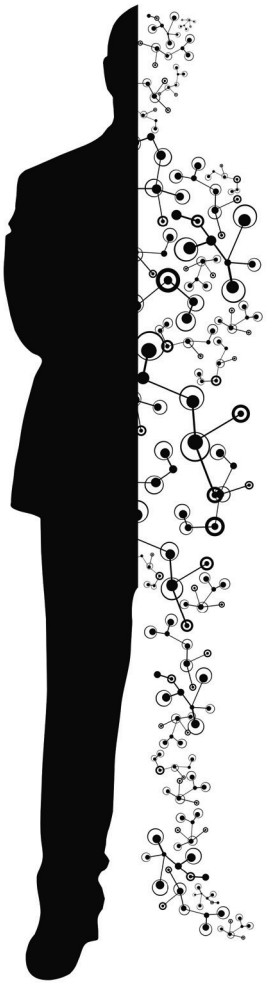
# Stem cells in plastic and regenerative surgery

# CHAPTER 10



# 10

# Valorization

## Valorization

Stem cell technology is thought by many medical professionals in the field to bring about the next era in medicine. Countless research groups are working towards harnessing the body's own regenerative capabilities in endogenous or isolated cells, and tailoring the therapy to a specific disease, condition, request or person. At the moment we still rely largely on medication to treat diseases, but businesswise as well as socially this is a horrible model, according to Dr. Susan Solomon in her 2012 TED talk: "Currently, developing a drug takes an average of 13 years, costs $4 billion, and has a 99% failure rate.", and: "The way we've been developing drugs is essentially like going into a shoe store and no one asking what size you are … They just say, 'Well, you have feet. Here are shoes.'" This thesis was meant to explore new approaches to improve outcome in a variety of clinical conditions involving stem cells. This chapter focuses on discussing the societal and economic impact, as well as future implementation possibilities of the findings.

In Chapter 4, an animal study was carried out to assess the efficacy and safety of Neuro-cells, a standardized GMP-compliant and minimally manipulated product containing autologous stem cells from a patient's own bone marrow (derived from initial experiments in Chapter 3), on spinal cord injury. The prevalence of spinal cord injury (SCI) worldwide is estimated at 2.5 million cases and the financial burden per case is calculated to be between 200,000 - 260,000 Euros/year, aside from the tremendous impact on the quality of life for the patient and surrounding people.[1] The preclinical work in this chapter was part of a data set that has been used by the company Neuroplast to obtain an Orphan Drug Designation from the European Medicines Agency, allowing a fast track procedure for clinical trials. Currently phase I/II trials are being carried out. Neuroplast has raised €4 million in 2020 to proceed with a phase II/III study in 2021 and, if successful, obtain conditional market approval for treatment of patients suffering from spinal cord injury.

The proof-of-principle study in chapter 6, involving electrical stimulation (ES) of ASC in order to enhance their angiogenic properties, can pave the way for a non-invasive, painless procedure for the patient to optimize the results of AFT. Several subsequent steps can be taken based on the information that was obtained. These steps include a proof of principle in animals in which the effect of ES on AFT is investigated with a focus towards volume

retention, graft composition and immunomodulation. Multiple groups can be included to determine whether it could be beneficial to pre-operatively treat the donor site ("priming the graft"), or the acceptor site ("pretreating the soil"). In addition, the effect of altering key stimulus parameters such as wave form, voltage, pulse duration and frequency needs to be studied to assess which ES protocol provides the best response. A basic problem however, may be the size of the graft when using small animals as this is not representative for humans. Graft survival due to plasmatic diffusion plays a bigger role and penetration of ES into the graft could be drastically different. Therefore, a choice has to be made to either go for a big animal model where also the penetration of the ES into the tissue can be assessed, or go straight into a clinical trial. ES devices for use in humans have been on the market for years. However, the safety of applying ES after breast cancer has to be established, especially when the therapy is aimed at stimulating angiogenesis. Today, on average 3-4 sessions of AFT are needed for a complete breast reconstruction after mastectomy. Every AFT is an operation with inherent risks, costs and recovery period. The reduction of the number of surgical procedures may therefore prove a valuable goal both financially and for the patient's wellbeing and safety.

This thesis further identified AFT as a potential treatment for neuropathic pain in Chapter 3. Neuropathic pain has a major influence on patients' lives and the people around them, not to mention the economic burden for society when debilitating pain leads to chronic unemployment. Our clinical proof of principle study provides the basis for a subsequent clinical study in which the effects of AFT are analyzed more in depth. The effect of adding ES to the treatment protocol is another avenue that is of interest and could be investigated in a randomized, controlled clinical trial. Non-responders to established treatments of neuropathic pain could be ideal patients for this clinical trial.



## References

1. DeVivo MJ (1997) Causes and costs of spinal cord injury in the United States. Spinal Cord 35: 809-813