

Summary and key recommendations

Stem cell research is a highly dynamic research field that is striving to achieve clinical application with the help of numerous technological breakthroughs and an enormous growth in knowledge. Whereas blood stem cell transplants have long been an essential part of the medical repertoire, a new generation of stem-cell-based therapies has now entered the scene at clinical trial centers: tissue replacement based on human pluripotent stem cells.

Although stem cell research is conducted in Germany at a top international level, its clinical implementation, that is to say, the translation of relevant research findings from the lab to treatments beneficial to humans, has failed to live up to expectations. Stem-cell-based treatments are innovative, but also highly complex therapeutic concepts. They require close cooperation between various disciplines and those involved. With excellent medical schools, a highly innovative biotechnology sector, global players in its pharmaceutical industry and competent regulatory authorities, Germany is predestined to play an internationally leading role in the development of innovative cell-based therapeutic approaches.

Where do the gaps and obstacles lie in terms of the translation of stem-cell-based therapies in Germany? How can infrastructures and conditions be shaped to improve the translation process? The German Stem Cell Network (GSCN) interviewed national and international university and industry-based stem cell experts as well as regulatory experts for their estimation.

Based on a SWOT analysis, the GSCN has drawn the following conclusions and recommendations for action that relate to five overarching aspects of the innovation chain.

- **Take advantage of the enormous growth in know-how in stem cell research to develop safe, effective therapeutic approaches:** Innovative technologies, more relevant models and standardized manufacturing processes provide the basis for the clinical application of products derived from adult and pluripotent stem cells. To accelerate the translation of innovative therapies with human embryonic stem cells (hESC), the GSCN advocates that the current deadline of 1 May, 2007 as stipulated in the Stem Cell Act, be shifted and that the reservation for the use of hESC only for research but not for commercial use be lifted.
- **Review, exploit and continuously adapt the regulatory framework governing the manufacture of cell-based medicinal products:** Cell-based medicinal products that undergo biotechnological processing are classified in the EU as advanced therapy medicinal products (ATMP) and are centrally approved. The regulatory framework is designed to be flexible and risk-based, and formats for expedited approval have been created. ATMP developers in the academic sector and industry should seek out contact with regulatory authorities as early as possible and take advantage of existing consultation opportunities. In addition, developers of cell-based therapies should receive support at an early stage of development with the intricate planning process and the construction of production plants that meet the principles of good manufacturing practices (GMP).
- **Plan clinical trials carefully and involve relevant protagonists:** Cell replacement therapies are novel therapeutic approaches that are usually individualized. Their

testing in randomized, controlled clinical trials in a manner consistent with the criteria of evidence-based medicine requires a high level of expertise in the planning, conduct and analysis of such trials. Much depends on close collaboration between stem cell researchers, clinicians and the competent authorities. It is recommended that clinical trial units specializing in ATMP therapies be set up at German university hospitals.

- **Improve infrastructure in order to close existing gaps in the translation process:** Translation centers for regenerative medicine must focus more strongly on added value. In this respect, the developers of stem-cell-based therapies could benefit from the dynamic development of cell-based gene therapies (e.g. cancer immunotherapy). Efficient translation demands new cooperation and funding models for research institutes and industry. Outside consultation services and project management expertise are still underutilized. Technology transfer centers should be organized more efficiently and flexibly, and incubators and accelerator concepts should be intelligently integrated in the promotion of innovations.
- **Young doctors and scientists should be trained specifically in the translation of stem-cell-based therapeutic approaches:** The complex translation of stem-cell-based therapies calls for a new breed of scientists, for example clinical translation scientists. Conditions must be created at university hospitals to train translation-oriented young scientists and to open up attractive career prospects for them. In addition, educational institutions are still not adequately meeting the strong demand for specialists in the manufacture of cell products in cleanroom laboratories.