in the suddenly slaughtered animal, to get from such experiments light on the processes peculiar to the condition of life, undoubtedly furnish the germ of much valuable knowledge. But it is of the very nature of these experiments that they must always remain difficult and restricted, for the *living* object, the tissue-cell, is accessible to microscopic investigation only with the greatest difficulty. Comparatively small difficulties in this respect are offered only by the free-living cells of the organism, as, for example, by the leucocytes or blood-corpuscles. And as a fact, by the researches of Metschnikoff, Massart, Buchner, Gabritchevsky, and many others, we have recently acquired some important and wide-reaching experimental knowledge concerning the vital phenomena of these very objects.

"But if we place ourselves at the point of view of comparative physiology which Johannes Müller represented throughout his whole life with such success and energy, an infinitely broad perspective opens itself up for cellular investigations. A comparative view shows one fact of fundamental importance, namely, that elementary life-phenomena are inherent in every cell, whether it be a cell from the tissues of higher animals or from the tissues of lower animals, whether it be a cell of a plant, or, lastly, a free cell, an independent unicellular organism. Every one of these cells shows the general phenomena of life, as they lie at the basis of all life, in their individual form. With this knowledge, all that it is necessary for the inquirer to do is to select for every special object of experiment the fittest objects from the wealth of forms presented, and with a little knowledge of the animal and plant world, such forms really obtrude themselves on the attention of the experimenter. Accordingly, it is no longer necessary to cleave so timorously to the tissue-cells of the higher vertebrate animals, which, while alive and in normal environment, we can only use for microscopic experiments in the rarest and most exceptional cases; which further, the moment they are isolated from their tissues, are no longer in normal conditions, and quickly die or give reactions that may easily lead to wrong conclusions and to errors. Much more favourable are the tissue-cells of many invertebrate, cold-blooded animals or plants which can be more easily investigated in approximately normal conditions of life; yet even these, as a rule, will not outlast protracted experiments. But here appear as the fittest imaginable objects, for cellular-physiological purposes, free-living unicellular organisms —namely, protists. They seem to be created by nature expressly for the physiologist, for they possess, besides great powers of resistance, the incalculable advantage of existing in a limitless variety of form, and of exhibiting, as the lowest organisms that exist, all phenomena of life in their simplest conditions, such as are not to be found among cells which are united to form tissues, on account of their one-sided adaptation to the common life of the cellular colony.

"Concerning the application of experimental physiological methods to the cell, we need be in no perplexity as to which we shall choose. In the luxuriant multiplicity of form which this world presents, there can always be found for every purpose a great number of suitable objects to which the most different special methods can be capitally applied.

"We can, to begin with the simplest method, apply in the easiest manner imaginable to the free-living cell the method of simple microscopic observation of vital processes. In this manner mere observation has furnished us knowledge of the individual life-phenomena of cells in many details, and also of their mutual connection. Among the most recent achievements of this simple method may be mentioned only the extremely valuable knowledge concerning the more delicate and extremely minute circumstances of fecundation and propagation which Flemming, Van Beneden, the Hertwigs, Strasburger, Boveri, and many others have gained in recent years, partly from living cells and partly from cells fixed in definite conditions of life.

"Moreover, we can also conduct under the microscope vivisectional operations on unicellular organisms in exactly the same scope and with greater methodical precision than can be done on the higher animals. Several inquirers, as Gruber, Balbiani, and Hofer, have already trodden this path with great success, and a considerable group of researches has shown distinctly enough the fruitfulness which this cellular vivisectional method of operation promises for the treatment of general physiological problems. With this vivisectional method also Roux, the Hertwigs, and others conducted their splendid investigations on the 'mechanics of animal evolution,' by showing what functions in the development of animals fall to the lot of the different parts of the egg-cell, or to the first filial cells that proceed from their division.

"We can also apply here, in its whole extent, that powerful physiological method known as the method of irritation, and investigate the effects of different kinds of irritation on the life-phenomena of the cell or of different cell-forms. The vegetable physiologists have already collected a great mass of material in this field. But also in the department of animal physiology a great number of recent works have endeavoured to prove that the phenomenon of irritation which takes place on the application of chemical, mechanical, thermal, galvanic, and luminous stimuli to unicellular organisms are of the greatest importance for the phenomena of life generally.

"Finally, we can approach the life-phenomena of the cell chemically, although in this direction only the very first beginnings have been made, seeing that the microchemical methods have been hitherto little developed. Nevertheless, the labours of Miescher, Kossel, Altmann, Zacharias, Löwitt, and others have already shown that the microchemical investigation of the cell has a future of great promise."

INK-CRYSTALS.

THE pictorial representations of the forms taken by ice-crystals are familiar to everyone; and many young observers have been grievously disappointed with the difference between nature's handiwork and artistic fancy, as exemplified by the ice-crystals really seen and those which embellish scientific works. These "ice-flowers," as Tyndall called them, cannot always be conveniently produced, so a substitute for them, in the form of "ink-flowers," should be interesting to students of crystallography. Dr. E. Trouessart describes in *La Nature* how "fleurs de l'encre" can be procured, and the accompanying illustration reproduces some of the forms observed by him. The method employed is very simple. A drop of ink is allowed to dry on a slip of glass, and observed under a microscope with powers of

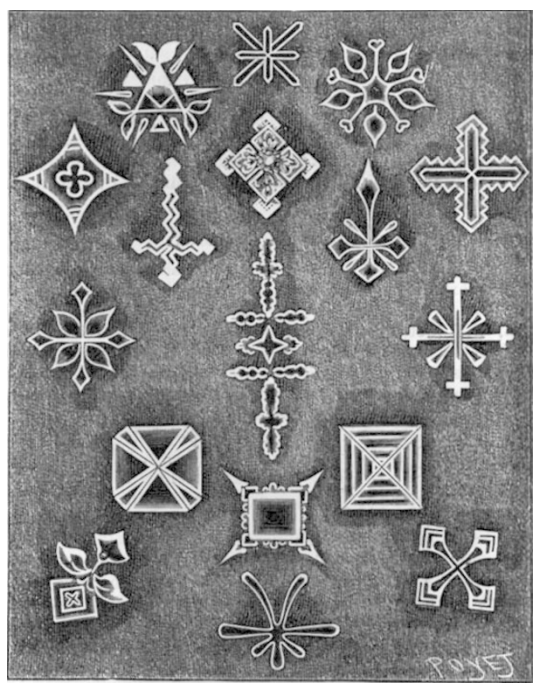

FIG. 1.—Crystals formed by the Evaporation of Ink.

50, 100, or 200 diameters. The inks of commerce vary somewhat in composition, hence the facility with which certain crystalline forms are obtained differs. All inks, however, having a base of solution of gall-nuts and sulphate of iron, give analogous results.

Dr. Trouessart hesitates to express an opinion as to the nature of the salt which crystallises in the forms illustrated. The crystals chiefly belong to the cubical system, and this suggests that they are magnetic oxide of iron. On the other hand, their white colour, and the peculiar shapes of some of the groups of crystals, indicate that iron disulphide or marcasite is the substance in question. Perhaps some worker in chemical crystallography will determine the point.

NOTES.

WE learn from the *Lancet* that the late Prof. Pouchet, of the Muséum d'Histoire Naturelle, has bequeathed his entire fortune to the Paris Society of Biology. The bequest is made in the following terms: "N'ayant pas de famille, je lègue tout ce que je possède à la Société de Biologie, où j'ai toujours trouvé bon accueil et sympathie depuis le jour où j'en ai été membre. Je crois fermement que c'est le meilleur usage social à faire du peu de bien que je laisse environ 2000 francs de rente." (£80 a year).

DR. WALTER DICKSON, R.N., the author of "The Antarctic Voyage of H.M.S. *Pagoda*," and several works on naval hygiene, died on the 9th inst. at the age of seventy-three.

BY the recent death of Lieut.-Colonel Garrick Mallery, in his sixty-fourth year, the U. S. Bureau of Ethnology has lost one of its chief ornaments. The results of his important researches into the sign and gesture language of American aborigines occur in the current annual report of the Bureau.

THE *Times* reports a severe earthquake and volcanic eruption at Ambrym, an island in the New Hebrides group. The disturbance is said to have occurred on October 15, when several severe shocks were felt throughout the whole island. Immediately afterwards the volcano, which is 2500 feet high, was observed to be in active eruption. The lava destroyed the native villages on one side of the island, and a large number of natives sought refuge on board H.M.S. *Dart*, which was cruising off the coast. Considerable damage appears to have been done in a large portion of the island

THE Christmas course of lectures, adapted to children, at the Royal Institution, will be delivered by Prof. J. A. Fleming, F.R.S. The subject will be "The Work of an Electric Current," and the first lecture will be delivered on Thursday, December 27, at three o'clock.

FOR several weeks the weather over the British Isles has been very unsettled, but no gales of serious importance had been generally experienced until Sunday night, when a deep barometric depression reached our south-west coasts from the Atlantic, accompanied with very heavy rainfall in the south and west; the amount measured at Scilly during twenty-four hours ending 8 a.m. on the 12th instant amounted to over three inches, or nearly the average fall for the month, while at Hurst Castle, on the Hampshire coast, the fall exceeded two inches. The central area of the storm passed the whole length of the English Channel, and crossed the North Sea during Monday night, strong northerly gales being experienced in the rear of the disturbance, accompanied with thunderstorms, hail, and more heavy rain, the amount measured in London on the 13th instant being about 0·75 inch. A very rough sea was experienced in the English Channel and in the Irish Sea. This disturbance was followed by another which approached our extreme north-west coasts on Tuesday night, causing strong gales over all parts of the country, and very heavy rain in the west. The temperature has been from 4° to 6° above the mean; during the week ended the 11th instant the highest maxima recorded were 61° in the Channel Islands, and 60° in the south of England, and the lowest minima fell to 29° in the south-west of England, and to 32° in the Midland Counties.

PROF. GUIDO CORA, of Turin, will, on his approaching birthday, December 20, be presented by his former students with "a special mark of esteem and affection" in the form of a memorial in recognition of the twenty-fifth anniversary of his first published paper. It is well known that he founded and has maintained the geographical journal, *Cosmos*, at his own expense. In order to give his many scientific friends an opportunity of sharing in the general recognition of Prof. Cora's labours, Prof. Paul Revelli, 12 Via Galliari, Turin, is prepared to receive any written "sentiment," portrait, drawing, or signature for the memorial volume. The date up to which such tokens of respect may be sent is extended to March 31, 1895.

DR. DONALDSON SMITH, who left London early this summer to attempt to reach Lake Rudolf from the north-east, has been able to send letters home from a position in 7° 11′ N., and 42° 11′ E., dated early in September. He had formed a caravan at Berbera, started with more than a hundred camels, and travelled south-westward through an unmapped country, of which he has made a running survey. At Turfa he reached a great river, which he believes to be the Erer, and to be continuous with the Webi Shebeli. Being unable to cross, he spent a week in following the course of this river, thirty miles of which he has mapped; and on his return he succeeded in finding a ford, where the caravan crossed with much difficulty. The country was very thinly peopled, on account of wars between the Gallas and Ogadams, but some natives were found to carry letters to the coast, a task which they must have performed very expeditiously. Dr. Smith has made large collections of the fauna and flora of the region traversed, and has had some thrilling adventures with big game. His men were doing well, and he was confident of success in his journey, although the time necessary to complete it appeared likely to be rather longer than was originally expected.

THE death is announced of Colonel R. Y. Armstrong, C.B., F.R.S., late of the Royal Engineers. He was born in 1839, and was the son of the late Rev. W. Armstrong, of Cairy, County Sligo.

IN the last number of the *Scottish Geographical Magazine* Mr. W. S. Anderson, of the Scottish Marine Station, discusses the relative merits of the methods for determining the density of sea-water by means of hydrometers and by direct weighing. He shows that if the temperatures of water, instrument, and air are in equilibrium, and the observations made on land, the *Challenger*-type hydrometer yields results of equal value with those of Sprengel tubes, provided the mean of a large number of observations is taken. At sea the hydrometer is less satisfactory. Mr. Anderson throws discredit on previous work in this direction, and assumes that the work of some earlier observers showed large discrepancies on account of the scale of the hydrometer being read from the wrong end. Unfortunately, he does not make any reference to the place where this work is published. By the use of a very large hydrometer admitting of