a great height above their bases. The group is situated on the north easterly projection of the axis of the volcanic zone of the Bay of Plenty, which, continued still further north eastward, strikes the Tonga and Samoan Groups, places where volcanic action is still going on. Two, if not three, volcanic disturbances have taken place at the Kermadec Islands within recent years, and earthquakes were very frequent there at one time; but since the eruption of Tarawera, June 10, 1886, they have ceased entirely. On Sunday Island the most prominent feature is the large crater near the centre of the island. It is $1\frac{3}{4}$ mile long by $1\frac{1}{4}$ mile wide; its walls are generally over 1000 feet high. Steam escapes occasionally from the Green Lake on the south side, and from the crevices in the precipitous cliffs of Denham Bay, while warm water oozes out of the sand on the north coast.

DR. HANS MEYER, who recently ascended Kilimanjaro, and Dr. O. Baumann, who accompanied Dr. Lenz up the Congo, are preparing to start on a new expedition to East Africa. Their object will be to make a thorough exploration and survey of the whole of the Kilimanjaro region.

RECENT issues of the journals published in French Indo-China, contain an interesting letter from M. Gauthier, describing a journey down the Meikong River, from Luang Prabang into Cambodia. The traveller spent forty days on the journey, and passed twenty cataracts, in one of which his boat was almost dashed to pieces. He visited the Laos States, and describes its inhabitants as doing nothing except laughing, smoking, and singing throughout the day, such business as there is being wholly in the hands of the Chinese.

OUR ELECTRICAL COLUMN.

GOUY has found that the attraction between two electrified surfaces maintained at a constant potential-difference is one hundred times greater in distilled water than in air.

ADMIRABLY well-equipped public electrical laboratories have been established in Paris and Vienna. When are we to see one in London?

VAN AUBEL (*Arch. de Genève*, xix. p. 105, 1888) has been studying the effect of magnetism and heat on the electric resistance of bismuth and of its alloys with lead and tin. Contrary to all other metals, the resistance of bismuth sometimes increases with reduction of temperature. He also verified the fact that the resistance of bismuth at low temperatures increases in the magnetic field. The effect is very feeble with alloys.

FOEPPL (*Ann. Wiedemann*, xxxiii. p. 492) has been endeavouring to prove Edlund's hypothesis that a perfect vacuum is a conductor, but has completely failed to do so. He makes the resistance of a vacuum to be three million times greater than that of copper.

MR. C. VERNON BOYS has communicated to the Royal Society some further details of his beautiful radio-micrometer. It is a thermo-electric circuit, consisting of a bar of antimony and bismuth, of small sectional area, the ends being formed by a loop of copper wire, suspended by a torsion fibre in a strong magnetic field. It is possible to observe by its means a difference of temperature of one ten-millionth of a degree Centigrade.

C. L. WEBER (*Centralbla't fiir Elek'rotechnik*, 1887, vol. ix.), experimenting on various amalgams and alloys of tin, bismuth, lead, and cadmium, has found that many of them have a higher conductivity than that of each of their constituents.

SIRKS, of Deventer (Holland), has found a peculiar dynamical action of the current on the electrodes. An electrical current passing through a solution of $CuSO_4$ between two electrodes of copper, which are varnished at the back, pulls *both against* the direction of the positive stream. Independently of the concentration, if only high enough to prevent the formation of gases, the pressure at the anode and the traction at the kathode amount to nearly 1 gramme per ampere and per square metre.

ON THE COMPARISON OF THE CRANIAL WITH THE SPINAL NERVES.

THE origin of vertebrate animals is to be found according to many morphologists in those invertebrates which are composed of a series of segments, and one of the chief arguments in favour of this view has always been the fact that the spinal nerves are arranged segmentally. It has, however, long been felt that the cranial nerves ought to give evidence of a segmental arrangement as clearly as the spinal before it is possible to speak of a segmentation based upon the arrangement of the nervous system; and indeed many ingenious tables have been manufactured by morphologists in order to bring the cranial nerves into the same system as the spinal. The failure of these attempts is to my mind due largely to the following reasons:—

1. Confusion has arisen because anatomists have been in the habit of looking upon the nervous system of the vertebrate as composed of two separate nervous systems, viz. the cerebro-spinal and sympathetic.

2. In the comparison of cranial and spinal nerves the morphologists have directed their attention too exclusively to the exits of the nerves from the central nervous system without taking into account the place of origin of the nerves in the central nervous system itself.

3. It has been assumed on insufficient grounds that the presence of ganglia in connection with motor cranial nerves indicates that the cranial nerves do not follow Bell's law, and are therefore not strictly comparable with spinal nerves.

These difficulties are all found to vanish as soon as a clear conception is obtained of what is meant by the nerves of a spinal segment.

Since the time of Charles Bell it has been recognized that a spinal nerve is formed by two roots: the one, posterior, which contains only afferent fibres, *i.e.* fibres which convey impulses from the periphery to the central nervous system; and the other, anterior, containing exclusively efferent fibres which convey impulses from the central nervous system to the periphery. In correspondence with these two sets of fibres the grey matter of the spinal cord is divided into two portions, named respectively the posterior and anterior horns. Another division, however, exists of almost equal importance, which is not so generally recognized, viz. a division both of the nerve fibres and their centres of origin in the grey matter for the purpose of supplying the internal and external portions of the body—a division of nerves and nerve centres into splanchnic and somatic as well as into afferent and efferent. The centres of origin of the splanchnic nerves are situated in the internal part of the grey matter of the spinal cord, being arranged in groups in the neighbourhood of the central canal, and the nerves themselves supply the viscera and internal surfaces of the body, together with certain muscles of respiration and deglutition which are derived from special embryonic structures known as the lateral plates of mesoblast. On the other hand, the centres of origin of the somatic nerves are situated in the outlying horns of grey matter, and the nerves themselves supply the integument and the ordinary muscles of locomotion, &c.,—muscles which are derived from the muscle-plates or myotomes.

Further, these two sets of nerves are arranged in the posterior and anterior roots in a special manner, the significance of which is the key to the whole question of the segmental nature of the cranial nerves. In the posterior roots the afferent fibres of both splanchnic and somatic systems pass into the spinal ganglion, which is always situated on the nerve root soon after its exit from the central nervous system; so that we may speak of the afferent fibres of both systems as being in connection with a ganglion which is stationary in position. In the anterior roots, on the other hand, we find that some of the fibres are in connection with no ganglia, while others are in connection with ganglia which are not fixed in position, but are found at various distances from the central nervous system (it is this system of ganglia which has hitherto been looked upon as forming a separate nervous system, viz. the sympathetic system), so that the fibres of the anterior root, all of which are efferent, are divisible into a ganglionated and a non-ganglionated group, of which the ganglionated group belongs to the splanchnic system, and is characterized by the smallness in the size of its fibres, while the non-ganglionated group is composed both of somatic and splanchnic nerves, and forms the ordinary large-sized motor nerve fibres of the voluntary striped muscles both of respiration and deglutition as well as of locomotion.

Again, it has been shown that these efferent ganglia are in reality offshoots from a primitive ganglion mass situated on the spinal nerves into which both afferent and efferent fibres ran.

We see, then, that both roots of a fully formed spinal nerve are ganglionated, so that the presence of a ganglion is no longer the sign of a posterior root, and we must define a spinal nerve as being formed by—