

with its great ideas of time, space, extension, magnitude, number, motion and power, all ruled by a supreme intelligence, takes precedence of any other branch of purely natural science, as a subject capable of filling the mind with noble contemplations, and furnishing a refined pleasure. Besides this influence, however, astronomy promises—so say those best qualified to judge—great material advantages for perhaps an early future, and it already has bearings on our every day lives, often unthought of, but of vast importance. A page or two on these utilitarian aspects of astronomy may not prove uninteresting to the reader who has found little time to inquire into them.

A single consideration sufficient to show how completely the daily business of life is affected and controlled by the heavenly bodies, is suggested by the fact, that from observations of them is obtained our only adequate measure of time, and our only means of comparing the time of one place with the time of another. Our artificial time-keepers, clocks, watches and chronometers, however ingeniously contrived, are but a transcript, so to say, of the celestial motions; they are of incalculable utility, but do not escape the imperfection of all machinery, the work of human hands. The moment we move with our time keeper, east or west, it fails, it keeps home-time alone, and often at home, to reverse the lines of Pope,

'Tis with our watches as our judgments, none
Go just alike, but each believes his own.

But for all kindreds and tribes and tongues of men—upon their own meridian—the eternal sun strikes twelve at noon, and the glorious constellations, far up in the everlasting belfries of the skies, chime twelve at midnight. The measure, too, of the year and lunar month, a knowledge of the exact duration of which is so indispensable to our progress, is derived from observations of the heavenly bodies. The phenomena upon which they depend are obvious, and to the supreme intelligence who rules the universe, there is, no doubt, a harmony in the numerical relation to each other of days, months and years, but to us this harmony is hidden, to us these divisions are not exactly commensurable, and to adjust them to each other, is one of the most difficult problems of practical astronomy. This remark is illustrated by the great embarrassment which attended

the reformation of the calendar by Pope Gregory in 1582, after the error of the Julian period had, in the lapse of centuries, reached ten days. In the land of the Czars they persist, at the present day, in adding 11 min. 12 sec. to the length of the year, an error which by accumulating for 19 centuries, now amounts to about 12 days, and which will, in time, make the month of July occur in mid-winter.

Astronomy is termed the soul of chronology, from the assistance which it gives in assigning to important remote events their proper dates. For example, Herodotus narrates that a battle between the Medes and Lydians was brought to a close by a total eclipse of the sun; another eclipse is known to have occurred about the time of the death of Herod the Great; by determining the dates of these from the cycle of eclipses, clues are obtained respectively to Persian chronology, and to the exact number of years from the building of Rome to the birth of Christ. Conjunctions of the heavenly bodies are employed, in seeking dates, in the same manner as the cycle of eclipses. In this connection, it is to be said that the data comet-hunters, and professional observers are rapidly gathering regarding the periodic re-appearance of, at least, a goodly number of the comets, promise great assistance to chronologists, for we have accounts, say leading astronomers, of all the comets which have appeared for thousands of years.

The momentous voyage, of which the four hundredth anniversary occurs in 1892, owes to astronomy its conception and its successful accomplishment. Profound meditation on the sphericity of the globe, was one of the main reasons, which led Columbus to undertake his perilous expedition, and the almost innumerable obstacles which attended its prosecution, were, in his own judgment, overcome by his thorough acquaintance with the astronomical science of that day. No doubt, without the invention and improvement of astronomical instruments, and without the clear steady light, which long and careful observation has shed on the celestial phenomena, modern commerce would never have attained such a vast expansion, compared with that of the ancient world. The variation of the compass bewildered Columbus, on his way across the Atlantic; that same variation