theory. The elastic theory, however, is regarded as somewhat less convenient as a working hypothesis than the electric.—In this number appears Part I of an exhaustive monograph, with numerous illustrations, on the geology of the volcanic island of Fernando de Noronha, South-West Atlantic, by John C. Branner.

THE last volume (xviii.) of the *Memoirs of the Kazan Society of Naturalists* contains an elaborate inquiry into the distribution of solanin (an alkaloid discovered by Desfosses in many *Solanaceæ*) in plants, by E. Wotschall; short reports on geological exploration in the Governments of Vyatka and Ufa, by A. Netschaeff and A. Lavrsky; and a description of the flora of the neighbourhood of Ufa, by A. Gordyaghin.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, February 7.—"The Principles of Training Rivers through Tidal Estuaries, as illustrated by Investigations into the Methods of improving the Navigation Channels of the Estuary of the Seine." By Leveson Francis Vernon-Harcourt, M.A., M.Inst.C.E.

After stating the principles upon which the training of the non-tidal portions of rivers are carried out, the undefined and unsatisfactory condition of the principles followed in training rivers through wide tidal estuaries, and the discordant views of engineers on the subject, were pointed out. The absence of definite principles, and the divergence of opinion amongst engineers, have received a remarkable illustration in the great variety of schemes proposed for extending the training walls in the Seine estuary beyond Berville, where the works were stopped, in 1870, owing to the unexpected changes the works had already produced. It occurred to the author in August 1886, that if it should be possible to reproduce, in a working model, the original state of the Seine estuary before the training works were commenced, and next the present state of the Seine, as modified by these works, could be obtained, then the successive introduction in the model of the several schemes, proposed for the extension of the training walls, might furnish results indicating approximately in miniature the changes which the works would actually produce if carried out in the estuary, and also afford a basis for the establishment of general principles for training rivers through wide estuaries. A model, accordingly, was made of the tidal Seine, to the scale of 1/40,000 horizontal, and 1/400 vertical; the bed was formed of fine sand, so that it could be moulded by the current; the fresh-water discharge was produced, at the upper end, by the flow of water from a small cistern; and the tidal ebb and flow were effected by the tipping of a tray, placed at a suitable angle at the lower end, representing the open sea. The model was first worked in November 1886, and the experiments were continued at intervals up to 1889. Silver sand was first used for forming the bed of the miniature estuary; and some of the phenomena of the actual estuary, such as the *bore*, the "*verhaule*" or reverse current, and the shifting channels, were reproduced in the model; but when the training walls were introduced into the model, on the lines of the existing training walls, it was found that the silver sand could not be adequately carried in suspension by the small currents in the model to reproduce the accretion which has occurred in the estuary behind and beyond the training walls. A variety of fine powders, of low specific gravity, were consequently experimented on in the model, but they mostly proved too sticky, or pasty, or otherwise unsuitable. At last a fine sand from Chobham Common, belonging to the Bagshot beds, containing an admixture of peat, offered better results, and was employed for the subsequent experiments.

After working the model for some time with a bed formed of this Bagshot sand, the channels assumed a form very closely resembling in general outline the chart of the Seine of 1834. This result, by reproducing a former condition of the estuary, confirms the previous results obtained by Prof. Osborne Reynolds with a model of the Upper Mersey estuary, showing that it is quite practicable to reproduce in a model the main tidal channels in an estuary.

The second stage of the investigation involved the quite novel condition of introducing training walls in a model, and producing the resulting accretion. This most essential stage was the subject of a long series of experiments, but was at last satisfactorily accomplished with Bagshot sand. The existing training walls were inserted in the model, and the resulting deepening of the trained channel and the accretion outside and beyond were reproduced in the model, and also the shifting channel between the termination of the training walls and the sea.

The third stage of the investigation was then entered upon, consisting in the successive introduction in the model of the lines of the five principal schemes at present advocated, observing the changes they respectively produced in the model of the estuary, and recording them in the form of charts of the estuary, which are appended as plates to the paper. A final experiment was also made with an arrangement of training walls forming as gradually expanding a channel as practicable, without restricting the width of the outlet. The lines designed for the extension of the training walls in each scheme are briefly described in the paper, as well as indicated in the charts, and also the channels and accretion which they each produced.

The probability of the results obtained really representing in miniature the results which corresponding works in the estuary of the Seine would actually produce was then considered; for if the effects of any training works could be foreshadowed by experiments in a model, the value of such experiments, in guiding engineers towards the selection of the most suitable design, could not be over-estimated. Though the effects of winds and waves, and the actual rate of accretion, cannot be reproduced in a model, it is evident, from the first stage of the investigation, that the main forces at work, in the comparative shelter of an estuary, are the tidal ebb and flow and the fresh-water discharge, which are the forces which can be produced in a model. Moreover, the correspondence of the second stage of the investigation with the existing state of the Seine estuary confirms the accordance between the results in the model and the condition of the estuary. The extension of training walls decreases the influence of winds and waves; and therefore the results of the third stage of the investigation are more likely to correspond with the changes which such works would actually produce in the estuary, than those of the first and second stages. Also the results obtained in the model with the two earlier schemes are precisely those which the author predicted would occur, before the experiments were commenced, if the schemes were actually carried out in the estuary.

The paper concludes with a classification of the experiments, with the view of deducing general principles for guidance in training rivers through tidal estuaries. The three classes are, (1) outlet of estuary considerably restricted, and channel trained inside towards outlet; (2) channel trained in sinuous line, expanding towards outlet, but kept somewhat narrow at changes of curvature; (3) channel trained in as direct a course as practicable, and expanding regularly to outlet.

The experiments of the first class exhibited a deep outlet, and a fairly continuous channel inside where the training works were prolonged to the outlet. The channel, however, was irregular in depth near the outlet; and a bar appeared in front of the outlet outside. The breakwater, also, extending across part of the original outlet, occasioned deposits both inside and outside the estuary, by producing slack water in the sheltered recesses.

The second class of trained channel was designed to profit by the well-known scour at the concave face of bends in non-tidal rivers, and to continue the depth thus obtained by restricting the width between the bends. Experiment, however, did not bear out the advantages of this system, probably owing to the variable direction of the flood tide at different heights of tide, its being checked in its progress by the winding course, and not acting in unison with the ebb, from the difference in its direction and the width of the trained channel near the outlet. The third class of trained channel afforded a wide channel, tolerably uniform in depth, in the experiments; the flood tide was less impeded in its progress than with the other forms of training walls, and appeared to act more in concert with the ebb.

The experiments accordingly indicate that the only satisfactory principle for training rivers through wide estuaries with silt-bearing currents is to give the trained channel a gradually expanding form, with as direct a course as practicable to the outlet. The rate of increase in width between the training walls must be determined by the special conditions of the estuary.

February 14.—"On a Series of Salts of a Base containing Chromium and Urea," No. 2. By W. J. Sell and Prof. W. J. Lewis.

The paper is a continuation of that published by one of the authors (Proc. Roy. Soc., vol. xxxiii. p. 267). It is here shown

that the chief product of the reaction of chromyl dichloride on urea is the dichlortetrachlorochromate of a base containing the elements of urea with chromium to which the formula $\left\{(CON_2H_4)_{12}Cr_2\right\}\left\{^{4CrO_3Cl}_{Cl_2}\right.$ is assigned. This compound crystallizes from hydrochloric acid in brown-yellow crusts, which are immediately decomposed by water with formation of the dichlordichromate and hydrochloric acid. Among a large number of other new salts described, of which the normal bromide, $(CON_2H_4)_{12}Cr_2Br_6H_2O$, and iodide, $(CON_2H_4)_{12}Cr_2I_6$, may be taken as typical, the base also forms a perbromide, $(CON_2H_4)_{12}Cr_2Br_6Br_2$, and a periodide of similar composition, behaving in this respect like the organic bases. These substances, as indeed all the salts hitherto obtained, crystallize with great facility, and are as a rule sparingly soluble.

**Anthropological Institute**, February 12.—Dr. John Beddoe, F.R.S., President, in the chair.—Dr. Beddoe read a paper on human remains discovered by General Pitt-Rivers at Woodcuts, Rotherley, and Winkelbury Camp.—Mr. Bernard Hollander read a paper on centres of ideation in the brain. The object of this paper was to furnish the basis of a scientific phrenology. The author took it for granted: (1) that all mind manifestation is dependent on brain matter; (2) that the various elements of the mind have distinct seats in the brain, which, however, have not been as yet determined; (3) that the recent researches by physiological experimenters and pathological investigators, which have resulted in defining distinct regions for motion and sensation, established the physiological correlative of psychological actions. By applying galvanic currents to definite portions of the brain, or by destroying certain areas, physiological experimenters caused movements of certain limbs and muscles. In itself the distribution of motor areas in the brain would be of little value to the psychologist, except that it proves to him the plurality of functions of the brain. When, however, we observe that the movements caused by excitation form the physical parallel of a mental action, we may arrive at the psychological function of a certain portion of brain by reducing the various faculties of the mind to their elements, and watching their physical expression. To arrive at the demonstration of centres of ideation: (1) we must observe the physical expressions of our thoughts and feelings; (2) we must take the limbs and muscles, which are affected by definite emotions, and see on what occasions they are made to move by central excitation. Thus we find that in a definite part of the frontal convolution (Ferrier's centre No. 7) the galvanic current had the effect of elevating the cheeks and angles of the mouth with closure of the eyes. On no other region could the same be effected. Darwin points out ("Expression of the Emotions," p. 202) that under the emotion of joy the mouth is acted on exclusively by the great zygomatic muscles, which serve to draw the corners backwards and upwards. The upper and lower orbicular muscles are at the same time more or less contracted. Duchenne and Sir Chas. Bell are of the same opinion, and Sir Crichton Browne, speaking of the general paralysis of the insane, says that in this malady there is invariably optimism, delusions as to wealth, rank, &c., and insane joyousness, while its very earliest physical symptom is trembling at the corners of the mouth. The effect produced by the galvanic current on Ferrier's centre No. 7 is thus shown to be the physical expression of the emotion of joy. Combe located there his "organ of cheerfulness" which he afterwards called "Hope"; and there is no doubt some relation between the effect of Ferrier's experiment and the result of Combe's observation. Prof. Sigmund Exner says the centres for the facial movements extend from the gyrus centralis anterior to the latter halves of the lower frontal convolutions, an area which corresponds with Gall's "centre for mimicry" (afterwards named "Imitation.") Most marked, however, is the harmony between the results of modern experiments and the observations made by the early phrenologists when we arrive at the demonstration of the "gustatory centre." Ferrier's experiments on the lower extremity of the temporosphenoidal convolution caused movements of the lips, tongue, and cheeks—indications of gustatory sensation. Looking up the *Edinburgh Phrenological Journal* (vol. x. p. 249), we find that many men claimed the discovery (in 1824) of the organ for gustatory sensation, as afterwards called "Gustativeness" or "Alimentiveness," and that they located this centre in exactly the same region. As this organ is difficult to be observed on account of the zygomatic arch and the temporal muscle, phrenology was much abused at the time. Prof. Ferrier's experiments on his centre No. 11, on the lower extremity of the ascending parietal convolution, resulted in retraction of the angle of the mouth. The action is that of the platysma myoides muscle, which, as Sir Chas. Bell ("Anatomy of Expression," p. 168) states, is strongly contracted under the influence of fear, and which he calls the muscle of fright. Phrenologists (Gall and Spurzheim) located in this region their organ of "Cautiousness," which they found largely developed in persons known for their timidity. Prof. Ferrier's centre No. 7 is said to cause "raising of the shoulders with extension of the arms," a movement which Darwin and Mantegazza refer to the expression of patience, submission, and the absence of any intention to resist. Gall's organ of "Veneration," which corresponds with this centre, is said to produce an instinctive feeling of respect, and when defective in children, Combe says, it has the effect of making them regardless of authority, prone to rebellion, and little attentive to command. Though the work, as described, is far from complete, it may have the effect of causing Gall's theories to be re-examined, and of pointing out a sure method for the demonstration of centres of ideation.

**Mathematical Society**, February 14.—J. J. Walker, F.R.S., President, in the chair.—Mr. H. F. Baker was admitted into the Society.—The following communications were made:—On the diophantine equation $y^2 + \left(\frac{dy}{dx}\right)^2 = \text{square}$, Prof. Cayley, F.R.S.—Sur la transformation des équations algébriques, Signor Brioschi.—On projective cyclic concomitants or surface differential invariants, E. B. Elliott.—On secondary invariants, Prof. L. J. Rogers.—Remarks upon algebraical symmetry, with particular reference to the theory of operations and the theory of distributions, Major Macmahon.

**Royal Meteorological Society**, February 20.—Dr. W. Marcet, F.R.S., President, in the chair.—The following papers were read:—Report on the helm wind inquiry, by Mr. W. Marriott. The helm wind is peculiar to the Cross Fell Range of mountains in Cumberland, which runs from north-north-west to south-south-east. This range is high and continuous, and is not cut through by any valley. Cross Fell is 2900 feet above sea-level. From the top of the mountains to the plain on the west there is an abrupt fall of from 1000 to 1500 feet in about a mile and a half. At times when the wind is from some easterly point the helm forms over this district; the chief features of the phenomenon being the following: a heavy bank of cloud rests along the Cross Fell Range—at times reaching some distance down the western slopes, and at others hovering just above the summit; while at a distance of two or three miles from the foot of the Fell a slender roll of dark cloud appears in mid-air and parallel with the helm cloud; this is the helm bar. The space between the helm cloud and the bar is usually quite clear, while to the westward the sky is at times completely covered with cloud. The bar does not appear to extend further west than about the River Eden. A cold wind rushes down the sides of the Fell, and blow, violently till it reaches a spot nearly underneath the helm bars when it suddenly ceases. The observations that have been made in the district during the past three or four years show that the helm wind is not such a rare occurrence as it was popularly supposed to be, the bar having been observed on forty-one occasions in 1885, sixty-three in 1886, and nineteen in 1887. The phenomenon takes place usually when the sky to the eastward is covered with cloud.—An atmospheric sketch, by Mr. F. A. Velschow.—The drought in New South Wales in 1883-84, and rainfall at Corella, 1879-88, by the Ven. Archdeacon Wynne.

**Royal Microscopical Society**, February 13.—Annual Meeting.—Dr. C. T. Hudson in the chair.—The Report of the Council was read, showing an increase in the number of Fellows, and in the revenue of the Society. This will probably be the last annual meeting in the present library, which is required by King's College, and the Society will have to seek a new habitation.—Dr. Hudson delivered his annual address, taking as his subject, "Rotifers and their Distribution."

## PARIS.

**Academy of Sciences**, February 18.—M. Des Cloizeaux, President, in the chair.—On the vaccinal properties of pathogenic microbes transformed to simple saprogenic microbes destitute of all virulent properties, by M. A. Chauveau. These researches have been undertaken for the purpose of estimating

the value of certain facts supposed to throw some light on the natural history of micro-organisms in general, with special reference to the question of specific transformation. The main conclusion is that the charbon microbe entirely deprived of its virulence has not become the simple saprogenic microbe of ordinary fermentations set up in inorganic centres, for it has still preserved one of the most essential attributes that indicate the infectious nature of the pathogenic microbe; hence it has not undergone specific transformation. Such at least is the present inference, without prejudice to the question of possible ulterior metamorphoses of which *Bacillus anthracis* may be capable under the action of compressed oxygen or any other means. In a future communication it will be shown that at this stage the microbe has not even been deprived of the faculty of reverting to its virulent state.—On Egyptian blue, by M. F. Fouqué. The *author has undertaken a fresh study of this pigment, which was* discovered by Vestorius, of Alexandria, but which ceased to be made after the fall of the Western Empire. He finds its formula to be $CaO,CuO,4SiO_2$, consisting of 63·7 parts of silica, 14·3 of lime, 21·3 of copper oxide, with a trace of iron; specific gravity 3·04.—On two fossil Echinodermata from Thersakhan in Turkestan, by M. G. Cotteau. These specimens from the banks of the Sumbar, an affluent of the Attrek, are identical with the *Coraster vilanovæ* which abounds in the Upper Chalk of Alicante, Spain. Their presence in Turkestan at such a distance from the Pyrenees shows that at one time the Cretaceous seas occupied vast regions stretching eastwards to Central Asia and India.—Summary of the solar observations made at the Royal Observatory of the Collegio Romano during the second half of the year 1888, by M. P. Tacchini. Compared with the corresponding period for 1887 and 1886, the solar spots show a further decline in 1888, with a maximum of days without any spots. The protuberances have also decreased, but more irregularly, and at a less rapid rate.—On shooting-stars, by M. E. Minary. It is argued that the incandescence of these bodies cannot be explained by the transformation of motion into heat. The gases being perfectly elastic bodies, and in the upper atmospheric regions in an extremely rarefied state, heat cannot be produced by the shock of bodies endowed with great velocity and impinging on perfectly elastic molecules capable of receiving the motion and acquiring the velocity of those bodies; in this case the movement is communicated, not dissipated or transformed to heat. Had such transformation taken place, the velocity of the bodies on their trajectory would be progressively retarded, while the incandescence would be proportionately increased. But observation shows only luminous flashes, and more or less uniform velocities of translation at least for all the bodies that are not combustible. The reading of the paper was followed by some observations by M. Cornu, who remarked that the illumination of the trajectory of the shooting-stars might be attributed to a development or a discharge of static electricity without any considerable rise of temperature; as implied by the incandescence of detached particles of meteorites. This would agree with the spectral observations made on the shooting-stars, and would lend support to the view that certain cosmic phenomena, such as auroras, the zodiacal light, comets, solar protuberances, &c., are electric manifestations analogous to those that are so easily generated in rarefied gases.—On a general law relative to the effects of reversible transformations, by M. Gouy. It has been noticed that the effects produced by mechanical actions are often opposed to those actions (law of Lenz, thermic effects). Here M. Gouy establishes a general law, of which these facts form a particular instance, and which is applicable not only to direct mechanical actions, but also to a large number of reversible transformations.—Experimental studies on the dynamic and static elasticity of metallic wires, by M. E. Mercadier. As a complement to various researches in acoustics and thermodynamics, the author here determines the velocity of sound in metallic wires, first by directly registering their longitudinal vibrations, and then by deducing the velocity from the measurement of elastic expansions. His researches extend to copper, steel, platinum, aluminium, silver, and gold wire, varying in diameter from 0·5 to 1 millimetre.—On the rotatory power of crystallized chlorate of soda, by M. Ch. Eug. Guye. The results of these experiments agree fairly well with those obtained by M. Schuke for the visible parts of the spectrum. They may easily be reduced to a uniform temperature by employing the coefficient given by that physicist. These studies will be continued for the purpose of ascertaining whether the same coefficient is equally applicable to the ultra-violet radiations.—Tests for the mercaptans, by M. G. Denigès. Isatine, already used in sulphuric solution as a test for thiophene, is here shown to be also an excellent test for mercaptan.—On the origin of the eruptive rocks, by M. A. de Lapparent. From the constitution of the acid rocks—that is, those charged with silica—a fresh argument is drawn in support of the theory respecting the primordial fluidity of the globe.—Papers are contributed by M. M. Meslans, on the preparation and properties of the fluorides of propyl and isopropyl; by M. A. Lacroix, on the petrography of gneiss occurring in Ceylon and in Salem (Madras); and by MM. G. Weiss and A. Erckmann, on the optical properties of natural and false amber.

## BOOKS, PAMPHLETS, and SERIALS RECEIVED.

*Natural Inheritance*: *F. Galton (Macmillan).*—*Cactus Culture* for Amateurs: W. Watson (U. Gill).—Key to Lock's Elementary Trigonometry: H. Carr (Macmillan).—Key to Lock's Trigonometry for Beginners (Macmillan).—On Truth: St. G. Mivart (K. Paul).—The History of Ancient Civilization: edited by Rev. J. Verschoyle (Chapman and Hall).—Galileo and his Judges: F. R. Wegg-Prosser (Chapman and Hall).—The *Coleopterous* Fauna of the Liverpool District: J. W. Ellis (Liverpool, Turner).—Prodromus of the Zoology of Victoria, Decade xvii.: F. McCoy (Melbourne, Brain).—Das Klima des Aussertropischen Südafrika: Dr. K. Dove (Göttingen).—Proceedings of the Royal Society of Edinburgh, Nos. 126 and 127 (Edinburgh).—Report of the Marlborough College Natural History Society for Year ending Christmas 1888 (Marlborough).—Logic: R. F. Clarke (Longmans).—Practical Organic Chemistry: S. Rideal (Lewis).—Elementary Synthetic Geometry: N. F. Dupuis (Macmillan).—The Mineral Wealth of Queensland: R. L. Jack (Brisbane).—Basic Slag: C. M. Aikman (Edinburgh).—The Practical Use of the Spectroscope: J. Parry.—Zeitschrift für Wissenschaftliche Zoologie, Band 31–45 (Williams and Norgate).—Proceedings of the Boston Society of Natural History, vol. xxiii. Parts 3 and 4 (Boston).—Annalen der Physik und Chemie, 1889, No. 3 (Leipzig, Barth).—Quarterly Journal of the Geological Society, No. 177 (Longmans).—Journal of the Bombay Natural History Society, No. 4, vol. iii. (Bombay).—Kryptogamen-Flora von Schlesien, 3 Band, 5 Liefg. (Breslau).—Tōkyō Sūgaku Butsurigaku Kwai Kiji, Maki No. 4, Dai 2.—Die Natürlichen Pflanzenfamilien, Liefg. 26, 27, 28 (Leipzig, Engelmann).

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