Aarhus University and the University of Edinburgh
Excellence in European Doctoral Education (ExEDE)

Title: Accelerating bone ingrowth to implants by local strontium release

What was done:
An interdisciplinary consortium was established consisting of both an industrial partner, a GTS institute ("approved technological service") and Aarhus University. The consortium was financially supported by The Danish National Advanced Technology Foundation. A post doc and a PhD student were employed by Aarhus University.

The goal of the consortium was to develop and market a solution for decreasing the healing period associated with the insertion of dental implants by local release of strontium. Strontium is currently used in the treatment of osteoporosis as it stimulates bone growth while inhibiting bone resorption. The technological route was based on investigating the effect of magnetron sputtered strontium-comprising titanium coatings on peri-implant bone quality.

Initially, the involved partners were concerned with developing an industrial production platform enabling deposition of the strontium comprising coatings. This production platform was later used to synthesize a range of varying strontium comprising samples and these were subsequently analysed with respect to chemical composition, morphology, amount of strontium released as a function of time and *in vitro* biocompatibility properties. This led to the development coatings that were tested using *in vivo* (rat) models. The results from the performed models have shown the potential of this novel technology as a significant increase in peri-implant bone volume and bone-to-implant contact was found for several of the tested coatings, compared to pure titanium references. The technology has been IPR protected. While the technology is initially intended for dental implant applications, the idea is to expand to associated markets such as hip/knee replacement implants and systems for trauma surgery ect.

The overall process has been carried by the goal of performing high-quality research that will be useful for a specific group of end users (people who receives implants) while at the same time ensuring that the research allows for education of students and publishing in high impact peer review journals. This model has shown to be effective for educating both masters and PhD students and to give them a desirable profile for obtaining a job in the industry.

The PhD student (Ole Zoffmann Andersen) in the project is now employed at a biomedical device company and the collaboration between Aarhus University and the company extends beyond the initial project.

Links to:

- Employer engagement, including employers not traditionally associated with the recruitment of doctoral graduates

Motivation and aims:
The overall motivation was to develop a technology that would show an increased performance for bone ingrowth applications, compared to existing technologies on the market, and to refine this product to the stage where clinical testing could be initiated. Equally important was the aspect of educating students during the project with a profile that would be useful for employment in the industry afterwards.

Lessons learnt: The combination of advanced research competence development and encouragement to pursue solutions that are of commercial interest has been found to be valuable for the students that have been educated during this project. It is necessary for the supervisor to be aware of IPR issues and to encourage the students to pursue the more technical aspects of research as well.
Scalability and transferability: This practice is both scalable and transferable. While basic research is equally important, the current project has shown that collaboration between university and industrial partners, having focus on an end product, is advantageous for driving both the research and the education of students. During this model, the students get a chance to learn about which competences the industrial partner desires and how the general work environment differs from that of the university. At the same time the company learns about the qualifications of the students
Further information: Andersen et al., Biomaterials (34) 2013; p.5883-5890 http://scitech.au.dk/roemer/okt13/hurtigere-bid-i-nye-taender/
Location of practice: Interdisciplinary Nanoscience Center – Aarhus University
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Work package titles and themes:

- International dimensions to examination, supervision and the doctoral experience
- Design and development of a doctoral supplement to cover broader activities, training and experiences with a particular focus on employability & mobility
- Employer engagement, including employers not traditionally associated with the recruitment of doctoral graduates
- Approaches to training and support for doctoral candidates and supervisors
- Dissemination and promotion

Note for authors:

These case studies will be made publically available via the project website and may be included in future project publications and reports (printed and online).

Project website: www.doctoralexcellence.dk

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