Dr. Werner Siemens has constructed a selenium photometer, in which the selenium is prepared so as not to be affected by the changes to which that substance is liable, and which consists of a single sensitive plate mounted upon a vertical axis, upon which it can be turned through a certain angular distance limited by stops. When touching the one stop the selenium stands opposite the normal candle, and when touching the other opposite the light to be measured, the distance upon the former being changed upon a scale until no effect upon the needle of a galvanometer is produced in turning the sensitive plate in rapid succession from the one stop to the other.

The lecture was concluded by the exhibition of a selenium eye, which Mr. Siemens had prepared to illustrate the extraordinary sensitiveness of the selenium preparations. It consists of a hollow ball with two circular openings opposite each other, the one being furnished with a lens $1\frac{1}{2}$ inches in diameter, and the other with an adjustable stopper carrying a sensitive plate, which is connected by wires to a galvanometer and one Daniell's cell. The lens is covered by two slides representing eyelids, the ball itself being the body of the eye, and the sensitive plate occupying the place of the retina. Having placed a white illuminated screen in front of the artificial eye, on opening the eyelids a strong deflection of the galvanometer was observed, a black screen giving hardly any deflection, a blue one a greater, a red a much greater, but still short of that produced by the reflected white light. The eye was thus sensitive to light and colour, and as stated, it would not be difficult to arrange a contact and electro-magnet in connection with the galvanometer, so that intense light would cause the automatic closing of the eyelids. The artificial eye is subject to fatigue, and the lecturer considered that this experiment might be suggestive to physiologists as regards the natural conjoint action of the retina and the brain.

THE LATE COLONEL STRANGE, F.R.S.

LIEUT.-COL. ALEXANDER STRANGE, F.R.S, whose death we last week announced, was the fourth son of the late Sir Thomas Strange, and was born at Westminster on the 27th of April, 1818, and was educated at Harrow. On leaving school in 1834, at the early age of sixteen, he proceeded to India, and joined the 7th Regiment of Madras Light Cavalry, where his natural talents began to develop themselves. He shortly afterwards made the friendship of General Worster, who soon discovered that he had mechanical abilities of the highest order, and who subsequently instructed him in the use of astronomical and surveying instruments, and pointed out to him that nature had intended him for a scientific career. During the next few years he became a devoted student at the Magnetic and Meteorological Observatory at Simla, then under the direction of Major-General Boileau, R.E., at whose recommendation he was nominated, in 1847, by Col. (now Sir Andrew) Waugh, R.E., Surveyor-General of India, to the office of Second Assistant in the Great Trigonometrical Survey, where he found work suited to his talents. He was originally selected on account of his ability as an observer, and for his extraordinary mechanical skill, which in this department was of special value, and was displayed in such a remarkable degree as to call forth the highest commendation from Col. Waugh. In the season 1848-49 he was attached to the party under Capt. (now Col.) Renny Tailyour, R.E., in order that he might acquire a practical knowledge of geodetical operations. Such was the rapidity with which he made himself master of this difficult subject, that in 1850 he was promoted to the grade of First Assistant. Capt. Tailyour was ordered to undertake the triangulation of what is known as the "Karáchi Longitudinal Series," which constitutes the southern flank of that considerable portion of the principal triangulation of the Survey of India known as the North-west Quadrilateral. It commences at Sironj in Central India, and terminates at Karáchi, in Sind. The extent of this arc of longitude is equivalent to 670 miles in length, covers an area of 23,000 square miles, and is one of the largest longitudinal arcs ever measured on the surface of the globe. At the end of the first season, Capt. Tailyour's services being required at head-quarters, Capt. Strange was ordered to take over the entire charge of the Series, and it is on this great undertaking that his fame as an Indian Surveyor rests. After crossing the Desert, over which the triangulation had to be carried nearly 200 miles, the work was carried on with the highest skill across the Plains of Sind, until at length, after much anxiety, and having overcome almost insuperable difficulties, the last angle which completed this great triangulation was measured on April 22, 1853, and the work brought to a successful close.

The remarkable energy and rapidity with which this series was carried on, under many and great difficulties, was reported by the Surveyor-General to reflect on him the highest credit. He was directed to join the Surveyor-General's camp near Attock, where he took part in the verificatory base line. After this he returned to Karáchi with the base-line apparatus, and took a leading share in the measurement of the base-line at that place in the year following. Meantime he had been distinguished with the title of "Astronomical Assistant." In 1855 Strange joined the Surveyor-General's Head Quarters' Office, and in the following year was placed in charge of the triangulation which was being extended from Calcutta southwards towards Madras, along the eastern coast. In April, 1857, whilst conducting the triangulation in the Goomsoor Hills, a notoriously unhealthy tract, he was struck down by jungle fever, and was afterwards ordered to the Neilgherry Hills for the recovery of his health. In the year 1859 he was promoted to the rank of major, and in accordance with the then existing regulations of the service retired from the Survey, on which occasion he received the special thanks of the Government of India.

In January, 1861, he returned to England after twenty-six years' continuous service in India, and finally retired from the army as lieutenant-colonel on the 31st of December, 1861. His career in England was no less brilliant than that in India. In 1861 he was elected a Fellow of the Royal Geographical Society as well as a Fellow of the Royal Astronomical Society. He served on the Council of the latter from 1863 to 1867, and was Foreign Secretary from 1868 to 1873. On the 2nd of June, 1864, he was elected a Fellow of the Royal Society, of which he soon became a distinguished member; he served on the Council from 1867 to 1869.

In the year 1862 the Secretary of State for India in Council sanctioned the provision of an extensive equipment of geodetical and astronomical instruments of the first order, for the service of the Great Trigonometrical Survey of India, consisting of one great theodolite, two zenith sectors, two 5-feet transit instruments, two electro chronographs, two diagonal transit instruments, two 12-inch vertical circles, and three astronomical clocks. The task of designing and superintending their construction was entrusted to Lieut.-Col. Strange, who was also appointed to the post of Inspector of Scientific Instruments to the Indian Government. To enable him to test these valuable instruments as well as the current supply required by the Public Works, Survey, Meteorological, and various other Departments in India, an Observatory was established at the India Store Depôt in Lambeth from designs prepared by himself. This observatory, in its various ingenious details, is a monument of Col. Strange's consummate mechanical genius.

At this Observatory, theodolites, levelling instruments, prismatic compasses, sextants, telescopes, barometers,

© 1876 Nature Publishing Group

thermometers, drawing, and mathematical instruments of all kinds were rigorously inspected, compared, and verified under Col. Strange's personal superintendence, and the improved forms of instruments now supplied to the services in India, are in a very large measure due to his efforts, and it must have been a source of gratification to him to find that they were received with almost universal approbation. He devoted much anxious time and thought to the laborious task of testing the magnificent series of instruments above alluded to.

The telescope has an aperture of $3\frac{1}{4}$ inches, with a focal length of 36 inches. The instrument is constructed upon what is known as "the flying micrometer plan," and possesses a great number of peculiarities which are quite unique. It will be found fully described in a paper read by him before the Royal Society in 1872. This is undoubtedly the finest instrument of its kind ever constructed, and will be an enduring monument to his unremitting energy and constructive genius. The zenith sectors were designed for the accurate determination of latitude, and in design are unlike any of their predecessors; being intended for portable instruments the problem was to get the maximum of power out of the minimum of weight, and in this he was eminently successful, for on comparing one of these with the weight of the zenith sector designed by the present Astronomer Royal for the Ordnance Survey of Great Britain it was found to be only about one-half. With regard to the performance of these instruments, Capt. J. Herschel, R.E., F.R.S., who has been employed in determining latitudes in Southern India, in comparing the facility of working the zenith sector and the former astronomical circles of the Great Trigonometrical Survey, states that "the sectors are competent to turn out at least double the amount of work of the same order," adding, "at this rate two or three years' work, would equal in amount the whole results up to the date of the arrival of the sectors, and ten years (a comparatively short period for which to arrange a system of observation on a matter of this magnitude) will see us in a position to look back on the arrival of the sectors as on the commencement of a new era." All the other instruments present evidences of Col. Strange's constructive genius.

Such is the amount of skill and forethought brought to bear upon the design of these exquisite instruments that an observer may select a series of stars differing only five minutes of time in Right Ascension. Each star is observed twice in reversed positions of the telescope at the same culmination, and each of the two reversed observations involves two settings of the telescope in altitude, four microscope, two level and one micrometer reading. To admit of all these operations being performed within five minutes of time, with the deliberation requisite for observations aiming at fractions of a second, demands the highest conveniences of instrumental construction.

After their completion and final testing, they were severally despatched to India, where they have for some years been employed in the Survey Department, unapproachable for manipulative facilities and giving results unsurpassed in accuracy. Indeed, it is not too much to say that these instruments, in the construction of which Col. Strange had the advantage of being so ably seconded by the late Mr. Cooke, of York, and the well-known firm of Troughton and Simms, are the most perfect and powerful geodetical instruments which have ever been constructed or are likely to be constructed for some years to come.

Among his publications which appear in the Memoirs of the Royal Astronomical Society, vol. xxxi., are the following: "On Testing the Vertical Axes of Altazimuth Instruments," "On a Direct Method of Testing and Adjusting the Equipoise of Altazimuth Instruments," "On a Proposed Isolated Flange for Conical Axes." In the Monthly Notices of the Royal Astronomical Society, vol. xxiii.: "On Aluminium Bronze as a Material for the Construction of Astronomical and other Philosophical Instruments;" and in the Journal of the Royal United Service Institution, vol. vi., "Geodesy, especially relating to the Great Trigonometrical Survey of India." He contributed papers on various subjects to the Royal Society, the British Association, the Society of Arts, the Meteorological and other scientific and learned societies.

His scientific activity, however, was by no means confined to these questions, which came before him in his official capacity. In compliance with a request made by her Majesty's Commissioners for the International Exhibition of 1862, Col. Strange served the office of juror. He also performed the same functions at Paris in 1867. "While in the Royal Society," to quote from the memoir in the *Times*, "he insisted upon the accuracy of the measurements used in physical inquiries, in the British Association, and was the clear-sighted and constant advocate of increased instruction in science and the increased utilisation of it in our public departments; and he was among the first to insist upon the national importance of fostering the pursuit of knowledge in those fields which, though unremunerative to the cultivator, are eventually of the highest importance to the nation. To him belongs the whole credit of having initiated in 1868 the movement which resulted in the appointment by her Majesty of the 'Royal Commission on Scientific Instruction and the Advancement of Science,' of which his Grace the Duke of Devonshire was chairman, and the five years' labours of which have but recently terminated. Before he died he had the satisfaction of knowing that the proposals contained in the scheme which he originally propounded to the Commission, and on which nearly the whole of the witnesses were examined, were adopted in the main by the Commission, and recommended for the consideration of the Government. Thus the breadth of his views, and the clearsightedness which he possessed not only combined to render his services to the Indian Government and to the various scientific societies, Councils, and Committees on which he served of the utmost value, but they have left a memorial in the recommendations of this Commission, some day, we hope, to be rendered more lasting by their adoption. He died on the 9th inst. at the comparatively early age of fifty-seven, and the void his death has created in the scientific world will be one very difficult to fill."

PROF. FLOWER'S HUNTERIAN LECTURES ON THE RELATION OF EXTINCT TO EXISTING MAMMALIA

V

ORDER *Sirenia*. The purely aquatic habits and fish-like form of the animals of this order formerly caused them to be confounded with the Cetacea, but a more intimate knowledge of their structure has shown that they really belong to a widely different type of the class. Their skeleton is remarkable for the massiveness and density of most of the bones of which it is composed, especially the skull and ribs, and the bodies of their vertebræ want the disc-like epiphyses so well marked in the Cetacea. The existing members of the order pass their whole life in the water, being denizens of shallow bays, estuaries, and large rivers, but unlike the Cetacea they are never found in the high seas away from shore. Their food consists entirely of aquatic plants, either marine algæ or fresh-water grasses, on which they browse under water, as the terrestrial Ungulates do on the green pastures on land. They are generally gregarious, slow and inoffensive, and apparently stupid in disposition. Though occasionally found stranded

[1] Abstract of a course of lectures delivered at the Royal College of Surgeons "On the Relation of Extinct to Existing Mammalia, with Special Reference to the Derivative Hypothesis," in conclusion of the course of 1873. (See Reports in NATURE for that year.) Continued from p. 388.

© 1876 Nature Publishing Group