Imperial College London

Enterprise-University Partnership
The university point of view

Professor Mary Ritter; Pro Rector for Postgraduate and International Affairs

June 2008

Agenda

- Introduction to Imperial College London
- Links with enterprise
- Doctoral training programmes
- University-enterprise interactions
- Conclusions

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**Setting the context – Imperial College London
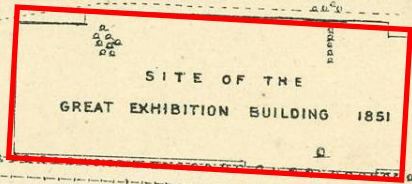Science, technology and medicine at Imperial**

Imperial College London

Prince Albert's vision

PLAN A
Q 1025

Plan of Estates
IN THE PARISHES OF
KENSINGTON
AND
St MARGARETS WESTMINSTER.
IN THE COUNTY OF
MIDDLESEX.
Purchased by
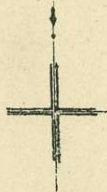### HER MAJESTY'S COMMISSIONERS
FOR THE
EXHIBITION OF 1851.

NOTE.
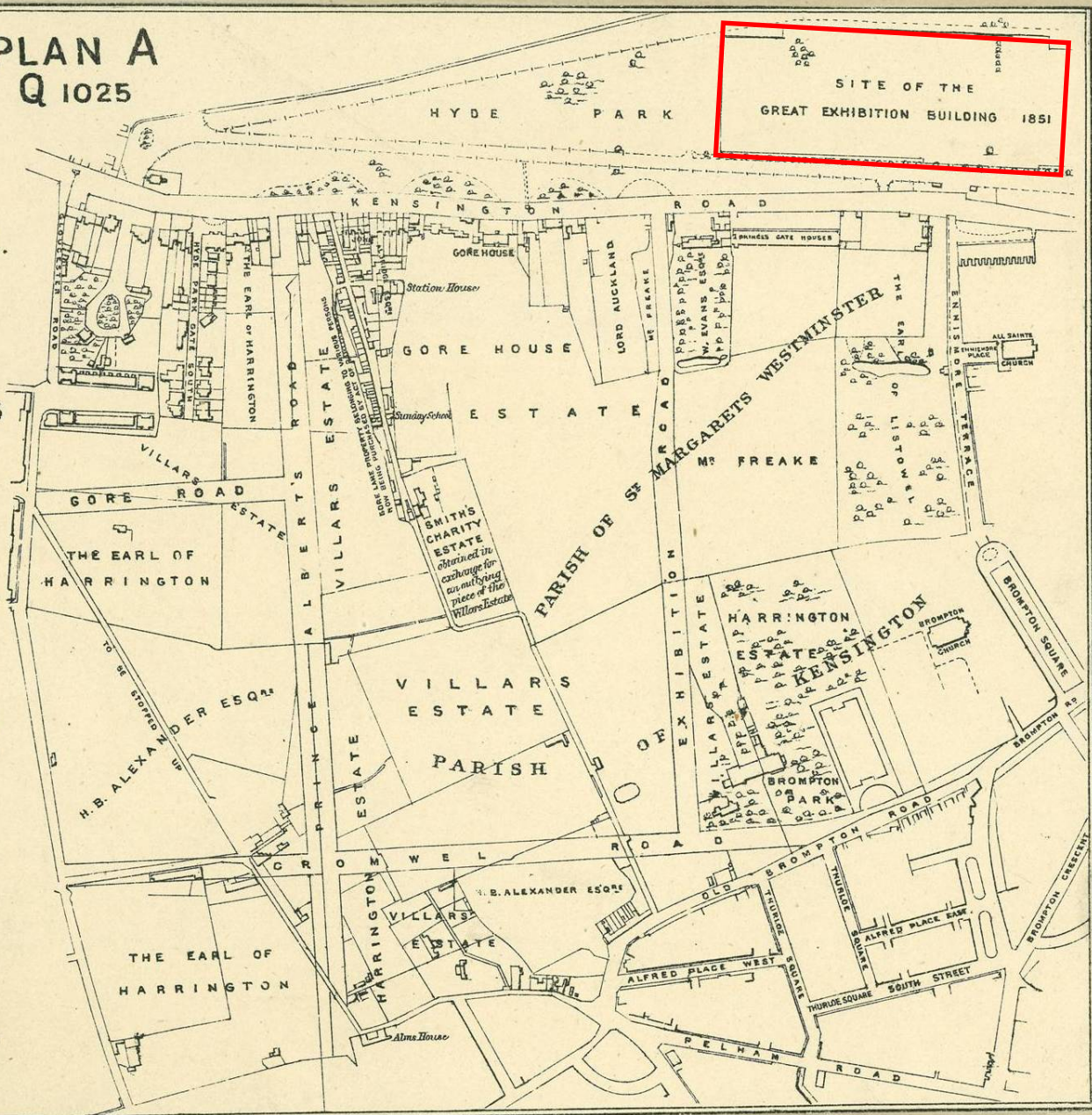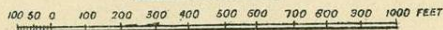
The Green color indicates the Commissioners' Estate the different properties composing it being enclosed in boundary lines of various colors. viz.

Gore House Estate............Blue
Villars Estate............Red
Harrington Estate............Yellow
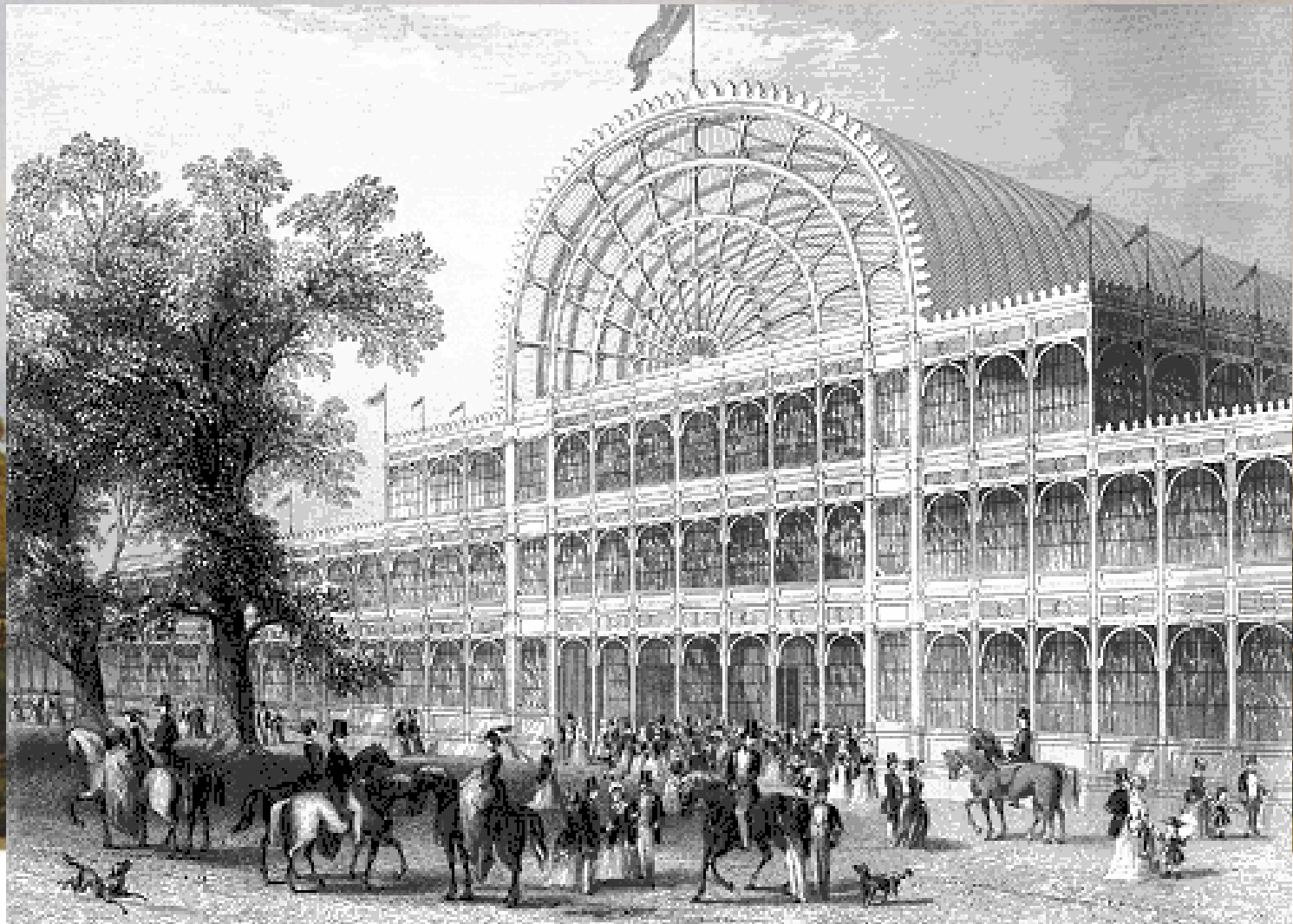Smiths Charity Estate............Brown

The Light Brown color indicates the different roads intersecting and bounding the Estate, the whole of them with the exception of the Kensington Road on the North, having been newly constructed by the Commissioners.

Scale of Feet.
100 50 0   100 200 300 400 500 600 700 800 900 1000 FEET

HYDE   PARK

SITE OF THE
GREAT EXHIBITION BUILDING   1851

KENSINGTON   ROAD

HYDE PARK GATE SOUTH
Station House
GORE HOUSE
LORD AUCKLAND
Mr FREAKE
2 PRINCES GATE HOUSES
J. EVANS ESQr
W. EVANS ESQr
ENNISMORE PLACE
ENNISMORE TERRACE
ALL SAINTS CHURCH

THE EARL of HARRINGTON

GORE HOUSE   ESTATE

Sunday School
VILLARS ESTATE
ALBERT'S ESTATE
PRINCE'S   GATE

GORE ROAD

THE EARL OF HARRINGTON

GORE ROAD

SMITH'S CHARITY ESTATE obtained in exchange for an outlying piece of the Villars Estate

GORE LANE PROPERTY BELONGING TO SUNDRY PERSONS NOW BEING PURCHASED BY ACT OF PARLIAMENT

PARISH OF St MARGARETS WESTMINSTER

Mr FREAKE

THE EARL OF LISTOWEL

PARISH   OF   EXHIBITION   ESTATE

VILLARS   ESTATE

HARRINGTON
ESTATE   of
KENSINGTON

BROMPTON CHURCH

BROMPTON PARK

BROMPTON SQUARE
BROMPTON RD

H. B. ALEXANDER ESQrs

TO BE STOPPED UP

PRINCE'S   ESTATE

VILLARS
ESTATE
PARISH

CROMWELL   ROAD

OLD   BROMPTON   ROAD

THURLOE SQUARE

BROMPTON CRESCENT

THE EARL OF HARRINGTON

HARRINGTON ROAD

H. B. ALEXANDER ESQrs

VILLARS ESTATE

ALFRED PLACE WEST

ALFRED PLACE EAST

THURLOE SQUARE   SOUTH STREET

Alms House

PELHAM   ROAD

The Crystal Palace – Great Exhibition of 1851

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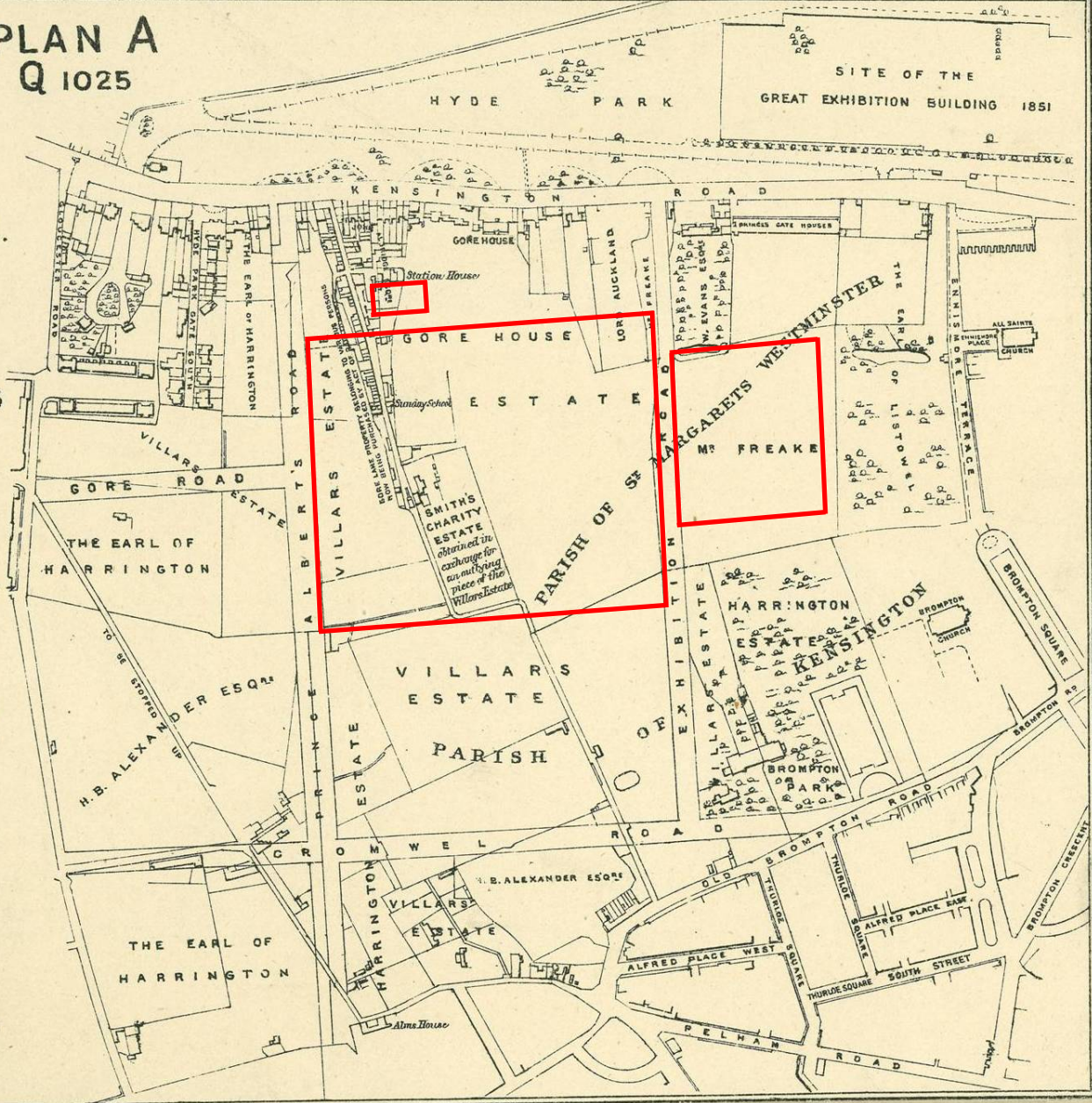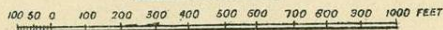FOR THE
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GORE LANE PROPERTY BELONGING TO THE POOR PERSONS
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TO BE STOPPED UP

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H. B. ALEXANDER ESQ.RS

OLD BROMPTON ROAD

THURLOE SQUARE

BROMPTON CRESCENT

HARRINGTON ESTATE

VILLARS
ESTATE

ALFRED PLACE EAST

ALFRED PLACE

THE EARL OF
HARRINGTON

ALFRED PLACE WEST

THURLOE SQUARE SOUTH STREET

Alms House

PELHAM   ROAD

Our History

1851-1890
Constituent Colleges formed, realising Prince Albert's vision for the pursuance of science and learning following the Great Exhibition

1907 – Imperial College founded by merger of:
City and Guilds College
Royal College of Science
Royal School of Mines

Our History

1988-2000 Mergers with London Medical Schools:

St Mary's Hospital Medical School

National Heart & Lung Institute

Charing Cross/ Westminster & Royal Postgraduate Medical Schools

Kennedy Institute

2007 – Our Centenary: 100 years of living science

Our Charter and mission

Our Founding Charter in 1907…*to give the highest specialised instruction and to provide the fullest equipment for the most advanced training and research in various branches of science especially in its application to industry*

Our mission now: Imperial College embodies & delivers world-class scholarship, education and research in science, engineering and medicine, with particular regard to their application in industry, commerce and healthcare. We foster interdisciplinary working internally and collaborate widely externally

Imperial is focussed on Science, Technology and Medicine

Imperial College London
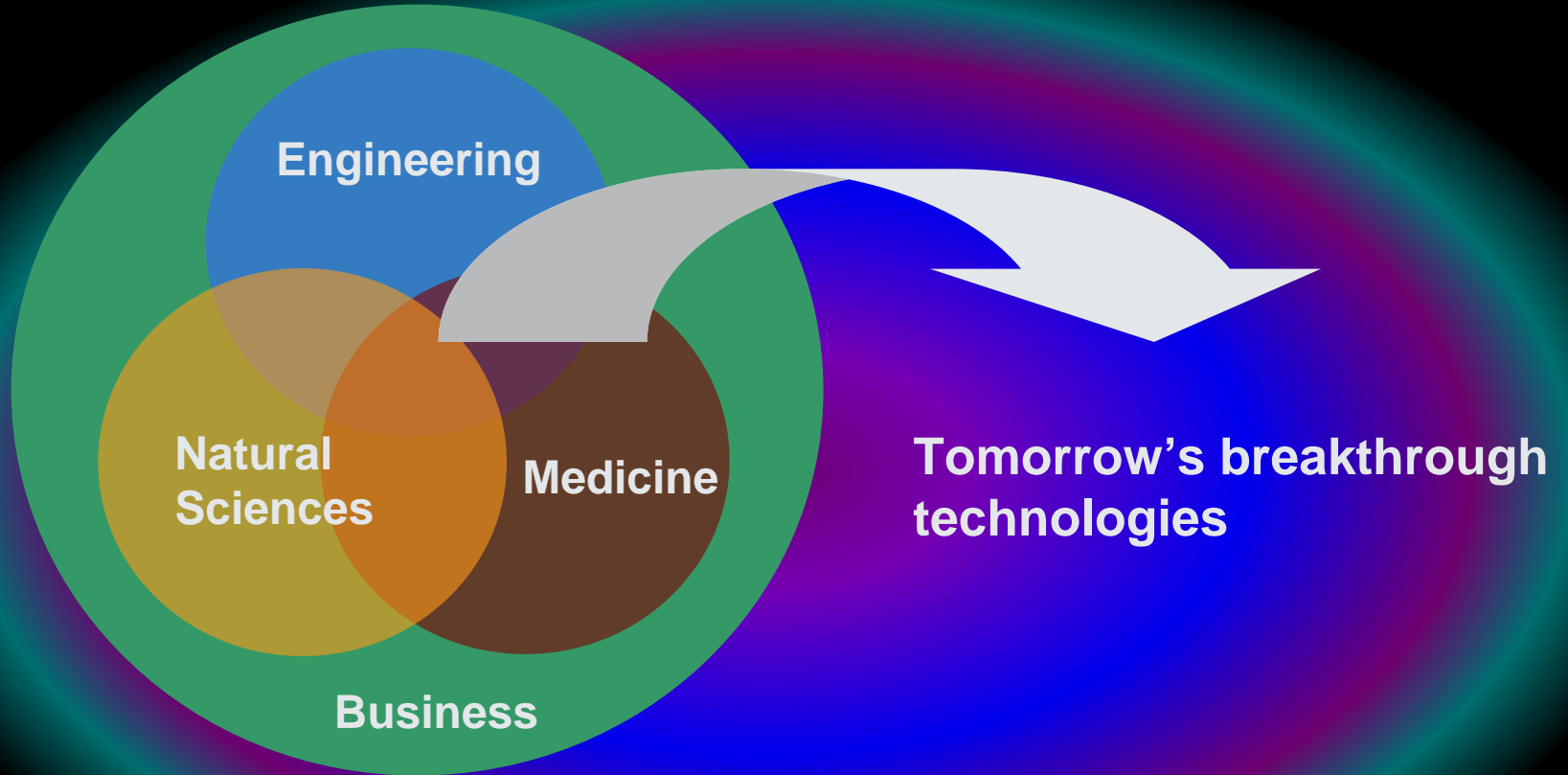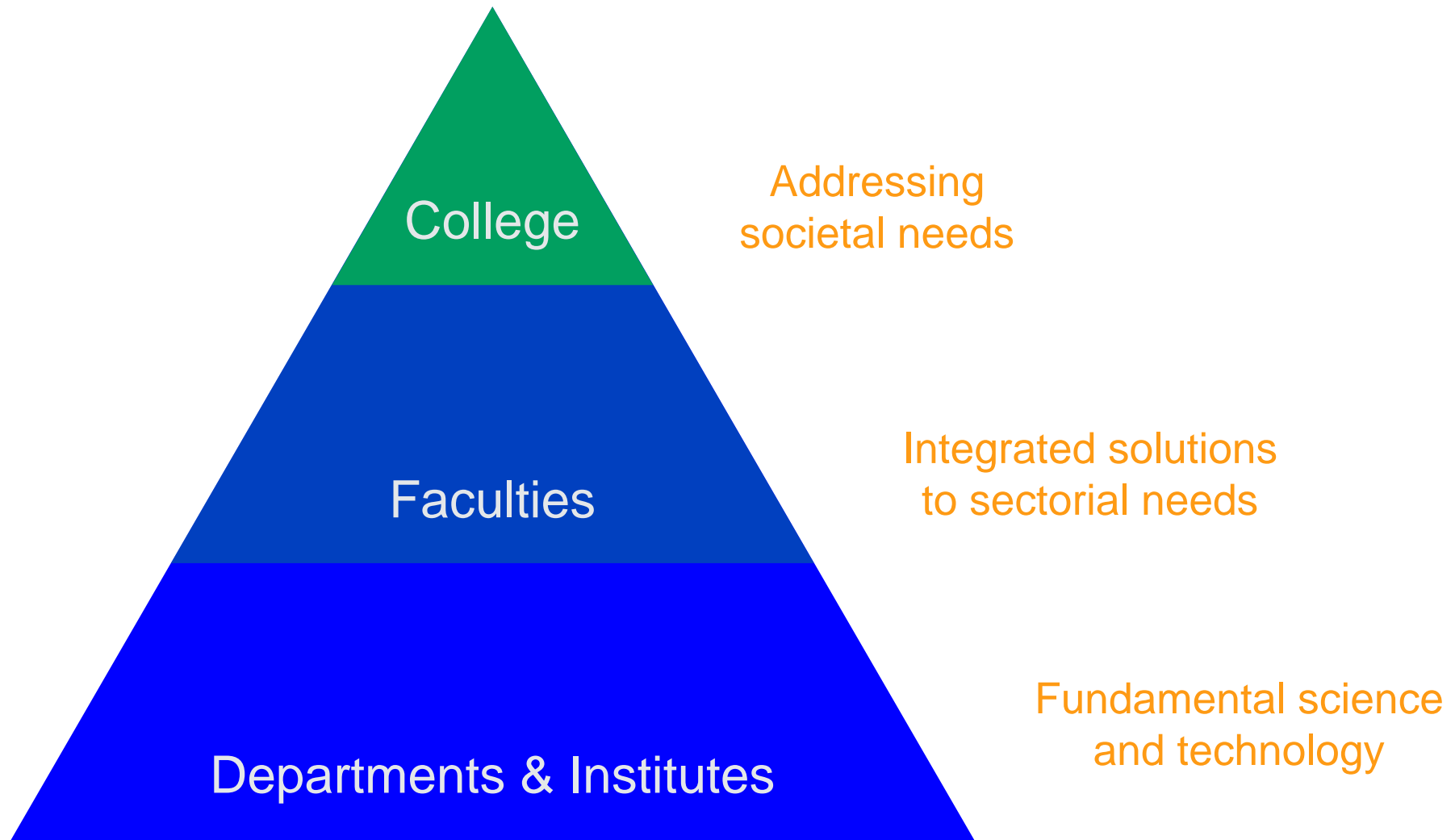
Integrated research strategy
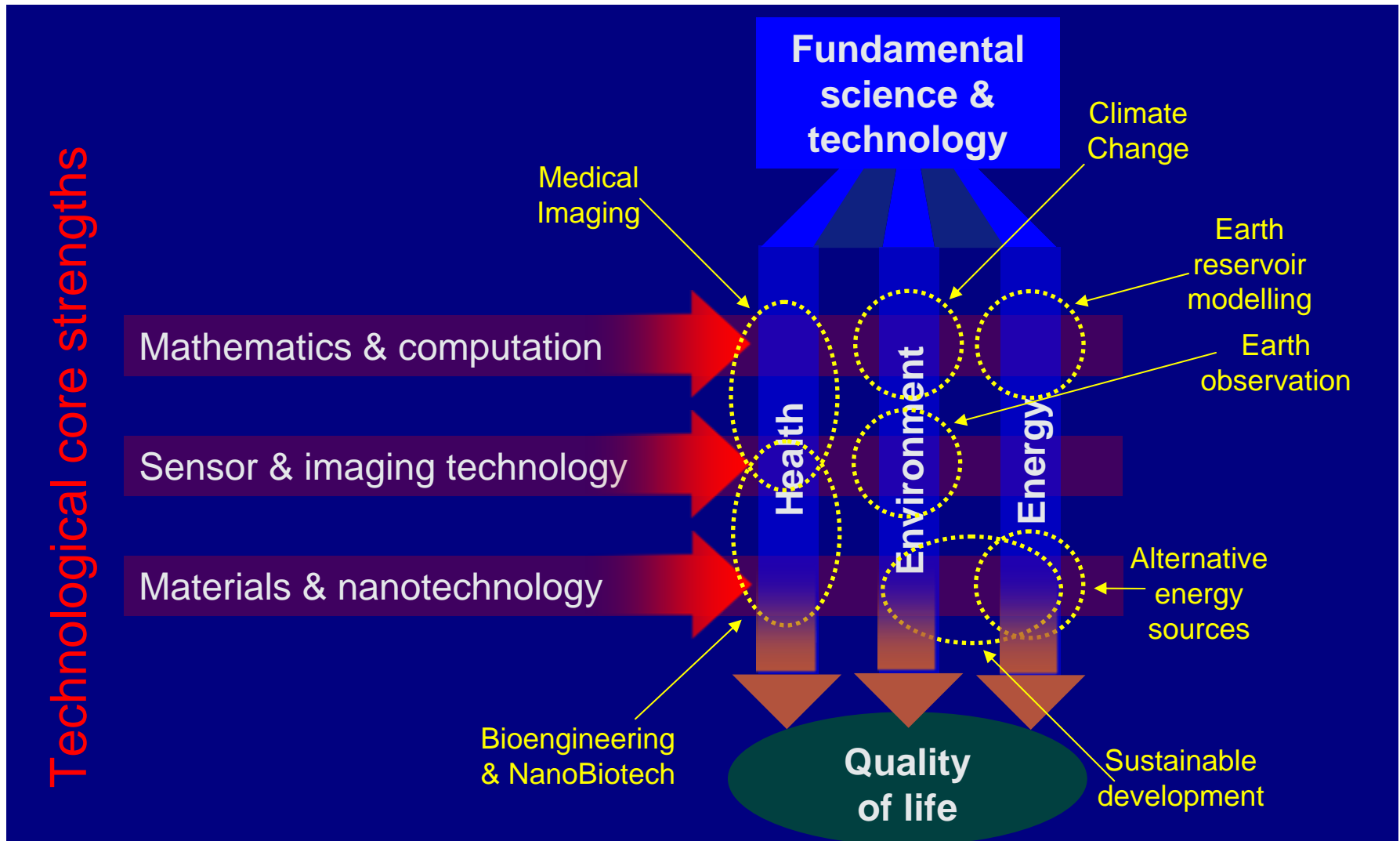
Our staff

8,200 staff and visiting staff

- **3,000** academic and research staff
- **3,000** support staff
- **1,700** honorary staff
- **700** academic visitors and visiting researchers

Our students

- 13,000 students
  - 8,300 undergraduates
  - 2,200 taught postgraduates
  - 2,500 research postgraduates

- 30% are from outside Europe
- Students from **123** countries

- 32% of staff non-UK nationals

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College structure (simplified)
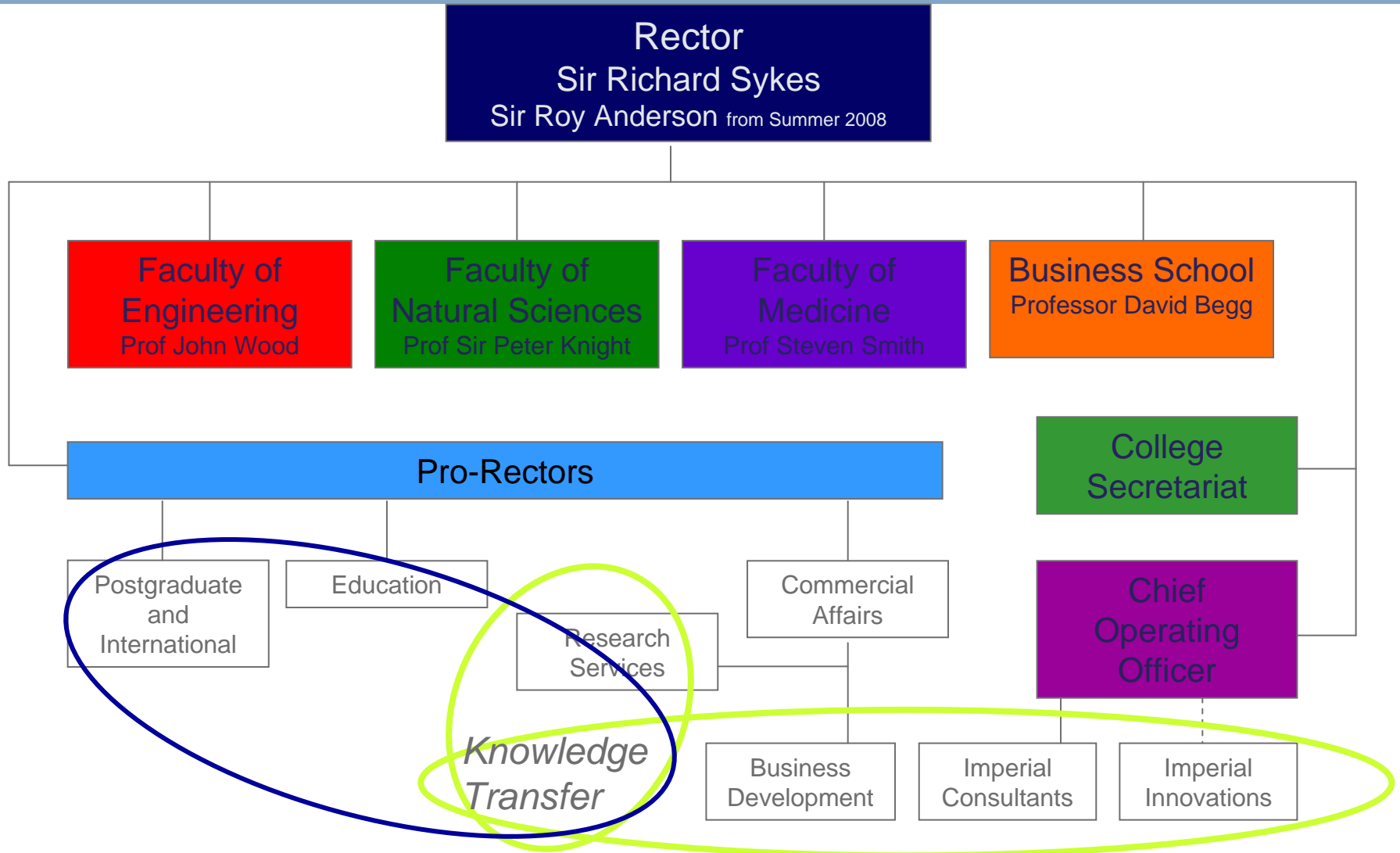
Our links with business

Royal Charter of 1907 states purpose of College as:

"giving…highly specialised instruction… providing…advanced training and research in… science…especially in its application to industry"

Today:

Imperial College Consultants (ICON)	Business Development	THE ENERGY AND ENVIRONMENT OFFICE
Problem Solving **Scientific Services** **Expert Advice**	**Mission to increase the quantity, size and quality of research collaborations**	**Establishing strategic relationships with UK and international business and industry, government and NGOs to initiate research projects concerned with energy and the environment**

Innovating

58 spin-out companies

> 150 licence agreements

Examples of our spin-outs:

Nexeon Ltd

Novel battery technology

Heliswirl Technologies Ltd

Helical-flow pipe technology

Expected to improve transport of fluids in applications including oil and chemical industries

Ceres Power

Fuel-cell technology company founded by Imperial Innovations as a spin-out in 2001

Technology to transform power generation
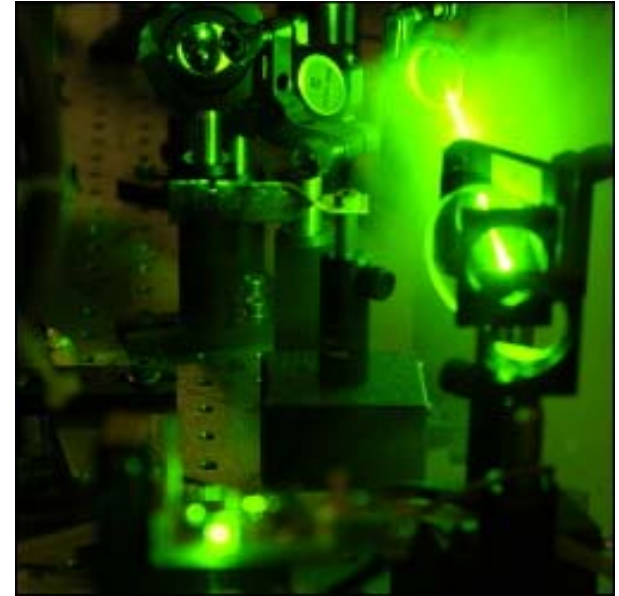
Admitted to AIM in 2004 with market capitalisation of £66M

Realised £2M for Imperial Innovations Group

Imperial Innovations became first majority university-owned technology transfer company to float in the UK (AIM)

Raised £26M August 2006

Market value: £150M

Applying our research in industry

Our links with business

Imperial received Supporter of British Industry Award at Best of British Industry Awards 2006

- honours organisations that proactively engage with industry

"Imperial is on a very sharp upward trajectory. If we look at where it was ten years ago and where it is now, there is a massive transformation, especially in interaction with British industry." Professor Sir David King, Government Chief Scientific Adviser, 11 2007

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Our postgraduate students

- ~4,700 postgraduate students

- 35% of total student population (~13,000) at Imperial

- >50% are doctoral candidates (2,500)

- 70% EU
  - 46% UK
  - 24% non-UK

- 30% overseas (non-EU)

- All masters and PhD students belong to one of the two Graduate Schools

Our Graduate Schools at Imperial

- Established to ensure quality and to further develop and enhance postgraduate training and excellence
- Graduate School of Life Sciences and Medicine, 1999
- Graduate School of Engineering and Physical Sciences, 2002
- Membership: all masters and doctoral students
- Role
  - Quality of training
  - Academic environment/Interdisciplinarity; distinguished guest lectures; student research symposium; etc
  - Transferable skills programme (THES Prize 2006)
  - Representation - an integrated 'voice' within the university

Doctoral (PhD) training

- Evolution from a research apprenticeship to a
- multi-stranded education
- 3-4 years

Taught elements

Transferable/Professional skills

Research element

Year 1	Year 2	Year 3
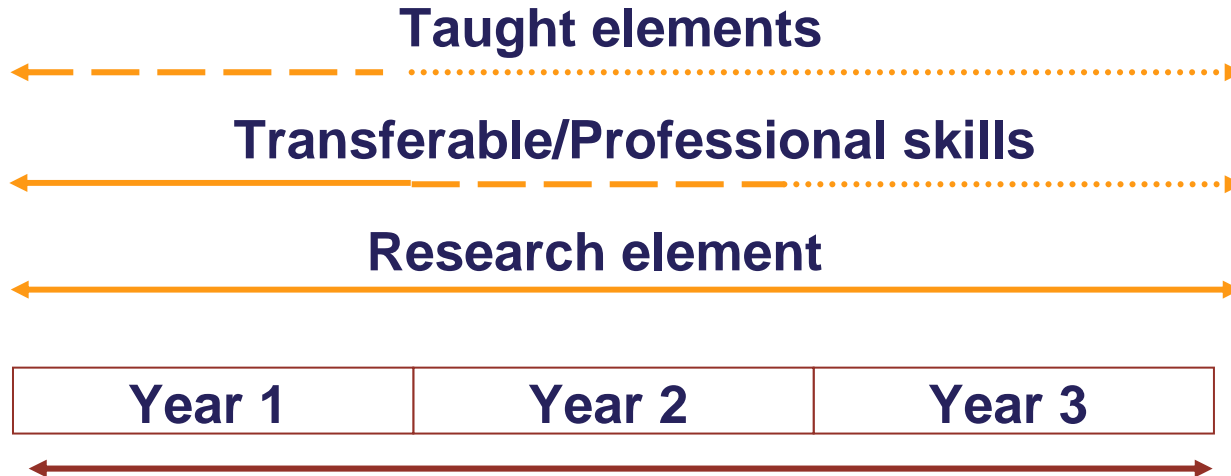
Direct University-Enterprise links (1)

2 main areas: Research and Skills training

Research

- University-enterprise collaborative research projects
  - University laboratory + enterprise/industrial laboratory
  - University supervisor (main) + enterprise supervisor (co-supervisor)
  - ~1 year at Imperial: 2 years in enterprise; but flexible according to nature of the project
  - Imperial College London PhD
  - Range of funding: government CASE, KTI; industry
- Collaboration, research 100% in university
- Collaboration, research 100% in enterprise (EngD, 'professional doctorate'; EPSRC government research council funding)
- Consultation/advice: enterprise represented on Doctoral Training Advisory Boards

Direct University-Enterprise links (2)

'Transferable' skills

- Role of Enterprise:
  - Direct participation in delivery
  - Consultation/advice with university
  - Consultation/advice at national level (e.g UK GRAD Advisory Board)

What skills and why?

- Roberts review (and funding!)
- Input from stakeholders
  - students
  - staff
  - employers (e.g. enterprise)
  - data from University and national level
- Research

'Roberts' Review: SET for success (2002)

- A review, chaired by Sir Gareth Roberts, into the supply of science and engineering skills in the UK
- Review was commissioned as part of the UK Government's productivity and innovation strategy

"PhDs do not prepare people adequately for careers in business or academia"

- *"in particular, there is insufficient access to training in interpersonal and communication skills, management and commercial awareness"*

Roberts' Recommendation 4.2

Recommendation 4.2: PhD training elements

Despite the welcome current moves by the Funding Councils to improve the quality of PhD training, institutions are not adapting quickly enough to the needs of industry or the expectations of potential students. The Review therefore believes that the training elements of a PhD – particularly training in transferable skills – need to be strengthened considerably. In particular, the Review recommends that HEFCE and the Research Councils, as major funders of PhD students, should make all funding related to PhD students conditional on students' training meeting stringent minimum standards. These minimum standards should include the provision of at least two weeks' dedicated training a year, principally in transferable skills, for which additional funding should be provided and over which the student should be given some control. There should be no requirement on the student to choose training at their host institution. The minimum standards should also include the requirement that HEIs – and other organisations in which PhD students work – reward good supervision of PhD students, and ensure that these principles are reflected in their human resources strategies and staff appraisal processes.

Furthermore, in order to assure employers of the quality of PhD students, as part of these standards the Review recommends that institutions should introduce or tighten their procedures for the transfer of students to the PhD. In particular, the Review believes that HEIs must encourage PhD projects that test or develop the creativity prized by employers.

...the training elements of a PhD – particularly training in transferable skills – need to be strengthened considerably.

...include the provision of at least two weeks' dedicated training a year, principally in transferable skills,

Roberts Recommendation 5.3

Recommendation 5.3: A vision for postdoctoral researchers

It is important for postdoctoral researchers to be able to develop individual career paths, reflecting the different career destinations – Industrial, Academic and Research Associate – open to them, and that funding arrangements reflect the development of these career paths. The Review believes that enabling the individual to establish a clear career path, and a development plan to take them along it, is critical to improving the attractiveness of postdoctoral research. The Review therefore recommends that HEIs take responsibility for ensuring that all their postdoctoral researchers have a clear career development plan and have access to appropriate training opportunities – for example, of at least two weeks per year. The Review further recommends that all relevant funding from HEFCE and the Research Councils be made conditional on HEIs implementing these recommendations.

HEIs take responsibility for ensuring that all their postdoctoral researchers have a clear career development plan …

… and have access to appropriate training opportunities – for example, of at least two weeks per year.

What do we mean by transferable skills?

UK Research Councils/UK GRAD Programme
- Joint skills statement 2000

Transferable skills training - 7 major areas identified

Research skills and techniques

Research environment

Research management

Personal effectiveness

Communications skills

Networking and team-working
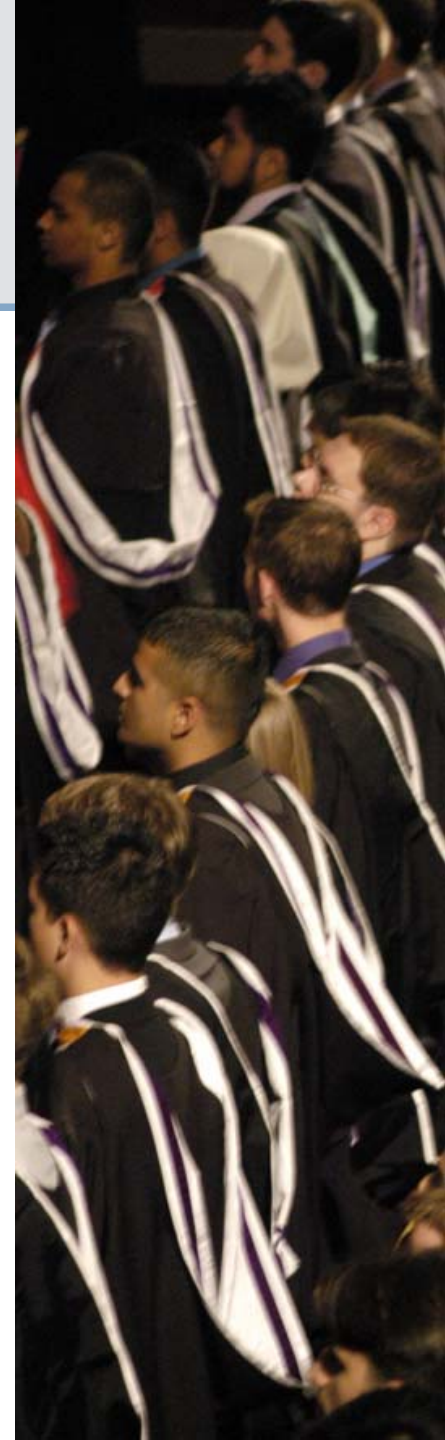
Career management

The range of skills

Research skills and techniques

Research environment

- Ethical issues - peer review, pressure for results, conflicts of interest, secrecy, obligation to the public
- Commercialisation

Research management

- Time management, prioritisation, realism
- Project management, milestones etc
- Data management, IT skills

The range of skills

Personal effectiveness

- Self-discipline, motivation, initiative
- Awareness of self limitations, training needs

Communication skills

- Writing
- Oral presentations: brief, long
- Professional audiences, public understanding
- Teaching, media
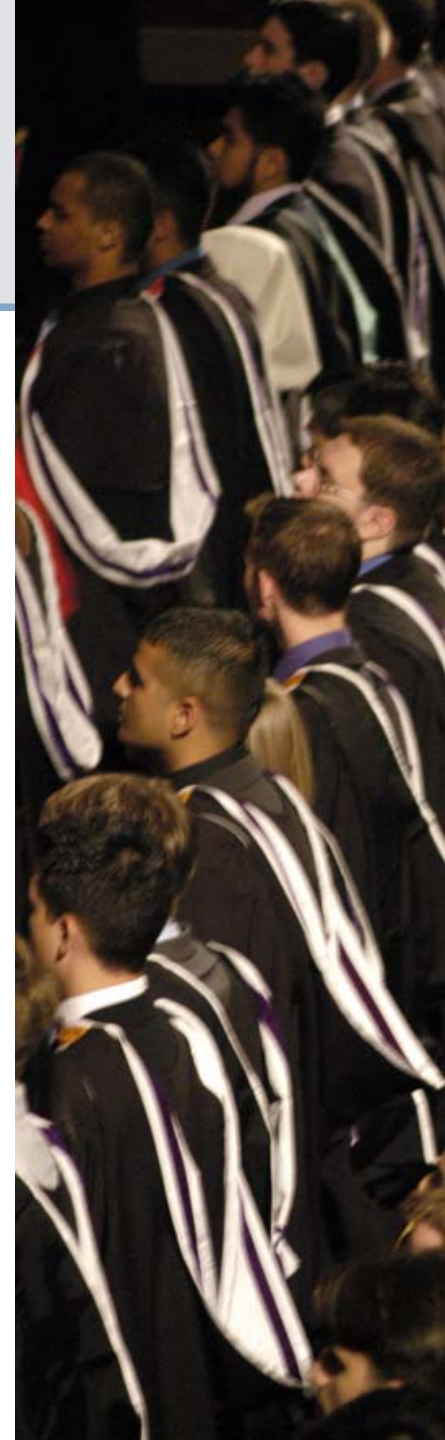
The range of skills

Networking and teamworking
- Within research group, institution, wider research community
- Understand behaviour, impact on others
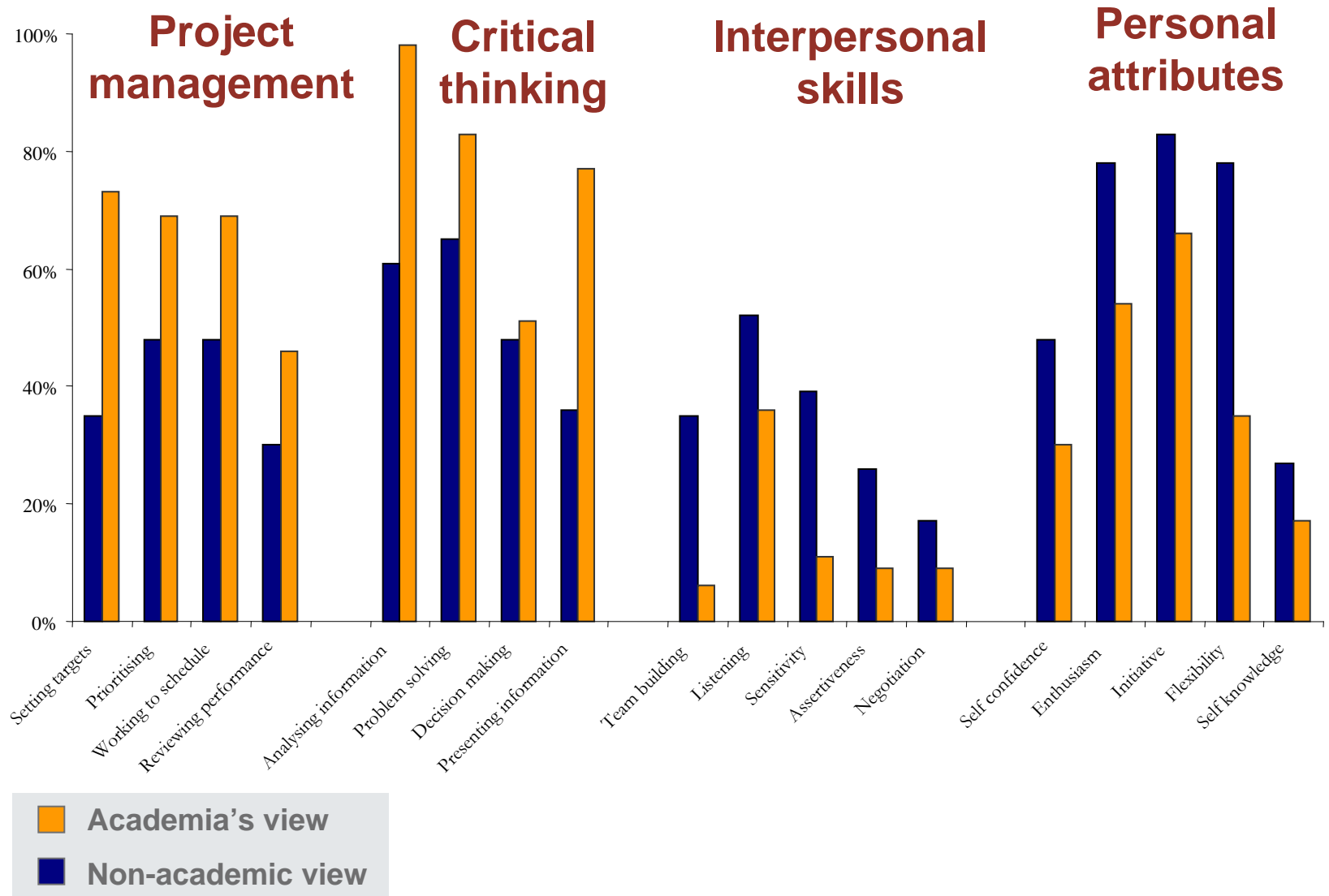
Career management
- Ownership, realistic goals, identify development needs
- Insight into transferable nature of research skills, range of career opportunities within/outside academia
- Effective presentation - CVs, applications, interviews
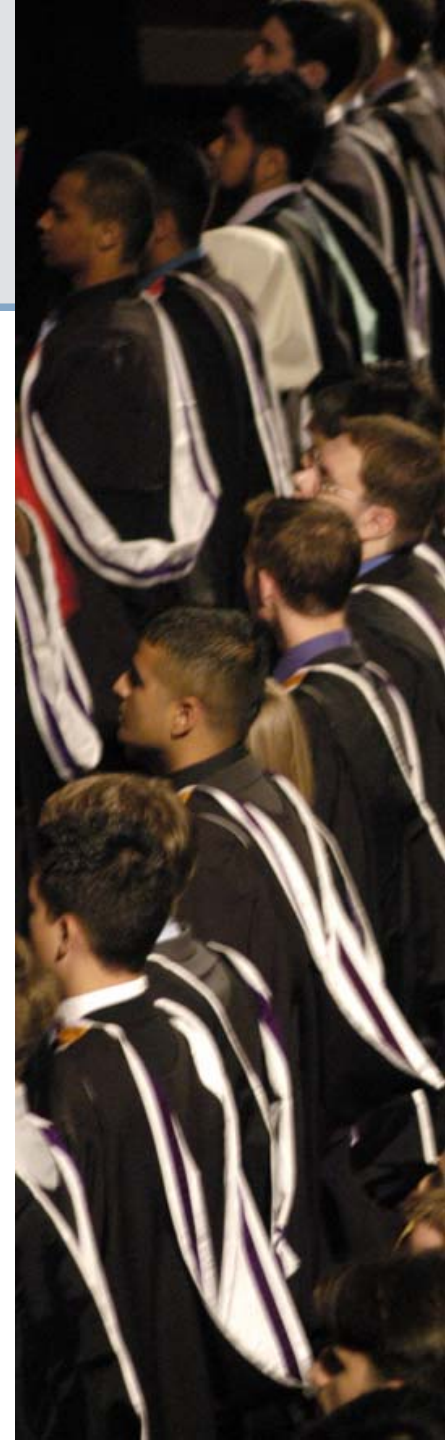
Stakeholders - What Do PhDs Do?: Key Occupations
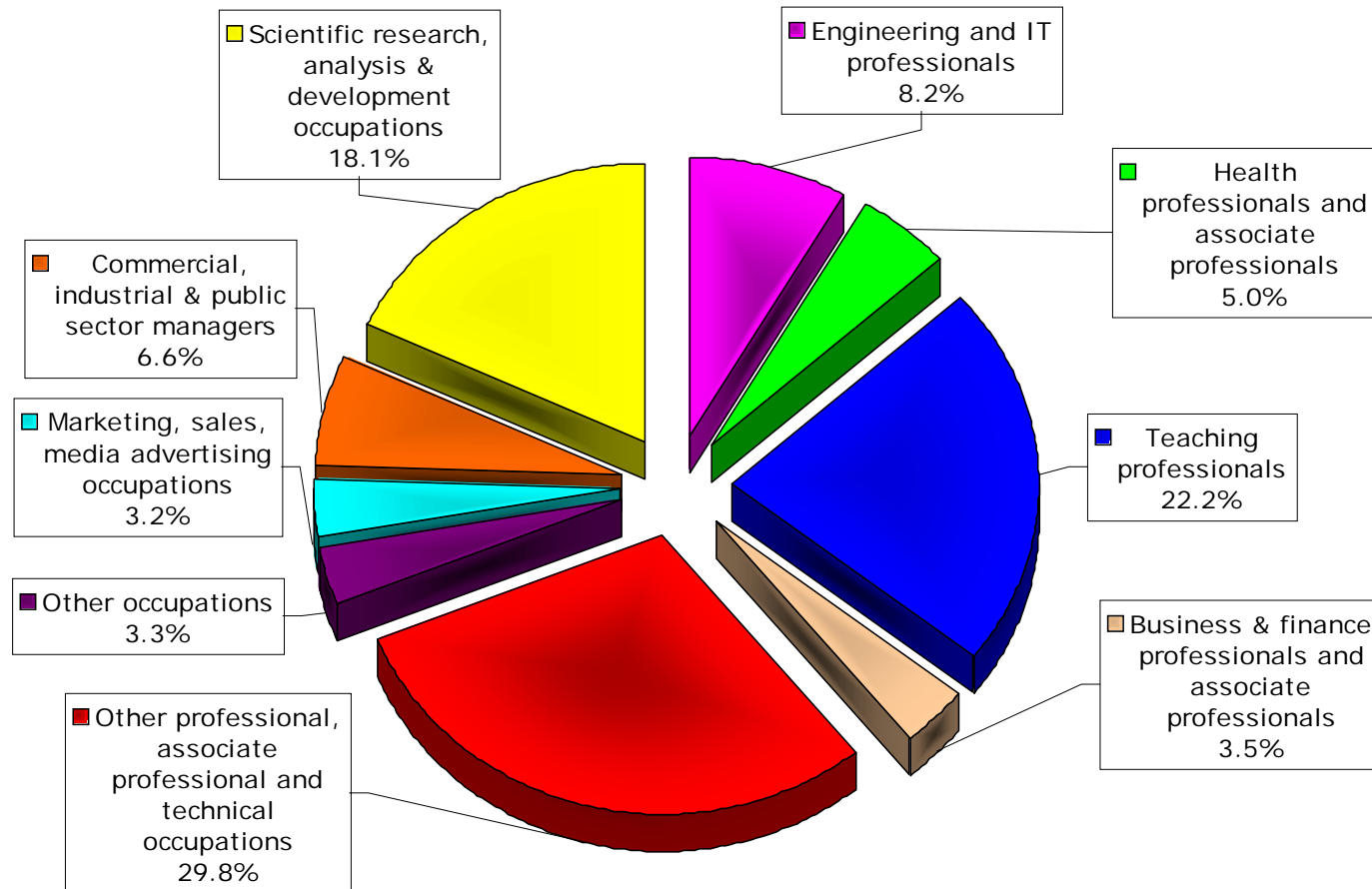
Stakeholders - Skills and attributes essential for researchers

Stakeholders - Less than a preparation for a career...

2003 Study: PhD career paths 6-8 years on

[50% private sector / 35% academia / 15% public sector]

Skills that could have been given more emphasis:

- project management: 32%
- leadership: 23%
- financial management 23%
- time management: 21%
- teamwork and communication: 19%
- organisation and planning 13%

Study of the Career Paths of PPARC PhD graduates, 2003

Transferable skills training - 7 major areas identified

Research skills and techniques

Research environment

Research management

Personal effectiveness

Communications skills

Networking and team-working

Career management

Additional key skills

Skills to operate in an intercultural, global context

Skills to operate in an entrepreneurial commercial/industrial context

Outreach; the next generation; sustainability

Not just about gaining new skills

Recognition of skills you already have

Transferable skills – examples of some of the >40 different training workshops

Science, research and integrity

Time management and personal effectiveness

Communication and presentation skills

Writing skills

Science and the media

Commercialisation of research

Information retrieval

Statistics

Teamwork

Negotiation skills

Motivation

Career planning

Thesis writing and completing the PhD

3-day residential workshop; Easthampstead Park

Residential 3-day workshops for all students in their 1st and final year

Easthampstead Park, Berkshire

- Space for team activities and informal interaction
- Distance from their lab/department!

Year-1 course:

- Designed for students early in their research careers, with long term career effectiveness
- Ethos: enhancing personal and research skills

Final year non-residential course

- Career focus

- *Collaborative residential workshops with: IDEA League; NUS & NTU*

Day 1: Research Skills

Planning and Project Management

- The framework MPhil ➔ PhD

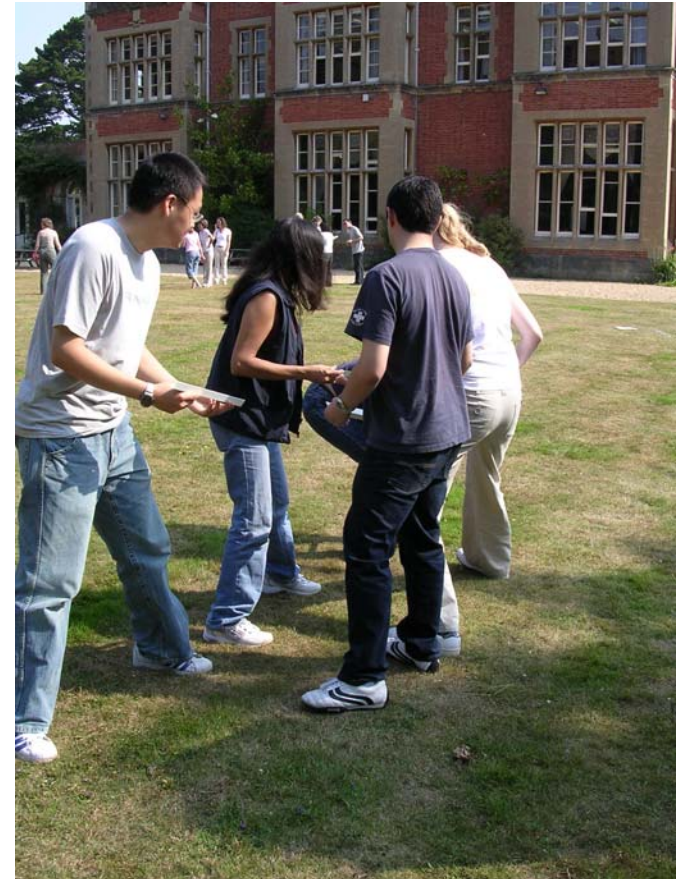Individual Research Degree Planning

- Gant and network charts

Creativity

- Attitude and skills

Resources

- Technical, analytical, social

Day 2: Self Awareness and Relationships

- Group Dynamics
- Introduction to Myers Briggs
- Conflict and Collaboration
- Course Dinner

Day 3: Succeeding in Research

Research Collaboration

Research Challenges

- Student – supervisor relationship
- PhD planning
- Motivation
- Networking
- Stress management

Who delivers this training?

Internal professionals

- 2 Senior Lecturers in Transferable Skills (2004)
- Science Communication Group, Humanities Department
- Business School staff

Training-the-trainers

- Cohort of ~50 internal academic staff (from Science Departments)
- Communications and presentation skills
- Teamwork

External professionals (very few)

Times Higher Awards 2006
Outstanding Support for Early Careers Researchers

Imperial's Graduate Schools won the Times Higher Awards 2006 in the category of Outstanding Support for Early Careers Researchers.

More than 90 of the UK's universities took part

The judges felt that

- *'Imperial College has taken an innovative and integrated approach to supporting early-careers researchers.'*

Ethos of Imperial College

- Research-led development of transferable skills programme
- Skills development is no longer viewed as something that is bought in or tagged on, but rather something that staff across the College work together to produce
- Is skills training effective?

Are we doing the right thing? Are our programmes effective?

Short term metrics

- Students score workshops/courses highly
- On a scale of 0-5, all workshops score >4 for both usefulness and tutor quality

Long term metrics e.g.

- Employment rates
- Employers' views
- Benefit to the economy?
- Benefits to society?
- More difficult and too early to assess

Are we doing the right thing? Are our programmes effective?

Is the training useful and effective?

An important area of research in itself!

SKIPI: a Skills Perception Inventory for Evaluating Postgraduate Transferable Skills Development

- Evaluation inventory; questionnaire
- Designed to provide quantitative feedback on effects of training
- 3-day residential RSD course for 1st year PhD students
- Measures students' perception of their skill levels in 4 skills domains:
  - Group work
  - Communication
  - Project management
  - Personal awareness
- 5th area measures students' attitudes to benefits or not of Transferable Skills training
- Statistical analysis (Crobach alpha calculation) to refine this; all 5 scales have good reliability
- Administered at start and finish of course, and 5-6 weeks later
- 10 courses; 298 participants

Esat Alpay and Elaine Walsh. "A Skills Perception Inventory for Evaluating Postgraduate Transferable Skills Development", Assessment and Evaluation in Higher Education (2007).

Marked 1 (v uncomfortable) to 5 (v comfortable)

- Recognising excessive stress in myself
- Co-ordinating a group project
- Being able to enthuse a non-expert about my work

- Having a good understanding of research ethics
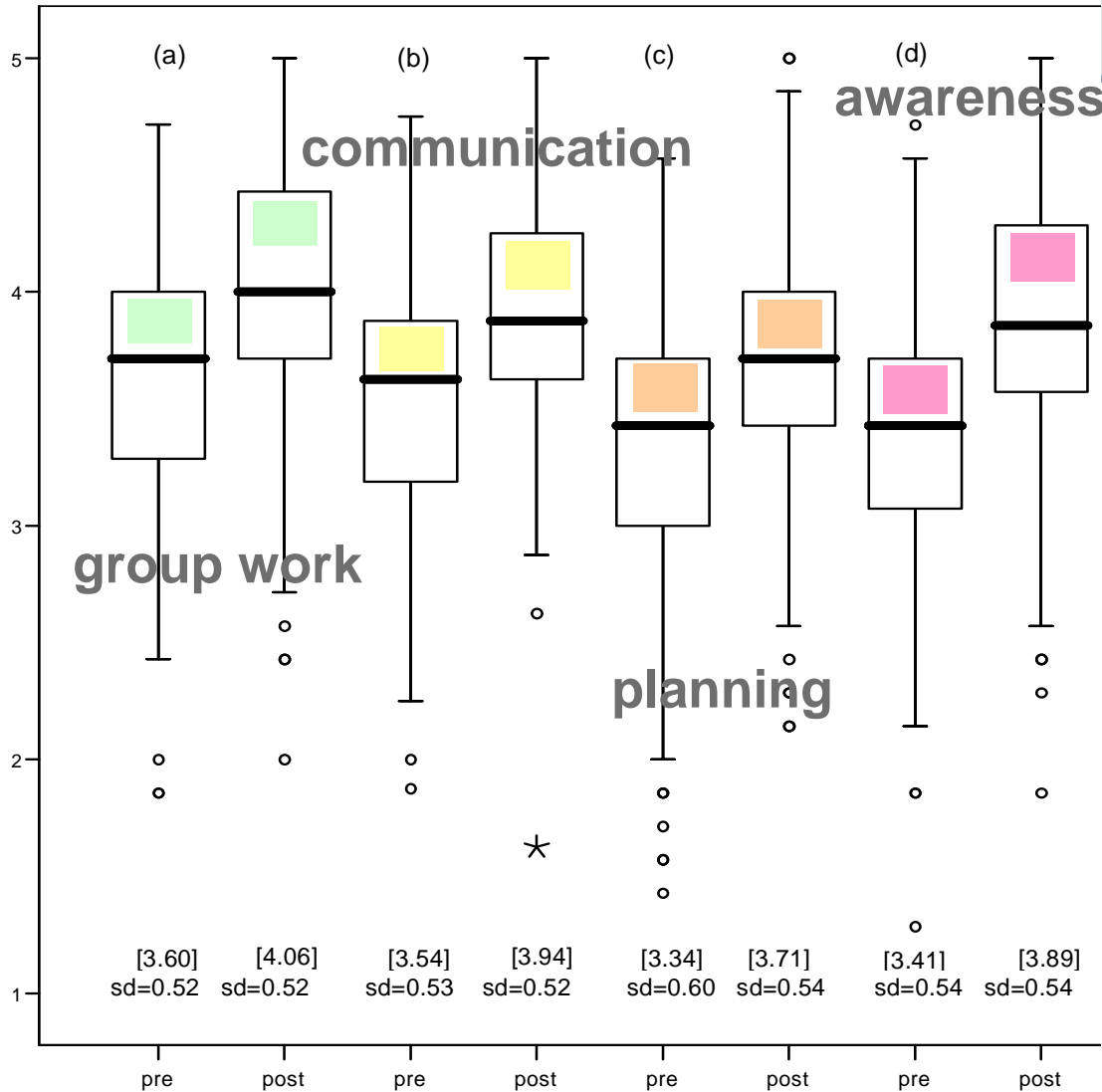- Describing the good attributes of a conference poster

SKIPI – some results so far (1)

- Focus of this research/analysis was on student confidence and beliefs

- Significant improvement in all 4 domains when pre- and post course data compared; maintained at 5 weeks
- Similar improvement in perceived value of skills training

Pre- and Post-Course Differences?

✓ p < 0.001 for all cases

✓control Q's:
no differences

SKIPI – some results so far (2)

- Gender differences seen in perceptions on 'group work' and 'communication' pre-course but post-course differences not significant
- Subject area differences
  - Students from Faculty of Natural Sciences believed the value of skills training was lower than their counterparts in Engineering and Medicine
- Country of residence
- The project itself has raised student awareness of the skills that they already have and need to develop

Future work

- University context:
    - Refine analysis; in depth analysis of specific skills domains
    - Longitudinal study – to determine long-term efficacy
    - Focus groups, interviews, case studies
    - Future course development in light of these findings
- National context
    - UK GRAD
        - » Research Councils UK
        - » Advisory Board
        - » Centre of Excellence; Incubator; Regional Hubs
    - "Rugby" Team
        - » A Sector working group (many stakeholders)
        - » working on the evaluation of skills development of early career researchers

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Research training and the knowledge society

Key ingredients:

Specialist research skills and knowledge

Ability to use and transfer these skills and knowledge to

- Career path
- Society

Doctoral training: some conclusions

- Recognise the continuum from Bachelors to Masters to PhD to postdoctoral scientist

- Need appropriate modes of delivery: ranging from skills acquisition embedded in specialist academic training to 'total immersion' residential transferable skills workshops

- Need to cater for wide range of careers, not just academia and industry

- Need to involve doctoral candidates, postdoctoral researchers and employers in developing the repertoire of skills training

Doctoral training – some conclusions

- Ensure that PhDs and postdoctoral researchers gain both the specialist and transferable skills they need – in consultation with the stakeholders/employers

- Ensure that PhDs and postdoctoral researchers know and understand what specialist and transferable skills they have

- Ensure that employers know and understand what specialist and transferable skills our PhDs and postdoctoral researchers have

BUT PhD is still a training in research by research!

Changing nature of doctoral programmes

"the product that the PhD researcher creates is not the thesis – vital though that is to their subject area through the creation of original knowledge – no, the product of their study is the development of themselves"

Sir Gareth Roberts

Thank you