



Doctoral Programmes as a Strategic Dimension in Science, Technology and Innovation in Ireland

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**Ireland - UKCGE: Colloquium on Graduate
Education**

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Context

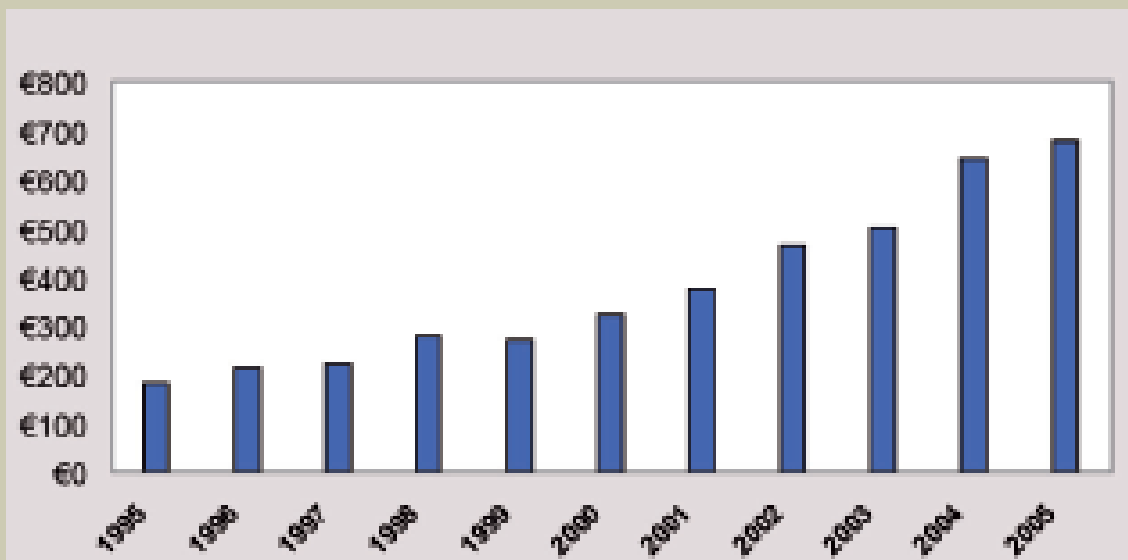
- Scale
- Location
- Language
- Demographics
- Education system
- Tradition of emigration
- Recent development of STI infrastructure
- Economic success – recent phenomenon

Research in Irish Universities – up to mid 1990's

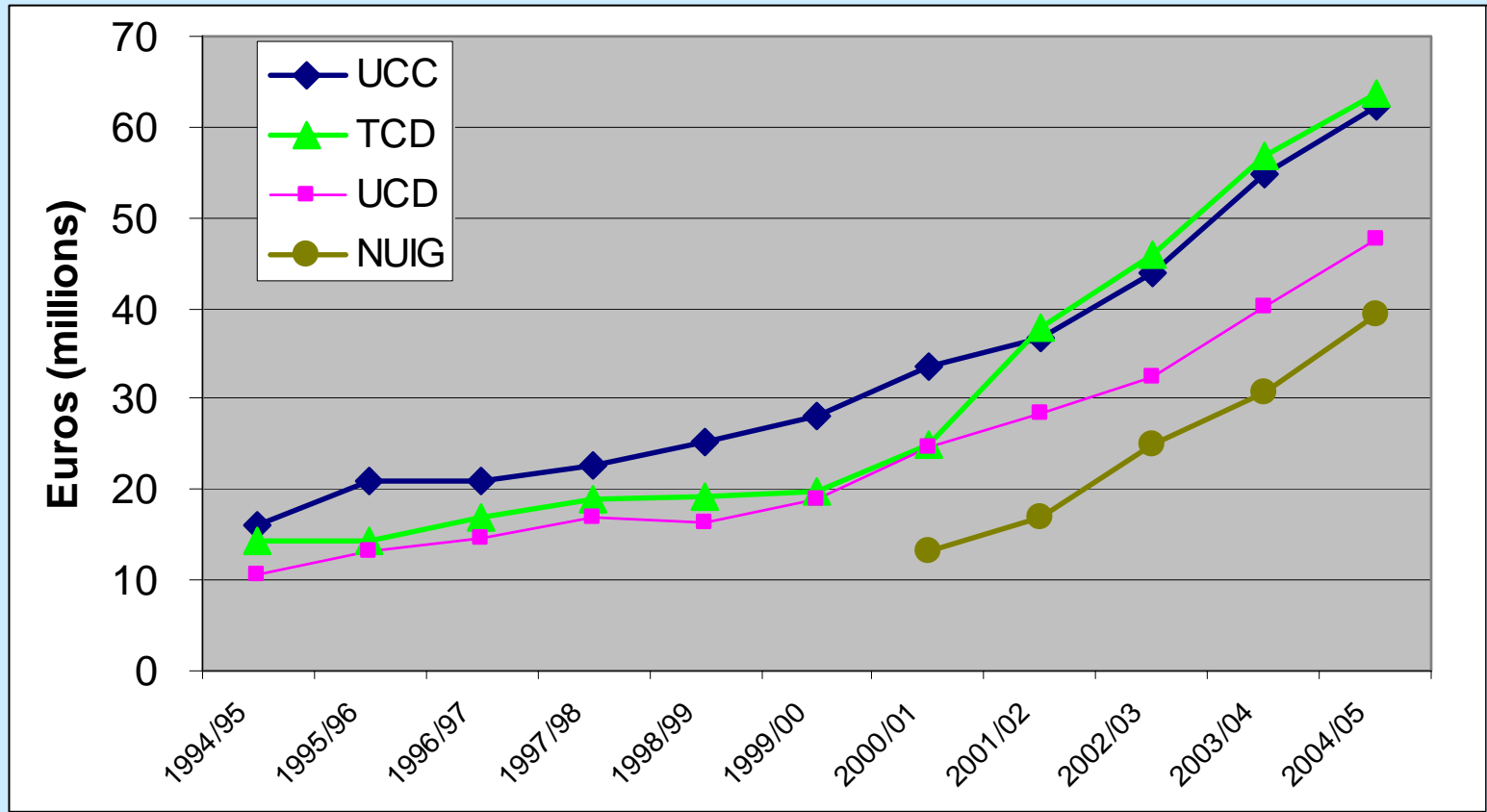


- Very limited national research support
- Modest awards from Enterprise Ireland and Health Research Board
- EU Framework programmes – critical in sustaining Irish research
- Infrastructure inadequate
- Absence of critical mass and sustained funding
- Emphasis on Applied Research

Table 1. Government Expenditure on STI 1995-2005
in Public and Private Sectors (Constant Prices)



Peer Reviewed Research Income





ICSTI

- Irish Council for Science, Technology and Innovation, established in 1997– Department of Enterprise, Trade and Employment
- 25 person advisory council, Chair Dr Edward Walsh, President Emeritus, University of Limerick
- advises Minister responsible for Science and Technology on science, technology and innovation policy
- members include industry, education sector, development agencies
- major projects, including Technology Foresight, and key policy statements on State expenditure, public funding of research, SET education, S&T awareness



Technology Foresight - 1999

Irish Council for Science Technology and
Innovation (ICSTI)

www.forfas.ie/icsti/

Establishment of Science Foundation Ireland

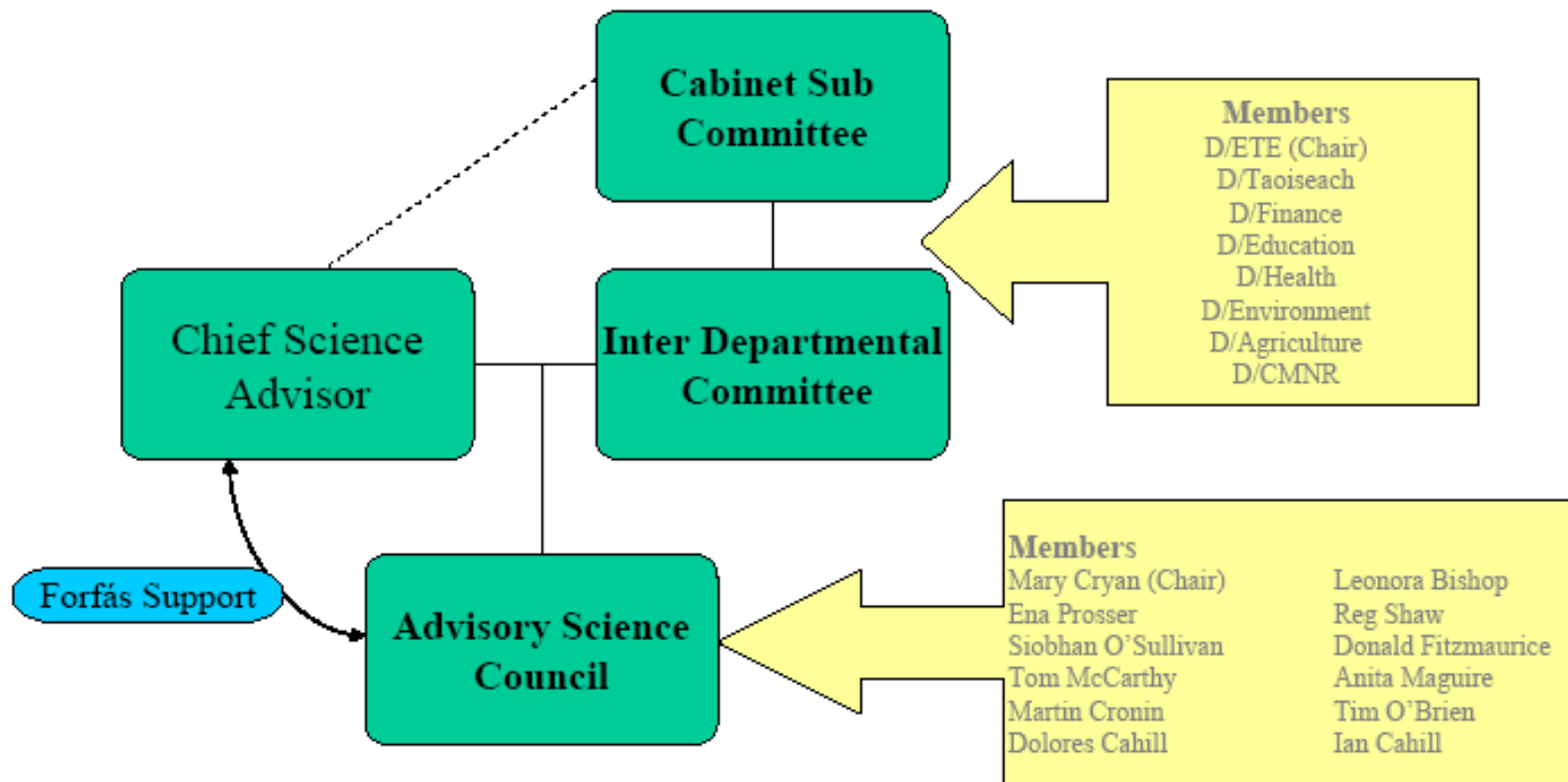


Science Governance, 2004

- **Cabinet Sub Committee on Science, Technology and Innovation (CSC)**, which includes the Taoiseach and the Ministers for Enterprise Trade and Employment; Finance; Education and Science; Health and Children; Agriculture, Fisheries and Food; Communications, Energy and Natural Resources; Environment, Heritage and Local Government; and Transport and Marine.
- The CSC is served by the **Interdepartmental Committee (IDC) on Science Technology and Innovation**. This is made up of senior civil servants from the relevant Government departments and the CSA, and is chaired by the Department of Enterprise, Trade and Employment.
- The **Chief Scientific Adviser (CSA)** provides independent advice to Government. The CSA attends meetings of the Cabinet Sub Committee and formally reports to it via the IDC.
- The **Advisory Science Council (ASC)** made up of senior figures from industry and academia prepares and provides advice on science issues from the points of view of the main stakeholders.

New STI Structures

Government Decision June 2004





Advisory Science Council

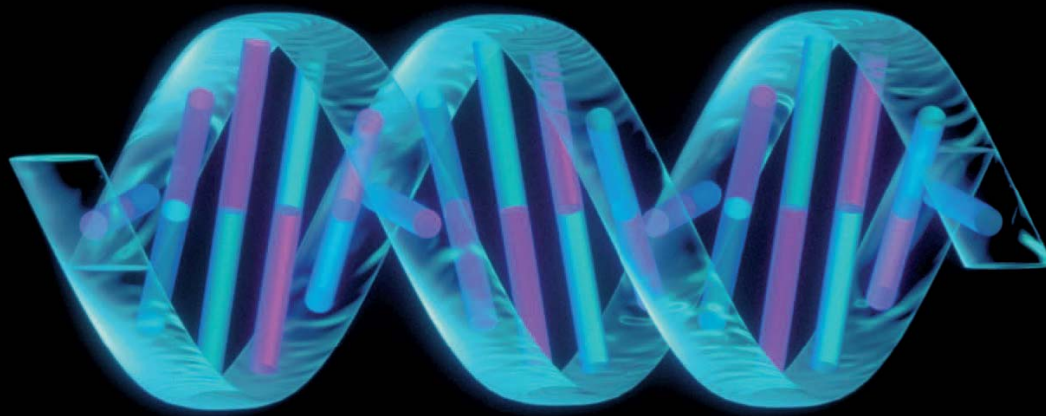
- Advisory Council for Science, Technology and Innovation
- Established 2005
- Reports to the IDC on STI
- Chaired by Mary Cryan, 12 members
- 'The Advisory Council for Science, Technology and Innovation is the Irish Government's high-level advisory body on Science, Technology and Innovation (STI) policy issues. It serves as the primary interface between stakeholders and policymakers in the STI arena.'
- <http://www.sciencecouncil.ie>



ASC Task Forces

- Researcher Careers
- Towards Better Health : Achieving a Step Change in Health Research in Ireland
- Promoting Enterprise – Higher Education Relationships
- SSTI
- National Code of Practice for Management of IP for Public-Private Collaborative Research

Strategy for Science, Technology and Innovation



2006 ~ 2013

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- “Ireland by 2013 will be internationally renowned for the excellence of its research, and will be to the forefront in generating and using new knowledge for economic and social progress, within an innovation driven culture.”
 - Increase BERD to €2.5bn by 2013
 - Double number of PhD graduates by 2013
 - Formalise graduate education
 - Total cost of Strategy €1.88bn up to 2013



Lisbon Agenda

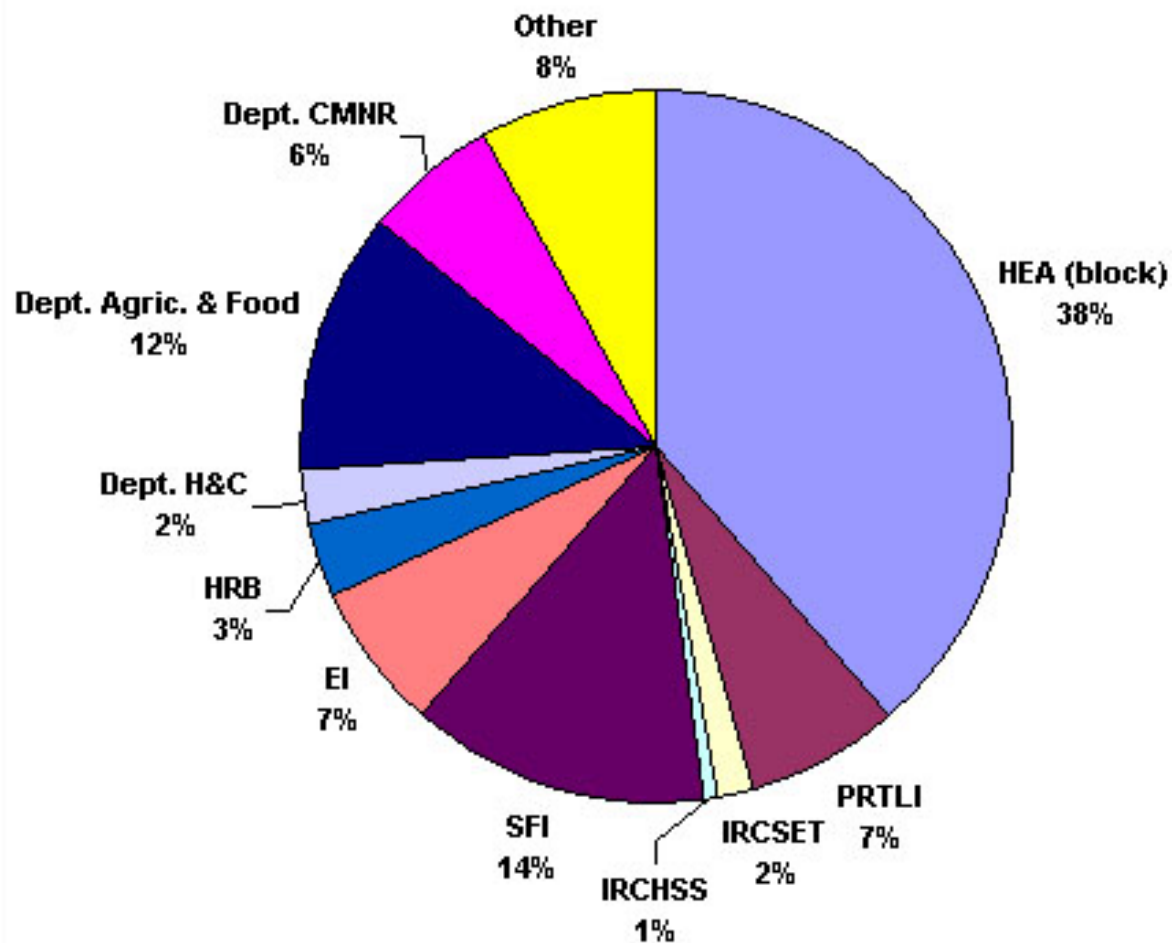
- Make Europe more innovative and competitive on the world stage
- European Council have agreed a target of spending 3% GDP on R&D by 2010; 66% of this from industry
- Ireland – currently 1.6%

Progress in Investment in Research



- Public funding of R&D increased by > 300% in real terms in the decade 1996-2006
- Exchequer funding for research in both public and private sectors
 - 2000 €334M
 - 2005 > €680M
- Research funding increased from 0.27% GNP in 2000 to 0.4% in 2006 at a time when GNP increased at 6-7% per annum
- Target 2.5% GNP by 2010, 66% of increased expenditure by enterprise

Government Funding of R&D 2005 (€531 M)



Source: Forfás Science Survey, 2006



Human Capital

28% of all third level graduations in 2005 were in Science & Engineering



PhD Graduates

	Total PhDs	Science/Eng. PhDs
Switzerland	364	163
Finland	363	187
UK	239	144
Denmark	169	86
Netherlands	153	81
Norway	143	42
US	143	81
Ireland	125	89

Source: NSF Science and Engineering indicators 2004



Fourth Level Ireland

- Number of researchers per 1000 of population – Ireland 14th out of 30 OECD countries
- PhD graduates (SET)
 - 2005 543
 - 2013 997
- PhD graduates (HSS)
 - 2005 187
 - 2013 315



Research Revolution in Ireland

- Science Foundation Ireland
 - Basic research support
 - ICT
 - Biotechnology
- PRTLTI – capital investment in Third Level Institutions
- IRCSET – Irish Research Council for Science, Engineering and Technology



Science Foundation Ireland

- *Technology Foresight* led to establishment in 2000
- Strategic Research Areas
 - Biotechnology
 - ICT
- €646 million 2002-2006
- First Director General, Dr William Harris

SFI Fellow
Awards

CSET

Research
Professorships

Investigator
Programme
Grants

E.T.S. Walton
Visitor Awards

Workshops
Conferences

Biotech

ICT

SFI Fellow
Awards

CSET

Research
Professorships

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Research Frontiers Programme



SFI – Research Support

- Research Professorships
- SFI Fellow Awards
- Principal Investigator Programme Grants
- Walton Visitor Awards
- Stokes Professorships and Lectureships
- Research Frontiers Programme

SFI – Industry related initiatives



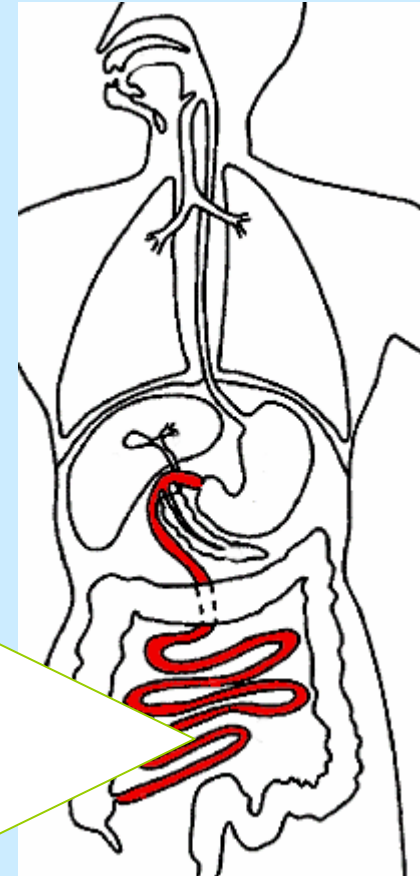
- CSET – Centres for Science, Engineering and Technology
- Strategic Research Clusters
- Industry supplements for PI's to collaborate with companies



Centres for Science, Engineering and Technology - CSETs

- Centre for Research on Adaptive Nanostructure & Nanodevices - CRANN, Trinity College Dublin, collaborations with UCD and UCC
- Nanotechnology
- Partnership with Intel Ireland
- Work with SME's

SFI Alimentary Pharmabiotic Centre



The interface of food and medicine
Microbial-host signalling within the gut



Procter & Gamble





SFI Initiatives

- STAR – School Teachers
- UREKA – Undergraduates
- PIYRA – Postdoctoral Researchers
- PICA - Principal Investigator Career Advancement



Higher Education Authority: Programme for Research in Third Level Institutions (PRTLII)

- Prioritisation of research activities
- Redress major capital infrastructural deficiencies
- Multi-disciplinary; Inter-institutional; Centres of Excellence; Competitive & Peer-reviewed
- Contribution to teaching
- Investments in Buildings, Equipment, Researchers (Postdoctoral Fellows & Postgraduates)
- Promotion of a strategic approach to research



Distribution of Funding

	€M	
	Capital	Recurrent
PRTL1 2000-3	177.85	28.6
PRTL2 2001-4	48.8	29.7
PRTL3 2002-6	178.0	142.4
PRTL4 2007-11	108.8	120.3
	513.1	321.0

<http://www.heai.ie>



PRTL 1-3: Thematic areas

% Total Allocation/Euros funding to date

•Biosciences/Biomedical	47%	290m
•Environment/Marine	11%	63m
•New Technologies & Materials	11%	69m
•ICT/Advanced Communications	10%	60m
•Social Science/Humanities	8%	46m
Food and Health Science	1%	4m
•Analytical Methodologies	3%	18m
<hr/>		
•Research Resources/Library	9%	54m



Universities – Strategic Research Management

- Establishment of formal research management structures – Vice-President for Research and Research Support Officers
- Intellectual Property, Industrial Liaison, Technology Transfer
- Strategic approach – identify and underpin key research strengths
- Multidisciplinary and inter-institutional approach



IRCSET

- Irish Research Council for Engineering, Science and Technology
- Established in 2001 – Department of Education and Science, budget €90M 2002-2006
- Promote excellence in research across the sciences, engineering and technology
- Embark programmes for support of PhD students and post-doctoral researchers in basic research across all disciplines in ES&T
- Graduate Education Programmes
- www.embark.ie



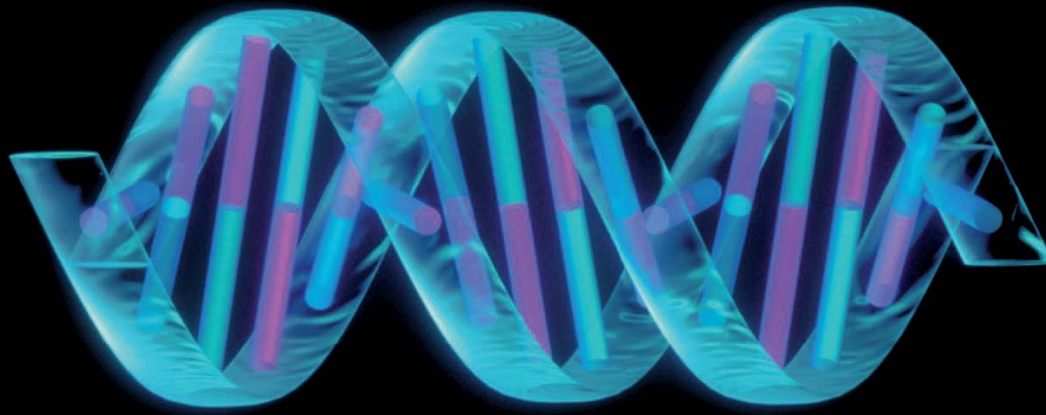
Embark – Enterprise Partnership Scheme

- Collaborative awards between IRCSET and individual companies
- Modest contribution from company
- Student spends ~3 months in the company
- Very positive feedback
- Excellent means of developing links with third level institutions



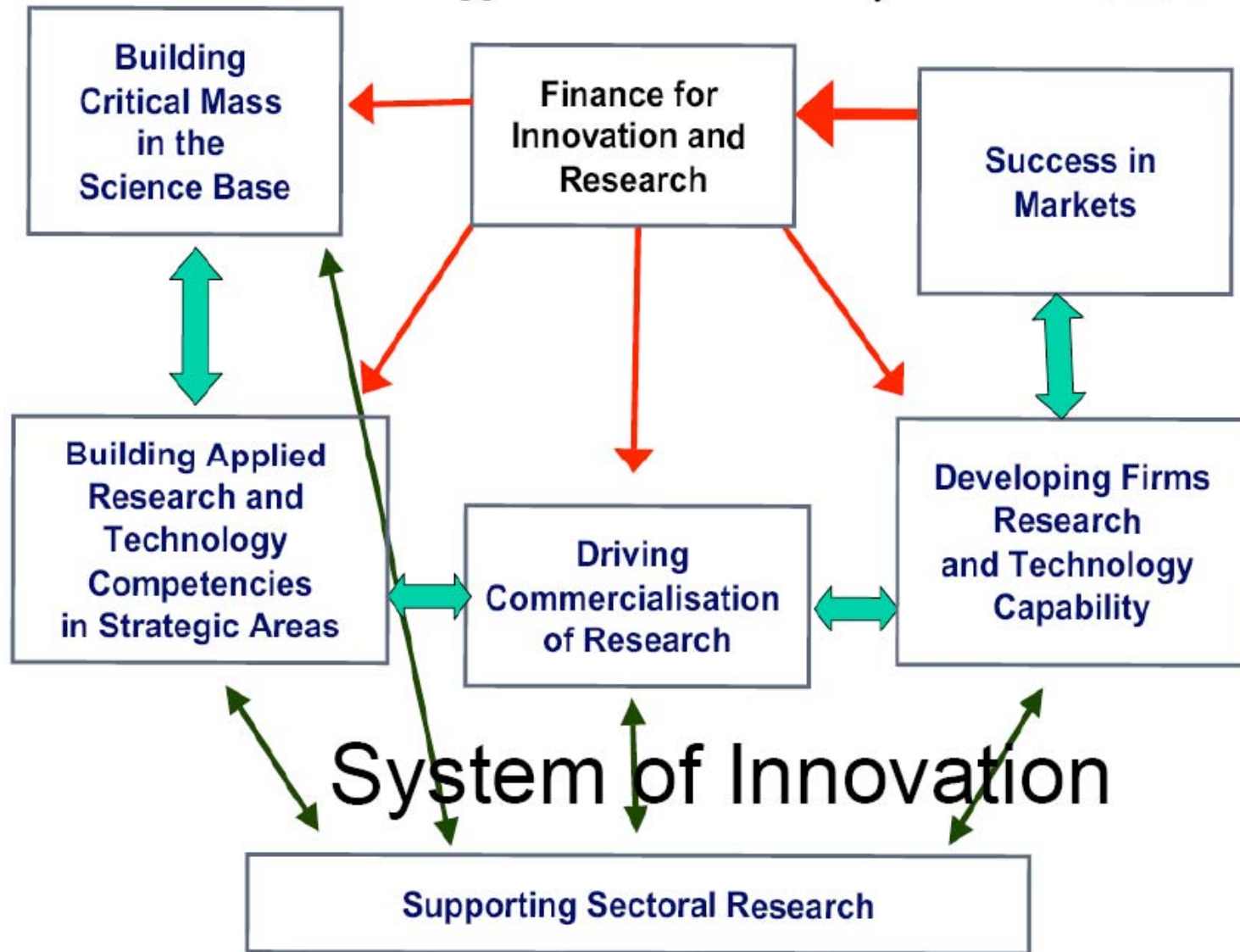
What next?

Strategy for Science, Technology and Innovation

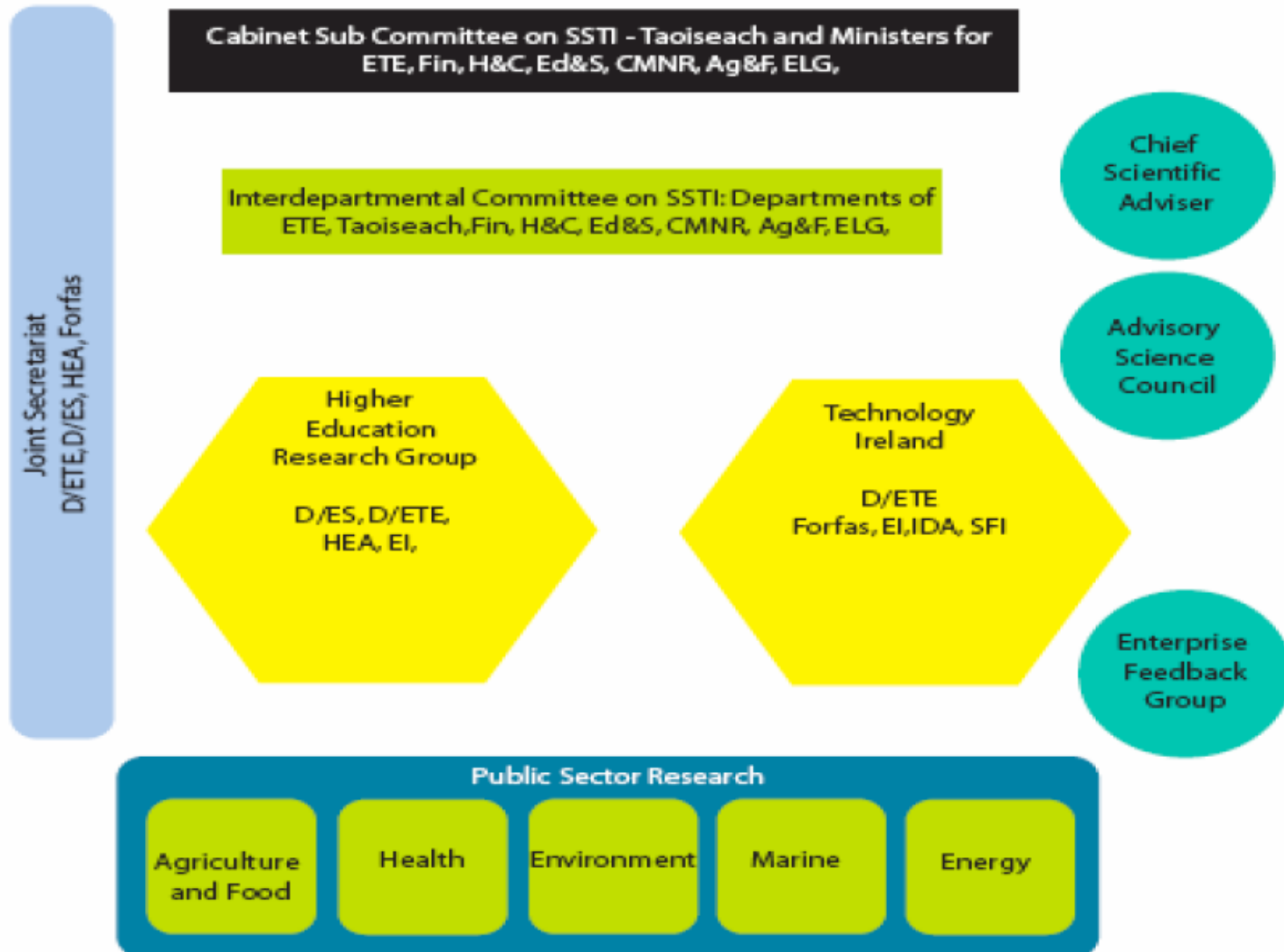


2006 ~ 2013

Appendix II – National System of Innovation



Implementation Structures





National Development Plan

- NDP 2007-2013 Transforming Ireland
- Public investment in STI under the NDP will amount to €8.2 billion
- www.ndp.ie



Business Expenditure on R&D

Table 4.1. Business Expenditure on R&D (BERD) as per cent of Output, 2003

Sector	BERD *(€m)	% Output *Ireland	% Output **EU	% Output **OECD
Electrical and Electronic Equipment	212.2	0.9	3.6	3.8
Pharmaceuticals	190.2	3.8	10.0	10.3
Medical Technology	115.9	2.0	4.9	7.8
Food, Drink and Tobacco	42.3	0.2	0.2	0.3
Machinery and Equipment	39.4	2.4	1.8	2.1
Other Manufacturing	72.1			
All Manufacturing	672.1	0.7	1.9	2.4
Software	378.3			
Others	25.2			

Total BERD €1,075.6

* Data for Ireland is 2003 and estimated from the BERD survey and the 2003 Census of Industrial production. ** Latest data available for EU (21 countries) and OECD is 2000. Source OECD ANBERD series 2004.



Expanding Enterprise R&D

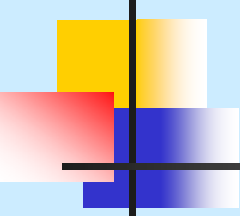
- R&D Grants & Tax Credits
- Inter-company Networks
- Increase the absorptive capacity of firms new to R&D, through strengthening technology skills
- Coherence between the policy and support agencies – Technology Ireland
- Development of the Enterprise – Academic interface
 - Collaborative research programmes
 - Competency centres in strategically important areas
 - IP management



Doctoral Programmes

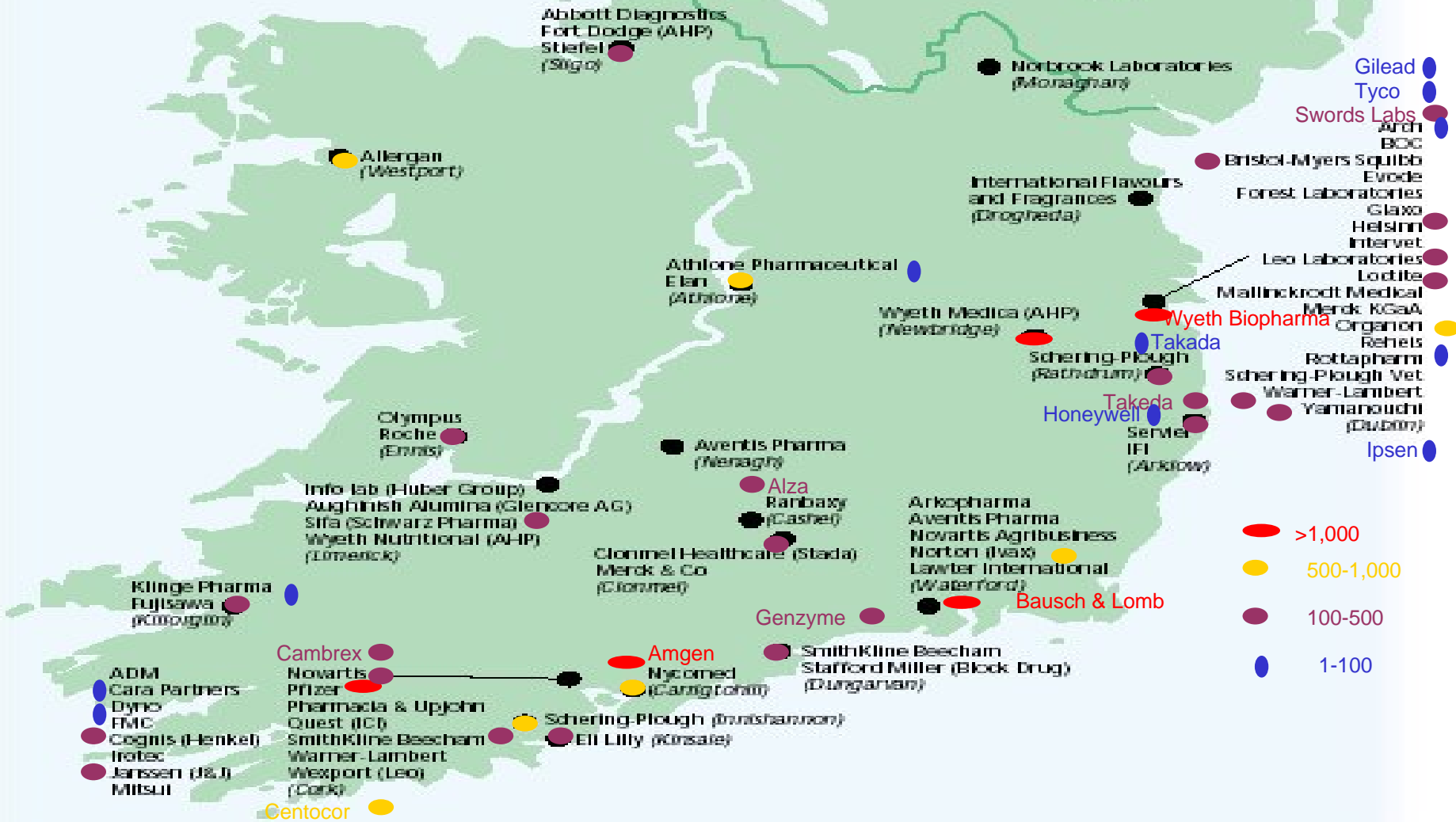
- Formalise graduate education
- Develop generic skills and discipline specific skills to underpin future careers
- Inter-disciplinary and inter-institutional graduate programmes as appropriate
- Researcher careers

Pharmaceutical Sector in Ireland



- 14 of the top 15 companies
- 2005 exports >€40 billion- 45% national total
- Over 24,000 employees, ~50% graduates
- Highly regulated and technology based
- Estimated replacement value of investment €40 billion (2003)
- Until recently, mainly production with limited R&D activity

NORTHERN IRELAND



- >1,000
- 500-1,000
- 100-500
- 1-100



Strategic Development of the Pharmaceutical Sector in Ireland

- Increased diversity of activities in the sector
- Biopharmaceutical / biotechnology sector
- Increased Process Development activity – position Irish sector earlier in the R&D chain
- Ireland as the primary site for initial scale-up of processes
- ICSTI Task Force Report *Embedding the PharmaChem Industry in Ireland*, February 2003
- www.forfas.ie/icsti/statements.html

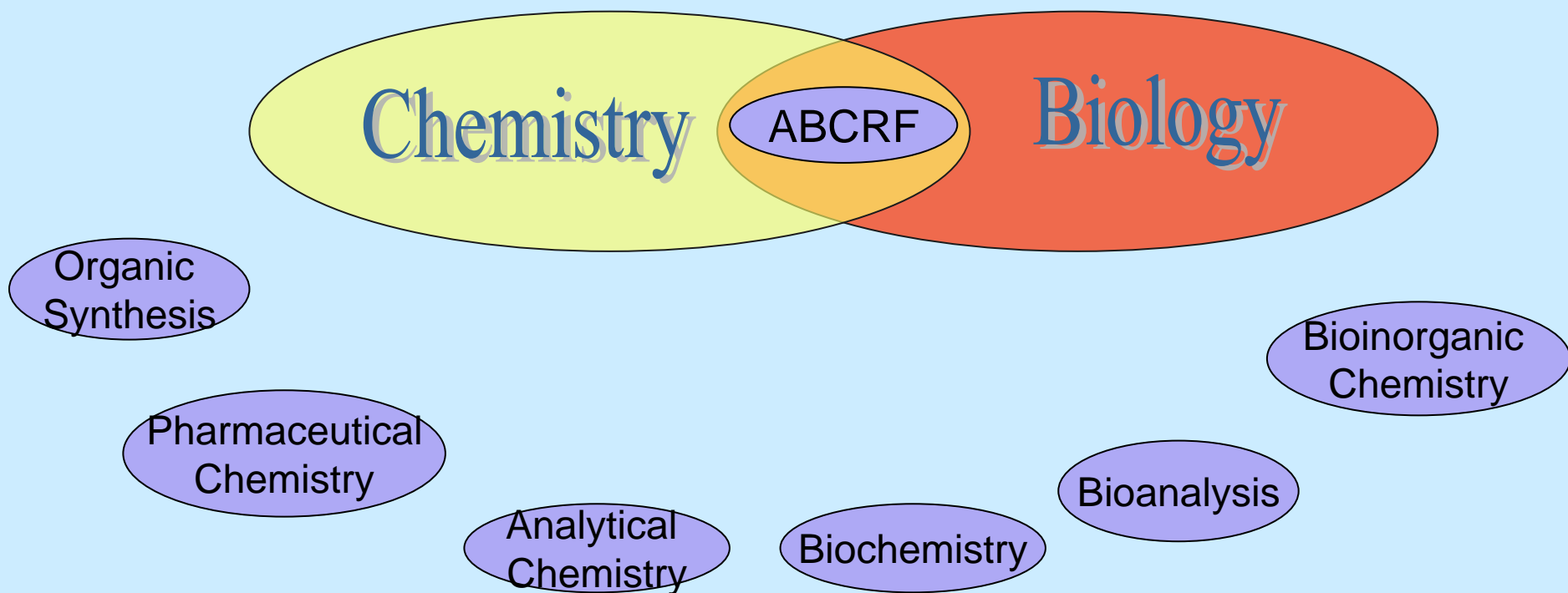


Strategic investment to underpin BioPharma sector

- NIBRT – National Institute for Bioprocessing Research and Training established in Dublin 2005
- Underpin recent developments in this sector – Wyeth, Amgen and Centocor

Analytical and Biological Chemistry Research Facility

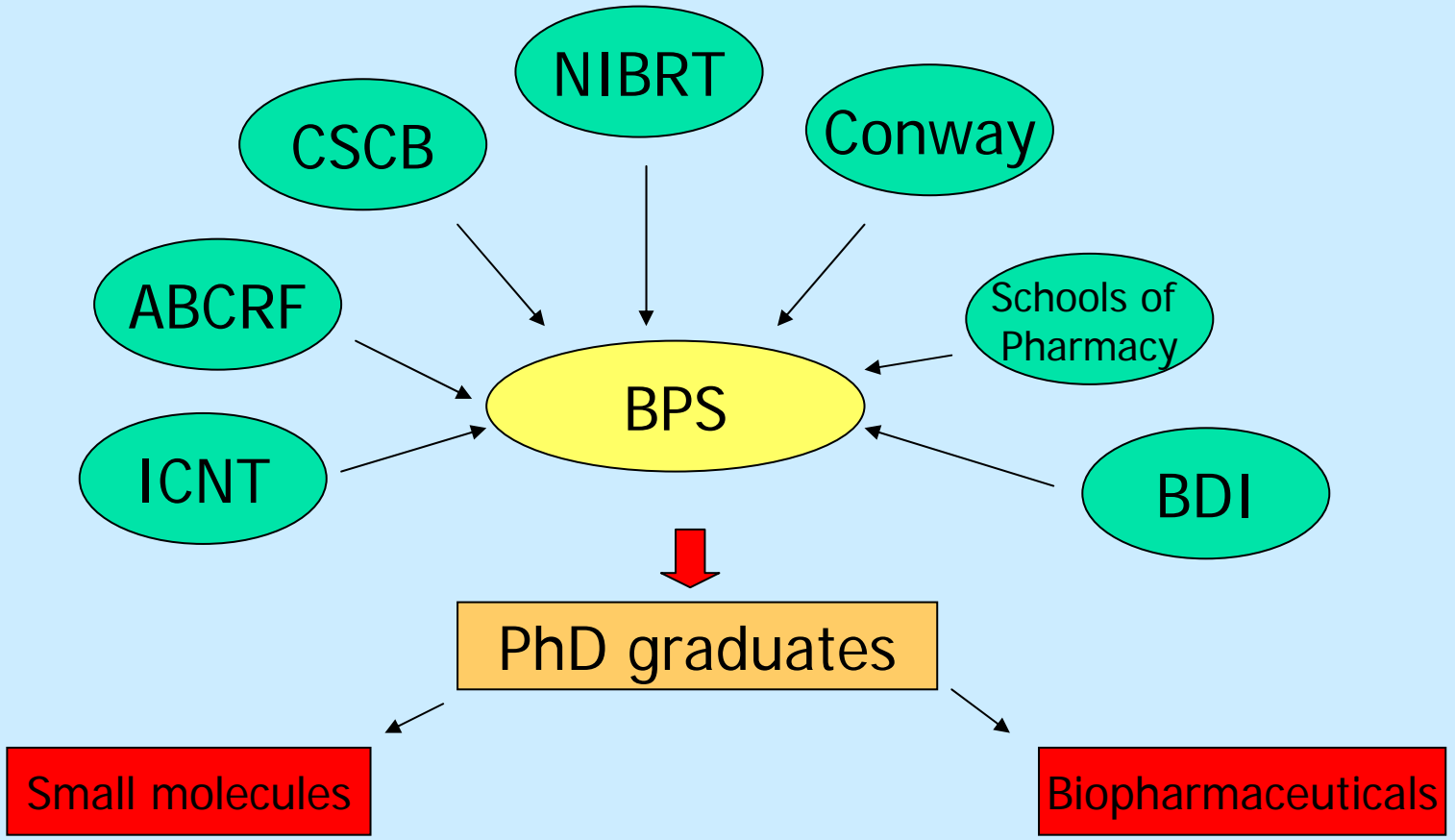
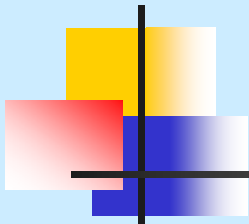
- Interdisciplinary research centre – PRTL13
- <http://abcrcf.ucc.ie>





National Programme on (Bio)pharmaceuticals and Pharmacological Sciences

- PRTL14, 2007-2011
- UCD, TCD, DCU, UCC, RCSI, QUB
- €19.2M

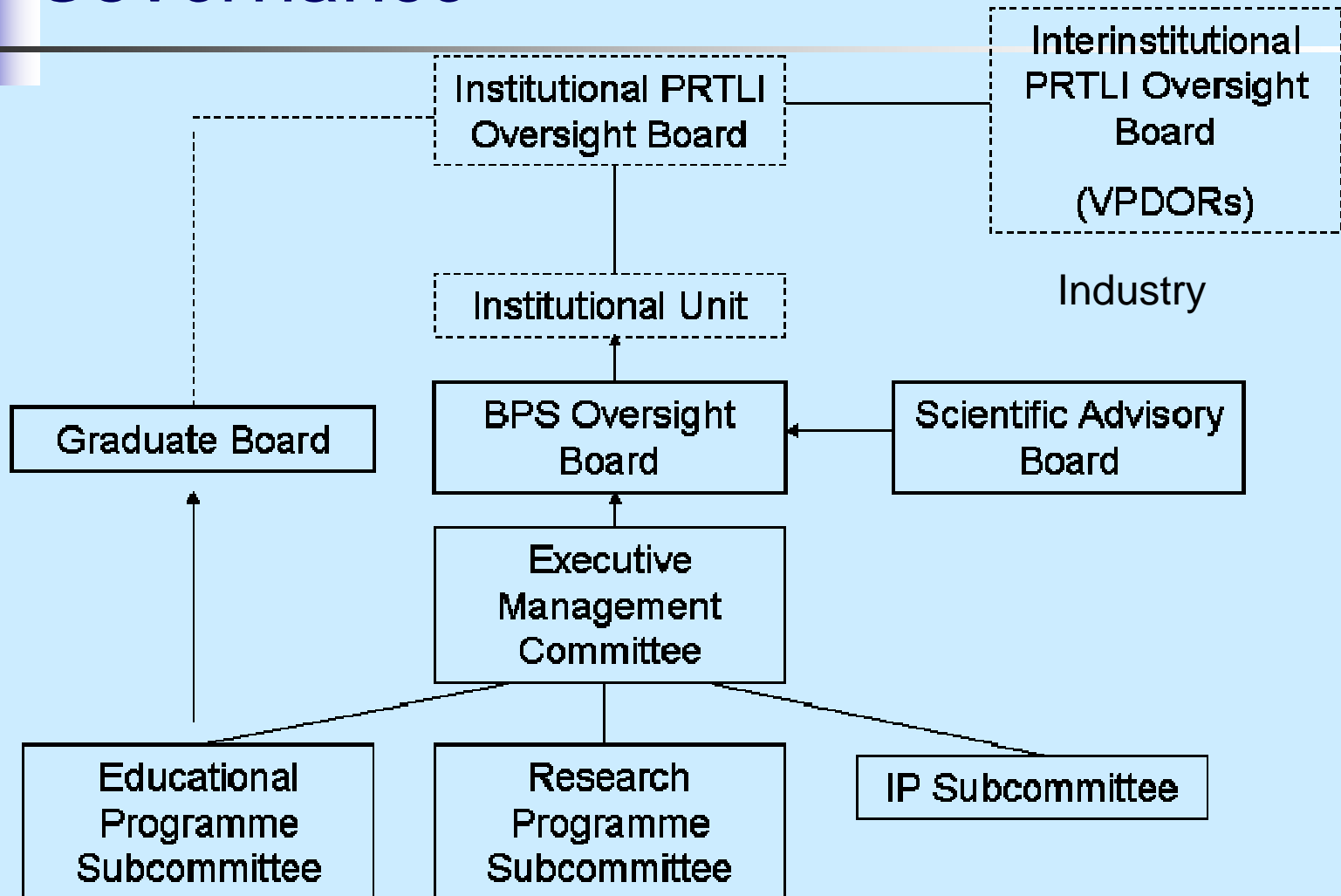


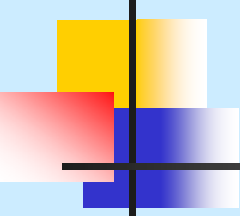
(Bio)pharmaceuticals and Pharmacological Sciences

National Graduate Education Programme Modules

- Biopharmaceuticals and bioprocess engineering
- Downstream processing
- Pharmaceutical chemistry
- Glycobiology
- Drug Formulation
- Physical properties
- Medicinal Chemistry
- Structural biology
- Toxicology
- Diagnostics
- Clinical Pharmacology

Governance



- 
-
- Graduate education is a key element underpinning Ireland's ambition as a knowledge economy
 - Provide the human capital with the requisite skills to underpin future development

Research Ecosystem

Research Careers Portal <http://www.researchcareersireland.com/Page.aspx?SP=41>

- HEA - Higher Education Authority <http://www.heai.ie/>
- HRB - Health Research Board http://www.hrb.ie/display_content.php?page_id=85
- Irish Research Council for the Humanities and Social Sciences www.irchss.ie
- Irish Research Council for Science, Engineering and Technology www.ircset.ie
- Programme for Research in Third-Level Institutions
<http://www.heai.ie/index.cfm/page/sub/id/448>
- Science Foundation Ireland (SFI) www.sfi.ie
- Enterprise Ireland www.enterpriseireland.com
- & Biotechnology Commercialization <http://www.biotechnologyireland.com/>
- R&D News <http://www.enterpriseireland.com/News+and+Events/eNewsletters/RandDNews/>
- IDA: Research Landscape <http://www.idaireland.com/home/index.aspx?id=677>