

studying those properties of matter that are preserved distinct in ever so large a number of individuals which are characteristically and specifically alike: while physicists had been mainly studying the properties of distance, motion, velocity, and size, which, if added together, merge themselves into a common sum, integral or average. It does not follow that, even so far as these latter properties are concerned, the numberless individual particles of matter behave alike; their sizes, velocities, and movements may be very different: indeed it is evident that, in a large crowd of moving particles, they must be widely different.

39.
Doctrine of
averages.

In assigning numbers to these data, it was therefore clear that only average or mean values could be meant, and that our actual physical knowledge of the individual elements resembles that statistical information which we possess, for instance, regarding the mortality, average age, and general properties and ways of the members of a great population. It is statistical knowledge, it is not individual, historical, or biographical knowledge, that we possess.

The individual behaviour of the single molecules, their sizes, their velocities, the length of their paths, their vibrations, rotations, and internal motions, remain unknown. What can be known is only the average magnitudes of these quantities, and possibly the extreme limits within which these individual magnitudes vary. The great differences exhibited by larger portions of different kinds of matter—*i.e.*, the chemical differences or qualities—were reduced to the actual composition and qualities of the molecules and atoms themselves. Chemists and physi-