

Book Review

Advancing nuclear medicine through innovation

National Research Council and Institute of Medicine of the National Academies*

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Although this is a report written about the state of Nuclear Medicine in USA the challenges faced are not unique and the call for combined research involving health care, industry and universities to facilitate further research into the use of some of the more 'exotic' and as yet non-commercial radionuclides will have common ground elsewhere. Nuclear Medicine's scope, range and potential applications of nuclear medicine already wide ranging is set to increase further—if funding and resources for research can be found.

In reviewing this book, I have to agree with the chair of the committee who says in the preface that this report allows the reader to stand back and appreciate the magnitude of the progress that has been achieved. The recent developments and advances in Nuclear Medicine, the current state of the art radiopharmaceuticals and imaging equipment we now rely on were made possible by collaborative research and funding for investments in Chemistry, Physics, Engineering and training of specialist personnel.

As a report this book starts with a summary of the key findings and goes on to list the current abilities and applications of Nuclear Medicine—an impressive list already but the emerging possibilities are even more impressive, e.g., brain chemistry, plaque formation, metabolism and pharmacology of new drugs and assessment of practice, targeted cancer therapies

and new developing techniques and technology platforms to find out what we are actually doing to patient, more resolution more sensitive instruments. The need to develop and exploit the possibilities opened up by hybrid PET/CT and PET/MRI scanners to improve diagnosis and treatment is also discussed. Non-invasive disease detection and treatment monitoring is already having a major impact and there is still more to come.

Further developments discussed include radiopharmaceuticals that enable the understanding and characterisation of normal and abnormal cell biology. Greater understanding of tumour biology will allow more effective methods to be developed. This opens up the potential for person centred diagnostic testing.

Chapter 2 of the report is intended to be an introduction to the highly specialised and multi-disciplinary character of Nuclear Medicine, covering basic definitions to advanced applications. It is also a good review for those working in Nuclear Medicine and for students exploring the applications, relevance and potential of Nuclear Medicine. Reason enough to recommend purchase. The chapter clearly unpicks and expands on the definition of Nuclear Medicine as allowing 'study of physiological processes non-invasively to diagnose, stage and treat disease' (p. 17). Elsewhere the phrase 'living biology' is used. The chapter also covers early history to recent developments interesting and informative but mainly given from the USA perspective.

*A committee on the state of the science of nuclear medicine, involving the nuclear and radiation studies board division of earth and life sciences the board of health sciences policy institute of medicine.

Advances that may be possible from continued multi-disciplinary research are discussed in Section 2.2 'Frontiers in Nuclear Medicine'. Included in the highlights is targeted therapy etc. Developments will also enable clinicians to work out the individual risk for disease, and monitor responses to a new treatment, potentially shortening drug trials. PET FDG scans can show response to treatment in weeks. Alpha particles used to treat tumours may be feasible. The potential to seek out the microscopic and sub clinical and deliver curative doses needs to be vigorously explored. Europe may be ahead of the USA in this field and calls for more research in USA are made.

The development of specialised infrastructure and radiopharmaceuticals to support the growth of Nuclear Medicine is discussed in Chapter 3. This chapter includes coverage of basic studies through to 'personalised health care'—targeted treatment of cancer delivering of therapeutic doses of radiation attached to antigens. This (promised) development made possible by latest development and research findings.

Not only can NM diagnose in the pre-clinical stage it can give early indication of effects of interventions—effects of treatment on individual tumour—useful in drug development.

Impediments to research (in the USA) include shortage of suitable radionuclides, or more specifically the facilities to make them and the regulatory framework.

Commercial facilities are often fully committed to market demand and have no time to produce radionuclides for research purposes. The Cancer Institute did fund research into exotic radionuclides being used at universities and this did spark commercial interest but this is not the norm.

Sources of radionuclides depend on reactors;—primary users of reactors do not have time for (medical) research and reactors are getting old and about to be decommissioned. This will have a knock on effect on the supply quantity and quality of radionuclides. Some research reactors in universities but these are also old or not effective no plans to replace. Lack of dedicated facility for year round supply limits development. Medical research community does not have its own generators to produce the required type and quantities in timely production needed.

The report was sponsored report into the state of nuclear medicine and how to advance it. Other chapters are also interesting but more concerned with situation in USA. Although the funding and politics vary from country to country the book is clearly identifies research possibilities and need for evidence based practice. To realise the promise, research must be focused and there needs to be a collaborative effort between academic, clinical and industry and the various disciplines that impact on Nuclear Medicine. There is also a need for specialist trained staff and this review should generate interest.

A shorter review would be 'wow', but I will leave the last word to the chair of the committee who finished the preface with . . .

An exciting, forward looking document that makes clear the potential for further advances in nuclear medicine and suggests practical approaches to facilitate further progress.

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