

proposed by Balmer and others to express them. The suggestions of Dr. Johnstone Stoney and the later developments of Kayser and Runge will not be forgotten in this relation. He also made observations on atmospheric absorption in the spectrum, using photographic methods, at his country house at Courtenay, where he used to spend most of his vacations. He thus was able to fix the inferior limit to the ultra-violet end of the spectrum, so far as it is visible at low elevations, and found that in the laboratory air is opaque to ultra-violet waves of a lesser wave-length than  $0.185 \mu$ . His work on meteorological optics has thus been summarised by M. Guillaume:—"Such researches, in the course of which he was often led to a scrutiny of the sky, could not fail to draw his attention to the optical phenomena of the atmosphere, the study of which, though energetically pursued by the French physicists of last century, is to-day somewhat neglected. The splendid glows which were observed in the sky toward the end of 1883 furnished to Cornu an occasion to utilise the profound knowledge which he possessed of the phenomena of optics. He showed that the twilight glow, which at that time gave such marvellous charm to the sunsets, was due to a diffraction caused by fine powders, and it became evident that the formidable volcanic explosion of Krakatoa was the prime cause of it."

Cornu published an elegant method for the investigation of the optical constants of lens systems. He devised the optical lever for the measurement of the curvatures of lenses, and he perfected the Jellet prism for polarimetric work. To him is due the elegant geometrical construction in which spirals are applied to express graphically the relative intensities of the light in diffraction images. His preference for geometrical demonstrations of theorems which might otherwise be hidden under a burden of analytical symbols was well known. He worked at acoustics in conjunction with M. Mercadier, and at elasticity, and in conjunction with M. Baille redetermined the constant of gravitation. He was occupied, too, with the problems of the synchronisation of two resonant systems capable of vibration under elastic forces, these memoirs being published in 1888 and 1889, the second of them including the application of his ideas to the synchronisation of clocks for the distribution of time. His plan was closely akin to that of Wheatstone, depending on the sending, at every second, of feeble induction currents generated by the movement of a magnet attached to the pendulum of a master clock. In 1884 he reported on the electric transmission of power by M. Marcel Deprez on the Chemin de Fer du Nord. He took part in the first electrical congress at Paris in 1881. In 1886 he became a member of the Bureau des Longitudes, and in 1900 of the International Commission on Weights and Measures. He was president of the Académie des Sciences; twice, at different periods, president of the Société de Physique; and by general consent was elected to preside also over the International Congress of Physics in 1900.

He was elected a foreign member of the Royal Society in 1884, and was also an honorary member of the Physical Society of London. In 1878 he received for his work on the velocity of light the Rumford Medal of the Royal Society. At least twice he gave Friday evening discourses at the Royal Institution; the last of these in 1895 on the physical phenomena of the high regions of the atmosphere.

In 1899 he delivered, with delightful eloquence and learned ease, the Rede lecture at Cambridge, on the wave-theory of light and its influence on modern physics. On this occasion, which was at the time of the jubilee celebration of Sir George Stokes, he received the honorary degree of Doctor of Science.

In Cornu, France has lost one of her most distinguished men of science, and one who, not only as investigator,

but as teacher and wise counsellor, had won universal esteem and respect. A true follower of the great traditions of France in the pursuit of science, and a passionate follower of Arago, Biot, Fresnel and Fizeau, he was in his own person much more than this. He was the ideal of a well-equipped, well-balanced, intellectual leader in scientific thought.

SILVANUS P. THOMPSON.

#### M. VIGNON'S RESEARCHES AND THE "HOLY SHROUD."

AT the meeting of the Paris Academy of Sciences on April 21, some remarkable photographs of brownish stains found on the "Holy Shroud" kept in the Treasure Chamber of Turin Cathedral, and traditionally said to be the winding-sheet of Christ, were exhibited in connection with a paper by Dr. P. Vignon, of which a translation from the current number of the *Comptes rendus* of the Academy is given below. Upon reproducing these stains by photography, Dr. Vignon found that he obtained a realistic picture of a human figure, and the suggestion is that the picture is actually a representation of the body of Christ, produced by radiographic action from the body, which, according to ancient texts, was wrapped in a shroud impregnated with a mixture of oil and aloes. We give Dr. Vignon's paper, which it will be noticed is confined to an account of principles relating to radio-activity.

#### ON THE FORMATION OF NEGATIVE IMAGES BY THE ACTION OF CERTAIN VAPOURS.

IT is known, from the work of M. Colson, published in the *Comptes rendus* of the Academy of Sciences in 1896, that freshly cleaned zinc emits vapours at the ordinary temperature which are capable of affecting photographic plates in the dark. The researches of Russell have also shown that the striations of a plate of zinc reproduce themselves on a photographic plate. But it is a long step from this to the realisation of an object in relief. I have succeeded in obtaining images either with medals powdered with zinc, or with bas-reliefs or objects fully embossed, in plaster, and rubbed with zinc powder. These images are negatives, not by the inversion of light and shade, since they are formed in the dark, but by the fact that the reliefs give more energetic impressions than the cavities. To interpret these it is necessary then to invert photographically; positive images are then obtained in which the scale of relief is scrupulously respected, which is far from being the case in normal photographs of the same objects illuminated from the front. Naturally, upon images made at a distance, the reproduction of the most minute details could not be expected, the precision of the detail obtained being less as the distance increased. The clearness of the image depends upon the rapidity with which the action diminishes when the space increases between the emissive surface and the receiving screen.

From a point of the active surface let a perpendicular be lowered on to the receiving plate; the foot of this perpendicular constitutes the centre of a circle which makes a more energetic impression in its central region than on its edges; the clearness of the image will thus be greater the smaller the surface of the circle acted upon, and this surface varies inversely as the rapidity with which the actions decrease when the distance increases. It is on this account that the images correspond very nearly to those which would be realised if the actions were produced only according to the orthogonal projections of the different points of the active surface.

It is a curious point that the images converted into positives frequently give rise to the impression of having been lit from above.

This will be the case when a plane, such as the forehead, is seen from the front and forms at the same time a strong relief, whilst a plane near it is rapidly shifting, such as, for example, the region which connects the superciliary arch to the eyeball. When this plane shifts it appears to sink into a deep shadow.

The truly specific character of these negative images which arise from action at a distance lies in the softness of the contours. The limit of the visible portion is the result for the eye of the receding of the surface. If this falling back takes place at a small distance from the receiving plane, the contour is still marked, though vaguely; but if this falling away is produced

only at a distance greater than that at which the vapours can act, no corresponding effect is produced in the image, which gradually weakens up to its borders by insensible gradations until it disappears altogether.

Practically in spite of the softness of the details and the outlines, the impressions produced by vapour are far from consisting of simple shadows; if the object is in strong relief, the image is energetic and well marked; it appears simply as if the object were seen through transparent gauze, or as if it had half emerged from a fog.

Negative images have also been obtained by acting with ammoniacal vapours upon cloths impregnated with a mixture of powdered aloes and olive oil; it is known that aloes contains a principle which turns brown and is oxidised under the influence of alkalis in moist air. A plaster hand covered with a suede glove which has been moistened with a solution of ammonium carbonate acts similarly. There is obtained in this way a sort of print of the hand, a negative softened at the edges and wanting in proportion in so far that the points where the hand is too far from the cloth are too faint, the points of contact of the hand and cloth, on the other hand, being too strongly marked. The fermentation of urea, easily brought about by the addition of a little urine, leads to the formation of ammonium carbonate and thus causes the browning of the aloes. The fermentation of a febrile sweat, rich in urea, leads to the same result, as is already well known.

The extension of Dr. Russell's researches on the photographic activity of certain bodies in the dark, contained in the above paper communicated to the Paris Academy by M. Vignon, has given rise to a most curious discussion.

There is a so-called "Holy Shroud" at Turin in which tradition states the body of Christ was wrapped after the Crucifixion. An article in the *Times* thus refers to it and its connection with M. Vignon's work:—

"It is said to have been brought from the East in the fourteenth century, and in the following century it passed into the hands of the House of Savoy, and was deposited at Chambéry. Finally, it was transferred in 1578 to its present resting-place by Duke Emmanuel Philibert, who wished to spare Carlo Borromeo, the sainted Archbishop of Milan, the fatigue of a pilgrimage to its distant Savoyard shrine. The Shroud bears upon it, traced in hues of brown, what is alleged to be a double impression of the figure of Our Lord, the outlines both of the face and back of which have reproduced themselves with wonderfully distinct exactness. So seldom, however, is it exposed to view that this remarkable characteristic had almost been forgotten when, in May, 1898, some photographs specially taken of it by Signor Secondo Pia, of Turin, with the consent of its possessor, the King of Italy, once more drew attention to this strangely living likeness. Eighteen months ago these photographs came under the notice of M. Vignon, who, recognising their exceptional importance, at once began that inquiry of which the results were made public in a paper communicated to the Académie des Sciences."

In Paris, therefore, it has been generally accepted that a demonstration has been given by science of the authenticity, not only of the so-called shroud, but of all the historical events connected with it, and a much closer rapprochement between science and theology is predicted for the future.

Here, however, difficulties have been raised. Father Thurston, a learned Jesuit, writes to the *Times* as follows:—

"Before we can profitably discuss the value of Dr. Vignon's scientific explanation of the marks on the 'Holy Shroud' a serious difficulty of quite another order has to be cleared up. The Abbé Ulysse Chevalier claims to have proved to demonstration that the linen winding-sheet exhibited at Turin is a spurious relic manufactured in the fourteenth century, and, as the writer believes, with fraudulent intent. M. l'Abbé Chevalier is a scholar of distinction, and of his perfect loyalty to the Catholic Church there can be no possible question. Moreover, his essay ("Étude Critique sur l'Origine du S. Suaire," Paris, Picard, 1900) has been warmly welcomed by the more critical journals devoted to hagiography. In the Bollandist periodical,

the *Analecta Bollandiana*, for instance, its Jesuit editors state (vol. xix., 1900, p. 350) that the Abbé Chevalier's discussion of the subject is final, and that "il ne reste plus qu'à proclamer "à haute et intelligible voix," comme le voulait le Pape Clément VII.: "Hæc figura . . . non est verum sudarium Domini Nostri Jesu Christi."

"They go on to state that the story of the 'image of the shroud' given by Geoffroy de Lirey to the college founded by him in 1353 is not lost in the mist of ages, and does not happen to present any of those obscurities by which the historian who wishes to impart his own laboriously-acquired conviction to others must at times find himself baffled. We have, for instance, the document addressed to the Pope by Bishop Peter d'Arcis, in which he denounces the fraudulent dealing of the Chapter of Lirey, who for motives of avarice pretended that miracles were worked by this shroud, whereas his predecessor in the see of Troyes had officially investigated the matter and proved it to be a forgery. 'Et probatum fuit etiam per artificem qui illum (pannum) depinxerat, ipsum humano opere factum, non miraculose confectum vel concessum.'"

There is also another difficulty. It is stated that there is at least one other Holy Shroud in another holy place.

#### NOTES.

THE governing body of the Jenner Institute of Preventive Medicine has appointed Major Ronald Ross, F.R.S., whose name is well known in connection with his researches on malaria, to be head of a new department in the Institute at Chelsea.

WE learn from the *British Medical Journal* that the Legislature of New Jersey has passed a Bill which sets aside 10,000 dollars for the support of an experiment station where scientific investigations are to be made into the habits and breeding-places of mosquitoes and their relations to public health.

WE regret to see the announcement of the death, at the age of sixty, of M. Henri Filhol, professor of paleontology at the Jardin des Plantes, Paris; and also of Prof. I. L. Fuchs, professor of mathematics in the University of Berlin.

THE council of the Royal Institute of Public Health has conferred the Harben Gold Medal for the year 1902 upon Prof. W. R. Smith, late medical officer of the School Board for London, in recognition of his eminent services to the public health.

THE Washington correspondent of the *Times* reports that Lord Kelvin and Mr. Westinghouse both gave evidence on April 24 before a committee of the House of Representatives appointed to consider the present system of coinage and weights and measures. Lord Kelvin advocated the passing of a Bill to substitute the metric system for the standard now employed in the United States. Mr. Long, Secretary of the Navy, expressed the hope that England would take the lead in this change, but said that if England did not the United States should, and England would then follow. Mr. Westinghouse supported the Bill, but declared that it would take ten years for the people to learn to use the metric system.

IN connection with the second International Congress of Medical Electricity and Radiography, to be held at Bern on September 1-6, there will be an exhibition of apparatus relating to electro-physiology, electro-therapy and radiography. The physiological apparatus will be exhibited in the Physiological Institute, and will be in charge of Prof. Kronecker, director of the Institute, to whom communications relating to it should be addressed. The induction coils, contact-breakers, vacuum tubes and other apparatus connected with the production and uses of Röntgen rays in medicine will be in charge of Herr O. Pasche, chief of the Röntgen Institute of the Bern