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A brief history of the elements and the periodic table

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The lecture will begin with a brief history of the origins of the periodic table, beginning with the contributions of Lavoisier, Dalton, Döbereiner and others. I will proceed to the Karlsruhe conference and the ensuing independent discovery of the periodic table by as many as six individuals, culminating with Mendeleev's table just over 150 years ago. We will move on to the challenges that the periodic table faced, such as the existence of pair reversals and the discovery of the noble gases.

Next came several discoveries in physics, including X-rays, radioactivity and the electron, all of which had a profound effect on the understanding of the periodic table. Research in atomic structure beginning at the turn of the 20th century prompted some physicists such as J.J. Thomson and Niels Bohr to begin to seek a fundamental explanation for the periodic table in terms of electronic structure. The later developed quantum mechanics of Heisenberg, Schrödinger, Pauli and others led to a more rigorous explanation, although some open questions remain up to present times. For example, there is yet no fundamental explanation for the empirical rule that the occupation of atomic orbitals proceeds via the simple $n + l$ rule.

In addition, relativistic effects are being increasingly considered in attempts to understand the heavier elements in particular.

Finally, several other remaining open questions will be discussed, such as the membership of group 3 of the periodic table, alternative representations such as the 32-column format, the left-step periodic table and whether there may exist an 'optimal form' of the periodic table.