

mation of the molecule of hydrochloric acid depended upon an exchange of places of the atomic constituents in the molecules of the elementary substances, an atom of chlorine being substituted for an atom of hydrogen in the hydrogen molecule, and *vice versa* in the chlorine molecule.

About the middle of this century the conviction was thus firmly established in the minds of chemical philosophers that the simple symbolism by which Dalton and Berzelius expressed chemical combinations and processes was insufficient for the purpose of systematically arranging the

nition of the difference between atom and molecule belongs also to Gerhardt, who emphasised a fact known already to Berzelius—*viz.*, that hydrogen according to his notation appeared to combine with other bodies always in paired atoms. This fact remained unnoticed if the atomic number of hydrogen was put at 1, oxygen at 8, as was done by English chemists and reintroduced by Gmelin. Berzelius did not attach a fundamental importance to this fact. Blomstrand ('Die Chemie der Jetztzeit,' 1869, p. 30) has shown that this originated in his clinging to Lavoisier's oxygen theory. Oxygen was made the centre and measure of everything in chemistry, also of the equivalence of substances: Berzelius thus started from a unit which was too large, and with which the smaller value of hydrogen could not be measured. Gerhardt fully recognised the importance of this fact; showed in many examples that the combining or atomic weight of hydrogen had been fixed too high; and proposed to halve most of the organic formulae. In this way he proposed to bring harmony into the theory of combining volumes and the atomic theory. He partially succeeded in doing so, although in the

case of inorganic elements he went too far. This important step, which has been extolled by some, and depreciated by other historians of chemistry, is lucidly expounded by Rau in his 'Theorien der modernen Chemie' (vol. ii. p. 107, &c.) Wurtz ('Théorie atomique,' p. 64) considers Gerhardt's influence as a reform, and alludes to it as bringing again into view the hypothesis of Avogadro: "Voilà le thème d'Avogadro et d'Ampère, qui revient à l'horizon, comme une étoile dirigeante, après une longue éclipse. Et pourtant on ne peut pas dire qu'elle ait été pour Gerhardt, à cette époque du moins, un guide exclusif. Les considérations maîtresses qu'il a invoquées sont plutôt d'ordre purement chimique. Elles étaient justes, et il s'est trouvé qu'elles concordaient avec une idée également juste, et qui était tombée dans l'oubli. La distinction entre deux espèces de petites particules, molécules et atomes, qu'Avogadro et Ampère avaient introduite inutilement dans la science, que M. Dumas avait essayé de faire revivre dans sa Philosophie chimique, cette distinction était peut-être faite dans l'esprit de Gerhardt, mais elle n'apparaissait pas encore dans son langage."