

the mind of Whewell when, after writing his historical work, he attempted in the philosophical sequel to abstract the general ideas which have led scientific research; but it is instructive for our present purpose to note how, writing about the middle of the century, he hardly brought out any of those principles which in the course of its second half have turned out to be fruitful, and have almost become watchwords of popular science. In the year 1857, the date of the publication of the latest editions of Whewell's works, nothing was popularly known of energy, its conservation and dissipation,—nothing of the variation of species, and the evolution of organic forms,—nothing of the mechanical theory of heat or of that of gases—of absolute measurements and absolute temperature; even the cellular theory seems to have been popular only in Germany. And yet all the problems denoted by these now popular terms were then occupying, or had for many years occupied, the leading thinkers of that period. But we find no mention of them in Whewell's works.¹ So

6.
Whewell's
'History,
and 'Phil-
osophy.'

¹ The dates of the birth of these leading ideas of the second half of our century are approximately as follows:—

Absolute measurements were started by Gauss about 1830, and the scheme published in 1833 in his memoir, 'Intensitas vis magneticæ terrestris ad mensuram absolutam revocata.' They were extended to electrical phenomena by Weber in his 'Electrodynamische Maasbestimmungen,' 1846. The absolute scale of temperature was introduced by William Thomson in 1848.

The cellular theory was propounded by Schleiden in 1838, and

extended to animal structures by Schwann in 1839; the term "protoplasm" was introduced by Mohl in 1846.

The mechanical theory of heat dates from Mayer's and Joule's determinations of the equivalent of heat in 1842 and 1843.

The doctrine of the conservation of energy dates from Helmholtz's memoir, 'Ueber die Erhaltung der Kraft,' in 1847; that of dissipation of energy from William Thomson's paper "On a Universal Tendency in Nature to the Dissipation of Mechanical Energy," 1852; it was prepared by Watt's and Poncelet's