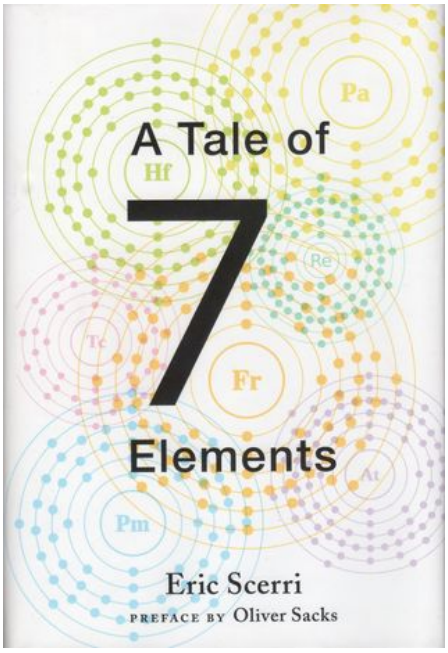

A Tale of Seven Elements

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In 1913, English physicist Henry Moseley established an elegant method for "counting" the elements based on atomic number, ranging them from hydrogen (#1) to uranium (#92). It soon became clear, however, that seven elements were mysteriously missing from the line up--seven elements unknown to science.
In his well researched and engagingly narrative, Eric Scerri presents the intriguing stories of these seven elements--protactinium, hafnium, rhenium, technetium, francium, astatine and promethium. The book follows the historical order of discovery, roughly spanning the two world wars, beginning with the isolation of protactinium in 1917 and ending with that of promethium in 1945. For each element, Scerri traces the research that preceded the discovery, the pivotal experiments, the personalities of the chemists involved, the chemical nature of the new element, and its applications in science and technology. We learn for instance that alloys of hafnium--whose name derives from the Latin name for Copenhagen (hafnia)--have some of the highest boiling points on record and are used for the nozzles in rocket thrusters such as the Apollo Lunar Modules. Scerri also tells the personal tales of researchers overcoming great obstacles. We see how Lise Meitner and Otto Hahn--the pair who later proposed the theory of atomic fission--were struggling to isolate element 91 when World War I intervened, Hahn was drafted into the German army's poison gas unit, and Meitner was forced to press on alone against daunting odds. The book concludes by examining how and where the twenty-five new elements have taken their places in the periodic table in the last half century.
A Tale of Seven Elements paints a fascinating picture of chemical research--the wrong turns, missed opportunities, bitterly disputed claims, serendipitous findings, accusations of dishonesty--all leading finally to the thrill of discovery.

A Tale of Seven Elements Details

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Author	:	Eric Scerri
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From Reader Review A Tale of Seven Elements for online ebook

James Vitarius says

Tales of the discovery of chemical elements that, while predicted by the periodic table, eluded scientists for decades. Mr. Scerri, a philosopher of science, has written a book that will appeal to the chemist in all of us but does fall short in the sense that he spends too much time reviewing high school-level chemistry and not enough time describing the scientific methods involved in the discovery of new elements. But for those who stick with it, there is a fascinating discussion around how integrating relativity theory with the chemistry of superheavy elements may change the way we think about basic chemical interactions.

Robin Friedman says

We Are Seven

Quickly, what are technetium, promethium, hafnium, rhenium, astatine, francium, and protactinium? What do they have in common? Eric Scerri provides answers to these questions and many others in his recent book, "A Tale of Seven Elements" (2013). Dr. Scerri teaches chemistry at UCLA and specializes in the history and philosophy of science. Besides engaging in his own technical research, Scerri has written several books explaining difficult and important scientific principles to non-specialist readers. He has written two introductory studies of the periodic table, "The Periodic Table: Its Story and Its Significance", and "The Periodic Table: A Very Short Introduction" in addition to this new, more narrowly focused book.

Scerri's book discusses seven chemical elements, named above. But why, precisely, these seven and not others? Why not more familiar elements such as oxygen, carbon, gold, and more? And why not five elements, or eight? As the book unfolds, Scerri develops the reasons for the focus. Understanding the background for the choice of the seven elements is at least as important to this book as is the individual treatments of each.

After an extended introduction on the nature of science and scientific discovery, Scerri offers two background chapters on the historical development of chemistry. These chapters are critical to understanding the discussions of the seven elements that follows. Broadly speaking, in the late 1860s, Dimitri Mendeleev formulated what is essentially the modern periodic table and the periodic law. Then, in the early years of the 20th Century, a number of scientists did a great deal of revolutionary work in studying x-rays, radioactivity, modern atomic theory, and quantum physics. In 1913 -- 1914, a young scientist, Henry Mosely, synthesized the current knowledge to conclude that the chemical elements could be ordered by atomic number in a sequence that at the time ran from 1 .... 92. Prior to Mosely's discovery, the elements were ordered by atomic weight which resulted in some confusions and inaccuracies. Mosely developed a technique for ordering the elements which soon showed that seven elements were missing from the traditional periodic table which ends with uranium, element 92. These elements had atomic numbers 43,61,72,75,85,87,91 -- the seven elements with which this review began, listed in ascending numerical order.

In successive chapters, Scerri tells the story of the discovery of each of these elements and of their basic chemical and physical properties. He discusses the elements in the order of their discovery with each chapter beginning with a diagram of the periodic table with the element in question highlighted for a frame of reference. Scerri does indeed tell stories. He is interested in the historical, social element that led to the discovery of each element. After Mosley's findings became known, scientists competed with one another to discover the "missing links" in the periodic table. Scerri discusses these efforts for each of the elements and

the differing techniques they used. Some scientists worked slowly and carefully, while other seemed to opt for flash-in-the pan approaches and, in a small number of cases, for an ethically questionable manipulation of data. Luck invariably also played a role in both the successes and the failures. Scerri focuses in particular on elements of nationalism among the competing scientists as most of the research on these seven elements took place during the WW I -- WW II years. Scerri uses substantial source material which shows the scientists and their respective supporters frequently arguing with each other about the merits of the research and about priorities in discovery. Scerri puts a human, halting face on the nature of scientific progress.

With all the emphasis on history and story, the discussion of the seven elements was the most interesting part of the book. Scerri develops the similarities and differences among the seven and tries to account for the properties of each element by the physical and chemical principles he develops beginning in the book's earlier chapters. He shows why each of the elements was rare and difficult of discovery. Of the seven elements, four are radioactive and inherently unstable. Two of the elements were discovered through synthesis rather than in nature. Of the seven elements, six bear odd atomic numbers, explaining their instability. With each element, Scerri shows the unsuccessful attempts at discovery and explains why these attempts failed while other succeeded. The discussion of the chemical and physical properties of the elements frequently is difficult for a lay reader such as myself. But with careful reading, I thought I increased my understanding of what chemistry was about.

Of the seven elements, Scerri seems most fascinated by no. 72, hafnium. The discovery of this element became intertwined with the earlier discovery of elements 70 and 71 as competing researches thought that element 72 would fit into different groups of elements. The ultimate discovery of the element owed a great deal to quantum physics leading some researchers to conclude that chemical properties ultimately were reducible to physical properties. In a section captioned "The Role of Hafnium in Philosophy of Chemistry", Scerri discusses this issue and concludes that the reducibility of chemical to physical properties has not yet been scientifically established.

Scerri has written a fascinating book about science, discovery, and philosophy of science that requires substantial effort to read. Scerri emphasizes historic and cultural and quirky factors influencing scientific research. Scerri, however, is neither a relativist nor a skeptic. Early in the book, he writes:

"Whereas theories and concepts that appear in textbooks are presented as being fully formed, real science is in a constant state of flux. When science is reported in the press, one seldom hears of the errors that led up to a discovery. In fact, actual science is full of mistakes and wrong turns. We don't ever reach the 'truth'. The best we can hope for is an approach to the truth, perhaps in an incremental fashion, meaning that current science is necessarily incorrect."

What comes through strongest in this book is the seriousness of the search for knowledge and understanding that manages to factor out to a degree competitiveness, human frailty, nationalism, and error. Science reaches results that form approximations to what is real through the processes of shared, disciplined inquiry.

I am grateful to OUP and to the author for the opportunity to read and review this book.

Robin Friedman

Brett Thomasson says

Eric Scerri is a chemistry professor at UCLA who also writes on the history and philosophy of chemistry. He's written several books on the development of the periodic table of the elements, that odd tiered chart we

may vaguely recall from high school chemistry classroom walls.

A quick summation of the history of that table opens his 2013 book, *A Tale of 7 Elements*. From there he gets into the main part of his story. In the late 19th century, as the periodic table neared the form we have it in today, it accounted for most of the elements known to people at the time. But there were seven gaps -- places where the table's organizing characteristics said there should have been elements. The problem was that no substances known at the time matched what those characteristics should have been. So Scerri describes how the seven were ferreted out by researchers and scientists.

Anyone who thinks that science is a dispassionate quest for the truth unadulterated by human failings like pride, greed and nationalism will learn some things from the stories Scerri offers. Those failings and several others are on full display as claims and counterclaims are made by one team or one scientists or another, research corners are cut and contradictory evidence covered up or ignored.

Even the advancing technology that aids the search -- and in the case of a couple of the previously unknown elements is the only thing that makes their discovery possible -- doesn't completely remove the human element from it. Scerri spends perhaps more time than he needs in explaining the development of the table itself, but his clear writing style goes easy on the chemistry terms and works to explain the ones he has to use.

The book closes with a couple of entries in the search for the elements that come after the original ones listed by Dmitri Mendeleev, the ones theorized but which are so unstable their atoms exist for only fractions of a second before breaking down. So there will be plenty of opportunities for scientists to show they're human all over again, even if some of the last centuries' spats may be exchanged for new ones. Given the weirdness of the modern American college campus, at least, there's a significant likelihood of that.

Original available here.

Kate Kroll says

Dull, with some small interesting tidbits of the discovery of some elements.

Reese B. says

This was an interesting book. That is, it had interesting content. Being the chemistry nerd that I am, I tried to stick with it and got to about 70%. But to be honest, it wasn't written in an engaging tone. It was a bit above my head too, but being only in Organic Chemistry, I suppose I shouldn't be too surprised.
This author clearly knows his stuff and there's no doubt this is would be a great source for those who are looking for information about the discovery of these elements. It just didn't suit my desires.
I would recommend this for chemistry/scientific history lovers who are willing to read about a topic regardless of the tone it's written in. Anyone new to the periodic table? Try The Disappearing Spoon instead.

Terri Timonen says

A basic understanding of the periodic table of elements such as author, Eric Scerri's "The Periodic Table: Its Story and Its Significance" (2007) will help the reader glean more from this fascinating book. However, the author makes it "user-friendly" enough for even the layperson to understand and in the first two chapters gives a condensed version of the aforementioned book.

"A Tale of Seven Elements" is about the last seven elements to be discovered of the first 92. It's not just a scientific account, rather the "tale" of each element is rich with history, scandal, betrayal, and untruths from prevarication to unwitting misconceptions. The discovery of each of these elements takes us behind the scenes covering such controversial elements (pun intended) of who(m) to credit it's discovery or "Priority assignment", what actually constitutes discovery of an element (it's more ambiguous than one would think) and what properties must the "said element" possess to even classify it as one. A layperson myself, much of what I assumed to know about the history, creation and application of the periodic table of elements was incorrect. Eric Scerri's ability to write succinctly while intuitively expounding upon and clarifying chemical terms and processes makes it a thoroughly enlightening read. What separates this book from other like-minded books that are written for and marketed to the general public is that this one works. Scerri successfully combines the right proportions of history, chemistry and physics that is inter-woven with compelling story-telling that keeps the reader engaged and motivated to continue reading (even through difficult passages like one quote written in French (literally).

Brian Clegg says

Eric Scerri, author of this book, is the wizard of the periodic table. He knows more about the chemistry student’s bane, and about elements and their history, than pretty well anyone else, full stop. His book The Periodic Table is the ultimate history of the development of this distinctive layout of the elements showing their relationships. But the blessing of his expertise and knowledge can also be a bit of a curse.

The trouble is, because he does know so much, Scerri does sometimes give us a bit too much detail. In this book, after a couple of chapters introduction to the origins of the periodic table (the least readable part of the book, which he hints you may wish to skip over) he tells us about the discovery of seven ‘missing’ elements, added late to their places in the table: protactinium, hafnium, rhenium, technetium, francium, astatine and promethium.

What is great about these discoveries is that they aren’t straight forward. Far from it. In fact in many cases there were stumbles along the way, with incorrect claims to have found a missing element, or downright disputes over who got there first. This is a very useful insight into the real nature of scientific discovery – not the cut and dried, steady progress of a school history of science book, but the messy and sometimes downright acrimonious progress of real people making discoveries and desperate to get there first.

There is, obviously, a huge opportunity for storytelling here, but the downside of the approach taken for the non-specialist popular science reader is that, although the personalities are there, we get rather too much of the dry science and step by step analysis of their work, and rather too little of the people and how they interacted. That’s a shame. It doesn’t by any means invalidate the book, but it does mean that it is far more suitable for history of science students and chemists who want to really get into the origins of some of their elements than it is for the general reader who wants to get a better picture of how science really works, along with some interesting history.

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Joshua Zucker says

Meh. Some good parts but mostly just tedious. Focuses a lot too much on who should get credit for the discoveries instead of on what they did to discover the elements. Very weak compared to the story of the periodic table and even there he wrote too much about priority instead of science history.

Howard Weingart says

Need a high level college education in chemistry to understand this book.

AbdulMawla Mohammed says

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Scott says

An interesting book about the last elements to be discovered other than the transuranium elements. I was a little disappointed that some of the quotations from foreign language journals weren't translated into English.

Rob says

I agree with another reviewer that, for a book aimed at a generalist audience, this book had too much recitation of basic science, and too little storytelling of the discoveries and the personalities. While the science was interesting, and generally not too simplistic, I think that it left the book more dry than one would hope. It came out more as an introductory science than a history book.

Roger Boyle says

Magnificent. Enjoyed this immensely.

At the border of science and the sociology of science by an accomplished and literate author. Communicates the issues and the problems beautifully and involves you in the chase ... but more interesting are the back stories which read like a partial history of the C20.

And the things you learn! A natural fission reactor in Africa, 10^-9 years ago ...

I actually used my elementary understanding of quantum theory and my A level in chemistry to enjoy this, so it may not be for everyone.

Comrade_Bazarov says

Interesting subject to write a book about. Scerri is interested in the history behind each element and doesn't spend too much time describing the actual science behind each discovery. His painstaking descriptions of each spurious claim (supplemented with letters) gets tedious at times. Seems like he is more interested in solving priority disputes (and touting his original research) than in the actual science. Could have been more streamlined and better organized.

Eric Jackson says

Interesting anecdotes, very technical both in the sense of the science the science discussed as well as the historical scholarship. I think it misses the mark as a "popular" science book and is, in fact, an excellence and readable reference.