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SPES BONA

INNOVATION OPPORTUNITIES
Spring 2016

Innovation Opportunities presents some of the recent technologies emanating from the University of Cape Town's (UCT) research that are available for commercialisation. They come from a range of disciplines and are at various stages of market readiness and may be of interest to entrepreneurs starting up ventures, as well as established firms looking to expand their portfolios.

Whilst technologies have been categorised in their primary sector, they may be relevant to other sectors too. This publication is printed periodically, the online version will include the most current offerings (available at **www.rci.uct.ac.za**).

Research Contracts and Innovation (RC&I) acts as the liaison between UCT's research community and the private sector with regards to intellectual property, commercialisation and business development activities. RC&I has helped to transfer numerous technologies from the university laboratories to industry both locally and internationally.

RC&I seeks to stimulate the growth of a diversified South African economy that is globally competitive, especially by fostering small business development and through the creation of local jobs. Additionally the selected technologies are actively licensed to global market leaders who have the capacity to bring products to international markets, whilst ensuring that South Africans see the benefits of these innovations.

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Technology Readiness Levels

Technology Readiness Levels (TRLS) are used to define the maturity of a technology ranging from TRL 1, when research has been initiated, to TRL 9, once technolgies have been commercialised. In this booklet, each technology has been assigned its TRL in the footer. This table provides stage descriptors for different technology sectors, i.e. science and engineering as well as health sciences/medical.

Level	TRL 1	TRL 2	TRL 3	TRL 4	TRL 5	TRL 6	TRL 7	TRL 8	TRL 9
Science & Engineering	Basic Idea	Concept Developed	Experimental Proof of Concept	Lab Demonstration	Lab scale validation (early prototype)	Prototype demonstration	Capability validated on economic runs	Capability validated over range of parts	Capability validated on full range of parts over long periods
							Pilot system demonstrated	System incorporated in commercial design	Proven system ready for full deployment
				Component and/or system validation in laboratory environment	Laboratory scale, similar system validation in relevant environment	Engineering/pilot-scale, similar (prototypical) system validation in relevant environment	Full-scale, similar (prototypical) system demonstrated in relevant environment	Actual system completed and qualified through test and demonstration	Actual system operated over the full range of expected mission conditions
Medical Science	Basic Research		Preclinical Research		Late Preclinical Research	Phase I Trials	Phase II Trials	Phase III Trials	Phase IV Trials
Phase	Research			Translation/Development				Commercialisation	

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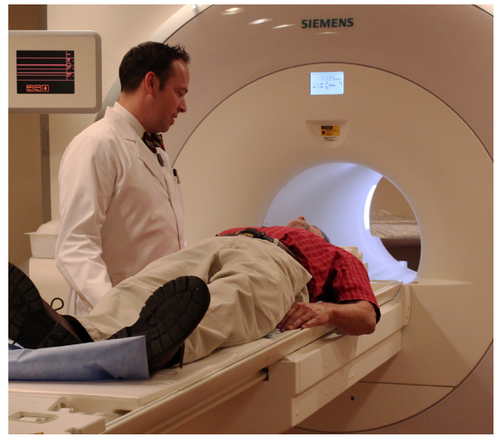
HEALTHCARE

Tracking patient orientation during MRI scans



UCT researchers have developed a device that tracks accidental / inadvertent motion during magnetic resonance imaging (MRI) scans. An MRI scanner applies magnetic fields to a body to generate an image of internal structures and the quality of the images are impacted by even small movements. For this reason it is very difficult to image children, or elderly patients suffering from diseases that result in involuntary motion.

The inventor observed that the earth's gravitational field and the main magnetic field of the scanner are perfectly orthogonal, which led to the creation of a simple and cost effective device capable of tracking the movement of a patient during long scans by determining the orientation of the device. These measurements are used to correct for scanning error introduced by movement, resulting in improved image quality and the accuracy of scans.

Benefits

- No scanner-specific calibration is required unless very high accuracy scans are necessary, in which case a once-off calibration can be performed.
- Orientation estimates are transmitted either optically or wirelessly out of the scanner for further data processing.
- The device can be made very small, for example to fit into a patient's ear, and only a single point needs to be used.

Market

MRI manufacturers / users

Technical Description

The orientation tracking device includes:

- memory for storing reference data relating to the direction of the static magnetic field of an MRI scanner in a reference co-ordinate frame and the direction of the gravitational field of the earth in the reference co-ordinate frame,
- a three axis accelerometer for measuring an acceleration vector in the device's co-ordinate frame,
- a three axis magnetometer for measuring a magnetic field vector in the device's co-ordinate frame,
- a communication module and a processor for determining the orientation of the device.

The inventor is Adam Van Niekerk

Intellectual Property Rights:
Britain (priority founding): 1513558.5

Technology Readiness Level:
4 - Validated in Relevant Environment

Correcting magnetic distortions in MRI scanners

A Magnetic Resonance Imaging (MRI) scanner uses magnetic fields and radio waves produce detailed images of the inside of the body. Due to a number of internal and external effects these fields are never completely homogenous, may be distorted, change with time (magnetic drift) and negatively impact the quality of the image. Scanners adjust for this through a process called "shimming".

The shim device developed at UCT comprises a number of coils that produce small magnetic fields which are superimposed on the main magnetic field to correct distortions at the outset of the scan. Drift and interference can still occur during the scan, but this is resolved by implementing this invention which tracks, and corrects for, the main magnetic field drift.

Benefits

- Measure, report and correct for all changes in magnetic field throughout an MRI scan
- Improved image quality
- A major advantage is the ability of the double volumetric navigator sequence to measure and adjust shim over selected regions in a 'slab-by-slab' or 'slice-by-slice' fashion
- Integrable into any MRI pulse sequence, including functional MRI (fMRI) and diffusion tensor imaging (DTI)
- Higher order shims can be implemented if the hardware of the particular MRI scanner permits this

Market

Hospitals, medical practices, MRI instrument manufacturers and veterinary practices that require accurate images in order to investigate the anatomy or physiology of a human or animal body.

Technical Description

A 3D navigator pulse is interleaved in the scanning sequence after the acquisition of each volume. A second navigator is introduced, with a different echo time to the first, before the next volume is acquired. The two corresponding navigator images are obtained and a magnetic field map is determined via complex division of the images. This magnetic field map is then used to determine the parameters required to adjust the system central frequency of the MRI scanner to compensate for drift.

The inventors are Alqadafi Alhamud, Ernesta Meintjies and Andre van der Kouwe

Intellectual Property Rights:
USA: 14/796,268
South Africa: 2015/04963

Technology Readiness Level:
5 - System Validated in a Relevant Environment

Correcting for movement due to breathing improves MRI images of the heart

Cardiac Magnetic Resonance Image (MRI) scanning lasts for several heart beats and as the heart moves with breathing, it makes high resolution images difficult to obtain. Researchers at UCT have developed an algorithm that enables respiratory motion to be automatically compensated for whilst the patient breathes normally, resulting in timesaving and clear MRI images.

To prevent blurring of the MRI image a patient is asked to hold their breath, but patients with heart problems may find it difficult to hold their breath for up to 20 heartbeats. If more than one breath-holding period is required to complete an image slice, the position at which the patient holds their breath is rarely identical.

A set of pre-measurements of movement during breathing ('navigators') are made and during the actual image capture are used to predict the displacement of the heart, enabling the image to be mathematically reconstructed to produce a clear image.

Benefits

- Clear cardiac MRI images during MRI scanning, whilst patients breathe normally
- Increases efficiency by reducing time taken to obtain a clear image

Market

- MRI equipment manufacturers
- MRI users, specialist imaging centres, hospitals, etc.

Technical Description

'Diaphragmatic Navigator Gating' is often used to limit the impact of respiratory motion, but it has an inherently low respiratory efficiency, which is further compromised by respiratory drift. 'Prospective Slice Following' becomes temporally more outdated as the segment duration increases and the slice following less accurate.

In this invention, the difference between the measured and estimated outputs (the error) is fed back constantly to correct the model, minimising divergence over time. Before the scan, the diaphragm motion is modelled as a sine wave with the frequency set to the patient's breathing rate. It has been tested on a phantom and healthy volunteers and it is being validated clinically on patients at present.

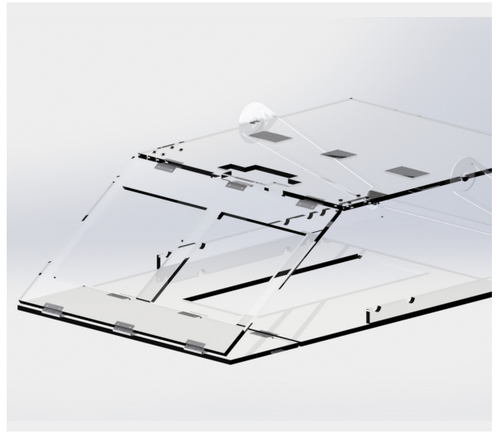
The inventor is Ian Burger

Intellectual Property Rights:
Britain: 2478403
South Africa: 2012/06353
USA: US-2012-0319685-A1

Technology Readiness Level:
4 - Validated in Relevant Environment

Laxmeter – A device for measuring knee laxity

The 'Laxmeter' facilitates patient support when examining the hip, leg and knee (laxity or total knee arthroplasty) for injury or disease, using X-ray. Stress radiographs form part of the traditional diagnostic methods for knee diseases or injury. Generally stress is created by assistants, resulting in them undesirably being exposed to x-rays. With the Laxmeter, the images can be collected in the absence of an assistant and thigh and pelvis restrains promote stability and facilitate more accurate application of stress to the joint, thereby improving the diagnosis.



Most of the existing devices for measuring knee laxity are large, complex devices, uncomfortable for patients and very costly. In contrast, the Laxmeter is highly ergonomic and practical. For example, female patients, especially in traditional Indian dress, are able to be comfortable during the laxity measurements without having to assume awkward positions.

Benefits

- Low cost device, which is simple to use and ergonomic
- Provides superior support during laxity or total knee arthroplasty
- Technicians are not exposed to X-rays
- Radiolucent

Market

Radiologists and radiographers

Technical Description

This knee laxity radiography device can be used for obtaining stress radiographic images at various angles of flexion. The device comprises three different panels that are made of perspex, which does not impact the X-ray image. The panels can be positioned at various angles between 0-90° to create the different stress positions in a consistent manner. Further, the pelvis restraint prevents compensation by the patient that occurs when a patient is manipulated manually.

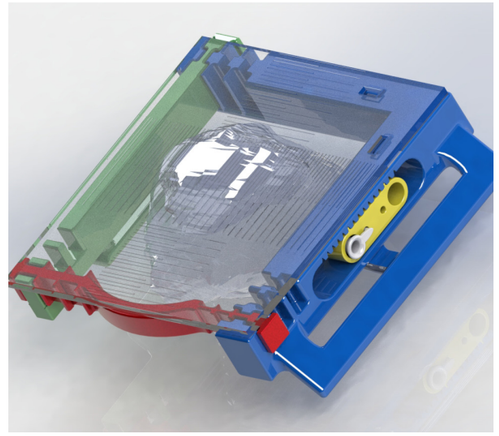
The inventors are Sudesh Sivarasu and Sarthak Patnaik

Intellectual Property Rights:
India: 1137/KOL/2014
UK: GB 2520046
USA: 9,211,098

Technology Readiness Level:
4 - Lab Demonstration

Patellofixator Rig - Drill guide to aid knee surgery

This invention is a surgical tool to help an orthopaedic or sports surgeon drill tunnels in the patella of a patient's knee during medial patella femoral ligament (MPFL) reconstruction surgery.



During MPFL replacement surgery, the insertion of the replacement ligament must be very precise, and drilled tunnels must be at the correct angles for the reconstructed ligament to function optimally. For double bundle MPFL replacement surgery (the best practice surgical technique), the tunnels must be absolutely parallel, otherwise the ligament could rip off the patella, or break the ligament off. This is very difficult, as the surgeon will need to estimate the correct angle of drill entry into the patella with his eye. This often requires a number of intra-operative X-ray scans to ensure that drilling is correct.

The "Patellofixator Rig" is designed to reduce a surgeon's apprehension to drilling tunnels, and also minimise their exposure to intra-operative radiation. In use, the device is placed on top of the knee, to form a tight grip on the patella. Holes in the side of the device guide the drill accurately.

Benefits

- The guide is non-invasive and grips the patient's patella over the skin
- The guide minimises the need for intra-operative X-ray scans and thus reduces the exposure of surgeons and patients to radiation
- The guide is made to be disposable and therefore does not require repeat sterilisation

Market

- Manufacturers of orthopaedic soft tissue repair and arthroscopy surgical tools and kits
- Medical doctors or hospitals

Technical Description

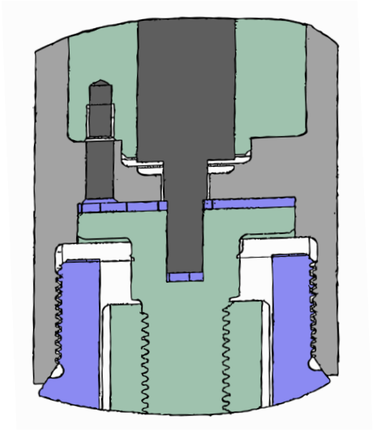
The device consists of a number of elongate limbs that form a rectangular aperture. In use, the device can be secured to the top of either one of the knees, above the skin, to form a tight grip around the patella. A pair of parallel holes in the sides of the device allows the drill to be guided accurately towards a side edge of the patella to enable holes or tunnels to be formed at required positions for attachment of the reconstructed ligament. The device also has a radiopaque scale that enables monitoring and measuring drill progress during X-ray scans.

The inventors are Sudesh Sivarasu and Sarthak Patnaik

Intellectual Property Rights:
PCT: PCT/IB2016/053967

Technology Readiness Level:
5 - Early Prototype

Prosthesis that 'grows' as a child grows



UCT researchers have developed an endoprosthetic device for use in replacing and extending human limbs, particularly, but not exclusively, in skeletally immature patients.

In children, osteosarcoma necessitates the removal of cancerous bone and often the end region of the bone where the cells are actively replicating to grow and lengthen the bone. Prostheses that are implanted to replace the bone need to allow for extension to mimic normal growth in the other limb.

Competing devices either require surgery to achieve the lengthening, or if motorised, require cumbersome external induction coils to actuate the motors. The microcontrollers used in these devices ensure precise incremental extension. Unfortunately this includes negative consequences i.e. limit the type of sterilisation used and preclude the use of radiation for imaging due to component damage. The UCT innovation overcomes these limitations.

Benefits

- A sterilisable implant that is capable of 'growing' in tandem with a child's normal limb
- Radiation can be used for both patient imaging post implant and sterilisation prior to implantation
- A medical practitioner can program the time-extension profile and the patient can extend the implant on a daily basis at home

Market

Companies with an orthopaedic range

Technical Description

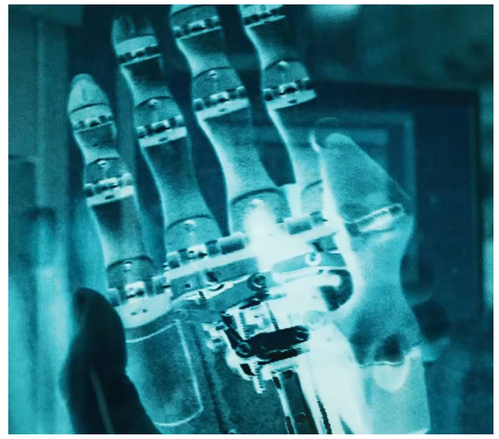
The device includes an elongate housing with a drive secured through a threaded drive shaft to an extension shaft. The drive can be activated to move the extension shaft axially with respect to the housing, lengthening the implant. The housing can be secured to a bone. A control circuit, capable of withstanding X-ray, includes an inductive coil. The control circuit provides a predetermined output which operates the drive in a step-wise fashion upon receiving power through the inductive coil.

The inventors are George Vicatos, Samuel Ginsberg and Adam Parsons

Intellectual Property Rights:
South Africa: ZA 2014/00342
USA: 14/127,933
Europe: 12759507.2

Technology Readiness Level:
4 - Lab Demonstration

Prosthetic Hand



Current mechanical prosthetic hands tend to be designed either with appearance in mind, rather than functionality, or are functional but not aesthetically appealing. Prosthetic hands that are both aesthetically appealing and functional are often very costly.

This cost effective, mechanically operated prosthetic hand, which allows the patient to use the amputated hand to perform everyday activities, is functional and aesthetically appealing. Whilst the device is mechanically operated, other high-end models will incorporate myoelectric sensors and motors to operate the hand.

A fully functional prototype has been developed and positive feedback has been received from prosthetists regarding its functionality and usability. Further refinements are being made, along with the development of an external 'glove' for aesthetic appeal.

The device was awarded the Popular Mechanics 'Inventor of the Year' Award in the 'Cutting Edge' category.

Benefits

- It grants patients independence to perform their daily activities, and fingers operate independently to grasp a round object
- Ergonomically designed, mimics standard anatomy
- Low cost of manufacture and easy maintenance with the ability to be upgraded to a myoelectric device

Market

Public healthcare, therapists, NGOs, and upper limb amputees

Technical Description

The current mechanical prosthetic hand comprises four fingers and a thumb, which are movable to enable the hand to take on a position of an open, partially closed and fully closed hand. The hand has a metal cord at the wrist that is either released or pulled in a direction parallel to the fingers. By pulling the cord, the fingers will grip until the hand is closed. The cord works together with a knob, adjacent to the fifth metacarpal. When the knob is manually rotated or pushed the fingers become locked in position. The thumb is attached by a swivel to rotate and move either towards or away from the fingers.

The inventors are George Vicatos and Severin Tenim

Intellectual Property Rights:
PCT: IB2015/05507

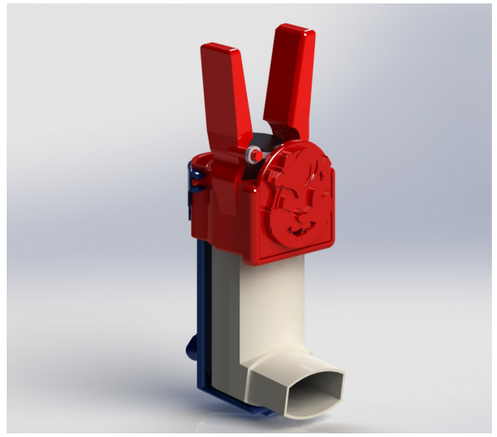
Technology Readiness Level:
6 - Advanced prototype

Force reducing attachment for medicinal inhaler

This device can be attached to standard medicinal inhalers (e.g. an asthma pump) to reduce the amount of force required to activate the inhaler.

Patients with respiratory ailments, such as asthma, often rely on inhalers to provide a metered quantity of medicine via the respiratory system. Experiments show that the amount of force required to activate a typical inhaler and release the medicine is around 39.2 N. This is substantially more than most children and geriatric patients are able to apply.

There are a number of modified inhalers on the market to reduce the required application force, but these devices are typically complex (e.g. electronic), expensive or non-standard. The invention is an attachment sleeve that fits over a standard inhaler to reduce the force required to activate the inhaler to about 12.26 N, which makes it manageable for most children and geriatric patients.



Benefits

- Allows for easy activation of the inhaler, is cost effective, reusable, and is adjustable so that it can be used with a wide range of standard inhalers
- Includes a dosage counter to indicate the number of dosages delivered or that are remaining
- Designed to appeal to children and can be made to resemble a comic character such as a rabbit with ears
- Patients have the option of employing a number of different grip types to activate the inhaler, whichever is most comfortable for them

Market

Pharmaceutical companies, pharmacies and children's hospitals

Technical Description

The device has a body for receiving a replaceable conventional inhaler with canister and a mouthpiece. At least two symmetric levers are attached to the body and extend away from the body. The free ends of the levers are moveable towards and away from each other. An inwardly directed cam surface on each of the levers engages with the canister to dispense a dose.

The inventors are Sudesh Sivarasu, Giancarlo Beukes, Jason Voorneveld, and Michael Levin

Intellectual Property Rights:
Britain (priority founding): 1604709.4

Technology Readiness Level:
5 - Early Prototype

Biomarkers for diagnosing bacterial vaginosis

UCT researchers have developed a method that will form the basis for point of care test for diagnosing symptomatic and asymptomatic sexually transmitted infections (STIs) and bacterial vaginosis (BV). STIs and BV cause inflammation in the female genital tract increasing their risk of contracting HIV. In resource-limited settings BV and STIs are managed according to signs and symptoms since this is easily implementable, relatively inexpensive and patients are given immediate treatment.

A recent study done by researchers at UCT have found that STIs and BV are often present without producing or showing any symptoms (asymptomatic), and women who had asymptomatic infections had the same level of inflammation as women with symptomatic infections. Many women may thus not be aware that they have an infection and hence do not seek healthcare or treatment putting them at increased risk of HIV infections and reproductive complications.

Benefits

- Detects asymptomatic bacterial vaginosis and/or sexually transmitted infections
- Provides a low-cost, point of care screening suitable for public health services or home testing

Market

- A low cost point of care device for low to mid income countries where syndromic management is presently applied. This can be sold to government, family planning clinics, and individuals.
- A higher value detection device with a calorimetric, smart-phone based device directed at measuring cytokine control bands will be appropriate for high income countries and can be promoted as a 'self-check' sexual health status home kit, similar to pregnancy tests. The idea is that it will not be marketed as a diagnostic, but rather as an informed lifestyle choice, where a positive result is followed up with an accurate diagnosis and visit to the doctor.

Technical Description

The UCT team has identified a number of small molecule proteins of the general class of cytokines that when measured in samples collected from the inside of the vagina are accurate predictors of the presence of BV. Interleukin (IL)-1ß, interleukin (IL)-1α, interferon-γ induced protein (IP)-10, TNF-α, TNF-ß, MDC, IL-7, IFN-γ and GRO have all been found to have predictive potential and any combinations of these cytokines may serve as useful biomarkers to identify women with BV.

The inventors are Lindi Masson and Jo-Ann Passmore

Intellectual Property Rights:
Europe: 14809984.9
USA: 15/033,225
South Africa: 2016/03606

Technology Readiness Level:
4 - Preclinical

TB urine biomarkers

The invention relates to the identification of *Mycobacterium tuberculosis*-specific biomarkers in urine and the method employed, using a urine sample to diagnose active tuberculosis (TB) or a latent tuberculosis infection.

In recent years, TB has emerged as the leading cause of death after influenza and pneumonia in South Africa. Globally, South Africa is rated second after India and China in terms of TB incidence. The major challenge faced by scientists in combating TB has been accurate diagnosis of the disease at an early stage. This failure is attributed to the fact that there are many TB subtypes and different forms of TB which exist in various body compartments or organs, preventing a 'one size fits all' approach.

The biomarkers identified by the UCT team can be used to distinguish between active and latent-TB. This could in turn lead to improved and early diagnosis of TB disease.

Benefits

- Non-invasive method for detecting TB
- Quick access to result
- Distinction between active and latent TB

Market

Private and public hospitals, diagnostic laboratories, governments, NGOs, research institutes, and diagnostic device manufacturers.

Technical Description

The Mycobacterium tuberculosis proteins identified as being TB biomarkers in urine include Rv1664, Rv1977, Rv2490c, Rv2694c, Rv2748c, Rv1161, Rv2280, Rv1759c, Rv2126c, Rv3202c, Rv1450c, Rv3775, Rv3885c, Rv0765c, Rv1235, Rv2981c, Rv1475c, Rv0014c, Rv0578c, Rv1522c, Rv2737c, Rv1464, Rv0668, Rv3345c, Rv3736 and Rv2455c. More preferred TB biomarkers are Rv1664, Rv1977, Rv2490c, Rv2694c, Rv2748c and Rv1161, which are specific for active TB disease, and Rv1759c, Rv2126c, and Rv3202c, which are specific for latent TB infection.

The inventors are Keertan Dheda, Jonathan Blackburn, and Brandy Young-Gqamana

Intellectual Property Rights:
PCT: PCT/IB2014/063987

Technology Readiness Level:
4 - Lab Demonstration

Smart Mask to monitor and prevent TB spread

Researchers at UCT have developed a Smart Mask that is able to limit transmission of TB or other highly infectious air-borne diseases, monitor cough frequency and determine the infectious risk to a group, community or region.

Globally, approximately 500 000 tuberculosis (TB) patients have untreatable Multi Drug Resistant TB (MDR-TB). Anti-microbial resistance occurs when the organism develops the ability to evade an antimicrobial drug that was originally effective for treatment of infections caused by it.

Under MDR-TB patients, there is a group of patients who are highly infectious and referred to as 'superspreaders'. Although the number of MDR-TB patients and superspreaders is small (2% of total caseload), these patients consume more than 45% of South Africa's total R1.6 billion TB budget. The mask could dramatically reduce the disease burden caused by superspreaders and MDR-TB patients.

Benefits

- The mask is fitted with a compliance sensor and GPS for detecting whether or not the face mask is worn and properly positioned on a person at any relevant time, for example, when the patient is travelling
- The mask is able to map and model the potential spread of infectious disease, informing infection management

Market

Research institutes, government TB initiatives, non-government organisations (NGOs), and medical doctors or hospitals.

Technical Description

The mask comprises a modified facial mask with GPS and environmental sensors measuring ambient carbon dioxide (CO_2) concentration, humidity and temperature, and light intensity, and is able to relate CO_2 concentration to a projected number of people in the mask wearer's proximity. The mask has an auditory cough monitoring microphone, and sensors measuring skin and exhaled air temperatures.

The inventors are Grant Theron, Keertan Dheda, Lester John and Sudesh Sivarasu

Intellectual Property Rights:
PCT: PCT/IB/2015/053143

Technology Readiness Level:
5 - Early Prototype

Phenothiazine-based anti-TB drugs

Phenothiazine, a tricyclic organic compound with formula $S(C_6H_4)_2NH$, is well known for its use as antipsychotic and antihistamine. The compound has also been reported widely as having antimicrobial activity, notably anti-tubercular (anti-TB).

UCT researchers have developed chemically modified phenothiazine-based compounds, which separate the anti-TB activity from the psychotropic activity by increasing the polarity of the molecules and hence their solubility. This reduces their ability to cross the blood-brain barrier sufficiently suppressing the psychotic side effects.

Phenothiazines have also demonstrated synergistic interaction with a wide spectrum of anti-microbial or anti-bacterial agents. It has been proven that thioridazine is active against multi- and extremely drug resistant forms of tuberculosis (TB).

Benefits

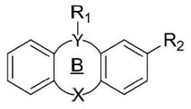
- It retains antimicrobial activity while excluding psychotic side effects
- It is non-toxic to macrophage cells with no negative impact on the patient's immunity

Market

TB sufferers worldwide, with specific focus on countries with a high incidence of TB.
In 2012, 8.6 million people were diagnosed with TB globally and 1.3 million died from the disease. Patients being treated for psychosis with phenothiazine were found to be cured of their TB, if infected.

Technical Description

The invention is a tricyclic derivative of general formula,



where R_1 is an alkyl sulphonate or sulphonamide group; R_2 is hydrogen, a halogen, a substituted alkyl group, a thioether or an acetyl group; Y is N, or C; X is S, SO, SO_2, N, O, CH_2, C(O), CO_2, NHCO, and ring B is a 6, 7 or an 8 membered cycloalkyl ring. When R_1 is a phenothiazine derivative, then R_2 is not H.

The inventors are Anwar Jardine and Muazzam Jacobs

Intellectual Property Rights:
China: CN 104812394
South Africa: 2015/03466
Russia: 2015125300
India: 3088CHENP2015

Technology Readiness Level:
3 - Drug Discovery

Plant based HPV pseudovirion production

UCT researchers have developed an alternative production method for human papilloma virus (HPV) pseudovirion (PsV) using plants.

The current paradigm for genetic vaccination is to use naked nucleic acid vaccines. However, naked nucleic acid vaccines have generally shown lower immunogenicity in patients. An emerging mode of delivery for DNA therapeutics is the employment of non-replicative viral particles, or PsVs that exploit viral capsids to facilitate the delivery of the gene.

The application of the HPV PsV as a DNA therapeutic delivery vehicle would extend beyond cervical cancer. HPV is ubiquitous in cutaneous tissues and hence they are also indicated in other cancers such as skin, throat and lung cancer. Thus the HPV PsV would have application in treatment of most if not all cutaneous cancers.

Recent advances potentially widen the application of HPV PsV. These studies demonstrate that HPV PsV efficiently delivers DNA into dendritic cells of patients to trigger cytotoxic T-cell immunity. This would mean that all infections presenting antigens in the blood could potentially be targeted.

Currently, PsVs are only made in mammalian, cancer-derived, cultured cells by transfection of purified DNA. This creates the possibility that the PsVs that are produced could encapsidate oncogenes (cancer-causing genes) from the cell lines, or could be contaminated by mammalian viruses. Our technology obviates this concern.

Benefits

- Recombinant protein expression in plants is a highly scalable process
- Plant based expression removes the possibility of oncogene or mammalian virus contamination, as the plant virus-derived DNA that is encapsidated in the particles has no possibility of replicating in normal mammalian cells, or of recombining with other mammalian viruses or transposon-like sequences

Use in vaccine testing

Another application of HPV PsV is in affordable candidate vaccine development and, in particular, inexpensive testing of immune sera. In fact PsV-based neutralisation assay (PBNA), is currently the gold standard for testing candidate HPV vaccines. HPV PsVs therefore have commercial value either as a stand-alone product or as a commercial neutralisation kit, which could be sold to companies or to individual researchers to test their candidate HPV vaccines. The luciferase reporter gene has been included, which makes the assay simpler and cheaper compared to the conventional SEAP assay.

The inventors are Edward Rybicki and Inga Hitzeroth

Intellectual Property Rights:
South Africa: 2016/00098
USA: 14/907,323
Canada: 2,918,158
Europe: 14776902.0

Technology Readiness Level:
5 - Early Prototype

BIOTECHNOLOGY

Ostrich probiotic

An ostrich probiotic has been formulated from specific microorganisms isolated from the faecal matter of healthy adult ostriches. One of the major problems facing the industry is chick mortality, which can be as high as 50% in the first three months. A predominant cause of death is pathogenic infections of the gastrointestinal tract. Treatment with antibiotics may result in the development of resistant pathogens and has other adverse effects. The ostrich probiotic is positioned as an alternative product to replace conventionally available antibiotics.

In the wild, ostrich chicks acquire the necessary gut microorganisms by consuming faecal material of adult birds. The composition of the intestinal microflora is very important for the development of a strong immune system. Intensively farmed ostrich chicks are reared in the absence of adult birds, so they may not obtain the correct balance of bacteria in their guts. Furthermore, the microflora are considerably affected by diet components.

Benefits

- Improved health, growth and survival of ostrich chicks
- Diminishes the need for antibiotics
- Enhances normal gut microflora development
- Stimulates immune development

Market

Ostrich farming sector & animal health companies

Technical Description

The technology provides an ostrich feed supplement composition which includes at least one bacterial strain of *Lactobacillus oris, Lactobacillus brevis, Lactobacillus johnsonii, Bifidobacterium pseudolongum subsp, globosum,* and *Enterococcus faecalis.* These bacteria have GRAS (generally regarded as safe) status and are frequently used as food supplements as they can survive in air and are effective colonisers of the gastro-intestinal tract.

The inventor is Sharon Reid

Intellectual Property Rights:
Australia: 2011218616
Brazil: PI1104336-9
South Africa: 2011/06400

Technology Readiness Level:
5 - Early Animal Testing

Blue food colourant

The Centre for Bioprocess Engineering Research (CeBER) has developed a method of extracting and purifying the blue pigment (phycocyanin) from Spirulina biomass as a product for the food colorant industry.

Phycocyanin is one of very few natural blue pigments that are approved for use in the food and cosmetics industries where it is in high demand and of value. The pigment is one of the major constituents of Spirulina, a 'microalgae,' used in many countries as dietary supplement whose nutritional and therapeutic values have been well documented.

Recently, there has been a trend in the food colorant industry towards using natural equivalents. Thus beyond the existing natural pigment market there is even potential for an increase in market size over the next few years. This can be evidenced by the fact that global sales of natural food colourings surpassed those of synthetic colours for the first time in 2011. A part of this has to do with a change in legislation. For example, in Europe, regulatory limits on use of artificial colourants has created a huge demand for natural. Consumers are also now seeking products that contain simple, easy to recognise ingredients that are close to nature.

The UCT team has developed a novel process that improves the recoveries of phycocyanin from spirulina and enables the rigorous microbial quality targets to be attained. The extraction process can be used for either dried or freshly-harvested, wet biomass.

Market

Producers and distributors of natural colourants for the food and cosmetic industries.

Intellectual Property Rights:
Not yet filed

Technology Readiness Level:
4 - Lab scale demonstration

A drought stress inducible plant promoter

Abiotic stresses, which include drought, salinity, cold and extreme temperatures cause extensive losses to agricultural crop production. It is estimated that these loses can be as high as seventy percent. These losses could be dramatically reduced if the crops were able to tolerate drought conditions.

Stress-inducible promoters have previously been identified, but there is a shortage of efficient promoters for gene expression that display favourable characteristics in their native plants as well as in xenogenic species. The Psap1D promoter offers advantage over constitutive promoters to produce genetically modified drought tolerant crops.

The Psap1D promoter causes an increase in expression of genes under its control during adverse climatic conditions. The promoter induces expression at a level about six times higher than under unstressed conditions.

Benefits

- The promoter is relatively short, which is an important consideration in the creation of genetically modified organisms. This allows for better transformation efficiency and increased stability
- The promoter is inducible under drought stress, which circumvents where the target protein is continuously produced. Expression of genes in large amounts at times when they are not needed is metabolically taxing to the plant
- Expression returns to baseline upon rehydration
- The promoter is functional in both monocots and dicots

Technical description

Psap1D is derived from Psap1, which is a promoter isolated from the resurrection plant, Xerophyta viscosa. Psap1D is 1103 base pairs long as compared to the full length promoter (2083 base pairs). The reduction in size has been accomplished by removing an internal section of the promoter, which is not required for normal activity.

The inventors are Revel Iyer, Jennifer Thomson, Mohamed Rafudeen, Kershini Iyer, Tamaryn Ellick and Bronwyn Arendze-Bailey

Intellectual Property Rights:
Brazil: BR1120150048978
China: 201080040614.2
South Africa: 2015/01618
United States: 14/426,445
Canada: XPCT/IB2013/058399

Technology Readiness Level:
7 - Tested in multiple crops

Multigene drought tolerance cassette for crop transformation

A combination of genes are expressed in concert by a single inducible promoter to produce a drought tolerance phenotype in crops. The individual genes and promoter are derived from a resurrection plant with each individual gene linked to the precursor by a small gene sequence. The gene cassette in plants confers tolerance to drought as well as a positive side effect, i.e. faster maturation. The market for drought tolerant maize alone is estimated at $2.7 billion per year.

About 70% of worldwide reduction in crop productivity is due to abiotic stresses which include drought, salinity, cold and extreme temperatures. These stresses, particularly drought as a result of climate change, cause extensive losses. For farmers, the effect of climate change is simply that the weather has become far more unpredictable, and extreme weather has become far more common, so drought tolerant crops are desirable.

Using a multi-gene approach, whereby a number of genes are arranged in tandem behind a single promoter makes it feasible to apply a polygenic (number of genes) approach to something as complex as drought tolerance where previously only single genes were applied. In such systems the specific combination and arrangement of the genes has an influence on the phenotype.

A drought stress inducible promoter is used, which circumvents the problem with constitutive promoters where the target protein is continuously produced, creating an unnecessary 'overhead' on an unstressed plant.

Technical description

The technology incorporates a stress inducible promoter to drive expression of a multi-gene construct. This ensures that the transgenes are only expressed under stress conditions albeit relatively early (60-65% relative water content).

The technology applied in order to generate a multi-genic transcript is referred to as the 'foot and mouth virus 2A peptide system'.

The inventors are Revel Iyer, Jennifer Thomson, Suhail Rafudeen, Kershini Iyer, Revel Iyer, Tamaryn Ellick, Bronwyn Arendze-Bailey, Shakiera Sattar, and Karusha Moonsamy

Intellectual Property Rights:
UK: GB 1609969.9

Technology Readiness Level:
6 - Prototype Demonstration

ELECTRONICS

Symbiotic sensor and communication system

This sensor system designed to function symbiotically as part of a communication system that uses the electromagnetic spectrum in the whitespace allocations. Although it is built on the principles of commensal sensor, it differs in many respects.

This invention differs from conventional commensal radars in that a spatially distributed network of receivers and transmitters is used to achieve diversity for detection and tracking of objects. This eliminates the need for complex cancellation techniques, or a design limited to area topography.

Whitespace systems are currently being developed for the provision of internet to remote regions where ordinary wireless internet is not available. A whitespace communication system is therefore ideally suited to sparsely populated areas, which are also regions where radar surveillance is typically useful, such as remote borders

Benefits

- Symbiotically uses existing whitespace for communication & sensing applications
- Improved synchronisation of multiple sensors
- Achieving frequency diversity for improved countermeasures to signal jamming and interference

Market

The ideal commercial partner would be a large, multinational aerospace and defense company with interests in developing economies. Other potential partners include government bodies responsible for Coastal Surveillance, Border Control and Homeland Security.

Technical description

The invention envisages a number of base stations in communication with a wider communication network. Each base station includes a transmitter able to transmit signals that include digitally multiplexed data over a frequency band to the user terminals. The base station also has a receiver able to receive signals over a frequency band that at least partially overlaps with the transmitted frequency band. The system further includes a radio frequency front-end capable of processing the transmitted and received signals, a digitiser to digitise the received signals, sensor processing modules, and communication processing modules.

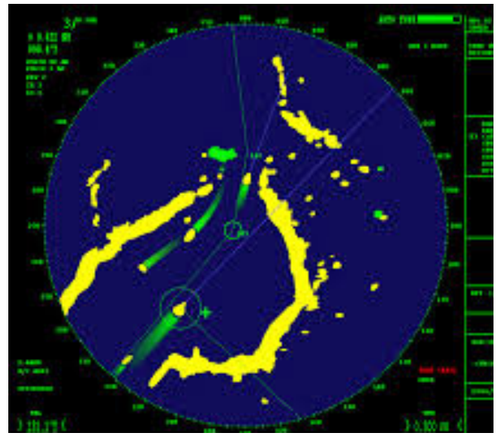
The inventors are Michael Inggs, Amit Mishra, & Alan Wilson-Langman

Intellectual Property Rights:
South Africa: 2015/05936
UK: GB2525550
India: 2962/KOLNP/2015

Technology Readiness Level:
3 - Proof of concept

Commsense system

The UCT innovation, CommSense, is a sensor system that utilises established communication systems to monitor changes in an environment. The technology has the potential to detect incidents such as traffic conditions, floods, fires, insurgent activity, crop growth, etc.



The key novelty of the technology is that it uses the pilot or reference signals in consecutive received communication signals to accurately estimate the changes in the channel state (also known as fading channels) that occur as a result of a change in the environment and correlates the fading channels to predict the actual change event. The system can also be trained to potentially distinguish between different change events within a known scene, e.g. one train entering a station, compared to two trains entering a station in parallel.

Benefits

- It can potentially be used in any communication system like GSM, 3G, 4G, LTE, and even TV broadcast signals, thereby broadening the scope of its application
- The system has the potential to make sensor systems available for applications that extend beyond conventional military uses to civil society, at substantially lower costs
- It can be trained to identify specific events in a varying area allowing it to potentially be more robust and less sensitive to environmental changes

Market

The technology has been envisioned as a base technology for potential commercial partners to develop client specific applications. UCT is targeting a commercial partner interested in a solution to monitor events in an area with an existing communication systems as mentioned above.

Technical description

The technology is a method of monitoring changes in an environment by means of one or more communication devices within the environment that are able to receive wireless communication signals transmitted from a source. The method is conducted by a central computing device, and entails receiving, from each communication device, device data including channel equalisation information, and using the received device data to generate an estimate of the environment, and recording changes in the generated estimate of the environment over time so as to monitor changes in the environment.

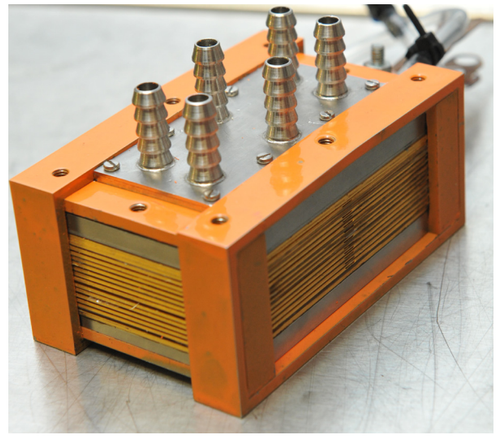
The inventor is Amit Mishra

Intellectual Property Rights:
PCT: PCT/IB2016/052235

Technology Readiness Level:
3 - Proof of concept

ENERGY AND ENGINEERING

OBIS: Fuel Cell State of Health



The OBIS system is a compact and scalable hardware platform to determine the "state of health" of fuel cells. State of health measurements are important because fuel cell systems involve complex and non-linear multi-physical and multi-scale systems. They are vulnerable to operating conditions and various fault states may occur.

An industry standard for monitoring fuel cell systems is by performing electrochemical impedance spectroscopy (EIS). This makes use of an expensive frequency response analyser (FRA) that introduces AC signals at an array of frequencies and determines the impedances.

The OBIS (Optimised Broadband Impedance Spectroscopy) system is a hardware platform that is able to capture the impedance spectrum of a fuel cell system within a very short time period when compared to conventional impedance analysers. The OBIS technology can perform a health assessment of a fuel cell within 4-8 seconds translating into near real time feedback on critical and abnormal conditions of the fuel cells. This vital information allows for the optimisation of fuel cell usage and greatly reduces fault conditions from arising.

Benefits

- Faster data acquisition cycle allowing for rapid diagnostics
- Compact and scalable system capable of considering a single fuel cell or a stack of cells
- Able to integrate into existing fuel cell diagnostic systems
- Can be implemented in a stand-alone diagnostic instrument

Market

- Fuel Cell component manufacturers
- Fuel Cell stack integrators and/or system level stakeholders
- Fuel Cell laboratories and research institutes

Technical description

The OBIS technology involves an efficient circuit, carefully selected semiconductors and specifically designed broadband signal based on the electrochemistry of fuel cells to allow a system to provide rapid diagnostic information. The multisine broadband signal is optimised both in the time domain and the frequency domain.

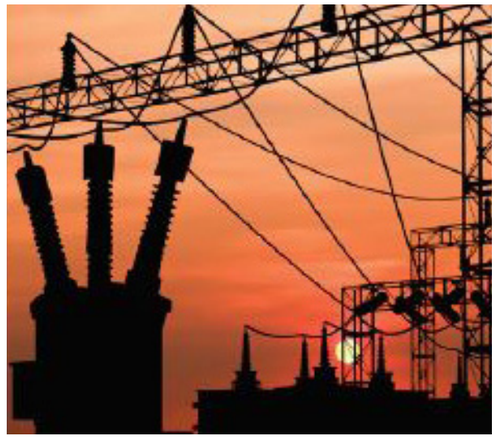
The inventors are Paul Barendse and Chris de Beer

Intellectual Property Rights:
PCT: PCT IB 2015-054727

Technology Readiness Level:
5 - Validation in relevant environment

Optimal current injection/extraction for electricity distribution optimisation

An algorithm has been developed that is applied to an inverter so that power can either be optimally injected into an electricity network, or withdrawn from it. This will become increasingly important as 'green' technologies such as wind farms and solar panels are connected to the grid. It can be applied to a single phase or multi-wire power network so that the power reaches its destination where it is consumed with minimal losses. This increases the efficiency of utility networks. Practically the algorithm is implemented through software installed on inverters and the efficiencies, increased capacity and importantly network stabilisation that result, will be of interest to utility providers who control power networks.



Benefits

- Decreased losses of energy on the distribution grid thereby leading to power savings
- Improved quality in power supply to end users
- Real time information of electrical network characteristics
- Enable more autonomous intelligent distribution management systems

Market

- Utility and network operators who control and/or manage electricity power networks
- Industries who consume large amounts of electrical energy and/or who have large reticulation systems such as a petrochemical plant, mine, heavy manufacturing entity, etc.
- Electrical network, inverter or power quality instrument and equipment manufacturers

Technical description

The most efficient way of transmitting power in a two wire single generator system occurs when the current is in phase with the generator voltage. In the case of multiple wires and generators, the way of transmitting currents with minimum losses becomes more complex to resolve, but is achieved by determining an equivalent Thévenin circuit that is representative of the whole network. A complicated mesh network may be represented as a simple Thévenin network for each phase.

The algorithm for injecting power into or extracting power from a network involves:

- Determining dynamically changing Thévenin parameters in the form of a Thévenin voltage and a Thévenin resistance of an equivalent Thévenin circuit with respect to each wire of a point of common coupling;
- Calculating a total Thévenin power for all the wires based on a specific amount of power at the point of common coupling and the determined Thévenin parameters and calculating a dynamically changing optimal current to be injected into or extracted.

The inventor is Amit Mishra

Intellectual Property Rights:
Brazil: 1322487.8
USA: 15/106,041
China: CNPCT/IB2014/067017

Technology Readiness Level:
6 - System Validation in Relevant Environment

Non-metallic pressure vessel

A novel composite pressure vessel has been developed at UCT, which can be used as a high powered water rocket. The invention combines relatively simple parts to form a light weight pressure vessel capable of containing 10 MPa. It is unique amongst other pressure vessels of the same pressure capacity in that there are no metal parts. The technology was used for the *Ascension III* water rocket, which on 26 August 2015 shot to an altitude of 835 meters, beating the previous world record by 217 meters. Currently other applications of these novel pressure vessels are being investigated and developed.

Benefits

- Light weight with no metal parts
- Easy to manufacture at a low cost
- Exceptional pressure to weight ratio
- The size and length/diameter ratio can be adapted to suit particular applications

Market

- The technology can be marketed to the global water rocket community. Students, inventors, hobbyist and enthusiasts from around the world can either use the patented invention or procure a pre-manufactured kit to realise their own world record water rocket
- Applications where lightweight, non-metallic pressure vessels are required.

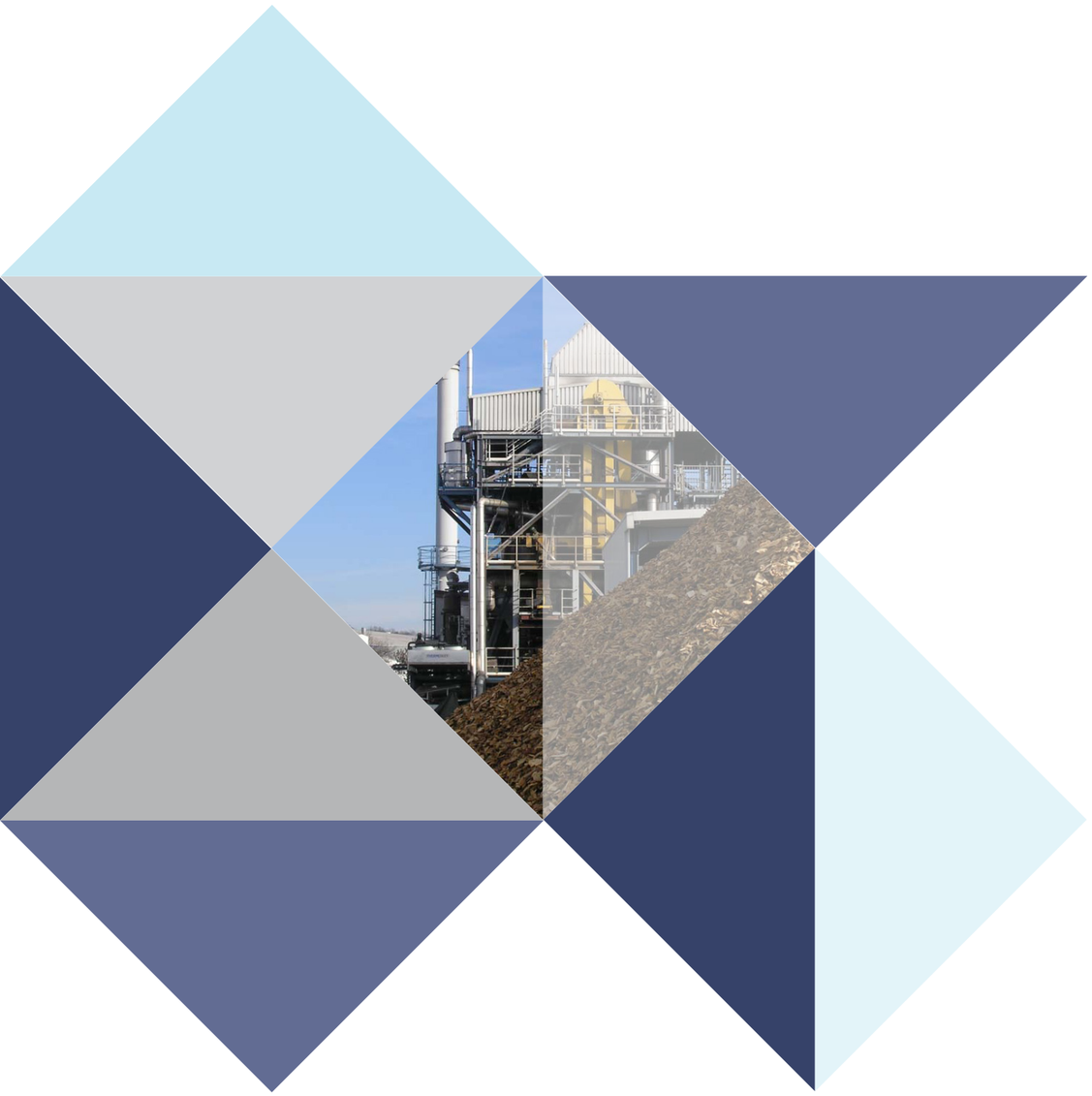
Technical description

The composite pressure vessel has a rubber liner to make it air tight. The water rocket had a volume of 12.2 litres, a pressure capacity of 10 MPa and weighs 1120 g. The design comprises an off-the-shelf thin walled carbon fibre epoxy tube, plastic end caps and a thin rubber liner. The liner is 0.2 mm thick and is coated on as a liquid and hardens due to a chemical reaction. A quick release mechanism is fitted to the filler end, which also has a conduit to pressurise the vessel.

The inventors are Stuart Swan and Arnaud Malan

Intellectual Property Rights:
UK(priority founding): PPA 1517711.6

Technology Readiness Level:
6 - Advanced Prototype



CHEMICAL AND MATERIAL SCIENCES

Process control to select for valuable olefins

Researchers at UCT and University of Oldenburg have developed a process modification, which allows one to dramatically improve the olefin selectivity over a wide carbon number range in the Fischer-Tropsch reaction via co-feeding of suitable gases such as ammonia. Notably this is achieved with no or tolerable loss of catalyst activity.

The techno-economics of feeding ammonia versus the improved 'higher value' olefin profile, achieved using this process, have been assessed and found to be positive

Benefits

- Improvement of selectivity of valuable chemicals in Fischer-Tropsch synthesis
- Can be incorporated in existing Fischer-Tropsch plants/ units without catalyst modification (both cobalt and iron based catalysts can be used)
- Allows flexible operation of Fischer-Tropsch plants/units in either 'fuels' or 'chemicals' mode.

Market

An ideal commercial partner to use this modified process will be a company that is in the the feed-to-liquid (XTL) business with a focus on chemicals production or a company that is already in the XTL business, but with an interest in making use of the potential of the Fischer-Tropsch synthesis to produce highly valuable olefins.

Technical description

The process involves the production of hydrocarbons from synthesis gas during catalytic hydrogenation of the carbonaceous gas component at a temperature of between 160°C and 400°C and co-feeding of pressure of between 1 bar and 50 bar. At least one compound containing one or both nitrogen and phosphorous (e.g. ammonia) is fed to the reactor together with the synthesis gas. Process conditions are selected to favour the production of olefins.

The inventors are Michael Claeys, Eric van Steen, Frank Rößner and Andreas Rausch.

Intellectual Property Rights:
China: 200980115993.4
Europe: 09732501.3
GCC: 13301/2009
South Africa: 2010/07627
United States: 12/937,694

Technology Readiness Level:
3 - Proof of Concept

Synthesis of nitrogen or phosphorous containing compounds

In this modified Fischer-Tropsch process valuable nitrogen containing products of varying chain length are produced via co-feeding of suitable gases such as ammonia. These nitrogen-containing products include amines, nitriles, amides and formamides.

Amines and nitriles are important base chemicals and they are typically produced from oxygenate precursors which themselves are derived from olefins. Our process eliminates the use of two steps.

Benefits

- Can be incorporated in existing Fischer-Tropsch plants/units without catalyst modification (iron based catalysts are best suited)
- Allows flexible operation of Fischer-Tropsch plants/ units in either 'fuels' or 'chemicals' mode
- Suppression of oxygenate formation including carboxylic acids
- Possibility to selectively convert oxygenates including glycerine to valuable nitrogen containing compounds
- Can be tailored to respond quickly to changing market conditions ('demand driven production')

Market

An ideal commercial partner to use this modified process will be a company involved in the feed-to-liquid (XTL) business with a focus on chemical production, or a company that is already in the XTL business, but with an interest in making use of the potential of the Fischer-Tropsch synthesis to produce highly valuable nitrogen containing compounds. It is also useful to those who want to selectively convert oxygenates including glycerine to nitrogen containing products.

Technical description

A process for the production of nitrogen containing compounds from synthesis gas during the hydrogenation of carbon monoxide and or carbon dioxide components in the synthesis gas in a catalytic operated reactor at between 160°C and 400°C and a pressure of between 1 bar and 50 bar, through cofeeding a nitrogen containing gas to the reactor together with the synthesis gas. The heterogeneous catalyst and the process conditions are selected to favour the production of nitrogen containing compounds.

The inventors are Michael Claeys, Eric van Steen, Frank Rößner and Andreas Rausch

Intellectual Property Rights:
China: 200980113744.1
Europe: 09733651.5
GCC: 13302/2009
South Africa: 2010/07629
United States: 12/988,052

Technology Readiness Level:
5 - Validated in a lab environment

Soluble biopolymer catalyst backbone

UCT inventors modified Chitosan, a sparingly soluble natural polymer so that it becomes almost completely soluble in aqueous media. This broadens the application to green chemical technologies that replace or minimise the use of organic solvents particularly in the pharmaceuticals industry.

Chitin is the second most abundant natural biopolymer in the world, behind cellulose. This abundance, combined with the specific chemistry of its derivative, chitosan, provides for an array of potential applications. Chitin is recovered from a number of bio sources such as waste crayfish shells.

The present trend, is to produce high value products, such as cosmetics, drug carriers, feed additives, semi-permeable membranes, chromatographic supports and supported catalysts. The difference in value between newly developed high-end products and the low-cost polymers that dominated the industry in the past is one of the main driving forces behind finding new applications of chitin and chitosan in both chemical and biotech industries

Benefits

- Current technologies utilise polymer-free homogeneous catalysts, or heterogeneous synthetic polymer-based catalysts, or unmodified chitosan. The latter two polymers have limited solubility whereas the modified chitosan polymer is water soluble, biodegradable and permits double the catalyst loading
- The polymer can be selectively functionalised to perform stereo-selective reactions (stereo-selective hydrogenation and carbon-carbon bond formation are likely)

Market

The main market is for the production of catalysts used in the production of pharmaceuticals, fine chemicals, cosmetics, and in the biotechnology industry.

Technical description

Chitin derived from a source such as crayfish shells is converted to chitosan. In turn the chitosan is modified (by converting the 6-hydroxy group of the polymer to a 6-aminogroup). The modified-chitosan polymer support which can have a variety of linkers onto which active molecules can be attached. For example, a metal immobilised 6-amino-6-deoxy-chitosan, which utilises Schiff- base ligands as linkers that coordinate metals such as palladium, platinum, rhodium, ruthenium, iridium, manganese, osmium, nickel, cobalt and iron.

The inventors are Anwar Jardine, Greg Smith and Banothile Makhubela

Intellectual Property Rights:
Britain: GB 10842020.9
China: 201080040614.2
Europe: 10842020.9
India: 2724/DELNP/2012
South Africa: 2012/02047
United States: 13/496,116

Technology Readiness Level:
4 - Validated in a laboratory

Production of potent antioxidant-ergothioneine

Researchers at UCT have developed a process for synthesising ergothioneine. Ergothioneine is a naturally occurring amino acid that has antioxidant to counter the oxidative stress caused by free radicals. Unfortunately, humans cannot produce it and rely exclusively on acquisition of the amino acid via the diet.

Ergothioneine is produced in certain types of bacteria and fungi, and is absorbed by plants through their association with fungi-rich soils. Modern agricultural practices have drastically reduced fungal content of soil, ultimately reducing the amount of ergothioneine available in plant foods.

Existing synthetic methods for ergothioneine are very difficult to reproduce and often generate very low yields. Our method is superior in that it allows for good reproducibility with an overall yield of up to 80%.

Benefits

- The process starts with N-benzyl protected histidine. The protection of the histidine allows for more stable intermediates to be produced, shortening and simplifying subsequent process steps
- Increased overall yield of up to 80% is achieved at room temperature, which is significantly better than existing processes

Market

Producers of food supplements and nutraceuticals.

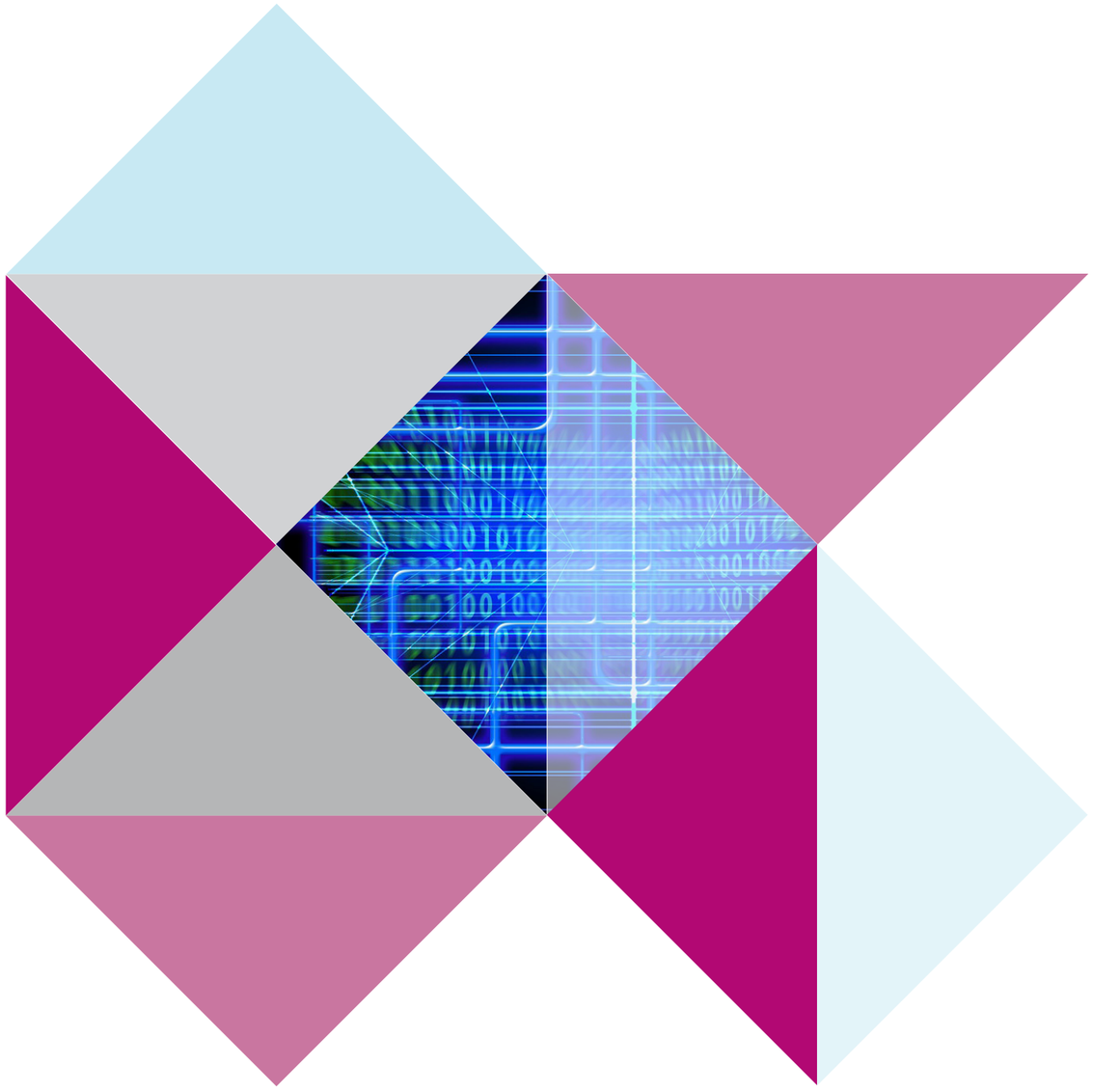
Technical description

The new process for synthesising ergothioneine entails deprotecting an N-benzyl protected histidine to form N-benzyl histidine, converting N-benzyl histidine to two propanoic acid intermediates, brominating the imidazole ring of the last proponaoic acid to form 5-bromohercynine lactone, and converting 5-bromohercynine lactone to a stable ergothioneine sulfide intermediate. The sulfide intermediate can then be cleaved either non-enzymatically (using pyridoxal phosphate or PLP) or enzymatically (using EgtE enzyme) to form ergothioneine.

The inventors are Anwar Jardine and Lutete Peguy Khonde

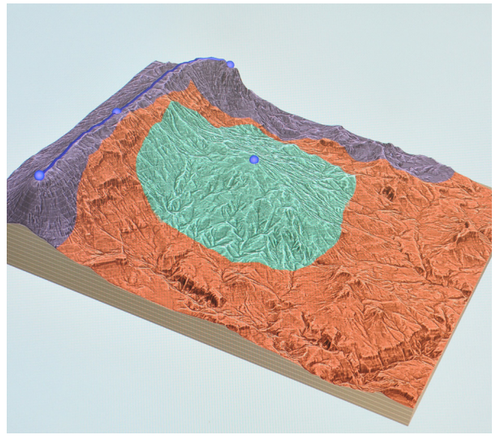
Intellectual Property Rights:
PCT: PCT/IB2015/001668

Technology Readiness Level:
3 - Proof of concept



INFORMATION TECHNOLOGY

Virtual terrain generation



Researchers at UCT have developed the realistic Terrain Synthesis System (RTS), which is an improved method for creating a realistic-looking virtual 3D terrain on a computer. It synthesises new terrains in real time, subject to the constraints sketched/selected by the designer, utilising real terrain examples drawn from a database of Digital Elevation Maps.

The designer starts with a working terrain with target dimensions and an associated height, chooses a template terrain (such as bare terrain, a canyon, a mountain, vegetation, a river, or rolling hills, etc.) with an associated height dimension, and then modifies the working terrain by 'height matching' it to the template terrain. The designer can apply user-defined constraints to further modify the working terrain and produce a final landscape with the desired features. The computer algorithms achieve seamless integration of the various terrains for a more realistic image.

Benefits

Existing terrain generation software tends to produce unrealistic terrain, or uses computationally complex simulation processes to create realistic-looking terrain. These processes, being slow, do not support quick iterative design cycles, and are expensive. The RTS system fills a niche since there are no current terrain generation software systems, which combine its speed, ease of use and user control.

Market

Development and publishing houses that use 3D computer artists and animators tasked with creating digital terrains.

Technical description

In contrast to current approaches, we adapt parallel texture synthesis to produce terrains. Texture synthesis is a software technique that, given one or more input colour images or photographs, is able to generate larger images in the same style by cutting and re-stitching the inputs. Our innovation is an adaptation of existing texture synthesis to the specific case of digital terrains, along with extensions to allow user-driven constraints that provide artists and animators with control over height and surrounding slope by means of constraint points and curves; a paint-by-numbers interface for specifying the local character of terrain; and copy-paste functionality to directly transplant terrain regions. Furthermore, our technique allows both larger input terrains in the synthesis database, thus providing greater variety, and larger output terrains. While there has been some previous research into using texture synthesis for terrains, our system employs per-pixel parallelisation on the GPU and is thus orders of magnitude faster, as well as offering much greater user control over the shape of the terrain.

The inventors are James Gain, Patrick Marais, and Bruce Merry

Intellectual Property Rights:
PCT: PCT/IB2016/052442

Technology Readiness Level:
5 - Alpha release

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