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Ray's Awareness. Radiation Health Effects Made Easy with Professor Dee and Doctor Hay

K.H. Chadwick, 2014

York Publishing Services Ltd, York, UK

ISBN 978-0-9931158-0-6

Dr Chadwick's book 'Ray's Awareness. Radiation Health Effects Made Easy with Professor Dee and Doctor Hay' was written with the aim of providing in a clear and simple manner an explanation about how radiation can effect human health for the general public. More specifically, it was prompted by the "sensational reporting of the 2011 Fukushima-Daiichi disaster and the subsequent panic reaction by the local population".

To achieve this, the 146-page book has been divided in 8 chapters discussing, in a logical order and in relatively simple language, what ionising radiation is and how it works, how this relates to biological and health effects, and what radiation protection is, followed by a penultimate chapter on non-ionising radiation and chemicals (more on that later), and a final summary chapter. Two cartoon characters, Professor Dee and Dr Hay, are introduced at the start of the book to 'guide' the reader through the mathematical bits and related graphs, and who provide regular summaries or take-home messages to make sure the main messages from the different sections are clearly marked.

In simple terms, readers are guided through principles of radiation and radioactivity, and alpha, beta and gamma particles, half-lives and units of measurement are introduced. Subsequently, the basics of cells, molecules, chromosomes and DNA are discussed. When the reader is familiar with these concepts they are combined to discuss how radiation effects DNA through strand breaks. This is where equations get introduced to describe how radiation dose relates to dose-effect associations for primary and secondary double strand breaks. It is all kept relatively straightforward and sufficient explanation is included for people without special training to follow the arguments.

Having made the case for radiation dose and double strand brakes as the main biological mechanism, the book continues with outlining how these double strand breaks and dose- and doserate-effect associations relate to cellular effects such as chromosomal aberrations, mutations, hereditary effects, and cell killing and survival. And finally, using the same set of relatively simple equations, the book outlines how these are related to short-term and chronic health effects, or cancer. The main 'take home message' being that short-term effects have a threshold for effects to occur while this is not the case for cancers.

This leads Dr Chadwick to the two important conclusions of the book: (1) despite what some in the radiation research community argue, there is no threshold effect for cancer, and (2) the linear no-threshold model (LNT) and dose-rate effectiveness factors (DDREF) used by ICRP is incorrect, but does nonetheless result in broadly correct estimates of risk. With these conclusions, Dr Chadwick or, more specifically, Dr Hay and Prof Dee, are at variance with some in the radiation research community. This is however outlined at the start of the book, and should therefore come as no surprise.

So did it succeed in explaining how radiation affects health to the general population? Very much so indeed. The book is written in relatively simple, straightforward language, and the arguments laid out

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3 are clear, logical and concise. There are few equations for a book like this, and those that are, are well
4 explained. Moreover, there is sufficient recap and 'take home messages' to ensure that people
5 without basic training in radiation science don't get lost along the way.
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8 However, although I appreciated the frequent recap, I did not understand the inclusion of Professor
9 Dee and Doctor Hay, especially not where they were added to figures. This acted as a distraction and
10 minor irritant in places (my apologies to Mrs. Chadwick whose idea this was). I understand the idea
11 behind the inclusion of some light-hearted characters in a book aimed at the general public, and can
12 see how this may have worked had they been drawn professionally, but unfortunately they are not,
13 and are drawn using what I believe to be MS Word shapes. This, together with the layout and colours
14 selected for the book covers, make me wonder whether the target audience is actually early-mid teens
15 rather than 'the general public'. This is, of course, a minor issue only.
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19 Given the intended aim of the book, it should have included a (short) overview of areas of
20 disagreement and uncertainties, including for example cardiovascular effects of radiation, for which
21 there is good evidence, but which likely acts through another biological mechanism than that of
22 double strand breaks. In that respect, it would have been beneficial if there would have been some
23 collaboration with epidemiologists (although, of course, I would say that). This is especially evident in
24 the Chapter dealing with UV, non-ionising radiation and chemicals and which, despite these areas
25 having their own, entirely separate, research communities, are only covered in generalities at the end.
26 It is too short to do the issue of non-ionising radiation and of chemical exposures justice, while the
27 conclusion that non-ionising radiation cannot possibly cause biological and health effects is not
28 necessarily in agreement with recent epidemiological and mechanistic data (with the latest evidence
29 coming from the US National Toxicology Program [NTP, 2018]) indicating other, non-thermal,
30 mechanisms may be at play. Regardless of one's standpoint on this, it is unclear to me why this chapter
31 was included at all. It seems a stand-alone, somewhat ad hoc Chapter, and the book would have been
32 more concise had it been left out.
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38 Despite these points of criticism, in conclusion this book is a good introduction to radiation and its
39 biological and health effects aimed at the general public, and maybe specifically late teens. It is written
40 in an easy style with very clear and concise arguments, and I believe it would be very beneficial to the
41 public understanding of radiation risks and the communication surrounding incidents if more people
42 would read this book. Hopefully a second edition can address some of the highlighted issues. I will
43 keep this copy on the bookshelf in my office and will lend it to all new staff that will work on radiation
44 epidemiology to read.
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