

Life Science and Technology Innovation in Scotland

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Scottish Development International

Scotland

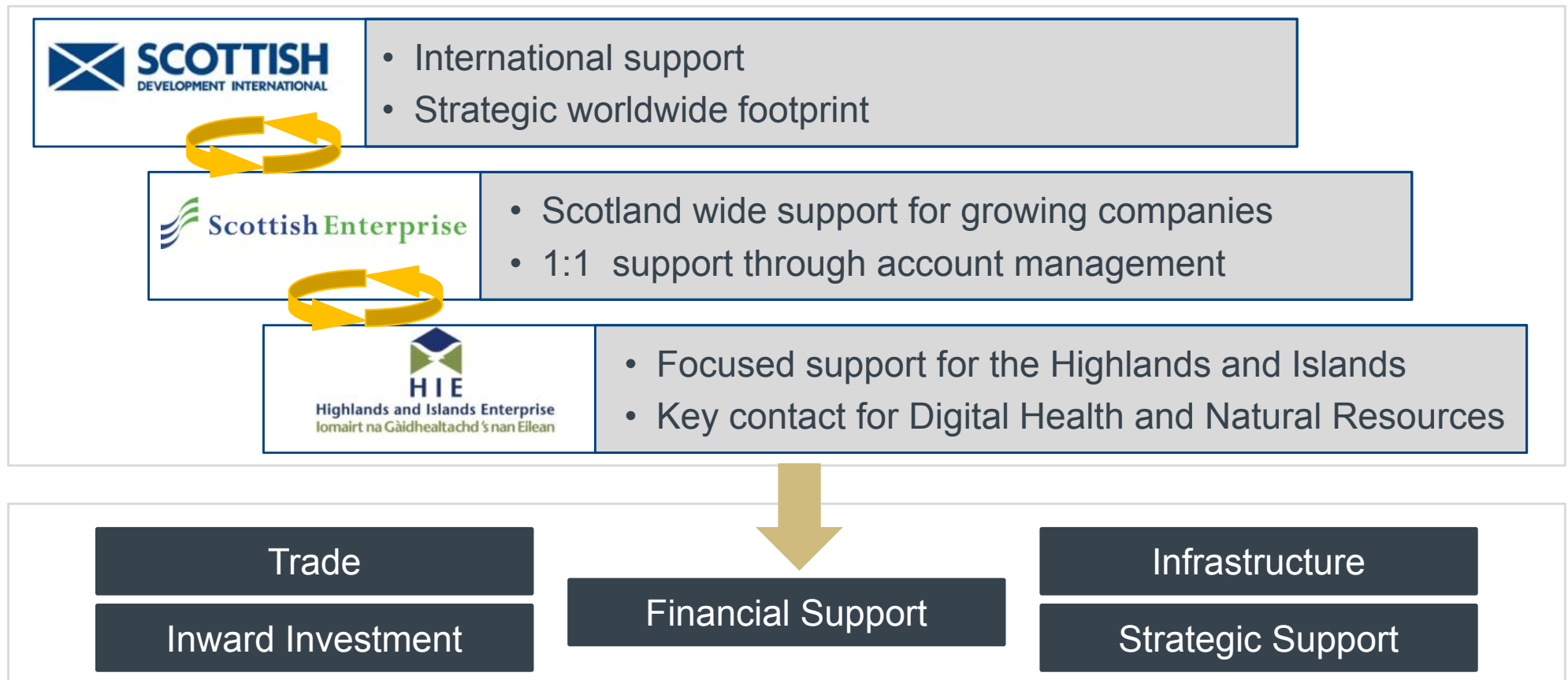
From our people to our quality of life, there are many reasons companies choose to start, grow and invest in Scotland:

- 5.3 million people - 8.3% of UK (2012) and a stable population
- Well connected (exchange of knowledge, transport of people and shipment of products) and supportive environment
- Foreign investment in Scotland stands at a 15 year high 10.9% of all UK FDI projects
- Most medical research per head of population in Europe
- Strong history of medical innovation and scientific discovery



Relationship Model

Support for Scottish companies operating in national and international markets



Supporting Company Location

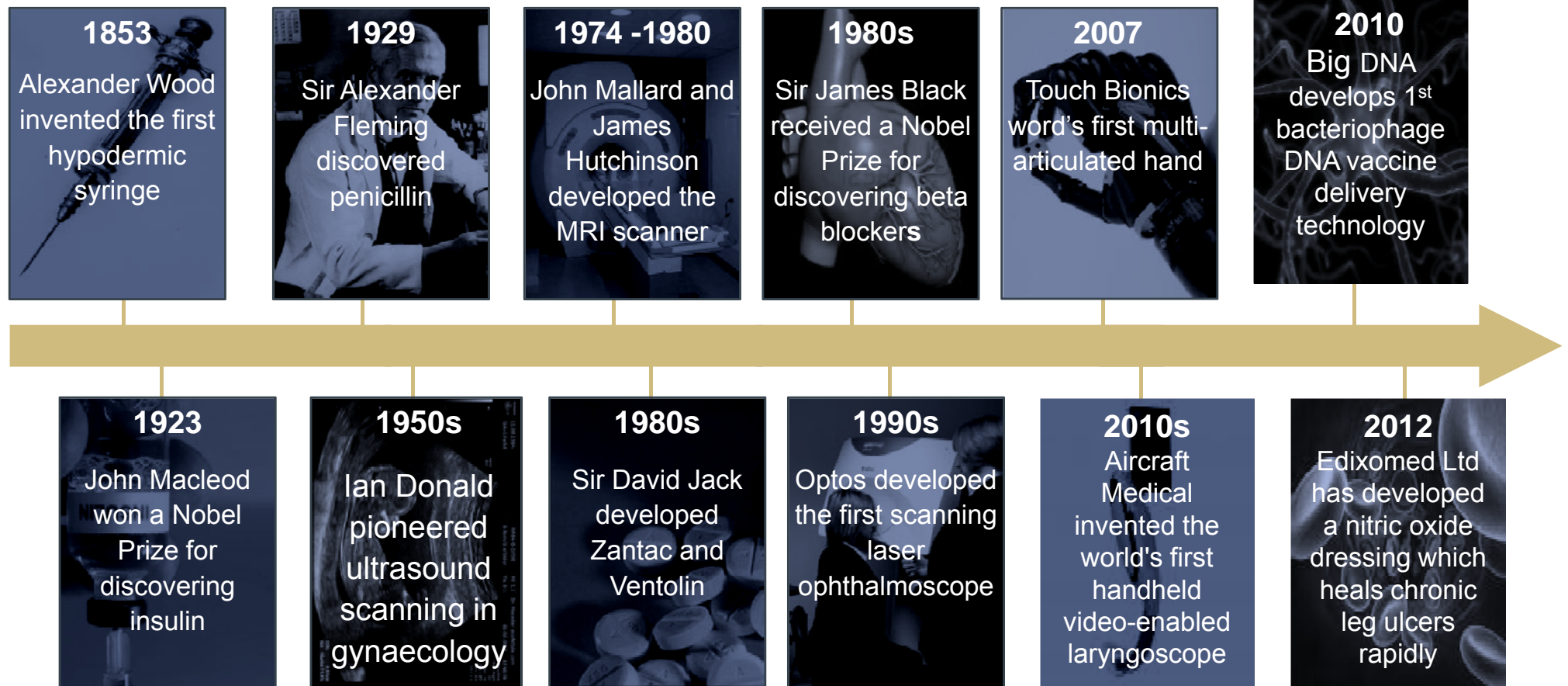
SDI actively manage relationships with more than 400 inward investors in Scotland to nurture & build on the 150,000 jobs they provide



Investment Incentives	Grants	Tax Incentives
<ul style="list-style-type: none">Regional Selective AssistanceEquity Funding	<ul style="list-style-type: none">R&D GrantAdditional Innovation Grants	<ul style="list-style-type: none">Tax CreditsPatent box

A History of Innovation

Scotland has a strong track record of Innovation



Life Sciences Landscape



NHS Scotland
a single healthcare
system

over **170** core
medical device
companies

cluster of
world class
researchers and
clinicians

Life Sciences in Scotland

Cradle to Grave
single medical record

a **world leading**
centre for
**stem cell research &
regenerative medicine**

Growing **Digital and Connected
Health** capabilities and assets

More than **30,000**
employees in over **600**
organisations



Over **160** **pharma
services
companies**

Innovative start ups to major global players





Areas of Strength

Scotland hosts one of the most sizeable Life Sciences clusters in Europe

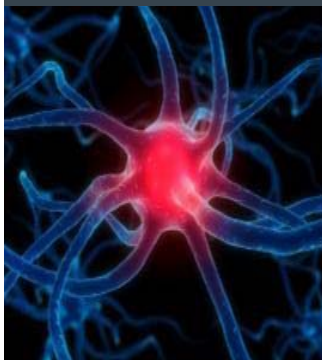
Medical Technologies



Pharma Services



Regenerative Medicine



Connected Healthcare



Precision Medicine



Animal Health



Pharmaceutical Services



Drug discovery excellence in Scotland

Drug Discovery

Scotland has world class discovery consortia involving the world's biggest pharmaceutical companies

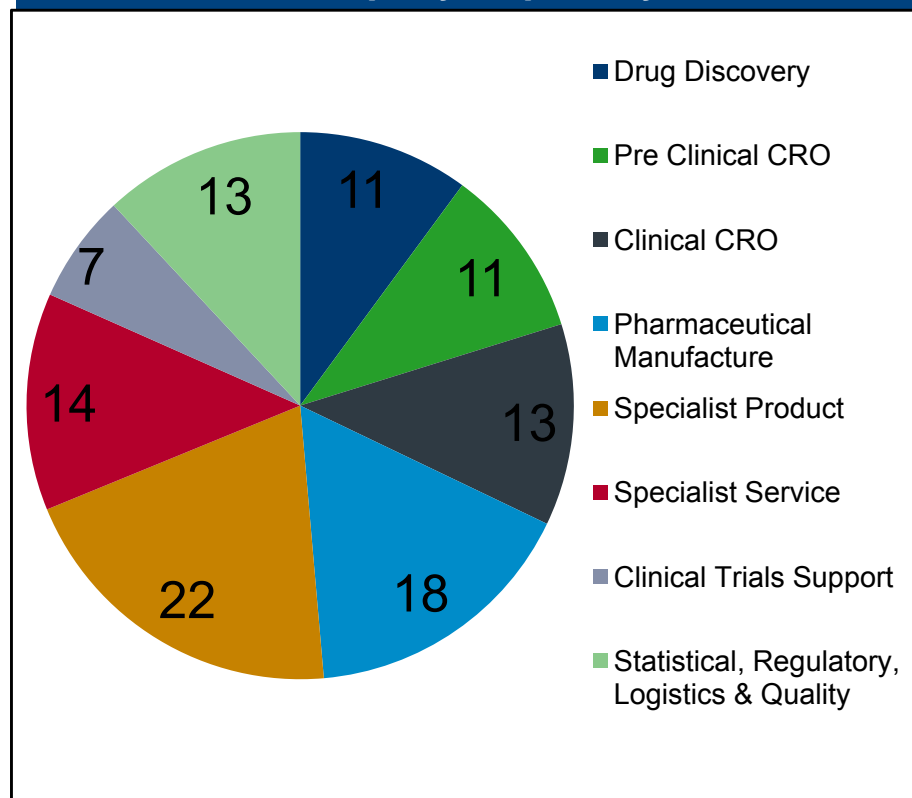


- Scotland has a history of **drug discovery excellence** and Scottish scientists:
 - Discovered world's first vaccine against viral Hepatitis B
 - Awarded Nobel prize for discovering beta blockers
 - Discovered Atracurium, the world's best-selling muscle relaxant
 - Discovered Salbutamol, the world's best-selling asthma treatment
 - Discovered Zantac for peptic ulcers
- Innovative discovery assays supporting **early lead identification and validation**
- Host to **Joint European Compound Library** and **European Screening Centre**, part of £100m EU project

Strengths of pharmaceutical services in Scotland

- **More than 160 companies** employing over **9,000** people with a turnover of **£1.2bn**¹
- Global CROs and specialist service providers ensure **a comprehensive supply chain** across all stages of drug discovery and development
- **60% of Europe's biopharmaceutical safety testing** is carried out in Scotland²
- Preferred clinical trial site for **Pfizer, PPD, Quintiles and Roche**
- Global leaders in pharmaceutical manufacture **AMRI, BASF, Capsugel, GSK and SAFC** recognise the advantages of operating in Scotland
- Refined testing and manufacturing expertise in **fast-growing ADC market**

% of Pharmaceutical Services Sector by Company Capability



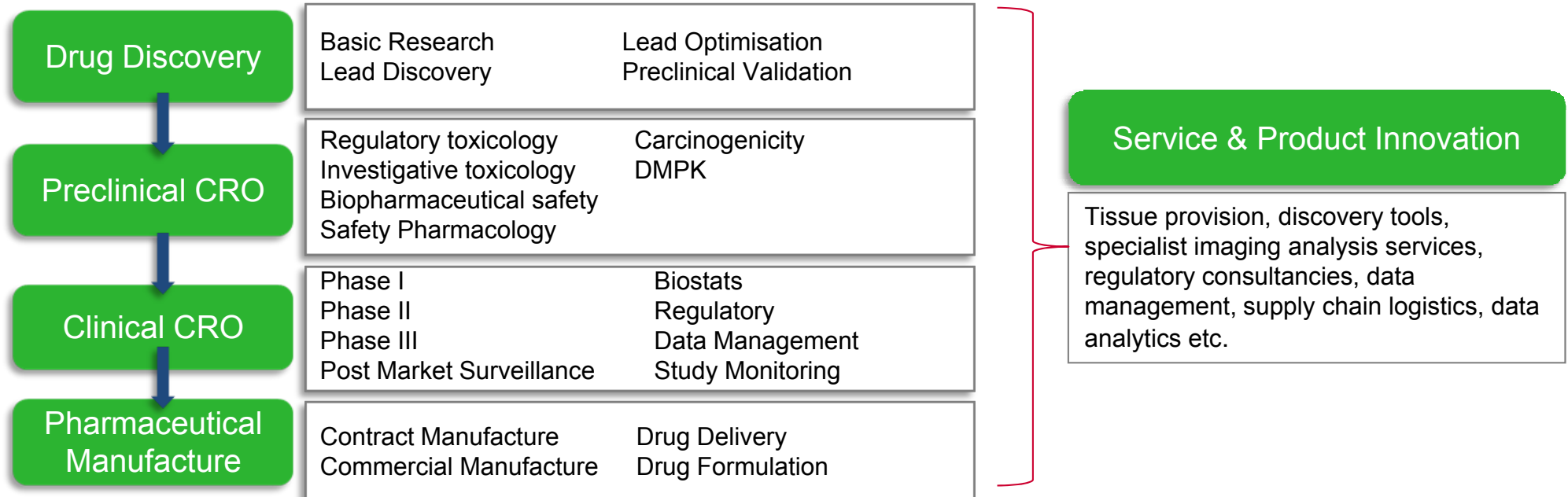
¹ Internal analysis 2014

² Biopharmaceutical drug development capabilities: Benchmarking Scotland's position versus key markets, Evolution LS 2010.

A comprehensive supply chain in Scotland

Scotland's Pharmaceutical Services sector incorporates every stage of the complex and diverse drug discovery, development and manufacturing process

Scotland fulfils all stages of drug development



Scotland delivers across all stages of drug development



Innovative and expert pre-clinical testing in Scotland

Preclinical CROs

60% of Europe's preclinical testing of biopharmaceuticals is carried out in Scotland



- **Global leaders in preclinical contract research** are based in Scotland such as Bioreliance, BioOutsource and Charles River Laboratories
- Niche expertise in companies such as Biopta, Tissue Solutions and Clyde Biosciences provide **innovative solutions to pre-clinical efficacy and safety testing**.
- **Diverse Capabilities** including investigative toxicology, safety evaluation, laboratory sciences and expert in-vivo scanning and imaging capabilities
- **Bespoke testing and formulation expertise** in fast-growing ADC market

Globally competitive clinical research in Scotland

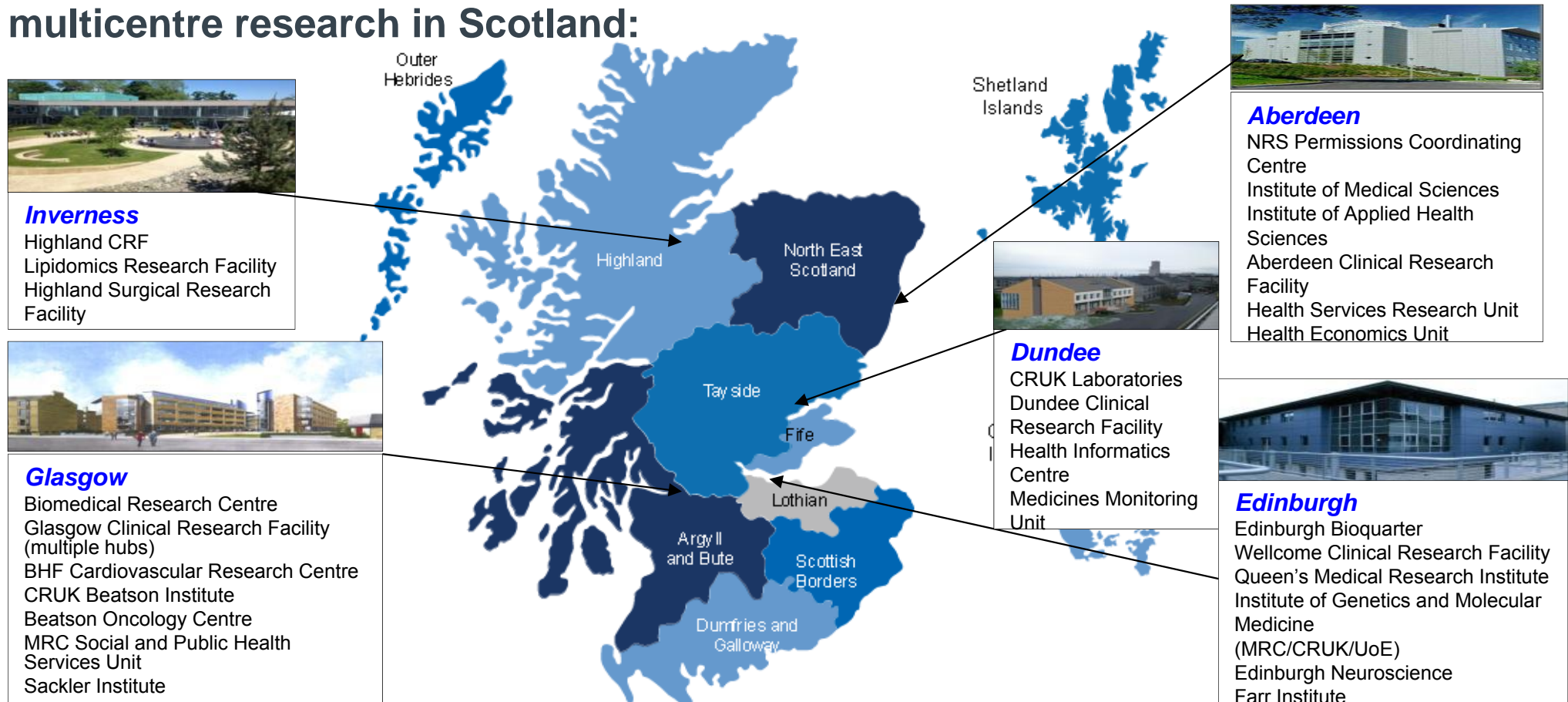
Clinical CROs

Scotland is one of the top 5 sites world wide for recruitment and start up times.

- **Preferred clinical trial site** for Quintiles, PPD and Pfizer
- **Managed clinical trial delivery** through NHS Research Scotland
- **Globally Competitive** trial recruitment and start-up times (commercial approval 20 days)
- **A unified health provider (NHS)** with outstanding collaboration across academia government and industry and a **unique patient identifier number** (CHI) used from cradle to grave creating a unique environment for data driven clinical research
- **Access to Clinical investigators and patients** across all major therapeutic areas including diabetes, oncology, dementia, MS and stroke
- **A clinical CRO company base** that can support Phase I to IV clinical trials and post-market surveillance.

Globally competitive clinical research in Scotland cont.

Streamlined process for feasibility and to obtain R&D permission for multicentre research in Scotland:



Innovative manufacture and drug delivery in Scotland

Pharmaceutical Manufacture

Global leaders in
pharmaceutical manufacture
recognise the advantages of
operating in Scotland



- **30 dedicated** pharmaceutical manufacture and speciality formulation companies located in Scotland
- **Improved cost efficiencies** through widespread lean processes.
- **Strong compliance** badging and supply security
- **Global top two** universities for pharmacological research
- **Innovative** manufacture solutions such as XstalBio and Solid Form Solutions providing **bioformulation** and **complex delivery expertise**.
- Industry leaders AMRI, BASF, Capsugel, GSK and SAFC recognise the advantages of siting **global operations in Scotland**.

Diverse and expert products and services in Scotland

Specialist Service +
Product Innovation

Excellent transport links with
reliable courier services
delivering to most of Europe
within 24 hours.



- Deliver to most European destinations **within 24 hours**; Scotland's dominance in preclinical testing in Europe is reflected in Scotland's specialised logistics network
- **Over 50** specialist service and product companies including data analytics, imaging analysis, drug discovery platforms, clinical trial packaging, quality management systems, regulatory consulting, tissue procurement, genetic testing
- Reliable **supply chain logistics**
- **Comprehensive bio and health informatics** infrastructure and existing company base

Regenerative Medicine



Stem Cells and Regenerative Medicine: Vision

Our vision is for Scotland to be Europe's leading location for the development of stem cell applications, and to establish the optimum environment for translating research into therapeutic benefits for patients.

Scotland's reputation as one of the leading locations for the development of new tools and technologies, as well as the clinical assessment of new cell-based therapies, is due to:

- **its connectivity**
- **its comprehensive translational, clinical, analytical and regulatory support mechanisms.**



Scottish Government Investment

Scotland is one of the world's leading locations for stem cell the Scottish Government has, since 2004, invested over £100 million across various interventions to help translate this expertise into applied medicine and practice

Innovation & Infrastructure		Funding	People	Promotion
Manufacturing: Roslin Cells	Scottish Centre for Regenerative Medicine	Scottish Enterprise & MRC Cell Technology Translational Fund	Skills Development Scotland – Life Sciences Skills Investment Plan	International Promotion
Manufacturing: Blood Cells	Manufacturing: Cell Lines for Pre-Clinical Use	Scottish Enterprise & UKSCF Cell Therapy Translational Fund	Attracting Talent for Scottish Centre for Regenerative Medicine	International Collaborations & Partnerships

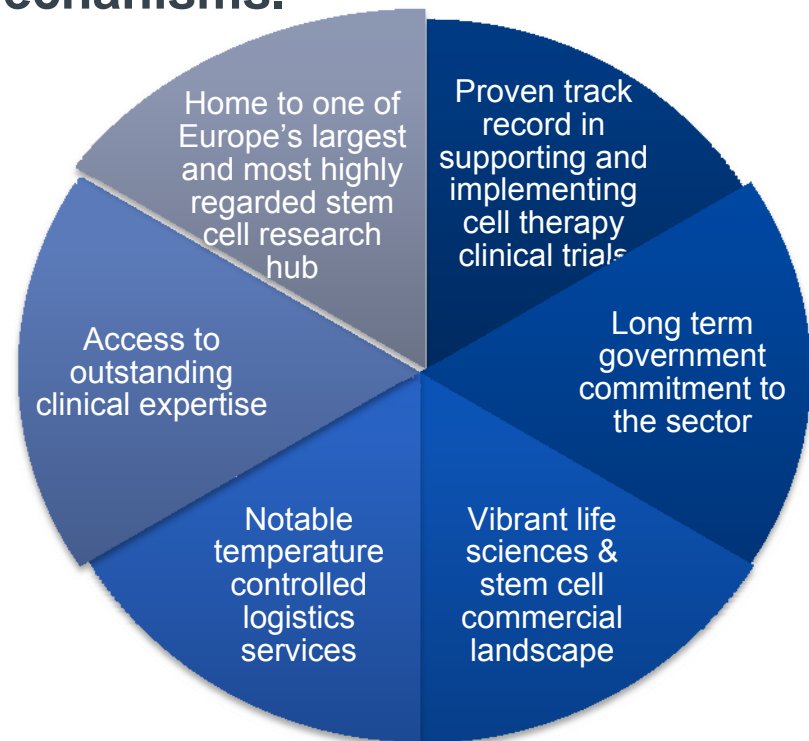


Scotland's Stem Cell Cluster

“Scotland's reputation as a leading location for the development of new tools and technologies, as well as the clinical assessment of new cell-based therapies, is due to its connectivity and to its comprehensive translational, clinical, analytical and regulatory support mechanisms.”

Over the last ten years Scotland has:

- Capitalised on its world-leading research expertise in stem cells
- Invested in the infrastructure and commercial support necessary to create a viable industry cluster and
- Created a strong supply chain as well as strong inclusive and collaborative community.



<http://www.lifesciencesscotland.com/solutions/scotland's-strengths/stem-cells.aspx>

Stem Cells Commercial Landscape

R&D

Pre-Clinical

Phase 1

Phase 2

Phase 3+

Launch
Product

Therapeutics
&
Manufacturing



Drug
development,
Tools &
Services



FibromEd



sb DRUG DISCOVERY



Tissue
Solutions™

Working with you, for you...



Enabling
technologies
& Contract
Research



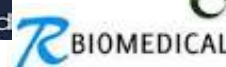
Regulatory
Advice &
Guidance



STIENT BIORESEARCH



QPMED Global Ltd



AptivSolutions
Accelerating the Possibilities



Logistics



Successful Delivery of Cell Therapies

Scotland is one of Europe's leading locations for the development of stem cell applications.

Cell Therapies in Clinical Practice	Cell Therapies in Clinical Development		
Pancreatic islet programme representing 50% of UK islet transplants	Phase I CTX stem cell line for critical limb ischemia	Phase I/II CD133 cells for chronic liver failure	Phase IIb T-cell immunotherapy for melanoma
EBV Cytotoxic T lymphocyte (CTL) bank to treat patients with post-transplant lympho-proliferative disease including refractory EBV-driven non-Hodgkin's lymphoma	Phase I/II corneal epithelial stem cell transplant for corneal blindness	Phase I ReN001 neural stem cell therapy for patients left disabled by ischemic stroke	Phase II MultiStem for ischemic stroke

Scotland has significant expertise in regulatory approval & clinical trials



Regenerative Medicine at Edinburgh BioQuarter

The MRC Centre for Regenerative Medicine is a world leading research centre based at the University of Edinburgh, studying stem cells, disease and tissue repair to advance human health.

World Leading Research

- Scottish Centre for Regenerative Medicine - MRC Centre for Regenerative Medicine:
- Pluripotency & iPS
- Lineage & Cell Specification
- Neural Differentiation & Tissue Repair (Brain & Spinal Cord)
- Haematopoietic Stem Cell Biology & Regeneration (Blood)
- Liver Stem Cell Biology & Tissue Repair

iPS Cell Bank

- Roslin Cells Leads European iPS Cell Bank
- €35 million project
- European consortium of 26 partners including Neusentis/ Pfizer, AstraZeneca, H. Lundbeck, Janssen and UCB Pharma
- Leading facility for storage and distribution of iPS cells

The Niche

- £25M Regenerative Medicine Platform funding to boost the development of regenerative medicine therapies
- £5M for Edinburgh Stem Cell Niche Hub
- £10M for Edinburgh Computational and Chemical Biology of the Stem Cell Niche

Cell Therapy Manufacturing

- Roslin Cells & SNBTS
- 6 Cell Therapies Manufactured at EBQ including cell therapies for
- Pfizer/Neusentis & Reneuron

Medical Technologies



Scotland's Multinational Medtech Companies

A number of companies have grown in Scotland to become global players based on Scottish innovation/IP



Toshiba Medical Visualisation Systems Europe

- Voxar : Founded early 1990s
- Powerful 3D CT, MR imaging software
- Nov 2008 – acquired by Toshiba
- Based in Edinburgh



LifeScan Scotland

- Created in 2001 when Johnson & Johnson acquired Inverness Medical Ltd.
- Employ over 1,000 people
- Main area of interest: diabetes.
- Main product is the OneTouch® Brand of blood glucose monitoring systems



Optos Plc

- Founded in 1992
- Scanning laser ophthalmoscope - captures a digital ultra wide-field image of the retina in a single take
- Over 33 million eye performed examinations so far, \$196m turnover in 2012



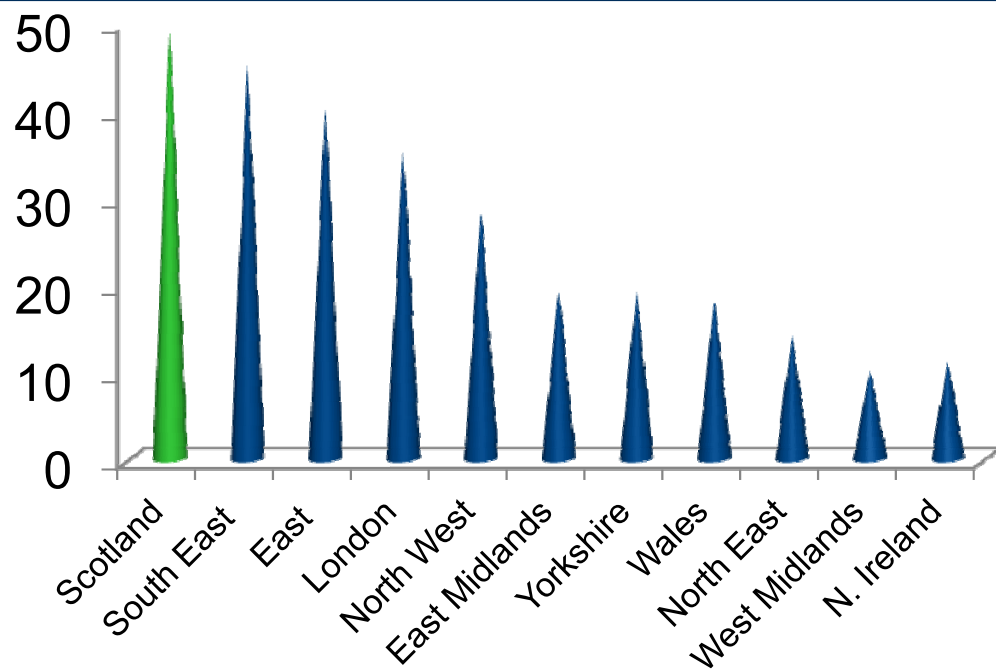
Vascutek Terumo

- Founded 1982
- Develop and manufacture vascular implants
- Growth fuelled by strong R&D capability most recently in endovascular area

Innovative Start-ups

Scotland is the UK's leading location for Life Sciences Start-ups

Number of Start-up Companies in the UK 2007-11



Approx half of all life science start ups from 2005-2009 were Medtech focused (approx 22 in total).

Medtech Start Ups

- Ambicare
- Mode Diagnostics
- Reactiv Lab
- Ohmedics
- Vueklar
- i2eye Diagnostics
- Taragenyx

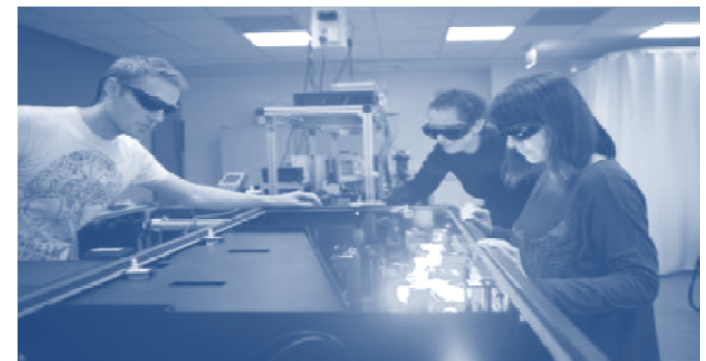


UK Life Sciences Start Up Report 2010 and 2012, Mobius Life Sciences

Academic Research in Medical Technologies

Scotland's research base offers easy access to a wealth of world-class, expertise and facilities as well as depth of relevant experience in convergent technologies critical to development of modern medical technologies

- Scotland's 15 universities are all involved in ground-breaking med-tech research
- Centres of excellence:
 - Strathclyde Institute for Medical Devices
 - Institute for Medical Science and Technology in Dundee
- University pools are gateways to academic excellence
- Strathclyde Medtech: Strathclyde Institute of Medical Devices is running a supporting scheme for industry and academia collaboration



Commercial innovations

Scotland has an impressive track record of medical innovations:

In the past decade, Scotland's medtech companies have launched global health innovations including:

- A portable unit to treat non-melanoma skin cancer using photodynamic therapy – Ambicare
- The first scanning laser ophthalmoscope to provide enhanced clinical information to detect diseases of the retina - Optos
- The world's first commercially available multi-articulated prosthetic hand – Touch Bionics
- A hand-held light-based device for checking breast health – PWB Health
- The world's first handheld video-enabled laryngoscope to facilitate intubations – Aircraft Medical



Connected Health



Connected Health

Outstanding level of collaboration between industry , universities, NHS and Government – open innovation environment

Industry collaboration is a key part of the vision in creating a world leading R&D environment to develop informatics based healthcare solutions of the future.

Strong Academic And Commercial Base

- Scotland is building on a strong academic and commercial base in informatics to develop work class infrastructure to support the continuing move towards a connected and personalized healthcare environment.

Stable Population

- In comparison to rest of UK and US populations, Scotland has an incredibly stable population. It has cradle to grave patient records underpinned by the Community Health Index (CHI) number; the only unique patient identifier for Scotland assigned to everyone who is registered with a GP practice.

Centralised Healthcare Provider

- A centralised healthcare system- including a national Picture Archiving System (PACs)- and a high incidence of morbidity of common complex diseases.

These elements make Scotland well differentiated to develop new solutions for healthcare based around informatics, big data and patient stratification.



Connected Health

Continuing to develop and build upon current strengths and expertise:

Scottish Health Informatics Programme (SHIP)	<ul style="list-style-type: none">• \$6.4m collaboration of four Scottish universities and the NHS to deliver improved infrastructure and governance for research using linked health records in Scotland.
e-Health Informatics Research Centre (e-HIRC)	<ul style="list-style-type: none">• One of 4 UK e-health informatics research centres with Scotland's centre leading the UK-wide network.
Health Informatics Research Advisory Group (HIRAG)	<ul style="list-style-type: none">• Developing a national strategy for health and bioinformatics research in Scotland.
The Farr Institute	<ul style="list-style-type: none">• Investment builds on the e-HIRCS to strengthen the UK's capacity to analyse patient records and health data in safe environments.
Scottish Informatics & Computer Science Alliance (SICSA)	<ul style="list-style-type: none">• This university research collaboration that allows companies to engage with 10 of Scotland's software universities via one access point.
Significant Academic Expertise and Growing Company Base	<ul style="list-style-type: none">• e.g. Aridhia, OracleBio, Pharmatics Ltd, Toshiba, Craneware

Digital Health in Scotland

“Scotland has a highly collaborative Telehealthcare community drawing together leading academics, policy makers, multinational companies and a globally admired National Healthcare Service”.¹

- Strong government push, favourable environment (policy & financial - £98M pa)
- Scotland will integrate health and care – led by NHS24 (different to England and Wales)
- A total investment of up to £23 million is being made in the UK-wide DALLAS programme – Delivering Assisted Living Lifestyles at Scale. This comprises an £18m investment by the Technology Strategy Board and the National Institute for Health Research, with a further £5m contribution from the Scottish Government, Highlands and Islands Enterprise and Scottish Enterprise.
- CHI Number: Anonymised electronic patient health information
- Around 100 Scottish companies active in this space
- Recently launched Digital Health Institute



Ageing population

Rise in long term conditions and co-morbidity

Health Service Constraints

Personalisation of Medicine

Low carbon economy

¹ George Crooks OBE, Medical Director NHS 24

Digital Health Cluster

A highly networked, innovative community of pioneers from business, academia and healthcare

- Rapid growth in activity with a world-class pool of skills and talent
- A highly networked, innovative community of pioneers from business, academia and healthcare with a fully representative supply chain
- At Scale Deployment: One of the world largest deployments of digital healthcare is under way (initiated in 2012).
- New national Innovation Centres in digital health, stratified medicine and sensors



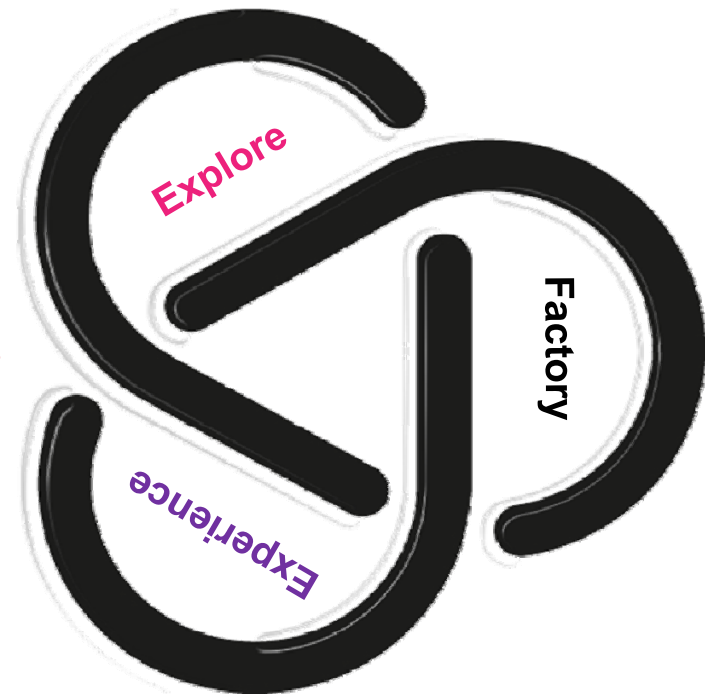


The Digital Health Institute

Mission: To develop products and services that will result in a step change in health and care delivery



- Enable collaboration between industry, National Health Service (NHS), care, academia
- Agile design processes to assist product development
- Trials and evaluation facilities
- Open to all companies to participate



Working together to deliver solutions in Scotland

Scottish Life Sciences Strategy 2011

Creating Wealth, Promoting Health



2020 Vision

Life Sciences
SCOTLAND



Life Science Advisory Board – Industry, Academia, NHS and Government

Edinburgh BioQuarter



South Glasgow Hospital Campus



An Ethos of Innovation through Collaboration



SMSIC

- Stratified Medicine Scotland IC

DHI

- Digital Health IC

IBioIC

- Industrial Biotechnology IC

CMAC

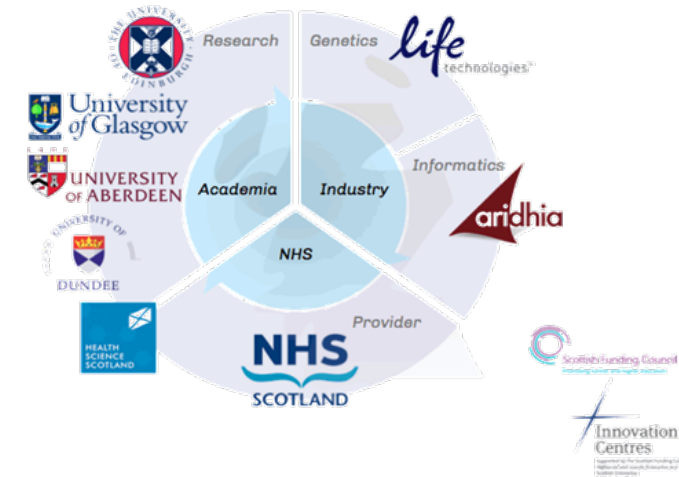
- Cont. Manufacturing & Crystallisation

HIP

- Health Innovation Partnership

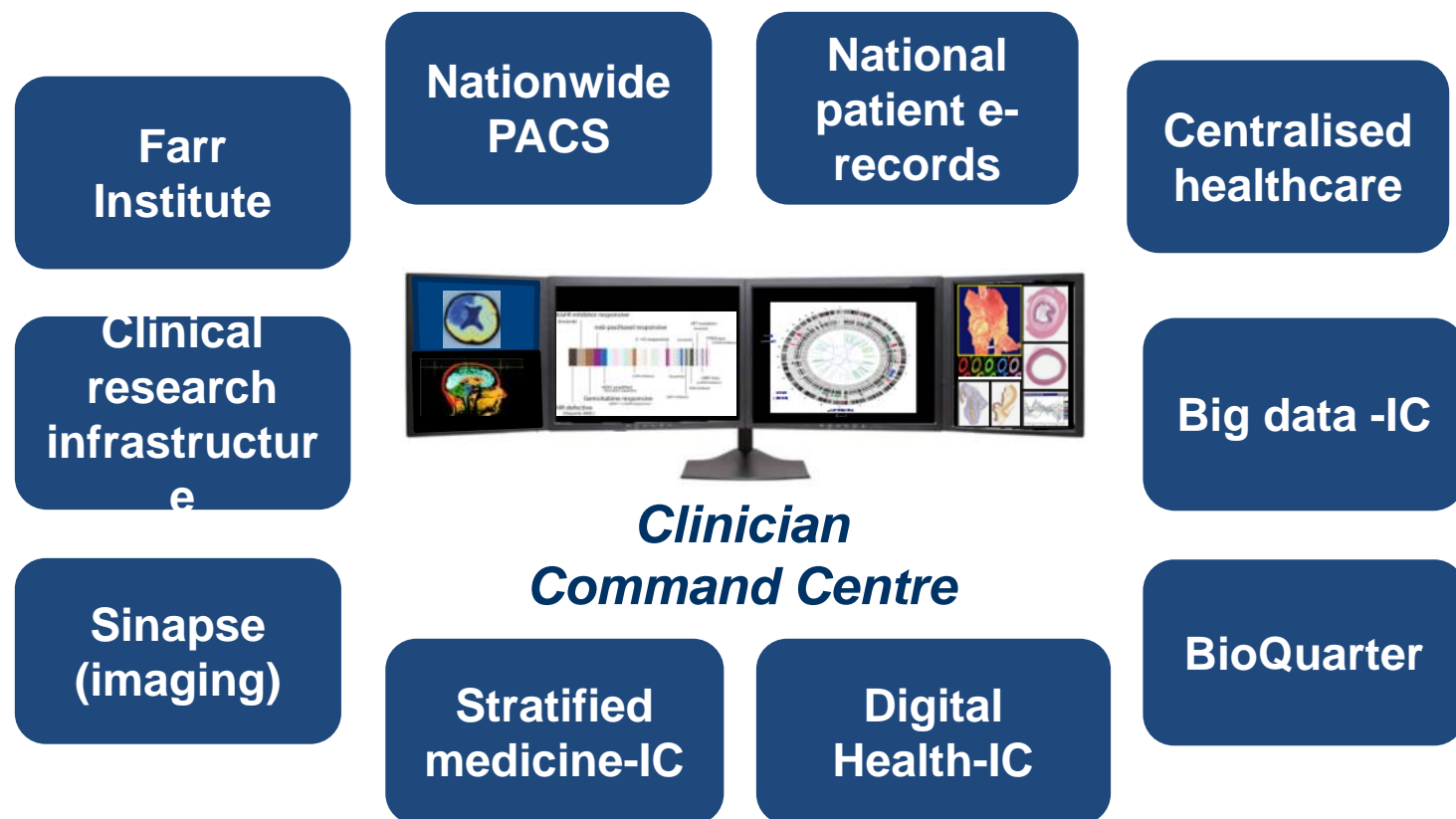
NRS

- NHS Research Scotland



Joined up healthcare environment

A patient-centric, technology-agnostic future requires use of multiple biomarker types, access to retrospective/prospective database and clinical judgment





有難う 御座います

arigatou gozaimasu

Thank you!