Centre for Digital Healthcare Technology - CDHT  Oct 2021 – 5G
NIBEC founded in 1985 by Professor John Anderson

Traced back to Professor Partridges idea of mobile coronary care

New building in 1994 and 2004

**Our Connected Health History**
35 Year old – opened by Dr. Christian Bernard, 90 researchers, multi-disciplinary research centre applying nanotechnology and bioengineering to the following research themes:

The Multidisciplinary Assessment of Technology Centre for Healthcare (MATCH) (Birmingham, Brunel, Nottingham & Ulster)

The Centre for Advanced Cardiovascular Research CACR – Focused on Heart Failure Systems and AF Detection.

The £6m Connected Health Innovation Centre (CHIC) is focused on business led research in the area of connected health.

The £8m Eastern Corridor Medical Engineering Centre (ECME) is focused on cardiac engineering – Heart Failure and AF solutions via analytics, algorithms and medical grade wearables.

300 employed via spin outs

Founders: C. Bernard

Director - Professor Jim McLaughlin

NIBEC- Nanotechnology and Integrated Bioengineering Centre

Director - Professor Jim McLaughlin

Ulster University

NIBEC

Nanotechnology & Integrated Bioengineering Centre
CDHT Mission (new)

The Centre for Digital Healthcare Technology-CDHT acts as a facilitator, innovation and knowledge broker and a stimulus for ABC multidisciplinary collaborative partnerships that address clinical and healthcare challenges with world-class research & development, discovery and knowledge exchange through skills development, co-ideation, enhanced facilities and highly efficient productivity pathways.
Key Discovery & Innovation Leaders

Professor Jim McLaughlin
Healthcare Technology Sensors – Diagnostics

Professor Chris Nugent
Software Engineering Ambient Assistant Living

Professor Tara Moore
Ophthalmology Biomolecular Science - Experimental Trials

Dr Mark Spence
Cardiology Belfast Trust

Dr Paul Beaney
(Innovation)plus CHIC; ECME; Biodevices Lab and CARL

Industry-led collaboration

Microsoft, RANDOX, AWS, GE Healthcare, pwc, NVIDIA, Deloitte, Intellesens, DELL EMC, BT, Stryker, kainos, SECURE, axisthree, CIGA, CHIC, BIODEVICES LAB

Examples of Major International Links

USA – UCSD, UCLA, MIT, Stanford, NCSU, Asia – SUST, Tsinghua University, Amity, IIT-Mumbai, Samsung - Korea
Europe - Cambridge, Surrey, INSA, Fraunhofer-Mainz GE Healthcare Albany; Philips Eindhoven;

#BRcitydeal
Our Innovation success

Patents
- 35 patents: wide range in the area of Medical Devices and Technologies

IPR
- Heartsine, Heartscape, Intelesens, Laboratories Fournier, Maersk Medical, Tyco, Axis Composites, Lenis Aer

Spin Outs
- Heartsine, Heartscape, Intelesens, Surf-Spec

Spin-in
- SiSaf

NIBEC Hatchery’s
- Currently developing
- 10 hatchery companies

Impact and Technology Transfer in NI and globally in NI
- 300 jobs and growing
- £50m turnover per year
- Driving medical devices

Grand Challenges
- The $10 Million Global Competition to put Healthcare in the Palm of Your Hand.
- Last 5 out of 360 entrants and finished joint 3rd.
Key capabilities - 32 academic staff and five clinicians

Thematic Areas

- **Artificial Intelligence**
  - Diagnostics
  - Algorithm Development
  - Predictive analysis
  - Deep Learning
  - Decision making

- **Business incubation**
  - Living Lab based product validation
  - Space provision
  - Hatchery programme
  - Access of state of the are facilities / expertise

- **Biomolecular Sciences**
  - Ocular health
  - Biomarker Gene therapy
  - Gene therapy
  - Lateral Flow Diagnostics

- **Smart Environments**
  - Ambient sensing
  - Novel interface technology
  - Smart homes
  - Behaviour monitoring

- **Healthcare Technologies**
  - Sensors & Remote Mon.
  - Connected Health
  - Energy Harvesting & IOT
  - Rapid prototyping
  - Clinical grade sensors
  - Image Analysis

Currently rated
- 9th in the UK in EE:
- 14th in Mechanical
- Top 10 in Biomedical Engineering
- Top 5 in Studies allied to Medicine
- The NI Turning Report - UU Computing AI section one of the top in the UK

Living Lab
- RVH Cardiology
- Respiratory

GBD & new site
- CHIC
- ECME
- Biodevices Lab
- BT Lab
The Digital Health Technology Hub will feature:

- **4000 m² of R&D facilities**, living lab space and incubation space (£45M investment in total).

- World class **equipment and expertise**.

- Large investment into **Living Labs** at RVH site of Belfast Trust.

- **MedTech Park - Digital Healthcare Industry** (Catalyst to Heron Rd).
1. Clinical Living at Belfast Trust – RVH
   (City Deal Capital Funding – mainly Kit)

2. New Building at Northland House
   CDHT HUB (City Deal Capital Funding)

3. New Harbour Commission Medtech Development
   (Not City Deal Funding)

3. Healthcare Research Eco-System in Northern Ireland
### Alignment with National & Regional Policy

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**4 Posts from UU in Health Tech**

plus further 4 posts naturally in Health Tech - total academics 32 in area

**CDHT Stakeholders engaging –**

DELL; Microsoft; PWC and BT anchor

**BC Innovation Pillar**

**CDHT and New Med-Tech (HC) Plans**

launched plus RVH Engagement

**CDHT FDI companies –**

Avelino and TriVirex / others

**BCRD CDHT OBC**
The Digital Health Technology Hub
Supported by:

Department of Health
Large Multinational Companies
SMEs
International Collaborative partners

European Connected Health Alliance
ECME; CHIC
Interacting with I-Reach, GII, AMIC and CTRIC
HIRANI

Local Health Trusts and HSC
Harbour Commission Belfast
Markets
The end market is an expanding global one driven by a number of key factors that are causing healthcare providers to consider alternative approaches.

Drivers
- an ageing population;
- rising healthcare costs;
- complexity of diseases;
- co-morbidity; and
- antimicrobial resistance.

Market Growth - Globally, the market for medical device technologies is forecast to grow to $529 billion by 2022 driven by a number of social, economic, technological and demographic factors including an ageing and increasing population.

Post Covid-19
- Virtual Hospital – Clinical grade Remote Diagnostics
- POC Diagnostics
- Sensing systems; IOT; AI for enhanced decision making
Typical Projects / Products

- **Heart Failure Diagnostics Systems** – Microfluidics and wearable patch approach to nt-pro BNP / RR etc.
- **Cardio based clinically relevant wearables** – 3 Lead to 12 lead approaches
- **Cardiovascular risk assessment in the eye** – CMOS analysis of PWV in the eye for early detection of heart disease
- **Cardio vital signs and biomarker algorithm development** – machine learning techniques for a combinational approach.
- **Early stage sepsis monitoring** – use of ecg, SpO2 and RR via AI derived algorithms to early detect on set of sepsis
- **Cardio Lateral Flow Diagnostics** – development, reader and associated software
- **AI for improved Patient Flow Systems**
- **AI in improved sensitivity of AF detection** via patch electrodes, and optical approaches including ppg
- **Next generation wearable electrodes** via dry electrode and optical technology
- **Non invasive BP monitoring** via PWV techniques
- **Cognitive Behavioural and Rehabilitation Assessment Others** – Drug Delivery Patches; Microneedle patch systems, early warning infection control; Cognitive Behaviour monitoring; Non-invasive Dementia monitoring; Integrated biomarker reader systems designed for improved Lateral Flow diagnostics etc.
The CDHT team is currently addressing the Covid-19 challenge and leading a wide range of successful developments including:

- **COVID-19 Antibody Test & App** development joint with Government led UK – Rapid Test Task Consortium (UU trial validation complete & UX starting in August)

- **Modelling for Government** - the lockdown and recovery phases of Covid-19 via trackers for utilities and strategy.

- **NI Stop Covid-19 Task Force** – ROI app to NI and validating for CE marking – RF/UX and compliance testing via technical trial at Ulster

- The **modelling, simulation, design and development** (joint with industry) of Incubation; CPAP and Face Aerosol Protection - **Designed Vitamaterials Visor**

- **NIR – AI COVID-19 study**– EPSRC funded AI

- **NIH, KTP and DOH funding for above work**

- **Ongoing Remote monitoring - Virtual Hospital**

- **Validation Air Flow and Purification - ILIMEX**
Our big Covid-19 Success areas stories

Kill Covid-19

NI Stop Covid-19 App

Diagnostics

Visor design to Vitamaterials

CE/FDA/MHRA Approved and currently on sale and delivered to the DOH

Modelling Covid-19 transmission to Government
The new Belfast Campus – Ulster University
The new World of Health after Covid-19

• The Connected World

• Artificial Intelligence
• Internet of Things
• Automation
• Point of Care Diagnostics
• Smart PPE
5G healthcare.

Current network disadvantages.

System is not reliable
Real-time data collection is difficult
Lacks in continuous monitoring of patients
Lacks in data sharing mechanism and personalized data analysis
There are no continuous suggestions for the prevention and treatment of diabetes

Current advantages of 5G.

Low cost: Facilitates out of hospital treatment so cost of treatment is reduced
Comfort: It ensures that daily activities of the patients’ is not disturbed
Personalization: By collecting blood glucose data through machine learning algorithm, it personalized treatment for patients
Smartness: Early detection of the disease is possible with this system
Belfast City Council focus on
- Health and Well being
- Mobility
- Energy
Future Applications: IoT Smart Energy Solutions; Microgrids and Industrial WSNs


Developing the technology that will charge UAVs by RF energy at distance, using the flexible lens-based rectifying arrays, for high efficiency and power, medium-range WPT infrastructures.

Passive sensor networks, able to measure the backscatter channel between interrogator networks and batteryless tags to improve the far-field WPT.
Gerry McQuade, CEO of BT’s Enterprise unit, said: “Our UK-first 5G trial with Belfast Harbour last year was a powerful illustration of how 5G-led technology can transform port operations, propel the success of local businesses and drive economic growth. Today’s deal with Belfast Harbour will make these benefits a reality, with the creation of a sophisticated digital ecosystem comprising of 5G, AI, IoT and Connected Vehicles. This will act as a springboard for Belfast Harbour to achieve its ambition to be the world’s best regional smart port and an innovation hub for the region.

The project has also been awarded a PhD studentship to help generate fundamental research.

The digital fabric should support, within an open access model, the following communications technologies: Narrowband IoT, LoRaWan, 4G, 3G, Wi-Fi, SigFox, Wi-Max, 5G (mmWave, LowBand and Sub6).
Summary

- A proposal for new unique multimillion R&I Digital Healthcare Technology Centre in Belfast City Centre – positioned beside the new GBD Campus Development. Housing over 140 researchers from academia, industry and healthcare.

- A new Cardio-focused Clinical Innovation Living-Lab will be developed at the RVH as part of the CDHT roll-out with a FDI-centric HC MedTech Park under development.

- The center will address Healthcare 4.0 challenges as Healthcare faces a huge need for digitisation, home-based care diagnostics, the utilisation of AI and IOT systems.

- The sustainable center grows on the success of world-class research and innovation at NIBEC- Engineering, SERG-Computing and BMI - Life & Health Sciences Health Technology at Ulster, along with clinical excellence in the Belfast Trust and a high-quality set of global, SME and multinational Industry partners.