



STUDY ON VETERINARY STEM CELLS

ADVANCES AND APPLICATIONS

Núria Ribalaiga Pinyol. July 2016

INTRODUCTION

Regenerative medicine refers to therapies that seek to restore the form and function of normal cells using the **body's own biological machinery**, as are stem cells.

Since the first study succeeded in achieving pluripotent stem cells in 1981, the aim of the research has been changing diversely, from preclinical model in experimental studies for human diseases to clinical therapeutic applications in animals.

WHAT ARE STEM CELLS?

Stem cells are functionally defined as cells with:

- Capacity to **self-renewal**
- Ability to **generate differentiated cells**

Maintained indefinitely in culture and still maintain the competence to produce cells in a foetus.

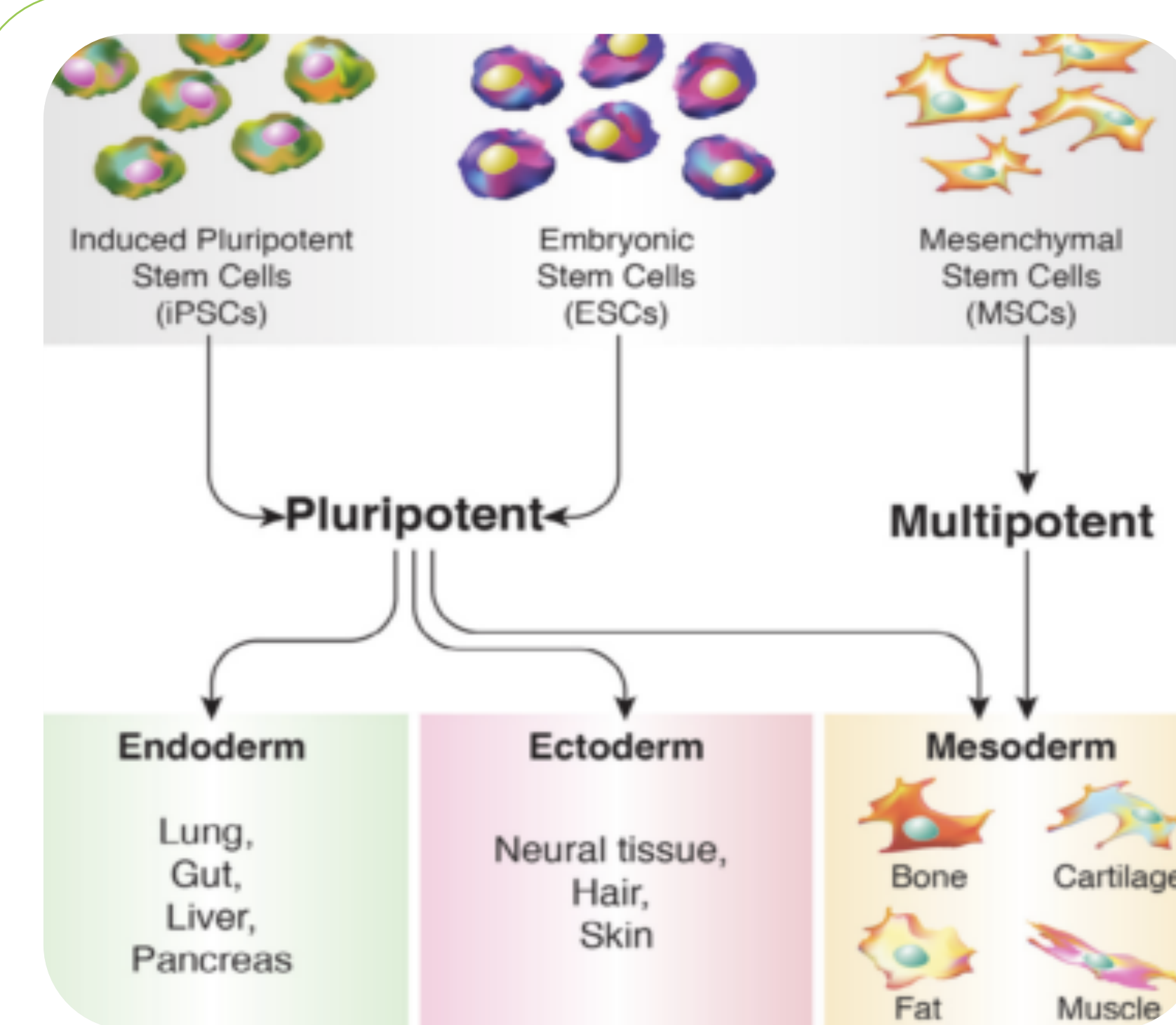


Figure 1. Stem cell classification (Whitworth i Banks, 2014).

CLASSIFICATION

According to their ability to differentiate:

- **Pluripotent:** embryonic stem cells (ESCs) and induced pluripotent cells (iPSCs).
→ give rise to all the tissues of the body
- **Multipotent:** mesenchymal adult somatic cells (ASCs).
→ replenish cells within specific organs or tissues

The stage of development where they are obtained:

- **Embryonic stem cells** → inner cell mass of the blastocyst.
- **Adult somatic stem cells** → tissue lineages.
(endoderm, mesoderm and ectoderm)
→ Mainly from bone marrow and adipose tissue.

STEM CELL APPLICATIONS

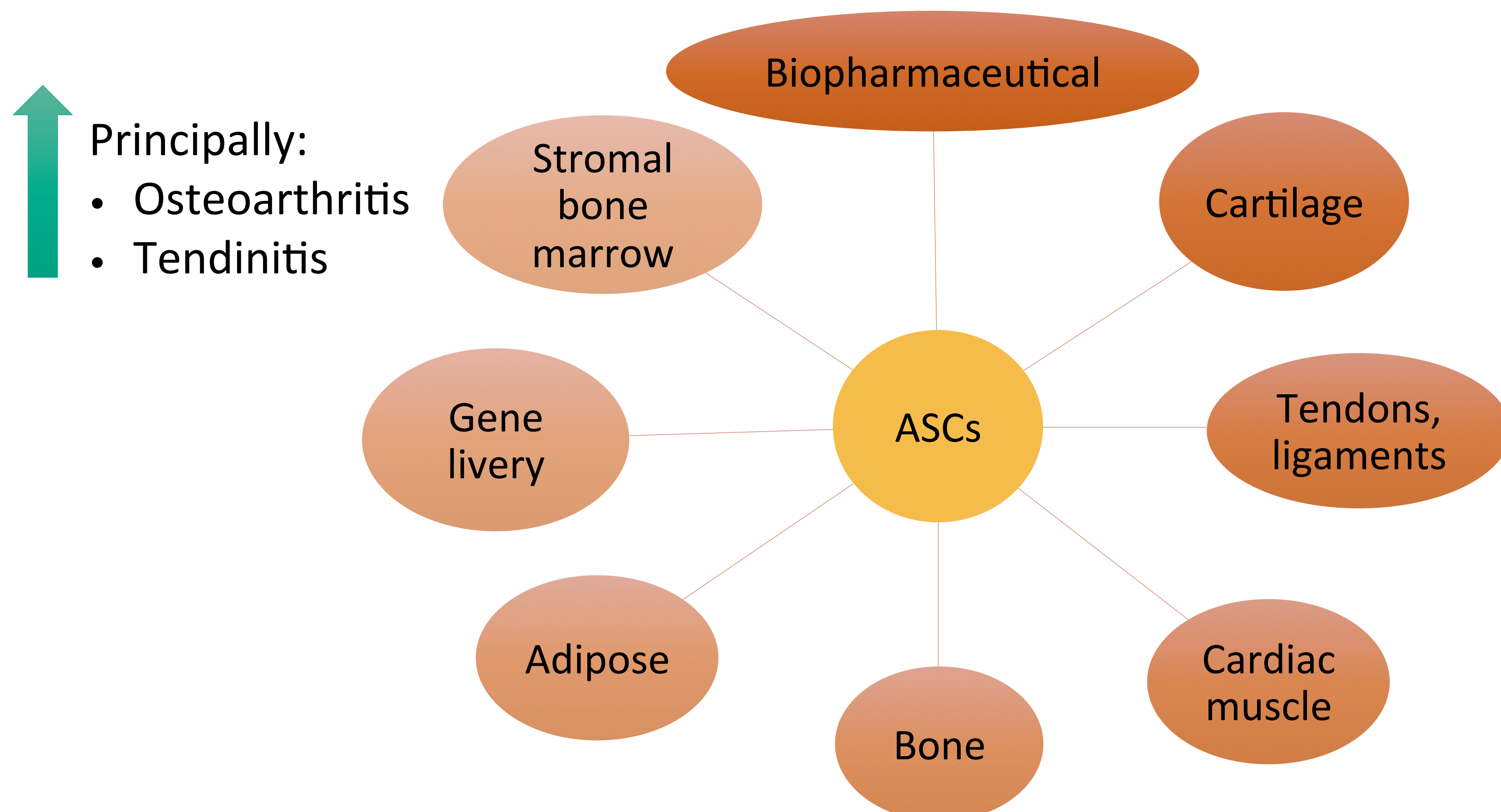


Figure 2. Potential applications of adult stem cells from adipose tissue.

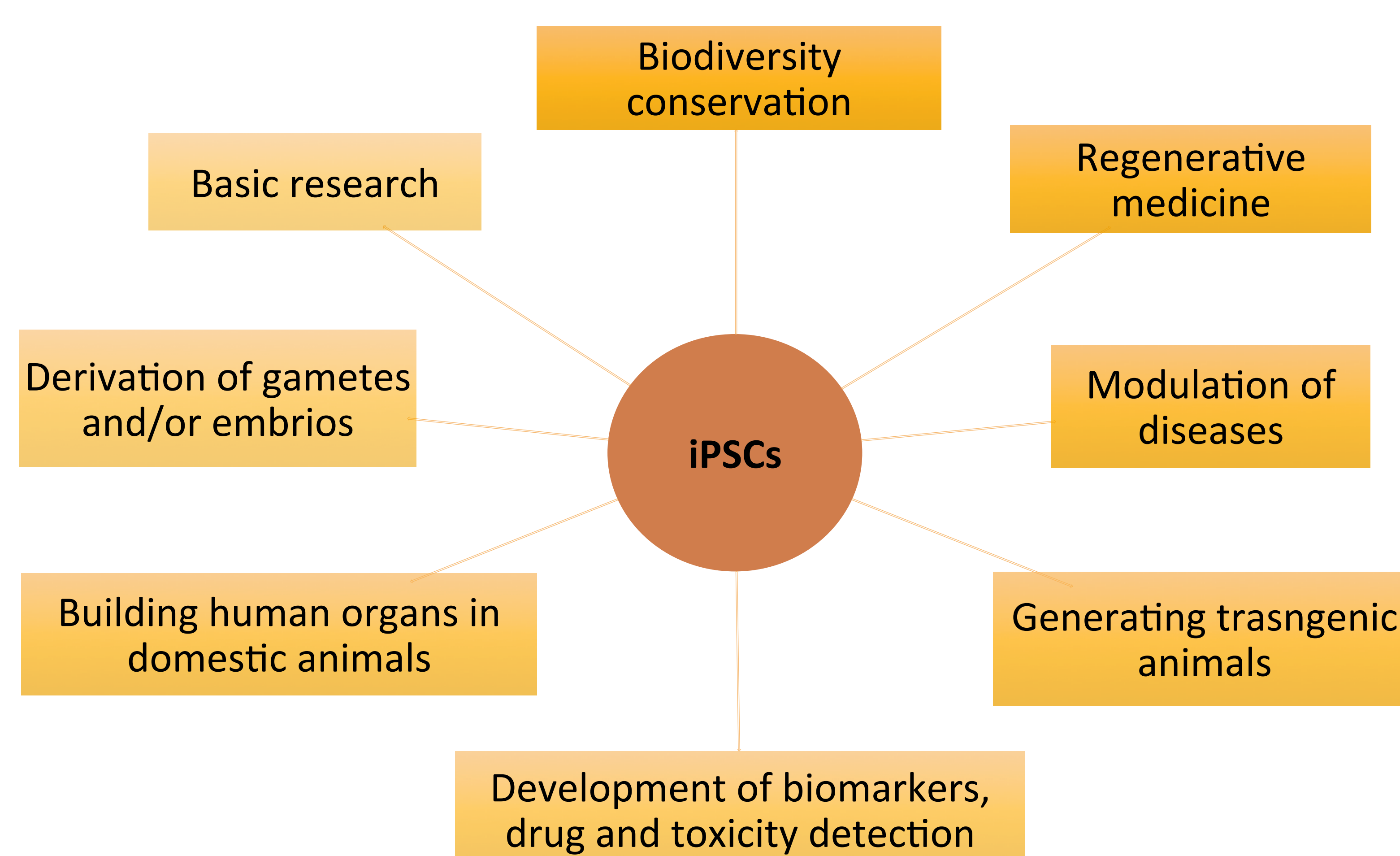


Figure 3. Potential applications of induced pluripotent stem cells (A. Cebrian-Serrano et al., 2013).

COMPARISON BETWEEN STEM CELL TYPES

ESCs	ASCs	iPSCs
Derived from the inner cell mass of the blastocyst	Come mainly from bone marrow or adipose tissue	Come from reprogramming of somatic cells
Pluripotent	Multipotent	Pluripotent
Allogenic	Autologous	Autologous
No clinical applications	There are clinical applications (main source of actual therapies)	Still clinical applications in study
Risk of teratomas and teratocarcinoma	Slight tumorigenic risk	Risk of teratomas

Table 1. Features of different stem cell types.

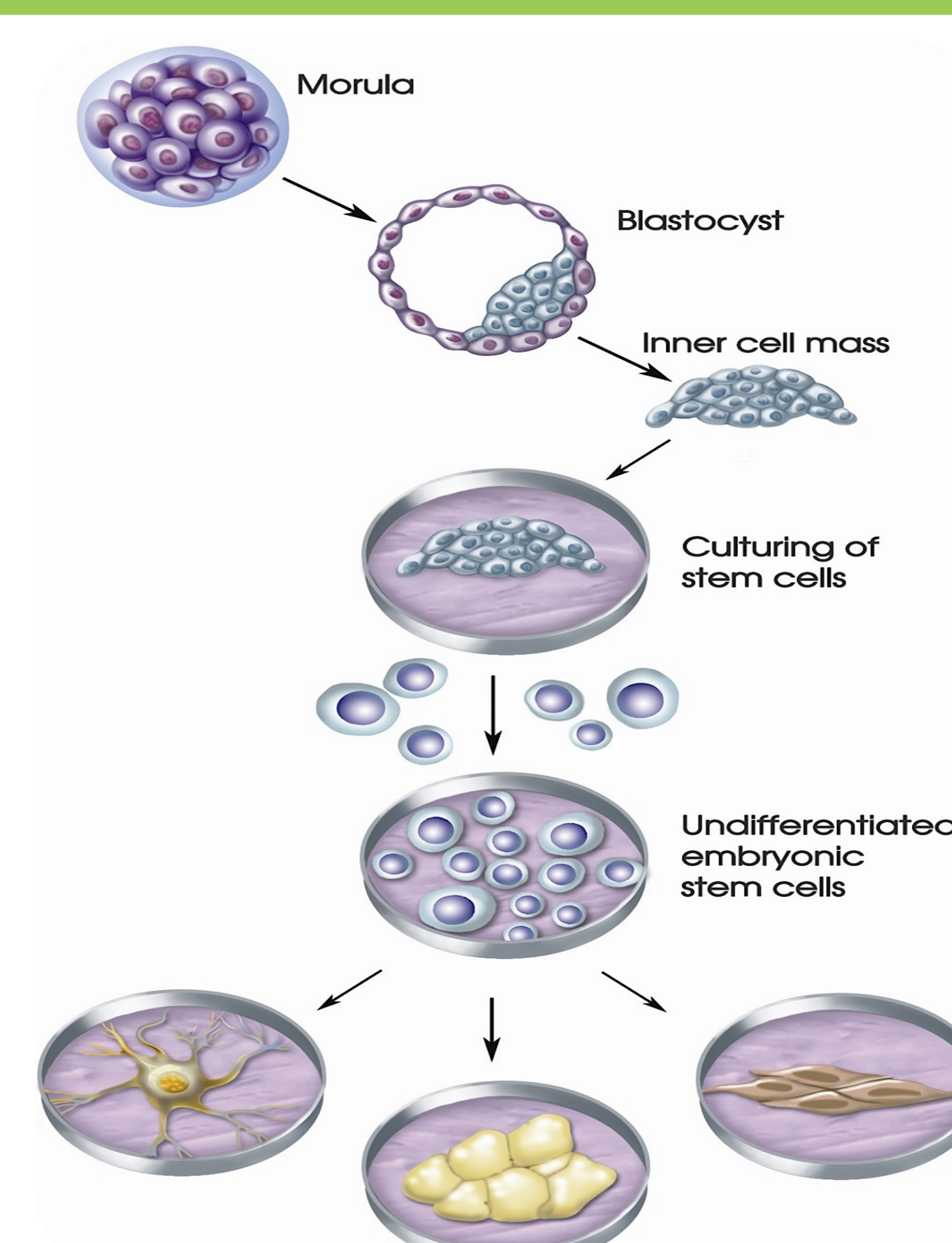


Figure 4. Obtaining ESCs (National Academies, 2010)

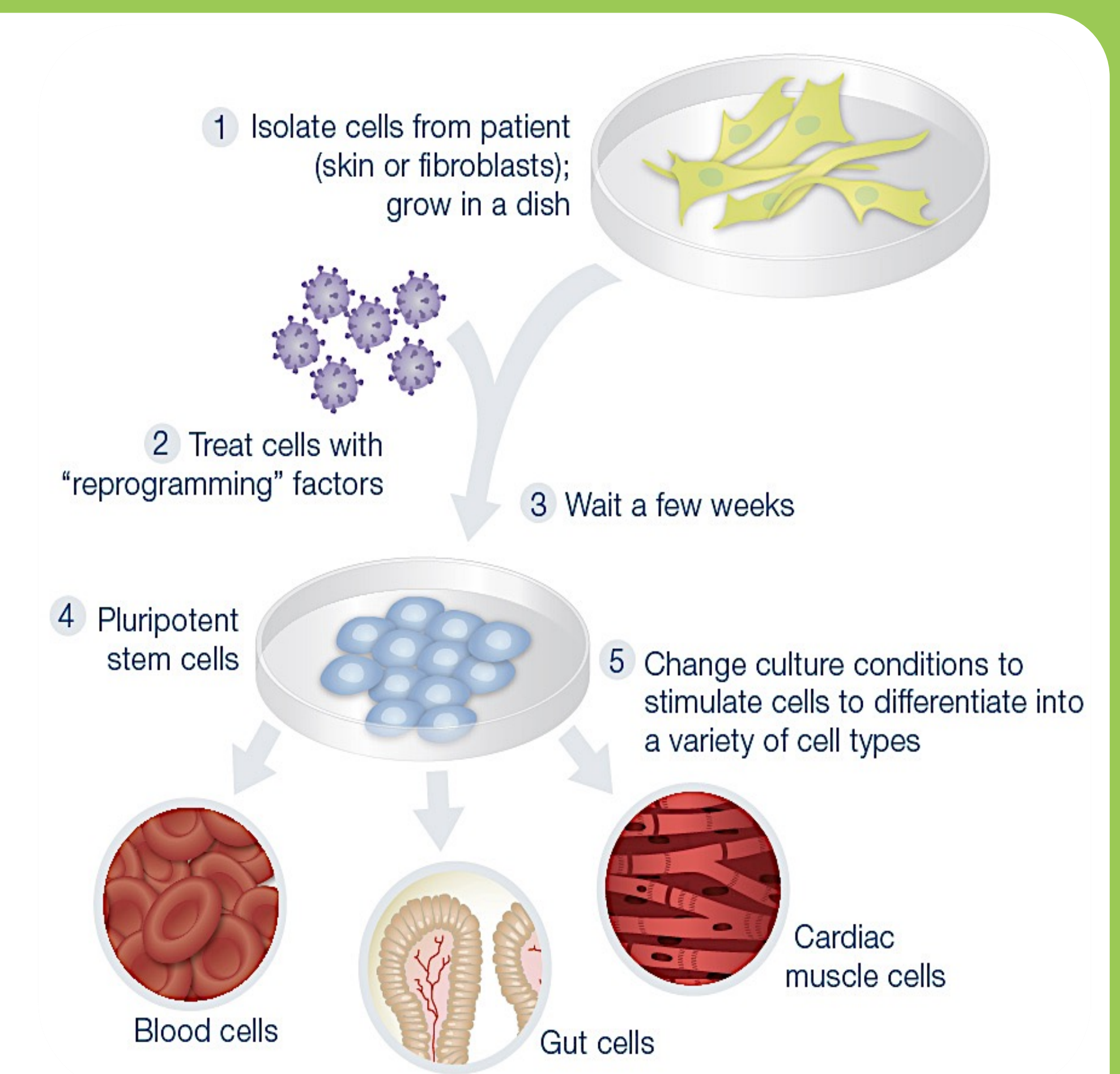


Figure 5. Obtaining iPSCs (Genetic Science Learning Center, 2016)

CONCLUSIONS

- Advances in studies in veterinary medicine have opened a wide range of opportunities for regenerative medicine therapies.

→ However the studies **do not follow** the standards or protocols
Its reliability is questionable and may jeopardize the **reputation** of the field.

- Most applications today are for **musculoskeletal diseases**, but gradually new doors are being opened for other diseases

→ Cardiac or hepatic disorders, diabetes, transplants..

- When regenerative medicine is well-defined it will give tools for new therapeutic approaches and to improve the research in human medicine.