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Invisible Rays: A History Of Radioactivity

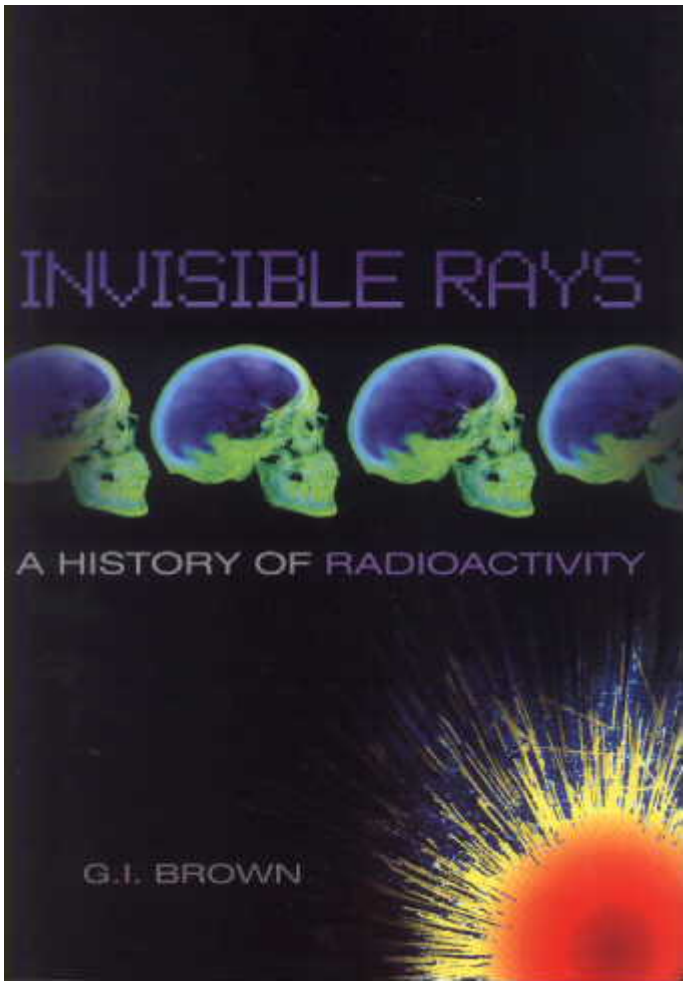
THE BOOK

Author	G.I.Brown
Publisher	Sutton Publishing Limited
Published	1945
Format	Hardback
ISBN-10	0750926678
Price	£19.99

Editor's recommendation — this book carries the editor's "must buy" recommendation.

VERY INFORMATIVE AND THOROUGHLY ENJOYABLE

Invisible Rays: A History Of Radioactivity, 2002 by G.I.Brown (Hardback)
Sutton Publishing Limited, Phoenix Mill, Thrupp, Stroud, Gloucestershire, GL5 2BU. : 248 Pages: ISBN 0 7509 2667 8: Price UK £19.99



G.I.Brown

The blurbs on the dust jacket of this book informs the reader that G.I. Brown is a retired teacher of chemistry and the author of a number of popular books such as "*The Big Bang: A history of Explosives*". During the Second World War he served as a technical officer with the Special Operations Executive in England and with the Services Reconnaissance Department in Australia. What the blurbs don't mention is that he is the author of "Introduction to Physical Chemistry" (Longmans, 1964) a well-recognised school chemistry text in the 1960's. Our sister publication has run a detailed interview of Dr. Brown. Readers desirous of reading this interview may want to click here.

For most people the Atomic Era dawned on the 6th of August 1945 at 10.15 a.m. at Hiroshima. Others with a basic knowledge of Physics would say that it all began with Henri Becquerel in 1896. According to this book however the history of radioactivity "began peacefully enough, in 1789, when a mineral called pitchblende was analysed by Martin Heinrich Klaproth".

Pitchblende, the waste product

Pitcheblende was a by-product of silver mining and was thought to contain zinc and iron. Klaproth disproved that, extracted a black powder and mistakenly believing it to be a new element named it Uranium after the newly discovered planet Uranus.

Thus the atomic era was born.

Early Days

The first few chapters of this book are a chronicle, which starts with the discovery of pitchblende. It then goes on to describe the development of the cathode ray tube, Roentgen's work with X-rays, the Curies, Lord Rutherford, Geiger and Fermi. These are some of the main players that most people would instantly recognise but Brown brings in a host of other lesser-known players who helped change the world. For instance, not many people would have heard of Frederick Soddy, James Chadwick and F.W.Aston. I doubt it if very many people have heard of C.T.R.Wilson. I certainly hadn't heard of Wilson although in the 1960's as a schoolboy I knew of his invention the cloud chamber. (See box 1)

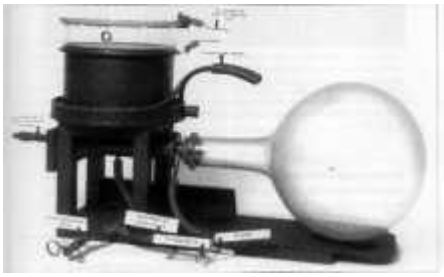
The main players are however Pierre and Marie Curie, Lord Rutherford, Niels Bohr and Enrico Fermi. In presenting the scientific developments Brown however does not ignore the human aspects of the players involved. This adds to the fascination of the book. For instance the chapter on the Curies is a mini biography of the Curies and in a later chapter of the book their daughter Irene enters the story.

A story it is and what a story! Brown is a great storyteller!

The Cloud Chamber

The cloud chamber is one of those simple but ingenious devices that one wishes was one's own invention! As all great inventions it was devised for a different purpose from what it was eventually used. Basically, a cloud chamber formed a cloud inside a small glass chamber by the simple process of cooling saturated air by reducing the pressure.

A 1911 model of Wilson's original cloud chamber (this figure appears on page 71 of the book)



This was achieved in turn by the simple downward movement of a piston or by squeezing and releasing a rubber bulb. The cloud formed in the chamber was an ideal medium to visualise the tracks of alpha particles. The apparatus described by Brown is C.T.R. Wilson's 1911 version. With modern equipment no doubt a more 'modern' version could be constructed but the principle will remain the same.

With the easy availability of laboratory facilities in Western universities perhaps present day researchers may not appreciate the difficulties that the pioneers had to undergo. The account of Marie Curie refining tons of pitchblende with the help of a cauldron in a cold draughty shed is touching. In the present "Buy in bulk, order on-line, disposable-do-not-refill" era that we live in it is easy to forget that these early workers worked with hand blown glass apparatus held together by string and sealing wax!

Brown in his account does not forget to give credit to the supporting cast such as the glassblowers who made the early experiments possible. Then of course there were the unexpected effects of radiation on the human body: Radiation induced illnesses, which certainly shortened the lives of the pioneers.

To me these first chapters remain the most fascinating part of the book. In spite of the Human Interest aspect of these chapters there is no shortage of scientific facts and insight.

The Thorium Decay Story

With the help of a few carefully chosen sentences and simple line drawings Brown manages to explain seemingly complex scientific instruments and concepts such as the cathode ray tube and radioactive decay. The scientific discoveries and puzzles are presented in the order they happened and the reader is made to look at the problem from the pioneer's point of view.

Rutherford and Soddy's analysis of the Thorium series is a case in point. Initially these two workers did not fully grasp what they were looking at. The whole business puzzled them. In the end they wrote that a series of spontaneous atomic changes must have been taking place 'of a different order of magnitude from any that have before been dealt with in chemistry'.

To explain the Thorium decay series Brown follows up this statement with a simple flow diagram used by Rutherford and Soddy, and then with the refined version of the flow diagram but using the historical names of the elements. He then refers the reader to the modern representation of the series using modern terminology and conventions.

Perhaps modern day students should be introduced to radioactive decay in the same manner.

Brown uses clever easily understood examples to illustrate scientific terms. For example isotopes are described as '..like having identical twins who differ only in their weight..'.

The relatively unknowns

Most readers would know the major players in the book. These are some of the relatively unknowns. 1. Klaproth, Martin Heinrich
Born: Wernigerode, Germany 1st Dec 1743
Wanted to study Theology but circumstances pushed him into taking up an apprenticeship with an apothecary.
Became a chemist and later Professor of Chemistry at the University Of Berlin. Studied pitchblende and discovered Uranium oxide.
2. Peligot, Eugene
Frenchman.
Professor of Analytical Chemistry
Showed that Klaproth's black powder was not Uranium but Uranium oxide thereby becoming the first person to make metallic Uranium.

3. Thomson J.J.
Born Manchester. Left school. Could not get apprenticeship with local manufacturers of locomotives. Failed first attempt to get into Cambridge. Inherited the Cavendish Laboratory as Professor of Experimental Physics. Described as a much loved human being.

4. Hahn, Otto
Young chemist from Germany. Came to England to improve his English. Discovered radiothorium. Went back to Germany in 1906 but since radioactivity was not a recognised subject was given premises in carpentry shop in basement of University of Berlin.

5. Müller, W.
Student working with Geiger who developed the Geiger-Müller counter.

6. Aston, F.W.
Born England 1893. Worked for a brewery. Later joined Cavendish Laboratory. Developed mass spectrograph. Discovered two isotopes of Chlorine.

7. Wilson, C.T.R.
Born 1869 Scotland. Father died when Wilson was 4. Family moved to Manchester and Wilson later entered University. Taught at Bradford Grammar School. Later Jacksonian Professor at Cambridge. Invented the cloud Chamber.

If you ever wondered what a critical mass of Uranium-235 looked like in size the answer is here in this book: Close to that of a golf ball!

By the time the reader reaches chapter 8 (Early Uses) he or she would have a very good understanding of radiation, isotopes, decay, artificial radioactivity and the concept of half-life. I certainly did not have to look up my old chemistry books!

Chapter 8 describes the early medical uses and quack misuses of radiation. Radium based creams, compresses, radioactive water, shampoo and others all quickly appeared. Then there was of course the saga of luminous paint. Most of these probably disappeared fairly quickly (including radium based paint) but up until the 1950's an x-ray based machine known as the pedoscope was used for testing the fit of a shoe.

Hiroshima and Nagasaki

Chapter 9 covers The Fission of Uranium, which is logically followed by Hiroshima and Nagasaki (chapter 10). The destruction of Hiroshima and Nagasaki is presented in a scientific and factual manner and without recourse to emotive language. Political aspects are kept to a minimum but nevertheless not totally ignored.
In this chapter the reader is introduced to the centrifugal method for separating Uranium-235 from Uranium-238 and immediately understands why UN weapons inspectors in Iraq are looking for such apparatus. (Uranium enrichment is further described in one of the appendices)

The climax is reached in chapter 11 entitled the Aftermath where the reader is taken through the development and testing of the Hydrogen Bomb. For the first time the researchers became aware of the awesome powers that they had released. This was the start of the so-called Cold War and also the start of harnessing the power for peaceful means.

Chapter 12 (Atoms For Peace) deals with the development of nuclear power. This is recent history. One learns of the different types of Nuclear Power plants and the scientific and political thinking behind their development. The military was not far away from all this and most people would remember USS Nautilus the first nuclear powered submarine.

Chapter 13 (Living with Radiation) deals with the hazards of radiation and starts off with an account of the fate of early X-ray workers. Roentgen himself escaped unscathed 'perhaps because he kept his X-ray tubes in a metal box'. Marie Curie of course died of a blood disorder. (Whether this was Aplastic Anaemia or Leukaemia is not clear from Brown's account.)

This chapter discusses radiation dosage and the concept of "absorbed dose" (expressed in the unit known as the Gray) and the "equivalent dose" (expressed in sieverts).

Cancer to Smoke Alarms!

Modern Uses (chapter 14) mostly covers the medical uses of X-rays and radioisotopes and also describes the origins of Nycomed-Amersham, the British company responsible for the production and development of radioisotopes. Some of the medical uses, for example that of Iridium-192 in the treatment of breast cancers is now only of historical interest. The industrial and other biological uses of radioisotope, for example as tracers, are also discussed, as is the use of gamma radiation in the sterilisation of food and medical instruments. Brown keeps his readers interested by bringing on an everyday household device: The smoke alarm! (See box 2). This definitely is Popular Science!

Chapter 15 is about Nuclear Accidents and here again Brown sticks to facts and scientific analysis without political bias and without the use of emotive terms especially when dealing with Chernobyl. This is one of the succinct accounts of Chernobyl that I have read. Brown almost never uses the term "disaster" but prefers the non-emotive "accident". There is a refreshing lack of sensationalism in his style of writing. Indeed after a diligent search I could only find one instance of the use of the word "disaster" between pages 174 and 192! (On line 22 of page 190).

This to me is the right way of looking at an accident: To learn the lessons to be learnt and not to score political points. Problem Areas is the next chapter and looks at the problems involved with the disposal of and transport of so-called Nuclear Waste and the decommissioning of nuclear power stations.

The smoke alarm

The smoke alarm is an almost compulsory fixture in British households and probably saves hundreds of lives every year. It is also probably the only item in any household to contain a radioactive isotope! A small quantity of americium-241 oxide conducts an 'electrical current' across an open chamber by means of naturally emitted alpha particles. This prevents the alarm from sounding. As soon as smoke gets into the chamber the alpha particles get deflected, the conductivity drops and a piercing piezoelectric alarm goes off. (Interestingly the piezoelectric effect was discovered by one of the pioneers!) The radiation hazard from smoke alarms is negligible and there is no radiation warning on the outside of the device which is just as well given the panic induced by the mere mention of the word RADIOACTIVE!

The final short chapter ("What Next?") discusses alternative forms of energy. This at the moment is of course a controversial subject and there is no doubt that future events in the Middle East may alter the balance and our way of thinking in the energy debate. As a reader with a basic background in chemistry and physics I found myself wanting to go back.to my A-Level days! The book certainly brought back fond memories of school days.

As a book written for a popular audience one should not criticise statements such as "Fearful of the fate of his (gold) medal he dissolved it in concentrated nitric acid." My thinking has always been that Gold only dissolved in a mixture of Nitric acid and Hydrochloric acid but then this is nit picking!

If a second edition is contemplated it might be an idea to include a chapter on the pathological effects of radiation on the human body, for example radiation necrosis, blood dyscrasias and radiation-induced tumours but from a historical point of view.

Throughout, the book is illustrated with simple but effective line drawings. A good example is the small diagram on page 106, which measures only 7 X 3.5 cms, and consists of two squares and a few simple arrows. Using this Brown explains the concept of critical mass. Brown is of course a retired chemistry teacher, which would explain a lot. This is a classic chalkboard drawing. Over the years he obviously has developed the knack of presenting complex subjects to unpromising, recalcitrant school audiences!

There are a large number of black and white photographs of a very good quality and the reproduction is excellent (The book is printed on coated paper). The illustrations include not only historical photographs but also documents such as Rutherford's handwritten notes. There are several appendices including one on Enriching Uranium. References for each chapter are included and there is a comprehensive bibliography. The book is well researched.

The print quality, binding and the presentation of the book are excellent and there is of course a dust jacket.

Who should read this book?

Everyone is the short answer!

School libraries as well as Medical libraries should obtain copies. Trainees in Radiology and Radiotherapy should start with this book. Journalists and sub-editors covering the present problems in Iraq would do well to read this book if only to prevent grossly misleading statements appearing in their journals.

I am not sure how to classify this book. It certainly is not a heavyweight physics/chemistry textbook filled with scientific data.

It very certainly is not a glossy "A to Z colour guide to X-rays and Atomic Weapons"! Then there is of course the historical and biographical material.

If asked to classify this book I probably would classify it as a Popular Science book. What matters is that it is a very informative and thoroughly enjoyable book on a very complex but important subject.

-Gyan Fernando

Dr Gyan Fernando's first choice of career involved steam locomotives. In his childhood imagination he worked firstly as a fireman and later as an engineer. Nothing came of these dreams except an enduring love of locomotives. At a later stage in life he developed a dangerous interest in Chemistry, mostly relating to



explosive agents and rocket propellants. Circumstances and his parents however pushed him towards a career in Medicine and into Pathology. He is at present the Home Office Forensic Pathologist for Devon & Cornwall.

View this book on Amazon

-Editor-in-Chief