



The Olav Thon Foundation announced this year's awards:

- 1. The Olav Thon Foundation's International Research Award 2019 goes to Professor Lene Vestergaard Hau, Department of Physics at Harvard University, USA***

Lene Vestergaard Hau (b. 1959) is the Mallinckrodt Professor of Physics and of Applied Physics and is on the faculty of the Harvard Biophysics Program. Prior to joining the Harvard faculty in 1999, she was a senior scientist at the Rowland Institute for Science in Cambridge, Massachusetts. She holds a Ph.D. in Physics from University of Aarhus, Denmark.

Hau led a team who succeeded in slowing a pulse of light to 15 miles per hour and brought light to a stop. They took matters even further as they stopped and extinguished a light pulse in one part of space, and subsequently revived it in a different location. In the process, the light pulse is converted to a perfect matter copy that can be stored - put on the shelf - sculpted, and then turned back to light. These results represent a new paradigm for information processing.

Vestergaard Hau has recently embarked on a new research program at the interface of the fields of light-matter interactions, nanoscience, and molecular and synthetic biology. The research involves fundamental studies of light-driven photosynthetic proteins coupled to engineered, inorganic nano-scale structures, and encompasses both natural and gene-engineered membrane proteins as well as *de novo* designed synthetic proteins. The research has applications, for example, for the development of new schemes for biofuel production. Hau's research has included studies of ultra-cold atoms and superfluid Bose-Einstein condensates, as well as channelling of high-energy electrons and positrons in single crystals with experiments at CERN and Brookhaven National Laboratory.

Lene Vestergaard Hau is a 2001 MacArthur Fellow. She was elected to the American Academy of Arts and Sciences, the Royal Swedish Academy of Sciences, and the Royal Danish Academy of Sciences and Letters. She is a Fellow of the American Association for the Advancement of Science and of the American Physical Society and is the

recipient of numerous awards, including Harvard University's Ledlie Prize, the Ole Roemer Medal, awarded by the University of Copenhagen, and the Richtmyer Memorial Lecture Award. In 2010, she was appointed a National Security Science and Technology Faculty Fellow by the Secretary of Defence, and was named "World Dane", thus becoming one of only three Danes to have been elected for this honour. In 2011, she was named Distinguished Alum of Aarhus University, and in 2012 was named "Thomson Reuters Citation Laureate" by Thomson Reuters.

Amount of Award: NOK 5 000 000,-

2. Financial support by The Olav Thon Foundation for Nordic research in medicine 2019 goes to the following two projects:

- a. Prevention of severe osteoarthritis by treating focal lesions with tissue engineered cartilage and early osteoarthritis with gene therapy.

Head of Project: Professor Lars Engebretsen, University of Oslo. Staff members: Research Fellow Jan E. Brinchmann University of Oslo, professor Helena Brisby University of Gothenburg et.al.

This is an outstanding application, directly addresses essentially all of the OTF's goals of utilizing stem cell biology, genetic approaches, tissue engineering, biotechnology and regenerative medicine to repair/replace damage cartilage. Treating cartilage lesions early to prevent severe disease will be accomplished by utilizing mesenchymal stem cell implantation in cartilage discs to repair focal lesions without the use of biomaterials. These experiments are being performed in rabbit knee with the goal of applying for permission to perform a phase 1 clinical study before the end of the funding period. The current technology only generates discs large enough to treat the human ankle, as opposed to the knee, but it should provide proof of principle in a relatively small number of patients. Several sources of stem cells are proposed. A separate line of experimentation proposes genetic manipulation of microRNAs, particularly miR-140, in the guinea pig knee as a mechanism to prevent OA progression. The goal is a phase 1 clinical trial of injection in the human knee. Although the proposal is extremely ambitious, this is a very accomplished team of four PIs, with all the necessary expertise to carry out the proposed experiments.

Strong preliminary data are included demonstrating the collaborative nature of the team, and the innovative aspects of the approaches.

Amount of support, NOK 10 mill.

b. Enhancement of bone regeneration by in vivo targeting of skeletal stem cells.

Head of Project: Professor Moustapha Kassem, University of Southern Denmark. Staff members: Professor Rigmor Solberg, Professor Harald T. Johansen University of Oslo.

This application proposes to enhance bone regeneration in mice through in vivo targeting of resident mesenchymal stem cells (MSC) using pharmacological and tissue engineering approaches. They will test that novel hypothesis that inhibiting legumain, a cysteine protease, will enhance skeletal regeneration, determine the molecular mechanism of legumain regulation of bone regeneration and determine if circulating legumain may be a biomarker of bone fragility in humans. This very strong team of investigators have a legumain inhibitor in hand (MP-Lo1) but also propose state-of-the-art in silico design and virtual screening of small molecule inhibitors. Functionalized scaffolds containing inhibitors will be introduced into murine critical-size calvarial defects, a model of non-healing fractures. Effects of the scaffolds will be quantified by following transplanted hMSC expressing luciferase using IVIS spectrum in vivo imaging. Finally, through study of 600 well-characterized elderly patients who have been followed for 5 years, the utility of legumain as a predictor of bone fragility and fracture risk will be determined. This is a mechanistic study with a high likelihood of translation.

Amount of support NOK 10 mill.