sity of optic divergence, when the pictures are binocularly regarded through them, if the stereographic interval exceed 80 mm. As this limit is not unfrequently exceeded, optic divergence is often practiced unconsciously in using the stereoscope. Every oculist is familiar with the mode of using prisms to test the power of the muscles of the eyeballs, for both convergence and divergence of visual lines, and knows that 4° or 5° of divergence is not uncommon. Helmholtz (3) refers to the use of stereographs for the same purpose.

But familiar as is the production of optic divergence by artificial means, little or nothing seems to have been written in regard to the modification which the possibility of it imposes upon the theory of binocular perspective held by both Wheatstone and Brewster, accepted by most writers on vision since their time, and abundantly reproduced in our text books on Physics.* Of these I have not been able to find one that gives any account of the stereoscope except on the hypothesis that the visual lines are made to converge by the use of this instrument. On the uncertainty attached to the judgment of absolute distance from convergence of visual lines alone, Helmholtz ([4]) has written more fully than any one else. It is unfortunate that no English translation of his masterly work on Physiological Optics has ever been published. Although he gives no analysis of the visual phenomena produced in binocular fusion by optic divergence, his discussion of the judgment of distance would certainly tend to cast some doubt upon the explanation of vision through the stereoscope, as found in our text-books. And yet Helmholtz himself employs Brewster's theory in his mathematical discussion ([8]) of stereoscopic projection. This discussion, on the data assumed, is a model of elegance; but it contains no provision for divergence of visual lines. It is strictly applicable to the conditions involved in taking photographs with the binocular camera, and to the projection of images viewed in the stereoscope when the convergence of visual lines is identical with that of the camera axes, but not otherwise. Instead of human eyes we may assume a pair of camera lenses, an interocular distance apart, and a pair of sensitized plates behind them. Helmholtz's formulas enable us to determine the stereoscopic displacements in the images projected. If proofs from the negatives thus obtained be inverted and placed in front of a pair of eyes in such manner that the visual lines passing through corresponding photograph points shall bear to each other the exact relation that existed between the secondary camera axes that terminated in them, these two points will appear as one, and nearly at the distance of the real point in space to which the camera axes were converged. The effect is much the same as if the eyes, with normal convergence of visual lines, had been substituted for the cameras. But if the proofs be too near together or too far apart, increase of convergence makes the whole picture seem nearer, while divergence makes it farther. The relation between the different parts having been fixed at the time the picture was taken, increased convergence makes the distance from background to foreground seem less, divergence makes it greater. No one can have failed to notice the gross exaggeration of perspective often seen in the stereoscope, when the pictures are so far apart as to make the visual lines parallel or divergent, while the angle between the camera axes, when they were taken, was relatively large. But in no case do these conditions cause variations of such magnitude as Brewster's theory of binocular perspective would demand. This is easily illustrated with Wheatstone's reflecting stereoscope. ([5]) Suppose the stereograph to represent a concave surface with the opening toward the observer, and that the arms of the instrument are properly adjusted. If they are pushed back, so as to make the visual lines divergent, the cavity apparently recedes and deepens; if pulled forward, so as to make them strongly convergent, it seems to approach and grow shallow. The apparent diameter of the image enlarges in the first case and diminishes in the second. Wheatstone notices this last variation in the account which he gave of his invention and its applications, in 1852, in the Bakerian lecture before the Royal Society ([6]); but, strange to say, the variation which is produced in apparent distance and depth under the same conditions seems to have escaped his notice, and the possibility of using his instrument to test the peculiarities of binocular vision with divergence of visual lines, seems not to have occurred to him. For the refracting stereoscope, however, like Brewster, he constructs a table of apparent distances corresponding to various optic angles, and applicable in using the binocular camera for the purpose of taking slightly dissimilar pictures of the same object. He adds, ([7]) "when the optic axes are parallel, in strictness there should be no difference between the pictures presented to each eye, and in this case there should be no binocular relief; but I find that an excellent effect is produced, when the axes are nearly parallel, by pictures taken at an inclination of 7° or 8°, and even a difference of 16° or 17° has no decidedly bad effect. There is a peculiarity in such images worthy of remark; although the optic axes are parallel, or nearly so, the image does not appear to be referred to the distance we should, from this circumstance, suppose it to be, but it is perceived to be much nearer." This would not have seemed anomalous to Wheatstone, had he supposed binocular vision possible with divergence of visual lines, and entered into an analysis of the resulting visual phenomena. This analysis will be given in a future paper.

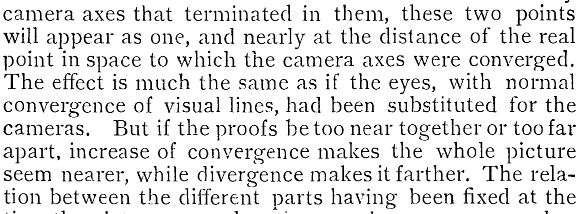

Fig. 3.

THE WATERS OF PARIS.

In one of the previous numbers, *La Nature* gives an account of the work of an English observer, Mr. J. Hogg, on the waters of London. But since 1850, Mr. Hassall[a], at the request of the inhabitants of London, examined the degree of purity of the potable waters of that city, and more recently, Professor Farlow, of Boston, make an analogous work at the request of the citizens of that city.[b] M. A. Gérardin[c], however, has studied this question with a certain authority, by observing the cryptogamic vegetation in small streams of water which receive the waste products from the factories and manufactories on their banks. M. Gérardin observed that such industry favored the development of certain particular species which were

(3) Helmholtz, Optique Physiologique, pp. 616 and 827.

(4) Ditto, pp. 823, 828.

(5) For description see Phil. Mag., s. 4, vol., III., June, 1852, p. 506.

(6) Phil. Mag. s. 4, vol. III., p. 504.

(7) Ditto, p. 514.

(8) Opt. Phys., p. 842.

* Nov. 15th. Since the above was put in type, I have received from Prof. C. F. Himes, of Carlisle, Pa., an article written by him in 1862, in which he mentions his successful attainment of binocular vision by optic divergence, and criticises Brewster's theory of distance in relation to the stereoscope. Though his observation was independent, as my own was also, I find that he was preceded by a German, Burckhardt, in 1860 or 1861. I have already referred to Helmholtz in this connection (*Am. Journal of Science*, Nov. 1881, p. 361) and therefore have claimed no priority in discovering the possibility of this unusual, but still voluntary, employment of the eyes. It is the more remarkable that in our text-books the assumption should be so universal, that convergence of visual lines is a necessity in binocular vision for the determination of the apparent point of sight.

replaced by others in places where a different industry was in operation.

It is in this same order of ideas that the Administrator of Bridges and Roads of the Seine and Oise sent us lately a difficult question to answer. The question was to disinfect a river on the environs of Beaumont, which, during the heat of summer, was poisoned by a cryptogam of the genus Leptothrix. This vegetable is an aquatic and filaceous fungi .which thrives and grows on the refuse of factories. The only answer to make was the well-known axiom: *sublata causa tollitur effectus.*

M. Neuville, the author of the memoir of which we are treating, is astonished that a work similar to that which he has undertaken, has not yet been done for the waters of Paris, whose sources are different, and which, consequently, do not present an equal degree of purity. Placing himself in a purely utilitarian point of view, he seeks to enlighten the administrator and the public on one of the indispensable sources of nourishment, that is to say the water consumed each day, by making use of his knowledge of cryptogams, and chiefly those of the family of Diatoms, for the study of which he had a predilection.

The complete purity of water is not always on account of the greater or less number of organic matters that it contains; it must be that these matters have a purifying character in themselves, and this condition obtains only when they are living vegetable growths, containing chlorophylle or green matter, having the property of freeing the oxygen which is dissolved in the water, on the one hand, and of absorbing, on the other, the carbonic acid gas which makes the water unfit to drink. Aquatic plants, then, are useful to the water which gives them shelter, yet with the condition that their bodies do not, by their accumulation, counterbalance the salutary effects.

Another cause very often acts to give water unhealthy properties. The lime salts which it holds in solution, and sometimes in great quantity, cause troublesome and sometimes serious diseases. The carbonate, but above all the sulphate, of calcium, makes the waters selenitic, as it is said, and then they become unfit for the cooking of vegetables, do not dissolve soap, and are indigestible. It is possible, however, for water to dissolve soap and nevertheless to cook vegetables; this occurs when in place of sulphate of calcium it contains magnesium.[d]

The waters of the source are often sought after for their limpidity and freshness, which does not always imply that they are really potable; it is even probable that if the waters of our rivers were taken at their source they would not have the qualities which they acquire after a journey of several miles. But when these rivers pass through an important manufacturing city, the injections, the impurities of all sorts which they receive will rapidly change their qualities; stocked, so to speak, in the passage by the city, they are yet able to improve themselves somewhat after a new journey in the country, which permits them to deposit the foreign matters which contaminate them. There are these elementary considerations which should always insist that the waters which supply a city should be taken above and not below the city.

Borrowing from the interesting works of M. Miquel, the savant of the Observatory of Montsouris, whatever they contain of use to his work, M. Neuville, among other things, reproduces the following table of comparison for the use of the reader, and shows what organisms the waters from the source and of different qualities can contain, observed with considerable magnifying power:

PROPORTION OF LOW ORGANISMS CONTAINED IN DIFFERENT WATERS.

	Microbs by hund. cube.
Water of condensation	0.2
Rain water	35.0
Water of the Vanne	62.0
" " Seine, in Paris	1200.0
Sewer water	20000.0

It is indispensable that analyses of this nature should be made rapidly, because in a short time the microbes grow in a great degree, and will no longer give exact figures.

The method which M. Neuville has followed does not consist of chemical analyses of the waters of Paris, which had been done long before by well-known scientists; it is rather a kind of statistics of the foreign matters contained in each of them, and which the use of the microscope reveals.

The waters submitted to his examination are those of the Marne, taken at Saint-Maur and Charenton; of the Seine, at the Port-à-l'Anglais, at the bridge of Austerlitz, taken at Chaillot, Auteuil, and at Saint-Ouen; the waters of the canal of Ourcq, of the Vanne, of the Dhuis, of Arcueil, of the sources cf the Nord of Paris, of the artesian wells at Grenelle and Passy, finally that of a well of the left bank of the Seine.

A constant quantity of five litres of water was taken at the middle of the above-mentioned streams, or at the inlet of the waters of the sources; then after a settling of 12 hours, by means of an appropriate siphon, he decanted until it was reduced to 300 grammes. The contents were turned into a graduated gauge and after rest, by the use of a small pipe be gently raised the liquid in order to leave but a deposit of two to three centimetre cubes. It is this deposit which is directly submitted to microscopical observation, after having been put in cellular preparations before being preserved. Observation was made on a determined number of preparations, all sketched in a light room, and the sum of the latter serves to form one of the plates which accompany this article, which contains seventeen. A diagram, or schematic table, indicates the result of chemical analyses and of microscopical observations made for the Seine in its journey through Paris.

The water of the Marne taken at Saint-Maur, is relatively rather pure; yet organic matters are found in great abundance in it; but they are, above all, living matters, and more purifying than corrupting (Fig. 1.) They are a part of the Desmids in the green matter and belong to the genus *Pediastrum* (No. 9) or *Raphidium* (No. 10); or else cf filaceous algæ (No. 11) of the genus *Ulothrix*. On the other hand, and much more abundant are the Diatoms with silicious carapace, and, for the most part, gifted with movements of translation very curious to observe. Such are the genera *Sirurella* (No. 1), *Nitzschia* (No. 2 and 3), *Cymatopleura* (No. 4), *Cynedra* (No. 5), *Diatoma* (No. 6), *Pleurosigma* (No. 7), etc., or even Infusoria (No. 13), which make prey of several of these small growths; but, above all, the organic remains. Finally the mineral matters which, in the water of the Marne river, are always more or less muddy, form the small chrystalline groups in the preparation (No. 15). This water is then very good; but on approaching its confluence, that is to say, at Charenton, not only the Diatoms are increased in number, but the Infusoria abound in it as well as detritus, which probably is due to the inhabitants of the Marne at this place.

In the water of the Seine taken at the Port-à-l'Anglais (fig. 2), a very great proportion of organisms is found. This point of the river, intended at one time to furnish Paris with a very potable water, has lost its value on account of the factories and manufactories which are built on it above the city, and the length of the small streams of water which it receives in these places. Desmids are found in it the genus *Closterium* (No. I), *Scenedesmus*

[a] A microscopic exam. of water . . . of London, 1850.

[b] Remarks of some Algæ found in the water . . . of Boston, 1877.

[c] Rapport sur l'altération, la corruption et l'assainissement des rivières, 1873.

[d] Translated from *La Nature.*

(No. 2), *Raphidium* (No. 9), *Tetraspora* (No. 10), and other Algae as *Chlamydococcus* (No. 11) or *Ulothrix*. Infusoria equally (*Chætonotus* [No. 20], *Brachytous* [No. 23], *Euglena* [No. 12]) and several species of Diatoms already named or a little different. But that which is striking is the already notable quantity of organic remains, fragments of plants (No. 24), mycelium of mushrooms (No. 18), and an eel (No. 17), moving about in the middle of all this multitude, and, in fig. 2, crossing a spicule of Spongille (No. 15).

The water taken at the bridge of Austerlitz is more charged with detritus; the purifying algæ disappear and diatoms are rare. It is infusoria and their bodies which predominate, then finally there are remains of tissues of linen or cotton, of vegetables in decomposition, etc., which the waters of Bercy, of Rapée and Bièvre brought.

If now the water of the pump of Chaillot is examined (fig. 3), the maximum contamination of the Seine is attained. (If this is not, however, the water taken at Saint-Ouen; but at this place the stream has received, as is known, the sewer collector at Asnières, which is a serious cause of infection of the water for a long distance.) The quantity of carbonic acid has already increased, and the oxygen grown less.

In the Chaillot water (fig. 3) there are scarcely any more algæ, here and there remains of conferva (*Cladophora* [No. 14] or some rare specimens of more reduced species (*Pandorina* [No. 1]), *Chlanydococcus* [No. 5], *Sirurella* [No. 2], *Stauroneïs* [No. 3], *Epithemia* [No. 4]), yet most often there is only the silicious carapace, void of endochrome, of these last diatoms. On the other hand, the deposit of detritus is dominant in it: muscular fibres, (No. 10), vegetable cellules (No. 11). then myceliums of inferior fungi, and lastly eels (No. 9). Yet there is still more: some microscopic crustaceans appear (*Daphnia pulex* and others [Nos. 7 and 8]), the whole associated with earthy or indeterminable remains.

M. Neuville disputed the opinion of M. Frankland who refuses to admit that rivers purify themselves. He maintains, which seems to be perfectly demonstrated, that after a tranquil journey without receiving other impurities, a river purifies itself, little by little, by deposition, either on the bottom of the bed, or on the banks, of the substances which it held in solution. The harmful matters held in solution are eliminated and they disappear; the carbonic acid becomes exhausted little by little, and the oxygen, on the other hand, returns in proportion.

During the war of 1870–71, the forced stopping on the rivers which habitually received the injections of factories and of industries polluting these streams, had changed their conditions. Thus the Bièvre, tainted from Arcueil to its arrival in the Seine at Paris, had again become limpid, and fish had made a home in it, coming from the parts above Arcueil, although however the bottom of the bed of the Bièvre was at this moment covered by a thick bed of mud nauseating at ordinary times.

The water of the Seine at Saint-Ouen became again more impure than any other part; but, as has been said, this was due to the sewer collector of Asnières. The carbonic acid which, at the bridge of Austerlitz, was represented by 16.2 by hund. cube, reached here the proportion of 65, that is to say the maximum for the waters of Paris. Living creatures here are very rare; but the remains of stuffs: linen, yarn, cotton, animal and vegetable fibres abound here. It is no longer a deposit, it is a real soup. The chlorides, the sulphates, and the sal ammoniacs, as well as sulphuretted hydrogen, are largely represented here. Finally further on, where the Seine passes by St. Denis and receives from it some quantity of refuse, vegetation is no longer found in it, and the bottom of the stream is nothing but a blackish and contaminated mud, as M. Gérardin observed it.

The canal waters of Ourcq have been for a long tim the principal source of the supply of Paris. They ar selenitic; but yet M. Neuville does not consider them the worst waters used in the city. A great number of algæ live in them, this being in their favor, and their relative tranquillity is also one of the causes of this notable growth of vegetation. The numerous boats which sail on these waters and the warehouses bordering this canal, where unloading is done, must prove sources of pollution of these waters? Their hydrometric degree is 30° to 31° while the mean of the waters of the Seine is between 17° and 20°, but this does not constitute in the eyes of M. Neuville a plausible reason of inferiority for the waters of Ourcq. It is their stagnation which ought to be the dominant cause of their depreciation.

Figure 4 represents the composition, in organisms, of the waters of the Vanne. It is, according to microscopical observations as well as according to the official reports, the best of the waters of Paris. M. Belgrand says: "comparison was not possible between the excellent waters of the Vanne and those of the Seine and the Ourcq, which, warm in summer, cold in winter, agitated and not transparent in all seasons, are besides tainted more and more by the residue from industrial and human refuse. After a journey of 176 kilometres by means of closed inlets, the waters of the Vanne arrive at the reservoirs of Montsouris and can furnish 100,000 metres cubes of water in 24 hours. Limpid, fresh, exempt from organic matters, it unites all perfections, says M. Neuville, it is water that I wish to see distributed in all Paris."

Several algæ of good quality, such as *Ulothrix* (No. 7), *Melosisa* (No. 2), *Meridion* (No. 1), *Navicula* No. 3), and *Synedra*, are the respectable inhabitants of these waters; here and there some vegetable growths and earthy remains, and finally some crystals of carbonate or sulphate of calcium (No. 11).

The waters of the Dhuis (fig. 5) only arrive at the reservoirs of Ménilmontant, associated with those of the Surmelin. At their point of junction, those of the Dhuis appear rather pure but nevertheless they are agitated and have need of rest. It is a remarkable thing that the microscope reveals no algæ in them; on the other hand, organisms of another order are met with, some filaments of Mucorinées (No. 1), mycéliums (No. 2), and some earthy or organic remains (Nos. 4, 5, 6). According to all appearances, these waters are not sufficiently oxygenated, and a journey a little prolonged in the open air and in the light will make them perfect.

Rivalling with the waters of the Vanne for purity and freshness, the reputation of the waters of Arcueil has been known for a long time (fig. 6); they were so named because they flow through the valley of the Bièvre over an aqueduct at Arcueil. But in truth, they have come from the village of Rungis since the Roman epoch, for these are the waters which supplied the baths called baths of Julius Cæsar or thermæ of Cluny. To the Roman aqueduct, of which several traces remain, succeeded that which can now be seen, built by Desbrosse in 1624, which has to conduct the waters of Rungis to the palace of Luxembourg and in the Saint-Jacques quarter. Advantage is taken of this monument, solidly constructed, to build above it the new aqueduct for the waters of the Vanne, which are conducted to the basin of Montsouris. M. Neuville says "with difficulty can be seen in them, several Vorticelles and Oscillaries (Nos. 1, 5, fig, 6), then several diatoms (*Gomphonema* [No. 3], *Nitzschia* [No. 2]) and lastly some salts of calcium, chrystallized and precipitated from their solution by the loss of a portion of carbonic acid. It is water of good quality, which can be improved by means of successive cascades, and it is unfortunate that we have not more of it.

The sources of the Nord of Paris offer but little interest. Given up to the consumption of the inhabitants of Paris from the end of the twelfth century, they were for a long time the only waters which supplied the fountains of the capital. These, with the waters of Arcueil are the most ancient known. They are furnished by

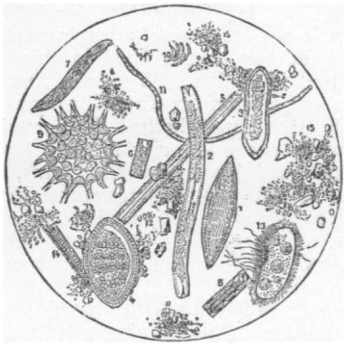

FIG. 1.—Water of the Marne at St. Mauer.

FIG. 2.—Water of the Seine at Port-à l' Anglais.

FIG. 3.—Water of the Seine at Chaillot.

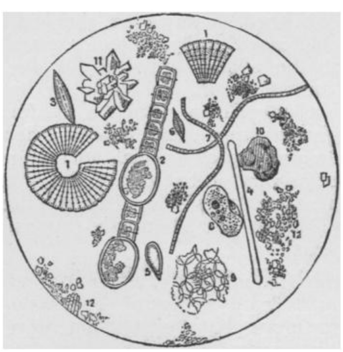

FIG. 4.—Water of the Vanne.

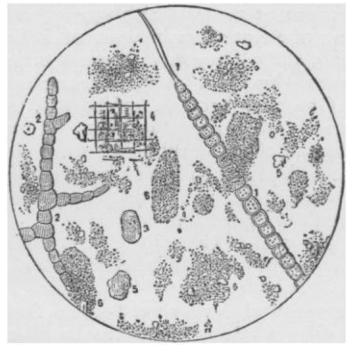

FIG. 5.—Water of the Dhuis.

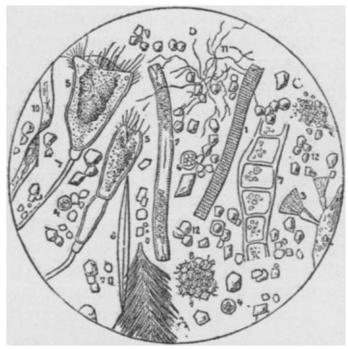

FIG. 6.—Water of Arcueil.

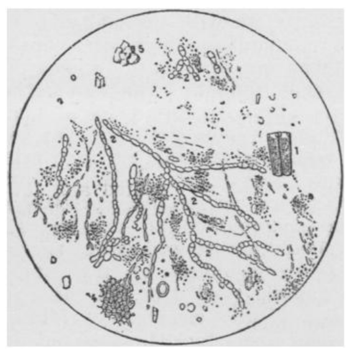

FIG. 7.—Water of the Well of Grenelle.

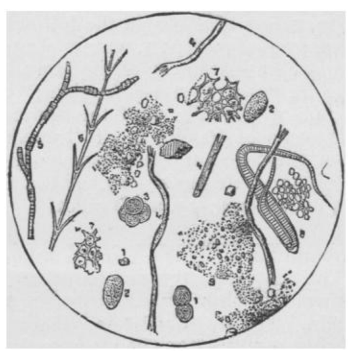

FIG. 8.—Water of the Artesian Well of Passy.

THE WATER SUPPLY OF PARIS.

Saint-Gervais and the heights of Belleville. Their quality leaves much to desire.

"Essentially selenitic, their hydrometric degree reaches enormous proportions: 100 degrees to 150 degrees according as the waters of Saint Gervais and of Belleville are more or less mingled." They contain very little organic matters, some rare algæ and many calcareous crystals.

The well of Grenelle, become celebrated, was commenced in 1833 and only finished in 1841. It was on the occasion of its boring that the relations of the elevation of temperature to the depth of the soil observed by Arago and Walferdin, were stated; that is to say, with every 32 metres the temperature rises one degree.

The water of the well of Grenelle (fig. 7) lacks oxygen which it can gain in the basins of the Pantheon where it is conducted. This water is limpid, indicates at its outlet about 28 degrees, and is very nearly pure from all organism, since it only contains some traces of mycélium of mushrooms (No. 2) and, here and there, several Diatoms (No. 1) probably drawn from the tubes through which it flows. The traces of sulphuretted hydrogen which it contains, impairs a little the quality of this water, but not enough to make it unfit for consumption.

The water of the well of Passy, perforated from 1854 to 1861, can be compared with that of Grenelle (fig. 8). The results which the piercing of this well caused are known; the sale of the water of Grenelle was made considerably less. The carbonate of lime, as well as the bicarbonate of potash, are abundant in both. All things equal, moreover, M. Neuville gives his preference for the waters of Passy rather than for those of Grenelle. Several algæ are found in them (*Calothrix* [No. 8], *Rhizoclonium* [No. 5], *Cosmarium* [No. 1], Glœocystis [No. 9]); several encysted infusoria (No. 2), and a few unimportant organic remains.

Lastly, the waters of ordinary wells are potable only when they are not found in a great city. The varied infiltrations, the connection with the soil, and the industries which can contaminate them, are considerations which must be taken into account in deciding the quality of the waters of wells, and which can render them unfit for consumption. They contain at Paris much of the nitrate and sulphate of lime, and they are also very much charged with organic matters in a state of decomposition; but of algæ there is no trace and there are, here and there, several microscopic crustaceans. It is above all in the neighborhood of cemeteries that the waters of wells should not be used except for gross purposes. This advice is upheld by the studies of M. Belgrand, who has observed that, in the environs of Père-Lachaise and of the cemetery of Montparnasse, the waters of wells were stocked, above all during the heat of summer.

Basing his results on microscopical analyses, M. Neuville arranges the waters of Paris in the following order to indicate their degree of purity: 1, waters of the Vanne; 2, of the Marne at Saint-Maur; 3, of the Marne at Charenton; 4, of the Seine at Port-à-l'-Anglais; 5, of the canal of Ourcq; 6, of Arcueil; 7, of the sources of the Nord; 8, of the wells of Passy; 9, of Grenelle; 10, of the Dhuis; 11, of the Seine at the bridge of Austerlitz; 12, of a well on the left bank; 13, of the Seine at Saint-Ouen; 14, at Auteuil; 15, at Chaillot.

Tidal Power at Bristol.—At a recent meeting of the Town Council of Bristol a motion was brought forward, but not adopted, that "instructions be given to the sanitary authority to cause inquiries to be made into the tidal power of the Avon with a view to its being utilized for working electric lights for the city, the storage of motive power and other purposes, and that scientific aid be employed for the purpose."

THE EVOLUTION OF FLYING ANIMALS.

By Charles Morris.

Continued from page 536.

Yet there is one instance of a leaping animal in which a partial flight has been gained in this manner. We allude to the flying-fish. Whatever first induced this creature to spring from the water through the impulse of its swimming motion—whether the pursuit of enemies, or some other cause—at any rate its fore limbs were already developed into wing-like organs, through their use as fins. The flying-fish does not really fly. But an increased spread of its supporting fins, which act as parachutes, would enable it to make longer leaps, and natural selection has undoubtedly produced this extension of the fins.

Land animals present us with several instances of this parachute motion. And significantly it never arises in earth-leaping, but always in tree-leaping animals. Among mammals we find three instances of such a habit, in widely separated families, embracing the Flying Squirrel, the Flying Phalanger, and the Flying Lemur. Among reptiles there is one instance, the Flying Dragon. The three mammalian genera mentioned include a number of species, and an imperfect flight is gained in the same manner in every case. During their so-called flight the limbs are extended almost at right angles to the body, and the skin of the sides has been developed until it is expanded into a broad membrane between these limbs, which, in the case of the Flying Lemur, extends from the nape of the neck to the tail. In their bold leaps from the branches of trees these creatures are partly supported by their membraneous wings, so that they descend slowly and easily. Some of them can even slightly vary the direction of their motion, so as to pursue insects.

The flying reptile, the little Draco Volans, gains its support in a somewhat different manner. In this case the extended membrane is supported, not upon the limbs but upon the false ribs, which grow out horizontally from their vertebral connection to a considerable distance, giving the animal a wing-like expansion of its sides.

We may readily conjecture the method in which such an organization was gained. The smaller tree dwelling animals are exposed to attacks from foes, the same as all other animals. Or, if carnivorous, they need to pursue their prey. In both these cases the power to make long leaps from branch to branch, or from tree to tree, is so obvious an advantage, that it is not surprising that many animals have become very bold and skillful in this particular. Many of these animals have also the habit of crouching on the branches of trees for concealment, their legs being extended side-wise, and their bodies flattened. This position of the legs in rest would most probably be retained during the leaping motion in which they are not employed. If, then, in any case, the width of the body should be increased, as by a chance extra expansion of the skin of the sides, supported by the outstretched limbs, the animal would be borne up by the air, and could make a longer leap. Such a conformation would aid it in flight or pursuit, and natural selection must operate to retain any such special advantage of form. It certainly seems very probable that the supporting membrane of these creatures was thus developed, and that the Flying Dragon gained its rib expansion through a similar process.

These cases may seem of little importance in an investigation of the origin of the flying power in birds; yet they are, in reality, of considerable importance. They point significantly to the most probable method of flight development, namely, as the result of an original leaping habit, from branch to branch or from tree to tree. Although the above cases are instances of parachute motion only, not of true flight, yet we have strong reason to believe that the earliest flying animals gained their power of flight as a direct extension of the above method.