The Institute of Physics and Engineering in Medicine (IPEM)

This talk will overview how to apply your current studies towards a career in Medical Physics or Medical Engineering.

IPEM is the UK Professional Body that will support you along this career path:

- beginning with successful completion of a physics / engineering degree
- then leading to further training and qualifications that specialise in fields applied to medicine or biology

What will we talk about?

- What have physicists and engineers done for health?
- What kind of roles are there for physicists and engineers in medicine?
- What is IPEM and how can we help you?
- Your future as a medical physicist or medical engineer
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Well-known applications in medicine

• Medical imaging
  – X-ray, CT and MRI
  – Nuclear Medicine
  – Ultrasound
• Radiotherapy
  – X-rays from linear accelerators to treat cancer
  – Brachytherapy
  – Radiation protection and staff safety
• Medical device development
  – Endoscopes
  – Artificial hearts and implants
  – Physiological monitoring
Research, Innovation, Development – Physics

From the first basic X-ray in 1895, medical imaging has developed into a series of sophisticated diagnosis and research tools, such as CT, PET, and MRI scanners. Imaging technologies enable the diagnosis and treatment planning of common conditions (e.g. cancer, heart defects) as well as groundbreaking research to better understand complex illnesses like schizophrenia and depression.

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Research, Innovation, Development – Engineering

Neonatal incubators were developed in the 1920s to regulate body temperature and evaporation loss in premature babies. Modern incubators tightly control a range of environmental conditions to minimise physiological stress while continuously monitoring the newborn through sensors and instrumentation.
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Employment in “Health”

- NHS
- Other
- Healthcare delivery
- Industry
- Academia
Specialisms in Medical Physics

Radiotherapy

• Planning and calculating treatments
• Calibrating radiation equipment
• Ensuring dose delivered to tumour is accurate

Radiation Safety

• Monitoring radiation exposure for workers
• Designing facilities to comply with safe practice and radiation laws

Imaging with Ionising Radiation

• X-Ray / Computed Tomography (CT)
• Nuclear Medicine / Positron Emission Tomography (PET)

Imaging with Non-ionising Radiation

• Ultrasound / Optical imaging
• Magnetic Resonance imaging (MRI), spectroscopy (MRS) or functional imaging (fMRI)
Specialisms in Medical Engineering

Biomedical and Tissue Engineering

• Developing new materials which can adapt to, and interact beneficially with, living tissues and cells

• Developing new technologies which improve patients’ lives (such as artificial heart valves, pacemakers or knee implants)

Clinical Engineering

• Repairing, maintaining, managing equipment used to treat patients
• Designing and developing new products to meet needs identified at the patient interface

Physiological Measurement

• Measuring, analysing and recording body functions (e.g. cardiac, neurological parameters) for diagnosis or treatment control
Specialisms in Medical Engineering

Rehabilitation Engineering / Assistive Technology

- Assessing the needs of people with disabilities or age-related limitations
- Prescribing commercially available assistive devices to assist mobility and comfort
- Designing, developing and manufacturing new bespoke devices for patients

Working in “Health”

- NHS: Most large hospitals have a ‘Medical Physics and Clinical Engineering’ department. Graduates enter a 3-year hospital-based training programme (including an MSc) to qualify as a Healthcare Scientist/Engineer.

- Academia: There are over 30 UK universities active in medical physics/engineering research; many have international reputations and PhD opportunities.

- Industry: Many sector-leading companies have large UK facilities (Philips, Elekta, Smith & Nephew). Many specialist UK companies with innovations, for example in lasers, ultrasound & medical devices
Working in the NHS

Graduate-level training through supervised hospital placements, with integrated study towards an MSc in Healthcare Science:

Key Duties

- Check for accuracy and precision of medical equipment, imaging techniques or radiation treatments
- Radiation safety for staff and public
- Design new or improved treatments or technologies
- Calculation and measurement of radiation dose
- Data analysis, storage and processing
- Work alongside other healthcare professionals in delivering care, diagnosis and treatment

Working in Academia

Supervised postgraduate study towards a higher degree, with the opportunity to present and publish research that may change healthcare practice:

Key Duties

- Fundamental research that improves our understanding of biological or physical processes
- Applied research that improves our ability to diagnose, model, treat or measure processes in the body
- Publish findings in peer-reviewed journals and present results to scientific conferences
- Teach the next generation of physicists/engineers
- Communicate the impact of findings to the public
Working in Industry

Graduate-entry employment with a company that manufactures, designs or develops technology for patient monitoring or for the diagnosis or treatment of disease

Key Duties

- Research and development of ‘next generation’ technologies, devices and solutions
- Manufacture of medical appliances and devices
- Intellectual property exploitation
- Scientific project management
- Safety testing and quality assurance
- Opportunities for enterprise and innovation

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What is IPEM?

• The Institute of Physics and Engineering in Medicine is the only professional body in the UK exclusively dedicated to the application of physics and engineering to medicine or biology.

• A worldwide community of 4000 medically-specialised physicists, engineers and technologists.

• Members are based in hospitals, universities and industry - making it a very focused, inclusive and multidisciplinary organisation.

What do we do?

• Access to extensive listings of job vacancies
• Provide information and advice on how to apply for training or employment opportunities
• Publish high impact journals and reports
• Facilitate professional discussion forums
• Organise conferences (with student sessions)
• Further postgraduate career development to chartered status (C.Sci. & C.Eng.)
• More information available online at www.ipem.ac.uk
What we can do for you!

• Joining IPEM as a student member will allow you to become a member of our community

• As a member, we can put you in touch with professionals working in hospitals, university or academia

• We can offer career advice for you:
  - applying to the NHS training scheme
  - information on PhD/MSc opportunities

IPEM Prizes

• IPEM has a number of prizes recognising scientific excellence and commitment

• We sponsor a £250 Prize for the best Final Year dissertation or project on your course (only if it is accredited by IPEM) in any area of Medical Physics / Medical Engineering

• The winner is decided by the staff here however we will promote your work through a profile and summary on our website.
Why join IPEM?
For a nominal fee of £10.00 for your entire course (or £5.00 per year if more suitable) you will:

• Receive regular mailings and job adverts
• Save substantially reduced fees for conferences (with some free sessions)
• Gain access to professional and informal networking – essential for your career

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Your Future

Things to do to increase your career prospects:

• Take opportunities to network (e.g. to find a valued but hard-to-come-by work placement)

• Ensure you are obtaining regular job adverts and careers mailings – www.ipem.ac.uk

• Volunteer in local or national student science organisations (e.g. local university society, Sense about Science “Voice of Young Science”)

Your Future

Some examples of successful careers in medical physics and medical engineering:

Gail ter Haar
From a degree in physics, Gail ter Haar now works as Professor of Therapeutic Ultrasound at The Institute of Cancer Research

Christie McComb
With a degree in physics, Christie now works at the Glasgow Royal Hospital for Sick Children as an MRI clinical scientist

Ian Swain
From a degree in electronic engineering, Professor Swain developed a NHS-spin out company designing medical devices
Remember…

- There are lots of worthwhile problems to solve in healthcare science and engineering
- Problem solving is something engineers and physicists are good at
- The only satisfying jobs are difficult....

Good Luck with your degree!