

Editorial

60 year anniversary of Applied Radiation and Isotopes



1. Introduction

2016 marks the 60th anniversary of the International Journal of Applied Radiation and Isotopes (ARI). The ARI founding father, Henry Seligman, has described the genesis of the journal at the *International Conference on Peaceful Uses of Atomic Energy* in Geneva in 1955 (Seligman, 1988). At the time, Seligman was Director of the Isotopes Division at the United Kingdom Atomic Energy Research Establishment (AERE), Harwell. His counterpart in the USA, who Seligman described as the “King of Isotopes” was Paul Aebersold, Director of the Isotopes Division of the US Atomic Energy Commission, Oak Ridge, TN. At the conference, they were approached by an enterprising young publisher, Robert Maxwell, who attended their session on isotopes and quickly persuaded them that they should form a scientific journal to promote peaceful uses of radiation and isotopes. Aebersold's lasting contribution to the journal was the choice of color scheme for the journal. The yellow and blue was a reminder of his Budgerigar parakeet! Seligman and Aebersold identified eight other leading scientists with a good geographical distribution to join them on the editorial board. No one was identified as editor in chief.

They also formed for the journal an Advisory Board of distinguished scientists in many disciplines. Among these were two Nobel Prize winners, John Cockcroft and George de Hevesy. Cockcroft shared the Noble Prize in Physics in 1951 with Ernest Walton for splitting the atom; their work with the *Cockcroft-Walton* proton accelerator on a lithium-7 target producing two helium nuclei (Cockcroft and Walton, 1932). de Hevesy, the Hungarian radiochemist, received the 1943 Nobel Prize in Chemistry for his work using radioisotopes as tracers, the first use being lead-212 as a tracer in agricultural studies. This was a nice touch for a journal on *radiation and isotopes* to have a Nobel Prize winner from each discipline on the Advisory Board.

Harwell and Oak Ridge, the two biggest suppliers of isotopes for the expanding world market, were soon joined by other federal laboratories with reactors and accelerators in France, the USSR, and Canada. A News and Notes section in the first issue gives details of schedules for isotope production in UK, USA, USSR and Austria. The editors thus had a great vehicle in the journal to promote sales of radioisotopes from their facilities. The publisher benefited from library subscriptions and paid advertisements from producers and suppliers to the growing nuclear industry. And, academic and industrial investigators now had a journal to showcase their new applications in the field.

The journal was launched in 1956 as one of the first titles of Pergamon Press. The preface to the first issue (Fig. 1) was written by Sir John Cockcroft. His editorial shows the unbridled enthusiasm coming out of the Geneva Conference on *Peaceful Uses of Atomic Energy*. He expresses the hope that the journal will stimulate progress in the science and technology of applied radioactivity and radiation.

It was important in 1956 to have the editors widely distributed geographically because manuscripts were submitted by post and it was not uncommon to receive packages from the far corners of the world consisting of tissue thin papers barely held together by scores of exotic postage stamps. (Considered an advantage if the editor happened to be a stamp collector.) It is not clear how the editors divided up duties for the first issue, but we do have an invitation to submit a manuscript from Paul Aebersold to Wilfrid B. Mann at the US National Bureau of Standards (NBS), which is shown here as Fig. 2. Mann had also worked for Cockcroft during and following WWII and Cockcroft had encouraged him to take a position in the Radioactivity Section at NBS. Mann submitted a paper on *The Preparation and Maintenance of Standards of Radioactivity* which was accepted and published on page 1 of volume 1 of ARI (Mann, 1956). Mann joined the editorial board in 1965.

Henry Seligman and Wilfrid Mann would define the course of ARI for the next 35 years. Entertaining articles on Seligman's colorful early career are contained in a special issue of ARI on the occasion of his 75th birthday (Maxwell, 1984; Rose and Mann, 1984) (See Fig. 3). In 1958 Seligman left Harwell to become Deputy Director General for Research and Isotopes at the IAEA. In 1973, he became the first Editor-in-Chief of ARI. As EIC for ARI and Deputy DG for the IAEA, he was in the ideal position to be the international advocate for applications of radiation and isotopes. Seligman, a physical chemist, welcomed Wilfrid Mann, a nuclear physicist, as Editor-in-Chief for North America in 1976. (See Table 1) Mann (See Fig. 4) also had a colorful early career, also detailed nicely in the contributions on the occasion of his 75th birthday (Coursey and McLaughlin, 1984) and in his autobiography, published by Pergamon Press (Mann, 1982). Seligman was the senior manager and administrator and used his world-wide contacts in the industrial nations and in the developing world to encourage contributions to the journal. Both Seligman and Mann spent time developing new editors, who were initially called “associate editors” until they proved their worth in soliciting good papers and applying judicious editing. Both shared a belief that authors from developing countries should be given encouragement, and they spent considerable time editing grammar as well as technical content.

Mann took a more focused look at ARI journal matters and had in some ways a more academic approach. He encouraged his staff, colleagues, and collaborators to submit articles to the journal (but that did not spare them from his wit and red pen when it came time to edit their papers).

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Editorial

THE contributions of radioactive isotopes, used both as tracers and as sources of radiation, are already acknowledged in the pure and applied sciences. In medical diagnosis and therapy, in agricultural development, and particularly in industrial research and process control, tremendous strides have been made in the last decade through the use of radioactive methods.

Large fluxes of radiation, from radioactive sources and from particle accelerators, are now being used for such purposes as sterilization, the production and study of genetic mutations, and the initiation of chemical reactions.

The versatility of radioactive and radiation techniques has led to their use in a variety of specialist fields. Isotope methods, potentially of wide application, have tended to be published in a large number of scattered specialist journals where the results, rather than the method employed, have been emphasized.

It was evident at the recent International Conference on the Peaceful Uses of Atomic Energy that, in this as in other fields, much work had been duplicated in different parts of the world, through difficulties in keeping in touch with current developments.

This journal is intended to provide a forum for the publication and discussion of these techniques, for the reporting of news of general interest in the field, and for the promotion of international co-operation.

Thus it is hoped that the journal will stimulate progress in the science and technology of applied radioactivity and radiations, whose contributions to the welfare of mankind may well prove as far-reaching as those of nuclear power itself.

J. D. COCKCROFT

Fig. 1. Preface to volume 1 of ARI by Sir John Cockcroft, 1951 Nobel Prize in Physics.

Seligman and Mann worked together as Editors-in-Chief, but their very different approaches are apparent in that Mann had 38 citations for contributions in the journal over these three decades while Seligman had only two. Upon Seligman's death in 1993, his long-time protégé David M. Taylor from the UK, replaced him on the masthead as EIC. Taylor, a radiobiologist, had an illustrious career in Heidelberg and Karlsruhe in Germany and in Sutton in the UK. Taylor made valuable contributions to ARI over a period of 51 years until his death in 2015. Mann retired as EIC North America in 1988, and his replacement was his colleague, William L. McLaughlin, the world renowned expert on radiation dosimetry for high-dose applications (see [McLaughlin et al. \(1989\)](#)).

Over the past six decades ARI has published about 15,000 articles. It is difficult to assign an exact number because in the early years articles were accepted as Technical Notes as well as full articles. The editors made a decision as to whether the work warranted a full article, and sometimes authors were instructed to shorten their manuscript such that it could be acceptable as a Technical Note. This was sometimes painful to the authors but was probably necessary at the time to keep the page size for the issue in line with the production schedule and price of publication. Other counts of articles note “conference proceedings” as distinct from articles. Up until the 1980s it was sometimes negotiated with conferences that the entire proceedings would be published in one issue of ARI. The guest editors were responsible for refereeing and editing all contributions, and providing the typescript of the entire issue to the publisher. A member of the ARI Editorial Board was selected to oversee the entire process. This worked well when the guest editors did a conscientious job of editing, but the typescript usually did not look as good as galley proofs from the publisher. In addition, too many special issues had the effect of delaying publication for submitted manuscripts.

ARI was intended from the outset to be an “international journal.” It is remarkable that at the height of the Cold War a scientific journal was accepting papers from the USSR and the Western World. Mann's first article in the journal included abstracts in French, German, and Russian as well as English. Many early articles in the journal were published in French, German, and Russian, although today the journal is primarily in English.

ROOM 103, U.S.A.E.C. ADMINISTRATION BUILDING

Oak Ridge, Tennessee
October 21, 1955.Dr. Wilfred Mann
Radioactivity Section
National Bureau of Standards
Department of Commerce
Washington, D.C.

Subject: INTERNATIONAL JOURNAL OF APPLIED RADIATION AND ISOTOPES

Dear Dr. Mann:

At the time of the recent International Conference on the Peaceful Uses of Atomic Energy in Geneva, an independent meeting was held by leaders in isotope utilization to consider establishing an International Journal of Applied Radiation and Isotopes. The Pergamon Press, Ltd., 4 Fitzroy Square, London, W.1., agreed to publish and promote this new Journal. They plan to publish it quarterly on an international basis, with papers being accepted in English, French, German, and Russian. Abstracts of the papers will appear in the four languages and translations of any article will be provided by the press to subscribers on request.

An Editorial Board has been set up and consists of the following persons

U.K.	-- H. Seligman, W. V. Mayneord, J.L. Putman
U.S.	-- P.C. Aebersold, J.C. Bugher, H. R. Nelson
U.S.S.R.	-- K. Kursanov
France	-- J. Coursaget, M. Magat
Holland	-- A.H.W. Aten

In addition, an Advisory Board of scientists of international repute is being established by the Pergamon Press. The "Scope and Aims" of the Journal are summarized on the attached sheet.

The Press proposes to publish the first issue by March 1, 1956. It is planned that this issue will contain about 140 printed pages of which approximately 40 pages of U.S. contributions are requested. It was asked that this be split up into 3 or 4 articles. That would mean articles of 4,000 to 7,000 words each.

As a member of the Editorial Board, I have been asked to coordinate U.S. contributions for the Journal. The purpose of this letter is

Dr. Wilfred Mann

-2-

October 21, 1955.

to inform you of this publication and to invite a contribution from you for possible inclusion in the first or second issue.

Because of your experience and excellent work in this field I feel sure that you will be able to make a very worthwhile contribution to this new International Journal. There is much interest in and general need for latest information on methods for standardizing the activity of radioisotopes. Would you give me an appropriate title of a paper on this subject and its approximate length (4,000 -7,000 words desired).

It should be both a recognition of your work and an international service to contribute to this Journal. The time for submission is not fixed yet but should be sometime in January 1956.

We sincerely hope you will furnish a contribution. I would appreciate hearing from you as soon as possible.

Very truly yours,

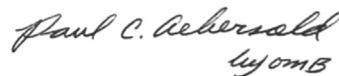

Paul C. AebersoldEnclosure:
Scope and Aims of the Journal

Fig. 2. 1955 invitation letter from Paul Aebersold to Wilfrid Mann.



Fig. 3. Henry Seligman, one of the founding editors of ARI. Courtesy International Atomic Energy Agency.

2. Scope and directions of ARI

The founders recognized that authors had other choices of journals in the broad fields of radiation and isotopes. Papers on accelerator engineering and solid-state radiation detectors usually went to *Nuclear Instruments and Methods Parts A and B*. Carbon-14 dating was such an important specialty that the journal *Radiocarbon* was established for papers on isotopic dating. Two important parallel journals from Pergamon Press were *Radiation Physics and Chemistry* (RPC) introduced in 1969 and *Nuclear Medicine and Biology* (NMB) in 1973. Brian Cox, the manager of sales for Pergamon Press has described Maxwell's strategy at the time of introducing new titles and using revenue from existing journals to support them until they developed a subscription base (Cox, 1998). In a move to increase subscribers, Maxwell and Cox decided in 1985 to re-brand the journals under the umbrella of the:

- International Journal of Radiation Applications and Instrumentation*
- Part A. Applied Radiation and Isotopes*
- Part B. Nuclear Medicine and Biology*
- Part C. Radiation Physics and Chemistry*
- Part D. Nuclear Tracks and Radiation Measurements*

The designs and color schemes of the covers were changed to give the journals the same look and feel. ARI remained yellow and blue, and the other journals had color covers from a similar palette. The newly renamed journals were published from 1986, although fortunately the volume

Table 1
Editors in chief of the journal Applied Radiation and Isotopes 1956, to present.

Editor-in chief	Editor-in-chief North America
Henry Seligman Physical chemist Founder of board 1956 EIC 1973–1993	Wilfrid Mann Nuclear physicist Joined board 1965 EIC-NA 1976–1988
David Taylor Radiobiologist Joined board 1964 EIC 1993–2004	William McLaughlin Radiation physicist Joined board 1976 EIC-NA 1988–1998
David bradley Medical physicist Joined board 1993 EIC 2004–2009	Bert coursey Physical chemist Joined board 1977 EIC-NA 1998–2005
Richard Hugtenburg Medical physicist Joined board 2005 EIC 2009 – present	Brian Zimmerman Radiochemist Joined board 2003 EIC-NA 2005 - present

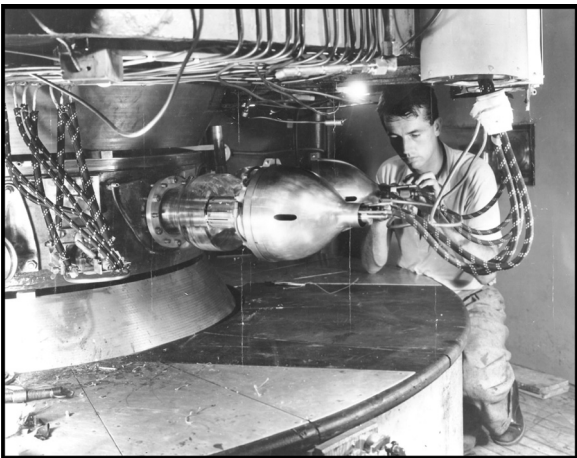


Fig. 4. Wilfrid Basil Mann in 1937 working with cyclotron in E.O. Lawrence's Radiation Laboratory in Berkeley.

numbering was retained from previous issues. The close partnerships of the four journals were strengthened by having editors and editors-in-chief serving on two or more journals. William Eckelman from the US National Institutes of Health took over as EIC of *Nuclear Medicine and Biology*, and Wilfrid Mann and Bert Coursey were added to the NMB editorial board. Mann prepared an exhaustive guideline for authors submitting papers to the four journals that was published in NMB (Mann, 1986). In addition to the usual admonishments to use the *Systemé International* (SI units of measurements) and IUPAC conventions, he included instructions intended to prevent authors from making all the errors he routinely corrected in English grammar, use of hyphens, and misuses of the word radioisotope. It was agreed (at least on the US side) that papers dealing with *in vivo* behavior of radiopharmaceuticals would go to NMB and those with *in vitro* applications could go to ARI. This was not uniformly adopted by all editors as some continued (as they do today) to accept nuclear medicine papers for ARI.

On the radiation physics and chemistry side, there was good coordination from the beginning as William McLaughlin (US), Arne Miller (Denmark), and John Hubbell (US) were frequent collaborators, with McLaughlin and Hubbell serving on the boards of RPC and ARI. When Pergamon Press was acquired by Elsevier B.V. in 1993, the first three journals reverted to their former names. Part D became *Radiation Measurements* in 1994. Current papers in that journal deal with radiation physics and solid-state dosimetry, and thus have some overlap with the scope of RPC.

3. ARI: the journal responds to evolving needs in applications for radiation and isotopes

Applications of radiations and isotopes have undergone tremendous change in the 60 years covered by the journal. Not all of the groundbreaking new applications have been published first in ARI. In most cases emerging applications have been published first in leading journals such as *Science*, *Nature* and *Physical Review Part C*. But ARI has often been fortunate to attract the follow-up papers which provide greater detail for the specialists.

The scope of the journal is so broad that papers span topics from radon concentrations in spa waters to treatment planning for radiation oncology. Still there are some disciplines, that use applications in radiations and isotopes that look first to ARI to present their work. Table 2 contains a listing of keywords and search results obtained using the PubMed search engine (National Institutes of Health, 2016). This is by no means an all-inclusive listing, and searches on keywords have obvious shortcomings; choices of keywords by authors have changed over six decades. Because of the name change in 1986, one has to search under the title *International Journal of Applied Radiation and Isotopes* for the first 30 years and simply *Applied Radiation and Isotopes* for the last 30 years. This turns out to be convenient, however, as we can see something of the trends in contributions to the journal in terms of the interests of the authors. There is also a nice correlation between Tables 1 and 2, in that we can see evidence of how the Editorial Board has had some success in steering the journal over the years.

The top three disciplines in Table 2 are dosimetry, radiopharmaceuticals, and radioactivity standards. These three communities of users consider ARI to present their papers, to organize scientific conferences, and to publish Special Issues devoted to specific topics. A good example of this is the McLaughlin special issue on dosimetry in 1982 (McLaughlin, 1982). This Special Issue was essentially a textbook on dosimetry, with chapters by the world experts in dosimetry from many fields. This was followed later by a Special Issue on electron-spin-resonance (ESR) dosimetry (Desrosiers and Skinner, 1993), which has evolved in recent decades from a research tool to a mainstay of industrial high-dose dosimetry.

One of the pioneers of nuclear medicine, Marcel Brucer from Oak Ridge, was on the ARI Board from the beginning. He was joined by David

Table 2
Number of citations identified by keywords in *Applied Radiation and Isotopes* using the PubMed search engine (NIH, 2016). Of the 15,000 contributions to the journal, 25% were published in the first 30 years and 75% in the last 30 years.

Keywords	1956–1985	1986–2016
Dosimetry	593	2080
Electron spin resonance	5	213
Medical physics	6	199
Radiopharmaceuticals	105	811
Positron emission tomography	17	331
Radioisotope production	72	388
Radionuclide standards	22	412
Environmental radioactivity	7	188

Taylor in 1964. The fields of nuclear medicine and biology include supporting technologies related to production of radionuclides, synthesis of pharmaceuticals, and the *in vivo* behavior of radiolabelled compounds. Brucer and Taylor took the lead in bringing these communities under the ARI umbrella. Taylor was the lead editor, with Michael J. Welch as Guest Editor, for the 1977 Special Issue on radiopharmaceuticals (Welch, 1977). At intervals of a few years, ARI has published a series of Special Issues dealing with specific radionuclides or applications; the most recent of these by the EIC North America, Brian Zimmerman, on gallium-68 calibrations for PET imaging systems (Mourtada and Zimmerman, 2013). One can see from Table 2 the effect of the technology that allowed more widespread use of PET imaging systems, and, correspondingly, more research papers related to radiopharmaceuticals for PET applications.

Wilfrid Mann was one of the founders of the *International Committee for Radionuclide Metrology* (ICRM), a worldwide organization for those interested in accurate measurements of radioactivity. ICRM is the forum for the world's radioactivity standards laboratories. From the early 1980s, Mann steered the working groups and conference organizers for ICRM to ARI to publish their proceedings. This has led radionuclide metrologists around the world to look first to ARI to present their work on standardization techniques for radionuclides. In addition to the proceedings of the biennial conferences of the ICRM, such as the Geel, Belgium meeting in 1983 (Coursey and McLaughlin, 1983), ICRM working groups in sub-disciplines, such as low-level counting and environmental radioactivity, have published in ARI (Mann, 1992). This accounts for some of the increase in papers in low-level counting in the past decades.

Medical physics is another major discipline that has turned to ARI in the past two decades. This has come about as a direct result of the EICs in the UK, David Bradley and Richard Hugtenburg. Before their tenure on the Board of ARI, papers dealing with radiation-therapy machines, treatment planning, and dosimetry were usually published in journals such as *Medical Physics* in the US and *Physics in Medicine and Biology* in the UK. Bradley was awarded the 6th JARI Medal for his scientific and editorial activities in medical physics in 2009. One can see from Table 2 that their work is having a pronounced effect on contributions from that very large segment of the research community.

4. Summary

Those readers who have a library with the first bound copies of ARI may find it enjoyable to compare Volume 1, No.1 from 1956 with an issue from Volume 118 in 2016. The range of applications has shifted away from agricultural and industrial uses of radiation and isotopes to current topics such as PET, Boron Neutron Capture Therapy (BNCT), and Intensity Modulated Radiation Therapy (IMRT). But, one is immediately struck by the high quality of the science and technology, and the rigor in the presentation of results, which have been hallmarks of the journal for 60 years. With continued efforts from our authors and the Editorial Board, we can anticipate several more decades of excellence for ARI.

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Bert M. Coursey
Gaithersburg, MD, USA
E-mail address: bert.coursey@nist.gov