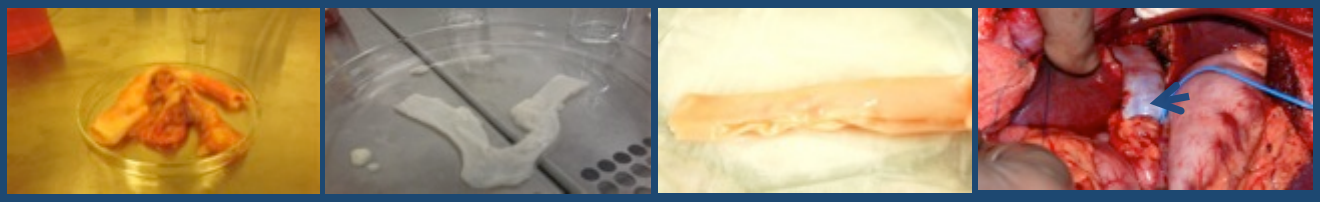
Technology and R&D

„Technology with a life changing impact“

NovaHep AB is a biotechnology company founded in 2005 as a spin-off from the Karolinska Institute with a unique, proprietary technology. As pioneers within our field, we have a clear vision to contribute to improved global health, quality of life and cost effective care through introduction of advanced personalized regenerative medicine. Having identified a growing market with an unmet need for improved solutions, at NovaHep we are developing the next generation of tissue-engineered products for vascular replacement therapy. The pipeline consists of high-quality, biocompatible products that are individualized with the patients' own stem cells. We focus on hollow and solid tissues that are not easily replaced by artificial or semi-artificial prosthetic grafts. Being covered by patent applications and trade secrets, our technology has awarded us a distinct competitive advantage in the emerging field of regenerative medicine.

Donor blood vessels | *Decellularised iliac vein* | *Recellularised iliac vein* | *Transplanted iliac vein*



In vivo proof of concept with vein shunts in 2011, results published in medical journal The Lancet in 2012

For the first time ever, a tissue-engineered vein was transplanted into a 10-year old girl to replace the portal vein leading blood from the intestines to the liver, giving the girl a whole new life. The iliac vein from a diseased donor was decellularised, characterized morphologically, histologically and biochemically, and then recellularised using bone marrow stem cells. Since this first successful transplantation, carried out at Sahlgrenska Hospital in Gothenburg, Sweden, the NovaHep technology has been refined to use stem cells from whole blood instead of bone marrow, which makes the procedure less troublesome for the patient. Additionally, the NovaHep technology has in preclinical tests been shown to work efficiently for a series of different organs, including veins with competent valves, arteries, liver and pancreas.

Challenges – unmet medical need

Today's solutions within vascular replacement therapy involve using a graft from another individual (an allograft), a semi-biological/-artificial graft or a synthetic graft. These solutions, however, all entail shortcomings and significant drawbacks: Sufficient allograft-material is oftentimes not available, allografts have short life spans and require immunosuppressive drugs, and synthetic grafts pose the risk of thromboembolic complications – with adverse consequences for patients and society.

Solution – NovaHep's technology

NovaHep holds a proprietary technology for de- and recellularisation of tissues and organs. In short, a donated tissue is decellularised into a clean "scaffold" (extracellular matrix) subsequently seeded with the patient´s own stem cells, resulting in an allogeneic ("foreign") tissue becoming autologous ("personalized"). With NovaHep's high-quality tissue-engineered products, the need for repeated surgery is diminished and the need for lifelong immunosuppression abolished. As a superior solution, the key advantages over synthetic and semi-biological/-artificial grafts are reflected by NovaHep's products being impermeable, thromboresistant, biocompatible, durable, and resistant to infections.

Milestones & IP

- De- and recellularization of blood vessels using autologous stem cells
- Technique developed for using stem cells from peripheral whole blood
- *In vivo* proof of concept, vein shunts (3 patients)
- *In vitro* proof of concept, veins with competent valves
- Collaboration on 1st clinical trial established with world leading vascular surgeons
- Collaborations with selected hospitals established
- Patent protection: Blood vessels de-/receullularisation
- Patent application: Blood vessels with valves

Chronic Venous insufficiency & other indications

Initially, we are targeting a leading position within the surgical treatment of Chronic Venous Insufficiency (CVI) with venous ulcer by offering tissue-engineered veins with competent valves. The prevalence of CVI is represented by 2.2 million patients annually in Western countries. No effective treatment is currently available and at least 27 000 of these patients would benefit from vascular surgery. The addressable market is estimated at approx. USD 200 million in Europe and the US alone. Subsequently, we will expand into other indications for veins, will do studies with other tissues (e.g. arteries, valves etc.) and whole organs and explore the market for *in vitro* products, e.g. liver tissue for predictive toxicity testing.

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