in enunciation of words was subsequently developed. The hands of our progenitors were adapted to climbing trees and by subsequent training are made dexterous in us in the use of tools. The point I desire to bring prominently into view is, that the speech faculty has for its basis nothing more important than prehensile abilities. The mechanic is entitled to the same amount of respect as the linguist; in fact, the mechanic is more apt to have acquired a respectable amount of skill in the use of his tools, as generally his labor is directed to some useful and definite end; not necessarily so with the linguist, his acquisition of a few jargons frequently causes him to be mistakenly regarded as intellectual. It is not the ability to use tools or to speak that elevates man above his fellow animals, for man is not the only animal that speaks or uses tools. The intellectual differences between men consist in the greater power of co-ordination and correlation of faculties.

Dr. M. Dax, in 1836, designated the left anterior lobe of the brain as the seat of language, because loss of speech often coexisted with disease of this part, though the labors of Bouilland previously had paved the way for this definiteness. Aubertin and Broca finally assigned this faculty as centralized in the "operculum," and Dr. Wm. A. Hammond (20), in reviewing the subject, concludes that: "The integrity of the posterior part of the third frontal convolution, and perhaps of the second, is indispensable to the normal operation of the function of speech." Hughlings Jackson, and Ferrier agree with Broca in restricting the location to the operculum, but Dr. Hammond (20) claims:

1. "That the organ of language is situated in both hemispheres, and in that part which is nourished by the middle cerebral artery.

2. "That while the more frequent occurrence of right hemiplegia, in connection with aphasia, is in great part the result of the anatomical arrangements of the arteries which favors embolism on that side, there is strong evidence to show that the left side of the brain is more intimately connected with the faculty of speech than the right."

I would like to suggest to the advocates of opercular and insular localization an idea which has probably not been previously advanced, to wit: The sinistral nature of central cerebral speech innervation has, doubtless, some relation to the azygous tendencies of the parts concerned therein; for example, the tongue, uvula, maxillæ, vocal cords, etc., though not strictly fused or impaired, present peculiarities of structure and synchronism of motion of the bi-laterally placed parts widely different from those of the extremities, which could easily influence innervation to centralize upon one side of the brain, particularly when favored by the better blood supply afforded by the left middle cerebral artery. Were the two hands of man joined so as to restrict motion mainly to a perpendicular plane, as in the case of the lower jaw, then we might expect the summit of the ascending frontal convolution on the left side to develop over the corresponding part on the right side as a centre for arm motions. But this matter of localization has not been firmly established. Dr. E. C. Spitzka, before the Medical Society of the County of New York in 1877, reviewed "The Localization of Cerebral Diseases in the Light of recent Anatomical Discoveries" (22). Spitzka acknowledged that "the fibres which ultimately abut in the hypoglossal and facial nerve nuclei can be traced into the operculum and island, giving us an anatomical basis for the aphasic symptom," but insisted that "our faculty of speech is certainly more complex than is generally supposed, and the terms amnesic and ataxic aphasia, by no means exhaust the possible pathological interferences with its delicate mechanism. The first step in the acquirement of speech is its phonetic element. We hear a word or sound, and as far as it is a mere sound impression it is registered in a sensory area of the cortex. We then experiment, as it were, with our motor apparatus, until we find the combination requisite to repeat said word or sound. This motor innervation has its conscious seat in Meynert's region, while the sensory perception is located in a distant area (probably, though not certainly) the occipital lobe. Now in order that the sensory perception may control the "correctness" of the motor expression the two must be associated. It will then be indifferent, whether the sensory center, the motor center, or the associating band be destroyed, we will have aphasia in either case. And there are still more intimate relations which may be equally interfered with, causing either aphasia, agraphia, alexia, or a combination of any two of these, or all." * * * "Any intricate intellectual processes *must* involve the greater part, or the whole, of one hemisphere." This was *a posteriori* completely, and "localizers" should not fail to read the proceedings of that meeting carefully. These views are consistent with the theory I recently presented to the American Neurological Society concerning the histogenetic function of nerve cells in opposition to their being "force producers." Spitzka has shown that the Island of Reil has nothing whatever to do with the development of the speech faculty. In some aberrant forms he found this lobe largely developed. It would seem that primarily this region has, if it have any connection at all with speech innervation, only a certain convenience of situation, an accidental contiguity to certain fasciculi which was taken advantage of as the speech faculty developed.

(1). Ziemssen's Cyclopædia.
(2). "Expression of the Emotions in Man and Animals."
(3). "The Brain as an organ of the Mind."
(4). "The Cat.'
(5). "On the Hypothesis that Animals are Automata and its history."
(6). Op. Cit.
(7). The Duke of Argyll, in *Nature*. See "SCIENCE," Vol. I, p. 24.
(8). "Anatomical uses of the Cat."
(9). Houzeau. "*Etude sur les facultés mentales des animaux comparées à celles de l'homme*, Mons. 1872. Bechstein "*Naturgeschichte der Hof und Stubenvogel.*, C. G. Leroy, Intelligence and Perfectibility of Animals."
(10). "Are languages Institutions? *Contemporary Review*.
(11). "*Origine du Langage*," Chap. III.
(12). *Naturliche Schöpfungsgeschichte*."
13. Op. Cit.
(14). "*Ueber die Taubstummen*" *u. s. w. Schleswig*, 1853, *S.* 54.
(15). Carpenter's Physiology, p. 727.
(16). Principles of Biology, Vol. I., p. 157.
(17). Ibid, Chap. V., p. 184.
(18). Loc. Cit., p. 187.
(19). "Physiology of the Mind.
(20). "Diseases of the Nervous System," Seventh Edition, 1881, p. 182, *et seq.*
(21). E. C. Seguin, *Quarterly Journal of Psychological Medicine*, Jan. 1868.
(22). Journal Nervous and Mental Disease, Vol. IV, pp. 724-734.

ÆTHER.

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The laws of æthereal action and re-action are laws of action and re-action in an elastic atmosphere.

The following well known laws have an important bearing upon photodynamics and other æthereal researches:

1. Cyclical activities may often be accurately represented by formulas which introduce mean or average ve-

locities and mean *vis viva*. This is the foundation of Maxwell's theory of the equality of mean *vis viva* in the molecular movements of different gases at equal temperatures, and of Pfaundler's discovery that in estimating the heat of dissociation, the mean should be taken between the temperatures of incipient and of complete dissociation.

2. The projectile force, which produces flight or cyclical motion against any central acceleration or retardation, is equivalent to the mean acceleration or retardation multiplied by one-half the time of flight or cyclical motion.

3. The velocities of wave motion in elastic fluids, and of cosmical and molecular orbital motion, can all be expressed by the common formula $v = \sqrt{2gh}$.

4. Every periodic vibrating or orbital motion can be regarded as the sum of a certain number of pendulum vibrations. (*Fourier's theorem.*)

5. The distance of the centre of oscillation from the centre of relative stability is at two thirds of the length of a linear pendulum, or at the square root of four tenths of radius in a rotating sphere.

6. The acceleration of any force, which is uniformly diffused from or towards a given centre, varies inversely as the square of the distance from the centre.

7. Times of revolution under the action of such forces, vary as the three halves power of the distance; distances vary as the two thirds power of the time.

8. Centres of inertia, or nodes, in a vibrating elastic medium, tend to produce harmonic nodes.

9. The mutual inter-actions of cosmical, molecular or atomic bodies are proportioned to the respective masses; actions which are considered with reference to a single active centre vary directly as the mass and inversely as the square of the distance.

10. In elastic atmospheres the densities decrease in geometrical progression, as the height above the surface increases in the arithmetical progression.

11. Living force, or *vis viva*, is proportional to the product of mass by the square of the velocity.

12. The distance of projection against uniform resistance is proportioned to the living force.

13. In condensing nebulæ, the velocity of circular orbital revolution is acquired by subsidence, from a state of rest, through one-half of radius.

The following additional propositions may be readily deduced from the foregoing.

14. *Mean vis viva* may be represented by the *vis viva* of centres of oscillation.

15. The force of planetary projection should be referred to perihelion; the force of incipient subsidence, to aphelion.

16. In synchronous orbits, the mean velocity of rectilinear oscillation is to the velocity of circular orbital oscillation as twice the diameter is to the circumference.

17. The acceleration or retardation of a centripetal force varies as the fourth power of the velocity of orbital revolution.

18. In cyclical motions, the resultant of all internal forces must be in equilibrium with the resultant of all external forces, at the expiration of each half cycle.

19. The modulus of cyclical motion is equal to the product of mean acceleration by the square of the time of a half cycle.

20. The sum of all external forces may, therefore, be represented by a velocity which is equivalent to the mean or resultant internal force acting for one-half of the cyclical time.

21. The influence of a central force which acts at the extremity of a linear pendulum is nine times as great upon the centre of oscillation, as its influence upon the centre of suspension.

22. The limiting *vis viva* of wave propagation is five-ninths of the mean *vis viva* of the oscillating particles.

23. In condensing nebulæ, rupturing forces which are due to central subsidence may be represented by fractions in which the denominator is one greater than the numerator.

24. In synchronous rotation and revolution, the nucleal radius varies as the three-fourths power of the limiting atmospheric radius.

25. The variation in mean *vis viva* of gaseous volume is to the variation in *vis viva* of uniform velocity as 1 is to 1.4232.

26. The mean thermal and mechanical influences of the sun must be in equilibrium.

27. The collisions of particles, in subsiding towards a centre of force, tend to form belts at the centre of linear oscillation.

28. The limiting velocity between tendencies to aggregation and tendencies to dissociation is to the velocity in a circular orbit as the ratio of the circumference of a circle to its diameter is to the square root of two.

29. In explosive, as well as in cyclical motions, equilibrium must be established between internal and external forces.

30. Apsidal and mean planetary positions must also be controlled by like tendencies to equilibrium.

31. Undulations in an elastic medium maintain the primitive velocity which is due to their place of origination.

32. When two or more cyclical motions are combined, they must all be modified by the tendency to conservation of areas.

33. In expanding or condensing nebulæ, the conservation of areas maintains a constant value for the modulus of rotation.

34. Instantaneous action between different masses or particles, by mere material intervention, is impossible.

35. In synchronous motions about different centres, the mean distances from the centres of motion vary as the cube root of the masses or other controlling forces.

36. Constant velocities, in a homogeneous elastic medium, represent constant living forces.

37. The time of acquiring orbital velocity, at Laplace's limit of possible atmosphere, is to the time of acquiring "nascent" or dissociative velocity at the nucleal limit, as the diameter of a circle is to its circumference.

These laws are applicable in all branches of radiodynamics, viz.: photodynamics, thermodynamics, electrodynamics, cosmodynamics, chemical physics, hydrodynamics and pneumatics.

COMET C, 1881.

At 3 A. M., of the 14th instant, a comet was observed at Ann Arbor by Mr. J. M. Schaeberle, an amateur astronomer, who has the privilege of the University Observatory.

Mr. Henry M. Parkhurst, of Brooklyn, whose recent calculations on comet B, 1881, proved to be very accurate, has published in the New York *Herald* the following observations on Mr. Schaeberle's comet:

"The position of the new comet on the 20th instant at 2h. 46m., Washington mean time, was :—Right ascension, 5h. 54m. 58s.; North declination, 40 degrees, 30 minutes. This shows a motion of 29 minutes per day—an increase of 7 minutes—showing that the comet is not so distant as I had hoped. I have not succeeded in reconciling my two positions with that telegraphed for the time of discovery. To satisfy the right ascension given the comet must have already passed its perihelion and be moving in such an orbit that it will pass between the earth and sun within a fortnight, and be no more seen in this hemisphere. The increased brightness this morning tends to support this idea. Yet it may not have reached its perihelion; in which case it may be visible for a month longer. I shall be compelled to wait for a third accurate observation before I can determine the orbit more exactly. In any event the comet is coming directly toward the earth, and it will become much brighter than at present, so that it will probably be visible to the naked eye as soon as the moonlight ceases to interfere. It is now about 12 degrees southeast of Capella, the bright star in the northeastern sky at 3 o'clock in the morning."