conceptual thought, language, which is nothing if not conceptual, begins. Roots are afterwards localized, and made the signs of our objects by means of local exponents, whether suffixes, prefixes, or infixes. What has been scraped and shaped again and again becomes as it were 'shape-her',' *i.e.* a shaft; what has been dug and hollowed out by repeated blows becomes 'dig-her',' *i.e.* a hole. And from the concept of a hole dug, or of an empty cave, there is an uninterrupted progress to the most abstract concepts, such as empty space, or even nothing. No doubt, when we hear the sound of cuckoo, we may by one jump arrive at the word cuckoo. This may be called a word, but it is not a conceptual word, and we deal with conceptual words only. Before we can get at a single conceptual word, we have to pass through at least five stages:—

"(1) Consciousness of our own repeated acts.
"(2) *Clamor concomitans* of these acts.
"(3) Consciousness of that *clamor* as concomitant of the act.
"(4) Repetition of that *clamor* to recall the act.
"(5) *Clamor* (root) defined by prefixes, suffixes, &c., to recall the act as localized in its results, its instruments, its agents, &c.

"You can see from my preface to the 'Science of Thought' that I was quite prepared for fierce attacks, whether they came from theologians, from philosophers, or from a certain class of scholars. So far from being discouraged, I am really delighted by the opposition which my book has roused, though you would be surprised to hear what strong support also I have received from quarters where I least expected it. I have never felt called upon to write a book to which everybody should say *Amen*. When I write a book, I expect the world to say *tamen*, as I have always said *tamen* to the world in writing my books. I have been called very audacious for daring to interfere with philosophy, as if the study of language, to which I have devoted the whole of my life, could be separated from a study of philosophy. I have listened very patiently for many years to the old story that grammar is one thing and logic another; that the former deals with such laws of thought as are observed, the latter with such as ought to be observed. No, no. True philosophy teaches us another lesson—namely, that in the long run nothing is except what ought to be, and that in the evolution of the mind, as well as in that of Nature, natural selection is rational selection; or, in reality, the triumph of reason, the triumph of what is reasonable and right; or, as people now say, of what is fittest. We must learn to recognize in language the true evolution of reason. In that evolution nothing is real or remains real except what is right; nay, in it even the apparently irrational and anomalous has its reason and justification. Towards the end of the last century, what used to be called *Grammaire Générale* formed a very favourite subject for academic discussions; it has now been replaced by what may be called *Grammaire Historique*. In the same manner, *Formal Logic*, or the study of the general laws of thought, will have to make room for *Historical Logic*, or a study of the historical growth of thought. Delbrück's essays on comparative syntax show what can be done in this direction. For practical purposes, for teaching the art of reasoning, formal logic will always retain its separate existence; but the best study of the real laws of thought will be hereafter the study of the real laws of language. If it was really so audacious to make the identity of language and reason the foundation of a new system of philosophy, may I make the modest request that some philosopher by profession should give us a definition of what language is without reason, or reason without language? "F. M. M."

## *FERDINAND VANDEVEER HAYDEN.*

WE reprint from the American journal *Science* (January 6) the following article on Dr. Hayden, whose death we lately announced:—Prof. Ferdinand Vandeveer Hayden, M.D., Ph.D., LL.D., who died in Philadelphia on the morning of December 22, was born in Westfield, Mass., September 7, 1829. Early in life he went to Ohio. In 1850 he was graduated from Oberlin College, and soon afterward read medicine at Albany, N.Y., receiving his degree from the Albany Medical College in 1853. He did not begin the practice of medicine, but in the spring of the year of his graduation was sent by Prof. James Hall of Albany, with Mr. F. B. Meek, to visit the Bad Lands of White River, to make collections of the Cretaceous and Tertiary fossils of that region. This was the beginning of his explorations of the West, which continued with little interruption for more than thirty years.

In the spring of 1854, Dr. Hayden returned to the Upper Missouri region, and spent two years in exploring it, mainly at his own expense, although he was aided a portion of the time by gentlemen connected with the American Fur Company. During these two years he traversed the Missouri River to Fort Benton, and the Yellowstone to the mouth of the Big Horn River, and explored considerable portions of the Bad Lands of White River and other districts not immediately bordering upon the Missouri. The large collections of fossils he made were given partly to the Academy of Sciences in St. Louis, and partly to the Academy of Natural Sciences of Philadelphia.

As one of the members of the Geological Survey has recently said, these collections and researches mark the commencement of the epoch of true geologic investigation of the Great West. The collections attracted the attention of the officers of the Smithsonian Institution; and in February 1856, Dr. Hayden was employed by Lieut. G. K. Warren, of the United States Topographical Engineers, to make a report upon the region he had explored; so that the results of his labours during the three previous years were utilized by the Government. This report was made in March of the same year, and in May following he was appointed geologist on the staff of Lieut. Warren, who was then engaged in making a reconnaissance of the North-West. He continued in this position until 1859, when he was appointed naturalist and surgeon to the Expedition for the exploration of the Yellowstone and Missouri Rivers, by Capt. William F. Raynolds of the Corps of Engineers of the United States Army, with whom he remained until 1862. The results of his work while with Liutenant Warren were published in a preliminary report of the War Department, and in several articles in the Proceedings of the Academy of Natural Sciences of Philadelphia for the Years 1857 and 1858, and more fully in a memoir on the geology and natural history of the Upper Missouri, published in the Transactions of the American Philosophical Society, Philadelphia, 1862. This paper also included chapters on the mammals, birds, reptiles, fishes, and recent mollusca of the region in which his geological investigations were carried on. During this period also he found time to make notes upon the languages and customs of the Indian tribes with which he came in contact. These notes were embodied in "Contributions to the Ethnography and Philology of the Indian Tribes of the Missouri River," published in the Transactions of the American Philosophical Society, Philadelphia, 1862; in a "Sketch of the Mandan Indians, with some Observations illustrating the Grammatical Structure of their Language," published in the *American Journal of Science* in 1862; and in "Brief Notes on the Pawnee, Winnebago, and Omaha Languages," published

in the Proceedings of the American Philosophical Society, Philadelphia, 1869.

In May 1862, Dr. Hayden was appointed acting-assistant surgeon of volunteers by the Surgeon-General of the United States Army, and was sent to Satterlee Hospital in Philadelphia. He was confirmed by the United States Senate as assistant-surgeon and full surgeon of volunteers on the same day (February 16, 1863), and sent to Beaufort, S.C., as chief medical officer, where he remained for one year, when he was ordered to Washington as assistant medical inspector of the Department of Washington. On February 19, 1864, he was sent to Winchester, Va., as chief medical officer of the army in the Shenandoah valley. Here he remained until May 1865, when he resigned, and was brevetted lieutenant-colonel for meritorious services during the war. During the remainder of the year 1865 he was employed in work at the Smithsonian Institution. It was during this year that he was elected Professor of Geology and Mineralogy in the University of Pennsylvania,—a position he held until 1872, when the increased executive duties in connection with the Geological Survey of the Territories induced him to resign it.

In the summer of 1866 he undertook another expedition to the Bad Lands of Dakota, under the auspices of the Academy of Natural Sciences of Philadelphia, for the purpose of clearing up some doubtful points in the geology of that region, and returned with large and valuable collections of vertebrate fossils, which were described in a memoir published by the Academy of Natural Sciences of Philadelphia in 1869. From 1867 to 1879 the history of Dr. Hayden is the history of the United States Geological and Geographical Survey of the Territories, of which he was geologist-in-charge, and to the success of which he devoted all his energies during the twelve years of its existence. In this time more than fifty volumes, together with numerous maps, were issued under his supervision. One of the results of his surveys, and the one in which he probably took the greatest interest, was the setting aside by Congress of the Yellowstone National Park. The idea of reserving this region as a park or pleasure-ground for the people originated with Dr. Hayden, and the law setting it apart was prepared under his direction. The work of the Geological Survey of the Territories had its consummation in the Atlas of Colorado, which increased greatly our knowledge of one of the most interesting portions of the Great West. In 1879, after the disbanding of the Survey of the Territories, Dr. Hayden received an appointment as geologist on the newly organized United States Geological Survey. For about three years he was occupied in the completing of the business of the Geological and Geographical Survey of the Territories, and the preparation of the final results of that survey. His health had already begun to fail, but early in 1883 he asked to be relieved from the supervision of the printing of the reports, and during the three following seasons he undertook field work in Montana. By the latter part of the year 1886 his health had become so poor that he was confined most of the time to his bed. He then resigned his position as geologist, closing an honourable connection with the Government that included twenty-eight years of actual service as naturalist, surgeon, and geologist. To the general interest in science excited by the enthusiastic labours of Dr. Hayden in his geologic explorations, is due in a great degree the existence and continuance of the present United States Geological Survey.

In 1876 the degree of LL.D. was conferred upon him by the University of Rochester, and in June 1886 the same degree was conferred upon him by the University of Pennsylvania. Dr. Hayden was a member of the National Academy of Sciences and of many other Societies scattered throughout the country. He was also honorary and corresponding member of a large number of foreign Societies.

As to Dr. Hayden's personal character, those who were personally associated with him know best how genial he was, and how sincere and enthusiastic his desire to forward the cause of science. Although impulsive at times, he was generous to a fault. His subordinates all knew that each one stood upon his own merits, and that due credit would be awarded to his successful efforts. The same spirit actuated him in respect to those not immediately connected with him. His views are expressed as follows in one of his earliest reports, when speaking of those who had preceded him: "Any man who regards the permanency or endurance of his own reputation will not ignore any of these frontier men who made their early explorations under circumstances of great danger and hardship."

His ideas were broad and liberal. He aimed to make a thorough astronomical, topographical, geological, and botanical survey of the Great West, with a view to the development of its mining and agricultural resources. The greater part of his work for the Government and for science was a labour of love.

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To the foregoing notice some token of recognition and regret on the part of brother geologists on this side of the Atlantic may perhaps be fittingly appended by one who knew Dr. Hayden personally, was familiar with his writings, and had wandered in his footsteps among the solitudes of the Far West. The first impression which the late geologist made on those who came to know him was one of gentleness, almost of timidity. They could hardly help asking themselves, "Can this be the man who has so successfully won over the blustering Congressmen to grant him year after year such large appropriations for his western surveys; who has organized such wonderful expeditions; who has gone through such hardships, and in an incredibly short space of time has made such excellent reconnaissances and published such voluminous Reports and admirable maps?" It was some time before one could see the real underlying secret of his success. This was undoubtedly a quiet enthusiasm for science, supported by an undemonstrative but indomitable courage, and a determination to gain the proposed end, cost what it might in bodily and mental endurance. No one who has not been in some measure admitted behind the scenes of political wire-pulling in the States, can realize what had to be undertaken by the man of science who would obtain and retain an annual subsidy from Congress for scientific investigation in the days when Hayden carried on his explorations. There were other rival claimants for Parliamentary aid who were doing similar work, under other Government Departments. There was likewise the wide outside circle of scientific men who had no State employment, and some of whom thought themselves at least as deserving of it as those who fortunately had gained it. Then there were the Gallios of Congress, who cared nothing about science of any kind, those who grudged money spent out of their own States, those who required to see on their drawing-room table a well got up Annual Report with pictures and maps before they could be made to believe that the money was well bestowed. And the weeks and months of early summer, so precious for field work, had to be passed in the lobbies of the Capitol, making sure that there would be no failure in the granting of the appropriation. The most wearisome and profitless part of his year was this "lobbying" at Washington. But Hayden had no choice in the matter. He must either go through with that part of his work or abandon his western surveys altogether. This alternative has not always been borne in mind by those who have judged of him.

There can be no doubt that among the names of those who have pioneered into the marvellous geology of Western North America, that of F. V. Hayden will

always hold a high and honoured place. This place will be his due, not only because of his own personal achievements in original exploration. His earlier work exhibits much of that instinctive capacity for grasping geological structure which is the main requisite for a field geologist. He had a keen "eye for a country." But he likewise possessed the art of choosing the best men for his assistants, and the tact of attaching them to himself and his corps. In this way he accomplished much excellent work, keeping himself latterly rather in the background so far as actual personal geological investigations were concerned, and contenting himself with the laborious task of organization and supervision, while he encouraged and pushed forward his coadjutors.

The abolition of his Survey and the appointment of one of his rivals to the post of Director of the reconstituted Geological Survey of the United States, was a blow from which he does not seem ever to have recovered. He was treated, however, with great generosity by the new Director, and had a share of the large annual appropriation to enable him to complete his Reports. He was urged to condense these voluminous works, and to present a concise and readable account of what he and his fellow-workers had done for the geology of the far West. But he had no literary proclivities, and in the end gladly surrendered the task of writing for the more congenial employment of renewing his personal acquaintance with the geology of the Western Territories. Perhaps among those, and there must be many, who personally knew and esteemed him, there may be one competent and willing to compile or complete the summary which he never completed, and thus to erect to his memory a more fitting and lasting monument than one of brass or marble. A. G.

## *NOTES.*

WE regret to announce the death of Dr. Asa Gray, the most eminent of American botanists. He died at Cambridge, Massachusetts, on Monday, aged seventy-seven. Next week we shall give some account of his services to science.

MR. GEORGE GODWIN, F.R.S., well known as the editor of the *Builder*, died on January 27. He was seventy-three years of age. Among his writings were several works in which, with great earnestness, he pressed upon the attention of the public the evil consequences springing from the neglect of sanitary laws.

MR. GEORGE ROBERT WATERHOUSE, late Keeper of the Department of Geology in the British Museum, died at his residence, Curton Lodge, Putney, on January 21, in his seventy-eighth year.

WE have also to record the death of the well-known botanist, Dr. J. T. I. Boswell, who was for many years Curator to the Botanical Society in London, and a Lecturer at the Charing Cross and Middlesex Schools of Medicine.

THE Medals and Funds to be given at the annual meeting of the Geological Society on February 17 have been awarded as follows:—Wollaston Medal to H. B. Medlicott, F.R.S.; Murchison Medal to Prof. J. S. Newberry, M.D., of New York; Lyell Medal to Prof. H. Alleyne Nicholson, M.D., D.Sc.; Wollaston Fund to John Horne, F.R.S.E.; Murchison Fund to E. Wilson of the Bristol Museum; Lyell Fund to Arthur H. Foord, and T. Roberts, B.A.

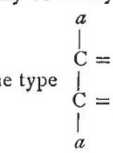
THE Academy of Sciences at Turin has awarded the great Bressa prize of 12,000 francs (£480) to M. Pasteur.

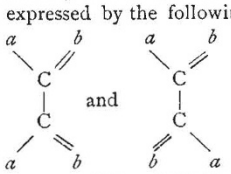
THE eighteenth International Congress of Orientalists will meet in Stockholm on September 2 next, and be opened by King Oscar in person, attended by the whole of the Royal family. The Congress will sit till September 6, when the members will visit Christiania as guests of the King, in whose name they will be entertained in the Norwegian capital for two days. They will then proceed to Gothenburg, where the Congress will be dissolved. In honour of the Congress a bibliography is to be issued, containing the portraits in heliography of all living Orientalists, and a *résumé* of the works published by each. The work is to be most sumptuously got up. The editor is Count Carlo Landberg.

THE following arrangements have been made for the Penny Science Lectures at the Royal Victoria Hall: February 7, by Dr. Percy Frankland, "Germs in the Air, and what they do for us"; February 14, by E. Wethered, "Earthquakes and Volcanoes"; February 21, by F. R. Cheshire, "Insects as Florists and Fruit-makers"; February 21, by E. Hodder, "Incidents in the Life of Lord Shaftesbury."

INFORMATION has been received of the arrival of H.M. surveying-ship *Egeria*, Capt. P. Aldrich, at King George's Sound, after a very successful deep-sea sounding cruise across the Indian Ocean. Between latitudes 10° and 35° S.,—a belt 1500 miles wide,—not a single sounding has heretofore been obtained in this ocean, and it is therefore satisfactory to learn that forty-three soundings, all of them accompanied with several sets of temperature observations, have been now obtained. The *Egeria's* track was from Sunda Strait to Mauritius, thence south to latitude 38°·5, and thence to Western Australia.

MEMORIALS are being sent from various public bodies in Hampshire to the Lord President of the Council, requesting that the proposed Forestry School for England may be established in that county. It is pointed out that the extensive Crown lands of Hampshire are peculiarly well fitted for scientific and practical forestry.

A PAPER of exceptional interest was read by Prof. Victor Meyer at the meeting of the Chemical Society of Göttingen held on January 24 In it were embodied some remarkable speculations upon the shape of the ultimate atoms of carbon. These ideas are the outcome of his recent work upon the oxims of benzil and certain other complicated organic compounds, and may be briefly summed up as follows. Certain compounds of the type  (where *a* represents a monad and *b* a dyad radicle) exist in two isomeric modifications which can only be expressed by the following different geometrical arrangement:



This necessitates an expansion of the theory of Van t' Hoff and Wislicenus, according to which, by rotation of one of the carbon atoms in the first case, the latter would be the only stable form; there are cases in which this rotation is free to occur, and cases like the present where it is prevented. From a consideration of the geometrical isomers of the benzyl cyanides, Prof. Meyer further shows that the valencies of carbon may be displaced out of their normal positions at the corners of a regular tetrahedron by the unequal attractions of unlike radicles. Finally, as the only means of accounting for all these varied phenomena, Prof. Meyer expresses his conviction that the atoms of carbon are spheres, each surrounded by an ether-shell, which forms the seat of the four valencies. On account of their probable electrical connection he terms these valencies "electrules," and considers that the electrules of the same atom are in isochronous oscillation, and