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scanty, but it is possible the drug was first investigated as an antidote to the nerve gas Sarin, and tested on prisoners at Bergen Belsen. It took a further court battle, all the way through to an appeal at the European Court of Human Rights in Strasbourg, before *The Sunday Times* was able to publish its full exposé.

Nor is it the end of the story for survivors of thalidomide, who campaign still for a better deal for all those affected, who are growing older and have ever-greater needs, and also for those involved in the marketing of thalidomide to be held to account.

Attacking the Devil is a moving tale both of the suffering of the thalidomide

families and of the heady days of brave and principled journalism. There is shocking archive film—a mother tells how she never saw the baby who was taken away from her and was told by her doctor to forget she had even given birth and go on to have another as soon as possible. The film could have been sensational but is not, thanks to the sensitivity of the film-makers. Those involved tell their own story. Listening to one of the thalidomide survivors speak straight to camera about having it easy as he grew up, explaining that the burden was on his parents, while he got on with his childhood, I hardly noticed that he has no arms or legs and yet was

profoundly moved by the injustice of it. I will not forget the photo of him as a little child, peeking his head around a door, with an expression on his face of such delight in the world.

There was one good outcome of the thalidomide story, which hardly gets a mention: proper drug regulatory systems were set up. Hopefully, they will help prevent another such tragedy. But if they do not, it is anyone's guess whether there will be sufficient, well-resourced, independent investigatory journalism to pick it up and fight in the same way for the victims.

Sarah Boseley

In brief

Book **Radiation's risks and cures**

The earliest radiograph, a 15-min exposure taken by Wilhelm Röntgen in 1895, remains the most famous image in the history of radiation. Less well known is the frightened comment of Röntgen's wife on viewing her skeleton: "I have seen my own death!" Possibly in reaction, a cautious Röntgen took precautions to shield himself with lead and experienced no ill-effects, unlike some other experimenters. As early as 1901, physician Francis Williams called for the protection of physicians and patients in *The Roentgen Rays in Medicine and Surgery: As an Aid in Diagnosis and as a Therapeutic Agent*. Its title indicated radiation's potential to cure cancer by killing cells: "the Hippocratic paradox", remarks radiation biologist Timothy Jorgensen in *Strange Glow: The Story of Radiation*, his three-part narrative history which integrates detailed science and carefully illuminated medical statistics with the personal lives of scientists.

The same period saw the introduction of another invisible phenomenon "greatly feared as a deadly and invisible threat to health": electricity. Why no equivalent

social acceptance of radiation? The book's goal—"to present the facts about radiation as objectively and evenhandedly as possible, leaving you to decide which aspects to fear"—is achieved with authority and style.

Jorgensen examines radiation's effects on health, ranging from occupational diseases to the effect of atomic weapons on the Japanese population, monitored by the Life Span Study (LSS) of 120 000 bomb survivors and controls from 1945 until now. He then turns to current controversies, including radon in homes, diagnostic radiography, cell phone radiation, radioactivity in food, and nuclear accidents.

Radiation risk, "an ever-changing metric", has proved much harder to quantify than electrical risk. To measure radiation's effect on biological tissue, the original unit was the rad (radiation absorbed dose), which was updated to the rem (rad equivalence in man) by applying weighting factors to doses from different types of radiation. Today, the preferred unit is the millisievert (mSv).

Radiation sickness typically requires whole-body dose levels above 1000 mSv; just 3% of atomic bomb

survivors suffered this, whereas 80% received doses less than 100 mSv. Indeed, their overall excess cancers are only about 6% more than expected for a control population with the same age and gender distribution. At Fukushima, in 2011, not even the most highly exposed reactor worker had radiation sickness (he received an effective dose of 640 mSv). However, the contamination of the environs compelled the Japanese authorities to raise the annual dose limit from 1 mSv, before the disaster, to 20 mSv.

For a typical modern radiograph of a broken arm, the patient receives an effective dose of 0.001 mSv, and in a typical mammogram, 0.5 mSv. To most of us these are acceptable risks. But how to respond to the high probability of a false-positive diagnosis of breast cancer? Over a century after Anna Röntgen's unquantified exposure, radiation remains—for all its incalculable health benefits—in many ways a strange and disturbing phenomenon.

Andrew Robinson

Andrew Robinson is the author of *Earth-Shattering Events: Earthquakes, Nations and Civilization* (Thames & Hudson, 2016).

Strange Glow: The Story of Radiation
 Timothy Jorgensen
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