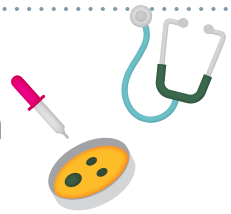
Emergence of regenerative medicine from bench research to bed side therapy



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Regenerative medicine is a biomedical field that is concerned with the replacement or regeneration of human cells, tissues or organs to restore their normal function. Imagine a world where fibrotic heart tissues and spinal cord injuries could not only be diagnosed correctly but also be treated effectively to allow patients to have a normal life. This vision is no longer a distant dream, but rather a developing reality of opportunities.

Last semester, the → Vision 2020 organizing committee consisting of four imMed PhD students put together a stimulating and interactive seminar series on the emerging topic of regenerative medicine. The seminar speakers shared their latest results from bench research to bed side therapy. They not only illuminated the great strides the field of tissue engineering, stem cell biology and spinal cord regeneration has made in the recent past, but also offered hope for future possibilities.

Biodegradable polymers for endogenous tissue growth

Dr. Andreas Emmendörffer, vice-president and operation manager of Xeltis AG Zurich, was the first speaker of this semester's series. Xeltis AG is a spin-off of the University of Zurich, a medical device company specialized in heart valve replacement and vascular surgery. It has developed an innovative technology that has replaced the traditional porcine valves typically used in heart-valve replacement surgeries. The research team now uses a biodegradable scaffold polymer that facilitates endogenous tissue growth. This technology minimizes tissue rejection and long-term use of immune suppressants and is already applied in pediatric heart surgery. The future challenge for this evolving technology will be to find new materials that can withstand the high pressures that prevail in the left chamber of the heart.

Multidisciplinary teams needed

The second speaker was Prof. Günter Tovar from the Institute of Interfacial Process Engineering and Plasma Technology, University of Stuttgart, Germany. He works with his multidisciplinary team on the development of novel materials that can replace the traditional heart valves and substitute endogenous blood vessels. Chemists test and select suitable scaffold polymers that allow physicists to evaluate the mechanics and polymer durability. Finally, biologists and immunologists test the usage of this novel material in various cell lines and animal models to evaluate their efficacy for clinical application.

Hope for spinal cord repair

A few weeks later, the committee invited Prof. Martin Schwab from the Brain Research Institute, University of Zurich and Department of Health Science and Technology, ETH Zurich, a well known proponent of regenerative medicine in the field of spinal cord repair. He initially discovered Nogo-A, a protein found to restrict regeneration of injured fiber tracts in the central nervous system. This discovery has stimulated research to find treatment options to rehabilitate patients with spinal cord injury. Prof. Schwab shared latest results from his team demonstrating that suppression of Nogo-A combined with treadmill training in rats with spinal cord injury could enhance the repair and facilitate neuronal regeneration in the central nervous system. These results were also in the media in the last months. The potential of Nogo-A antibody as a therapy is currently in clinical trials.

Pluripotent stem cells: limitless therapeutic opportunities?

The last speaker, Prof. Paul Fairchild from the Oxford Stem Cell Institute, UK is working at the interface between stem cell biology and immunology. Pluripotent stem cell therapy offers limitless therapeutic opportunities, but it still has to overcome an important challenge: the development of the right tissue immunogenicity to prevent rejection even though the tissue originates from the same person. Prof. Fairchild gave a clear overview of the underlying mechanism for triggering such immune reactions using in vitro and in vivo models. The research illuminated the opportunity to hijack self-destructive immune reactions giving hope for future therapy to treat cancer.

The informal discussion platform and friendly exchange of ideas from both speakers and participants gave a deep insight into the recent progress in the field of regenerative medicine. Although there are still challenges to overcome, it was encouraging to learn that regenerative medicine is not a dream anymore but already implemented in various forms of therapies.

The series is organized by a committee of → imMed PhD students. Next semester's topic will be → Synthetic Biology. Further information will follow soon.