

German, and the "type" theory to the French, school of chemists. But the idea of the "atomicity" and "valency" or saturating capacity of the element of any substance was not possible without the clear notion of the "molecule" as distinct from the "atom." This idea had lain dormant in the now celebrated but long forgotten law of Avogadro, which was established in the year 1811, almost immediately after the appearance of Dalton's atomic theory.

The atomic theory may be regarded in two distinct ways, and it is instructive from the point of view of the history of thought to see how these two different aspects of the theory have gradually presented themselves. The older and vague atomic theory professed to be a theory of the constitution of bodies, and to afford the basis for an explanation of physical phenomena; in order to do this, forces of attraction and repulsion between the particles of

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Two aspects
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It appears that this theory was largely based upon a compound prepared by Bunsen, and called "cacodyl." This compound was one of the few organic radicles which contained a metal—arsenic. Frankland, partly alone, partly in union with Kolbe, entered upon a series of researches which had two distinct objects. Both these objects were foreign to that school which had given up the radicle theory, and which, by looking upon organic compounds as essentially different from inorganic compounds, had lost that important clue—the connection of the two branches of chemistry. These objects were the isolation of the so-called radicles or compound elements and the preparation of other "organo-metallic" bodies. The latter research led to new insight into the nature of chemical combinations. "I had

not proceeded far," says Frankland, "in the investigation of the organo-metallic compounds before the facts brought to light began to impress upon me the existence of a fixity in the maximum combining value or capacity of saturation in the metallic elements which had not before been suspected. . . . It was evident that the atoms of zinc, tin, arsenic, antimony, &c., had only room, so to speak, for the attachment of a fixed and definite number of the atoms of other elements, or, as I should now express it, of the bonds of other elements. This hypothesis, which was communicated to the Royal Society on May 10, 1852, constitutes the basis of what has since been called the doctrine of atomicity or equivalence of elements; and it was, so far as I am aware, the first announcement of that doctrine" (ibid., p. 145).