Preliminary observations on the pathology of sea-sickness / by J.A. Irwin.

PRELIMINARY OBSERVATIONS

ON THE

PATHOLOGY

OF

SEA-SICKNESS

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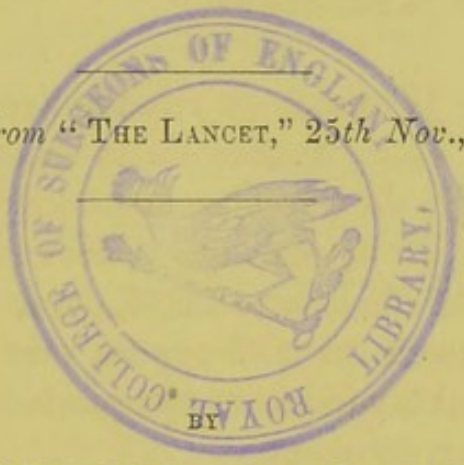
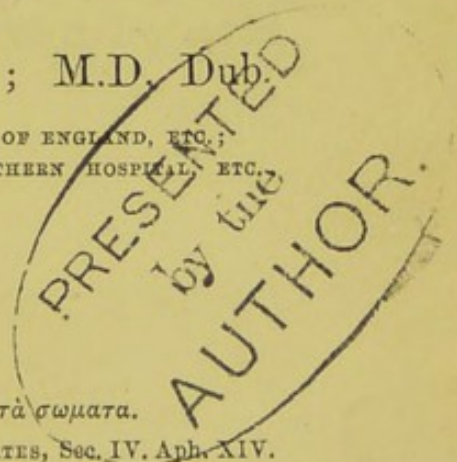


BY

J. A. IRWIN, M.A. Cantab; M.D. Dub.

MEMBER OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND, ETC.;
LATE HON. PHYSICIAN TO THE MANCHESTER SOUTHERN HOSPITAL, ETC.



ναυτιλίη δηλοῖ ὅτι κίνησις ταράσσει τὰ σωματα.

HIPPOCRATES, Sec. IV. Aph. XIV.

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THE PATHOLOGY OF SEA-SICKNESS.

As preliminary to the publication of a treatise on Sea-sickness, founded upon an experience of nearly four thousand recorded cases, I think it desirable to lay before the profession the substance of some novel views which I entertain upon that *questio vexata*—the pathology.

Sea-sickness, when once fairly established, is a complex condition in which unquestionably many organs are involved, acting and reacting one upon another in various ways. It seems reasonable, however, to believe that in the beginning, when first the ordinary conditions of daily life were disturbed, there was some one mainspring, the pressure upon which has set the whole machinery into confusion.

Foremost among the physiological facts revealed by the brilliant experiments of the past half century is the knowledge that our bodies are endowed with what may be termed a *supplementary special sense*, quite independent of, but at the same time in the closest alliance with, our other special senses, the function of which is "to determine the position of the head in space," and to govern and direct the

æsthetiko-kinetic mechanism by which is maintained the equilibrium of the body. This "faculty of equilibrium" appears to be more or less connected with the cerebellum, the optic lobes, and possibly with other parts of the nervous organization, but beyond doubt its principal seat is in the semicircular canals of the internal ear, which may for practical purposes be regarded as "the organs of equilibration."

Sea-sickness, or Motion-sickness, as it might be more correctly termed—for not only does it occur on lakes and even on rivers, but, as is well known, a sickness identical in kind may be induced by various other motions than that of turbulent water,—is essentially a disturbance of this function. It seems necessary that the motion should be either backward, downward, or oscillating, and that it should be continued for an appreciable time. A combination of these conditions is the most effective, especially if there be added an element of irregularity and uncertainty. Hence many persons who experience no inconvenience during the regular swing of a yacht under sail become sick in a rowing-boat or a steamer. Motion produces sickness by disturbing (*a*) the endolymph in the semicircular canals, (*b*) the viscera in the abdomen, and possibly (*c*) the brain and the subarachnoid fluid at its base.

The limited space at my disposal precludes the possibility of citing authority for each of the anatomical and physiological facts upon which I base the following argument. I can only say that such authority is to be found in the writings of Flourens, Vulpian, Goltz, Breuer, Mach, Crum-Brown, Cyon, Burnett, Helmholtz, Ferrier, &c.

The endolymph, flowing freely in the semicircular canals, and subject to all the physical laws of fluids —inertia, gravitation, friction, &c.,—follows the motion of the head (and ship) in those canals whose plane corresponds most nearly to the direction of that motion. When the motion is suddenly reversed by the semi-rhythmical oscillation of the ship, or altered in direction by the advent of a new wave striking her on another point, the endolymph continues to move on in the original direction until stopped by friction. This causes undue pressure in one or more of the ampullæ, by which wrong impressions are conveyed to the sensorium, and incoördination, giddiness, &c., are the result. The otoliths are washed about by each movement of the fluid; the ciliæ and the terminal nerve filaments are irritated and abused; and when this process has continued in operation for a certain time, a condition is set up which represents the true primary pathology of the ordinary form of sea-sickness—*irritative hyperæmia of the semicircular canals.*

The explanation of the well-known fact that sea-sickness is least felt in the recumbent posture, with the head low and the feet towards the stern, is simply anatomical. Nature has made small provision for the equilibration of the body in the horizontal or in any position much behind the perpendicular; hence we find the ampulæ of all six canals are situated on their anterior extremities. In consequence of this construction when the body is recumbent and the head thrown back, the endolymph and otoliths gravitate towards the least sensitive part, and disturbance of them will not have the same tendency to alter pressure, or produce irritation within the ampullæ. The same explanation accounts for the backward movement being so distressing, and in part for the unpleasantness of the downward, but for it there are other reasons. A strong confirmation of these views may be noticed in the extraordinary similarity between the symptoms of sea-sickness and those of labyrinthine vertigo—the pathology of which is now generally admitted to be a disturbance of pressure within the labyrinth. Space neither allows that I should describe the symptoms of sea-sickness, nor quote those of Ménière's disease. For the latter I refer to the accounts of Ménière, Trousseau, Hughlings-Jackson, Knapp, Charcot, and Burnett; and, with the exception of the deafness and tinnitus, which

are of purely cochlear origin (Knapp), the symptoms there described so closely agree with those of sea-sickness that they may be accepted as identical. Referring to the purely "head symptoms," I may say that in a well-marked case of sea-sickness these are almost constantly present in some degree—varying from "a queer sensation about the head," to decided vertigo, and cephalalgia more or less acute. In Ménière's disease, on the other hand, the extreme falling type of vertigo is only characteristic of the suddenness of the seizures, and frequently merges into a condition which I find suggestively described by Ménière himself as resembling "the sensations of being rocked by the waves," or "in a ship on a stormy ocean," &c. Reversing therefore the order of cause and effect, we may regard sea-sickness as a mild semi-physiological prototype of the non-cochlear part of Ménière's disease, The one is "vertigo of translation" (Charcot), in which a strong subjective "sensation of a translation movement of the whole body" (Charcot) is *induced* by an abnormal condition of the semicircular canals; in the other real objective translation movements of the whole body *induce* an abnormal condition of the semicircular canals.

Experience has convinced me that there are at least three distinct forms of sea-sickness, which can

be clinically distinguished one from another, and each of which is susceptible of relief by appropriate treatment. As vomiting, although not necessarily present, is usually a prominent feature in all forms it will be convenient to classify them as follows :—

1. Neural or labyrinthine vomiting.

2. Labyrintho-musculo-visceral vomiting; by which is meant vomiting *due* to mechanical disturbance of the viscera, *permitted* by incoördinate muscular action, the *result* of faulty labyrinthine impressions.

3. Stomachical vomiting :

(*a*) Primary stomachical vomiting.

(*b*) Secondary stomachical vomiting.

Which of these forms manifests itself in any given case is dependent on

(*a*) The nature and duration of the motion and

(*b*) The constitutional tendencies of the individual.

Class 1.—All the experimenters on the living labyrinth, with, I believe, the single exception of M. Löwenberg, are agreed that any irritation within, or in the neighbourhood of, the semicircular canals is invariably a cause of nausea and vomiting; and this conclusion is abundantly confirmed by the unanimous statement of clinicians that disease of these parts is directly productive of the

same results. Distinct from the usually accepted nervous connexion between these anatomically distant parts, Dr. Woakes has recently discovered another, which may go a long way to simplify this part of our subject. This class of sickness is of most frequent occurrence on large ocean-going Steamers, and has usually a rapid natural tendency to recovery—for which the recumbent posture is generally sufficient. The *only* remedies which give relief are those directly affecting the nervous system —*anodynes*, *sedatives*, and in a lesser degree *stimulants*.

Class 2.—The violent and complicated movements of a ship in a heavy sea have a tendency to mechanical disturbance and contusion of the abdominal viscera. In one accustomed to the life, involuntary muscular action steps in to protect the suffering organs. In others the course of events is as follows:—The endolymph, as already stated, follows the motion of the head, and after that motion has stopped, continues for a second or so (Mach), to move on the original direction. During this second, erroneous impressions are conveyed to the sensorium, which in turn sends a mistaken message to the abdominal muscles, a wrong set are brought into action, and complete abdominal confusion is the result. It is to be noted that this is precisely *the same second* which is of the greatest

importance to the affected viscera, for it is the same stopping or change of direction which alters their basis of support, and causes them to impinge one upon another. It seems possible that certain equilibrating impressions may be generated in the viscera themselves by means of the Pacinian corpuscles. But if this is so, such impressions, being more or less correct, would be at variance with those formed in the main centre of equilibration, and would but add another element to the general confusion. This class of vomiting is very violent, and usually attended with many distressing symptoms. It is common on the smaller craft, in a short angry sea, and may be regarded as the general type of *channel-sickness*. It is relieved on the same principle as Class 1, with the important addition of a tight bandage around the abdomen.

Class 3.—The primary variety (*a*) is caused by the mechanical disturbance of the usually semi-fluid contents of the stomach. It occurs most frequently in small boats, has no symptoms beyond slight paleness and nausea, and is usually relieved immediately by vomiting. In the secondary variety (*b*), the stomach, irritated and abused by the continuance of the conditions described under Class 2, and frequently with a predisposition of some kind, takes on abnormal action on its own account. Everything swallowed is rejected immediately for days

and even weeks together, and thus life may be threatened from mere exhaustion. It is cured by the judicious employment of the same treatment as in Class 1, together with remedies addressed especially to the stomach, both *external* and *internal*. It will be seen from the foregoing how hopeless must always be the search for a universal specific.

That sea-sickness can exist independently of visual impressions is easily demonstrable; there can be no doubt, however, that these impressions exercise an important influence in some cases. Ordinary visual vertigo depends upon either an exhaustion of the optic mechanism, or a discrepancy between the visual impressions of the moment and the conceptions formed in the central organs of equilibration. In the visual vertigo of sea-sickness there appears to be a discord between the immediate or true visual impressions and a certain *visual habit* or *visual sense of the fitness and order of things*, which passes into consciousness as a distressing feeling of uncertainty, dizziness, and nausea. It seems possible that tactile impressions or feelings of indefinite motion conveyed through the feet in walking, &c., may also exercise some influence.

This leads to the question of how all the phenomena of sea-sickness have usually a rapid tendency to pass away. Nature constructed the organ of equilibration of a character eminently fitted to

receive impressions through the physical behaviour of its contents, but it was *habit* which taught that organ to convey to the sensorium within correct information of the inference of those impressions. The child cannot walk until it has learned. The rope-dancer cannot balance until after continued practice. In the same way upon the ocean habit teaches the canals to adapt themselves to the new condition of things, and to pass over unheeded erroneous impressions which were noticed at first. In fact, the new habit may become so strong that a disturbance of it, by a return to the land, will be marked by similar phenomena ; hence the unsteady gait sometimes observable in a *not-drunken* sailor during his first few hours on shore after a long and stormy voyage.

To conclude with two points of hypothetical interest. M. Semanas, having come to the absurd conclusion that "un miasme marin est la cause essentielle du mal de mer," gave quinine in large doses, and found that it did much good. M. Charcot finds large doses of quinine the most effective remedy in Ménière's disease ; and Dr. Knapp recently stated the novel view that quinine induces anæmia of the labyrinth. *If* there is any structural change of the labyrinth during prolonged sea-sickness it must be of a congestive character. Can M. Semanas, then, have been rational in his treat-

ment, if not in the theory on which it was founded? My own experience on this point is at present worthless, as although I gave quinine in my early empirical experimentation on sea-sickness it was not in such doses as would be likely to exercise any influence upon the labyrinth.

Wollaston from observing the sudden rises and falls in the mercury of a ship's barometer during a storm, started the theory that the blood behaved in a similar manner, and that resulting mechanical congestion of the brain was the cause of sea-sickness. In Buck's "Hygiene," &c., 1879, I find this remark from the pen of Dr. Turner:—"Sea-sickness [which] appears to be the result of very small oscillations in the column of the blood, induced by the minute changes in the äerial pressure, from the rising and falling of the ship, &c." We know that pressure upon the membrana tympani, whether mechanical or äerial, may be transmitted through the ossicles to the internal ear, causing symptoms of labyrinthine pressure. Can these äerial changes spoken of by Dr. Turner be ever sufficient to affect in this way a person whose tympani are insufficiently ventilated?

I have in project certain direct experiments on the semicircular canals during artificially induced motion sickness, the result of which will be put before the profession as soon as circumstances permit; meantime I shall welcome criticism.

Now preparing for publication.

A TREATISE

ON THE

HISTORY, PATHOLOGY, AND TREATMENT

OF

SEA-SICKNESS

AND ON THE

EFFECTS OF SEA VOYAGES.

No effort will be spared to make this work a complete text-book of the entire subject. It will be divided into Three Parts.

PART I.—Will be a history of the literature of the subject from the earliest times, briefly tracing the many theories which have been advanced, and the views of successive ages and peoples, upon the causes, benefits, and dangers of sea-sickness. The Author has already collected nearly 300 references both ancient and modern, but will be grateful for any assistance.

PART II.—Will discuss the Causation, Pathology, Nature, Differentation, Symptoms, and Treatment of the various forms of Sea-sickness; including the consideration of the mechanical means which have been suggested for its prevention. A wide experience has convinced the Author that the search for an universal and unfailing Specific must always be a fruitless one. Sea-sickness is to a large extent preventible; but when once established the particular form of the disease must be carefully diagnosed, and treated on ordinary rational scientific principles.

PART III.—Will treat of the effects of Sea Voyages in health and disease; their uses and dangers in Chest Affections, Scrofulous and Nervous Diseases, Insanity, &c.; the relative advantages of voyaging on various seas, and of rapid transit by steamer, as contrasted with slow cruising in a sailing vessel.