of the tentacles is extended with incredible speed so that the membranes of skin between adjacent tentacles form a closed canopy or "net" under which the shrimp and fish lurking in the sea weeds are impounded; (4) now the canopy is gradually diminished in size by pressing the tentacles closer to the ground in such a manner that the catch is slowly forced inward towards the mouth. The whole process is then repeated, sometimes in quite rapid succession. One specimen kept under observation from a rowboat made fifteen "hauls" in twenty minutes. The method is sometimes modified somewhat to a more commonly observed one whereby the animal pounces forward upon the prey with a less extended canopy.

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INFECTIVITY OF EXTRACTED, UNPRESERVED TOBACCO MOSAIC VIRUS RETAINED 28 YEARS

THE extracted, unpreserved virus of mosaic-diseased tobacco may retain its infectivity for a long period of time *in vitro* under certain conditions.

On February 27, 1914, I set aside a portion of the original extracted virus of tobacco mosaic with which I was working at this time. This virus was used for studies upon which early papers were based, including, among others, "The Mosaic Disease of Tobacco"[1] and "Effects of Chemicals on the Virus of Mosaic Disease."[2]

A portion of the original virus, merely filtered through filter paper, was placed in a vial, tightly stoppered with cork, and kept on a shelf at room temperature since 1914.

This virus, tested in 1936, was found to be as infectious as when first extracted. It was again tested in 1942, by inoculating twenty small Connecticut Broadleaf plants, using the method of rubbing the virus on the glandular trichomes of the leaves on February 27. The first symptoms of mosaic were indicated on March 7 on nine plants, and the remaining eleven plants showed symptoms on March 9. Control plants had shown no symptoms several weeks later.

The pH of this original virus was determined at the time of testing in 1942 with a Beckman pH meter, using a glass electrode, and was found to be 6.76 or near neutral. These tests indicate clearly that this virus, although stored without preservatives at room temperature, was highly infectious 28 years later.

In "A Textbook of Plant Virus Diseases," by Kenneth M. Smith, 1937 (p. 232), it is stated that sterile, filtered juice retains its infectivity probably several years, but that ordinary extracted sap stored at room temperature soon becomes reduced in strength. The latter statement appears to be based upon the paper "Accuracy in Quantitative Work with Tobacco Mosaic Virus," by F. O. Holmes.[3] Holmes found a rapid reduction in number of infections in aging, undiluted and unpreserved virus stored at room temperature. His results would indicate a partial breakdown or denaturing of the infective principle, whereas this has been slight in the case of my 28-year-old virus.

Long ago I found that the degree of infectivity of such extracted, unpreserved virus would quickly decline, even to the point of becoming entirely innocuous, or the virus might remain highly infectious for years. In general, two types of fermentation appeared to occur, one resulting in acid conditions apparently very destructive to the virus, accompanied by a sour or acid and not unpleasant odor; the other with a near neutral reaction or low acidity condition favoring retained virulence, characterized by a most persistent and offensive odor.

Dried and ground leaf material obtained from mosaic-diseased tobacco on November 9, 1915, and stored in a jar at room temperature was no longer infectious in 1936.

These tests would indicate that the retention of virulence of extracted, unpreserved sap depends upon the type of fermentation which gains control under certain conditions.

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WEATHER FORECASTS

AMONG the *Science News* "Items" in SCIENCE for December 26, the one on weather forecasts gives a quaint little pat on the back to one of the most persistent and wide-spread of popular misconceptions about our atmosphere. It is that "The air is heavy with moisture" when it is likely to rain. Of course the notion is wrong in both of its two possible aspects: (1) because of the molecular weights of water and of the hydrogen-oxygen mixture. If all the molecules of water vapor in a given volume of saturated air were taken out and replaced by an equal number of air molecules, all other conditions being unchanged, the weight would be increased by something of the order of one per cent. Dry air is heavier than moist air. (2) When it is likely to rain the barometer is invariably low and therefore the weight of the whole atmosphere above a given area of the earth's surface is proportionally less than on a fine day when the barometer is ordinarily higher. Yet, if you try to get an average university student to understand these facts, he is very apt to simply look reproachfully or

[1] *Bull.* 40, U. S. D. A., 1914.
[2] *Jour. Agric. Res.*, 13, 1918.
[3] *Bot. Gaz.*, 86: 66–81, 1928.

pityingly at you. If he has enough nerve he may tell you that every one knows that the air is heavy on a muggy day because you can feel it so. To him it is a question of psychology and not of physics. One is tempted to wonder what the writer of the news item feels about it.

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SCIENTIFIC BOOKS

THE CEREBRUM

Emanuel Swedenborg. Three Transactions on the Cerebrum. Now first translated by ALFRED ACTON. Philadelphia: Swedenborg Scientific Association. Vol. 1, 1938. xxxiii + 731 pp. "Anatomical Plates" (bound as a separate volume, 175 pp., 148 figs.) Vol. 2, 1940. viii + 179 pp. $12.00.

EMANUEL SWEDENBORG entered the field of neurology with an essay "On Tremulation." He had studied Willis and Vieussens, but was under the spell of Baglivi's "De Fibra Motrice." Baglivi, working with Pacchioni, had seen the dura mater pulsate with powerful systole and diastole, and had called it the heart of the brain. The cerebral cortex, they agreed with Malpighi, consisted of minute glands which extracted a nervous fluid from the blood and discharged it through excretory vessels that made up the white or medullary substance. Thence the nervous fluid was sent through the peripheral nerves to all parts of the body, impelled in the twinkling of an eye, with the velocity of light, by the contractions of the dura mater. Every one knows, says Baglivi, how swiftly a sensory impression made by external objects is conveyed to the mind's chief domicile, the cerebrum; and he discusses the transmission of *oscillations* through solids and through liquids.

For Swedenborg the oscillations are *tremulations,* and life (audition, vision, every sensation and motion) consists of these little vibrations—stillness and rest is death. Impacts from without are received by the cuticle, "which is nothing but a ramification of nerves," and are conveyed centrally along the nerve sheaths which are extensions of the dura mater. "The meninges produce a continuous system of membranes over the whole body." "The dura mater," for example, "applies itself closely to the bones," sending little tendons or threads far into their substance. Bone and periosteum are good transmitters, as are other membranes save when slack, so that reception, spreading like lightning through connective tissue misinterpreted as nerve, is diffuse; yet in the meninges "reside the most subtle sensations."

Outgoing tremulations in the nervous fluid follow the nerves into "finer and finer branches until they are finally expanded into membranes," and the circuit is complete. The fluid distilled into the medullas flows "through the nerves into the membranes and then back again to the medulla, making a circulation similar to that of the blood." Fear, with low blood pressure and therefore slack membranes, prevents transmission of the nervous fluid and paralyzes. In telepathy one's membrane "trembles from the tremulation of the other person's cerebral membranes, just as one string is affected by another, if they are tuned in the same key."

With visions of a new neuropathology, Swedenborg published in briefest note nine "rules" of tremulation (1718), and prepared a manuscript on that subject which he handed to the Royal Medical College a year later. The Board of Health (Sundhets Collegium) to whom it was referred for an opinion, passed it around and lost it; Swedenborg did not preserve the original draft, and all that remains of it is indeed the essential part, which he had sent with interesting letters, to his brother-in-law, librarian of the University of Upsala.[1]

For the next 15 years Swedenborg was occupied "exclusively with mineralogical and metallurgical studies," which led to his *Opera philosophica et mineralia* (Leipzig, 1734, 3 vols., fol.). Then he returned to neurology, reading and copying excerpts from nearly all the standard texts. In 1734 he published also "De Infinito," or, in its English translation, "The Philosophy of the Infinite,"[2] in which he considers the relation of soul and body, and concludes: "The soul resides particularly in the cortical substance of the cerebrum, and partly also in the medullary, where exquisitely subtle membranes can run connectedly from particle to particle, likewise above, around and within every particle of the above substance." This idea of the prime importance of the cerebral cortex was not new. Willis (1664) had said that the reason for the duplex substance of the cerebrum appears to be that the cortical part exists to *produce* the "animal spirit," and the medullary portion to distribute and utilize it. Varolio (1573) in colorful lines had declared the white substance of the cerebrum to be the mirror of the intellect and servant of the mind, since he considered the gray layer merely as white discolored through its great vascularity.

Captivated by neurology, Swedenborg in 1736, at

[1] "On Tremulation," by Emanuel Swedenborg. Translated by C. Th. Odhner. Boston [1899]. xiii + 79 pp. (This includes parts of the letters, the entire publication of 1718, and all that remains of the 1719 MS.)

[2] Outlines of a philosophical argument on the infinite, and the final cause of creation and on the intercourse between the soul and the body. Transl. from the Latin by J. J. G. Wilkinson, London, 1847. xxx + 160 pp. Reprinted as "The Philosophy of the Infinite," Boston, 1848. 64 pp.