

# ***CHALLENGING LIFE SCIENCE UNIVERSITIES TO DELIVER GRADUATES FOR A GLOBAL WORLD***



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# “THE ASK”

- a. Reflect on leadership challenges as Dean of Life Sciences at Reading to deliver qualified graduates capable of addressing global challenges
- b. How life sciences [higher] education needs to change (drivers? Why change)
- c. Provide (part of) start to our discussion

# ***CHALLENGING LIFE SCIENCE UNIVERSITIES TO DELIVER GRADUATES FOR A GLOBAL WORLD***

## Why Global?

- Globalisation (trade and much more)
- Interconnectivity (weather systems to internet)
- Global Equity (including International Law)
- Pollution ignores national boundaries
- Isolationism and Nationalism are no more (?)
- Graduates' opportunities less constrained by national boundaries than ever before
- Survival of the HEI

# NOT EVERYONE AGREES WITH GLOBALISATION / INTERNATIONALISM

Until June 23<sup>rd</sup> 2016

Same coach thereafter



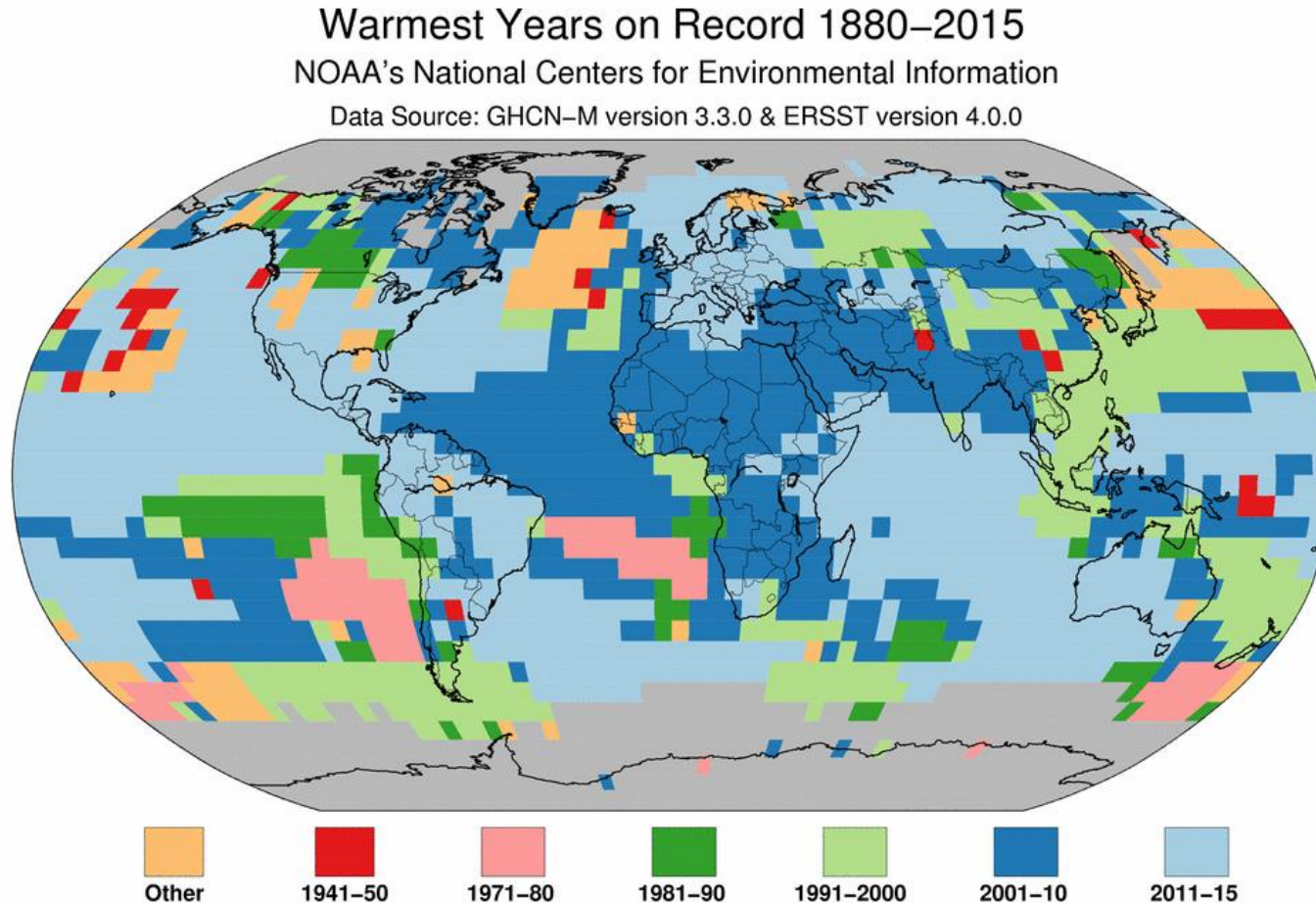
Majority of UK graduates voted  
Remain, but substantial minority  
voted Leave.

Conservative "Eurosceptic"  
MEP (SE England) Daniel Hannan



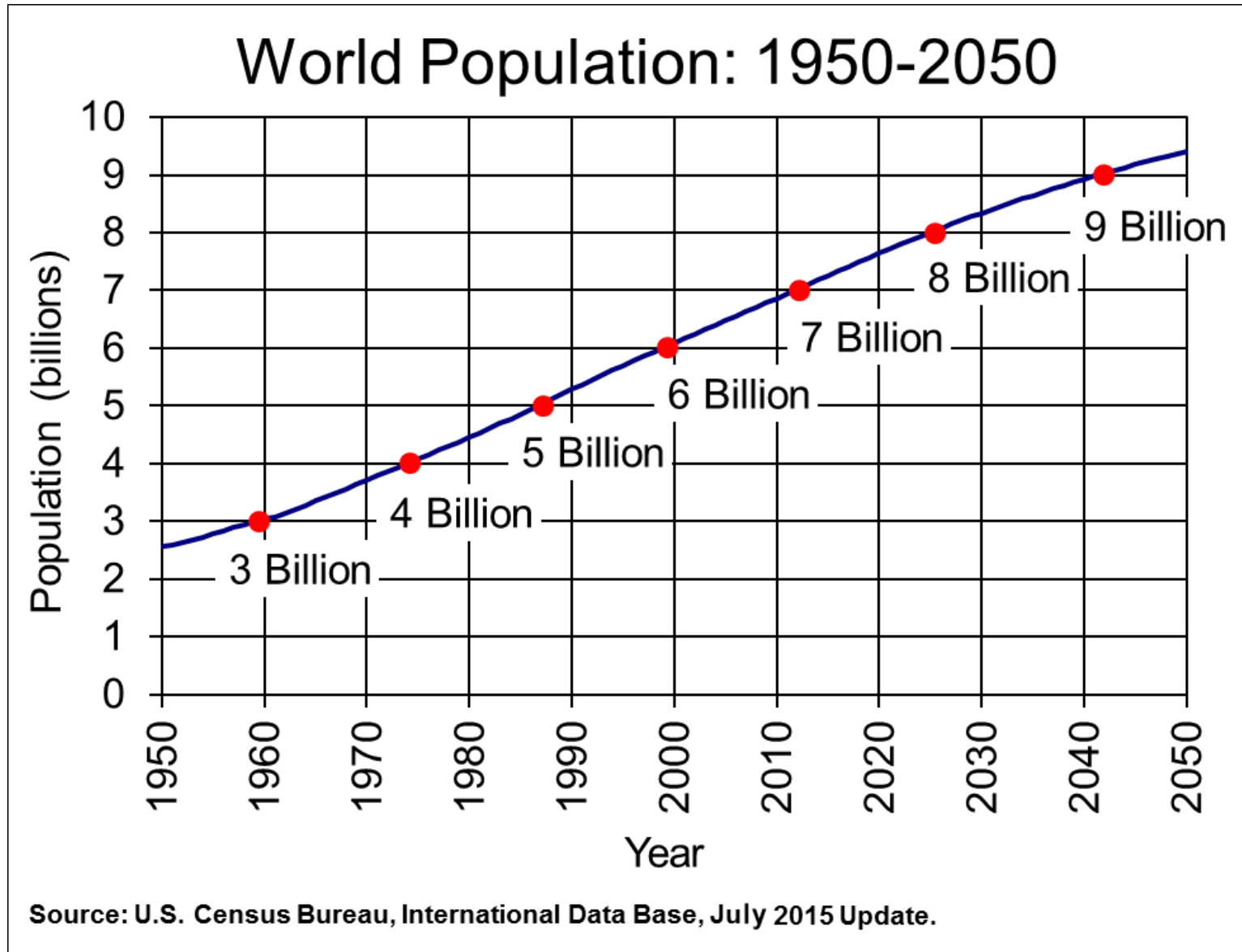
# CLIMATE CHANGE

## WARMEST YEARS ON RECORD (LAND & OCEANS) *DARK (2001-10), LIGHT BLUE (2011-15)*

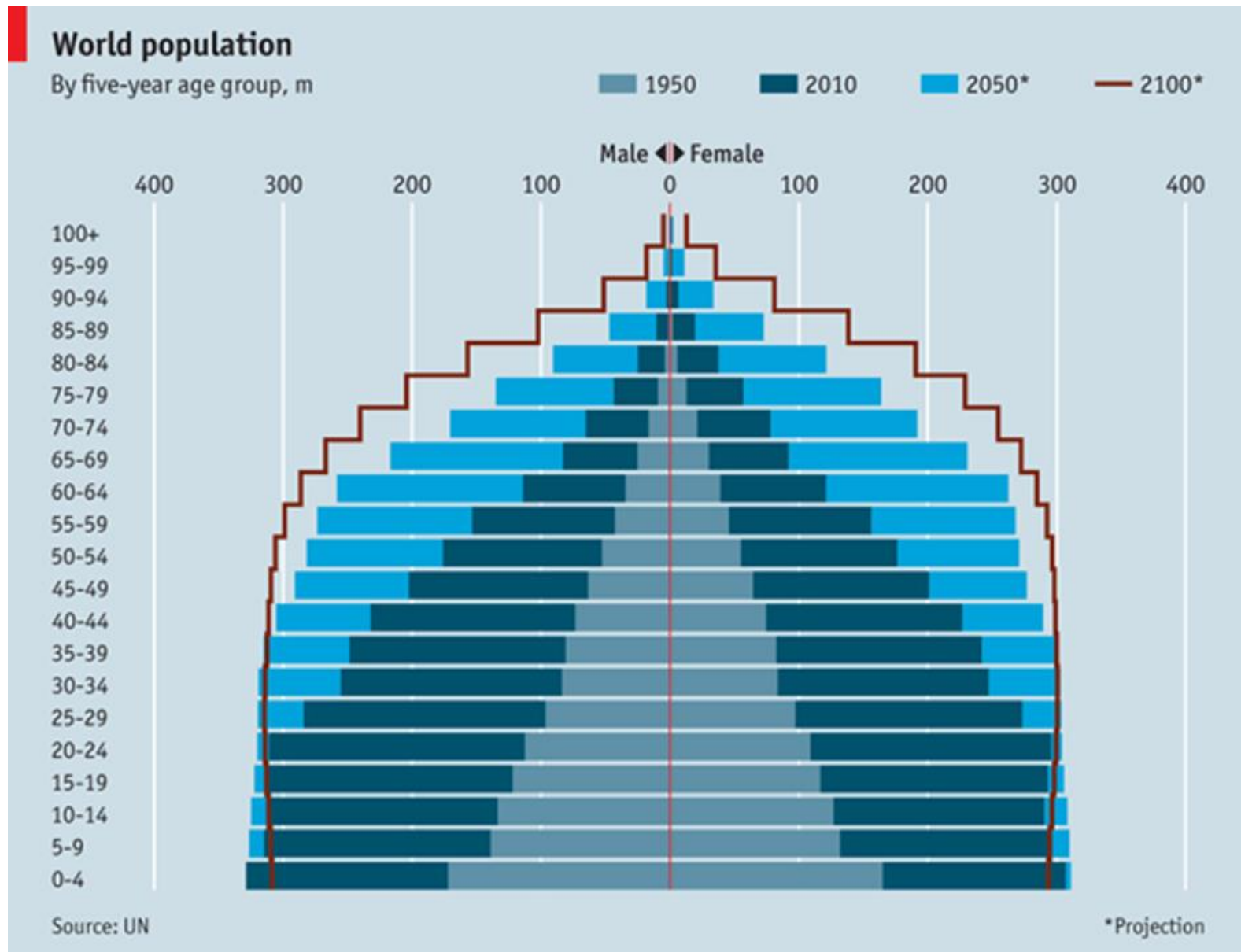


# POPULATION GROWTH

LOWER ESTIMATES FOR 2050 THAN 30 YEARS AGO - THEN DECLINE



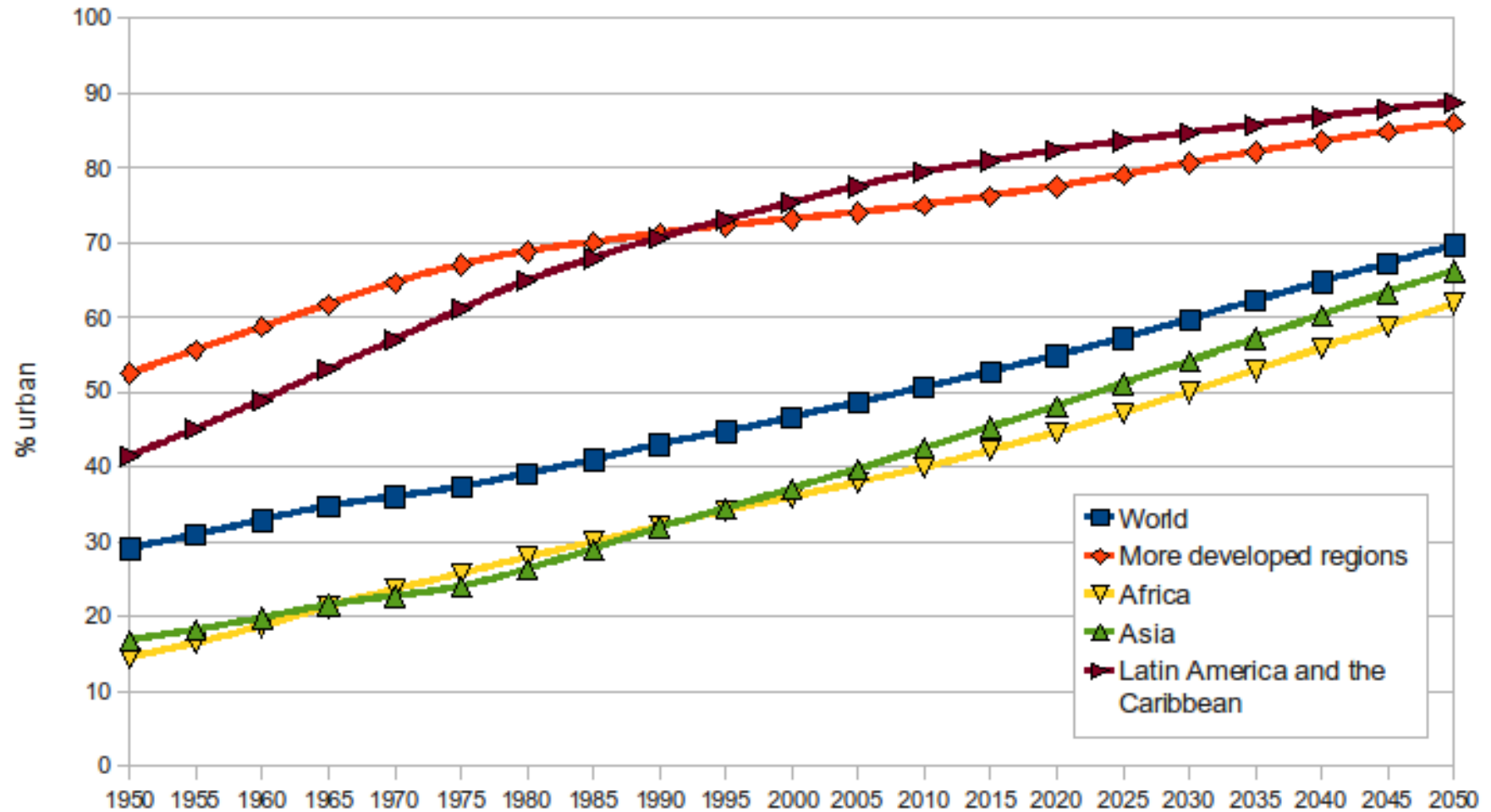
# DEMOGRAPHICS (NOT JUST ME GETTING OLDER)



# OVER HALF GLOBAL POPULATION LIVE IN CITIES (BLUE LINE)

Percentage of Population Living in Urban Areas by Region, 1950-2050.

Source: UN World Urbanization Prospects, 2007.





# SUSTAINABLE DEVELOPMENT GOALS (UNDP) 2016-2030

Sustainable Development Goals (SDGs or Global Goals) will

- **end poverty**
- **protect the planet**
- **ensure that all people enjoy peace and prosperity**

Build on Millennium Development Goals successes & other interconnected goals:

- **climate change**
- **economic inequality**
- **innovation**
- **sustainable consumption**
- **peace and justice**

Spirit of partnership and pragmatism - **right choices for future generations**

Where are the life sciences and the life sciences universities **not** involved?

*Not = more  
food production*



**THE GLOBAL GOALS**  
For Sustainable Development



# OUR LIFE SCIENCES UNIVERSITIES HAVE

## Contributed substantially to

- the debate underlying the SDG
- & generation and dissemination of the discovery and understanding of the problems and of the solutions or mitigations or adaptations required either directly (through our own R&D and communications) and indirectly through the actions of our alumni.

But also, acknowledge ..

- Our share of responsibilities for what went before (ourselves or our graduates)
- Difficulties in addressing such matters “head on” in our curricula

# LIFE SCIENCES UNIVERSITIES CAN

Address the **Sustainable Development Goals** (SDG) and **COP21** (2015 Paris Climate Conference goal to keep global warming below 2°C); e.g., **teach**

- **Food and nutritional security and safety**
- **Sustainable management of natural resources**
- **Develop and utilisation of bio-renewable resources**
- **Enhancement of economic viability** of food and non-food chains (including “circular economy”)
- **Reduction of poverty.**

But remember

- Few “customers” for a direct approach to e.g. SDG (e.g. BSc International Development cf other programmes)
- “Granny State” / overload / generational fairness problems

# N – S HEI RELATIONSHIPS

A difficult question for HEIs

- How to link curricula **N- S amongst HEIs?**
- How do **N** HEIs support **S** HEIs?
- Or just mutual support to students and staff?

Don't forget value of producing books, papers, other media.

National regulations (including charity law), institutional autonomy, Competition and Mergers Authority (UK), provide a complex set of rules for HEI collaboration – as well as IPR

**Open online courses [(M)OOCs]:** e.g. delivery (only) by Futurelearn ([www.futurelearn.com](http://www.futurelearn.com)) - University of Reading in one of many universities worldwide providing OOCs on this UK platform



# LIFE SCIENCES

“Fields of science that involve the scientific study of living organisms – such as microorganisms, plants, animals, and human beings – as well as related considerations like bioethics”

## The life sciences

“... help in improving the quality and standard of life.”

“... have applications in health, agriculture, medicine, and the pharmaceutical and food science industries.”

From Wikipedia

# LIST OF LIFE SCIENCES (1/3)

FROM WIKIPEDIA

## *Biology and its branches*

**Agriculture**; Anatomy; Biochemistry, Bioengineering, Biomechanics, Biomedical research, Biophysics; Biotechnology; Botany; Cell biology; Developmental biology; **Ecology**; Epidemiology; Evolutionary biology; Genetics; Haematology; Marine biology; Microbiology; Molecular biology; Mycology; Neurobiology; Paleontology; Pathology; Physiology; Phytopathology; Population biology; Sociobiology; Structural biology; Systems biology; Toxicology; Zoology.

# LIST OF LIFE SCIENCES (2/3)

## *Medicine and its branches*

Anaesthesiology; Cardiology; Critical care medicine; Dermatology; Emergency medicine; Endocrinology; Gastroenterology; General Practice; Geriatrics; Gynaecology; Haematology; Hepatology; Infectious disease; Neurology; Nephrology; Oncology; Ophthalmology; Otolaryngology; Pathology; Paediatrics; Pharmacology; Pulmonology; Psychiatry; Radiology; Rheumatology; Splanchnology; Surgery; Urology; **Veterinary medicine.**

# LIST OF LIFE SCIENCES (3/3)

*New / other life sciences*

Affective neuroscience; Biocomputers; Biocontrol;  
Biodynamics; Bioelectronics; **Bioinformatics**;  
**Biomaterials**; Biomedical science; Biomedicine;  
Biomonitoring; Biopolymer; Cognitive neuroscience;  
Computational neuroscience; **Environmental science**;  
Fermentation; **Food science**; Genomics; Health sciences;  
Immunogenetics; Immunotherapy; Kinesiology; Medical  
device; Medical imaging; Medical social work;  
Neuroethology; Optogenetics; Optometry;  
Pharmacogenomics; Pharmaceutical sciences;  
Pharmacology; Population dynamics; Proteomics;  
Psychiatric social work; Psychology; Sports science.

- 1907 Science and Letters Faculties created
- 1926 **Faculty of Agriculture and Horticulture** created
- 1961 Renamed **Faculty of Agriculture**
- 1971 Renamed **Faculty of Agriculture and Food**
- 2000 Renamed **Faculty of Life Sciences** – and expanded with all of the Biological Sciences, plus Applied Statistics, plus International Development (what was Agricultural Extension & Development)
- 2004 School of Pharmacy created within Life Sciences
- 2016 **End of all Faculties** at the University of Reading



- ... covers breadth of biological-chemical sciences & application to real world with which we all interact: from embryology & child development, through human behaviour (economics & psychology), to ageing.
- Human well-being supported directly by agriculture, horticulture, food, nutrition together with biomedicine & pharmacy.
- Teaching & research seek to understand biodiversity and its conservation in current & future climates worldwide in context of human development & poverty alleviation.
- Staff & students are cosmopolitan with high international reputations in teaching & research, impacts of our research regionally, nationally & globally , & in our graduates' achievements.

# LIFE SCIENCES

## A RANGE OF INTERPRETATIONS?

- USA and UK - Life Sciences tends towards biomedical/pharmaceutical (“Health and Life Sciences”) – and developed world?
- Continental Europe - Life Sciences tends more towards agriculture, food, rural environment and economy - and global interpretation?
- University of Reading – in middle/both of above? New building to be “Health and Life Sciences”

# LIFE SCIENCES UNIVERSITY OF READING



- Life Sciences, 67th in world (Times Higher Education, 2015)
- Agriculture and Food, 12th in world (QS World University Rankings by Subject, 2016)

In last 8 years

- 54% increase in total student FTEs (whilst fees trebled), within which a more than doubling of International FTEs;
- Substantial increase (>50%) in research activity and annual external research income won
- UK Research Excellence Framework (REF) 2014 excellent results

# LIFE SCIENCES UNIVERSITY OF READING

Achieved by a senior team

- working well together (critical allies; mutual support)
- across normal discipline boundaries
- recognising (urgent) need for change
- having clear visions
- encouraging innovation
- adapting plans year-by-year as markets changed (recognising which innovations succeeded; closing those that did not).

## UNDERGRADUATE PROGRAMMES

BSc Nutrition and Food Science; BSc Food Science; BSc Food Science with Business; BSc Food Technology; MPharm Pharmacy; MChem Chemistry; BSc Chemistry; BSc Chemistry with Forensic Analysis; BSc Chemistry via the Open University; BSc Agricultural Business Management; BSc Agriculture; BSc Animal Science; BSc Consumer Behaviour and Marketing; BSc Environmental Management; BSc Food Marketing and Business Economics; BSc International Development; BSc Psychology; BSc Psychology with Professional Placement; BSc Language Sciences & Psychology; BSc Speech & Language Therapy; BSc Psychology with Neuroscience; MSci Psychological Theory and Practice; BSc Biochemistry; BSc Biological Sciences; BSc Biomedical Sciences; BEng/MEng Biomedical Engineering; BSc Ecology and Wildlife Conservation; BSc Microbiology; BSc Zoology

Majority of above can be combined with a [Year in Industry](#)



# NEW PROGRAMMES

## NEW TYPES OF CAREERS

e.g. **Postgraduate Diploma Physician Associate (PA)**

Healthcare professional trained in medical model works under supervision of doctor in diagnosis and management of patients

**New role in UK NHS - >40 years in USA post Vietnam**

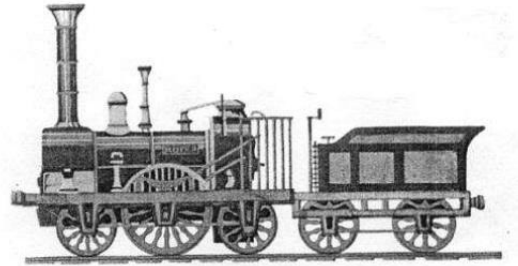
- 2-year premium-fee, student-funded programme
- Good quality BSc in Biomedical Science or similar entrants
- VBR – NHS Values-Based Recruitment
- Extensive **collaboration with NHS** Trusts and GP practices
- 25% “academic education” 75% workplace training and reflection
- National examination (not UoR)

# BIOLOGY

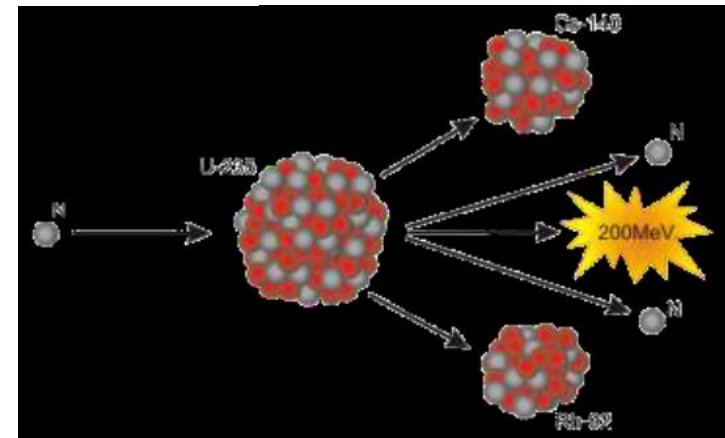
## “THE 21ST CENTURY SCIENCE” (?)

**Association with scientific and technological progress  
by century**

**19th: Age of Engineering**



**20th: Age of Chemistry & Physics**



**21st: Age of Biology**



# SHOULD LIFE SCIENCES GRADUATES CONSIDER BIOLOGY THE 21ST CENTURY SCIENCE (½)?

- No – **misleading hyperbole**
- Life sciences graduates will need to be able to (understand and ) **integrate across the silos** of the many different sciences & technologies to define and solve real world problems
- The **many different sciences & technologies** include biology writ large (Life Sciences), but also big data-bioinformatics- biomathematics-computing-AI-robotics, nanoscale and larger chemistry & engineering, etc, etc
- *Continued*

# SHOULD LIFE SCIENCES GRADUATES CONSIDER BIOLOGY THE 21ST CENTURY SCIENCE (2/2)?

- *continued*
- & **economic and social sciences** (not just management)
- & understand realistically “**real world of business, trade, innovation and entrepreneurism**”
- But deep understanding of all the above is impossible
- So, understand enough of the disciplines to **communicate effectively across the silos**
- Hence - amongst “soft skills” development - ability to **work in and lead teams of diverse specialists**
- And **ethics** ....

## **Across business and including banking post 2007-8 crisis**

No longer CSR (corporate social responsibility)  
delegated to one board member, but ...

- responsible business,
- responsible managers,
- responsible directors,
- behaving ethically

(?)



# GORDON GECKO IS NO MORE?

“The point is, ladies and gentleman, that greed -- for lack of a better word -- is good.

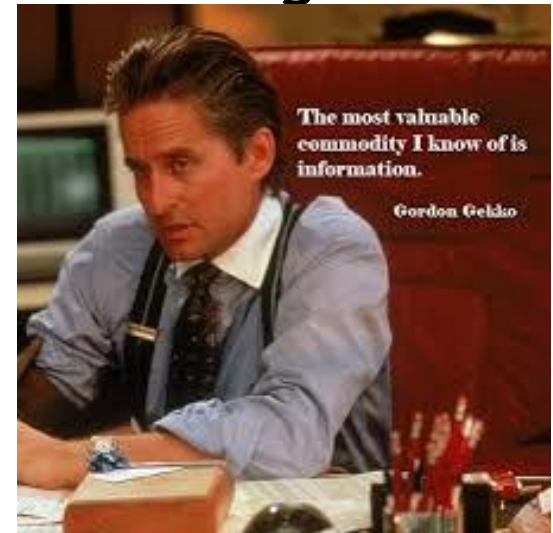
Greed is right. Greed works.

Greed clarifies, cuts through, and captures the essence of the evolutionary spirit.

Greed, in all of its forms -- greed for life, for money, for love, knowledge -- has marked the upward surge of mankind.

And greed .... [will save] ... the USA.”

From "Wall Street" (1987) Director: Oliver Stone



# STUDENTS

- **Learners**
- **Customers\***
- **Colleagues** (particularly postgraduates; staff lifelong learners too)
- **Alumni thereafter**
- **Student recruitment & (disconnected) graduate employment markets**

\*Undergraduate fees

1998/9	free to students across UK
1999/2000	£1,000 pa England**
2005/6	£3,000 pa England
2012/13	£9,000 pa England
2017/18	£9,250 pa England
From 2014	Treasury cap on student numbers abolished

\*\* Differs amongst England, Wales, Scotland, Northern Ireland (a devolved power)

# MARKET FORCES

# STUDENT VOICE

# EMPLOYERS' OPINIONS

Market: constraints to delivering (enough) life sciences graduates for a global world in free market economies?

Student voice: to what extent should university students determine their own curricula (how flexible should “pick and mix” be?)

Avoid curricula hindering personal development of the mavericks and/or high flyers –future potential game changers

Or legislate for less-able fraction of population?

***(Inclusive curricula and learning environments for all)***

Extent of response to employers' expressed opinions?

Is extent of role of degree-accrediting professional bodies in determining curricula appropriate?

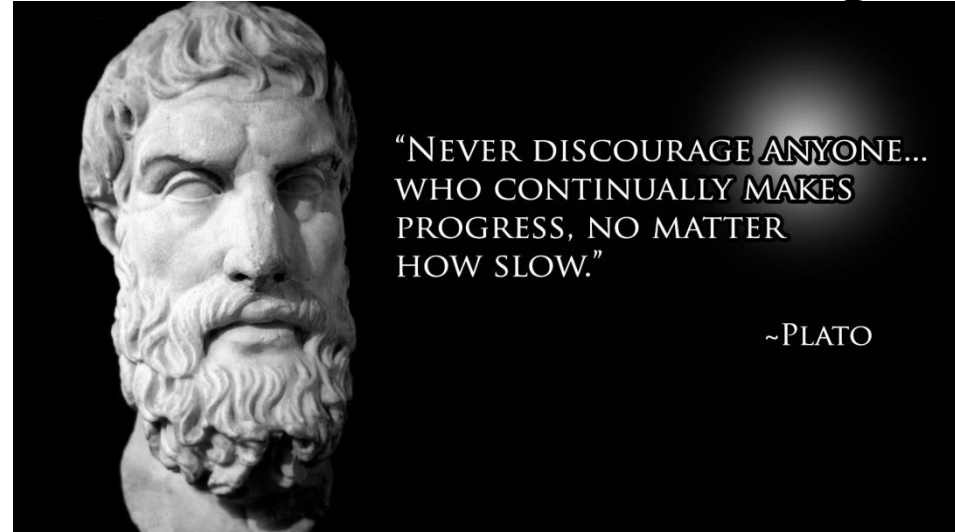
Or governments (e.g. EU rules for health programmes)?

# STUDENT ENTRY INTO LIFE SCIENCES UNIVERSITIES (UK)



THEN	NOW
High academic achievements in Biology, Chemistry, Geography, Mathematics, Physics	Academic (A levels, many disciplines) and more vocational qualification (BTec) routes to entry
Relevant experience	Placements during programmes?
Made of the “right stuff”	Widening participation
Age participation rate <b>4-8%</b> (UK; early to late 1960s)	Age participation rate <b>47%</b> (UK; 2014/15)
Centrally planned & implemented	Market forces: students are now customers
“Elitist HE system – opening up”	“Mass HE system”

# “THE OFFER” - MORE THAN JUST CURRICULUM



“NEVER DISCOURAGE ANYONE...  
WHO CONTINUALLY MAKES  
PROGRESS, NO MATTER  
HOW SLOW.”

~PLATO

Higher **education or training**?

From the times of the Greek Empire

Purpose of education:

- produce a well-trained, obedient, and fit army (Sparta); or
- create citizens able to philosophise on science and art through logic (Athens)?

Latter is the way to create new knowledge and understanding, and lifelong learners; but e.g.

- Training in how to work safely in field and laboratory;
- Use a microscope; etc

*Plus need to **engage fully in extra-curricular activities** at University*

# “CONTENT” PLUS

- **Subject-specific knowledge and understanding ...**
- **Abilities and skills ...**
- **Intellectual skills ...**
- **Practical skills ...**
- **Analytical and data interpretation skills ...**
- **Communication skills ...**
- **Digital literacy and social media skills ...**
- **Interpersonal and teamwork skills ...**
- **Self-management and professional development skills ...**

Including “demonstrate the competence, behaviour and attitude required in professional working life, including initiative, reflection, **leadership** and team skills”

*(From: HEFCE Subject Benchmark Statements)*

# PRACTICAL SKILLS

MSc Wildlife Management & Conservation:

**7 am:** bird netting (by licenced staff), identification, weighing, sexing, recording



# PERSONAL GROWTH AT UNIVERSITY (1/2)

From: Prof Jeff Brenzel (2010) ([www.huffingtonpost.com](http://www.huffingtonpost.com))



*Questions to graduating students :*

- “Are you graduating with broader views of what you might do in life compared to the ideas you had when you arrived?
- To what degree have you learned how to lead by subordinating your own ambition to the common good, rather than vice versa?
- Have you mastered a mode of inquiry, or developed anything that could constitute a permanent and fertile source of intellectual interest?
- How much more did you contribute to classes and organizations and jobs than you took from them.”\*

\* Be an **energy giver** not an energy taker (UoR graduations)



# PERSONAL GROWTH AT UNIVERSITY (2/2)

From: Prof Jeff Brenzel (2010) ([www.huffingtonpost.com](http://www.huffingtonpost.com))



*Questions to graduating students (continued) :*

- “Have you as yet loved anyone or anything beyond reason?
- Have you learned how and why to risk a serious, public failure?
- How well can you sustain a determined, focused and disciplined attempt to solve an important problem?
- How much more inclined and more able are you to recognize and appreciate real genius, whatever its mode of expression?
- What have you become willing to do without getting paid, graded or recognized?
- How much room have you been able to leave for the inconvenient exercise of compassion, kindness and generosity?”

*i.e. personal development (unlikely from distance learning?)*

**PROFESSOR ANNE GLOVER CBE,  
CHIEF SCIENTIFIC ADVISER TO  
PRESIDENT OF THE EUROPEAN COMMISSION  
AT OECD FORUM ON GLOBAL BIOTECHNOLOGY, PARIS, 2012**

**“ What do we need to fully deploy the opportunities  
offered by life sciences?**

- Smart scientists who develop**
- Smart politicians who regulate**
- Smart citizens who accept ”**

~~(accept)~~ unless education is simply “to produce a  
well-trained, obedient, and fit army”.

# FIRST DEGREE IS NOT ALWAYS ACADEMIC ENDPOINT

Practical experience in Agriculture or Food Industry



BSc Agriculture or Food Science/Technology



MSc and /or PhD Agriculture or Food Science/Technology



Further workplace experience in Agriculture or Food Industry



Leadership in Agri-Food

Remember the “journey”

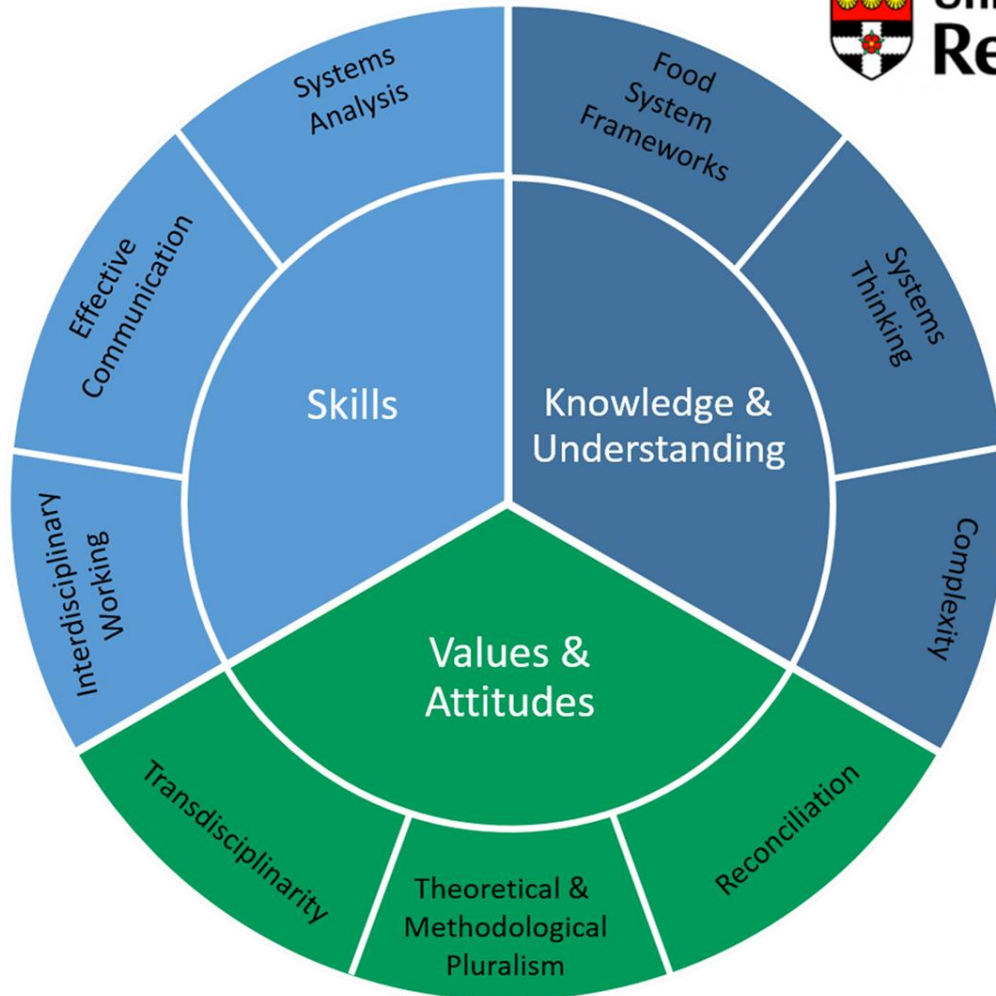


# IFSTAL

Innovative Food Systems Teaching And Learning



HEIs collaborating



University of  
Reading

LONDON  
SCHOOL of  
HYGIENE  
& TROPICAL  
MEDICINE



WARWICK  
THE UNIVERSITY OF WARWICK



SOAS  
University of London

RVC  
Royal  
Veterinary  
College  
University of London



**Postgraduate learning  
community and resource  
on food systems thinking**

fostering cross-disciplinary and  
inter-institution activities

40

# LIFELONG LEARNING

Growing realisation on all sides that

- Industry (**to prosper**) requires staff (employees) to be lifelong learners (beyond first degree)
- Staff require **time** for lifelong learning
- Staff require **funds** for lifelong learning
- Staff require **recognition** of lifelong learning achievements
- Industry and staff require **flexible** provision

Employer-University collaborations

e.g. **Food Advanced Training Partnership (Food ATP)**

Investment funding: competitive grant from UK Biotechnology and Biological Sciences Research Council (BBSRC)



The Food Advanced Training Partnership

**COLLABORATION**  
**2 UNIVERSITIES**  
**1 RESEARCH INSTITUTE**  
**1 INDUSTRY TRAINING BODY**  
**WITH RESEARCH COUNCIL SUPPORT**  
**FOR AGRI-FOOD INDUSTRY EMPLOYEES**  
***LIFELONG LEARNING IN WORKPLACE***



# FOOD ATP FLEXIBLE LEARNING

## Single modules as “one offs”

But also ...

**Modules can be combined** with other studies to **progress** to a **range of different postgraduate qualifications:**

**PG Certificate**

**PG Diploma**

**MSc**

**DAgriFood**

## Module

=

- 4-6 weeks distance learning
- + 3-4 days on campus intensive teaching
- + assignment by critical reflection & assessment



# *(HINDSIGHT)*

## AS DEAN / RECTOR: WHAT ARE THE LEVERS?

1. **Lead** by example
2. Ensure institution (or component) is **sustainable**
3. **Alert to/anticipate/aid** shifting sands of environment
4. **Appoint** the right staff
5. **Develop, promote, retain** staff with right values and achievements
6. **Recruit** the “right” students – and “right mix” **VBR**
7. “**Do right**” by your students (delivery) and alumni

Easier to achieve in a virtuous circle than a vicious circle, but “every journey begins with a single step”.



**"IT IS SIMPLY MADNESS TO KEEP  
DOING THE SAME THING,  
AND EXPECT DIFFERENT RESULTS"  
(ALBERT EINSTEIN)**

**“And in current times moreover ....  
to keep doing the same thing as  
before and expect the same results”  
(Richard Ellis)**