RICHARD HAUGHTON

New chemistry revives elementary question

The periodic table is a public symbol of chemistry. But as it grows larger, we must stress that science is not just about producing lists, says **Philip Ball**.

Rarely does chemistry enjoy the limelight as it has in past weeks. The announcement by the International Union of Pure and Applied Chemistry (IUPAC) that the seventh row of the periodic table has been filled through the discovery of four artificially created elements (numbers 113, 115, 117 and 118) has excited wide public discussion. What will these substances be called? What chemical properties do they have? How much further can the periodic table be extended?

This enthusiastic reception is surely a boon for chemistry. But rarely, also, does a feted scientific discovery have so few implications for the research agenda. IUPAC's announcement is not even of a discovery as such, but of the organization's assessment that the claims for the elements pass muster, and of its judgement on whose claims take precedence. The handful of laboratories worldwide that are equipped for the awe-inspiring task of making new elements did not require this seal of approval before pressing further into uncharted terrain.

Every new superheavy element raises interesting questions: whether there exists a region in which nuclear stability increases rather than diminishes with increasing mass, for example, and whether relativistic effects of the ultrafast movement of electrons distort the repeating patterns of properties in the table. There is plenty to celebrate and to study.

Whether nuclear science is chemistry at all has been in dispute ever since it began. Ernest Rutherford considered it a great joke that his 1908 Nobel prize for exploring radioactive decay was in chemistry — an attempt, some say, to win nuclear science back to chemistry after Marie and Pierre Curie's work on radioactivity won them a share in the 1903 physics prize.

The case for calling it chemistry was strong in the days when isolating and analysing radionuclides depended on the skilful and inventive application of separation methods to tiny quantities of material. The same might be asserted for studying the properties of the superheavies today. The experiments that refined and characterized a few atoms apiece of elements 104 (rutherfordium) to 108 (hassium) — each decaying within tens of seconds at most — are breathtaking examples of ultra-sensitive chemical analysis. But the methods used to make the elements in the first place, bombarding heavy nuclei with heavy ions by accelerating the ions to energies capable of penetrating the repulsive electrostatic barrier around the target nuclei, fall squarely within high-energy physics.

A deeper issue is what popular interest in the new elements implies about the status of the periodic table itself. Its systematization of elements has made it an icon for chemistry as a whole. Yet chemists rarely need to refer to it, and most of them work with just a handful of the more common elements.

It is fair to say that the periodic table holds more interest and glamour for the public than it does for the working chemist. That's awkward: it would seem to open a rift between what many people think chemistry is about (study of the elements) and what most chemists do (make molecules and materials, and investigate their properties and interactions).

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There is, however, nothing unique about this. Tabulation or enumeration of fundamentals also features in physics (the particles of the standard model) and biology (the genetic code, lists of genes and taxonomy). These classification schemes loom large in the popular consciousness, so that physics is deemed to be about finding new particles (after the Higgs boson come supersymmetric particles, particles of dark matter and so on) and biology becomes about identifying 'genes for' certain traits.

An enthusiasm for list-making is understandable. Not only does it seem to make complex ideas simpler, but it brings order to chaos, and may genuinely point — as the periodic table and the standard model do — to underlying symmetries and principles. We all like a good system. But the danger is that science then starts to look like a 'piling up of facts' — a tendency that seems, in the age of big data, to be colouring public perception and infecting research agendas.

The challenge for chemists, then, is to find a way to capitalize on the allure and coherence of the periodic table while avoiding the impression that it somehow tells the story of their research.

This focus adds weight to the question of how the new elements will be named. It seems a pity that the parochialism and nationalism, bordering sometimes on chauvinism, of the past (see germanium, francium, scandium, americium and various permutations on the Swedish town of Ytterby) seems likely to persist. ('Japonium' is widely anticipated for element 113, because priority for its discovery was awarded to a team at the Japanese research institute RIKEN.) Why not take the opportunity to awaken the imagination, rather than plant a flag?

I would dearly love to see an element called levium, after the writer and chemist Primo Levi. His *The Periodic Table* (Einaudi, 1975) remains the best book ever written about chemistry, and it would please my sense of irony to see a superheavy element given a name that could be interpreted as a reference to lightness.

Yet this is not just about levity. Levi's account of his time in the Auschwitz concentration camp, 1947's *If This Is a Man*, is one of the century's most profound and humane works, testament to fact that science can be a liberating, universal force for salvation, while recognizing its potential to be abused in terrible ways. Levium would signify that the periodic table is for all of humanity. ■

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Philip Ball *is a science journalist in London.*
e-mail: p.ball@btinternet.com