

Cause of Seasickness Discovered at Last?

Ailment Is a Form of Vertigo and Results from a Disturbance in the Ear, According to Two Physicians Who Have Made Tests

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THE mystery surrounding the cause of seasickness has been dispelled. It is an ear phenomenon. The ailment is a form of vertigo. All vertigos result from a disturbance of equilibrium, and the seat of equilibration is in the ear.

Persons whose mechanism of equilibration remains normal under all circumstances never become seasick. Also persons in whom the mechanism has been destroyed—deaf-mutes, for instance—never suffer from mal de mer.

Absolute knowledge warranting these definite statements has been evolved slowly. It has not been due to an epoch-making discovery by any one man. It has been the recognition, rather, of certain facts bearing on the problem by individual scientists whose theories and achievements have been put to the test in clinical practice.

Thousands of persons have been terror-stricken at the onset of a vertigo which tradition had led them to believe must be the forerunner of some mortal illness, or an irreparable organic derangement. It is now certain, however, that no one can suffer from a vertigo, no matter at what internal point it may seem to originate, unless there is an ear disturbance to give it an impetus.

In other words, there is good news in the fact that vertigos in themselves are nothing like as serious as has generally been supposed—not only by the lay victims of these unpleasant experiences, but by the majority of the members of the medical profession themselves.

A description of the mechanism of the ear and the disturbances which result in seasickness and other forms of vertigo is a bewildering and complicated matter, and the solution of these mysteries is a notable achievement in scientific research.

Two physicians, Dr. Lewis Fisher and Dr. Isaac H. Jones, have summarized what is known about the vertigo problem and related in detail the tests to which persons suffering from it are subjected in two of the Philadelphia college clinics, in an article on "Vertigo and Seasickness, Their Relation to the Ear," contributed to The New York Medical Journal. They dispose of the origin of vertigo at the outset of their article by saying:

Perhaps in the whole domain of medicine there is no subject which seems so vague and chaotic as that of vertigo. Doctors repeatedly speak in a general and indefinite way of "intestinal" or "stomach" vertigo, or vertigo from Bright's disease, dizzy spells from refractive errors, from indigestion, or neurasthenia, &c., without thinking even for a moment of the real mechanism of its production.

The most recent work on the ear makes it clear that vertigo is not some general manifestation accompanying disorders in this, that, or the other organ, but that it is a peculiar and definite disturbance perceived within the brain itself, just as sight and hearing are perceived in the brain, and that vertigo impulses are transmitted thereto through the vestibular portion of the ear and its associated paths.

The authors then describe the inner ear in elaborate scientific detail. It has two distinct functions, they assert, namely, hearing and equilibration. It is important to know, to reach a proper understanding of their argument, that that portion which presides over equilibration has subsidiary parts which control linear movements of the body from side to side, linear movements forward and backward, and "rotary or turning movements in all conceivable planes."

These rotary movements are controlled by what are known as the three semi-circular canals, delicate organisms which have little bulbs on one end in which "is placed a group of sensitive hair cells capable of excitation." In these cells are lodged nerve fibres of equilibration, and these fine nerve filaments communicate by means of wonderful mazes of nerve connections with the brain and all the important organs of the body. In addition, the semicircular canals contain a substance known as the endolymph, and it is really the disturbance of this that is

responsible for seasickness, as will be explained later.

The writers also acquaint us with a generally unfamiliar special sense, namely, the static sense, "whereby we are enabled to maintain our proper position in space." They also say:

Perfect equilibration is accomplished through a harmonious co-operation of several special senses, chiefly the static sense, sight, and muscle sense. Disturbance of any one of them will result in partial or complete loss of equilibrium; but the point to remember is, that the static labyrinth, unlike the others, has equilibration for its sole function, and is the most important organ for the maintenance of balance and of orientation. Any disturbance of the mechanism of equilibration induces vertigo.

By vertigo we mean a subjective sensation of a disturbed relation of one's own body to surrounding objects in space. That the labyrinth was a factor in maintaining the equilibrium of the body was suspected by numerous observers for many years. But it was not until 1900 that this relationship was established as a clinical entity. In that year Meniere of Paris published his epoch-making paper, in which he described the train of symptoms always referred to thereafter as Meniere's disease.

Many others followed him and made contributions to the subject, but no work has equaled the recent brilliant efforts of Dr. Robert Barany of Vienna. That his work upon the physiology of the labyrinth was of more than passing interest was attested to by his receiving recently the Nobel Prize, awarded annually for research work in medicine. He has established, beyond doubt, that the static labyrinth constitutes the chief organ of equilibration. It accomplishes this by being most intimately connected through the central nervous system with nearly every portion of the human organism. The nerves connecting this vestibular portion of the labyrinth with the rest of the body may be spoken of as the vestibular paths or tracts.

Stimulation, or irritation, or destruction of the labyrinth, or any portion of the vestibular tracts, induces vertigo or dizziness, with associated loss of equilibration. We must not be misunderstood as meaning that irritation of the ear itself is the sole and only way of producing vertigo. We all know that various visual disturbances, cardio-vascular affections, gastric or alimentary disorders, &c., may exhibit vertigo as a symptom. What we do wish to impress is that in the latter instances it is their direct action on the vestibular apparatus that is responsible for the induction of the vertigo.

The stomach of itself, or the kidneys, or the heart, &c., can no more produce vertigo than they can produce sensations of flashes of light, hallucinations of sound, or obsessions of smell. It is generally known and admitted as a matter of course that the light, sound, and smell sensations in these instances are produced by irritation or stimulation of the visual, auditory, or olfactory apparatus, as the case may be. Just in the same way, when disease in any of the organs just mentioned is accompanied by vertigo it is due to a direct effect on the static organ or its distribution. Should the same pathological states, for one reason or another, fail to irritate the vestibular tracts there will be no vertigo.

Vertigo produced by inflammatory or other conditions of the ear itself can be differentiated from other kinds of vertigo by an examination of the ear.

The importance of it has been recognized to the extent that at a number of our local leading teaching institutions, beginning with the University of Pennsylvania and followed by the Medico-Chirurgical College, special subdivisions of their respective ear departments were created, where all patients complaining of vertigo or suspected of an intracranial lesion are carefully tested out in this way with a view of determining the integrity of the labyrinths and the associated paths. These vertiginous cases are sent to the ear dispensaries from all the departments, chiefly the medical and nervous, to which many of the patients first apply for relief.

"Experimental or vestibular vertigo," says the article, "manifests itself in certain definite planes."

1. Sensation of turning in a horizontal plane either from the right to left or from the left to the right.

2. Sensation of turning in the frontal plane, or, rather, the sensation of falling to the right or falling to the left.

3. Sensation of turning to the sagittal plane, or, rather, the sensation of pitching forward or backward.

In connection with unpleasantness from these turning sensations we may consider seasickness. Mal de mer is unquestionably an ear phenomenon. As Barany has stated, the reason that this is not generally recognized is that the phenomena of the labyrinth and the vestibular apparatus are not generally understood. In 1881 Champeaux first showed the close similarity between Meniere's disease and seasickness. In both conditions there is an aura consisting of a sensation of flashes of color before the eyes and a breaking out of sweat; there is vomiting of a pro-

jectile type, which occurs very easily and produces only temporary relief. In both instances the sufferer feels worse on attempting to stand or move about and shows distinct ataxia; lying down and closing the eyes usually results in some relief. Headache is present in both instances and occasionally there is a nervous diarrhea after the vomiting.

Deaf and dumb people do not become seasick. This was first brought out by W. James. Similar proof of the relation of the ear to seasickness was proved experimentally by Kreidl. He constructed a floor on which he rocked animals, indicating the movement of a ship at sea. He was able to make the animals sick in this way. He then operated on the animals and severed both eighth nerves. When they recovered he conducted the same experiment and found that they could not be made seasick again.

Trotsenberg makes the observation that in very small children seasickness is uncommon, bringing out the fact at the same time that douching the ear with cold water in children similarly fails to produce nausea. This could be explained by the fact that the vestibular apparatus of small children, not yet being highly developed, shows but little response either to the movement of the ship or to experimental stimulation of the ear by douching.

Ruttin had the same idea as to the causation of mal de mer, and to prove it he performed the following experiment on himself. He went out to sea purposely to make himself seasick, and when in that condition he had a colleague of his, Dr. Beck, douche cold water in both of his ears simultaneously with an apparatus which he had devised. This produced a decided lessening of his seasickness. Unfortunately, for therapeutic purposes, the relief lasted only so long as the douching was kept up.

Barany has shown that persons who show no response to stimulation of their ears experimentally cannot be made seasick. This is substantiated by our own experience with patients who have "dead" or nonreacting labyrinths. Barany also brings out the following interesting facts: Persons who by stimulation of the ears become easily nauseated also become seasick easily. Neurasthenics are sensitive to being turned in a chair or having their ears douched, and they also become seasick easily. Persons who become seasick from certain movements of the boat, also become seasick by the very same kind of vestibular stimulation.

The manner of onset and the persistency of the nausea are the same in seasickness as in experimental vestibular stimulation. Furthermore, the sensations after seasickness are the same that we have after being nauseated by violent vestibular stimulation. Any means which would help against seasickness, such as altering the position of the head, helps as much against the unpleasant sensations experienced when one is being turned in a chair. After getting back to land the seasick person quickly becomes perfectly normal again; in the same way nausea produced by violent vestibular tests quickly disappears.

"Seasickness," says the article, "is therefore an ear phenomenon, by which we mean that the end organ of equilibrium, namely, the static labyrinth, is disturbed by the unaccustomed movement of the boat or ship. The tossing of a ship may be analyzed as movements in the following planes:

1. The horizontal plane from right to left and from left to right. This movement, however, is usually very slight, and, unfortunately, as we have already shown, it is the only plane of movement that is not unpleasant.

2. The frontal plane, namely, the rolling of the ship from side to side. If the subject is standing facing the bow of the ship, such a movement will influence the vertical semi-circular canals in the frontal plane. Such stimulation is unpleasant. If, therefore, the subject lies down with his head toward the bow or stern, the rolling movement would then affect the horizontal canals and the unpleasantness would disappear.

3. The sagittal plane, namely, a pitching of the ship fore and aft. If the subject is standing facing the bow of the ship, such a movement affects the vertical semi-circular canals in the sagittal plane. The resulting sensation is extremely unpleasant. If, however, the subject lies down with the line of the body extending across the ship from starboard to port, the pitching movement affects the horizontal canals instead of the vertical and the unpleasantness disappears.

The up and down movement of the ship—that is, the rising and the sinking—in a similar way affects the vertical semi-circular canals when the subject is in an upright position. The resulting unpleasantness is again relieved by the subject lying down, since then the up and down movements affect the horizontal canals instead of the vertical, the stimulation of which is so much less unpleasant. Unfortunately, the movement of the ship seldom takes place in one plane only. It is the combination of the various planes which plays havoc with the semi-circular canals.

In conclusion we should like to emphasize the following:

1. Vertigo, from whatever cause, is a dis-

turbance of the vestibular apparatus.

2. Disturbance of the vestibular apparatus can be definitely analyzed by means of the new ear tests.

3. Cases of vertigo, therefore, need no longer be regarded as vague or mysterious, but should be cleared up by means of the ear tests.

The authors have proved, apparently, that seasickness is not caused by oscillation or shaking up of the liver by the motion of a ship, or by any of the dozen other theoretical causes, which have been held responsible for it. They do not mention any specific cure for it, so that it is hardly likely that one may ward it off by standing in a rigid position on deck and staring fixedly at the horizon. Moreover, it is highly probable that the relief usually attributed to champagne is really due to the fact that the victim remains in a recumbent position while awaiting the remedial effect of the pleasant remedy.(?)