Modular mini-factories for autonomous & decentralised ATMP production

Booth 429

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Why?

There is an increasing demand for efficient production technologies for cell and gene therapies because more are approved each year against different diseases, including haematological cancer. CAR-T cells have already entered the market, and currently, many more gene therapies are being investigated – with promising results. Therefore, there is an increased need for a flexible and autonomous production system, reducing costs while increasing standardization.

How?

Currently, cell-based gene therapies are mainly produced manually or using all-in-one devices. We envision a modular approach, where each process step is represented by a module and a cassette. The modules can be used in the needed sequence. This enables production of different cell-based gene therapies in the same infrastructure. The cells are inside a biochamber, which is inside of the cassette which is added to the module. This results in a "GMP-in-a-box" system, eliminating the need for clean room facilities and staff. Sterile transfer of cells from one module to another using sterile re-connectors.

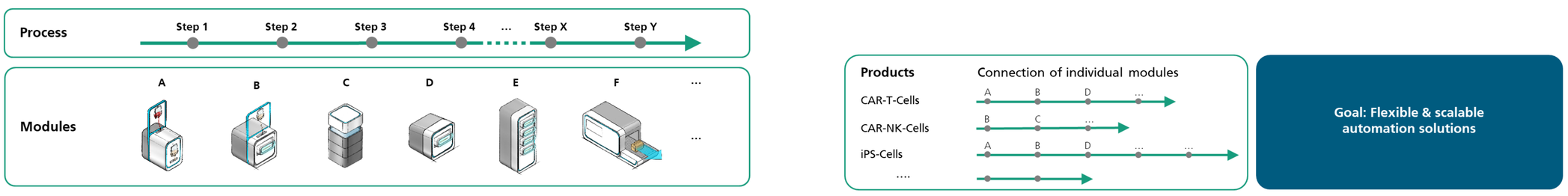

Figure 1: Each process step is represented by a module and a matched cassette. This enables flexible production of several cell based therapies using the same infrastructure.

The Biochamber

» cylindrical biochambers with membranes for the expansion of T cells and NK-cells –reaching up to 2-2.5 x10^6 cells/ ml in a batch process (figure 2) over two weeks

» better cell densities compared to cultivation in G-Rex 500 over the same timespan and using the same volumes

» currently fed-batch process is investigated and in the future the transfection of cells inside the biochamber will be investigated.

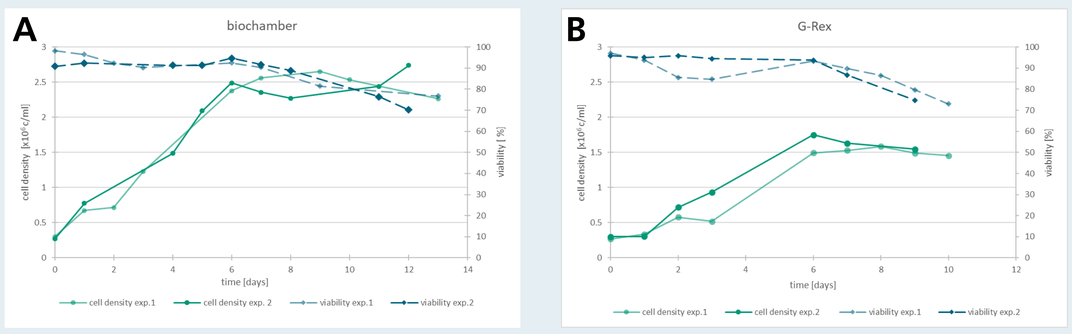

Figure 2: First data from our developed biochamer, reaching up to 2 x10^6 cells/ml cultured in 300 – 350 ml (A). Data from simultaneously performed G-Rex experiments, performed in 300 ml. (B)

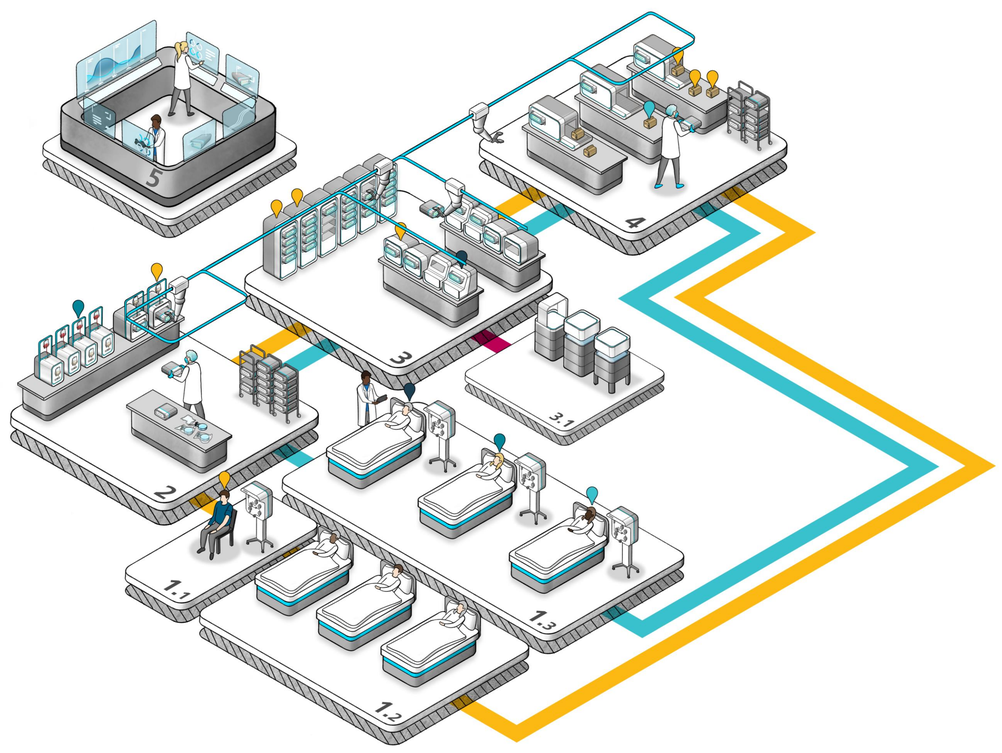

Figure 3: Vision of modular mini-factories for autonomous & decentralised ATMP production

1. Cell sourcing
2. Sample preparation & transfer
3. Cell prosessing and expansion
4. Formulation and packaing
5. Control Unit

Modular mini-factories

Figure 3 shows the vision of automated & decentralized ATMP production using mini-factories. Cells are sourced from patients or health donors (area 1) and then transferred into the biochamber and into the cassettes, either manual or automated (area 2). Then the cells are processed as needed (area 3) and prepared for final formulation and packaging (area 4). Everything is supervised in the control unit (area 5).

Summary & next steps

The modular structure gives a high degree of **flexibility** and **scalability** with a small footprint that requires **less cleanroom space** and trained personnel. This system is ideal for production near patients, e.g., clinics or specially equipped centres close to patients. Both robots and humans can operate the system. Currently, we are working on fulfilling this vision by developing the individual modules, their components with integration of online sensors. This will reduce system disruption through sampling, increases efficiency and leaves more material for medical treatment.

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