

only to show how closely that question is connected with the points we have been discussing. I have here a gas flame to which I feed air until its yellow luminosity has disappeared. If I add to the air supply the fine spray of a dissolved copper salt, the flame assumes a green tint characteristic of the metal. This green tint seems to belong to the whole flame, but if we dissect it by the apparatus already so often used, we find that the green tint is developed only in the outer cone. It is due, in fact, to oxide of copper, which can only exist on the outside of the flame. Similar peculiarities are noticed with some other coloured flames, and it is hoped that their study, which leads us into the domain of spectrum analysis, will yield some interesting information on points which are at present very obscure.

I have directed your attention this evening to terrestrial flames of small dimensions, but in conclusion I should like to remind you that at one time there were probably quite other flames upon this earth. The globe we inhabit is in the process of cooling and of oxidation; at one time we believe, in fact we know, that it was incandescent. If we take a chemical retrospect and imagine as we recede in time our present cool earth becoming hotter, we may follow out some interesting changes. We should soon reach a temperature too high for the persistence of liquid water; our oceans would be evaporated and surround the globe as an envelope of steam. In remoter times and at higher temperatures this steam could not exist even as steam, but would be dissociated into hydrogen and oxygen. At that time, too, many of the elements now existing as oxides in the solid crust of the earth would be floating in a gaseous state in the vast atmosphere. Let us stop our retrospect at this point, and look towards the present with a cooling earth. At a certain point chemical combination must have begun in the fringe of the ancient atmosphere, and it must have been the scene of colossal chemical activities, the hydrogen and vaporous metals flashing into their oxides. On gravitating to hotter regions, these combinations may have been again undone, the elements sent again into circulation. How long such a period may have lasted we need scarcely stop to ask. If the retrospect is reasonable, it is enough. It is interesting to think how such an earth as we have pictured must have resembled the sun as we know it at the present day.

There was formerly a chemical theory of the sun, which ascribed both its heat and light to the act of chemical combination. That theory has long since been refuted and discarded, and with it ordinary laboratory chemistry banished from that luminary as altogether unsuited to its high temperature. There is cause, I think, to ask if this is quite warrantable. We know extremely little of chemistry at high temperatures, but if the sun could be shown to have its reasonable share of oxygen, we might well ask if its surface phenomena were not largely ascribable to ordinary chemical activities and of the nature of flames. It is certainly remarkable, when we consider the unity of plan in which heavenly bodies are seen more and more to move and have their being, that the sun should not exhibit the possession of its fair share of that element—oxygen—which has ruled the chemistry of the earth throughout all geological time and long precedent ages of its evolution. But this is ground which the terrestrial chemist must tread with care. He still has many unsolved problems lurking in the flame of a common candle, and flame, wherever we find it, is still a mystery.

"The power of *Fire or Flame*," says Carlyle, "which we designate by some trivial chemical name, thereby hiding from ourselves the essential character of wonder that dwells in it as in all things was with the old northmen Loke, a most swift subtle *Demon* of the brood of the Jötnuns. The savages of the Landrones Islands too (say some Spanish voyagers) thought Fire, which they never had seen before, was a devil or god, that bit you sharply when you touched it, and that lived upon dry wood. From us, too," adds Carlyle, "no Chemistry, if it had not stupidity to help it, would hide that Flame is a wonder."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—On Monday, the 20th inst., Prof. E. B. Poulton, the President of the Ashmolean Society, gave a *conversazione* in the University Museum, which was numerously attended by members of the city and University, who were specially invited to meet the Local Executive Committee of the British Association. The features of the entertainment were: an interesting

lecture on features in the past history of science in Oxford, by Mr. Falconer Madan; physical experiments, by Prof. Clifton and Mr. J. Walker; exhibits of various entomological specimens from the Hope Collection; glass-blowing, by Herr Zitzmann; living animals and museum preparations, by Dr. Benham and Mr. Goodrich; physiological exhibits, by Messrs. Pembrey, Gordon, and Howard; and many other exhibitions which cannot be noticed for want of space.

The Junior Scientific Club, whose proceedings have been hitherto published in a somewhat haphazard manner, have decided to issue a series of fortnightly numbers, each of which contains an account of the papers read at the previous meeting. The first of these was published on the 17th inst., and is in all respects a credit to its editor. It contains, besides abstracts of papers read by Messrs. M. H. Gordon, S. A. Simon, and W. J. Waterhouse, a syllabus of all the papers read before the club during the past year, an obituary, and notes on the distinctions gained during the past year, by present and former members of the club.

At a meeting of Convocation held on Tuesday last, Dr. Arthur Thomson, University Reader in Human Anatomy, was appointed Professor of Human Anatomy.

CAMBRIDGE.—Mr. M. R. James, of King's College, has been appointed Director of the Fitzwilliam Museum in succession to Prof. Middleton.

An election to an Isaac Newton studentship in astronomy, astronomical physics, and physical optics, will be held in the Lent Term 1894. The candidates must be B.A.s and under the age of twenty-five. The studentship is worth £200 a year for three years. Applications to be sent to the Vice-Chancellor by January 26, 1894.

A syndicate has been appointed for the purpose of obtaining specifications and tenders for the erection of the Sedgwick Memorial Museum of Geology, in accordance with the plan of Mr. T. G. Jackson.

An influential deputation waited upon the Chancellor of the Exchequer on Tuesday in order to place before him the necessity for continuing, and, if possible, increasing, the Parliamentary grant of £15,000, which was conceded to the University Colleges in 1889. Sir W. Harcourt said that though he was prepared to recommend the renewal of the grant, the present condition of public finances would not permit him to propose its increase.

SCIENTIFIC SERIALS.

American Journal of Science, November.—On New England and the Upper Mississippi basin in the glacial period, by James D. Dana. During the recent discussions concerning the unity or otherwise of the glacial epoch in North America, it has appeared that workers in the central and western portions have mostly advocated two glacial epochs, while New England geologists have been the chief advocates of unity. The author has not found any facts in New England geology that require for their explanation an appeal to two glacial epochs, but has found an explanation of the appearances which have led western geologists to that opinion. The cause of this sectional divergence is mainly meteorological. Even at the present time, the precipitation in the east is far above that of the west, and in the glacial epoch the difference must have been still greater, owing to the greater elevation of the east. The conditions of the ice-sheet in the interior being near the critical point, a small meteorological change, if long continued, might carry off the ice for scores or hundreds of miles from a southern limit, while the eastern border was all the time gaining in ice, or was making only a short retreat.—On the use of the name "Catskill," by John J. Stevenson. Mr. Darton's suggestion that the term Catskill should be applied to the whole of the Upper Devonian period is inappropriate, since Catskill has been shown to belong to an epoch only, whereas "Chemung" carries with it the conception of those physical and biological characteristics which mark the great closing period of the Devonian.—The finite elastic stress-strain function, by G. F. Becker. This is an investigation of finite stress and strain from a kinematical point of view, and of the function which satisfies the kinematical conditions consistent with the definition of an isotropic solid. The bearing of the theory upon finite sonorous vibrations is compared with the corresponding deductions from Hooke's incomplete law.—A larval form of *Triarthrus*, by C. E. Becher. Since the discovery of antennæ and other appendages of this