clusion is drawn from the fact that the whole eggs did not fertilize in a drop of water as well as the enucleated fragments. His conclusions were criticised, for the whole eggs in abundant water all fertilized as usual. The only justifiable conclusion would be that confinement in a drop of water prevents fertilization of normal eggs, while it is not an unfavorable condition for enucleated fragments. The small available supply of oxygen may account for this. The second conclusion above given is drawn from contradictory results. The proper inference to draw is that the possibility of entrance of the sperm is determined in hybridization by other things than the presence or absence of the nucleus.

At the session of March 14th, a paper entitled 'The Derivation of Annelid Nephridia' was read by Mr. R. S. Lillie, consisting of a resumé and discussion of the various theories regarding the morphological significance of annelid nephridia.

C. M. CHILD.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

AT the 517th meeting of the Society, held April 14th at the Cosmos Club, Professor Geo. L. Raymond, of Princeton University read a paper on 'Some Æsthetic Aspects of Music.' He showed that the one distinction between talking and singing lay in the sustained character of the tones of the latter. Birds, dogs or men chirp, bark or talk in unsustained tones at those who have interrupted them. They sing, howl or hum in sustained tones, subjectively and spontaneously. This explains why music need not convey definite intelligence, nor imitate external conditions. But natural music, as when a man hums, does represent moods, and may repeat what has been heard. Artistic music develops, according to the laws of form, phrases of natural music; and what these mean may be determined by the meanings of time, pitch, force and quality as manifested in intonations of speech as distinguished from the articulations of words.

Mr. R. H. Strother spoke on the 'Physics of the Phonograph,' and C. K. Wead discussed 'Modern Problems in Acoustics.'

The 518th meeting, held April 28th, was devoted to a paper by Mr. Lyman J. Briggs 'On the Absorption of Salts by Organic and Inorganic Substances,' followed by 'An Unscientific Account of a Scientific Expedition to Hawaii,' illustrated by lantern slides, by Mr. E. D. Preston and the exercises closed with a statement by Mr. R. A. Harris of 'A new way of indicating the Acceleration of a point referred to Polar Co-ordinates.' The author showed how the ordinary expression for the acceleration of a point moving in a circle, or how the resolution of the acceleration with reference to tangent and normal for any path (plain or twisted), does by its form indicate the resolution with reference to polar co-ordinates.

E. D. PRESTON,
Secretary.

NOTES ON PHYSICS.

ANALYSIS OF VOWEL SOUNDS.

PROFESSOR LOUIS BEVIER, Jr., describes in the *Physical Review*, for April, some interesting work in vowel analysis. The author magnifies the ordinary phonograph record by a mechanical-optical device, thus obtaining tracings which he subjects to harmonic analysis. He has thus far analyzed only the vowel *a* (as in father). He finds two mouth tones in this vowel. The higher and more characteristic mouth tone has a pitch of about 1150 ± 150 vibrations per second. The lower mouth tone has a pitch of about 675 ± 125 vibrations per second. The resonance corresponding to the higher tone is the more pronounced, and this tone varies less in pitch than the lower tone, with different voices.

DISSOCIATION THEORY OF THE ELECTRIC ARC.

PROFESSOR C. D. CHILD applies the theory of ionic dissociation to the explanation of some of the more prominent of the phenomena of the electric arc in the *Physical Review*, for March, 1900. Professor Child explains the curve obtained by Mrs. Ayrton (representing the fall of potential from carbon to carbon). He explains the peculiar light clouds which N. H. Brown found advancing at different velocities from positive and negative carbons in an alternating current arc, and he verifies the drag of the ions upon the vapors of the arc by the method

employed by A. P. Chattock in case of discharge from point to plate. The question of the slow decay of the e. m. f. between the carbons of an arc, after the current ceases to flow (circuit broken), can be approximately answered in terms of the ionic theory. This e. m. f. would die away as the clouds of positive and negative ions near the carbon tips diffuse towards each other. The time required for this would be in the neighborhood of $\frac{1}{1000}$ second for an arc 1 cm. long, if we assume an ionic velocity of 3000 cm. per second per electrostatic unit of potential gradient, and the value of the counter e. m. f. at the instant of breaking the circuit (which would also be the real counter e. m. f. of the arc while running) could be easily calculated from Mrs. Ayrton's curve. Thus the curvature of Mrs. Ayrton's curve is the density of charge at each point; and from this the potential fall from carbon to carbon is easily calculated.

Practically, Mrs. Ayrton's curve taken in conjunction with the ionic theory of the arc settles the perplexing question of the counter electromotive force of the arc. Consider the freshly dissociated ions along the path of the arc. The positive ions have to be hauled up by the impressed e. m. f. into the cloud of positive ions, and the negative ions have to be hauled down into the cloud of negative ions. The work so spent is reversible, except that energy is being continuously dissipated at the carbons, as the ions in the clouds lose their charges. A small amount of energy is also dissipated because of the viscous drag of the arc vapors upon the ions. W. S. F.

CURRENT NOTES ON PHYSIOGRAPHY.

SHORELINE TOPOGRAPHY.

A SUCCESSFUL attempt has been made by F. P. Gulliver to trace a sequence in the development of shoreline forms, distinguishing those which are produced in the earlier stages from those which characterize the later stages of what may be called the 'shoreline cycle.' A large number of littoral forms recorded on maps from all parts of the world were thus classified in accordance with the processes of marine erosion as determined by local observation and general study, the results of the work appearing in a thesis entitled: 'Shoreline Topography' (*Proc. Amer. Acad.*, xxxiv, 1899, 177–258, 32 figures.) The author considers first the shorelines due to relative change of level of land and sea, and as yet essentially unmodified by sea action: these are the initial forms, on which the agencies of change then proceed to develop a long series of sequential forms, until interrupted by later movement. Systematic description and explanation is thus given to a large number of shore forms, such as cuspate forelands, off-shore bars, bars by which islands come to be tied to an adjacent mainland, bay-bars, spits, deltas, cliffs, and so on. Under each heading, a type example is selected and usually figured; additional examples are serviceably indicated by specific references to maps from many coasts. A bibliography of 100 titles is appended.

SHORE FORMS IN THE BRAS D'OR LAKES.

TARR'S account of cuspate forelands in the Bras D'Or Lakes of Cape Breton Island (*Amer. Geol.*, xxii, 1898, 1–12), is followed by a similar paper by Woodman (*Amer. Geol.*, xxiv, 1899, 329–342), describing additional shore features of the same irregular water bodies, where cusps, looped bars, single and double tombolos, and bars across the mouth, middle and head of bays are developed in remarkable variety. Through both these papers there seems to be some misapprehension of the share of work in making cuspate forelands attributed to waves and currents by Gulliver in his essays on the topography of the shore line (Cuspate forelands, *Bull. Geol. Soc., Amer.* vii, 1896, 399–422, and Shore-line Topography, as above). The former authors explain the cusps that they observed solely by what they regard as wave-action. The latter author refers the 'long-shore transportation that is involved in the production of cusps to currents which, in inland and tideless water bodies, he regarded as of wind origin. In so doing, it does not seem to have been his intention in the least to exclude from waves the power of moving shore materials, but to analzye the forces acting on a shore, much as had been done some years before by Gilbert, who wrote: "Usually, and especially when the wind blows, the water adjacent to the shore is stirred by a gentle current flowing parallel to the water margin. This carries along the particles of