

New risk marker for cardiovascular disease and diabetes

Research Presentation:

Atherosclerosis is a major health care concern worldwide and there is a clear need for more predictive biomarkers to support identification of patients at risk for atherosclerosis and cardiovascular diseases. Our research group has recently identified a form of CD 36 protein ("plasma CD36") in blood that is not bound to cells and thus more easily measured. Our invention relates to a method for measuring this plasma CD36 level in a blood sample and use the result to predict the risk for a patient to suffer from cardiovascular diseases and type II diabetes. Our current method is an immuno assay using commercially available antibodies for measurement of CD 36 in human plasma and plasma serum. To undertake studies from large longitudinal study groups, we need to further develop our assay method to ensure robustness and validity with a generation of proprietary antibodies. This will enable us to validate the biomarker's clinical value and support the development of a diagnostic kit for identifying patients at high risk of atherosclerosis.

Current State of technology

A commercial diagnostic kit would be available for patients in 4-5 years, validated by large clinical studies.

A research kit for generating data on the biomarker clinical value should be available within 1 year.

Business Presentation:

The technology will be used in the field of diagnostic of cardiovascular diseases, which are a major health concern in western countries and a growing problem in developing countries, with the increase in such countries of "western" diet and life-style.

The world wide market for cholesterol and other cardio-vascular diagnostic tests is estimated to reach 2.3 bn unit per annum by 2015,

Whilst there are a number of indicative tests available to date (lipid-profile, C-reactive protein, cholesterol, etc.) there continue to be concerns about their ability to discriminate those patients at serious risk for developing Atherosclerosis and related diseases.

A validated predictive biomarker would have clinically valuable application as a diagnostic tool for identifying at risk patients and for disease monitoring, supporting both prophylactic and therapeutics interventions to reduce symptomatic cardiovascular disease, saving long term healthcare costs and improve morbidity and mortality outcomes.

Intellectual Property Rights

"Method of evaluation of the relative risk of developing atherosclerosis in patients"

2006, WO2005/116644 2. Inventor: Aase Handberg

"A method for diagnosing atherosclerotic plaques by measurement of CD36",

2008, WO2008/ 095492. Inventors: Aase Handberg, Bente Halvorsen, Mona Skjelland, and Pål Aukrust,

Inventor



Aase Handberg, MD

Specialist in Clinical Biochemistry Research within the area of type 2 diabetes, atherosclerosis and fatty liver - pathophysiology and disease biomarkers.

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A new device for measuring body part movements and stretches

Research Presentation:

Musculoskeletal disorders cost society approximately 36 billion annually and are a major cause of early retirement. One of them is called hyperpronation (biomechanical problem in the walking process) and will require treatment due to a higher risk of developing knee, hip or back problems. Our group has developed a new device enabling the measurement of body part movement and stretch for diagnostic, prophylactic and therapeutic use, in order to measure the shape of the foot (or other body parts) and thus any fault position. The device comprises of a capacitive sensor that changes its resistance as a function of elongation that enables us to quantify movement of body parts (muscle stretch) and respiratory signal through changes in the resistance of the new device.

Current State of technology

We will spend the next 6 months qualifying the technology and building a robust prototype, connected to software that can read data sent from the device. The next phase of development will require clinical trials that will be conducted at Aalborg Hospital, Aarhus University Hospital.

Business Presentation:

The new device will be used in daily clinical practice, examining movement and injury risks during work situations, sport stress and support equipment for custom made shoes.

The new device will enable to:

- measure the effect of a therapy, minimizing human factors ensuring an accurate diagnosis of fault positions by a doctor or physiotherapist or whoever examines the patient.
- verify / measure if the custom orthotic actually helps reduce the hyperpronation of the foot. (an insole costs approx. 150-400 euros per patient. This should be important to investigate if the orthotics works as planned)
- measure foot movement inside a new shoe to assess how this fits the customer and if the shoes gives the right amount of support to the foot.

It is estimated that our technology will be sold for 8-15 € per customer as a disposable material.

The first development plan focuses only on the foot. In later projects we will focus on other important parts of the musculoskeletal system, starting with the measurement of back and shoulder movement.

Intellectual Property Rights

A patent application has been filed in September 2011. All rights are owned by Aalborg Hospital and Aarhus School of Engineering.

Researcher group

Ole Simonsen, D.M.Sci, Chief Surgeon, Associate Professor and **Michael Skovdal Rathleff**, Research Physiotherapist, stud. Ph.D. from the Department of Orthopedic Surgery, Aalborg Hospital - Aarhus University Hospital, have done extensive work on measuring the movement of the healthy foot and the association between pathology and foot movement.

Henrik Karstoft, Engineer, Professor, Group leader for the research group in Signal processing and Control at Aarhus School of Engineering - University of Aarhus and **Peter Ahrendt**, Engineer, PhD, Associate Professor, are working on practical applications of digital signal processing as well as local positioning techniques using eg.video.

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IDEAS
CLINIC

Low-cost technology for detection and measurement of (bio-)particles

Research Presentation

Generic optical technology that simultaneously measures particle size ($> 100 \text{ nm} - 100 \mu\text{m}$), concentration and flow speed in e.g. liquids with many applications. Based on low-cost components and tested principles.

Current State of technology

Relative short time-to-market, main challenges are related to development of functional models for specific applications.

Business

Potential applications of the technology

- Bacteria/particles in liquids – diagnostics or quality inspection of cleaning procedures in medical equipment
- Contactless measurement of size, concentration and flow speed of e.g. blood cells in vivo
- Can be mounted on the tip of optical fibers that can be inserted into places that are not reachable by standard equipment
- Can detect extremely low flow speeds in e.g. very precise dosing applications
- Point-of-care diagnostics
- Measurement of surface flow speed/velocity profiles/turbulence – e.g. windmills wings

Value proposition

- Low-cost, small-size and simultaneous measurement of particle size, concentration and flow speed. Outperforms in many parameters high-end Laser Doppler Velocimeters, bulky industrial particle counters and flow-cytometers

Market drivers

- Price and development of basic optical and electronic components in sensor is driven by uses in other applications

Intellectual Property Rights

There is currently no IPR on this technology. However, generic IP protection is most probably not realistic since similar principles are already known. Future IP protection will most likely rely on specific developments and applications.

Inventor or researcher/group



Anders Bienten, Associate Professor, Department of Engineering, Aarhus University. Co-operation with relevant partners at AU within optics and thin film technologies.

Research in sensor technologies is application-oriented with focus on detection/measurement of (bio)-particles (size, concentration, flow rates), biofilm/fouling. The technologies are robust, low-cost and have a wide range of industrial and biomedical applications.

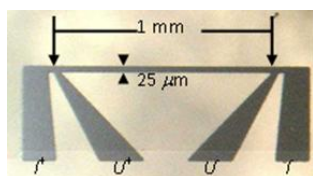
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Low-cost versatile bio-fouling sensor technology

Research Presentation



Generic thin film based technology that measures the thermal conductivity of the near surroundings ($1\ \mu\text{m}$ - $1000\ \mu\text{m}$). Thermal conductivity is an excellent marker for e.g. biofilm in surfaces or measurement of liquid levels. The technology is complementary/analog to capacitive touch sensors that measure e.g. changes in the relative dielectric constant.

Current State of technology

Well-established scientific characterization method. Relative short time-to-market, main challenges are related to development of functional models for specific applications.

Business

Potential applications of the technology

- Measurement of the presence of (bio-)fouling in equipment – testing integrity of cleaning procedures
- (Micro-)liquid level measurement
- Flow indicator

Value proposition

- Low-cost and small-size
- Extremely small measurement depth scale ($>1\ \mu\text{m}$) – not accomplished by similar sensor technologies
- Sensitive to non-polar substances e.g. biofilm and many organic substances (not accomplished by capacitive sensors)

Intellectual Property Rights

There is currently no IPR on this technology. Future IP protection relies on specific developments and applications.

Inventor or researcher/group



Anders Bentien, Associate Professor, Department of Engineering, Aarhus University. Co-operation with relevant partners at AU within optics and thin film technologies.

Research in sensor technologies is application-oriented with focus on detection/measurement of (bio)-particles (size, concentration, flow rates), biofilm/fouling. The technologies are robust, low-cost and have a wide range of industrial and biomedical applications.

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Tissue Oxygenation Monitoring for Diagnostic Imaging

Research Presentation:

AU researchers have discovered that oxygen availability in tissue depends critically on Capillary Transit Time Heterogeneity (CTTH), and not, as hitherto believed, only on local blood supply. As a result, altered capillary morphology in ageing and disease can cause hypoxia, overlooked by current diagnostic means, as well as inflammation and oxidative stress in tissue.

The researchers have developed techniques to estimate CTTH, and thereby whether attempts to normalize tissue oxygenation, and reduce inflammation and oxidative stress are successful or not. These techniques have been implemented across several diagnostic platforms, and provided proof-of-concept that CTTH is critically altered in diseases such as Cancer, Alzheimer's Disease, Cerebrovascular disease, Stroke, Diabetes and Critical Illness (sepsis).

Current State of technology

1st generation of the technology has shown proof of concept *in vivo*. The first investigator initiated clinical studies are planned for 2012.

Business Presentation:

- This is a multiplatform technique applicable on a number of medical imaging platforms including MRI, CT and US for diagnosis of an extended list of indications including: Cancer, Alzheimer's disease, diabetes, stroke and ischemic heart disease.
- The technology will be developed in a spinout in collaboration with the originating research center.
- The spinout will conduct focused R&D supported by clinical trials in collaboration with academic partners. Equipment development will happen through already established partnerships with instrument providers. The spinout will focus on a pipeline of top priority indications and use a license model to develop low priority indications.

Intellectual Property Rights

Five patent families and a trademark protect the technology platform including use of algorithms, apparatus using algorithms and certain treatment uses. All rights owned by Aarhus University and Central Denmark Region.

Inventor and research group

The technology is developed at the Center of Functionally Integrative Neurosciences (CFIN). The center has been funded by the Danish National Research Foundation since 2001 as one of DG's Centers of Excellence. The group of inventors are members of CFIN and is headed by Professor and Director of CFIN Leif Østergaard, MD, MSc, PhD, DMSc.



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Pro-angiogenic antibodies

Research Presentation:

A fully functional vascular system is vital for the human health. Formation of new blood vessels is complex and by intervening in molecular pathways, it is possible to alter a malfunctioning vascular network. A few antibodies has been approved by FDA for angiogenic therapy, however there is still a need to identify more molecular pathway which can be target. It is general agreed that a multi-targeting therapy would perform better than the current therapies.

We have isolated a panel of recombinant antibodies, using in vitro selection, with a potential to modulate the angiogenic process.

Current State of technology

The technology is still in early phase. A panel of 12 different antibodies capable of modulating the angiogenic process has been identified, a few has been tested in zebra fish and mice.

Business Presentation:

While anti-angiogenic antibodies are known in the field and can be used in a number for diseases where excessive angiogenesis is observed, such as cancer, pro-angiogenic antibodies is still lacking. Two of our antibodies has shown some potential as promoters of angiogenesis. While the market is large and mature for anti-angiogenic antibodies, the market for pro-angiogenic antibodies is still un-explored.

One of the problems observed with therapies focusing on intervention in the vascular system, is serious side effects. By extending the repertoire of antibodies applied and molecular pathways targeted, the possibility of decreasing side effects for vascular intervention therapies is increased.

Today most anti-angiogenic therapies are targeted against the VEGF and VEGF-receptor. By targeting new un-explored pathways, less side effects may be observed and a better market position could be obtained.

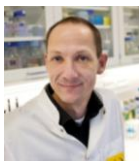
To go forward we need to expand the in vivo animal experiments to validate the in vivo potential and evaluate the possible side effects before entering into clinical trials.

Once that animal experiments has been conducted and molecular pathways identified, the potential to use other reagents to intervene in the relevant molecular pathways should be evaluated and compared to development of the antibodies into therapeutic agents. Also at this stage partners should be identified who could assist in clinical trials.

Intellectual Property Rights

Patent applications will be filed once our in vivo data is extended.

Inventor or researcher/group



Peter Kristensen, Associate Professor at Department of Engineering at Aarhus University.

The group is focusing on selection of recombinant antibodies for therapy. Areas of interest is currently cancer stem cells, vascular system and the vascular ageing process

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Patented membrane breathing mask, for treatment of hyperventilation, asthma and epileptic and febrile seizures.

Research Presentation:

In recent years, it has become clear that *dysregulated breathing* plays a major role in many disorders, among them asthma, epilepsy, febrile seizures and panic anxiety, as well as “classic” hyperventilation attacks. Obvious or unnoticed hyperventilation (with inevitable respiratory alkalosis) often acts as a trigger for acute attacks in the above disorders.

Several clinical trials has proven that CO₂ rebreathing, apart from its use in panic attacks/ hyperventilation, also acts as a very powerful anticonvulsant as well as being beneficial in preventive asthma treatment.

In the project, a novel CO₂ rebreathing mask using special membranes has been designed, constructed and tested in a pilot trial conducted over four weeks.

Current State of Technology

A working prototype has been constructed, patented and tested, and it has been verified that compared with existing mask types, the invention enables CO₂ rebreathing with a significantly lower reduction in oxygen saturation and a significantly lower vapor pressure in the mask volume, increasing patient safety and comfort. Results from the clinical trial show statistically significant improvements in acid/base blood status of patients with dysregulated breathing as well as a statistically significant decrease in symptoms. The mask is a passive device, being independent of a supply of gas or electrical power. Furthermore, the mask is compact, lightweight and uses commercially available components.

Business Presentation:

The invention has applications in a number of areas:

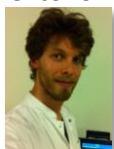
- As the first non-invasive and non-pharmaceutical method for effective seizure suppression in acute epileptic and febrile seizures
- Treating acute panic attacks/hyperventilation
- As a preventive treatment for asthmatics, normalizing blood gas status

Recent years has seen an exponential increase in the focus on reducing hyperventilation as a preventive asthma treatment. The current CO₂-raising treatments (notably the clinically proven Buteyko technique) demand a very high level of self control and perseverance of the patient, however. This contrasts with the present invention which is a user passive device, but with the same effect on blood gas status as the Buteyko technique. In treating acute attacks of epilepsy, febrile seizures and panic anxiety, it is essential to maintain as high a bodily oxygen concentration as possible. The membranes of the invented breathing mask facilitate a higher oxygen concentration and lower water vapor in the inspired air.

Intellectual Property Rights

A PCT patent application of the device has been filed (PCT/DK2010/050270). Recently, another patent application has been filed, covering further developments of the technology. All IP rights are privately owned.

Inventor or researcher/group



Troels Johansen. Master of Science in Engineering (DTU). Employed at the Lung Medicine Research Unit (Aarhus University Hospital).
CEO of Balancair ApS, an R&D company developing biomedical devices for respiratory disorders.

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Omnisensing nanobiosensor

Research Presentation:

The invention is a generic nanobiosensor, which can be tailored in the laboratory to measure virtually any small chemical molecule with a molecular weight less than 1000 g/mol and with high affinity and specificity. The sensor consists of a nanoparticle, 30-50 nm in diameter, made of polymer and a sensing component. The sensing component is encapsulated in the nanoparticle when the latter is synthesized. When the target of the sensor diffuses into the particle, which is porous, it binds to the sensing component. The binding is associated with a change in conformation, which is relayed to a change in signal from the sensing component. The signal is usually fluorescence, but other forms of signals can be built into the sensor.

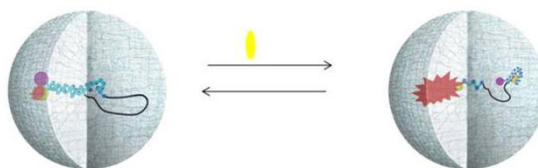
Current State of technology:

At the present time, a nanobiosensor for one small chemical compound (adenosine triphosphate, ATP) has been developed as a proof-of-concept, and the development of nanobiosensors for other small chemical compounds is ongoing.

Business Presentation:

The nanobiosensor can be used in many contexts. Either in its original form in bioassays to analyze for chemical compounds in laboratories or in a modified form to be inserted into small portable instruments to measure specific compounds, e.g. sugar, amino acids, drugs, etc. The nanobiosensor can be utilized in cell's in vivo without affecting the cell's inner environment. Moreover, the nanobiosensor has a short response time of only a few seconds.

Currently a nanobiosensor specific for ATP has been developed as a proof-of-concept. Further engineering of the ATP sensor is underway, as well as development of sensors targeting other small molecules of pharmacological interest.



Intellectual Property Rights:

IPR's are owned by the University of Southern Denmark. Patent application filed July 2009.

Inventor or researcher/group:



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Specific assessment of the split product C3c as a putative inflammatory marker

Research Presentation:

The present invention relates to antibodies with exclusive specificity towards neo-epitopes that are only exposed on the cleavage product C3c (the c fragment of the central complement factor C3). The introduced assay is based on one of these monoclonal antibodies and is able to accurately measure the plasma C3c level. The assay could potentially be of value in the assessment of the complement activation status during acute or chronic inflammatory processes.

Current State of technology:

A validated assay is established for the specific assessment of C3c. Blood samples (EDTA plasma) from relevant patient groups are currently being collected and will be evaluated for levels of C3c and other inflammatory markers.

Business Presentation:

The invention is a prognostic marker for inflammatory continuities of care. The prognostic marker provides the ability to assess the patient's condition and can be applied in the selection of the correct treatment method.

A broad range of diseases is characterized by complement activation and a systemic inflammatory response. Such diseases are among others autoimmune diseases such as systemic lupus erythematosus (SLE), rheumatoid arthritis and multiple sclerosis and acute reactions due to transplantation, certain cardiovascular diseases and infectious diseases, which involve systemic inflammatory responses. In light of this, components of the complement system are obvious biomarkers for systemic inflammation in acute and chronic diseases.

The inflammatory marker provides a faster analysis grounds for measurement inflammatory conditions than what is offered in the market today. As such acute patients can be evaluated faster and more efficient and can be provided correct treatment within an acceptable time frame.

Intellectual Property Rights

IPR's are owned by the University of Southern Denmark. US patent application filed May 2010.

Inventor or researcher/group



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A novel drug eluting scaffold enabling targeted drug delivery for the treatment of bone cancer

Research Presentation:

The invention is a combination of a macroporous, load bearing, bioresorbable scaffold with a drug eluting clay matrix. The technology allows for localised release of a relevant anti-tumor drug direct to a tumor site in addition to providing bone regeneration.

Current State of technology:

The inventing team have an initial prototype scaffold and have release data for a bone cancer drug and siRNA. Release kinetics is tunable to accommodate a wide range of drugs and treatment Protocols.

Business Presentation:

Background

Primary bone cancer is rare and can be considered an "orphan disease". About 2,300 new cases of primary bone cancer are diagnosed in the United States each year. Different types of bone cancer are more likely to occur in certain populations. Osteosarcoma occurs most commonly between 10 and 19. However, people over age 40 who have other conditions, such as Paget disease are at increased risk of developing this cancer. Chondrosarcoma occurs mainly in older adults (over age 40). Secondary malignant bone tumors are estimated to be 50 to 100 times as common as primary bone cancers, however data is very hard to obtain.

Value Proposition

The current standard treatment for bone cancer is a combination of surgery and chemotherapeutic drugs. The surgeries are carried out to remove the affected tissue to prevent spreading of cancer cells and chemotherapy is intended to kill any remaining cells. The efficacy of these drugs depends on the successful delivery to target cells. The drugs which are delivered intravenously suffer from a substantial dilution with the body fluid volume. The concentration of the drug at the target site is therefore balanced against the sides effects of high dosing.

Furthermore, cancer drug prices are increasing and wasteful usage of drugs due to an inefficient delivery system is an increasing problem. These problems can be solved by targeted drug delivery. An example is localised drug release implants or stents.

Development

- TTO + inventor will present technology to bone cancer companies and an external drug delivery group in a pharma company.
- This discussion will focus on potential collaboration.

Intellectual Property Rights

Aarhus University is the full owner of the all Intellectual Property Rights. The Priority Date is December 2010.

Inventor or researcher/group

Inventors: Muwan Chen, Prof. Jørgen Kjems, Prof. Cody Bünger

Project is a spin-off from collaborative research programs between the Interdisciplinary Nanoscience Center and the Orthopedic Research Group at Aarhus University. Expertise: Musculoskeletal tissue engineering, biomaterials, materials science, orthopedic surgery.

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