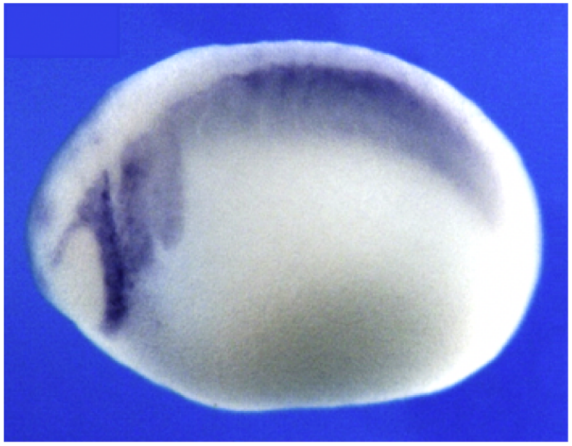
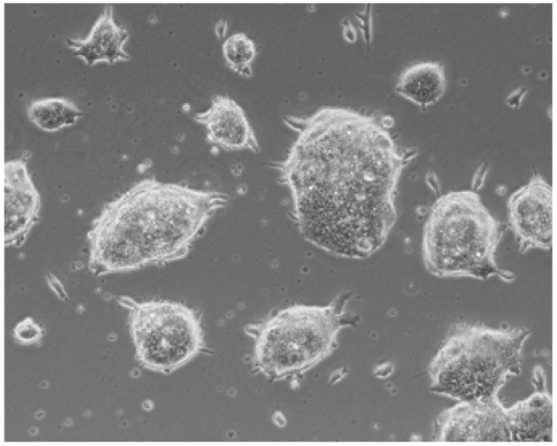
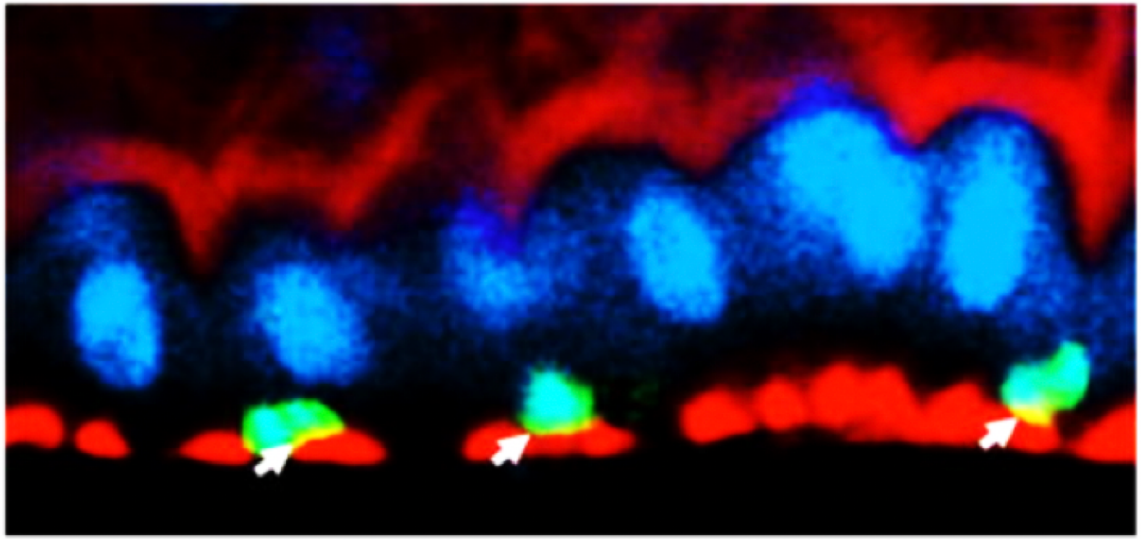
M2 - Master Gene Cell & Development
Workshop UE Practical course
Stem cells

October 13th – October 27th 2025







M2 - Master Gene Cell & Development
Workshop UE Practical course
Stem cells

Integrated approach:

Developmental biology
Genetics
Cell biology
In vivo/in vitro
Imagery

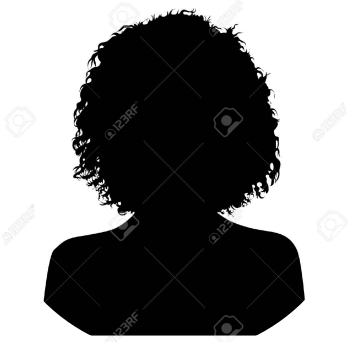
International Course certified
« Cours pratiques innovants de la GS LSH »

Teaching staff

Jérome Artus

Isabelle Guénal

Patrick Pla



Sophie Dupré

Sébastien Szuplewski

Caroline Borday

M2 - Master Gene Cell & Development
Workshop UE Practical course
Stem cells

Program and schedule

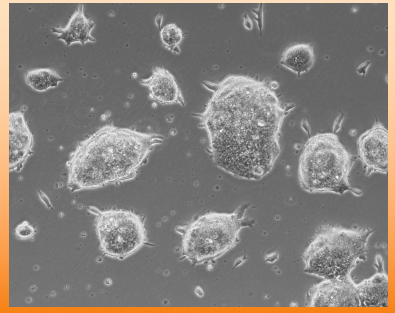
Evaluation

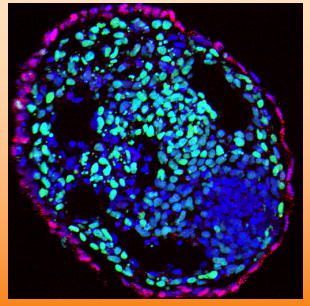
Practical details

State of mind in the pair and in the group

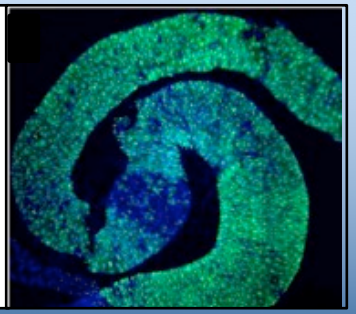
Program

Mini research project 1: *In vitro*
Pluripotency from ES to iPS cells





Mini research project 2: *In vivo*
Homeostasis of *Drosophila* adult midgut



Mini research project 3 :
Are Hedgehog and Wnt signaling pathways involved in neural crest cell specification and migration?

Schedule

<table>
<tr><th colspan="8">Week 1</th></tr>
<tr><th></th><th colspan="2">Monday oct 13rd
UVSQ</th><th>Tuesday oct 14th
NeuroPSI</th><th colspan="2">Wednesday oct 15th
UVSQ</th><th>Thursday oct 16th
NeuroPSI</th><th>Friday oct 17th
UVSQ</th></tr>
<tr><td>9h-10h</td><td colspan="2">General introduction</td><td rowspan="3">Xenopus FIV and injection training</td><td colspan="2">personal work</td><td rowspan="3">Fixation of the first batch of embryos at stage 18 / induction by DEX treatment of the second batch of embryos at stage 18 / cyclopamine treatment at stage 18</td><td rowspan="3">Cell culture & observation</td></tr>
<tr><td>10-11h</td><td colspan="2">Experimental design of the Xenopus project</td><td rowspan="2">Cell culture & observation</td><td>dissection</td></tr>
<tr><td>11h-12h</td><td colspan="2">Experimental design of the Drosophila project</td><td rowspan="2">dissociation</td></tr>
<tr><td>12h-13h</td><td colspan="2">lunch</td><td>lunch</td><td colspan="2">lunch</td><td>lunch</td><td>lunch</td></tr>
<tr><td>13h-14h</td><td rowspan="4">Design of the cell culture projects & Cell Culture</td><td rowspan="4">Drosophila dissection training</td><td rowspan="4">Xenopus FIV and mRNA injection</td><td colspan="2" rowspan="4">cytometry acquisition</td><td rowspan="4">WISH probe synthesis</td><td rowspan="3">cytometry analysis</td></tr>
<tr><td>14h-15h</td></tr>
<tr><td>15h-16h</td></tr>
<tr><td>16h-17h</td></tr>
<tr><td>17h-18h</td><td colspan="2">personal work</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td>made by teachers</td><td colspan="2">Inducing Ovulation</td><td rowspan="2">Drosophila infection</td><td colspan="2" rowspan="2">checking of the embryos / induction by DEX treatment at stage 12,5 / cyclopamine treatment at stage 12,5</td><td rowspan="2"></td><td rowspan="2">fixation of the second batch at stage 24</td></tr>
<tr><td colspan="2">Drosophila infection</td></tr>
</table>

Schedule

Week 2

	Monday oct 20th ***NeuroPSI***	*Tuesday oct 21st* ***NeuroPSI***	*Wednesday oct 22nd* ***UVSQ***	*Thursday oct 23rd* ***NeuroPSI***	*Friday oct 24th* ***UVSQ***	*Monday oct 27th* ***NeuroPSI***
9h-10h	WISH day 1: pre-treatments	WISH day 2: probe washes and incubation with anti-DIG antibody	Cell culture & observation	WISH day 4: Post-fixation, pictures of whole mount embryos	Cell Culture & observation	Presentation of the results
10-11h			Dissection fixation mounting			
11h-12h					Cell Culture analysis / Drosophila analysis	
12h-13h					*lunch*	
13h-14h	*lunch*	*lunch*	*lunch*	*lunch*	Perconal work, Cell Culture analysis / Perconal work, Drosophila analysis	social event
14h-15h	WISH day 1: pre-treatments, personal work, **QUIZZ**	WISH day 2: probe washes and incubation with anti-DIG antibody	Cell culture & observation	personal work, analysis of the results		
15h-16h		Conference on organoids	confocal acquisition/ analysis			
16h-17h						
17h-18h	WISH day 1 : o/n hybridization	WISH day 2 : o/n washes				
made by teachers	medium changes / *Drosophila* infection	*Drosophila* infection	WISH day 3: start NBT/BCIP coloration			

Assessments

1/ Understanding projects:
theoretical and technical aspects 15%

Quizz - *Monday October 20th*

2/ Lab notebook 15%

3/ Participation / Commitment /
Quality of experiments 15%

4 / Oral presentation of results to prepare
writing the mini-article ungraded

(20min + 10-15min discussion)

Monday October 27th

5/ Write a mini-article 55%

Topic is picked up randomly (Project 1 or 2 or 3)

Sunday November 02nd

The laboratory notebook (cf handbook)
handwritten or digital

Why do we use a laboratory notebook ?

- To guarantee research results traceability:
  identification of the date and authorship of research results
- To benefit from the laboratory's expertise and facilitate in-house knowledge transfer

CRISPR heavyweights battle in US patent court

The University of California, Berkeley, and the Broad Institute are vying for lucrative rights to the gene-editing system.

06 December 2016

http://www.nature.com/news/crispr-heavyweights-battle-in-us-patent-court-1.21101

US Patent Office Will Intervene in CRISPR Dispute Between UC Berkeley and Harvard, MIT

29 june 2019

https://www.thecrimson.com/article/2019/6/29/broad-berkeley-patent-interference/

The laboratory notebook (cf handbook)

What should be documented in this notebook ?

- The title and date of experiments
- The specific question you assess with each experiment
- Specific description of each stage of experiments as they are carried out (preparation of solutions with calculation of volumes, incubation times, temperatures…)
- Measurements taken and conditions in which they are obtained
- Any new (clearly formulated) working hypotheses
- Assessments, interpretations and comments on the obtained results
- Ideas for improving and completing the results
- Reference to any relevant documents which cannot be included in the laboratory notebook (electronic data, data of colleagues…)

Oral presentation

Monday October 27h

NeuroPSI

For two hours :

- 1 pair works on one project
- in the presence of the project supervisors to ask any questions
- End of oral preparation

Oral presentation :

- 20 minutes to present the project
  - a brief introduction presenting the scientific questions of the project
  - the main results and their analysis
  - a brief interpretation to conclude.
- 10 minutes for questions

Write a paper (on one project)

Sunday November 02nd

cf UE « Neural stem cells and nervous system development »

1/ Article Title
It contains the main message of the article

2/ Summary (max 2000 characters)
It gives concise objectives and major results.
Specify some keywords.

3/ Introduction
It clearly puts the subject in context, without aiming at an exhaustive review,
and identifies the questions and objectives of the work.
(Biological context, general problematics relative to your own objectives and specific problematics of the article).

4/ Material and Methods
This section orderly describes the used techniques (including imaging and statistical methods) and materials

The description should not be too detailed (washing ...)
but experiments should be reproducible by others (mention concentrations…)

Write a paper

5/ Results

This section describes the results of experiments.

It is organized into parts, with explicit titles, linked through transitions asking the questions sequentially.

For each result part: describe, analyse and interpret data *(biological conclusions)* **in scientific article-style format**

There are two modes of data presentation:

Tables:

Its title, always placed at the head, must be sufficiently detailed to enable an understanding of the table regardless of the text.

Figures:

The legend of the figure is usually placed at the bottom of figure

It must be both accurate and sufficiently explanatory.

It specifies the abbreviation used in the figure.

-For graphics: Prefer horizontal legends, which must be clearly readable on both axes, specify the statistical significance of the results (* and correspondence in the legend).

-For photographs: orientate them consistently, do not forget the scales, point the important elements (*e.g.* arrowheads) without invading the figure.

Write a paper

6/ Discussion

This section should:
remind the results of the experiments
provide their interpretations
confront them to the literature.

7/ References

This section provides the cited literature.
The format should be consistent.

Practical details

State of mind in the pair and in the group

Stem cell : definition & properties

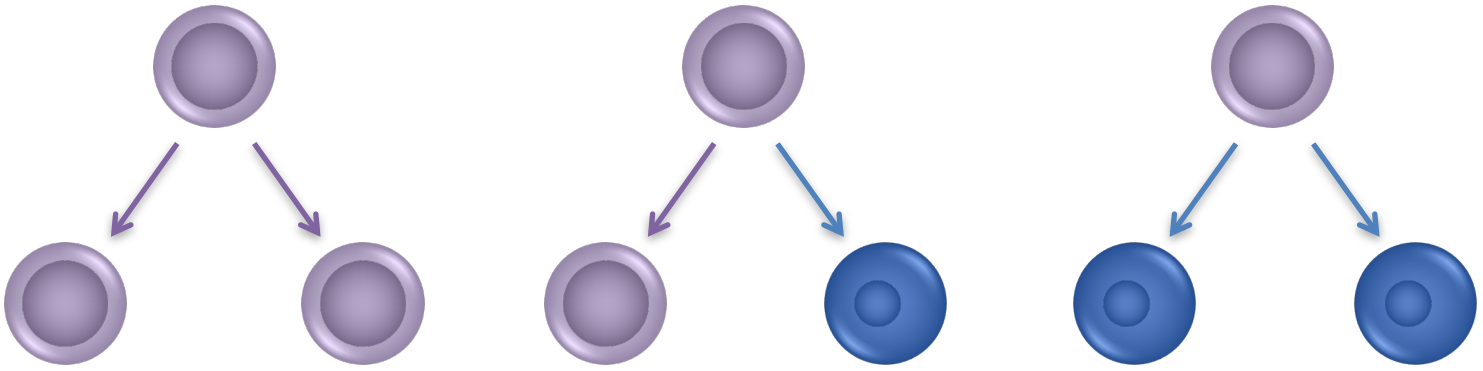
A cell that can continuously produce unaltered daughters and also has the ability to produce daughter cells that have different, more restricted properties. *Smith A. Nature 2006*

SELF-RENEWAL

Ability to go through numerous cycles of cell division while maintaining the undifferentiated state

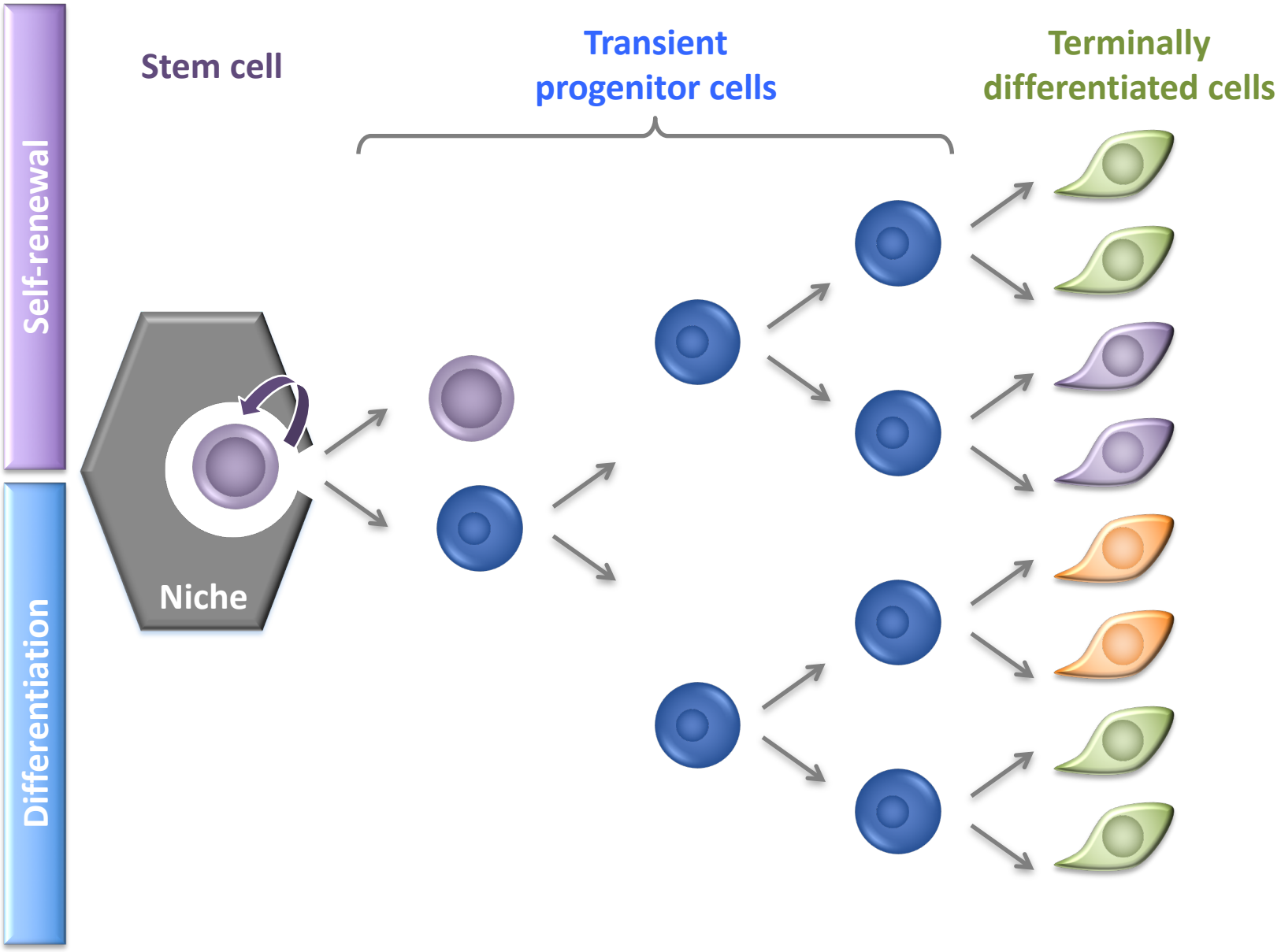
POTENCY

Capacity to differentiate into specialized cell types



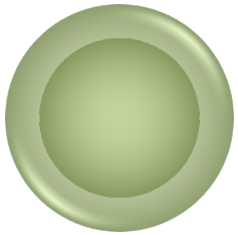
symmetric division | asymmetric division | symmetric division

Stem cell : definition & properties

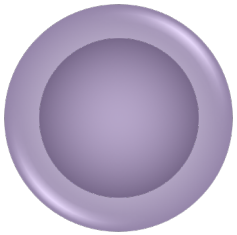


Stem cell : definition & properties

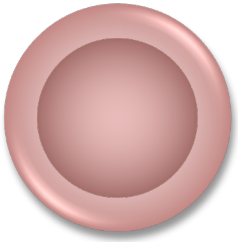
Embryonic SC



Adult SC



Cancer SC



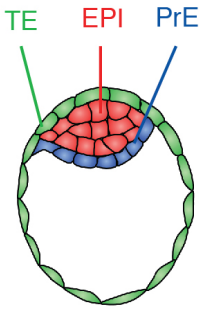
The human body (organs > tissues > cells)
30 000 billions cells
250 cell types

1. **Establish cell diversity**
2. **Maintain / repair adult tissues**

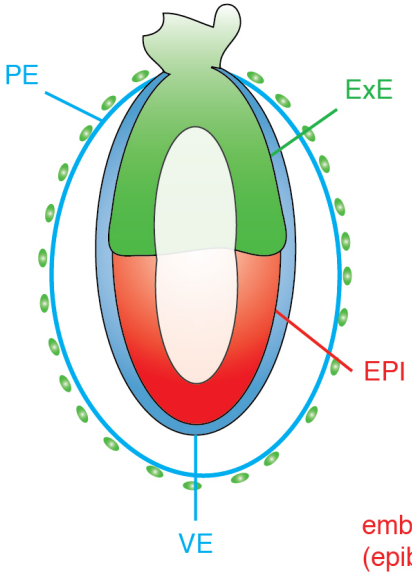
Stem cells and developmental potential

E0.5
1 cell

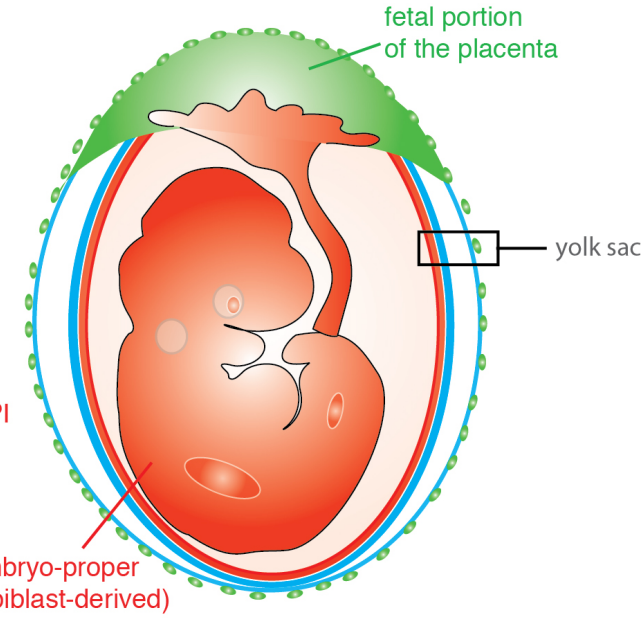
E2.5
8 cells



E4.5
blastocyst



E5.5
Early post-implantation
embryo



E10.5
Mid-gestation
embryo

Totipotent cells

Embryonic **AND** extraembryonic lineages

Pluripotent cells

ALL embryonic lineages

embryonic stem cells

Multi- > Oligo- > Unipotent cells

Limited number of lineages

Germline
stem cells

Foetal
stem cells

Adult
stem cells

The irreversible loss of potency

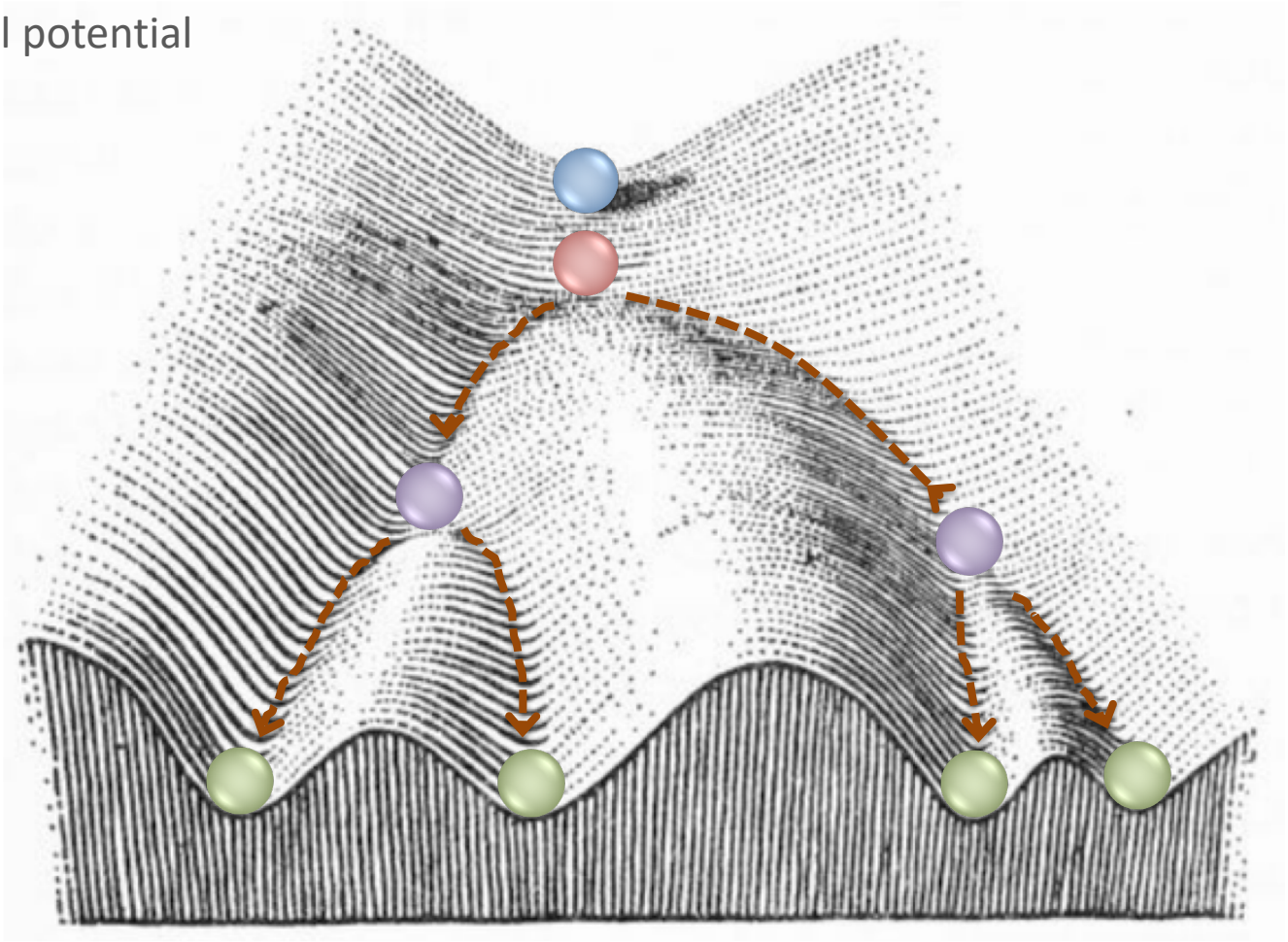
Developmental potential

Totipotent

Pluripotent

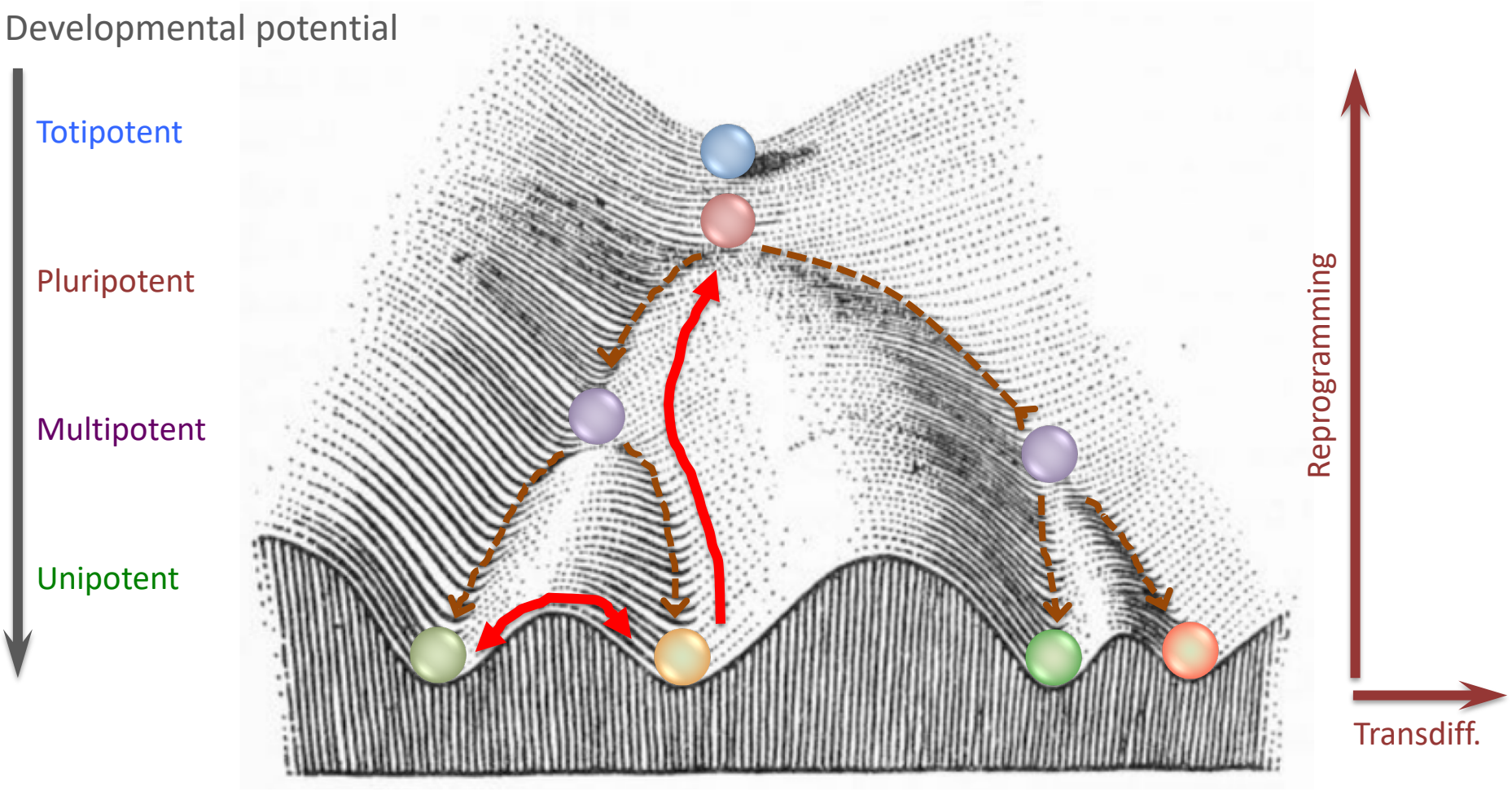
Multipotent

Unipotent



adapted from CH Waddington's epigenetic landscape model (1957)

Cell fate can be altered : reprogramming and transdifferentiation



adapted from CH Waddington's epigenetic landscape model (1957)