REFLECTIONS ON VERTIGO.*

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IN dealing with the subject of vertigo and endeavouring to arrive at a clear opinion of one's own—despite the chaotic theories and hypothetical interpretations presented by a great number of workers—and to define the essence and function of the so-called "static organ" or "sixth sense," certain fundamental ideas, *e.g.*, that of space and time, have to be considered, and terms such as "organ of sense," "tonus," and "co-ordination" must be correctly defined. Finally, the question of inheritance (constitution and disposition) must be taken into consideration.

"Organs of sense" are arrangements of the body able to receive and digest adequate external and internal impulses, which they transfer to certain nerves, of which they are the terminal apparatus, and which conduct the impulses through different stations or relays to the centre, where they become transformed to contents of consciousness.

The idea of "space" differs at different times; the eyes, the organs of touch—kinæsthesia—and the ears work together to produce it, *i.e.*, it is the psychological result of complex views of the size, form, position, and state of motion of the things around us, produced by the synchytic, harmonious action of these organs of sense. For many years two kinds of space have been distinguished—space of touch and space of sight, according to the mode of perception. To the determining factors a third should be added, namely the momentum of motion and muscular action, which is under the control of the "static organ." This third factor has been hitherto ignored, usually because the static organ acts below the threshold of consciousness.

"Tonus" denotes a specific, permanent tension and contractibility of the muscles, which exist in normal cases independently of voluntary innervation. "Co-ordination" is the result of a harmonious co-operation of groups of muscles for normal sequence, uniformity and expediency of function. This takes place automatically, as a rule; it is seldom under the control of will-power. In this respect all muscles are

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involuntary and act automatically whether they be smooth or striated. The old distinction of voluntary and involuntary muscles is only admissible in a limited sense, as most muscular actions are automatic and only the first impetus is sometimes under will power. Mention should here be made of the influence of congenital aptitude, predisposition, constitution, and the co-operation of the autonomous nervous system—sympathetic and parasympathetic—with the endocrine organs. In many ways we are returning to the old idea of neurotrophic influence. This fact and that of the growing knowledge of the interrelation of the endocrines and the autonomous nervous system are of great importance.

Vertigo is a subjective feeling of uneasiness caused by the apparent staggering or rotation of surrounding objects, or of movement of the ground, and the sensation of falling or instability. Purkinje called vertigo a "feeling of disturbance of equilibrium." Nitzig spoke of a mere psychic process.

There are, according to Purkinje's distinction, two different forms of vertigo—the vertigo of touch and the vertigo of sight. We distinguish a lateropulsion and a rotatory vertigo, when the motion is a result of angular acceleration. Both are supposed to occur when our observation is influenced by the static organ (or the reverse), so that there arises the feeling of falling, or of rotation either of ourselves, or of the objects around us. Fictitious motion is the essential characteristic of vertigo.

The "static organ" or "sixth" sense controls the feelings of location and motion of the body and the relation of the body to the perpendicular line and to surrounding objects; *i.e.*, it is the organ of equilibrium.

From the study of phylogenesis it seems probable that during evolution the different sense organs, with their different centres, have become adapted to different impulses. We know fairly well how to differentiate the organs of sense, but we do not know how to differentiate the "centres," although the knowledge that there are different centres is based on experimental research and clinical experience, which have resulted in the now well-established theory of localisation, and the consequent local diagnosis of brain diseases.

Reference must here be made to Johannes Müller's doctrine of the "specific energy" of sensory nerves, although it has been somewhat affected by later observations which have located

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the differentiation in the terminal apparatus, or in the centres, or in both combined. The natural processes are more complicated than we used to think, and we must modify our methods of thinking accordingly.

The different organs of sense consist of their terminal apparatus (the receiver), as it were, of the nerve (the transmitter), the different ganglia (intermediate relays), and finally the centre, the cerebral cortex and subcortex, the seat of perception of all internal and external impulses. Physiological experience ends here. The process of forming ideas is a matter of psychology and philosophy.

One of the most important components of the idea of space and time, besides those of sight, touch and kinæsthesia, is the perception of motion in ourselves and in the objects around us. The ideas of space and time together comprise the momentum of motion. The observation and estimation of lapse of time take place automatically through the different parts from the drum, stapes, labyrinth, brain-stem and cerebellum to the cerebral cortex, and *vice versâ*. It can be influenced to a great extent by training, but depends chiefly on the congenital, *i.e.*, constitutional endowment, the different gifts or talents.

The "static organ" is not to be understood as an independent and complete organ of sense such as the eye. No one doubts that he can see with his eyes, but, on the other hand, no one has ever had spontaneous knowledge of a "static organ." Formerly the sole function of the ear was considered to be hearing, but Flourens, Mach, Breuer, Crum Brown and others, have increased our knowledge in this respect. They have attempted to give a mathematical and physical explanation of the different phenomena of equilibrium and vertigo, and this attempt was the first step towards a scientific theory which is, however, still defective and far from complete. The only definite knowledge at which we have arrived is, that the ear has two different functions: (1) Hearing, and (2) the control of equilibrium, which means, *de facto*, the full control of all movements of the body, *i.e.*, of all muscular actions. We also know that motion is the most significant part of the idea of space and time. There are thus two closely connected points of view: The idea of space and time on the one side and the two functions of the organ of sense on the other. The ear appears to be more fully adapted than any other organ of sense for the comprehension and judgment of time. We know, further, that defects of the ear lead to

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vertigo, which means loss of control of motion, the most essential principle of space and time. Both are very closely linked together, time being, as it were, the fourth dimension of space. Is there not here a conclusive argument that the ear is the proper instrument for measuring time and space by a harmonious co-operation of both parts, the cochlea and the vestibule? Of course, I am not thinking, for a moment, of an exclusive action of the ear alone, but presume co-operation with the senses of sight, touch and kinæsthesia already mentioned.

The ear seems to me an anatomical, physiological and psychological unit with a dual function, constituting an appropriate and effective mechanism for the protection of the body and the preservation of life.

I have also other, perhaps more convincing, arguments upon which to found my conclusions. For more than twenty years I have based the diagnosis and treatment of certain ear conditions on the fact that I could influence vertigo, noises in the ear (and even some forms of insomnia produced by such noises), headache, and deafness, by means of my electromagnetic tuning-forks in different keys. I could often "irritate" (*i.e.*, "stimulate") and at other times could tranquillise, by the use of sound, the acoustic as well as the motor or static function. Further, this effect is produced not only by the direct application of the tuning-fork into the meatus but also by the conduction of the sound to the ear through a rubber pipe. This has been repeatedly confirmed, and Urbantschitsch and his followers have sometimes created vertigo by conducting the sound of his "harmonika" into the ear. Winkler, in Amsterdam, has lately demonstrated by experimental investigation the close anatomical connection and physiological interrelation of the whole inner ear (vestibule and cochlea). I am thoroughly convinced by my own long experience that the ear as an organ of sense is a functional unit with different types of reaction resulting from different impulses, and that, precisely for this reason, it is such a susceptible and finely adjusted instrument for the right reception and adequate conduction of centrifugal and centripetal messages. It is well protected, being embedded in the most solid bone of the skull (an excellent example of the economy of nature). Personally, I think that the two parts of the inner ear are not dissociated but are actually inseparable, two wings of one unit. In spite of this conviction, however, I use for convenience the customary nomenclature.

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The constitutional factor to which I have referred seems to depend mainly upon the functions of the endocrine system; I say this with necessary reservations. There are a great number of diseases of constitutional, *i.e.*, inherited, origin. The products of internal secretion—the hormones—have a great influence on the nervous system, and are, in turn, influenced by it. For example, the influence on the nervous system of the status lymphaticus and of the secretions of the thyroid, parathyroid and genital glands, is well recognised, and on the other hand, we know from experience the enormous influence brought to bear by the nervous system and the psychic condition—excitement, fatigue, fear, disappointment, sorrow, in short functional nervous affection—on the bodily economy. Again, any one endocrine organ influences another, or all of the others, thus showing the close interrelation not only between the endocrine glands themselves, but also between other organs and so demonstrating the unity of function of the whole body.

In Carlsbad there are relatively more cases of vertigo than there are anywhere else. When I began to practise there, thirty-five years ago, this was the first thing that struck me and I lectured to the Medical Society on vertigo during the second season of my practice. I had under observation a street sweeper who suffered from vertigo; sometimes he was unable to stand upright and was thought to be intoxicated. He was, however, a total abstainer. Examination showed a chronic vertigo from stapes fixation; both hearing and equilibrium were affected, and a successful synechotomy completely cured the trouble. Another patient, an American, aged about 50 suffering from chronic Ménière's disease with frequent acute attacks of "sea-sickness" and vertigo said to arise from "biliousness," had been to Carlsbad. He took the cure but became worse every day and his case was very serious. He never could walk alone, even at his "best" times. Examination showed a chronic catarrh of nose and throat and of both Eustachian tubes. Both drumheads were thickened and sunken, hearing was considerably impaired; he had ear-noises and suffered from headaches, insomnia, and great general nervousness. Weber was not lateralised, Rinné was still slightly positive, but Schwabach was noticeably shortened; whisper 1 m.-2 m. Medium-sized bougies passed on both sides only with great difficulty. Treatment consisted in dilating both tubes, employing my method of inhalation for nose and throat,

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and also my method of vibration with my tuning-forks. At first only "deep" forks were bearable, but in the end even the highest were tolerated; hearing 6 m., whisper; the vertigo disappeared and the patient could walk alone and climb the winding stairs to my office without aid. A year later he won a trotting race, and after that I lost sight of him.

Among other cases was that of a prominent lawyer, who had an attack of vertigo (thought by his friends to be an apoplectic seizure) on the railway station just as he was about to leave Carlsbad; also that of a member of the Austrian Parliament. Both were cured by inhalation and vibration carried out according to my method.

One patient had come to Carlsbad after many years' treatment for a condition diagnosed as intestinal and liver trouble, but which was really chronic catarrh of nose and throat, Eustachian tubes and middle-ear vertigo. He was treated by the inhalation tubage and vibration methods with satisfactory results.

There are many cases of chronic gastric and intestinal trouble — especially colitis, liver trouble, and biliousness — combined with vertigo, in which naturally both conditions must be treated if a permanent cure is to be effected. Therefore I use, in every case of ear trouble, with or without vertigo, my two methods of inhalation and vibration respectively; the first hardens the mucous membranes, the second hardens the nerves, and thus they inure patients to fatigue, diminishing sensitiveness and enabling them to resist changes of climate and weather, as well as psychical injuries, and, in a word, fitting them for their work.

In conclusion, it is evident that a thorough examination of the nose and ears in every case is the only means by which an exact diagnosis—and consequently a basis for treatment—can be obtained.

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