variation is correlated with a certain death-rate, it must be the cause of it, and that it is not possible to distinguish between variations which are directly useful, and those which are only physiologically correlated with the useful. But it seems to me that this is like talking of hitting a nominative case with a stick. The variation is a magnitude in an organism, survival or death is a relation between the organism and its environment. It is the relation of the variation to life which alone can be said to be the cause of death or survival. The relation to the conditions of life is advantage, disadvantage, or neutrality in the struggle for existence. If I have stated the logic of the matter correctly, I venture to think that the apprehension of this principle is a necessary preliminary to any attempt to demonstrate empirically the occurrence of natural selection.

Prof. Weldon's chief contention was that by the statistical method, when the law of growth of the characters examined was known, a measure of the rate and direction of the evolution of an organism could be obtained. Such a measure would be afforded by the selective death-rate. But he has not yet demonstrated a selective death-rate in a single instance. And further, a measure of the rate and direction of evolution has nothing to do with the cause of the selective death-rate. If characters of no apparent utility are proved to be subject to selection, there still remains the question how the selection is brought about. Measures of the rate and direction of the wind do not tell us the cause of the wind. They may help us to discover the cause, and I have no doubt that Prof. Weldon's investigations are a valuable contribution to the investigation of evolution. But it is only when it has been shown that the degree of utility of a variation, or its correlation with useful variations determines its survival, that the occurrence of natural selection has been demonstrated. J. T. CUNNINGHAM.

September 19.

Fossil Tridacnids in the Solomon Islands.

SOME months ago, on the voyage between New Guinea and Sydney, the small trading steamer on which I travelled called at a number of islands in the British Solomons, the first station at which we called being Rubiana, in the little-known island-complex of New Georgia. Here I became acquainted with the heavy arm-rings worn by the natives, and obviously made from the shell of *Tridacna* or *Hippopus*. What was very surprising, however, was the information which I obtained from all quarters and from different localities, from blacks as well as from whites, that these arm-rings are not made from recent shells found on the reef, but from shells obtained far away in the interior, or, as they say, in the bush. At first sight, the arm-rings, above referred to, strongly remind one of those made from the recent *Tridacna* by the natives of the Sir Charles Hardy Island, which lies to the north of the Solomon Group; but while the former are solid rings more than half an inch in thickness, the latter are deeply grooved on the outer border.

This difference is shown in Figs. 1 and 2, which represent cross-sections through the arm-rings of the Solomon and Sir

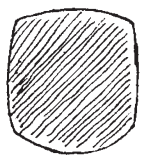

FIG. 1.

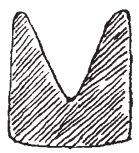

FIG. 2.

Charles Hardy islanders, respectively. But there are other differences, not so much of artistic as of economic importance. The grooved rings are much more readily obtained from the natives who make and wear them, than are the solid rings. The latter have a great value among the natives themselves, and when they are shot with a vein of reddish or reddish-yellow colour (derived no doubt from the hinge-line, which also gives their beauty to the nose-pieces of the New Guinea natives), they can only be mentioned with bated breath.

The reason why the Solomon Islanders prefer the ancient to the recent shells, lies possibly in the fact that, as a general rule, among the natives of the larger islands of the Pacific, the artists and artificers (apart from the making of canoes) are to be found among the bush-natives, rather than among those who live in proximity to the sea. The latter are traders *par excellence*—men of the world who do their business in great waters. The former live in primitive innocence, are possessed of uncouth manners, and produce poets, magicians, medical men, and professional dancers, together with workers in wood and stone. To the last-mentioned members of the community, therefore, the Tridacnid shells, when they occur in the bush through elevation of a former coral reef, are ready conveniently to hand.

I have thought it worth while to draw the attention of naturalists to the above indication of the existence of upraised coral reefs in the Solomon Islands, which would be well worth an attentive examination, and, while in Sydney, Mr. R. Etheridge, jun., informed me that he knew of other instances in the Pacific of coral reefs having been raised to an elevation of over a thousand feet. ARTHUR WILLEY.

Nouméa, New Caledonia, July 16.

Visual Aid in the Oral Teaching of Deaf Mutes.

PROBABLY every one is acquainted with Kœnig's manometric capsules and revolving mirrors, and it occurred to me that I might help a deaf mute to learn inflection in speaking by his imitating the curves produced by my voice in the mirrors. For this purpose I arranged two capsules with oblique membranes and small diameter side by side, one being higher than the other, so that two bands of flame half inch wide, and half inch apart, appeared in the revolving mirrors. The capsules were tuned alike, and furnished with tubes and conical mouthpieces; through one of these I made the sound of a note, vowel, or syllable in various pitches, and my friend endeavoured to imitate through the other tube the curve in the flame band produced by my voice. As an experiment the results were quite satisfactory, for before an hour was over he could imitate a range of nearly an octave, and would tell me correctly, through watching the curves of flame, when the note he uttered was like mine. I am not interested in the oral teaching of the deaf, but having frequently to use Kœnig's invention, I think the principle might be made useful to oral teachers. My friend, upon whom I experimented, is said to have been well taught, his age about twenty years, but his voice (?) is a hoarse monotone. T. HAWKSLEY.

11 Primrose Hill Road, N.W.

INTERNATIONAL METEOROLOGICAL CONFERENCE AT PARIS.

THIS Conference was held at the rooms of the Société d'Encouragement, in the Rue de Rennes, from September 17 to 23. About forty members were present. M. Mascart was elected President, MM. de Bezold and Tacchini Vice-Presidents, and MM. Angot, Erk, and Scott Secretaries. The complete report of proceedings has not yet been printed. It was decided that Committees should be appointed to continue the investigation of several subjects, viz.:

I. Terrestrial Magnetism and Atmospheric Electricity; Prof. Rücker (President).

II. Clouds; Prof. Hildebrandsson (President).

III. Radiation and Insolation; M. Violle (President).

IV. Aerostatics and Balloon Work; Prof. Hergesell (President).

On the motion of Mr. Symons, the International Meteorological Committee was reappointed with a few changes, rendered necessary by the respective resignations of Prof. Wild, Prof. Harrington, and Mr. Ellery. The President is Prof. Mascart, and the Secretary Mr. R. H. Scott.

ARMAND HIPPOLYTE LOUIS FIZEAU.

BY the death of M. Fizeau physical science has lost one who will rank high among those who have contributed to the scientific distinction of the nineteenth century. Every student of optics knows M. Fizeau's beautiful experimental method of determining the velocity of light; but not so many are aware of the other re-

markable researches by which he has partially answered some of the most difficult questions as to the relation of matter to ether, which are perplexing the best physical investigators of the time.

Born in 1819, Fizeau was only thirty years of age when his paper, "Sur une expérience relative à la vitesse de propagation de la lumière," appeared in the *Comptes rendus*. In this he put forward his plan of rotating a wheel having round its rim alternate teeth and spaces of equal width, so that these teeth and spaces should alternately intercept and allow to pass a beam of light from a source, and so adjusting the speed of rotation that the time occupied by the light in travelling from the wheel to a mirror and back again, should be equal to the time taken by the rim of the wheel to advance through a space equal to an integral number of times the width of a tooth or space. Curiously enough, the other experimental method of finding the velocity of light was described by Foucault in the very next volume of the *Comptes rendus*. In some respects the latter method —that of the revolving mirror—was even more striking than that of Fizeau. It allowed the velocity of light to be determined within an ordinary room, and, besides, enabled the question as to whether light travelled more or less quickly through a more refractive medium to be decided by direct experiment.

Another experiment of capital importance with which the name of Fizeau will ever be honourably associated is that by which he determined the amount of drift of light-waves in a transparent medium in motion. According to a theory given by Fresnel, the velocity of drift of ether-waves in a medium moving with velocity u is $(1-1/\mu^2)u$, where μ is the index of refraction of the medium. This conclusion of Fresnel was verified more lately by the experiments of Airy and Hoek, which proved, in opposition to the statement of Klinkerfues, that no change in the constant of aberration is observed when the tube of the observing telescope is filled with water. But it was tested directly by Fizeau in the most simple and beautiful manner. Two tubes were arranged side by side, and water was forced at a considerable speed (as much as seven metres per second) along one tube and back by the other, while a beam of light was split into two parts, which were sent round the tubes, one with the stream, the other against the stream, and then brought together again and tested for interference produced by the virtual difference of path traversed, arising from the motion of the water. The result gave exactly the formula quoted above, and has been confirmed by very careful experiments made comparatively recently by Michelson and Morley.

Fizeau made some notable observations on the number of interference bands observable with approximately homogeneous light, and, in conjunction with Foucault, carried out a most important series of observations on the light in different parts of the field of illumination in interference experiments. The method consisted in applying the spectroscope to examine the light taken from a narrow part of the field parallel to the bands, and proved *inter alia* that there is really interference in that region of the field which seems to be uniformly illuminated in consequence of overlapping produced by want of perfect homogeneity of the light.

One very important recent result of such observations has been to show that the detection of interference is limited only by the resolving power of the spectroscope employed, and that the usual inference as to the regularity of the vibrations in a source of light is unjustifiable.

Like Joule in this country, Fizeau carried on scientific research largely from his own private resources; and by a long series of most valuable papers published in the Memoirs of the French Academy and elsewhere, he has earned the gratitude of his countrymen and the world. But his most enduring memorial will doubtless be his determination by simple laboratory apparatus of the velocity of light (a velocity sufficient to enable the earth's path round the sun to be traversed in about twenty-six minutes!), and with his great colleague Foucault he will be held in honoured remembrance so long as men study the science of optics.

Fizeau was elected a Foreign Member of the Royal Society in 1875, and he received the Rumford Medal of the Society in recognition of his scientific work.

A. GRAY.

NOTES.

THE monument to Lobachevsky, erected at Kazan, in a square which bears the name of the great geometer, was unveiled on September 13, in the presence of the Bishop of Kazan, the Governor of the province, the University, the local Physical and Mathematical Society, and a great number of sympathisers. The Mayor of Kazan made a statement as to the funds raised for the erection of the monument. Prof. Suvoroff referred to the scientific work of Lobachevsky in mathematics and physics, and Prof. Vasilieff spoke of the great geometer as one whose life was worthy of emulation, and as an energetic worker for spreading scientific knowledge. In the evening the Physical and Mathematical Society held a special commemoration meeting before a distinguished gathering of visitors of both sexes.

A SERIES of *fêtes* have been celebrated at Alais, in the centre of the great mulberry and silkworm district of France, in commemoration of the services rendered by Pasteur to sericulture. A statue of Pasteur was unveiled during the celebrations; and, on Saturday last, a solemn service was celebrated in the cathedral in commemoration of the first anniversary of his death, which occurred on September 28, 1895.

THE Harveian oration is to be delivered before the Royal College of Physicians, on October 19, by Dr. J. Frank Payne.

IT is proposed to establish an International Botanical Station at Palermo, under the superintendence of Prof. Borzi, who desires the co-operation of botanists of all countries.

DR. A. ZIMMERMANN has been appointed botanist to the section of the Botanic Garden, Buitenzorg, Java, devoted to the cultivation of coffee.

THE Graefe gold medal, which is awarded by the German Ophthalmological Society every ten years, has this year been awarded to Prof. Theodore Leber, of Heidelberg, in recognition of his work on inflammation. Prof. von Helmholtz was the first to receive the medal, the award being made for his discovery of the ophthalmoscope, and his treatise on physiological optics.

A GAS exposition, beginning on January 25, 1897, is to be held for two weeks in the Madison Square Garden, New York. The object of the exposition, according to the prospectus, is to bring together a collection of gas apparatus and appliances of every description, for the purpose of affording the general public and the gas engineer an opportunity to study the developments that have taken place in the gas industry during recent years.

THE French Medical Press Association is organising a memorial festival in honour of the jubilee of the discovery of anæsthesia. The festival will take place in Paris, on October 18 and following days. The programme includes a ceremonial meeting at the Sorbonne, a banquet, and a special performance at one of the theatres. A suitable commemoration of the event is being arranged in Boston (Mass.), where the first