tive action on each other, according to known laws. The place, therefore, of every planetary body in the system can be definitely calculated for any period.

Now it was found by independent calculations made both by Leverrier, and by Adams of Cambridge, that the observed motions of Uranus, the most distant planet then known, did not correspond with the positions it would occupy if acted on only by the sun and other known planets: there were irregularities or perturbations unaccourted for, which, taking all the premises into consideration, they concluded were caused by the action of another unseen planet lying beyond the orbit of Uranus.

Leverrier, after a vast amount of labour, determined the distance of this unseen planet from the sun—its period of revolution—its mass and the spot in the heavens where it would be found. He communicated these calculations to Dr. Galle, of Berlin, and, marvellous to relate, that practical astronomer, on the evening of the day on which he received the communication, directed his telescope to the spot, and there caught the first glimpse of Neptune, as he pursues his course on the outskirts of the solar system.

In the experimental and observing sciences, the discoveries have been more numerous and even more important than those in Astronomy. The brilliant experiments of Davy, on the composition of bodies, shed a new light over Chemistry; and the still profounder investigations of Dalton, who unfolded the law of definite proportions —one of the most important generalizations in science—gave to Chemistry mathematical precision, and raised it to the rank of an exact science. More recently, Liebig has opened out a new field, and expounded the composition of organic bodies, and shewn the high practical value of these researches to physiology, and especially to egriculture.

Electro-Magnetism has arisen from the refined investigations of Oersted and Faraday; and it supplied the principles on which the electric telegraph is constructed—that marvellous invention, which almost annihilates time and space, conveying its intelligence with the lightning's speed over hill and vale, and even through the deep; by its means, the death of the Czar of Russia, the arch-troubler of our times, which took place between 1 and 2 o'clock on the Friday morning, was announced in Edinburgh by 6 o'clock on the evening of the same day.

To our own era belongs the construction of railways, and of the huge iron tubes (due to the experimental researches of Fairbairn) which span even straits of the sea; and more especially, the extended application of steam power to manufactures and to locomotion, whereby the productive power of our country has been enormously increased—new means of civilization have been furnished—and the comforts, and even some of the luxuries of life, brought within the reach of some of the humbler classes.

Within the present century, great additions have been made to Natural History : for example, one century ago less than 6000 plants were known to Linnæus, but at the present period 100,000 are known —a large proportion of which have been described. But it is more important to notice, that a new and more philosopical spirit has been infused into this interesting department of knowledge. Much of this is due to the distinguished Cuvier, who has shewn that in organised structure there is a purpose as well as a law, and that every organised being forms a system of its own, all the parts of which mutually correspond and concur to produce a defluite purpose by reciprocal action. The application of the microscope, also, has given a new insight into organic structure, which has improved physiology and led to more scientific principles for the preservation of health and the treament of disease.

Under the influence of a kindred spirit, Antiquarianism, which formerly was too often an accumulatio of useless lumber, has sprung into Archæology, which has thrown new light on pre-historic eras, and furnished interesting illustrations of the manners and habits of subsequent times; as a proof of this, I would refer to the remarkable Work of Daniel Wilson, * on Archæology and the Pre-historic Annals of Scotland.

Nor is it uninteresting to o'serve how, in our days, the sciences have been made mutually to illustrate each other—Electricity has been connected with Magnetism—Mathematical formulæ have been given to Chemistry—and Zoology and Botany have lent material aid to Geology. In the controversy which is now going on regarding the plurality of worlds, appeal has been made to Geology—the deep and dark recesses of the earth have been summoned to give evidence whether the far distant planet is inhabited.

"Geology," which, according to Herschel, "in the magnitude and "sublimity of the objects of which it treats, undoubtedly ranks in the "scale of sciences next Astronomy," is almost entirely the creation of the last fifty years. The Cosmogonies of former times were either crude speculations or pleasant romances. Burnet's Theory of the Earth, which was lauded by Locke, the metaphysician, and by Addi-

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son, the poet and essayist—is a work of brilliant imagination, rivalling, in this respect, the magnificent epic of Milton's Paradise Lost. But modern geologists, following the Baconian method of induction have observed and not invented—they have carefully compared their facts, and rigorously reasoned upon them, and not imagined; and by this process have arrived at the most important generalisations. The ancient archives of the earth have been laid open, and the characters impressed on the rocks have been deciphered; and it has been proved that the earth has been subjected to frequent revolutions in times long anterior to the appearance of man; that the rocks of which the crust of the earth is composed, exhibit various formations, each distinguished by the organic remains therein imbedded; the structural peculiarities of these ancient Faunas and Floras have been explained, and the different physical conditions which the earth presented at various successive periods have been revealed. These discoveries have had no unimportant influence in directing the search for coal, and on mining, engineering, and agriculture.

mining, engineering, and agriculture. The diffusion of science is not less interesting than its development. Formerly it was confined to the colleges of the learned and the halls of the wealthy. Great men appeared even in the early periods of its history, but their numbers were few; the rising sun lit up with glory the mountain tops, while the plains and valleys below lay in obscurity; but, in our time, science has descended to the mechanic's reading room; she finds a place in the well-conducted parochial school, and is even no rare visitant of the cottage.

It is cheering to notice the men who have sprung upward from the lower stations of life to scientific eminence. Faraday, whose researches in Electricity, Magnetism, and Chemistry, place him in the foremost rank of philosophers, was originally a bookseller's apprentice. Hugh Millar, the most popular writer on Geology, worked as a stonemason in the Old Red Sandstone Quarries of the north of Scotland, to which his genius and eloquence have given celebrity. Dalton, the discoverer of the law of definite proportions, was the son of a small farmer : science found him an humble schoolmaster among the mountains of Cumberland; she claimed him as her son, threw her mantle over him, and pointing upward bade him explore the regions of vapour and of cloud, and the more recondite laws which govern the combinations of matter.

Northumberland has been remarkable for producing eminent mathematicians, and natural philosophers, from the lower ranks of life. George Stephenson, the author of the Railway System, was for some time a brakesman, in a colliery on the Tyne; and the man, whose fame as a practical engineer filled Europe, —who had stood before Kings, —and who could earn his hundred guineas per day, at one period of his history was engaged in pulling turnips in the field at the magnificent sum of two-pence per day. Airey, the present Astronomer-Royal, is a native of Alnwick, and I believe, the son of an exciseman. Another distinguished mathematician, the author of some profound papers on physical astronomy, was a draper's assistant behind the counter at North Shields. Three other gentlemen who were in succession schoolmasters in a small village in the west of Northumberland, eventually became mathematical professors at Woolwich and Putney; and one extraordinary man, now occupying an important position in King's College, London, and who is the author of gome of the best of Weale's mathematical publications, began his mathematical career at a pit mouth in Tyneside, where he attended a steam engine, and at intervals worked his problems on the blackened door of the engine house.

Every son of toil may be encouraged by such examples to look onward and upward. The barriers of caste need not arrest or retard his advancement on the pathway of science; for here labour, if systematically pursued, and directed to a definite object, is the great element of success.

It has been said and sung that there are "mute, inglorious Miltons." I am sure, however, there are many more cultivators of science who contentedly follow their ordinary avocations, and employ their leisure hours and their holidays in scientific research. Several of these men may be found about Manchester and the vales of Larcashire. Some of the hand-loom weavers may be even throwing the shuttle, with Newton's Principia before them. Natural History, especially Botany and Entomology, are, however, the favorite studies. When any interesting plant is in flower or rare insect on the wing, these philosophers in humble life may be seen setting off. with their dinner tied in a handkerchief, to spend the day in some distant glen, or on some hill, where the much-prized treasures may be found. Sir James Smith, an eminent botanist, relates that being on a visit to Roscoe, the historian, he made inquiry after the habitat of a rare plant which grew in Lancashire. Roscoe referred him to a hand-loom weaver. The enthusiastic botanist set off in quest of this person; and, on his arrival at Manchester, he asked the porter who carried his luggage if he could direct him to this hand-loom weaver. "Oh yes," was the reply, "he does a little in my way." Sir James Smith found that these two men were friends, skilful botanista, and able to furnish him with all the information he required.