Hot Topic 2017 - Molecular Imaging

Dr Andy Scarsbrook
Consultant in Radiology and Nuclear Medicine

Royal College of Radiologists Research Day 2017
Royal College of Radiologists, Lincoln’s Inn Fields, London, 22nd November 2017
Molecular Imaging (MI)

- Molecular imaging - the in vivo characterization and measurement of biological processes at the cellular and molecular level.

- An important tool for pre-clinical and clinical research across a broad range of disciplines, including oncology, cardiology, neurology, psychiatry, and pharmacology.

- MI shows particular promise as a means to accelerate the transfer of laboratory discoveries into clinical practice and the implementation of precision medicine.

Mankoff DA et al. *JAMA Oncol* 2017; 3(5): 695-701
Molecular Imaging Techniques

- MI can be performed with CT, MRI, ultrasound, optical imaging and nuclear medicine techniques.

- Except for MRI spectroscopy and diffusion weighted MR imaging all MI techniques depend on the use of exogenous probes to provide imaging signal or contrast.

- FDG PET-CT is currently one of the most validated and clinically useful MI techniques.

Want to know more about MI?

- I gave a talk at the 2015 Research Day (available on the RCR website) covering different aspects of molecular imaging and research opportunities.

2015 Research Day
Presentations from the event are available below:

- ‘Trials and tribulations of setting up a research study’ Dr Aubrey Smith, Academic Radiology Registrar, Hull Royal Infirmary
- ‘Statistics for Imaging Studies’ Karen Thomas, Senior Statistician, Royal Marsden Hospital
- ‘Functional and Molecular Imaging - a fertile ground for radiological research’ Dr Andy Scarsbrook, Consultant in Radiology and Nuclear Medicine, Leeds Teaching Hospitals NHS Trust

- The current talk will focus more on my research career and some practical hints and tips picked up along the way which may be of use.
A short history of my academic career

- Oxford Radiology Training Scheme 2000-2006
- Research-active Consultant Radiologists but no formal Academic Department – encouraged to get involved in research after passing FRCR exams
- First visit to RSNA in 2003 was a real eye opener and provided an introduction to the vast potential of PET-CT and molecular imaging, inspired me to get involved in this new technology
- Coincided with push to expand PET-CT in the UK
- Committed to subspecialty training in Radionuclide Radiology and Nuclear Medicine (Year 6)
Catching the wave

- Lucky break - enthusiastic supervisors with academic track record and desire to establish a clinical PET-CT service

- Opportunity to get involved in high quality research projects

- Focus on making a good impression – under commit and over deliver!!
Academic Apprenticeship 2004-2006

- NIHR did not exist in 2004 (established April 2006)
- Few higher degrees undertaken by Radiology trainees but CRUK/RCR PhD fellowships starting
- I opted for Master and apprentice style training…..
- Initial research involved systematic review of literature on imaging for suspected PE in pregnancy – then not well understood and paucity of guidance
- Led to a 1st author publication in Clinical Radiology and helped in establishing a good relationship with academic supervisor
Laid foundation for several further original research projects optimizing role of imaging in pregnancy

6 publications (2006-2010) helped refine the optimal imaging algorithm and directly influenced National and International guidelines on Management of Pulmonary Embolic Disease over the next few years
Beware the Iceberg Illusion

Success is an iceberg

What people see:
- Success!

What people don't see:
- Dedication
- Good habits
- Disappointment
- Sacrifice
- Failure
- Persistence

Things I have to give up:
1....
2....
3....

The Leeds Teaching Hospitals
NHS Trust
Further opportunities arose for collaborative work on imaging in Endocrine Oncology as a senior trainee.
This led to a Travelling Fellowship

- British Nuclear Medicine Society funded Travelling Fellowship to Uppsala University Hospital, Sweden in 2006 to study state-of-the-art Endocrine Imaging
  - Novel PET imaging
  - Peptide receptor radionuclide therapy
  - Inspirational supervisor: Professor Anders Sundin
  - Built collaborative links and experienced a vibrant research culture
Transition to Consultant job

- Plans to stay in Oxford as a Consultant foiled due to Trust financial issues and freeze on new jobs

- Opportunity in Leeds to set up PET-CT service and help lead a large Nuclear Medicine department with renowned experts (Prof Philip Robinson, Dr Bob Bury)

- Started October 2006 after returning from Sweden

- In at the deep end with PET-CT service development – rapid expansion over the next few years with lots of opportunities to undertake clinically focused research with senior support
The chart illustrates the relationship between knowledge and expertise, highlighting three distinct phases:

1. **Beginner Phase**
   - "I know nothing" phase
   - Knowledge curve starts at a low point.

2. **Hazard Phase**
   - "I’m an expert" phase
   - Knowledge curve peaks, indicating a phase of overconfidence.
   - The "How much I think I know (%)" line rises steeply, while the "How much I actually know" line remains relatively flat.

3. **Expert Phase**
   - "I know nothing" phase
   - Knowledge curve asymptotically approaches the level of expertise.
   - The "How much I actually know" line continues to rise steeply, suggesting a growing awareness of what remains to be learned.

The chart emphasizes the realization that even experts have much more to learn, illustrating the concept of perpetual learning and the humility of acknowledging the complexity of knowledge in fields like medicine and healthcare.

*The Leeds Teaching Hospitals NHS Trust*
Building a Team

- PET-CT popular with trainees - lots of interest in research projects and Radionuclide Radiology !!
- Link with Oxford enabled trainees to undertake Year 6 Nuclear Medicine training and return as Consultant colleagues supporting expanding PET-CT service over next 2 years
- New Department with multiple SPECT-CT cameras in 2008
- Key focus on providing a high quality service and building MDT confidence in hybrid imaging
- Systematic research evaluating the impact of hybrid imaging main research focus
- Balancing academic demands with a busy clinical job was becoming more challenging
Time Management is essential!!

• Strategize – make time to write papers and grant applications, prepare teaching materials and carry out administrative duties
• Set priorities and review these regularly
• Delegate work to others
• Avoid guilt – don’t fall into the “fear of missing out” trap, learn to say no with grace and humility
• Take time to recharge
• Instilling a team ethic following these simple principles helps increase productivity

Pisano ED. *Acad Radiology* 2001; 8: 768-770
These are my principles and if you don’t like them.....well, I have others

Groucho Marx
Infrastructure Expansion

- Leeds PET-CT centre with 2 state-of-the-art scanners opened June 2010
- High throughput matching clinical demand
- Partnership with Alliance Medical
- Dedicated research scanner supported by NIHR and West Yorkshire Research Network funding (£2.1 million capital investment grant from NIHR)
- Major boost for patients in the region
- Leeds firmly on the PET-CT roadmap !!
- Continued focus on quality and clinical research
Sustaining the Research Mission

• Dedicated research PET-CT scanner - fantastic opportunity but now a big expectation to deliver!!

• Systematic evaluation of the impact of PET-CT in multiple settings in addition to supporting multiple NIHR portfolio trials

• Research outputs bearing fruit, showing positive impact on patient care, helped strengthen reputation

• Subsequent work by other researchers in Leeds has confirmed that research-active institutions deliver better patient outcomes for all patients regardless of whether they are within a trial*

Reputation Growing

Ministerial Visit to Leeds PET Centre - April 2011

The Leeds Teaching Hospitals NHS Trust
Balancing Academic and Clinical Work

- Becoming increasingly clear that I couldn’t secure major grant funding and produce high impact outputs without substantial ring-fenced time
- Time to seek advice and support from Senior Academic colleagues…..
- Charitable Trustees to the rescue - £1 million raised to establish Academic infrastructure linked to Cancer Imaging research
- Allowed 50% clinical backfill for 2 Academic Radiologists, research fellowships and consumable costs for 5 years
- Growing collaboration with University of Leeds
Biomedical Imaging Research Network

- Collaborative imaging research between University of Leeds and Leeds Teaching Hospitals NHS Trust

- Increasing opportunities for translational imaging research

- Active areas of research – cancer imaging in conjunction with radiology and academic radiotherapy; translational cardiovascular imaging; pre-clinical imaging; musculoskeletal imaging; hepato-biliary imaging
Advanced Imaging Centre 2017

- £6.8m centre aiming to transform diagnosis and treatment of patients suffering from cancer, heart disease and musculoskeletal diseases – opened January 2017

- Collaboration between Universities of Leeds and York and Leeds Teaching Hospitals NHS Trust – funded by MRC and British Heart Foundation Grants

- State-of-the-art MRI and pre-clinical imaging facility with high-field strength MRI, CT and PET-CT
Investing in the Future – Academic Imaging Training Pipeline for Future Growth
RCP Research Engagement Toolkit

- Information on range of research options and ways to get involved
- Information on different pathways into a career in research
- Resources to support research-active doctors
So are you a good candidate for a research career?

- Yes if you:
  - Are curious
  - Can handle criticism well
  - Are patient and persistent
  - Like to work as part of a team
  - Like networking
  - Want to know more than anyone else about a topic
  - Have “fire” in your belly to answer a question
Wobble but don’t fall over !!

- “Success is a lousy teacher. It seduces smart people into thinking they can’t lose” - Bill Gates
- “However beautiful the strategy, you should occasionally look at the results” – Winston Churchill
- Failure is common in academic medicine and can be instructive
- Grant applications rarely get funded 1st time round
- Getting published in high impact factor journals is hard, rejection is common and should be used as a learning exercise
- If at first you don’t succeed, get back on the horse !!
Why do research?

- To make your job more varied, fulfilling and fun

- Research opens many doors, allows you the opportunity to meet and work with many different people, make friends, have fun and travel the world teaching and presenting your work to others
Top tips for success

• Put patient’s best interests first
• Strive for excellence in quality of care
• Strive for excellence in quality of work
• Look out for opportunities and see where things are going to be, not where they are now
• Work with people who have a track record and who inspire and support you
• Learn to be resilient, deal with rejection with grace and humility and stick at it
• Remember balance in your life and take time to recharge
Conclusions

- Research underpins many advances in Radiology and places it at the cutting edge of medicine
- A career combining clinical and academic aspects of Radiology can be very rewarding
- Opportunities abound for radiological research at all stages of training
- Molecular imaging provides a fertile ground for future radiology research
Thanks for listening

Any questions?