Scottish Research Innovation Futures

Health and Wellbeing: Our Future Health in Scotland

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Speaker Biographies at End of Document

(EARLY DETECTION OF DISEASE)

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SINAPSE

1. PICTURES Exemplar Project: Prediction of Individual Patient Risk of Dementia (PIPaRD)

Susan Krueger and Dr Esma Mansouri-Benssassi, University of Dundee
E-mail: Skrueger001@dundee.ac.uk

Prediction of Individual Patient Risk of Dementia (PIPaRD) is one of two medical exemplar projects enabled through the 5-year PICTURES programme (InterdisciPlInary Collaboration for efficient and effective Use of clinical images in big data health care RESearch).

The aim of PIPaRD is to use anonymised routinely acquired clinical MRI images of the brain to accurately predict individual patient risk of dementia through machine learning and development of predictive algorithms for use by health care clinicians.

For the initial phase of this project MRI Brain images from participants in the integrated Tayside Bioresource (GoFUSION) will be obtained and machine learning algorithms will be developed by training on other linked anonymised clinical data resources, and genome-wide data available to the GoFUSION bioresource.

Once developed within GoFUSION the algorithm will be validated on wider national PACS data (without genetic component) in the Scottish Medical Imaging (SMI) environment (ie National Safe Haven). Ultimately it is envisaged that this methodology will result in scores that may then be used in clinical care and may be used in the context of SHARE for *in silico* identification of individuals for relevant clinical trials.

PICTURES

PICTURES aims to enable secure access to routinely collected imaging data for healthcare research with key challenges being: complex cohort building from real-world, messy data; scaling and handling big data within a Safe Haven environment; and ensuring that patient data is securely held and de-identified appropriately for research.

Website: www.imageonamission.ac.uk

MRC Medical Research Council · EPSRC Engineering and Physical Sciences Research Council · Public Health Scotland · The University of Edinburgh · University of Dundee · Abertay University · aidence human sense in artificial intelligence

(EARLY DETECTION OF DISEASE)

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2. Ultra-Sensitive Antibody-Based Tools for the Early Detection, Diagnosis, and Monitoring of Alzheimer's Disease using Interrogation of the "Tauosome"

Dr Soumya Palliyil and Professor Andy Porter
University of Aberdeen
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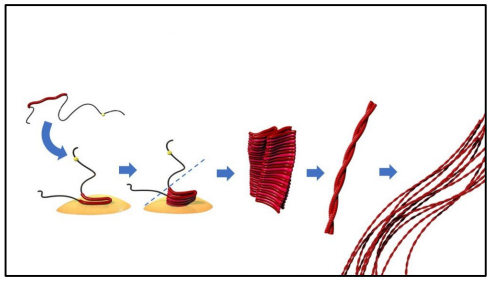
There are approximately 50 million dementia sufferers worldwide with one new patient diagnosed every 3 seconds. Clinical diagnosis is unable to detect those in the early stages of dementia and there is a complete absence of reliable, unbiased biomarkers that can detect early neuropathological changes in pre-symptomatic patients or predict the rate of progression towards cognitive decline in AD. TauRx Pharmaceuticals is a world leader in AD research, with a disease-modifying investigational drug in late stage Phase 3 clinical trials in several countries including the UK and the US. To complement this promising tau-based therapeutic candidate, which has been shown to slow or even pause disease progression, TauRx has joined with the Scottish Biologics Facility to develop an ultrasensitive, antibody-based blood biomarker test for the detection of early stage AD pathology. Exploiting nature's ability to generate an immunogen-specific antibody response and employing molecular biology and protein engineering tools, the SBF has developed a diverse panel of ultra-high affinity monoclonal antibodies capable of recognising multiple specific fragments of tau protein (the tauosome). Interrogation of the tauosome is believed to be the most likely route to unlocking biological signatures of the disease at an early, pre-symptomatic stage of its development. The SBF/TauRx teams have joined force to use different antibody pairings as a powerful and "super-sensitive", biomarker-based diagnostic system which has currently entered the proof of concept phase using a single molecule array immunoassay, or SIMOA, capable of detecting pg/ml quantities of tau fragments in blood.



Diagrammatic representation of tau processing in Alzheimer's disease. A short fragment from the microtubule-binding region of tau is involved in its polymerisation leading to the formation of paired helical filaments (PHFs) which make up the characteristic tangles found in Alzheimer's disease. It is believed that similar tau fragments found in blood may reflect pathology and unlock signatures of disease susceptibility or progression. ***Image courtesy –TauRx Pharmaceuticals Ltd.***

Website: www.abdn.ac.uk/sbf

TauRx Pharmaceuticals
Innovation in neurodegeneration

1495 UNIVERSITY OF ABERDEEN

(EARLY DETECTION OF DISEASE)

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ScotCHEM

3. SepSIS – Rapid New Methods for Sepsis Diagnosis in Hospitals Using Microsystems

Dr Melanie Jimenez, University of Glasgow
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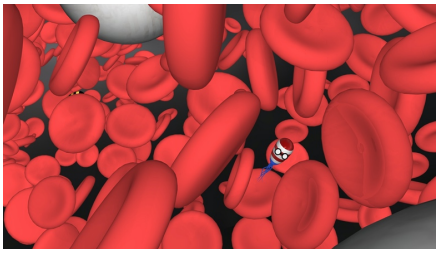
Sepsis is a life-threatening consequence of infection that kills 3,500 people every year in Scotland. Due to the rapid deterioration and severe morbidity and mortality in patients with sepsis, multiple broad-spectrum or last-resort antibiotics are routinely administered, which contributes to the development and spread of antibiotic resistance. Current methods to identify the underlying infection and better target treatment require culture of patient samples to see if bacteria grow from the sample. This takes several days to establish a result and so rapid diagnosis of a bacterial infection, coupled with bacterial identification, would enable the use of the right antibiotics straight away, reducing the risk of complications for the individual patient, and benefiting society by reducing use of last-resort broad-spectrum drugs.

This project aims to tackle the challenge of rapid diagnosis by engineering a miniaturised, portable platform that will isolate bacteria from clinical samples within minutes, without prior knowledge of their identity or longer culture steps. Importantly, this approach will be coupled to technologies already available in hospitals and new genome-sequencing technologies to perform bacterial identification and antibiotic susceptibility testing in a much-reduced timeframe.



Our team of engineers, chemists, immunologists and clinicians are constructing, from the ground up, new bio-receptors, nanoparticles and microfluidic technologies to combine in a unique tool for fighting bacterial infections and sepsis. We are also undertaking outreach with key partner charities to raise awareness of sepsis more widely (e.g. in schools).

Website: www.jimenezmelanie.weebly.com

Royal Academy of Engineering · Chief Scientist Office · Sepsis Research FEAT · University of Glasgow · ROSLIN · NHS Greater Glasgow and Clyde

(MANAGEMENT OF LONG-TERM EXISTING CONDITIONS)

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SRPe
Scottish Research Partnership in Engineering

4. Personalised Approach to Restoration of Arm Function in People with High-Level Tetraplegia

Dr Edward Chadwick, University of Aberdeen
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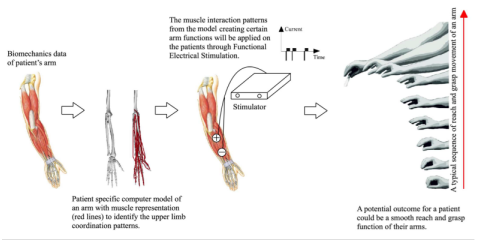
The goal is to improve the independence of people with arm paralysis by enabling functional movement using non-invasive electrical muscle stimulation. Functional Electrical Stimulation (FES) is an assistive and rehabilitation technology whereby low-level electrical signals are used to induce muscle contraction where voluntary control has been lost. Such muscle contractions can strengthen the muscle, load the bones, or produce functional movement in people with paralysis.

In the lower limb, FES technology is used to prevent foot drop during gait in post-stroke hemiplegia. In the upper limb, FES is much less widely used due to the highly selective nature of the movements that users want to perform, and the significant variability in motor deficits that exist in people with spinal injuries making the control of any stimulation system very challenging.



The project began in 2018 with an award of £370k from EPSRC to develop efficient methods for personalising a FES system to allow people with high-level spinal cord injuries to control their own arm movements. Biomechanical models representing the functional limitations due to an injury are used to predict the effects of surface electrical stimulation on the paralysed arm. System set up and muscle stimulation patterns are then optimised to achieve a desired set of tasks for an individual to help them regain their independence. This work is part of a larger body of work by the lead investigators, in which they have worked with the Cleveland FES Center on the development of implantable FES systems for the upper limb. The project involves a multidisciplinary team of biomedical and clinical engineers, rehabilitation specialists and NHS orthopaedic surgeons.

Website: www.abdnbiomecheng.github.io/TechForParalysis

(MANAGEMENT OF LONG-TERM EXISTING CONDITIONS)

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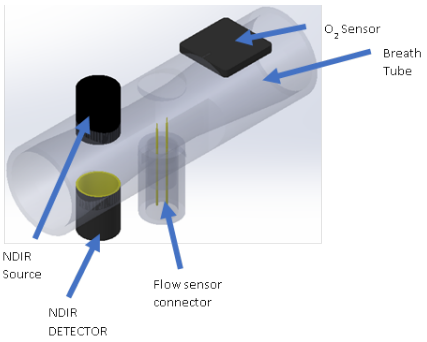
5. Fast Response Low Power Consumption Combined Air Flow/Carbon Dioxide/Oxygen Sensor for Measurement of Exhaled Breath and use for Diagnosis and Management of Chronic Respiratory Diseases

Professor Des Gibson & Dr David Hutson, University of the West of Scotland
E-mail: des.gibson@uws.ac.uk

There is a need for point of care (PoC) novel diagnostic and monitoring technologies to enable early diagnosis/ management of chronic respiratory diseases (eg chronic obstructive pulmonary disease [COPD], asthma), differentiation between respiratory diseases, establish the cause of acute exacerbations and to monitor disease progression. COPD is the third leading cause of death globally and presents a significant burden to patients, carers and health services worldwide. Annual total cost to European economy is circa €210 billion for COPD and asthma.

A low cost PoC device provides a means of self-diagnosis/management, allowing time for rapid self-treatment using inhalers/ medication, reducing probability of acute exacerbations and consequent irreversible reduction in lung function. Currently treatment normally requires hospitalisation when exacerbation event is advanced stage. The development device has emerged from a previous ERANET Horizon 2020 project – "Chemical Sensor based on a Miniaturised Infrared Spectrophotometer".

The device can also be used for sports medicine, assisting athletes in development of training regimes and monitoring influence of training regimes on respiratory efficiency. The device can also be used to determine resting and exercising metabolic rates. This has implications for information in relation to individual's general health. Further exciting developments also include: the monitoring of performance levels in elite and non-elite athletes, while capturing between gender differences. This is inclusive of both children and adults. In addition, the development would facilitate identification of training zones that will promote full recovery from exercise and minimise any risks associated with overtraining, including respiratory and muscular skeletal.



Website: www.itfsi.com

(EARLY DETECTION OF DISEASE)

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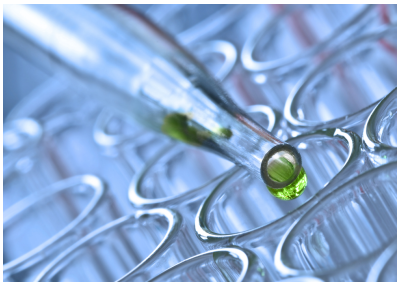
6. Testing Efficacy and Maximising Screening of Limited Cancerous Tissue in 3D with ONCO-Chip3D Technology

Dr Michele Zagnoni, University of Strathclyde
E-mail: michele.zagnoni@strath.ac.uk

A University of Strathclyde start-up, ScreenIn3D, has developed a microfluidic precision-medicine technology, which allows clinicians to tailor cancer treatments to individuals.

ONCO-Chip^{3D} technology enables medical professionals to simultaneously test dozens of different drugs – and combinations of treatments – on three-dimensional, live micro-tumours developed from a patient's biopsy. It also allows drug developers to conduct at least 20-times more testing than existing technologies for the same amount of starting primary tissue, with great cost-saving opportunities. Through the use of automation, the risk of human error is reduced significantly.

The process involves taking a tissue sample from a patient's tumour and processing it into a series of micro-tumours. These are placed inside compartments within the tumour-on-a-chip technology and treated with a few micro-litres of fluid containing different concentrations of a drug or immunotherapies. The micro-tumours are then left to incubate for as long as required, before the results are analysed and the most promising treatment for the patient is advised.



The technology has a range of potential applications, including cardiology, where it can be used to detect irregular heartbeats, and hepatology. The project has been supported by the University of Strathclyde, Medical Research Scotland Mand AMS Bio. CENSIS provided funding support for the initial research, which led to the creation of ScreenIn3D.

Website: www.screenin3d.com

University of Strathclyde Glasgow

MRS Funding a healthier future MEDICAL RESEARCH SCOTLAND

CENSIS

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SINAPSE

7. Transcranial MR Guided Focused Ultrasound (TcMRgFUS) for Treatment of Parkinson's Disease

Dr Tom Gilbertson, University of Dundee
E-mail: tgilbertson@dundee.ac.uk

Parkinson's disease (PD) is the fastest growing neurological condition in the world. Addressing the impact of this disease burden is a key priority for future health care planning Clinical Neurosciences in Scotland. For many patients with PD, symptom control early in the disease is inadequate from best medical therapy. TcMRgFUS applies the same principles for symptomatic relief in PD to established Functional neurosurgery techniques including Deep Brain Stimulation (DBS) but without the need for open surgery or hardware implantation. The minimally invasive nature of TcMRgFUS means that it is a potential early treatment option for mediction resistant patients. Preliminary evidence from clinical trials have demonstrated significant promise

As part of a £2m investment in the first TcMRgFUS Neuro system in Scotland (and the second in the UK) this research aims at establishing an evidence base for this treatment in PD for its early adoption into routine NHS care.

This collaborative project between clinicians and Biomedical Engineering within the University of Dundee will also aim to test the neuromodulatory effects of focused ultrasound on brain function. The aim of this research is to identify the next generation of functional neurosurgical targets that may relieve non-motor symptoms in Parkinson such as apathy and impulsivity – symptoms which are presently untreatable and are associated with a significant morbidity and poor outcomes in this patient group.

University of Dundee

(EARLY DETECTION OF DISEASE)

PRESENTED BY

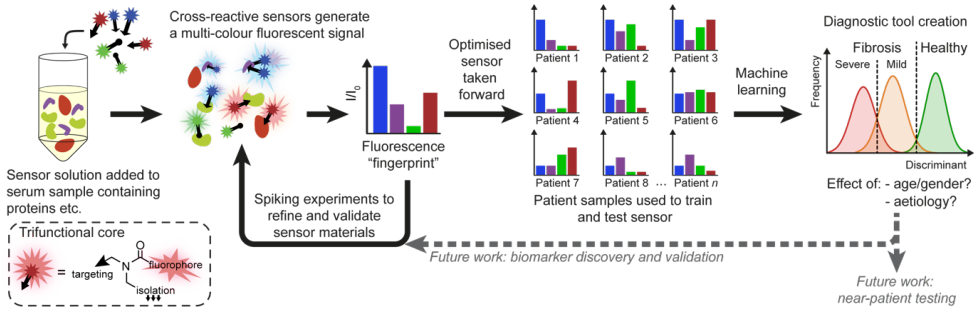
ScotCHEM

8. FibroTeC – Liver *Fibro*sis *T*arge*t*ing *C*himeras from Combinatorial Chemistry for Sensing, Diagnostics and Discovery

Dr William Peveler, University of Glasgow
E-mail: William.peveler@glasgow.ac.uk

Chronic liver disease (CLD) is among the top ten causes of death worldwide and in the top 3 in the UK. In most cases CLD is asymptomatic until disease is very advanced, and in many cases treatment options are limited to palliation rather than cure at the time of diagnosis. The common pathway to liver failure in all CLD is liver fibrosis. Traditional liver function tests perform poorly in the detection and measurement of liver fibrosis but recent advances in the development of non-invasive tests (NITs) has revealed that they can be used with great effect to detect, quantify and monitor changes in liver fibrosis leading to early diagnosis, permitting effective interventions to prevent life-limiting and life-changing complications of CLD.

The FibroTeC project (chemistry/clinical/industry) team are developing a fundamentally new approach to diagnostic chemistry, based on luminescent cross-reactive arrays (Peveler ACS Sensors 2016), and our technology has been proven in a preliminary trial (Peveler Adv. Mater. 2018). Now we are developing a new NIT for liver fibrosis with our sensing arrays, that can be delivered at point of need, with information-rich read out (disease state, underlying aetiology) and used in primary as well as tertiary care settings. Further to this, our sensing array approach, coupled with our new chemical chimeras, will enable us to undertake discovery science - to isolate and develop the next generation of targeted biomarkers for fibrotic disease and gain increased understanding of fibrosis biology, informing future therapeutic strategies.



Website: www.pevelerlab.wordpress.com

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9. Diagnosis of Infectious Exacerbation of Chronic Obstructive Pulmonary Disease (COPD)

Dr Wilber Sabiiti, University of St Andrews
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Respiratory diseases are the leading cause of morbidity and mortality [1]. COVID-19 has aggravated a situation that was already poor. Chronic Obstructive Pulmonary Disease (COPD) is on top of the big 5 respiratory diseases including Asthma, Acute Lower Respiratory Tract Infection (ALRTI), tuberculosis and Lung cancer which together affect over 400 million people globally and kill over 5 million per year [1]. COPD alone affects 65 million people of whom 3 million die every year [1–3]. Every COPD patient suffers 2-3 symptom exacerbations per year. Research has shown that 40 – 60% of COPD exacerbations are associated with bacterial infections [4,5]. The current diagnosis depends on microscopy and/or cultivation of the sputum in growth medium. The two tests have low sensitivity and specificity and take long to give results particularly culture. Poorly diagnosed infectious exacerbation is recipe for inappropriate use of antibiotics and can lead to death. We have drawn on the principle of our successful tuberculosis Molecular Bacterial Load Assay (TB-MBLA) to develop COPD-MBLA test. The test uses bacterial rRNA as a target to detect and quantify the four bacterial species that commonly cause COPD exacerbation. The test will enable clinics to rapidly rule- in or out bacterial exacerbation and prescribe antibiotics appropriately. By monitoring the change in bacterial load, the clinicians will be able to timely determine whether the prescribed antibiotics are effective against the bacteria and thus improving patient treatment outcomes. The kit is going into first clinical evaluation in NHS Fife and Uganda.

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5 Choi J, Oh JY, Lee YS, et al. Bacterial and viral identification rate in acute exacerbation of chronic obstructive pulmonary disease in Korea. Yonsei Med J 2019;**60**:216–22. doi:10.3349/ymj.2019.60.2.216

Website: www.vitalbacteria.com

University of St Andrews
Makerere University Lung Institute
MAKERERE UNIVERSITY COLLEGE OF HEALTH SCIENCES
Science for Healthy Lungs
NHS Fife
EDCTP
Scottish Funding Council
Promoting further and higher education
PanACEA
COMMONWEALTH SCHOLARSHIPS
GCRF
Global Challenges Research Fund
wellcome

(EARLY DETECTION OF DISEASE)

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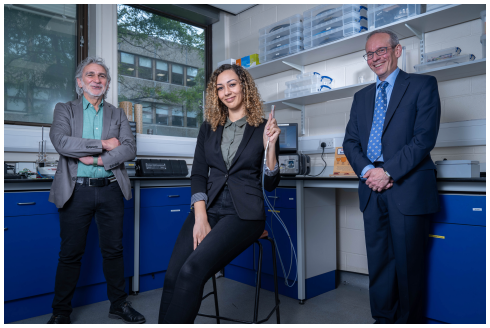
10. A New Way of Testing for Prostate Cancer: Mechanically Intelligent Digital Rectal Examination



Professor Bob Reuben, Heriot Watt University (pictured alongside Femi Johnson and Professor Alan McNeill)

E-mail: bobreuben@intellipalp.com

IntelliPalp D_x Ltd was established in 2020 as a spin-out from Heriot-Watt University and University of Edinburgh, researching, designing and manufacturing diagnostic devices for a world market. CENSIS is working with IntelliPalp to accelerate the process of bringing the test to market and, with help from the Medical Device Manufacturing Centre (MDMC), IntelliPalp is designing and making a prototype for use in a multi-centre validation trial.

There are 47,500 diagnoses each year for prostate cancer – equivalent to 129 every day – while as many as one in eight men develop the disease in their lifetime. Currently, a positive diagnosis with a prostate-specific antigen (PSA) test and subjective Digital Rectal Exam (DRE) leads to multi-parametric magnetic resonance imaging (mpMRI) scan and then biopsy for suspected cancer. ProstaPalp® is an objective, instant and simple test which supplements DRE and avoids the expense and delay of mpMRI. ProstaPalp® uses a patented method of dynamic mechanical measurement obtained from a finger-mounted probe, giving instant results in primary care.

ProstaPalp is a great example of the growing and evolving role that sensors play in the healthcare sector. Deliverable at the earliest and most anxious stage of the process of diagnosing prostate cancer, it will have a significant positive impact on patient experience and help health services better focus attention and resources. The test will also allow a technology researched, designed, and made in Scotland to realise global impact and benefit.

Website: www.intellipalp.com

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11. Early Diagnosis of Cancer of the Lung in Scotland (ECLS)

Professor Frank Sullivan, University of St Andrews
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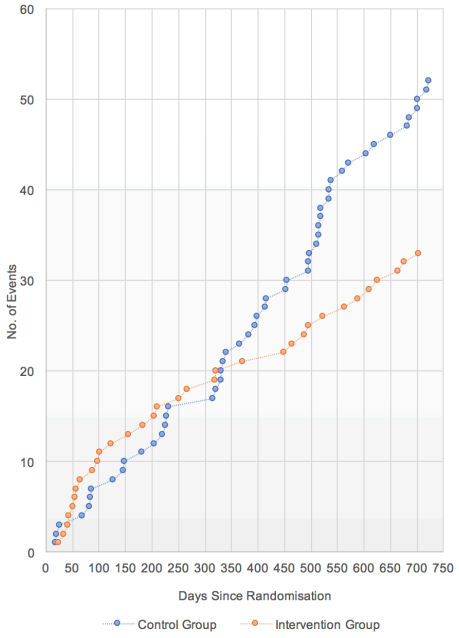
The EarlyCDT-Lung test is a high specificity blood-based autoantibody biomarker that could contribute to earlier diagnosis of lung cancer, lower burden on radiology services and reduce mortality. We have reported on the two year results of the
ECLS trial which was a randomised controlled trial of 12,208 participants at risk of developing lung cancer in Scotland. The intervention arm received the EarlyCDT-Lung test and, if test positive, Low-Dose CT scanning (LDCT) six-monthly for up to two years. EarlyCDT-Lung test negative and control arm participants received standard clinical care. Outcomes were assessed at two years' post-randomisation using validated data on cancer occurrence, cancer staging, mortality and comorbidities.



At two years, 127 lung cancers were detected in the study population (1.0%).
In the intervention arm, 33/56 (58.9%) lung cancers were diagnosed at stage III/IV compared to 52/71 (73.2%) in the control arm. The hazard ratio for stage III/IV presentation was 0.64 (95% confidence interval 0.41, 0.99). There were non-significant differences in lung cancer and all-cause mortality after two years. We are analysing the three year follow up data at present and may be able to present these in a poster.

The observation of a stage-shift towards earlier-stage lung cancer diagnosis merits further investigations to evaluate whether the EarlyCDT-Lung test adds anything to the emerging standard of LDCT. Plans for a larger community based trial (ECL-UK) are in development.

Primary Outcome: Diagnosis of Stage III/IV/Unspecified Lung Cancer Two Years After Randomisation in the Intervention and Control Arms.

Website: www.eclsstudy.org

(EARLY DETECTION OF DISEASE)

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SINAPSE

12. iCAIRD Exemplar Project: AI and Breast Cancer Mammography

Consortium Based Programme:
Academic Leads: University of Glasgow, University of Aberdeen, University of Edinburgh, University of St Andrews
Large Industry Leads: Canon Medical (Radiology) and Philips (Pathology)
SME Leads: Bering, Kheiron, Glencoe, DeepCognito
NHS Leads: Greater Glasgow and Clyde & Grampian

E-mail: info@icaird.com

The Industrial Centre for Artificial Intelligence Research in Digital Diagnostics (iCAIRD) brings together a pan-Scotland collaboration of 15 partners from across industry, NHS and academia funded by Innovate UK and key industrial partners. iCAIRD is building a world-class centre of excellence focusing on the application of artificial intelligence to digital diagnostics. iCAIRD brings together clinicians, health planners and industry, enabling research-active clinicians to collaborate with innovative SMEs to better inform clinical questions, and ultimately to solve healthcare challenges more quickly and efficiently.

iCAIRDs strategy has been to initially focus on building infrastructure to host AI development environment for both Radiology and Pathology, starting in Glasgow and Aberdeen as part of an eventual platform for federated learning. This incorporates expertise in data & security governance processes, as well as data extraction from both local and national NHS archives. It delivers platforms to facilitate AI training and experimentation as well as supporting clinical evaluation and validation. It also involves bringing our exemplar partners onto this infrastructure to build AIs – this includes areas involving radiology imaging such as acute stroke, chest X-Ray, mammography as well as digital pathology such as gynaecological cancer screening. we are moving to the sustainability phase of the programme, looking at how we support new exemplar projects and model generalisation through a network of federated training sites. Core to this phase is patient and public engagement to ensure we address trust and ethical issues around AI in healthcare.

Website: www.icaird.com

Please refer to case study #18 for further details of the Artificial Intelligence in Mammography iCAIRD exemplar project

iCAIRD University of Glasgow UNIVERSITY OF ABERDEEN THE UNIVERSITY of EDINBURGH University of St Andrews CANON MEDICAL SYSTEMS PHILIPS

Bering KHEIRON MEDICAL TECHNOLOGIES Glencoe SOFTWARE DeepCognito NHS Grampian NHS Greater Glasgow and Clyde

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Digital Health & Care Innovation Centre

13. The Scottish Capsule Programme (SCOTCAP) Evaluation Project

Michelle Brogan, Digital Health & Care Innovation Centre
E-mail: michelle.brogan@dhi-scotland.com

The Scottish Capsule Programme (SCOTCAP) is an integral part of the national redesign of outpatient gastroenterology services as it enables early and effective screening in the community, avoiding unnecessary referrals for hospital outpatient appointments.

It is administered by a managed service provider following referral from NHS and dispensed within a local community setting meaning patients do not have to travel unnecessarily to the hospital for an outpatient colonoscopy procedure.

It is a multi-stakeholder collaboration with innovators including the Digital Health & Care Innovation Centre, Scottish Government, Highlands & Islands Enterprise, NHS National Services Scotland, NHS Highland, NHS Grampian, NHS Western Isles, Medtronic, Corporate Health International, The University of Aberdeen and the University of Strathclyde.

The SCOTCAP Project represents the largest evaluation and examination of the use of Colon Capsule Endoscopy (CCE) for patients with new bowel symptoms across the NHS (UK). The project pioneered the creation of Scotland's first Innovation Partnership procurement contract, enabling commissioning bodies to "partner" and work collaboratively with industry.

This project is fast becoming an exemplar project in terms of accelerating innovation adoption in Scotland.

Following a successful evaluation, the innovative SCOTCAP service is being adopted by NHS Scotland as part of the Covid-19 Remobilisation plans not only benefiting NHS Scotland but the wider Scottish Life Sciences Community by generating economic growth and jobs with a particular impact on remote and rural regions. It is now being considered for adoption in England and Wales.

Website: www.dhi-scotland.com/projects/scotcap

(MANAGEMENT OF LONG-TERM EXISTING CONDITIONS)

PRESENTED BY

14. U-care: Deep Ultraviolet Light Therapies

Professor Robert Thomson, Heriot Watt University
E-mail: R.R.Thomson@hw.ac.uk

U-care is a £6.1M EPSRC-funded research project which started on the 1st of Jan. 2021. Our aim is to exploit cutting-edge techniques in laser physics to develop new sources of deep UV light (wavelengths of around 200 nm) which will be highly compact, robust and low cost. We will develop ways to deliver this light precisely to tissues, and work to understand in detail the biophysical mechanisms involved in the unque way such optical wavelengths interact with cells and tissues. Our efforts will focus on new therapies that target some of the biggest challenges facing medicine: cellular-precision cancer surgery, and the emergence of drug-resistant "super-bugs". Importantly, U-care will involve engineers and physical scientists working in close collaboration with clinicians and biomedical scientists to verify that the therapies we develop are effective and safe. By doing so in an integrated manner, we will drive our deep-UV light therapies towards healthcare impact and widespread use in the clinic by 2050.

PRESENTED BY

15. NeuroEyeCoach™: Eyesight Rehabilitation Following Stroke

Professor Arash Sahraie, University of Aberdeen
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Each year, approximately 100,000 people in the UK, EU and US suffer sight loss due to stroke, resulting in sudden unanticipated disability that can severely impact quality of life. Systematic reviews suggest that eye movement training represents the most promising approach to vision rehabilitation in stroke patients, but previous therapeutic approaches lacked reach due to the need for numerous clinic visits and substantial clinician time investment. Researchers at the University of Aberdeen, led by Professor Sahraie, have developed, evaluated and commercialised a new eye movement training therapy for patients with sight loss following stroke: NeuroEyeCoach™. One of the biggest benefits of NeuroEyeCoach™ is its accessibility. It can be accessed remotely by patients using any personal computer device, so can be used either at home or in clinics, and it is adaptive to the individual's disability, allowing tailored training matched to the patient's needs. Thus, it addresses two of the major issues that had not been addressed by previous therapies, namely standardisation and ease of access. Data from over 500 patients accessing NeuroEyeCoach™ has shown major benefits in improved vision and daily living activities, thus improving their quality of life. Having received regulatory approval, the therapy has been widely used to rehabilitate patients in the EU and the USA, and is also being used to rehabilitate patients in the UK.

Website: www.abdn.ac.uk/psychology/research/neuroeyecoach-643.php

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16. A Novel Modular Solution for Healing Non-Union Bone Defects

Ruth McKay, University of Glasgow
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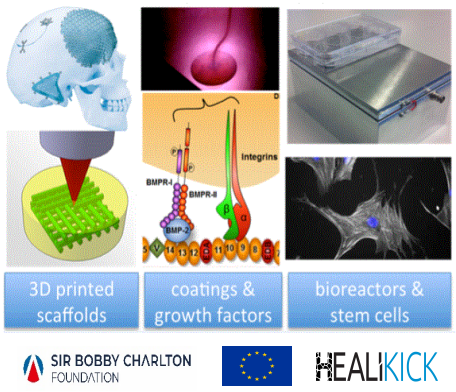
Professor Manuel Salmeron-Sanchez
Manuel.Salmeron-Sanchez@glasgow.ac.uk

Over the last year, most NHS bone health services were suspended due to Covid-19. Untreated fractures caused by long-term conditions such as Osteoporosis are expected contribute to increasing numbers of non-union fractures, an already significant long-term clinical challenge. The gold standard treatment is an autograft transplant, but supply is limited, there are frequent complications, and it requires significant clinical care.

University of Glasgow has been leading the development of bone regeneration technologies. In 2017 they received £2.7m from Sir Bobby Charlton Foundation towards research that is ongoing. In 2020, they received £5.2m for a 5-year project ending in 2025. This project received funding from the European Union Horizon 2020 programme research and innovation programme under grant agreement No 874889. Alongside local and international collaborators, they have developed an 'off-the-shelf' equivalent to an autograft.



Their modular strategy for repairing bone defects involves a novel bioactive coating applied to synthetic implant material and a novel stem cell therapy. The coating facilitates a safe and efficient way of delivering low dose BMP-2 (bone morphogenetic protein 2), a powerful growth factor required to stimulate bone regeneration, to the fracture. High dose BMP-2 has been associated with adverse systemic side effects. This has shown promising results in pre-clinical models and veterinary treatments. They have also developed a cell therapy where stem cells are osteogenically primed towards osteogenic commitment using mechanical stimulation and added directly to the fracture. This is being prepared for first-in-human trial in 2022.

This interdisciplinary team have developed technologies that provide an efficient, safe, and cost-effective alternative to autografts with the flexibility to treat bone defects of varying size.

Website: www.glasgow.thecemi.org

(EARLY DETECTION OF DISEASE)

PRESENTED BY

17. PREPare for the Real-World Evaluation of an Artificial Intelligent System for Breast Cancer Screening: The PREP-AI-R Study

Dr Rumana Newlands, University of Aberdeen
E-mail: r.newlands@abdn.ac.uk

Breast cancer is increasingly prevalent with 1 in 8 women in Scotland being diagnosed with this condition at some point in their lives. To facilitate its early detection the Scottish Government has created a Breast Screening Programme (BSP), which periodically invites women aged between 50 and 70 years old for a mammography. The demand and availability of diagnostic images is rapidly exceeding the capacity of available radiologists. There is a clear need for service reform to achieve high levels of diagnostic scans in a timely manner.

Artificial intelligence (AI) has such a potential to transform how healthcare is delivered. AI can be defined as the use of digital technology to create systems capable of performing tasks thought to require human intelligence. Implementation and evaluation of AI systems in real-world may be problematic, given numerous concerns raised around possible implications of AI for patient safety, data security, public acceptance and trust, accountability for decisions and the impact on the wider healthcare system. Considering stakeholders' views is a crucial aspect of problem solving by recognising their role in the context of implementation.

The PREP-AI-R study will develop a systematic approach to assist the evaluation of AI systems to be used as a part of the BSP in Scotland. For this, we are conducting a stakeholder analysis (a user-focused approach) that involves exploring what stakeholders' (such as service users, providers and policy makers) want and need from an AI assisted breast cancer detection system if it was to be deployed in clinical practice.

Website: www.abdn.ac.uk/hsru/what-we-do/research/projects/prepair-project-962.php

(EARLY DETECTION OF DISEASE)

PRESENTED BY

SINAPSE

18. Artificial Intelligence in Mammography – Helping to Detect Cancers in a Screening Population

Dr Gerald Lip, NHS Grampian; Dr Roger Staff, NHS Grampian; Prof Lesley Anderson, University of Aberdeen; Ms Dee Dineen, Kheiron Medical

Several challenges face the breast screening services in the UK. The Covid pandemic caused a pause in services with a significant backlog of cases. Coupled with this the Royal College of Radiology survey (April 2021) reported that 25% of breast radiologists intend to retire in the next five years.

The screening evaluation process is labour intensive requiring review of thousands of mammograms to identify small but significant numbers of cancers. Breast screening has been shown to be effective in reducing morbidity and mortality.

The Innovate UK funded Industrial Centre for Artificial Intelligence and Digital Diagnostics (iCaird) consortium was established in 2018 in Aberdeen and Glasgow. Aberdeen led the collaborative effort to assess and further develop the route to adoption of artificial intelligence (AI) in mammography screening. This interdisciplinary effort included cooperation between the screening services, National Services Scotland and the University of Aberdeen using a data safe haven and research environment built by Canon limited to test and evaluate a CE marked mammographic AI by Kheiron Medical.

This successful partnership has now transferred over 80,000 mammographic sets of images enabling analysis of the AI's performance using data scientists from iCaird to map performance and future pathways of AI use to the benefit of women with breast cancer.

Website: www.icaird.com

iCAIRD UNIVERSITY OF ABERDEEN CANON MEDICAL SYSTEMS NHS Grampian KHEIRON MEDICAL TECHNOLOGIES

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19. Self-Monitoring Coagulometers for NHS Patients Receiving Long-Term Vitamin K Antagonist Therapy

Pawana Sharma, Graham Scotland, Craig Ramsay, Miriam Brazzelli, University of Aberdeen
E-mail: m.brazzelli@abdn.ac.uk

Quality of life for patients on long-term oral anticoagulation therapy is negatively affected by the travel associated with up to 20 regular checks per year at their GP or hospital. Research, led by the University of Aberdeen Health Technology Assessment Group, was responsible for NICE guidance recommendations approving a Roche-manufactured device for self-testing by patients in both England and Scotland. The recommendations underpinned NHS Trust guidelines for patients and carers, saved time in NHS primary care settings, improved the quality of life for patients and generated commercial benefits. 17,000 patients in the UK use the device and in one NHS Trust with 500 patients, the number of out-patients attendees has halved, avoiding over 55,000 in-patient appointments in a seven-year period.

Website: www.abdn.ac.uk/heru/research/assessment-of-technologies/techadoption/point-of-care-coagulometers

UNIVERSITY OF ABERDEEN
NHS SCOTLAND
NICE National Institute for Health and Care Excellence
Roche

(EARLY DETECTION OF DISEASE)

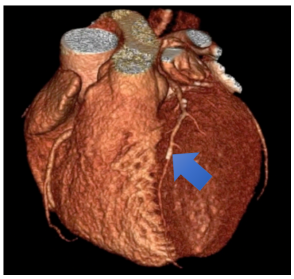
PRESENTED BY

SINAPSE

20. Incidental Calcification on Routine Thoracic CT and Cardiovascular Outcomes

Dr Michelle Williams, University of Edinburgh
E-mail: michelle.williams@ed.ac.uk

CT scans of the chest are now widely used to help diagnose a range of diseases. These scans are usually performed to diagnose problems unrelated to the heart and blood vessels. However, there are often signs of "hardening of the arteries", called calcification, on these CT scans which indicate the presence of undiagnosed heart and blood vessel disease (cardiovascular disease). These and other features of cardiovascular disease can be identified on routinely performed CT scans of the chest. Our current collaborative research aims to use machine learning to identify these features of cardiovascular disease on routinely performed CT scans of the chest, and to link these findings to other routinely collected healthcare data, such as risk factors for cardiovascular disease and medication use. We hope that this research will help to identify patients at risk of heart attack, stroke and cardiovascular death. In the future, this simple strategy could be used to identify at risk patients in order to guide preventative management, and potentially of saving many thousands of lives.



CT of the heart with the blue arrow showing coronary artery disease (calcification)

British Heart Foundation

THE UNIVERSITY of EDINBURGH

usher institute

Cedars Sinai

(EARLY DETECTION OF DISEASE)

PRESENTED BY

ScotCHEM

21. Point-of-Care Assessment of Drug-Induced Liver Injury

Professor James Dear, University of Edinburgh and Professor Duncan Graham, University of Strathclyde
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In the Western world paracetamol (acetaminophen) overdose is the commonest cause of acute liver failure. In the UK alone around 100,000 people attend hospital following paracetamol overdose and 50,000 need emergency treatment. In those patients who develop acute liver failure mortality is around 30-35%, with about 30% receiving a liver transplant (most of who survive). Of the remaining patients, including spontaneous recoveries, many occupy a critical care bed for weeks. Currently, the only treatment for paracetamol overdose is acetylcysteine. Prompt treatment of patients at risk of liver injury is critical as acetylcysteine is optimally effective only if started within around 8 hours of overdose. There is an unmet need to rapidly identify patients at high risk of developing acute liver failure. This would allow earlier treatment with acetylcysteine and galvanise clinical trials of new therapeutic agents.
We are creating a finger prick capillary blood, cheap, rapid (desired sample to result time 20min), quantitative liver injury assay for use at point-of-care (POC) (Emergency Department triage/ambulance) after paracetamol overdose. The assay uses a cheap lateral flow strip loaded with low volumes of antibody and red-gold nanoparticles (AuNP) to form a sandwich assay with the biomarker K18. AuNPs functionalized with a Raman reporter allow quantitative surface enhanced Raman scattering (SERS) assessment to take place using a handheld battery-operated spectrometer. Combining this POC device with portable SERS measurement will allow the assessment of liver injury risk next to the patient within 20 minutes of finger prick.

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(EARLY DETECTION OF DISEASE)

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22. Use of Low Cost Eye Tracking to Improve the Viability of Screening for Alzheimer's Disease

Ms Julia Blair and Dr Laura Sweeney, Glasgow Caledonian University
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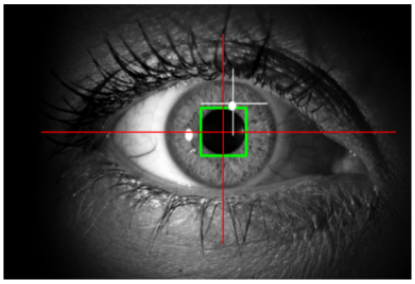
Currently, cognitive testing is the mainstay of Alzheimer's disease (AD) screening; however current tests show poor sensitivity and specificity. For example, the Addenbrookes Cognitive Exam III (ACE III) has a reported sensitivity of 74% and specificity of 78.1%, which is not compatible with a national screening programme (Kaszás et al, 2012).

Research examining eye movements using high resolution laboratory-based eye trackers has shown that patients with AD demonstrate eye movement deficits compared to age matched controls (Anderson and MacAskill, 2013), however these devices and paradigms are not suitable for wide scale rollout.

The project aims to determine the viability of an eye movement test administered using a low-cost eye tracker as a screening tool for AD. Our research aims to improve the accuracy of current screening tests for AD by monitoring eye movements with a commercially available video-based eye tracker and examining how the eyes move during simple visual tasks on a computer screen. The project has determined the optimum target characteristics and test paradigm for a rapid eye movement test which is suitable to be used in conjunction with cognitive testing to improve the efficiency of AD screening.

Eye movements are recorded binocularly using the Tobii Eye X remote video eye-tracking device (Tobii, Stockholm, Sweden) at a sampling rate of 60 Hz. Stimulus characteristics have been optimised to aid differentiation between age matched controls and AD patients, as previous research has demonstrated stimuli properties alter the eye movement response, however this has not been explored in AD patients.



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Kaszás, B., Kovács, N., Balás, I., Kállai, J., Aschermann, Z., Kerekes, Z., Komoly, S., Nagy, F., Janszky, J. & Lucza, T. 2012. Sensitivity and specificity of addenbrooke's cognitive examination, mattis dementia rating scale, frontal assessment battery and mini mental state examination for diagnosing dementia in Parkinson's disease. *Parkinsonism & related disorders,* 18**,** pp.553-556

GCU Glasgow Caledonian University
University for the Common Good

University of Strathclyde Glasgow

(MANAGEMENT OF LONG-TERM EXISTING CONDITIONS)

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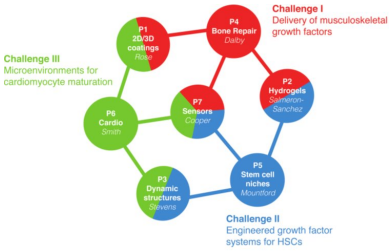
23. Engineering Growth Factor Microenvironments – A New Therapeutic Paradigm for Regenerative Medicine

Ruth McKay and Professor Manuel Salmeron-Sanchez, University of Glasgow
E-mail: ruth.mckay@glasgow.ac.uk | **E-mail**: Manuel.Salmeron-Sanchez@glasgow.ac.uk

University of Glasgow has brought together engineers and scientists, along with selected international partners, to develop a toolbox of novel functional materials able to modify the local stem cell niche. The ability to engineer the stem cell environment in vitro has remained, until now, a major hurdle. Together they hold great potential for the discovery of new therapies for numerous long-term conditions.

In 2016, they received £3.6m funding from EPSRC for this programme which will run until Oct '22. The overarching aim is to develop novel systems able to promote highly efficient growth factor (GF) delivery focusing on musculoskeletal, cardiovascular, and haematological diseases. GFs are growth-promoting substances that enhance cell activity, differentiation, and proliferation. Traditionally, GFs are administered in high doses and have significant unwanted side effects. Within this project, they have developed environments, for the first time, that can deliver GFs safely in low doses.

They have used this to 1) develop 3D printed bone scaffolds to engineer living bone grafts 2) engineer systems to promote the maturation of cardiomyocytes in vitro, previously a major translational hurdle, to produce cells available for transplantation and cardiotoxicity testing; 3) engineer bone marrow niches comprising mesenchymal and haematopoietic stem cells to allow better maintenance of cells used in leukaemia therapies.



Using a highly interdisciplinary team, they have engineered microenvironments capable of delivering GFs in low doses - a transformative approach for regenerative medicine. Not only does this have translational potential for the discovery of new therapies, but also for the development of novel laboratory tools and drug screening platforms too.

Website: www.glasgow.thecemi.org

University of Glasgow · Imperial College London · University of Nottingham UK | CHINA | MALAYSIA · CLYDE BIOSCIENCES · CELLINK LIFE SCIENCES
locate bio · biogelx · CELL guidance systems · Manchester BIOGEL

(EARLY DETECTION OF DISEASE)

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24. Host Gene-Based Diagnosis of Asymptomatic and Symptomatic Tuberculosis (TB)

Dr Wilber Sabiiti, University of St Andrews
E-mail: ws31@st-andrews.ac.uk

Tuberculosis is a global health challenge making 10 million people ill and causing over a million deaths per year. One-quarter of the world's population have 'sleeping' (latent) TB and express no symptoms, but they are carriers of whom 5% develop active disease at some point in life. To prevent active TB disease, the World Health Organisation has called for diagnostic tools that enable early detection and treatment to prevent development of severe TB disease. In response, my research group has developed diagnostic tool that uses change in the expression of human genes to detect presence or absence of TB. Over 10 years of study by several groups across the world has revealed that there are genes that are specifically switched on when a person gets infected with TB and have shown potential to distinguish patients with TB from those without. We have selected and packaged four of these genes into a diagnostic kit, Host Mycotbdx for early detection of TB and monitoring response to treatment. The kit is now at a stage of moving into the first clinical evaluation in Malawi. We aim to make the kit as simple as detecting TB in a single drop of blood from a finger prick. We believe this approach will enable early detection of latent TB and guide early treatment. The kit will also be very useful for forms of TB that cannot be detected in patient sputum, and children and HIV patients who often are unable to produce sputum.

University of St Andrews
EDCTP
Scottish Funding Council
PanACEA
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25. The Arclight Project

Dr Andrew Blaikie and Mr William J Williams, University of St Andrews
E-mail: ab312@st-andrews.ac.uk

The Arclight Project is a, university-led, cross-subsidising social enterprise based in the MacKenzie Institute, School of Medicine at the University of St Andrews. Our work focuses on the development, evaluation and implementation of easy-to-use solar powered frugal diagnostic tools. Our overall aim is to reduce the burden of *avoidable* global blindness and deafness in low resource countries that can be treated or prevented by known cost-effective means.

Low-to-middle-income-countries (LMICs)
In resource-poor areas our work supports those working to *equip, train, mentor and empower* eye and ear health workers of all grades. This is so they can confidently diagnose and manage disease on-the-spot *themselves* and avoid passing problems further along the chain using. We achieve these aims with targeted learning using bespoke simulation tools appropriate to the *actual needs* of those working on the ground. By building *early diagnosis amongst a wide range of health professionals* we hope to achieve real impact. Our reach is great with over 28,500 Arclight devices distributed in over 100 countries over the past 6 years.

Rich countries
In wealthier regions we aspire to re-energise *generalist* examination skills such as ophthalmoscopy and otoscopy that are too often squeezed out of busy curricula. We do this by encouraging a *frugal*, innovative, iterative design, engineering and education mindset over the usual 'perfect' expensive and over engineered orthodoxy. Simple, safe and effective interventions at scale within an evidence-based framework are one of health's *'best buys'*. Through a virtuous cycle profit from sales in wealthier countries drives our work on.

Website: www.med.st-andrews.ac.uk/arclight

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26. Multimorbidity in Scotland




Professor Colin McCowan; Dr Utkarsh Agrawal; Dr Adeniyi Fagbamigbe; Dr Amaya Azcoaga Lorenzo, University of St Andrews
E-mail: cm434@st-andrews.ac.uk

The UK Academy of Medical Sciences defines multimorbidity as the co-existence of two or more long-term conditions. Multimorbidity is common in the UK but not fully understood and we do not know how to develop our services for people with multimorbidity.
We have developed a longitudinal data resource for multimorbidity research in Scotland which holds data (including linked hospital, prescribing, disease registry and demographic records) from all patients aged 25 or over on 1st January 2000.
On 31st of December 2019 out of the 4,245,320 patients in this cohort 30.6% had multimorbidity and 11.9% had complex multimorbidity. Prevalence increased with age- from 7.6% and 1.8% among individuals under 50 to 60.4% and 26.9% among individuals 80 and above respectively- and deprivation- 22.4% for most affluent to 38.8% for most deprived population and complex multimorbidity more than doubled from 7.8% to 16.2%.
We have also studied the prevalence of multimorbidity in pregnant women in two Scottish Regions (Tayside and Fife) in 2018 finding that 22% of the women had multimorbidity and 5% complex multimorbidity. Most had at least one mental health condition (16%) and multimorbidity was associated with being obese (OR=1.96), being a smoker (OR=2.15) and being from a more deprived background (OR = 1.27). Pregnant women with multimorbidity were also at greater risk of having a preterm birth (OR=1.5).
We are collaborating with different Universities from across the UK to improve our knowledge on multimorbidity to subsequently informing how best to develop services to better manage patients with multimorbidity.

Website: www.med.st-andrews.ac.uk/pbs/research/

Collaborators:
National Multimorbidity Implementation Platform: MRC Biostatistics Unit University of Cambridge, Queen Mary University London, Queen's University Belfast, Swansea University, University College London, University of Aberdeen, University of Birmingham, University of Edinburgh, University of Oxford, University of St Andrews, University of Warwick
MuM-PreDiCT: Keele University, Queen's University Belfast, Swansea University, The University of Manchester, Ulster University , University of Aberdeen, University of Birmingham, University of St Andrews, Aberdeen Maternity Hospital - NHS Grampian, Birmingham Women's and Children's NHS Foundation Trust, Guy's and St Thomas' NHS Foundation Trust, St Michael's Hospital

HDRUK
Health Data Research UK

UKRI Medical Research Council

University of St Andrews

(MANAGEMENT OF LONG-TERM EXISTING CONDITIONS)

PRESENTED BY

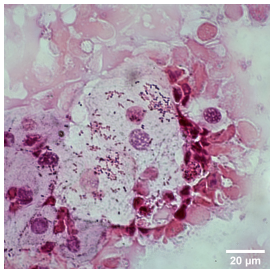
27. Assessing the Role of Biofilm Spatial Structure and Mechanics in Pathogenic Recurrent Tonsillitis using Mesoscopy

Gail McConnell, University of Strathclyde
E-mail: g.mcconnell@strath.ac.uk

Biofilms are communities of microorganisms embedded in a hydrated matrix of extracellular polymeric substances. It is well established that bacterial biofilms are involved in chronicity of infections and resistance to antibiotic treatments, causing a negative impact on the patient's quality of life.

Recurrent tonsillitis remains one of the most common problems that GPs manage, with an annual reported incidence of 100 per 1000 population. Recurrent tonsillitis can have a significant impact on a child's quality of life' repeated absences from school and hospital admissions can cause a serious negative impact on both the child and their family. Furthermore, there is a significant economic burden to the healthcare system. Chole and Faddis demonstrated, in a small series of 15 tonsillectomy specimens, that both gram positive and gram negative bacteria sit in the crypts of infected tonsils, and they possess the ultrastructural appearance of a biofilm matrix.

We are extending their very preliminary work in electron microscopy by using a combination of tissue processing, fluorescence staining, and optical microscopy and mesoscopy to quantify bacterial infection in intact, excised tonsils, with the overall aim of understanding the role of structure and mechanics in bacterial biofilms in tonsillitis.



Swab from the surface of an unfixed infected palatine tonsil prepared with Gram staining and imaged with a widefield microscope. This image reveals a mix of gram positive and gram negative bacteria, as well as white blood cells, epithelial cells and mucus.

(EARLY DETECTION OF DISEASE)

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28. Overdose Detection and Responder Alert Technologies (ODART): Transforming Preventive Care for Those Most at Risk of Drug-Related Death

Professor Catriona Matheson, University of Stirling
E-mail: Catriona.matheson@stir.ac.uk

Scotland is experiencing an ongoing public health crisis of drug-related deaths (DRD). In 2019, 1,264 DRD were recorded in Scotland, more than double the figure for 2008. The Scottish DRD rate is three times that of the UK as a whole and is the highest in Europe (National Records of Scotland 2020). In this project, four priority work streams are underway concerned with the development, testing, evaluation and roll-out of technological drug-death prevention solutions:

1. A solution to **detect onset of overdose and alert a responsible person** to administer first aid and naloxone and liaise with the Scottish Ambulance Service to request emergency care and provide information to support an optimal clinical response.

2. An **Overdose First Responder** software application solution that bystanders who witness a suspected overdose can use to alert (1) trained first responders in the locality to attend and administer first aid and naloxone and (2) alert the Scottish Ambulance Service to dispatch a paramedic and liaise with the bystander/first responder.

3. **Community provision of 'Naloxboxes'** which are publicly accessible boxes containing naloxone, instructions for its effective administration and appropriate first aid. These are the drug overdose equivalent of community defibrillators and would be located in areas with high prevalence of opiate overdoses and/or public injecting.

4. Development of **remote addiction consultations** including: consensus among Scottish Addiction health and care providers on the most appropriate system(s), protocols for delivery of care, engagement with associated services.

UNIVERSITY of STIRLING · SDF Scottish Drugs Forum · TEC · University of St Andrews · ABERDEEN CITY ADP alcohol & drugs partnership · Digital Health & Care Innovation Centre

(EARLY DETECTION OF DISEASE)

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ScotCHEM

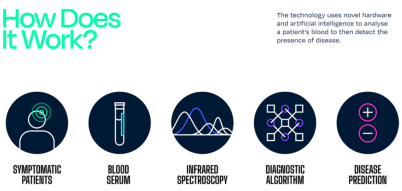
29. ClinSpec Dx: Liquid Biopsy for Cancer

Dr Matthew J Baker, ClinSpec Dx and University of Strathclyde
E-mail: matthew.baker@clinspecdx.com

ClinSpec Dx is a spin out of the Department of Pure and Applied Chemistry, University of Strathclyde. ClinSpec Dx formed in Feb 2019 with £1.67 M in funding from investors, Innovate UK and Higgs Edge to develop their patent protected novel spectroscopic liquid biopsy. Since forming the company has recently completed another raise of £3.55 M from investors including EOS, Mercia, UoS, Norcliffe Capital and Social Investment Scotland.

ClinSpec Dx's novel Drop, Dry, Detect™ methodology has been tested within NHS Lothian on 992 prospectively recruited patients for the triage of patients with suspected brain tumours. The results from these studies have been published and proves ClinSpec's clinically utility, results on par with current clinical benchmarks and effectiveness for patient management. In addition, ClinSpec have published several health economic papers / models to show cost-effectiveness within the US and UK healthcare markets. ClinSpec Dx are currently working on translating their test to the US via the CLIA/CAP route.

The Brain Tumour Charity in their Scottish Election manifesto 2021 have called for the next Scottish Government to "pilot a promising new blood test, ClinSpec DX, in primary care across Scotland as soon as possible and explore its potential to: triage those with possible symptoms and diagnose more brain tumours earlier, to improve patient experience and provide swift reassurance to those who do not have cancer"



Website: www.clinspecdx.com

ClinSpec Dx™ LIQUID BIOPSY FOR CANCER
THE UNIVERSITY of EDINBURGH
University of Strathclyde Glasgow
NHS Lothian
UNIVERSITY OF EXETER
UNIVERSITY OF LIVERPOOL

(EARLY DETECTION OF DISEASE)
(MANAGEMENT OF LONG-TERM EXISTING CONDITIONS)

PRESENTED BY

CENSIS

30. Improving Cellular Connectivity in Remote and Rural Areas of Scotland to Facilitate Developments in Telehealth and Telecare

Paul Winstanley, CENSIS
E-mail: paul.winstanley@censis.org.uk

A consortium of research partners led by CENSIS could pave the way for better connectivity in remote and rural areas by creating a new commercial model for delivering critical telecommunications infrastructure.

Funded by the Scottish Government, the project will develop an economic model that could redefine the assessments behind infrastructure deployment, prioritising the potential value to communities over cost. This new approach aims to address the 'digital divide' between areas that have access to fast, reliable telecommunications – typically large population centres – and communities that experience limited access to increasingly vital public services, many of which are in rural Scotland.

The study will draw on a much wider range of factors to determine the overall viability of network infrastructure, rather than relying purely on the number of people in a given area.
Using healthcare as the principal use case, it will factor in the societal and quality of life benefits that enhanced connectivity could bring to rural areas. This will be determined, for instance, by the cost prevention and health benefits delivered by supporting people with underlying conditions to live more independently and avoid hospitalisation, or re-admission, through tele-medicine or remote care services.

CENSIS is also interested in how improved cellular connectivity, combine with the analogue telecommunications switch off in 2025, could pave the way for new ideas and technologies for digital telecare to support older and vulnerable people in their own homes.

(EARLY DETECTION OF DISEASE)

PRESENTED BY

31. Airy Beam Light Sheet Microscopy

Prof Kishan Dholakia, University of St Andrews
E-mail: kd1@st-andrews.ac.uk

The St Andrews group headed by Kishan Dholakia has developed a suite of innovative imaging technologies. A particular highlight has been the recent ground-breaking development of the Airy light sheet microscope that delivers a large field of view whilst sustaining resolution, making optimal use of the available light. This work has major applications in neuroscience, developmental biology and beyond. The research led to an innovative portable Airy microscope design (patent licensed and marketed early 2016 with M Squared Lasers (MSL)). As a result, completely new business venture was established with MSL in 2017 (M Squared Life) based in Surrey Technology Park. The premier product for M Squared Life has been Airy beam light sheet imaging system, christened the "("Aurora" microscope (Institute of Physics Business Award winner 2017). This has resulted in excess of 20 sales across the world including in the UK, Sweden, Germany, USA and Australia and created a step change in thinking for this approach to imaging. The St Andrews group continues with further innovations in depth penetration using shaped light fields tailored to overcome losses and works closely with M Squared Lasers and M Squared Life through an EPSRC Prosperity Partnership to advance imaging approaches.

Website: www.opticalmanipulationgroup.wp.st-andrews.ac.uk

Scottish Research Innovation Futures

Health and Wellbeing: Our Future Health in Scotland

SPEAKER BIOGRAPHIES

Andrew Fowlie

Lead for Health, Social Care and Industrial Innovation
Scottish Government

Andrew works for the Scottish Government's Chief Scientist's Office Innovation Team with a focus on bringing new health and social care innovations into the NHS and Social Care. Supporting the Government's Innovation Plan to increase the quality and quantity of industrial innovation in health care and Life Sciences. Specifically driving productivity in public and private sectors to sustain health care services and harness global innovations.

Andrew has a strong association with Life Sciences and economic development in Scotland aligning closely with European and Global interests. National role in bringing exponentially changing health innovations into the Scottish market. He has 40 years in practice and Executive Management in health and social care with post graduate qualifications in Economics, Business Management and Primary Care.

Richard Hebdon

Interim Deputy Director for Health & Life Sciences
Innovate UK

Richard is currently Interim Deputy Director for Health & Life Sciences at Innovate UK, leading a team comprising of 21 colleagues working across healthcare, biosciences and agri-food. The current live Sector project portfolio comprises 341 projects with a total offered grant value of £161.3M, as well as innovation infrastructure investments including the Medicines Discovery and Cell & Gene Therapy Catapults, the four Agri-Tech Centres and the National Biofilms Innovation Centre.

Prior to joining Innovate UK, Richard worked in technology transfer, R&D management and research and innovation roles in industry and the public sector. This included working in pharmaceutical and vaccine discovery and FMCG product innovation.

Dr Poonam Malik

Start-ups Growth-Executive & Mentor | Board-Level Advisor
Consultant | Director | Social Entrepreneur & Investor

Dr Poonam Malik is an entrepreneurial academic business strategy leader. She has extensive experience of working in research, innovation, enterprise, governance, health and business sectors globally. As Board Member of Scottish Enterprise; Skills Development Scotland; Firstport Group for Social Entrepreneurs & Governor for the Court of University of the Highlands & Islands (UHI), enterprise, investment & economic policy advisory with The Royal Society of Edinburgh- Dr Malik holds leadership roles across public, private, higher education and social enterprise sectors.

Poonam brings expertise in Life Sciences, Biotech, Health &Technology businesses and is an investor in Innovation. Poonam is passionate about Diversity, Equality & Inclusive values. She is a Syndicate Investor with Investing Women Angels and Board-level Advisor, Chair & Consultant for Technology Startups. Poonam has held Academic positions at the Universities of Edinburgh, Glasgow and Cumbria/Lancaster and in India. Poonam holds an MBA (with Distinction) in 'Strategy and Leadership' from University of Edinburgh Business School, a PhD in Biomedical Sciences/Virology from University of Glasgow, UK, a Masters (MSc) degree in Biotechnology & a Bachelors (BSc) in Chemistry & Zoology from India.

Dr Tom MacGillivray

Senior Research Fellow
University of Edinburgh

Dr Tom MacGillivray, Senior Research Fellow at the University of Edinburgh, specialises in the field of image processing and analysis for clinical research. Tom's team staffs the Image Analysis Core laboratory of the Edinburgh Imaging QMRI facility joint with the Edinburgh Clinical Research Facility. The laboratory provides specialist support to investigators accessing data from a variety of modalities including MR, CT, PET, ultrasound and retinal imaging. Tom has extensive experience facilitating research that features retinal imaging and includes studies on stroke, cardiovascular disease, MS, and cognitive change with age and co-ordinates an interdisciplinary initiative called VAMPIRE (Vascular Assessment and Measurement Platform for Images of the REtina) – the aim of which is efficient, semi-automatic analysis of retinal images.

Professor Frances Mair

Norie Miller Professor of General Practice
University of Glasgow

Professor Frances Mair, Norie Miller Professor of General Practice, leads an extensive programme of chronic illness, multimorbidity and digital health research that promotes a move to person centred care, promoting the concept of “Minimally Disruptive Medicine (MDM)” which has gained traction internationally. She holds visiting Professorships at the Universities of Melbourne, Liverpool, and Southampton and is the NHS Research Scotland Primary Care Network Co-Lead responsible for promoting research in primary care. Her work takes into account the wider socioeconomic environment and social contexts in which patients live and the importance of understanding implementation issues to help bridge the translational gap between research and clinical practice.

Professor Roderick Murray-Smith

Professor of Computing Science
University of Glasgow

Professor Roderick Murray-Smith is a Professor of Computing Science at the University of Glasgow, in the "Inference, Dynamics and Interaction" research group. Roderick work in the overlap between machine learning, interaction design and control theory. In recent years, his research has included quantum imaging, music recommender systems, multimodal sensor-based interaction with mobile devices, mobile spatial interaction, Brain-Computer interaction and nonparametric machine learning. Prior to this Roderick held positions at the Hamilton Institute, NUIM, Technical University of Denmark, M.I.T., and Daimler-Benz Research, Berlin. He works closely with the mobile phone industry, having worked together with Nokia, Samsung, FT/Orange, Bang & Olufsen and Microsoft. He was a member of Nokia's Scientific Advisory Board and was the Director of the SICSA research pool, and the founding Head of Section of the Information, Data & Analysis Section in the School of Computing Science.

Russell Overend

Managing Director
WideBlue

Russell Overend, Owner and Managing Director of WideBlue, specialises in the commercialisation of products designed by WideBlue. The Wideblue team has worked together for almost twenty years designing a broad range of technology-based products for medical, consumer, and industrial applications. The team typically works on technologically challenging projects and is actively involved in products that exploit emerging technologies and cutting-edge research. Russell and his team always strive to find the most effective solution for their clients, with strong leadership and a methodical approach they successfully deliver highly engineered, desirable and unique products.

Dr Debbie Wake

CEO and Chief Medical Officer
MyWay Digital Health

Dr Debbie Wake, CEO and co-founder of MyWay Digital Health, is a respected entrepreneur, innovator, physician, educator and published academic. She is an NHS Innovation Accelerator (NIA) fellow, a national Women in Innovation award winner and a Diabetes UK Clinical Champion. She is passionate about improving the lives of people with diabetes through education and data driven care. She has led international diabetes projects in Kuwait and China, and raised more than £5m in academic and innovation grants. Her work is recognised with multiple innovation, entrepreneurship/ business and academic awards and accolades.

Scottish Research Innovation Futures

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