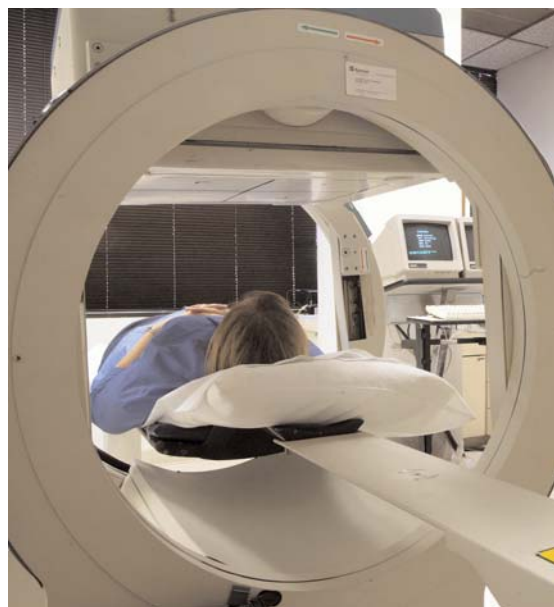


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A career as a . . . specialist radiopharmacist

By Zoë Gross, BPharm, MRPharmS

Radiopharmacists provide a clinical and technical pharmacy service within nuclear medicine. This article outlines the work involved and the career path followed by some of the pharmacists working in this field



Nuclear medicine camera in use. Radiopharmacists are required to have a working knowledge of a number of areas of nuclear medicine

Radiopharmacy is the branch of the profession that involves the manufacture and supply of safe and effective radiopharmaceuticals (radioactive products) for the diagnosis and therapeutic treatment of patients. It also involves providing advice and support on the use of radiopharmaceuticals. A radiopharmacy service in a hospital is provided either as a stand-alone service by a radiopharmacy department or by a radiopharmacy section of a nuclear medicine department. Radiopharmacies generally produce from 2,000 to over 10,000 doses every year. However, the range and complexity of the radiopharmacy (or nuclear medicine) service provided does not necessarily depend on the size of the hospital in which it is based.¹

Radiopharmacists are among those working as part of the radiopharmacy or nuclear medicine team. For everyday practice, radiopharmacists are required to have a working knowledge in nuclear physics, radiation protection, chemistry, biochemistry, radiochemistry, immunology, anatomy, haematology and law.² They also need computer skills and need to know and

understand a considerable amount of mandatory legislation and guidance as radiopharmaceuticals are controlled as both medicines and radioactive substances.² This article addresses the role of the radiopharmacist, the daily practice of three radiopharmacists and their career pathways, postgraduate training and networking. The workforce issues facing radiopharmacy are also discussed.

Role of the radiopharmacist

The radiopharmacist's main responsibility is for the procurement, preparation, quality control and supply of radiopharmaceuticals, ensuring the safety and efficacy of such products. Daily activities may include managing the production of radiopharmaceuticals. Radiopharmacists also have a clinical role to play, for example, providing advice on the use of radiopharmaceuticals and input into patient care in the nuclear medicine department. In addition, they may provide education and training to both their own staff as well as other health care professionals. There is scope to get involved in the research and development of new radiopharmaceuticals, including clinical trials, and in the development of new

dispensing techniques. Other examples of activities carried out by radiopharmacists and areas of expertise are summarised in Panel 1 (p316).

Day-to-day practice

So what do radiopharmacists and their teams do in practice? Radiopharmacist and chair of both the UK Radiopharmacists Group and the British Nuclear Medicine Society Radiopharmacy Group, Beverley Ellis, is head of radiopharmacy services at Central Manchester and Manchester Children's University Hospitals NHS Trust. Her main role is to manage the running of the radiopharmacy unit and to ensure that radiopharmaceuticals and radiolabelled blood components are prepared to the correct standards for administration to patients.

The radiopharmacy unit is based in the trust's clinical nuclear medicine department and prepares approximately 12,000 patient doses a year. It provides a clinical radiopharmacy service to the trust as well as to other hospitals requesting a radiopharmacy service. Dr Ellis works as part of a multidisciplinary team, comprising nuclear medicine physicians, medical physicists,

Zoë Gross is a freelance medical journalist

nuclear medicine technologists and nuclear medicine nurses. Giving examples of the type of work she does, Dr Ellis said: “I provide advice on potential and actual drug interactions with radiopharmaceuticals, possible causes of abnormal biodistributions seen on nuclear medicine scans, the choice and suitability of using drugs to enhance

Panel 1: Examples of activities or areas in which radiopharmacists can provide expertise^{1,2}

- Advising on:
 - Possibility of drug interactions
 - Possible causes of abnormal biodistributions
 - Stopping medicines that will interfere with scan quality or results
 - Stability and formulation of radiopharmaceuticals
 - Legal status of particular products
 - Use of drugs to enhance nuclear medicine studies
 - Whether a previously administered radiopharmaceutical will interfere with an isotope scan
- Investigating, monitoring and reporting adverse reactions
- Assisting with reporting scans
- Improving cost effectiveness of diagnostic tests
- Preparation and advice on special dosage formulations
- Health and safety of individuals while using radiopharmaceuticals
- Providing clinical information on new products
- Organisational and quality audits of radiopharmacy services, including maintenance and monitoring of facilities and equipment
- Advice to veterinary profession on use of radiopharmaceuticals

nuclear medicine studies, the stability and formulation of radiopharmaceuticals as well as monitoring and reporting adverse reactions.” However, the routine preparation and quality control testing of both radiopharmaceuticals and radiolabelling of blood components (for re-introduction into a patient for diagnostic purposes, eg, for infection and inflammation imaging) is mainly undertaken by nuclear medicine technologists who rotate through the radiopharmacy unit.

Consultant radiopharmacist, Jilly Croasdale is based at City Hospital, Birmingham, and fulfils both a managerial role at the hospital and a regional role with the West Midlands Regional Health Authority. She manages the hospital’s centralised radiopharmacy department, working alongside three radiopharmacy technicians — two pharmacy trained and one trained in nuclear medicine — to provide both an advice and supply service to City Hospital and five other hospitals. The team manufactures technetium radiopharmaceuticals for diagnostic nuclear medicine and radio-labels blood cells for clinical studies for all purchasers of the service. Her managerial role involves considering ways of developing the radiopharmacy service and possibilities for expanding the business, writing business cases and service level agreements, managing the department’s budget and ensuring customers’ needs are met.

Mrs Croasdale also conducts in-house research projects with a view to publishing or presenting the results, plays an active role in training new staff and participates in the dispensing and manufacturing process to help keep staff radiation dose exposure down and to “keep her hand in”. In addition, she is involved in a clinic for hyperthyroid patients, which is currently run by the radiopharmacy team at City Hospital two afternoons a week. Outside the City Hospital, she acts as regional expert which requires her to support other radiopharmacies in the region. “I visit them every quarter, sending a report to their chief pharmacist afterwards, and I audit them once a year,” she said.

Professor Malcolm Frier has been a radiopharmacist for over 30 years and now works on a part-time basis at Queen’s Medical Centre, Nottingham University Hospitals NHS Trust, as principal radiopharmacist. His job involves working as the production manager for the manufacture of radiopharmaceuticals, under the terms of the trust’s manufacturing (specials) licence, and as the qualified person for the manufacture of investigational medicinal products. “The job itself is varied, including hands on manufacture and testing of injectable products as well as financial and materials management”, he said. The radiopharmacy unit manufactures short-lived diagnostic products on a daily basis for the nuclear medicine clinics at Queen’s Medical Centre and those at Sherwood Forest Hospitals NHS Trust in North Nottinghamshire. It also provides longer-lived diagnostic products on request to seven or eight other NHS trusts throughout the East Midlands and supplies therapeutic radiopharmaceutical materials to another trust two or three times a week. Professor Frier runs the unit with the input and support of three clinical scientists, four medical technical officers and a domestic assistant. He added that the radiopharmacy unit is situated in the nuclear medicine clinic so he gets to spend a lot of time in the clinic itself attending clinic meetings and reviewing data.

— Career pathways

All three radiopharmacists described their career pathways and some of the research they have done or are undertaking in the field of radiopharmacy. These are presented in Panels 2, 3 and 4 (p317–8).

— Education and training

All three of the radiopharmacists interviewed take an active interest in teaching radiopharmacy to others, whether it be in-house, to undergraduates or on one of the radiopharmacy postgraduate courses (see Panel 5, p318). For example, Mrs Croasdale trains preregistration trainees undertaking

their general rotation in radiopharmacy as well as teaching undergraduates on the radiopharmacy option at Aston University. Mrs Croasdale, Professor Frier and Dr Ellis, all teach on, or have taught on, the postgrad-

uate course in radiopharmacy at King's College London and the European radiopharmacy course. In addition, Professor Frier teaches a radiopharmaceutical science module to technologists at BTEC level, at

Queen's Medical Centre, is a director of postgraduate study at the University of Montevideo, Uruguay, and has supervised and examined MSc, PhD and MD projects. Dr Ellis also teaches on the MSc in medical physics (nuclear medicine module) at Manchester University, the MSc in advanced practice (nuclear medicine) at Salford University and the BTEC National certificate in applied science (pharmaceutical) at City College, Manchester.

Panel 2: Career history — Beverley Ellis

Dr Ellis began her radiopharmacy career after embarking on a PhD in medicinal chemistry at King's College London. As part of her doctorate, she undertook research in radiopharmacy and nuclear medicine at Addenbrooke's Hospital, Cambridge. Her interest in radiopharmacy and nuclear medicine continued to develop while teaching undergraduate pharmacy students at King's College as part of their radiopharmacy practical course. After completing her doctorate, Dr Ellis took up a radiopharmacist post at Manchester Royal Infirmary and has since worked for Central Manchester and Manchester Children's University Hospitals NHS Trust for over 12 years. "As with many other radiopharmacist/radiopharmaceutical scientist posts, the

majority of my training has been acquired in post," she said. She added that her career in radiopharmacy had offered her the opportunity to "use my skills as a pharmacist as well as being able to work as part of a multidisciplinary team and undertake scientific research and teaching".

In terms of current research, Dr Ellis is a principal investigator on a British Heart Foundation research grant involving investigating the pre-clinical development of novel radioactive tracers for myocardial perfusion imaging. Aside from all of this, she is an active member of, as well as chairing, a number of national and regional committees and has an honorary academic appointment in the department of imaging science at the University of Manchester.

— Networking

There are many opportunities for radiopharmacists to network with each other and other members of the radiopharmacy or nuclear medicine team, as well as with other health care professionals. These include being active members of radiopharmacy groups and national and/or regional committees, attending conferences, workshops and meetings and taking part in on-line discussion groups, for example on the VirRAD website (see Panel 6, p318). Dr Ellis, Professor Frier and Mrs Croasdale are all active members of the various radiopharmacy groups and committees. Examples of the different national committees and groups of interest to radiopharmacists can be found in Panel 7 (p318).

Panel 3: Career history — Malcolm Frier

Professor Frier is scientific chair of the British Nuclear Medicine Society and previous chair and secretary of the UK Radiopharmacy Group. Professor Frier entered his career in radiopharmacy "purely by chance". Before joining the hospital service in 1973, he worked in commercial drug formulation for four years before applying for a post in hospital pharmacy production. At the interview for this job he was offered a post as a radiopharmacist instead of the one he applied for and has worked in radiopharmacy ever since. "I have found radiopharmacy the most rewarding of careers. It is so varied and you never really know what is going to turn up next. It has satisfied my scientific interests and brought me into contact with some fascinating individuals all over the world," he

said. Like Dr Ellis, Professor Frier has had to learn most of his radiopharmacy skills "on the job". "Education and training for the specialty were non-existent when I joined the service," he said. He added, "there were only two other established posts in the whole of the UK at that time." There are now a number of postgraduate courses in radiopharmacy (see Panel 5, p318).

In terms of carrying out research, Professor Frier said that his interests over the years have mainly been in connection with the biological fate of radiopharmaceuticals. "More recently my interest has been in using the technology of nuclear medicine, to understand the behaviour of drug delivery systems, and in developing targeting systems for therapeutically-active products," he said.

— Workforce issues

Recruitment, retention and training posts are among the issues that seem to be most concerning the radiopharmacy community at the moment, as is the need to establish an attractive and rewarding career structure for pharmacists within the speciality. The guidelines of a joint working party for the provision of radiopharmacy support to nuclear medicine state that the management of a basic radiopharmacy service requires staff to be of at least Grade D pharmacist or equivalent.¹ However, there is currently "a serious succession planning problem of senior level radiopharmacists in the UK," commented Dr Ellis.

According to Mrs Croasdale there are also few training posts available for pharmacists

interested in a career in radiopharmacy and even when there are, getting more pharmacists interested in applying is an issue. Consequently, “the small numbers have a knock-on effect on the logistics of training,” she said. “One of my priorities now is trying to generate interest in this field with a view to creating similar posts to the one I was lucky enough to have at City Hospital, Birmingham,” she added.

Professor Frier commented that Agenda for Change, the NHS Knowledge and Skills Framework, and the health care science nine-stage career pathway, which is currently being developed for radiophar-

macy, might all offer opportunities for improvement.

Conclusions

Radiopharmacy has recently been recognised under the Healthcare Science National Occupational Standards framework and a set of National Occupational Standards has been developed. Radiopharmacy provides pharmacists with the opportunity to be a key part of a multidisciplinary nuclear medicine team. According to Mrs Croasdale: “It is a job where you can use the science background

that is part of your pharmacy degree, as well as giving you contact with patients, managerial experience and practical work.” For those pharmacists thinking about a career in radiopharmacy, Professor Frier advises “to think carefully about the type of career you wish to pursue. As a pharmacist within a small specialty, you might find limits to promotional progression. On the other hand, if you wish to follow a career that is intellectually and scientifically challenging, with opportunity to interact with a wide range of scientists, clinicians and technologists, then radiopharmacy is the one”.

Panel 4: Career history — Jilly Croasdale

Jilly Croasdale’s career in radiopharmacy began in 1992 when she took on a basic grade pharmacist position based in the radiopharmacy department at City Hospital, Birmingham. “The job was one where I got experience [in all areas of hospital pharmacy] and discovered that I liked radiopharmacy the best,” she said.

During her four years at City Hospital she undertook a postgraduate clinical diploma in radiopharmaceutical sciences, run by King’s College London, before taking on the post of radiopharmacy manager at Leicester Royal Infirmary, where she managed a radiopharmacy service for three hospitals in Leicestershire.

From August 2000 until February this year, when she returned to work at City Hospital, Mrs Croasdale worked at the Royal Free Hospital, London, as a specialist radiopharmacist for the hospital and as an honorary research assistant for the department of academic oncology (supported by Cancer Research UK) in the medical school. In addition to managing the hospital’s radiopharmacy service, her remit

was to support the development of new radiolabelled proteins and peptides as part of a research programme into targeted tumour therapy. While in post, Mrs Croasdale also carried out some smaller research projects. One of the projects involved radiolabelling a peptide, dota-lanreotide, with the radionuclide lutetium to potentially target neuroendocrine tumours for therapy and at the same time be easily imaged to assess biodistribution. This was accepted as a poster presentation at the Society of Nuclear Medicine conference, held in Philadelphia last year. “Training posts in radiopharmacies are unusual, but in my case City Hospital’s original investment paid off,” she said. In terms of other postgraduate training, Mrs Croasdale, who is Secretary of the UK Radiopharmacy Group and chair of the West Midlands Radiopharmacy Group, has also completed one module of the European radiopharmacy course (European Association of Nuclear Medicine) and has done a postgraduate certificate in managing health services at De-Montfort University in Leicester.

Panel 5: Postgraduate courses and workshops

The following is a list of postgraduate courses and workshops in radiopharmacy. Information on who to contact for further information can be found at either the British Nuclear Medicine Society website (www.bnms.org.uk/bnms.htm) or the UK Radiopharmacy Group website (www.ukrg.org.uk)

- Postgraduate course in radiopharmacy (King’s College London)
- MSc in radiopharmaceutics and PET radiochemistry (King’s College London)
- Progress in radiopharmaceuticals workshops organised by the UK Radiopharmacy Group
- Professional development programme in pharmaceutical technology and quality assurance (University of Leeds)
- European postgraduate specialisation certificate in radiopharmacy (European School of Nuclear Medicine)
- European radiopharmacy course, Saclay, France (European Association of Nuclear Medicine)
- Aseptic preparation and dispensing of medicines course (University of Leeds)

This list is not exhaustive

Panel 6: Useful resources and information

- UK Radiopharmacy Group (UKRG) (www.ukrg.org.uk) — website includes UKRG newsletters and radiopharmacy handbook
- British Nuclear Medicine Society (www.bnms.org.uk)
- VirRAD — a virtual online learning environment for the radiopharmacy community (www.virrad.org)
- European Association of Nuclear Medicine website (www.eanm.org)
- Society of Nuclear Medicine (<http://interactive.snm.org>)

This list is not exhaustive

Panel 7: National committees and groups of interest to radiopharmacists include:

- UK Radiopharmacy Group
- British Nuclear Medicine Society Radiopharmacy Group
- Administration of Radioactive Substances Advisory Committee (ARSAC), which advises health ministers
- British Nuclear Medicine Society Council
- British Institute of Radiology Nuclear Medicine Committee
- Pharmaceutical Technical Specialists Education and Training Committee

References

1. Connolly M, Frier M, Lazarus CR, Maltby P, Thom J. Guidelines for the provision of radiopharmacy support to nuclear medicine. *Nuclear Medicine Communications* 2003;24:429–33.
2. Sampson CB, Sharpe S. The role of the pharmacist as a member of the nuclear medicine team, and ethics, responsibility, standards of practice and audit. In: Sampson CB. *Textbook of radiopharmacy*. 3rd ed. The Netherlands: Gordon and Breach; 1999. pp271–81.