Interreg Project developing new bioMaterials for PROliferation and in Vitro Expansion of STEM cells

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Interreg
EUROPEAN UNION
Grande Région | Großregion
IMPROVE-STEM
Fonds européen de développement régional | Europäischer Fonds für regionale Entwicklung

Expansion of mesenchymal stem cells for cell therapy purpose

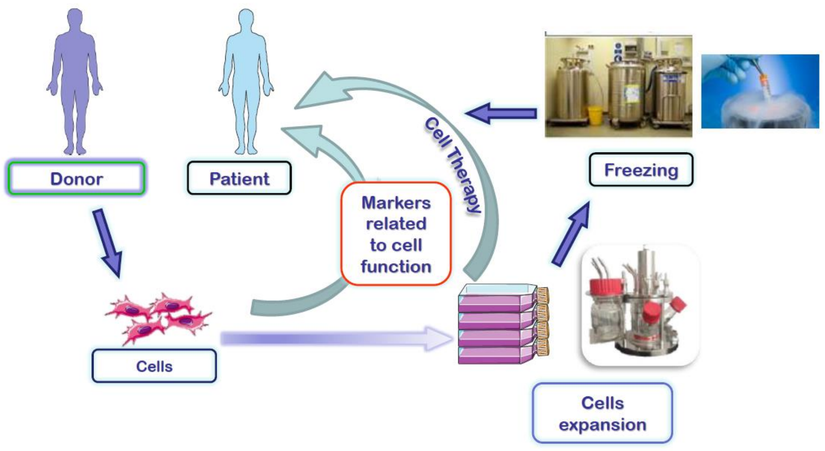
Mesenchymal stem cells (MSCs)

Present in **umbilical cords**, bone marrow, fat…

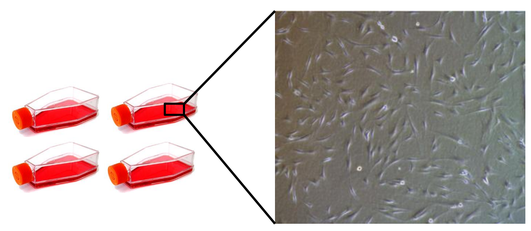
+ Differentiation capacity => Tissue engineering

+ Immunoregulatory effect => **Cell therapy**

- Scarcity *in vivo* (≈ 1 M per sample) => ***In vitro* expansion** (≈ 100 M per dose)



MSC expansion process



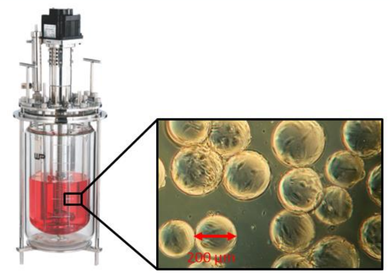
2D static culture

CSMs attached on the bottom surface of T-flasks

- Low ratio S/V

- No automation/control

- High operational costs



3D dynamic culture

CSMs attached on microspheres (microcarriers) in suspension in stirred tanks

+ High ratio S/V

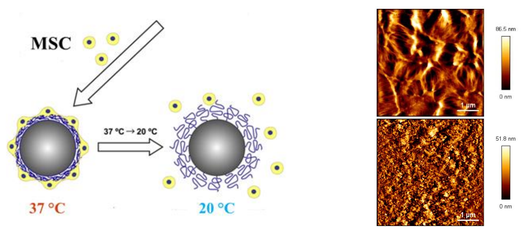
+ Automation/control possible => **How ?**

- Quality/Detachment issue (**Cell = Product**)

- Mechanical stress => **Damage to cells ?**

Towards an efficient process for stem cell expansion: A multidisciplinary approach

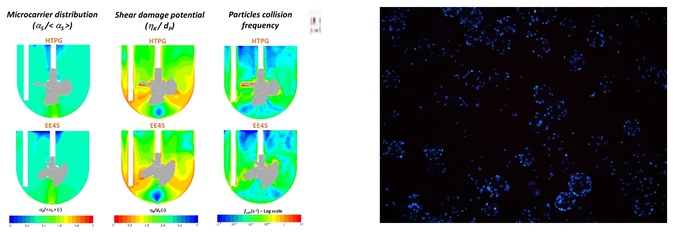
Microcarriers with smart surface properties



- **Microcarrier surface modification by grafting a thermoreactive polymère**
  - ✓ Promoting adherence during expansion phase
  - ✓ Ensuring detachment during harvest without chemical additions
- **Microcarrier surface characterization**
  - ✓ Mechanical resistance
  - ✓ Cell/Surface interaction

Biomaterial science

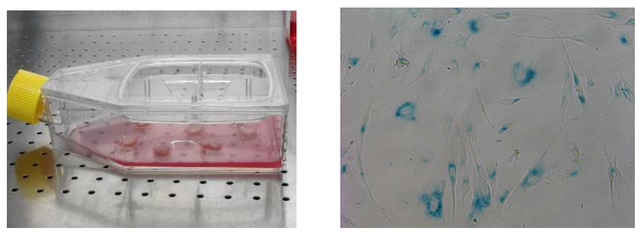
Optimized processes for MSC culture and harvest



- **Bioreactor design optimization**
  - ✓ Ensuring liquid homogeneity and microcarrier suspension
  - ✓ Avoiding mechanical stresses
- **Culture strategy and automation development**
  - ✓ Enabling a continuous expansion
- **CSM harvest optimization**
  - ✓ Avoiding cell damages
  - ✓ Enhancing harvest yield

Bio-chemical engineering

MSC sampling and quality control



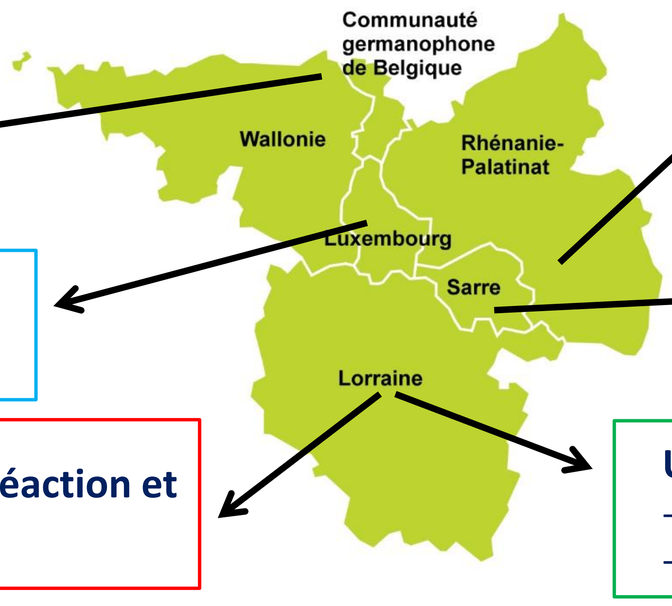
- **MSC sampling optimization**
  - ✓ Ensuring MSC quality and isolation from umbilical cords
- **MSC phenotypical and functional characterization**
  - ✓ Identifying markers for cell quality control
  - ✓ Ensuring quality and functionality from the sampling to the harvest steps of the process

Cell biology

Université de Liège
- Chemical Engineering
- CEIB

Luxembourg Institute of Science and Technology

CNRS - Laboratoire Réaction et Génie des Procédés



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