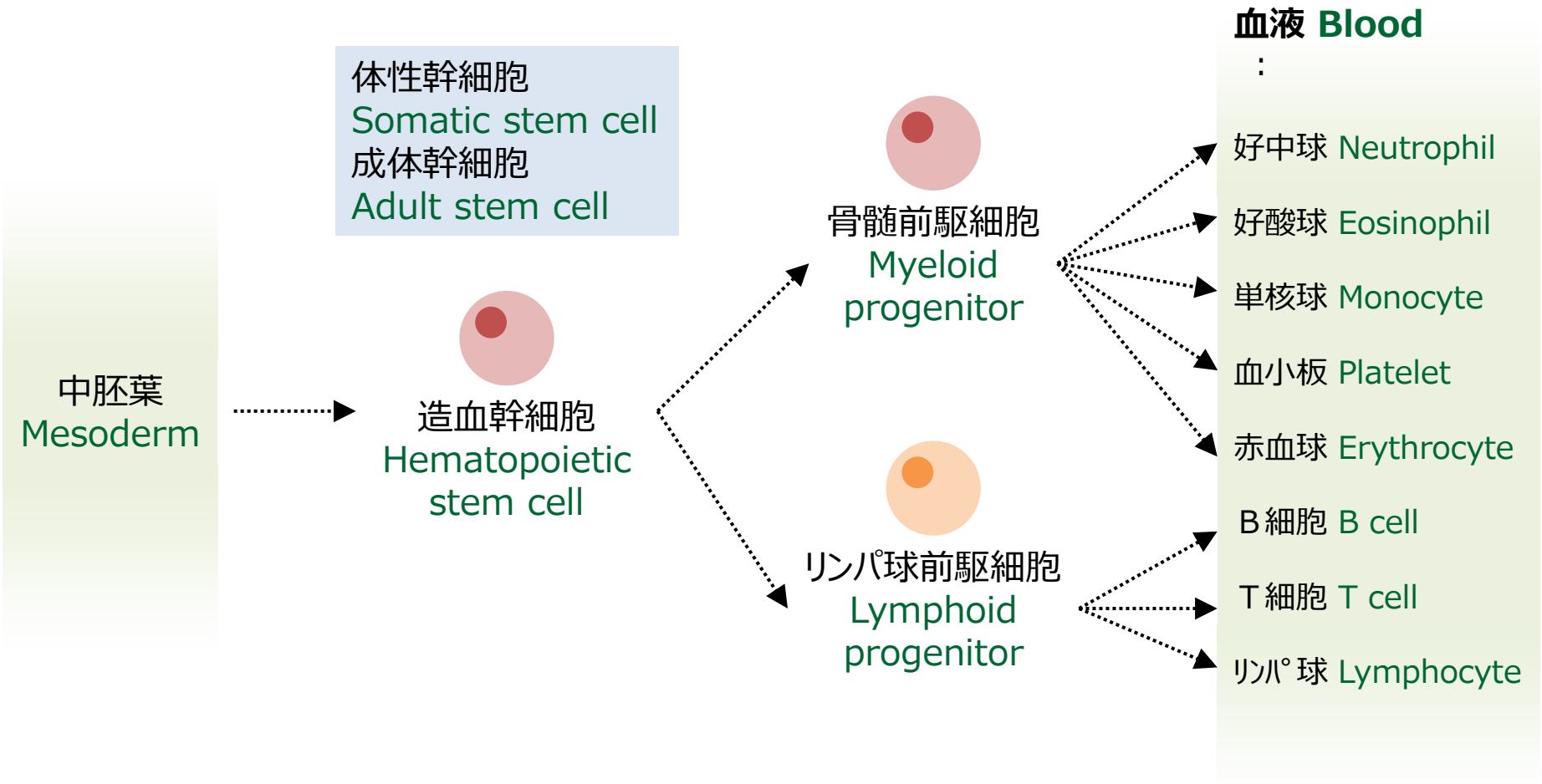
多分化能性幹細胞は、胚葉を超えた分化はできない。

Multipotent stem cells CAN'T differentiate into other germ layers.

発生運命の方向付け – Commitment



体性幹細胞 – Somatic stem cells



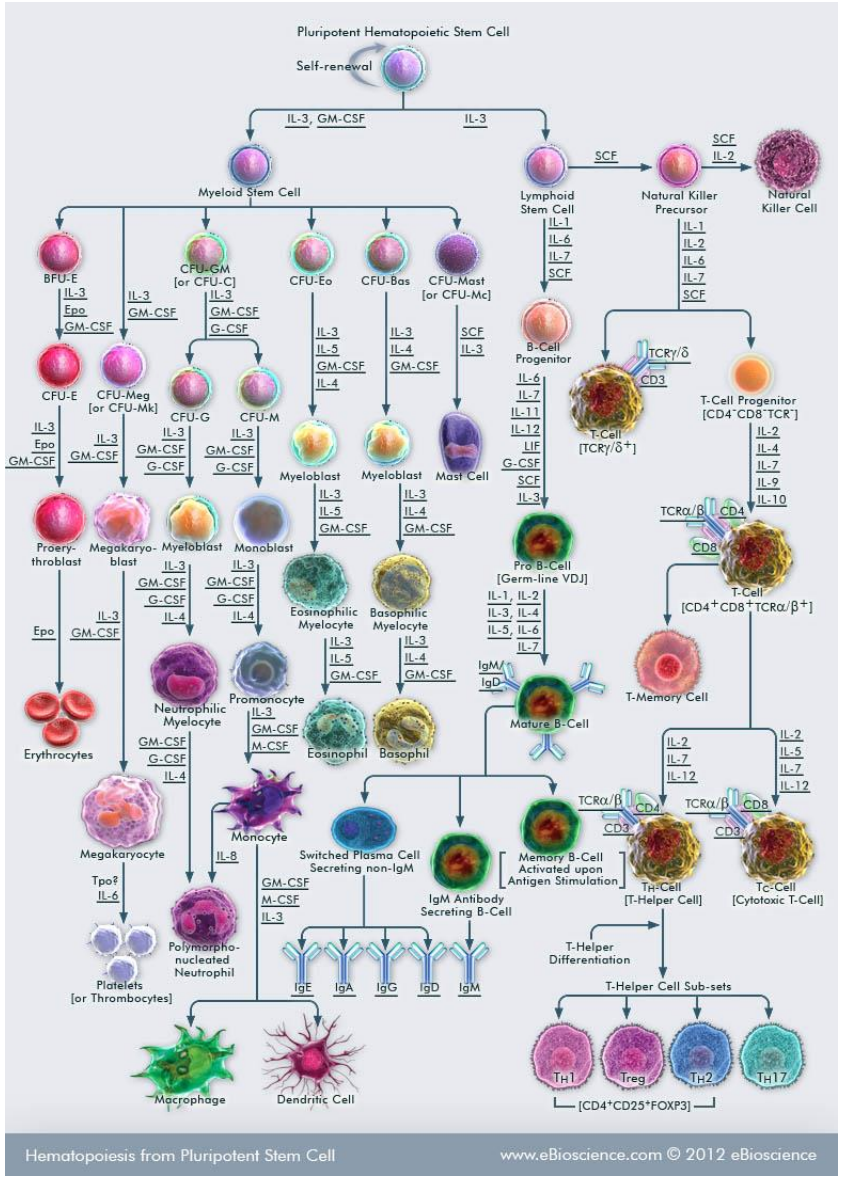
多分化能性幹細胞
Multipotent stem cell

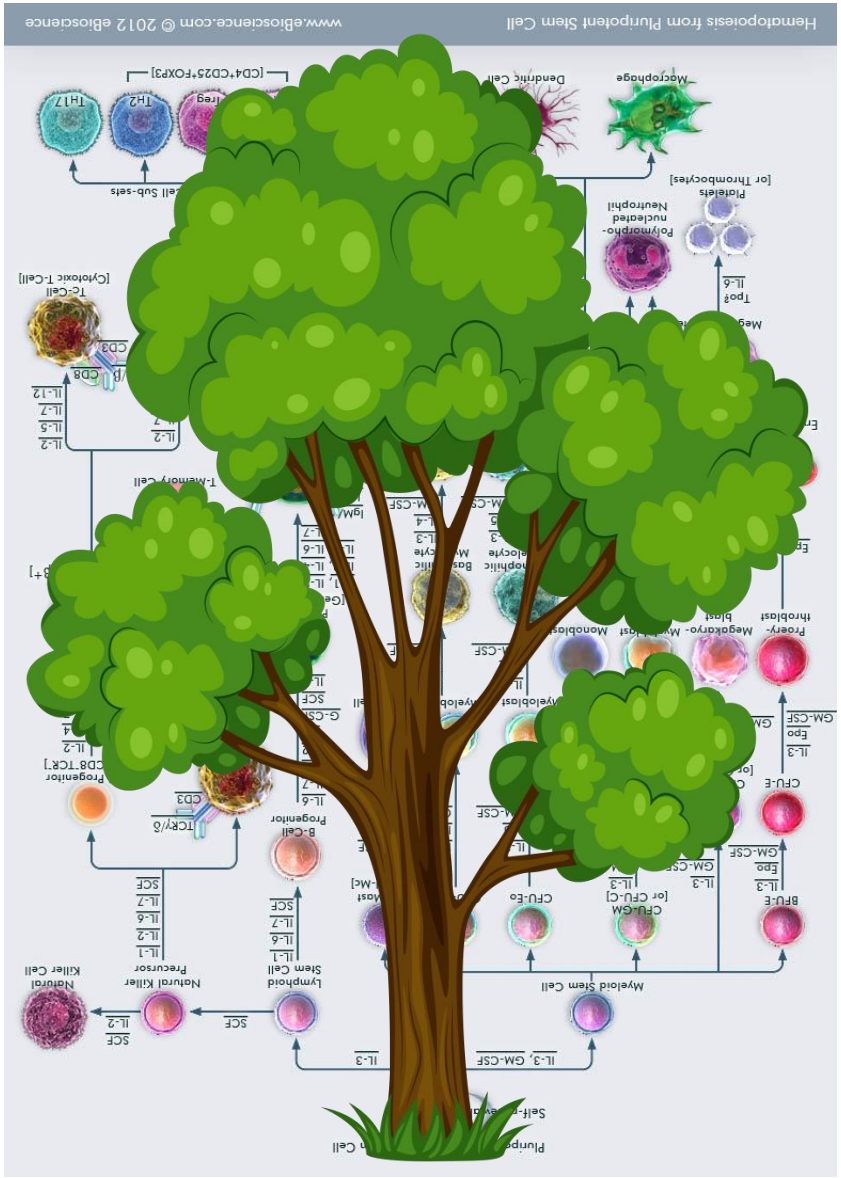
前駆細胞は、特定の細胞へ分化する前に、数回だけ分裂する。

Progenitor (precursor) cells can proliferate several times before restricted-differentiation.

最終分化細胞, 200種
Terminally differentiated cells, 200 types

幹細胞 – Stem cells





Stem Cells and Development

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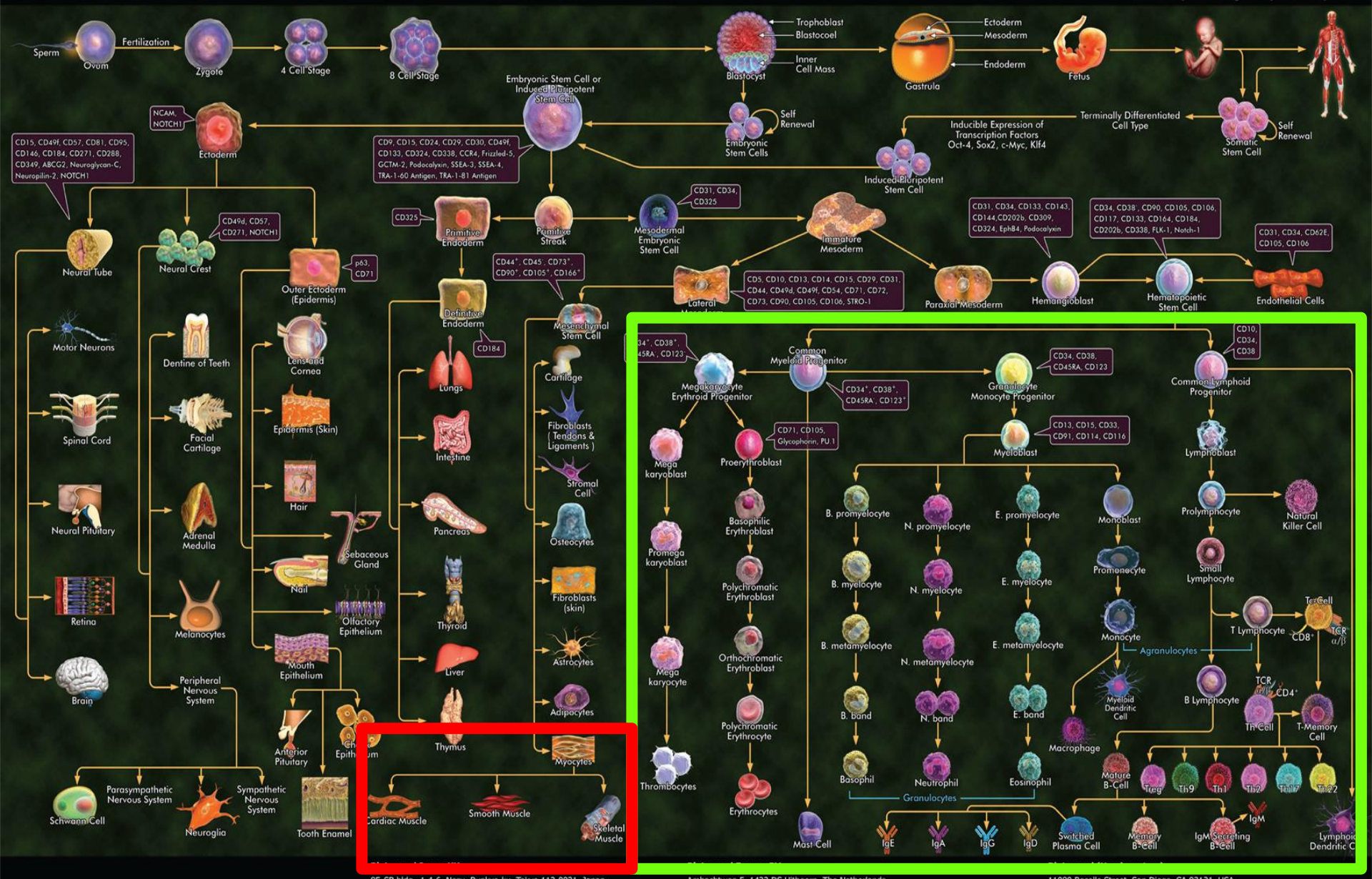

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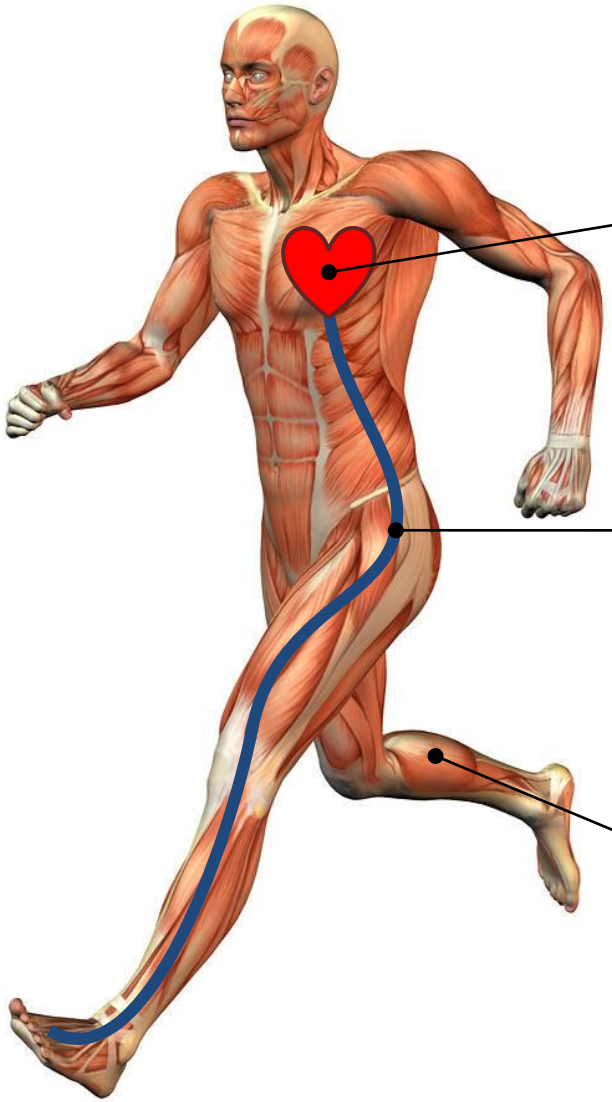
骨格筋幹細胞

Skeletal Muscle Stem Cells

３種類の筋肉 – Three types of muscles



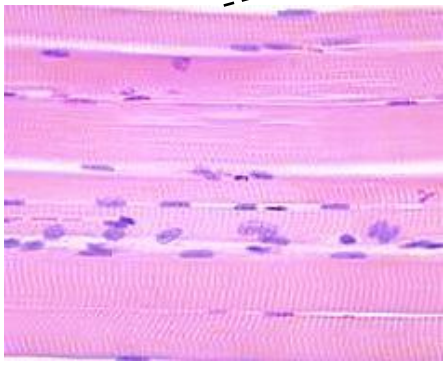
心筋 / Cardiac muscle
- 心臓 / Heart

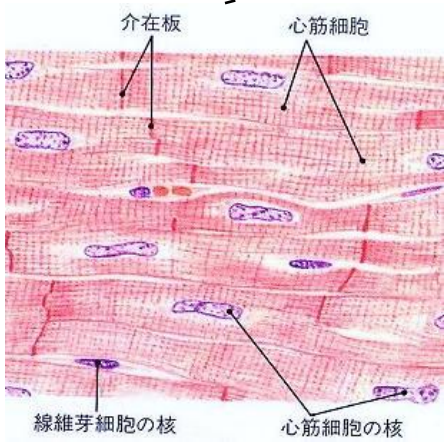
平滑筋 / Smooth muscle
- 内臓 / Internal organ
- 血管 / Blood vessel

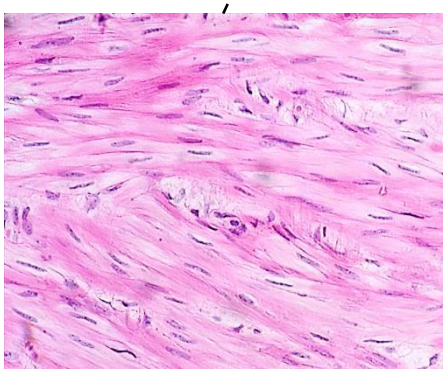
骨格筋 / Skeletal muscle
- 横隔膜 / Diaphragm
- 舌 / Tongue

筋肉の多様性 – Diversity of muscles

	骨格筋 Skeletal	**心筋** Cardiac	**平滑筋** Smooth
細胞分裂 Proliferation	**No**	No	Yes
再生 Regeneration	**Yes**	No	Yes
細胞融合 Cell fusion	**Yes**	No	No
筋節構造 Sarcomere	**横紋** **Striated**	横紋 Striated	平滑 Unstriated
筋収縮 Contraction	**随意** **Voluntary**	非随意 Involuntary	非随意 Involuntary

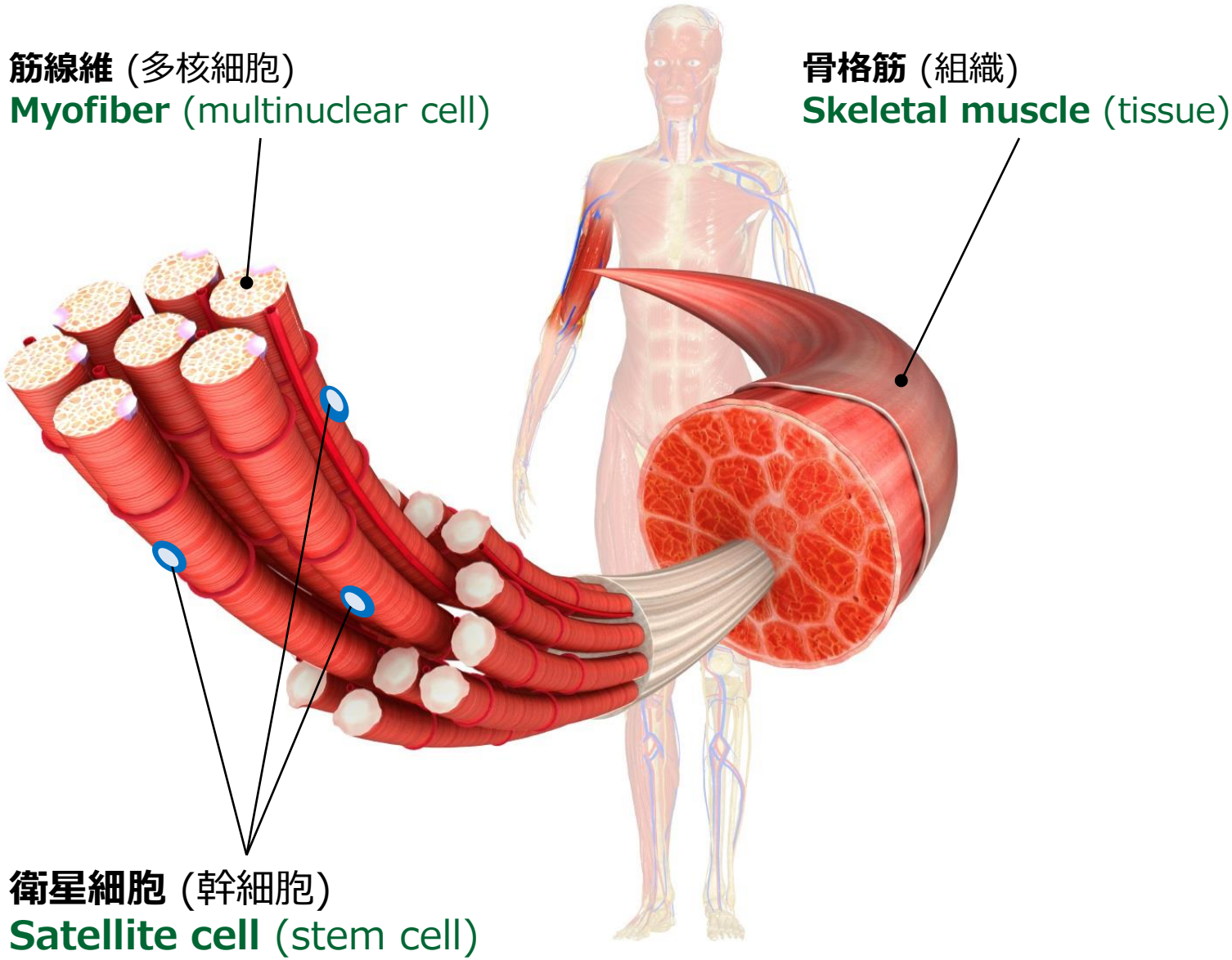




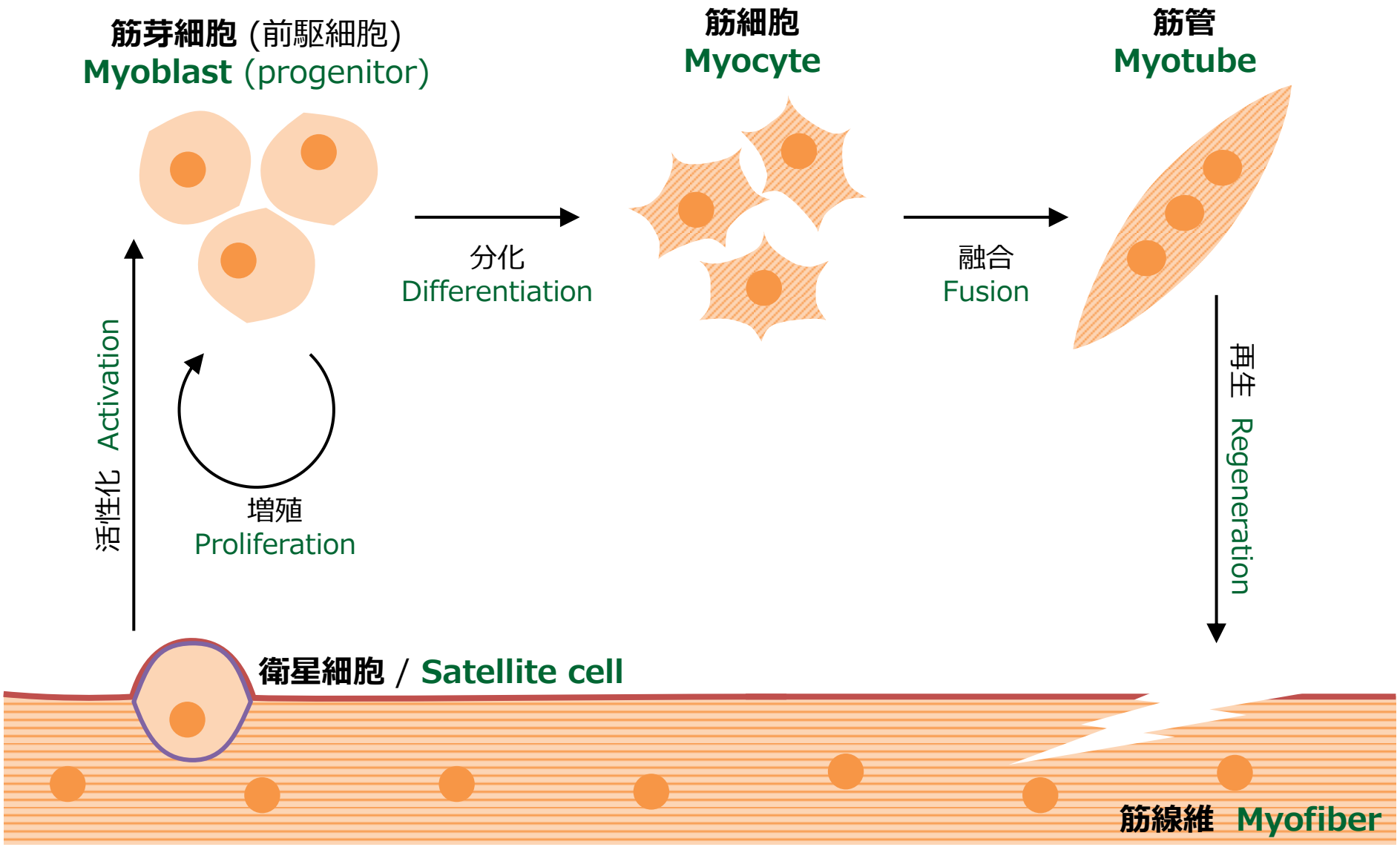


骨格筋の再生 – Skeletal muscle regeneration

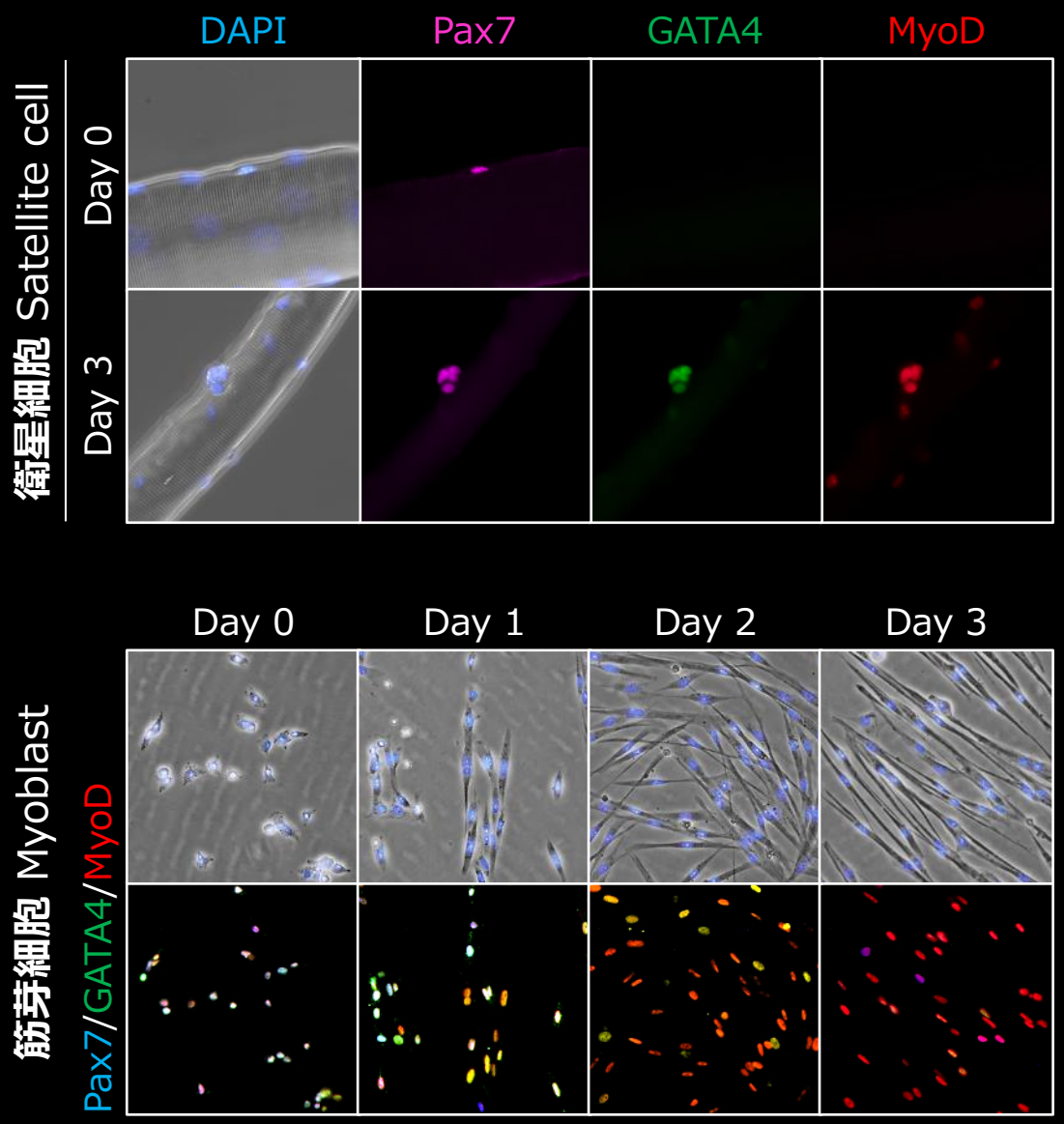
骨格筋幹細胞 – Skeletal muscle stem cell



骨格筋の再生 – Skeletal muscle regeneration



幹細胞の分化に伴う遺伝子発現の変化



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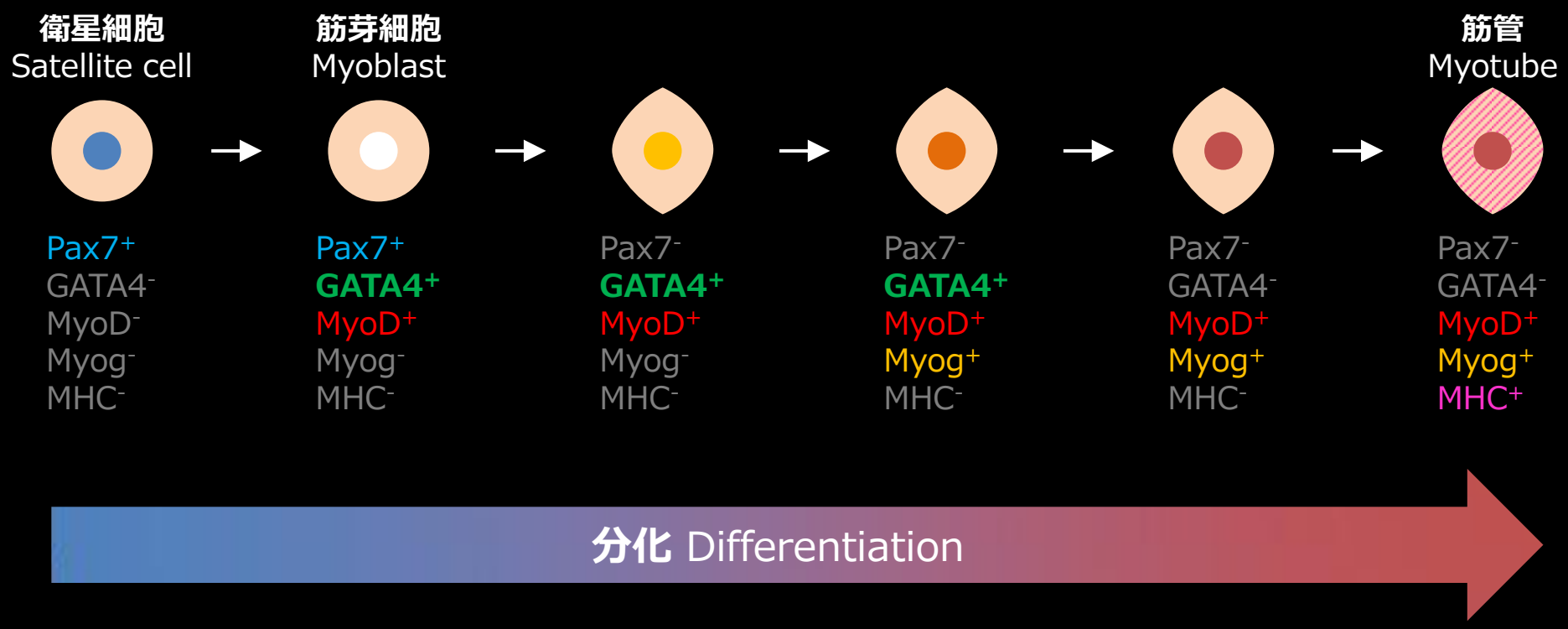
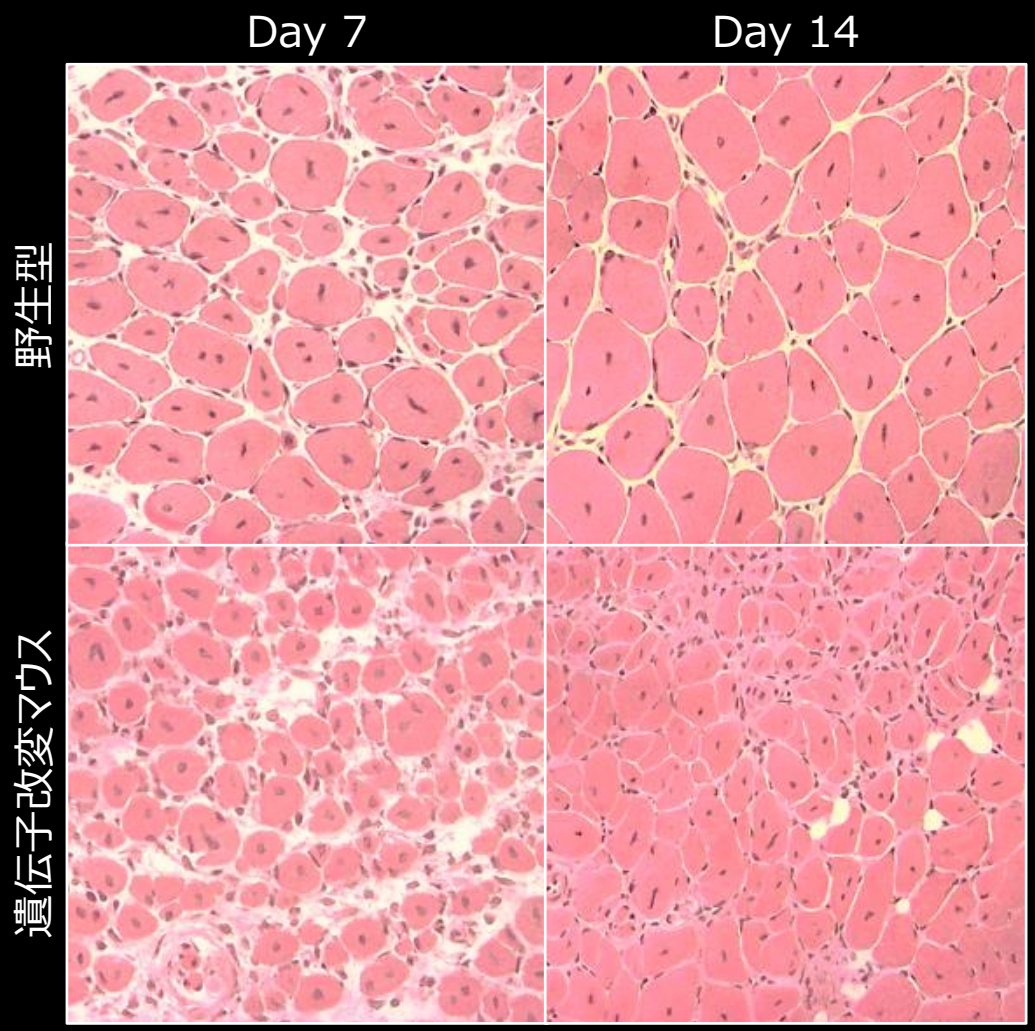
幹細胞に発現する遺伝子を破壊すると組織再生異常が生じる