Lebedintseff and W. Krzyzanowski.—Geological explorations along railway lines in South Russia, by V. Laskareff.—On the sexual reproduction of *Schizonzura lanigera*, by S. Mokrzecki (with a coloured plate).—On the influence of substitution on the rate of certain reactions, by P. Petrenko Krichenko.—*Crangon vulgaris*, var. *Shidlovskii*, from the Sea of Japan, by Dr. A. Ostroumoff.

Vol. xxi. part 1.—Materials for the fauna of Coleoptera of South Russia, by E. Kubkovski. An elaborate work which contains a review of the corresponding literature, a sketch of the distribution of Coleoptera in the Steppes, the sandy regions, the waters, &c., and a detailed enumeration of the species.

Memoirs of the Novorossian (Odessa) Society of Naturalists, Mathematical Section, vol. xvii.—Solar radiation, by M. Pantchenko. The author submits to a careful mathematical investigation the different formulæ proposed by Violle, Langley, Abney, Bartolli, Crova, Angot, and Angström. For purely meteorological purposes he finds Angström's formula sufficient; it gives very good results with the actinometric measurements made in Odessa in 1890, 1891 and 1894.

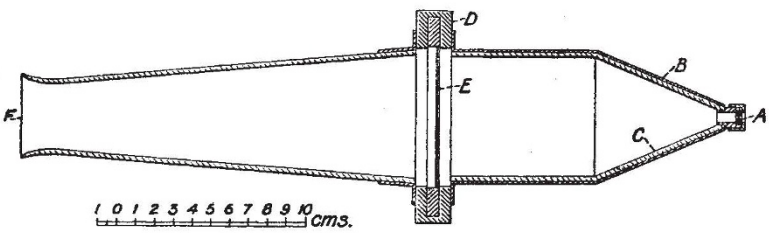
SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 16.—"On the Source of the Röntgen Rays in Focus Tubes." By Alan A. Campbell Swinton. Communicated by Lord Kelvin, F.R.S. Received June 7.

The author has already described at the Royal Institution (see NATURE for May 26, page 91) how he has found it possible to study by means of pin-hole photography the active area on the anti-kathode of a focus tube from which the Röntgen rays proceed.

By means of a special camera he has now been able to make further investigations. In the illustration A is the pin-hole in a lead disc secured by a cap to the brass cone B, which is lined with thick lead. D is a framework into which slides either the fluorescent screen E, or a carrier containing a sensitive plate should photographs be required. F is an observation tube for use with the fluorescent screen. It is made of insulating material to avoid danger of shocks.



With this apparatus directed at the anti-kathode of a focus tube, it is easy with the fluorescent screen in place to take accurate note of the image of the active anti-kathode area which appears on the screen, and to observe the variations in form, dimensions, and brilliancy that take place under varying conditions. Similarly by replacing the fluorescent screen by a photographic plate the image can be photographed.

The following are the main effects that the author has observed.

(1) When the anti-kathode intersects the kathode stream at the focus, the dimensions of the active area are independent of the degree of exhaustion. For all other positions beyond the focus it is larger the lower the exhaustion and *vice versa*.

(2) When the anti-kathode intersects the kathode stream beyond the focus, the active area is larger the greater the distance between kathode and anti-kathode.

(3) When the anti-kathode intersects the kathode stream considerably beyond the focus, the active area is found to consist of a well-defined and very intense central nucleus, surrounded by a much fainter but quite appreciable halo. Both of these increase in size as the distance between kathode and anti-kathode is increased. In some cases the halo consists of a well-marked hollow ring with a dark space between it and the central nucleus. In other cases two distinct concentric rings are visible surrounding the nucleus.

(4) With an anti-kathode inclined at an angle of 45° to the axis of the conical kathode stream, it is found that those portions of the stream which impinge most normally upon the anti-kathode surface are considerably the most efficient in producing Röntgen rays.

(5) At the degrees of exhaustion most suitable for producing Röntgen rays, and with concave kathodes of the usual dimensions, the kathode stream proceeds almost entirely from a small central portion of the kathode surface, the remaining portion of the surface being apparently practically inoperative. That this is so was very conclusively established by photographs taken with a tube in which three very minute fragments of glass had attached themselves on to the concave surface of the aluminium kathode. The shadows of two of these fragments appeared in the photographs, and enabled accurate measurements to be made.

(6) The different portions of the kathode stream proceeding from different portions of the kathode cross at the focus and diverge in a cone that retains any special characteristics of the convergent cone. The relative positions of the glass fragments on the kathode, and the positions and enlargement of their shadows on the anti-kathode were found to show this very clearly.

(7) Though by far the greater portion of the Röntgen rays given by a focus tube proceed from the active anti-kathode area, still a very appreciable quantity is also given off by all those portions of the glass of the tube that shows the green fluorescence.

Further, it is noticeable that that portion of the glass that shows the brightest fluorescence, *i.e.* that part which lies in the path in which kathode rays would be reflected from the anti-kathode surface were they reflected according to the law of equal angles of incidence and reflection—gives off the most Röntgen rays, while those portions of the glass that show no fluorescence do not give off any Röntgen rays. The conclusion appears obvious that whatever produces the one also produces the other, but as has been pointed out by Prof. S. P. Thompson the fluorescence is not due to the direct stream of rays from the kathode, but to some description of radiation that proceeds from the surface of the anti-kathode that faces the kathode.

Prof. Thompson calls these radiations "para-kathodic rays," stating that they differ from the Röntgen rays in respect of their power of penetration, and in their capacity of being electrostatically and magnetically deflectable. In these respects the author's experiments confirm those of Prof. Thompson; but when the latter goes on to differentiate these rays from ordinary kathode rays, on account of their not exciting Röntgen rays where they impinge on a solid surface, the author is unable to agree, for, as above stated, these rays do excite Röntgen rays where they impinge upon the glass walls of the tube.

The "para-kathodic" radiations do not, however, appear to be ordinary kathode rays. In the first place they do not proceed directly from the kathode, but only from the surface of the anti-kathode that faces the latter. Secondly, they do not appear to be negatively but positively charged. The author suggests that they may very probably consist of kathode ray particles which, having struck the anti-kathode, and having thus given up their negative charges and acquired positive charges, rebound, both by reason of their elasticity and also by repulsion from the anti-kathode. Perhaps, owing to the comparative roughness of the anti-kathode surface, they fly off to some extent in all available directions, but they do so especially in that direction which the law of equal angles of incidence and reflection requires. It also appears very possible that these rays are identical with the positively electrified streams proceeding from the anode, which the author has investigated by means of radiometer mill wheels, recently described in his paper to the Physical Society (see NATURE for March 31 and June 2, pp. 525 and 119.

"Mathematical Contributions to the Theory of Evolution. V. On the Reconstruction of the Stature of Prehistoric Races." By Karl Pearson, F.R.S., University College, London. Received June 6.

The object of this memoir is to illustrate the general theory by which we may reconstruct from the knowledge of one organ in a fossil or prehistoric race, the dimensions of other organs, when the correlation between organs in existing races of the

same species has been ascertained. The particular illustration chosen is the reconstruction of probable stature from a measurement of the long bones.

Up till quite recently this subject remained in great obscurity, partly on account of absence of theory, and partly for want of trustworthy data.

The estimated statures as obtained by Orfila, Topinard and Beddoe, or by use of their methods, differ widely, and those methods have no satisfactory theoretical basis. It was usual to suppose that there was some mean or average ratio of stature to long bone, and even when it was recognised that this ratio varied with the length of the long bone, it was thought sufficient to determine it for two or three separate ranges of stature, and determine its mean value for these ranges by a very limited number of cases.

The first stage in advance was taken when Rollet published his measurements, made in the Anatomical Theatre at Lyons, of the stature and long bones of 100 corpses. Rollet's attempt to establish ratios on the basis of his measurements is not very satisfactory, but to him belongs the credit of having first provided a respectable, if not large amount of data. Rollet's work was followed by a very able memoir on the reconstruction of stature by Manouvrier. There are many traces in Manouvrier's paper of the old view of a "coefficient" by which the long bone must be multiplied in order to obtain the stature. Beyond this view, it cannot be said to contain any theory, and it suffers from certain marked defects.

Manouvrier's memoir was rapidly followed by an excellent piece of work from Rahon, who collected measurements of the long bones of a very wide series of local races of man, and reconstructed their stature by aid of Manouvrier's tables.

The present memoir starts with the theory of probability, which the author has already applied to other problems in evolution, and deduces the most probable stature for any combination of the four long bones. It is shown that for a population with normal correlation, the relation between stature and one or more long bones is always linear. A general theorem is proved to show that no linear function of the long bones can give the probable stature with so small a probable error as the regression formula of the theory of probability. From this result the following conclusions are obtained:

(*a*) No constancy of the ratio stature to long bone is theoretically to be expected, but the ratio of deviation from mean stature to deviation from mean long bone, *i.e.* the regression coefficient is the quantity, the constancy of which might be anticipated.

(*b*) No method of predicting individual stature from the individual long bones, whether one or all are used, can give a result with a less probable error than 2 cm.

(*c*) For the same length of femur, tibia, and humerus, the stature is shorter the longer the radius. This result has considerable bearing on the relationship of man to the anthropomorphous apes.

Formulæ are then obtained for the reconstruction of probable stature as measured:

(*a*) On the corpse, from the lengths of the long bones containing animal matter, and with the cartilages attached. These will possibly be of service for purposes of criminal investigation.

(*b*) In life, from the lengths of the long bones without cartilages, and free of all animal matter.

Corrections are given for cases in which the femur is measured in the oblique position; the tibia is measured with the spine; and the left-, instead of the right-, hand members are known.

The manner in which natural selection modifies the regression formulæ is indicated. It is pointed out that the divergence between such regression formulæ really enables us to predict to some extent the nature of the differential selection which has taken place between two local races. To test how far we may safely apply our formulæ to other than French measurements, the stature of the Ainos ♂ and ♀ is reconstructed by means of them from Koganei's measurements of the long bones, and the result is found to be very satisfactory. With a view of illustrating the change in the regression formulæ owing to selection, the anthropomorphous apes are considered, and it is shown that the gorilla, in the regression formulæ for femur and tibia stands much closer to man than either the chimpanzee or orang.

The formulæ are applied to reconstruct the stature of prehistoric, mediæval and modern races. The modern populations occupying the same districts of Europe as Palæolithic and Neolithic man appear to be taller, but in the case of both south Germany and France there appears to be a slight, but sensible, decrease of stature since proto-historic times. Modern English do not seem to have decreased in stature since the ancient Anglo-Saxons. In the estimates of stature for the above races, the author differs, in some cases very considerably, from previous writers.

Beyond the range of normal population (say from 157 to 175 cm. for ♂), the line of regression ceases to be linear. An attempt is made, such as existing data will allow of, to express the line of regression by the equation to a curve. The prediction of the stature of dwarfs from the curve obtained from the data for giants shows only 2·25 cm. mean error, and must be considered satisfactory. Application is then made of the results to reconstruct the stature of Bushmen, Andamanese, Akkas, and of European neolithic dwarfs.

PARIS.

Academy of Sciences, July 11.—M. Van Tieghem in the chair.—On the decomposition of nitric acid by heat at moderately high temperatures, by M. Berthelot. Pure nitric acid is not decomposed when kept in the dark at the ordinary temperature, but at 100° measurable amounts of oxygen and nitrogen peroxide are produced. Nitric acid of specific gravity 1·333, is not appreciably decomposed under similar conditions.—On the compressibility of air considered as a gaseous mixture, by M. E. H. Amagat. In air, the oxygen and nitrogen appear to be compressed, as if each were at the pressure of the mixture; the volume of the mixture is sensibly equal to the volume of the constituents. A table is given showing the deviations found experimentally for pressures between 100 and 3000 atmospheres, deviations which are within the known experimental error.—On the systems of differential equations satisfied by quadruply periodic functions of the second species, by M. Martin Krause.—On a mode of supporting the motion of a pendulum, by M. A. Guillet. The impulses are given electrically by induction currents at the same point in its path, one as it ascends, and the other as it descends, the disturbances thus set up being exactly equal and of opposite sense. Comparisons with a free pendulum showed that the time of vibration was unaltered by the use of the mechanism described.—On the passage of electromagnetic waves from a primary wire to a secondary wire parallel to it, by M. C. Gutton.—On the mode of oxidation of cobalt salts in alkaline solutions, by M. André Job. It has been known for some time that cobaltous salts, treated with potassium bicarbonate and hydrogen peroxide, give a higher oxidation product having a green colour, the exact composition of which has not hitherto been proved. By means of the ferrous reducing agent recently described by the author, it is now shown that the oxygen taken up corresponds to Co_2O_3. The estimation of cobalt in presence of nickel and iron is easily carried out by this method.—Action of heat upon the double nitrites of the alkalis and metals of the platinum group.—Compounds of rhodium, by MM. A Jolly and E. Leidié. At 440° the double nitrite $Rh(NO_2)_6.6KNO_2$ is decomposed into nitrogen, nitric oxide, and a salt having approximately the composition $K_2Rh_6O_{13}$ or $K_2O.6RhO_2$. These results are considered as affording evidence in support of the oxide RhO_2.—On the production of tungsten blue, by M. Albert Granger. By the use of a mixed tungstate of barium and sodium a fine indigo-blue glaze is imparted to porcelain, if the temperature is about 1250°, and the heating carried out in a reducing atmosphere.—On the yttrium earths arising from the monazite sands, by M. G. Urbain.—On the brominating action of aluminium bromide in the fatty series, by M. A. Mouneyrat. Ethylene bromide, treated with $AlBr_3$ at 110° C. gave acetylene. With bromide and aluminium bromide, ethyl bromide is readily converted into ethylene dibromide, and the latter again into symmetrical tetra-bromethane. From this hexabromethane can be obtained without difficulty.—On some mixed phenyl-alkyl-carbonic ethers, by MM. P. Cazeneuve and Albert Morel. A description of the mode of preparation and physical properties of the phenylmethyl, phenylethyl, phenylpropyl, phenylisopropyl, phenylisobutyl, phenylisoamyl, and ethylallyl carbonates.—On the saponification velocity of some phosphoric ethers, by M. J. Cavalier.—Action of tetrazodiphenyl, tetrazodiorthotolyl, and tetrazodiorthoanisyl chlorides upon methyl and ethyl cyanacetates, by M. G. Favrel.—On the phosphates in urine, by M. L. Jolly. The facts noticed by MM. Lépine and Aubert, and explained by them by the assumption of incomplete oxidation of phosphorus

in the urine, are shown to be susceptible of another explanation. —Presence of chlorophyll in a nostock cultivated entirely in the dark, by MM. A. Étard and Bouilhac. The green colouring matter, previously noticed by M. Bouilhac, is here proved to be ordinary chlorophyll.—On a product of decomposition of albumen, by M. J. M. Albahary. In an attempt to prepare an iodine derivative of albumen, a new acid was obtained, ovalbuminic acid, forming a definite, crystallised sodium salt, and also a gold salt. The molecular weight of the acid determined by means of the latter was 1670.—Action of the sorbose bacteria upon xylose, by M. Gabriel Bertrand. The bacterium exerts an oxidising action, an acid, xylonic acid, being formed in small quantity.—New biological observations upon the life in colonies of the fixed tunicates, by M. Antoine Pizon.—Alkaline reaction of the chambers and galleries of ants' nests. Duration of life of decapitated ants, by M. Charles Janet.—Improvement of the wild carrot, by grafting it on the cultivated carrot, by M. Lucien Daniel.—Results of the ascents of three experimental balloons at Trappes, on June 8, by M. L. Teisserenc de Bort. The height attained was 13,000 metres, the lowest temperature -59° C.—On a means of avoiding collisions at sea by means of electromagnetic waves, by MM. A. Berget and L. Décombe.—On stereoscopic vision in kinematography, by M. Aug. Rateau.

AMSTERDAM.

Royal Academy of Sciences, May 28.—Prof. van de Sande Bakhuyzen in the chair.—Prof. Schoute, on cyclographic representation in space of Joachimthal's circles.—Prof. Haga, on maxima and minima of apparent brightness, resulting from optical illusion. When in a plane on which the eye is fixed, two zones of mutually different, but each in itself of uniform (or slowly varying) intensity of light are connected by a zone the intensity of light of which gradually decreases from that of the lighter to that of the darker zone, then the transition zone seems to be separated from the brighter one by a still brighter line and from the darker one by a still darker line. This optical illusion, which occurs under very different circumstances, and the peculiarities and possible explanation of which were briefly indicated by the author, is important: (1) because it has already often (*e.g.* in the case of X-shadow figures) made investigators imagine that they observed diffraction or other important lines; (2) because it is not impossible that, for the above reason, the indistinctness of the edge of a dark or a light line may give, or have given rise to the observation of an apparent doubling of such a line; (3) because it may lead to an incorrect estimation as to the place of the maxima and minima in systems of lines, in which the intensity of light is not symmetrically distributed with respect to the middle of those lines.—Prof. Beyerinck, on the relation of obligatous anaerobics to free oxygen. The moving bacteria present in great numbers in preparations for the microscope, which allow the air to enter at the edge of the cover-glass, arrange themselves in special figures according to their greater or smaller predilection for oxygen. The author has called them "figures of respiration." Formerly he thought that three types might be distinguished: the "aerobic type," represented by those bacteria which seek the highest tension of the dissolved oxygen; the "spirillous type," corresponding to a medium; and the "anaerobic type," corresponding to a minimum tension. Further researches have shown that the anaerobic type, characterised by the accumulation of anaerobic bacteria at the place where the oxygen tension is smallest—generally the centre of the drop—does not exist as a special case, and is only observed when the quantity of oxygen that enters, exceeds a certain minimum, and that at this minimum or below it all observed anaerobics arrange themselves into the figure of the "spirillous type," *i.e.* they do not seek the smallest tension, but a medium one, like the spirilli themselves. Consequently not three, but only two types exist, which may be termed *aerophily* and *micro-aerophily*. It can be shown that what has been said about the mobility holds good for the growth of some, possibly of all anaerobics, so that it is not absolute absence of oxygen that is most beneficial for their growth. The experiment is made by sowing a very great number of non-aerated germs of anaerobics together with a very great number of oxygen-absorbing aerobics in a solid culture mass contained in a glass tube, allowing diluted air to enter at only one end. A level of maximum growth of the anaerobics may then be observed, not deep down, where oxygen is quite absent, but at some distance from the surface, where the tension is most favourable for them, which clearly shows that anaerobics are micro-aerobics also in relation to growth. The anaerobic material, used for the experiment, must be taken from cultures, long continued with the exclusion of oxygen, which enables them to grow deep down in the tube. It is probable that the possibility of their aerobiosis depends on this very oxygen charge quite in the same way as is the case with alcohol yeast. In conclusion all living organisms, examined up to the present moment, are aerophilous or micro-aerophilous with respect to mobility as well as to growth.—Mr. Hamburger on the influence of salt solutions on the volume of animal cells, being at the same time a contribution to the knowledge of their structure.—Mr. P. Zeeman presented a paper on an instance of asymmetry in the change of the spectral lines of iron, radiating in a magnetic field.—Prof. Kamerlingh Onnes presented, on behalf of Mr. E. van Everdingen, jun., a communication entitled "Hall's effect in electrolytes." A formula for this effect in the case of a partially dissociated electrolyte is deduced. By means of the simpler formula for the effect in a completely dissociated solution, the numerical value of the rotation of the equipotential lines in a special case is calculated and compared with the result of Bagard's experiments in the same case. The theoretical value proves to be 10^6 times smaller than the observed value. The author concludes that the difference of potential, observed by Bagard, is due to disturbances, already indicated by Chiavassi and others.

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