John W. McGrath
School of Biological Sciences and QUESTOR Centre
Bishop: "I'm afraid you've got a bad egg, Mr Jones";
Curate: "Oh, no, my Lord, I assure you that parts of it are excellent!"
Microorganisms and Disease
Microorganisms and the Environment

- Microorganisms essential for nutrient cycling
  - Carbon, Nitrogen and Phosphorus
Environmental Microbiology
The Unknown Microbial World

• So far only 5,000 or so bacteria characterised
Environmental Microbiology in Ireland

- Environmental microbiology is practised throughout Higher Education Sector

Anti-Fouling Strategies - Biodegradation of fats, oils and greases: DCU
Clean-up of contaminated sites: UCD
Environmental Microbiology in Ireland

• Research seeks to tackle such problems as:
  – Energy generation
  – Environmental protection
  – Climate change
  – Sustainability through material recovery
  – Marine microbiology
Energy: Anaerobic digestion

Vincent O’Flaherty – NUI Galway

- Market for energy from waste: €3 billion p.a. 2025
- All the potential waste utilized generate energy equivalent to approximately 3 million barrels of oil annually
- Save between 0.22 and 0.35 million tonnes of CO₂
Key Themes

- Bioenergy from cold, dilute wastewaters (domestic sewage) - commercialisation
- 2nd generation biofuels: meadow grass; organic wastes; municipal solid waste
- Multi-disciplinary: microbiologists, engineers, policy makers, regulators
Biologically Mediated Sustainable Energy Generation
Environmental Protection: Eutrophication
John McGrath - QUB

- Eutrophication biggest global threat to good water quality
- Caused by discharge of phosphorus
- Lough Neagh / Erne highly eutrophic
- Of 238 EPA monitored lakes, 86 currently do not comply with phosphorus targets
Burkholderia cepacia AM19

pH 7.5

pH 5.5
Phosphorus Recovery
Sustainability: Bioplastic
Kevin O’Connor - UCD

- Ireland >300,000 tonnes plastic waste generated annually
- 80% landfill
- Biodegradable plastics are part of the solution.
- Can be manufactured from waste and from renewable non food resources.
Bioplastic Production

Packaging & Biomedicine
Collaboration: Superior Waste Treatment

Energy - Waste treatment – Recovery
Marine Microbiology
Alan Dobson/Fergal O’Gara - UCC
John McGrath - QUB

- Ireland has 220 million acres of sea (17 million acres land)
- Microorganisms constitute more than 90% of the living biomass in the oceans.
- Microbial activity produces half of the Earth’s oxygen
- The marine environment is an increasingly important source of new enzymes, antibiotics, drug compounds
- Metagenomics to screen for these.
Marine Biodiscovery

Identification of:
- Novel genes and enzymes
- Drugs and drug precursors.
Summary

• Microbial enzymes and microbial processes are critical for next generation of sustainable technologies.
  • Biomass to biofuel
  • Waste treatment
  • Waste to value added products (phosphorus / plastic)
  • Producing the next generation of antibiotics / cytotoxics
Summary

- Investment in Ireland’s (North - South) R and D base, and the provision of microbiology degree courses, will underpin competitiveness in this area.
  - Job creation
  - Economic growth