

Popular scientific description of the four awarded UNIKs

Technical University of Denmark

Title: The Catalysis discovery initiative: Sustainable energy solution

Popular scientific description

The wealth created in the World over the last century is based on easy access to inexpensive fossil fuels. This era is coming to an end. The resources are limited and the demand from everywhere in the world is growing rapidly. At the same time, it is becoming increasingly clear that the emission of CO₂ that follows the use of fossil fuels is threatening the climate of the Earth. Arguably this makes the development of sustainable energy solutions the most important scientific and technical challenge of our time. Any sustainable energy system must rely on the energy influx from the sun. In order to store solar energy it can be transformed into a chemical form, a fuel. The key to provide an efficient transformation of energy to a chemical form is the availability of catalysts. In essentially all possible sustainable energy technologies, the lack of efficient and economically viable catalysts is a primary factor limiting their use. We propose to create a research environment to foster the discovery of new solid catalysts and processes for energy conversion for a spectrum of energy sources. The central idea is to develop a science-based rational design strategy for new catalysts. The proposed initiative will enable the applicants to establish strategic alliances with major sustainable energy centers around the World. The initiative will serve to secure a strong Danish involvement in this research area, and it will contribute significantly to science-based education in sustainable energy solutions in the country. It will provide a substantial training effort for PhD students and postdocs, and provide access to highly skilled researchers for the Danish society. It will ensure close coupling to the industry in the field.

University of Aarhus

Title: MINDLab

Popular scientific description

Across the millennia, mankind has attempted to formulate theories of the human mind, values and feelings within different religions and philosophical schools. In recent decades, technological and methodological innovations have driven the study of the brain and the molecular, cellular and structural signatures of brain function which allow us to sense, think and act in the world. Furthermore, breakthroughs have been achieved which reveal the mechanisms behind debilitating neurological and psychiatric disorders. At the University of Aarhus, a unique collaboration has evolved across disciplines: Physicists, statisticians, philosophers, organizational theorists, anthropologists, psychologists, musicologists, linguists, scholars of religion, biologists and physicians work together in an effort to understand the brain, its disorder and its development through physical and social interactions – and vice versa. This work has created methodological and conceptual breakthroughs, as well as innovative approaches to the treatment of severe neurological and psychiatric disorders. This productive environment has attracted some of the most influential international cognitive neuroscientists. This UNIK will allow researchers to address central scientific problems within culture, music, language and memory. Combining this knowledge with research on the most devastating neurological and psychiatric disorders, this effort seeks to preserve and recover function and quality-of-life in relation to diseases accounting for 35% of the disease burden in Denmark. The UNIK will also develop new forms of teaching and sharing of knowledge, exploiting crucial synergies across traditional disciplines.

University of Copenhagen
Title: UNIK Synthetic Biology

Popular scientific description

The University of Copenhagen aims, as one of the first Universities in Europe, to launch a new world-class research, technology and education program on Synthetic Biology. This emerging area combines science and engineering to design and build biological systems with novel functions. The scientific objective of the proposal is to develop insights, tools and technologies for preparing and characterizing bio-inspired systems with tailor-made functions. In nature, biological molecules work together in teams that are specially organized to make the entire system more effective. The programme focuses on understanding how such systems are organized, and on learning to build similar systems by combining functional biological modules in new teams. Our research will focus on Synthetic Biology based on membrane proteins. Such proteins are essential to basic processes as cellular signalling, photosynthesis or the maintenance of electrochemical gradients across cell membranes. This focus in Synthetic Biology will provide the scientific basis for applications such as personal medicine, sustainable energy production, plants for the future, and molecular bioelectronics. It requires a broad multidisciplinary team to launch a competitive research initiative in Synthetic Biology. Accordingly, the proposal brings together a strong team of internationally highly recognized scientists in the key disciplines: Chemistry & Nano-science, Molecular Plant Biology, Molecular Neurobiology, and Biophysics.

University of Copenhagen
Title: Food, Fitness and Pharma for Health and Disease

Popular scientific description

The occurrence of lifestyle diseases such as obesity, diabetes and related cardiovascular disorders has increased dramatically over the last couple of decades and appears to keep on rising globally with staggering social and economical consequences. The reason for this is unclear, but it appears to be related mainly to a general change in lifestyle towards poor eating habits and lack of physical activity, importantly combined with genes predisposing for these diseases. The present UNIK is a cross-disciplinary research program aiming at identifying and characterizing the environmental and genetic causes of lifestyle diseases and at developing new means for preventing and curing these. The program will exploit the strong synergistic possibilities generated by the recent university merger bringing world-class scientists covering multiple different aspects of lifestyle diseases together in one organization. Major research themes of the program are:

- Food components and how they release satiety and hunger hormones from the gastrointestinal tract and controls our metabolism,
- How these hormones can be used as new drugs,
- The molecular basis for the health promoting effect of physical activity in muscle,
- The genetic basis for why some people get obese or get diabetes and others do not,
- Social and psychological factors leading to poor lifestyle, and
- The reason why people cannot change their obvious bad lifestyle.

It is the ambitious goal of the program based on top quality research to develop better, health-promoting food; optimal fitness programs; novel and efficient regimens for changing people's lifestyle; and new and better pharmaceuticals - all to help combat the global epidemic of lifestyle disease.