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Preface

Many books are published every year on the history of science, but I know of no comprehensive treatise that blends the essential historical data (chronology, biographies, major background political and economical events, etc.) *together* with science proper (principles, laws, experiments, observations, theories, equations, etc.). The present encyclopedic treatise does just that; it tells the reader not only *who* did it and *when* it was done but also precisely *what* was done.

The saga of this history of ideas, discovery and invention in the natural and mathematical sciences – spanning about 100 generations of great thinkers from Thales to Feynman – unfolds in all its grandeur before the eyes and mind of the reader. Whether to professional scientists, students, or unassuming curious laymen, the doors of this shrine are open, inviting them to browse, linger and study whatever suits them. I believe that every intelligent person can understand the development of science when properly presented from its beginnings; The historical method is the best for introducing scientific facts and ideas to unprepared minds in a thoroughly understandable manner.

The history of science is more than the arithmetical sum of the histories of all sciences, for it also explains the interrelations of them all. Indeed, our division of science into many branches is largely artificial. Like the branches of a living tree which have no separate existence, but grow together – the progress of each science is dependent upon the progress of all the others.

The main postulate of science is the unity of nature: *nature is one*; and therefore, *science is one*. Finally, the fact that simultaneous discoveries have been made by different groups of workers, in different settings, organizations and nations, demonstrate that *mankind is one*: one mankind through one science is unfolding the mysteries of one nature.

It follows that the only rational way to subdivide this history is not according to the sciences or countries involved, but only according to time; for each period of time we have to consider at once the *whole* of science's historical and intellectual development. This calls for the marshaling of all scientific facts, activities and ideas in a definite order; which means that we must try to assign to each of them a date as precise as possible – not just the date of their birth or their publication, but also that of their *actual incorporation into our knowledge* – often a very difficult thing to do, as the reader will not fail to appreciate. Such work of erudition is the bedrock upon which this history is built.

We have also considered some other departments of life which have bearing on the evolution of science. These are:

- General natural and human history, especially the history of civilization.
- The history of technology.
- The history of philosophy and religions.

To make this general synthesis possible, we found it expedient to write a large number of monographs on various subjects which emphasize the interrelations between environmental, economic, social, cultural, political and scientific ‘events’ (e.g. the history of epidemics is needed to correctly estimate the evolution of medical ideas).

The history of science is a field of endless complexity and incredible scope. There are many ways to study it and many points of view, none of which is exclusive of the others. The chronological order of discoveries is often very different from their logical sequence. What some people call the logic of scientific discovery is largely a retrospective construction; it is nevertheless useful to bring it out. Discoveries are not always made in logical order but it is worthwhile and helpful to attempt to explain them in such an order: the actual path of progress is not straight but very crooked, although the general direction is clear enough.

We have interspersed our history with a narration of general intellectual climate and of major social, cultural, political, economic and environmental events: science does not develop in a social vacuum and every man of science needs a modicum of food and other amenities in order to do his work; if called to arms and killed in battle his activities come to an end; if he is an empirical scientist, his opportunities will depend upon the laboratory or observatory to which he has been admitted or which he was able to fashion, and his freedom to pursue his work will be limited by the good or bad will of administrators or fellow workers. Yet nobody can completely control his spirit; he may be helped or hindered, but his scientific ideas are not determined by social factors. Honest men of science and mathematics have often continued activities detrimental to their material interests.

In this treatise, I have tried to draw a map of science, technology and great ideas that would be as accurate and complete as possible, yet sufficiently free from unnecessary details and sufficiently condensed so as not to obstruct the general view.

The book was composed through intensive work during 1991–2008. I had planned to present it to my readers just at the turn of the millennium, but unexpected difficulties prevented me from this symbolic gesture.

The diverse sources used in my work are listed in the bibliography and sometimes in the text itself. Whenever possible, the data was cross-checked between different sources.