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SEA SICKNESS.

— Its —

Etiology! Symptoms.

— And —

TREATMENT.

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Perhaps there is no derangement of organic function which causes so great an amount of suffering, and has had so little attention paid to it, by the medical practitioner as sea-sickness. Indeed there has been scarcely any attempt made to investigate and record the cause and best treatment of this distressing malady, in a scientific and accurate manner; nothing more than a casual allusion is made to the subject in any of the leading text-books on physiology, pathology, or the principles and practice of medicine. This seems strange when we consider the antiquity of the disease, and the vast number of individuals who have suffered from it;

dating as it probably does from the introduction of navigation even in its most primitive state. All other diseases are deemed the peculiar province of the physician, but the mal-de-mer is allowed to run its own course, or the sufferer has to be content with following the numerous suggestions which his own, or fellow passengers' imagination may dictate, in the hope that he may stumble upon some remedy which will give relief to his sufferings. It is only within recent years that the subject has been taken notice of by medical men; various writers having recorded their opinions in the columns of the medical journals. Unfortunately, however, the opinions advanced have been often contradictory and unsatisfactory.

in their nature, so that they tend to confuse rather than assist anyone in endeavouring to study the subject with the view of elucidating its etiology. The reason for this diversity of opinion, and absence of accurate information, is evident, when we consider the peculiar nature of the malady and the obscurity of its origin: Occurring, as it does, in persons who are otherwise in apparent good health, without regard to age, sex, or any of the physiological circumstances, which usually exert so great an influence in the causation of other diseases, and which afford some indication of the treatment required. It might also be said that the disease has not come under the

notice of that class of inquirers who are best fitted to give it the attention it requires, viz., men whose scientific researches and cast of mind, pre-eminently qualify them for the investigation of this difficult physiological problem. There has been almost no notice taken of the subject by naval medical officers, who might be expected from the opportunities of systematic observation afforded them, to be able to record the result of their observations as to the probable cause and best mode of treatment of the disease, in a practical form. The only medical men who have published their opinions, are, as a rule, men who have been merely sailing for pleasure or the benefit of

their health, or men who have been unsuccessful practitioners on shore, and consequently their observations are not characterised by the usual amount of precision. The most valuable suggestions as to the cause and treatment of sea-sickness, have come from men who have had but little practical experience in sailing, but who are possessed of the scientific knowledge which is most useful in the investigation of any physiological question; amongst whom I would specially mention Dr. Carpenter, Dr. Wollaston and Sir James Alderson.

Before proceeding to enunciate the result of my own observations, or criticise the views of others, as to the causation and treatment of sea-sickness,

it may be necessary to state my reasons for presuming to deal with the subject. My attention was first directed to this disease during the session 1875-6, in a debate on sea-sickness, held under the auspices of the Glasgow University Medico-Chirurgical Society; the theories and arguments then advanced, were of such a contradictory and speculative character, that I resolved to investigate the subject personally, if ever an opportunity presented itself. After graduating in July 1878 this opportunity occurred, being successful in gaining an appointment as Medical Officer on board the S.S. "State of Pennsylvania", one of the passenger ships running between Glasgow and New York.

This route is admitted to be one of the best for gaining a thorough experience of the effects of sea-sickness; and the time of year rendered it still more favourable to the development of the symptoms. As the ship went round the North coast of Ireland to take up passengers at Larne, I had the advantage of comparing the difference between the movement communicated to the ship whilst sailing through the rough "broken" water, which is characteristic of the sea near to the rugged coast, and that produced by the mighty waves and deep swell of the Atlantic.

The ship in which I sailed may be taken as a type of the class of steamers in which passengers are conveyed

to and from the American and European continents; having accommodation for about 500 passengers, but at that time of year only carrying from one to three hundred. The surgery on board was fitted up with a good medicine-chest, containing the principal drugs of the Pharmacopœia, and more especially those remedies usually given in sea-sickness. As Nitrite of Amyl was at that time coming into some repute as a remedy, I had this also added to the stock of drugs. As is usually the case in passenger ships, the "fore" part was allotted to the steerage, the "waist" or middle part of the ship to the intermediate or second Class passengers, and the after part to first Class passengers.

This distribution of the passengers afforded an opportunity of comparing the different effects produced on individuals while occupying different parts of the ship, and so determining the influence of position in the production of sea-sickness. The first object was to arrange some plan, which would enable me to make accurate observations, as to the cause and premonitory symptoms of the affection. This was accomplished by dividing each class of passengers into groups of ten or twenty, and taking careful notes as to any circumstance which might influence the result. During six voyages across the Atlantic, this system of observation and note-taking was strictly carried out.

Of course the number of cases, and the severity of the attack, varied with the roughness of the sea &c, and the great majority of the sufferers recovered after a few days. On the average I find there were 180 cases of sea-sickness each voyage, giving a total of over 1000 under my observation during the six voyages. The proportion of those who escaped the miseries of the affection was as low as 10 per cent; most of them having acquired the immunity by previous painful experience. It is a popular idea that an attack of sea-sickness is in some way beneficial to the health, but I have been unable to find any evidence of its being so; I have, however, seen several cases

in which it has given rise to disagreeable, and even serious effects. Persons of all ages are liable to the disease, though the symptoms are more severe and protracted in adults, than in children or the aged; the majority of those who escape being under ten, or over 50 years of age. Women are more readily affected than men; and men of a nervous, sensitive temperament, succumb sooner than the vigorous and phlegmatic. It is said that Americans are more susceptible to the disease than Europeans, but I have been unable to determine this satisfactorily.

The symptoms, which constitute the disease sea-sickness, are so characteristic and well known that they need only be briefly mentioned. Intense nausea is the most prominent and invariable symptom, and the word "nausea", (from the Greek *ναύς*, a ship,) both from its derivation & meaning, is particularly applicable in describing the affection. The other symptoms which are usually, though not invariably present are, severe tensive headache; considerable fever, the temperature ranging from normal to 105°; faintness and sinking at the epigastrium, the skin is usually moist with a clammy perspiration,

the bowels highly constipated, the urine scanty and high coloured, the pulse soft and compressible and slightly accelerated. In the most severe cases vomiting and retching are prominent symptoms, accompanied by severe mental depression, with complete indifference to surrounding objects. As evidence of the extreme degree of wretchedness and misery to which the sufferer may be brought, owing to the nervous and mental prostration, I have repeatedly heard patients express the wish that the ship would sink, and so end their misery. As will be seen the term "sea-sickness" is not applied here only to those cases in which vomiting is present as a symptom, but also

to those cases in which there may be only nausea present; indeed, in many of the most obstinately protracted cases there is no vomiting at all, nausea with mental and bodily prostration being the only visible symptom. One of the most peculiar symptoms of sea-sickness, (for it can only be described as such), is the loss of control over the mental faculties. It is almost impossible to concentrate the attention on any subject, - the mind becomes incapable of prolonged and sustained effort, and whatever is read or studied at sea, is only remembered with difficulty and soon fades from the memory entirely.

Proceeding to the consideration of the etiology of sea-sickness, it will be advantageous in the first place to notice the most important theories which have been advanced in this direction, examining each theory critically with the view of profiting by any suggestion which is made, and showing as far as possible, wherein each theory conforms to, or falls short of, the truth when practically tested. Respecting the remote cause of the disease, there is considerable unanimity of opinion, nearly all observers admitting that it is due to the vertical movement of the body through space, caused by the

rising, and falling, of the ship while passing over the waves. It is in endeavouring to decide on what organ, the cause of sea-sickness primarily acts, that the numerous conflicting opinions have arisen. Assuming then that it is the vertical movement communicated to the body which is the primary cause of the disturbance, and taking this as a common factor to all the theories, let us see through what channel this has been supposed to give rise to the symptoms of sea-sickness. The theory which has found the most universal acceptance, and received authoritative corroboration, was first advanced by Dr. Wollaston and subsequently more fully

expounded by Sir James Alderson. *
In this theory Dr. Wollaston refers
the symptoms to cerebral disturbance
induced by the repeated mechanical
congestion of the brain, which the
repeated downward movement of the
ship induces. Every time the body
descends, the blood is supposed to
cause a certain amount of cerebral
congestion and even concussion.
This he explains by comparing the
blood in its vessels to the column
of mercury in a barometer. He
says, "If a barometer be carried out
to sea in a calm, the mercury will
rest at the same height as when
on shore, but when the ship falls
by the subsidence of the waves
the mercury is seen apparently

* See *British Medical Journal*
Vol. II. 1872. Page 255.

to rise in the tube which contains it.*
In comparing the sickness sometimes
produced by swinging, to sea-sickness,
he says, "Sickness by swinging is
evidently from the same cause,
as sea-sickness, and that direction
of the motion which occasions the
most piercing sensation of uneasiness
is conformable to the same explanation.
.. It is in descending forwards that
this sensation is perceived, for
then the blood has the greatest
tendency to move from the feet
towards the head, since the line
joining them is in the direction
of the motion; but when in the
descent backwards, the motion is
transverse to the line of the body,
it becomes but little inconvenience,

* See British Medical Journal
Vol. II 1872 P. 255.

because the tendency to propel the blood towards the head is then inconsiderable."* Dr. Wollaston therefore considers that the action of the blood upon the brain is identical with that of the mercury on the top of the barometer during the descent of the ship, and that there is an actual pressure, and even blow, upon the brain, which by frequent repetition produces nausea and vomiting. Dr. Wollaston does not give any further explanation of this phenomenon, but Sir James Alderson who subsequently adopted this theory, gives the following explanation. "The fact is undeniable, that contact does take place between the mercury and the upper

part of the tube with more or less violence.... When the rigid tube falls, the mercury having its own inertia, and not being attached to, or part of, the tube, remains stationary - at least for a time; thus the tube is pushed down over the mercury, and the concussion takes place.

Exactly the same occurs between the brain and the vessels on the one part, and the brain on the other. The approximately rigid brain and vessels are carried downwards, the blood remains by its own inertia, and the consequence is to crowd blood into the vessels of the brain, and so press with increased force, producing a certain shock; this shock and the attendant

* British Medical Journal

Vol II. 1872. Page 256

pressure produce sickness and vomiting.* Sir James Alderson cites several facts to be observed in persons suffering from sea-sickness, in support of this hypothesis. For instance, that the feeling of nausea is most distressing during the descent of the ship, and that relief is sometimes obtained by assuming the horizontal posture. Without entering more fully into the details of the arguments advanced in support of this theory, it will be seen that the sum of the reasoning is to show that the nausea, retching, and vomiting, which constitute sea-sickness are due to brain disturbance produced in the manner set forth, and showing that the primary cause is purely mechanical.

This ingenious theory of the cause of sea-sickness is so much in accordance with the actual phenomena, that, in the absence of a more rational theory, it appears all that is necessary in the way of explanation, to be adopted without further question. There are some points, however, to which exception might be taken, both in the theory itself, and the grounds on which it is based. It might reasonably be objected, in the first instance, that a barometer, and the blood in its vessels are not strictly comparable. The mercury in the barometer is subjected to the pressure of the surrounding atmosphere at the open end of the tube - the condition on which the proper working of

a barometer depends. During the sudden descent of the ship the pressure of the atmosphere on the mercury will be considerably affected, and, to a less degree during the more gradual ascent. May not this be part of the explanation of the variation in the position of the mercury in a rough sea? In the case of the blood, which may be said to be contained in a closed tube, the pressure will not vary, as in the case of the mercury, seeing that there is nothing to fill the vacuum which would be created. And again, the greater specific gravity of the mercury than the glass tube, would lead one to infer that instead of the mercury lagging behind in the tube, it would

descend with even greater velocity than the tube. The downward movement is presumably communicated to the mercury and the tube at the same moment, so that we might expect them to fall at the same rate, except for the difference of Sp. Gravity, and this is clearly in favour of the mercury falling with increased velocity. The same view may be taken of the blood in its vessels. But the physical conditions of the barometer, and the blood in its vessels are not identical, and even if they were, it is doubtful if a mechanical instrument be justly comparable to a highly organised structure. Granting, however, that the comparison is in this respect

admissible we find that the theory itself is by no means conclusive, or conterminous with facts. Admitting that a certain amount of congestion and concussion of the brain takes place, persistent vomiting is the only symptom which is present in common with cases of congestion and concussion from other causes. We do not find the most distressing symptoms of sea-sickness, such as nausea etc. among the phenomena of cerebral congestion and concussion; and the other symptoms of cerebral congestion and concussion are not present in sea-sickness. Moreover, if the cause were so purely mechanical, we might expect that when the mechanical conditions were altered, as by assuming

(*) *Medical Times & Gazette*. Vol. II. 1864
Pages 246 & 274.

* *British Medical Journal*. Nov. 20th 1880
Page 838

the horizontal posture, the symptoms would cease to act. But this is not the case. Many passengers lie down directly they get on board, yet suffer most acutely; and again, the recovery of the majority of those on board takes place without the physical conditions being visibly altered.

That a mechanical force may be transferred into a vital disturbance we can readily understand, but the theory given fails to explain many facts which have to be accounted for. This theory of cerebral congestion has been supported by Dr J. Sanson* recently, and also by Dr Chapman* The last mentioned writer, however, thinks that the primary cause, is due more to congestion of the

* See *Lancet* Vol II 1875
Page 276

spinal cord than of the brain, and advocates the application of ice-bags to the spine, to counteract the congestion. Dr. Crouchley Clapham in supporting this view cites a case in which he made a post mortem examination, (in a case of sea-sickness) four hours after death, and found the spinal cord gorged with blood.* How this congestion of the spinal cord is caused, no explanation has been given, but it is evident that the mechanical theory which has been applied in the case of the brain, is not admissible here. After fully considering all the arguments put forth in support of the theory of cerebral and spinal congestion, and viewing them in

the light of observations made by myself, it seems that all that can be admitted is, that most likely the disease is due to nervous disturbance; but that this disturbance is secondary to a derangement of the circulation, is still very doubtful. To give anything like a complete conception of the etiology of sea-sickness, it will be necessary to notice several other hypotheses which have been advanced by different observers. Next to the brain and spinal cord, perhaps the abdominal viscera, and more particularly the stomach, has been pointed to as the organ on which the cause of sea-sickness primarily acts. Seeing that the chief symptoms point to gastric

* See Dr. Wilson's work on
"Spasms, Languor, Palsy &c"
Pages 122 & 123.

disturbance, it might be expected that the disturbing cause would also be referred to this region. A great variety of opinion has been offered in explanation of how this cause acts. Perhaps the earliest authoritative reference to the abdominal viscera as being the offending region in the causation of sea-sickness is to be found in Dr. Wilson's work on "Spasms, Languor, Palsy &c." * In speaking of the function of the abdominal muscles in supporting the viscera, he says, "Sea-sickness is occasioned by the want of tonic resistance in the abdominal muscles to the passive weight of the collected viscera, suddenly disturbed in their

* See *Lancet* Vol. II. 1875
Page 546

respective positions, and gravitating with the motion of the vessel. By continual practice of ready adjustment to a varying centre, the seaman learns to command his stomach, while he 'finds his sea-legs.' This theory has been recently ably supported by Dr. S. Wilks in a letter to the *Lancet*, giving a description of a voyage to Skye.* After giving testimony in favour of the idea that it is during the descent of the ship that the distressing symptoms are most prominent, he goes on to say that, "the sensations are due to a sudden falling of the abdominal viscera, and the want of due support by the muscular parieties during the act of falling." He then goes on

* British Medical Journal
Sept. 25th 1880. Page 507

to cite what he considers co-lateral cases; the symptoms of incarcerated hernia, and other gastro-intestinal affections being due, as he thinks, to the same cause as sea-sickness, viz. the want of the normal abdominal support. In connection with this theory which refers the protuberant cause to the abdominal region, it will be advantageous, before offering any criticism, to include here a modified view which has been offered quite recently by Dr Glyn Whittle*. This view of Dr Glyn Whittle's might indeed be taken as a distinct theory, but for the sake of brevity it is included here. The mode of reasoning and the view adopted by him is shown in the

following sentences.

1. "The stomach contains (except after urgent vomiting) fluid and gas, with or without a certain amount of semi-solid matter.
2. "Physiologically its contents are moved, slowly, in a circular manner from left to right along the greater curvature, and from right to left along the lesser curvature, except when the cardiac orifice opens to permit the reception of more food, or the pyloric to permit the expulsion of some into the duodenum.
3. "Pathologically the turbulent action of the sea, interrupts the slow and circular motion, substituting for it the rapid jumbling up and down of the contents of the stomach.

4. "The contents of the stomach thus become neither more nor less than a foreign body, whose presence readily accounts for all the distressing symptoms that usher in an attack of sea-sickness"

He anticipates two objections to his theory, viz. 1. "If this theory be correct all persons would suffer alike" 2. "Nobody would be able to recover from the disease while remaining at sea". These objections he answers by saying. 1. "The natural power possessed by the muscular elements in the coats of the stomach for accomodating their action to the motion of the ship, varies considerably in different individuals. 2. "This power when not natural can be

*See British Medical Journal
Sept. 25th - 188 Page 507.

acquired after a time, according to the law of 'demand and supply.*' As regards the statement advanced by Dr^o Wilson and Wilks, - that the symptoms are due to the withdrawal of the natural support, however plausible it may appear as a theory, it does not seem to be in accordance with practical observation. If this theory were correct we should expect to find that the symptoms of sea-sickness would not become developed if the necessary support was given to the abdominal viscera. I have repeatedly tried varying degrees of pressure and support to the abdomen, by means of pads and bandages, applied before the patient was -

exposed to the risk of sea-sickness, but without any visible effect as regards the prevention or even alleviation of the severity of the attack. Moreover, we do not find the symptoms of sea-sickness developed under conditions similar to that which the body is subjected on board-ship. For instance, we do not find any of the distressing symptoms produced by riding on horseback, which might be taken as an extreme example of this kind of motion, involving as it does alternate and sudden relaxation and contraction of the abdominal muscles. Nor do we find sickness usually (though it does occur occasionally) by riding

in a jolting carriage, swinging, or any other exercise which entails a sudden withdrawal of the abdominal support." These objections apply even more forcibly to the views advanced by Dr Glynn Whittle. Further objections might be raised to the arguments of the last mentioned writer. If the sickness was caused by the "jumbling up and down of the contents of the stomach," we should not expect it to occur where the stomach was quite, or nearly empty at starting; or that the symptoms would persist after the stomach had completely emptied itself by vomiting. The fact is, however, that the symptoms of sea-sickness

are more apt to occur in cases where the stomach is apparently empty, than in those where a good meal has been taken before starting. The truth of this statement is acknowledged by all observers and I have seen it repeatedly tested. We see then that the theory of gastric derangement, as it has been explained, is not borne out by what actually occurs, and fails to account for many important phenomena. The symptoms of sea-sickness are those of both nervous and gastric disturbance, but it is doubtful if the mechanical cause acts directly on either of the organs concerned; it is more likely that the gastric

symptoms are secondary to, and dependent on the derangement of the nervous system. It is easier to understand how a new kind of motion would affect the nervous centres, rather than the abdominal viscera. Especially when we consider how readily all external changes and impressions affect the sensory centres we are prepared to admit this as being an important element in the production of the unusual symptoms. But it is not necessary to speculate on any primary derangement of the circulatory system to produce this. The sensory centres in themselves have the power of originating all the symptoms when acted on in a

*See Kirke's handbook of Physiology
Pages 486 and 487*

particular manner. Modern physi-
ology shows that many phenomena
otherwise inexplicable, may be
easily accounted for by the power
which the sensory ganglia have
of originating a class of 'reflex'
actions, independently of the
cerebrum and the state of the
circulation. It is of importance
to notice also that these reflex
actions are most readily produced
when the sensory impressions are
of an unusual nature.* This
is the very condition to which
an individual is subjected on
board-ship for the first time,
while sailing through even a
moderate sea; The sensory impress-
ions are both unusual and strong

and likely to affect the sensory ganglia; and, probably sea-sickness is a manifestation of this derangement. Various circumstances have led me to form the opinion, that sea-sickness is more likely to be due to some derangement of the reflex function of the sensory ganglia, than to a more direct mechanical cause. I had frequently heard it asserted that the worst symptoms of the disease could be kept in abeyance by an effort of the will: that if the mind was resolutely made up not to give way to the first symptoms, after a certain time the disagreeable symptoms would pass off and no further effort was

necessary. This can only be interpreted as an instance of the superior power of the will, overruling and restraining the more uncertain and erratic phenomena, of reflex and sympathetic origin. Another method of attaining the same object is to fix the attention on some interesting or exciting exercise, so as to withdraw the attention from the particular channel into which the mind is predisposed to run, — that of impending sickness. The result obtained from this mode of treatment was so far satisfactory as to convince me of its value, both as a therapeutic and as a possible explanation of the

etiology of sea-sickness. My first consideration was to find out how far the opinions I had formed were in accordance with the facts of modern physiology, and to see if it afforded any further explanation of the phenomena; this I found to be favourable to the view I had taken.

When we consider that nearly all the physical conditions with which an individual was previously surrounded, and to which he had become accustomed, are altered on board-ship; and from the fact that the sensory ganglia are peculiarly susceptible to emotional and sensory impressions we would expect to find some

manifestation of its action on these centres. The sensations, which bring the organism into contact with the surrounding world, and to which he had become familiar, now convey impressions of a totally different nature, impressions which the sensorium, as yet, cannot interpret, and consequently cannot respond to in a normal manner. The sensorium being thus abnormally stimulated relieves itself by the abnormal manifestations which constitute the disease sea-sickness. It will be necessary to examine which of the senses are disturbed, and to see how they may be supposed to act on the sensory centres so as to produce the symptoms.

It is well known that to maintain the equilibrium of the body, and to walk with freedom and confidence, we depend almost entirely on the muscular, visual, and tactile senses. This has been so well established by physiological experiment, that it requires no further explanation. In a person at sea we find that all the senses mentioned are more or less disturbed; their normal function being interfered with greatly. The muscular sense is disturbed by the ever changing position of the boards on which the individual stands; the visual sense is confused by the shifting lines of the ship, and the surface

*See Carpenters Human Physiology
Page 622.*

of the water; the tactile sense disturbed by the heaving and sudden falling of the ship, occurring unexpectedly and irregularly. We have thus three of the senses disturbed, which are requisite for the normal performance of the functions of the body, more especially that of standing or walking securely. It now remains to be seen, whether the disturbance involved is sufficient, or likely, to produce the unusual symptoms. Taking first the muscular sense, we find that vomiting is one of the first symptoms produced, when the function of this sense is deranged.* The seat of the muscular sense has been traced

See Carpenter's Human Physiology.
Page. 622.

to the cerebellum, and any irritation produced here, gives rise to many of the symptoms of sea-sickness. Dr. Carpenter states that "the results of irritation of the cerebellum are usually vomiting, cephalgia, and convulsions", and in the same paragraph it is also stated that "in every case of extensive disease of the cerebellum, there are concurrent symptoms of disorder of the muscular movements, indicative of defect or absence of the muscular sense."*

Then taking the visual sense we find that when anything irritates, or deranges its function, we are apt to have symptoms of a similar nature. Many

persons when watching revolving machinery, or looking on any scene which presents a constantly changing surface, such as a rushing stream, or the embankments, etc. while riding in a railway carriage, suffer from giddiness, headache, nausea, and occasionally vomiting. This is evidently due primarily to excitement, and irritation of the retinae, the irritation being conveyed along the optic nerves to the optic thalami and from thence by means of the corpora quadrigemina, to the cerebellum. Again, the tactile sense is so closely related to the cerebellum, both by its structure and function, that it may safely included here.

* Carpenter's Human Physiology
Page 624

The close relation between the muscular, visual, and tactile senses is shown by Dr. Carpenter.

In speaking of the function of the cerebellum he says,* "There would seem much probability in the idea that it (the cerebellum) is the seat of the muscular sense, which has so important a share in the guidance of the co-ordinated movements; and this notion derives confirmation from the marked structural connection which exists between the Cerebellum and the optic ganglia, the purpose of which may not unfairly be surmised to be, to communicate the guidance of the visual sense to the organ by which the co-ordinated motions

are effected, in the same manner as the impressions appertaining to the muscular sense are transmitted by the rectiform columns"

From this we may assume that the cerebellum and optic thalamus, are the centres which are chiefly concerned in the derangement, but the other sensory ganglia may be supposed to share in the derangement also, their structure, and function, being so intimately connected. Though derangement of the visual, tactile and muscular senses are here regarded as important factors in the production of the symptoms of sea-sickness, it is not assumed that they are the only agents which take part

*Carpenter's human Physiology.
Page 109.

in the disturbance, or that they act precisely in the way indicated. There is every reason to believe, that there are other complex forces at work. The peculiar nature of the symptoms favour the idea, that the sympathetic system is also involved to a considerable extent. The vomiting, which is frequently present in sea-sickness, we might reasonably believe, to be the result of irritation of some part of the sympathetic nervous system.

This belief is strengthened, when we consider the function, & anatomical distribution of the sympathetic nerves.* We find that the stomach to a great extent is under the influence of the sympathetic, -

any irritation of this nerve producing muscular contraction of the walls of the stomach. The sympathetic nerve, however, is so intimately connected with the pneumogastric, that it is impossible to determine their actions, during sea-sickness, separately. Probably both the pneumogastric, and sympathetic nerves, are implicated in the vomiting of sea-sickness, the irritation being produced in the sensory centres close to their origin. It is needless to speculate, however, which of the nerves mentioned, is most actively involved in the disturbance, seeing that they are not the structures primarily affected, but only react in

response to the stimulus received at their origin. In sea-sickness, the impressions received by the sensory centres being emotional, as well as sensational, the symptoms might thus be referred to either the cerebro-spinal or sympathetic systems. Before proceeding to consider the way in which the sympathetic system contributes to the derangement, it will be convenient to summarize what has already been said, thus: -

The unusual conditions to which an individual is subjected at sea, - the motion of the ship etc. - so act on the senses, which convey external impressions, as to unduly stimulate, and disorder, the sensory centres,

which receive those impressions.

The sensory centres being thus morbidly stimulated, respond by means of the reflex power which they possess, resulting in nausea, headache, vomiting, and all the other symptoms of sea-sickness.

So far sea-sickness may be compared to many other reflex phenomena, such as irritation of the Schneiderian membrane producing sneezing; but in the

case of sea-sickness it is difficult to understand its utility to the animal economy, which is the object of all other reflex actions.

When we consider, however, that sea-sickness is the result of a morbid stimulus, it is reasonable

to suppose that it is also a morbid, and not a healthy manifestation. This idea is borne out by the fact that those who escape sea-sickness, do not suffer from any ill effects.

Apart from the derangement of the sensory centres in the way indicated, it has occurred to me that the organism might be affected in another way, viz: by deranged action of the vaso-motor nerves, under the influence of disturbing emotions. In every case of sea-sickness the emotions are evidently powerfully affected, these emotions being chiefly of a distressing nature. Anxiety, fear, and hopelessness, are among

the first signs of an impending attack of sea-sickness, and these feelings gain power as the disease progresses. Now, emotions of this kind are known to have a powerful effect on the vaso-motor nerves, causing relaxation, or contraction of the capillaries, throughout the whole body. From the character of the emotions we should expect contraction of the capillaries, and this seems actually to be the case, as shown by the pallid, blanched appearance of the sufferer.

As has been shown, however, there is reason to believe that a certain amount of congestion of the brain, and spinal cord is present. If this is the case probably the

explanation is, that the blood being driven from the peripheral surface of the body, is forced into the brain and spinal cord. This seems a more feasible explanation than that of mechanical congestion from the motion of the ship, as has been supposed.

Whether this is what actually takes place in the brain, and whether this is the correct explanation or not, the fact remains, that we have a powerful emotional disturbance at work, sufficient to cause serious functional derangement. The influence of emotional conditions of the mind in exciting, or suppressing the various secretions is well known.

*See Carpenter's Human Physiology,
Page 812.

Dr. Carpenter in speaking of the influence of emotional states on the biliary, gastric, pancreatic, and other secretions, says, *

"It is certain that the indulgence of the emotions produces a decidedly morbid effect by disordering the digestive processes, and thus reacts on the nervous system by impairing its healthy nutrition".

That the normal secretions of the body are diminished, and in some cases temporarily suppressed, is a fact well known to anyone familiar with the symptoms of sea-sickness. This derangement of the secretions, can be accounted for in no other way, than by assuming

that it is due to the influence of the emotions. It would be difficult to determine accurately, to what extent, the symptoms of sea-sickness are due to this disturbance, independently of the deranged sensory centres, but whether acting independently, or in conjunction with the deranged sensations, it is probably a powerful factor in the causation of the symptoms of sea-sickness.

The mode of reasoning, and theory advocated, in the foregoing pages may be briefly summarized thus. Sea-Sickness may be defined, as a functional disease of the central nervous system, affecting chiefly the sensory ganglia,

and also the sympathetic system. The disease is induced by primary derangement of the muscular, visual, and tactile senses, caused by the unusual surroundings, and unaccustomed movements of the ship, producing abnormal sensory impressions, and disturbing emotions. These acting on their respective central centres, originate the morbid reflex phenomena which constitute the disease sea-sickness.

The chief arguments in favour of this conclusion, are, 1st. That the physiological phenomena can be accounted for in no other satisfactory way, than by attributing them to functional

derangement of the central ganglia,
and sympathetic system. 2nd.

The nervous derangement referred
to is sufficient to account for
most, if not all, of the symptoms.

3rd. Nearly all attempts at
treatment have failed, which have
been directed against any other
supposed pathological condition,
or cause; and any degree of success
which has resulted from treatment,
may be accounted for, by its
action on the deranged centres.

Having thus considered the
etiology of sea-sickness, it now
remains for us to indicate what
is the best treatment of the disease,
or in what way its occurrence
might be prevented.

When we reflect on the conflicting nature of the views advanced, as to the causation of the disease, we are not surprised that the remedies recommended for its relief, are also of a diverse nature. Indeed, the treatment of sea-sickness stands in a similar position to therapeutics as cancer, epilepsy, or any other organic disease whose physiology and pathology is imperfectly if at all understood.

Old remedies have been tried repeatedly, and new remedies are eagerly welcomed, and employed, in the hope that they will prove more successful, but the result in every case has been far from satisfactory.

It will only be necessary to mention a few of the more important remedies which have been employed with any degree of success, noticing briefly the influence which the respective therapeutic agents exert upon the physiological condition. Chloral, morphia, the bromides of potash and soda, chloroform, and the nitrite of amyl, are the medicinal agents which have been administered, with varying degrees of success; while ice-bags to the spine, the maintenance of the horizontal position, swinging berths - to counteract the motion of the ship, have also been advocated as means of giving relief.

See Lancet Vol I. 1841. Page 326.

* See pamphlet on, "The constituents of
Climate; with special reference to the
Climate of Florida," By F. D. Lente.

Chloral was first suggested by Doring as an agent which gives temporary relief from the unpleasant symptoms, and was chiefly recommended for passengers making short voyages, such as crossing the Channel.* The way in which Chloral, morphia, and chloroform, give relief is only by means of narcosis, and as the action cannot be kept up for any length of time without producing bad effects they are inadmissible in long voyages. Bromide of potash first suggested by Dr. F. D. Lente as a preventive in sea-sickness,* is perhaps the remedy the administration of which has been followed by the best results. To be of

* See British Medical Journal Aug 28th
Page 302. 1880.

any service in sea-sickness, bromide of potash must be given in large and frequently repeated doses, extending over a period of from two to seven days, according to the state of the sea and the condition of the patient. The disadvantage of using bromide of potash, is the "bromisation" and derangement of the stomach, consequent on the use of large doses of the drug. With the view of avoiding the ill effects of the bromide of potash on the stomach, Dr. G. M. Beard, of New York, advocates the use of bromide of sodium instead. * Dr. Beard recommends that the administration of bromide of sodium should be commenced

two or three days before sailing, giving ʒʒ to ʒi doses, till bromisation is produced, and keeping up the action during the voyage if necessary. As far as my own observation goes, it is of no advantage to produce bromisation, and as this is frequently a disagreeable effect of giving large doses of the bromides, it is advisable to accompany their administration with small doses (1-5m) of *Liquor Arsenicalis*, with the view of checking the most troublesome effects of bromidism.

Given in this way bromide of potash or soda, is undoubtedly of great use in relieving, and in some cases totally preventing, the

See Lancet Vol. II. 1845.

Page 246.

worst symptoms of sea-sickness.

In cases where vomiting has already set in, Dr. Beard recommends the hypodermic injection of a solution of atropia to allay this symptom, before attempting the administration of the bromide of soda; if headache should be a prominent symptom he gives two or three grains of Citrate of Caffeine.

Nitrite of amyl. was first recommended and used for the relief of sea-sickness, by Dr. Clapham.* This remedy was given with the view of relieving the congestion of the brain, and spinal cord, which he believed to be the pathological condition of those structures. Whether nitrite of amyl

acts in this way or not, it certainly gives relief in some cases. The result of my experience of this remedy is that in about 10 per cent. of the cases in which I administered it, (about 300) it gives almost immediate relief; if, however, it fails in the first instance, no benefit is derived from repeated administration. After careful observation as to the class of patients who derive most benefit from this remedy, viz. those of an imaginative, emotional temperament, and considering the powerful, and characteristic effects of the remedy, I have been led to believe, that the good effects, are mainly due to its action on the imagination and emotions.

The application of ice-bags to the spine, I have never had the opportunity of trying, as this method is almost impracticable on board an ordinary passenger ship, owing to the difficulty in obtaining the necessary materials.

The idea of constructing swinging berths, so as to counteract the movements of the ship, was first practically tested in the "Castalia" in 1875, and though the result has not been altogether satisfactory, it has led to further efforts in a similar direction. At present there is being built a passenger ship, to be named the "Transit," of such large dimensions that

it is expected the largest waves of the Atlantic will scarcely cause any perceptible movement.

It remains to be seen whether the "Transit" will entirely prevent the development of the symptoms of sea-sickness, but it is in this direction that we must look for the solution of the difficulty.

It is scarcely to be expected, however, that sea-sickness will be entirely prevented, seeing that sickness of a kind similar to sea-sickness is occasionally produced by other vehicular movements, - as for instance in a railway carriage, - but it may be reduced to such an

extent, that medical treatment may be able to alleviate or cure the few cases that occur.

While speaking of the treatment of sea-sickness, I would mention a method which I have found to be a valuable auxiliary in the prevention of the disease, and which seems to have been taken but little notice of by medical observers. I refer to what might be called the moral treatment of sea-sickness. It is a known fact that most persons when setting out on a voyage, have their minds filled with a dread of the miseries of sea-sickness. Now, if by a little moral suasion the mind can be disabused

of this preconceived dread of the disease, and so help the patient to look upon it as preventable rather than inevitable, many cases might in this way be altogether prevented. The best way to keep the mind from preying upon itself by brooding over an impending attack of sea-sickness, is to substitute some interesting and if possible, pleasurable mental exercise, such as conversation, reading, etc. Many of the so called cures which have been effected by medicines, such as Nitrite of Amyl are, in my opinion, really due to the withdrawing of the attention from the symptoms,

* See "Zoonomia" Page 231.
By C. Darwin.

and concentrating it upon what has been administered.

The only reference which has been made to this mode of treatment, is by Darwin in his book "Zoonomia";* who says that, in passing from Leith to Kinghorn in an open boat, he observed that as he bent his attention with energy on the management of the boat, the sickness ceased, and recurred as often as he relaxed his attention. He adds, "I am assured by a gentleman of observation and veracity, that he has observed when the vessel has been in immediate danger that the sea-sickness of the passengers

has ceased, and returned when the danger is over. This seems to corroborate, fully, what I myself have frequently observed. Having thus noticed the more important means of treatment, the subject may be thus summarised.

Presuming that the individual is otherwise in good health the prophylactic treatment is first, to counteract any preconceived dread of the sickness by providing some healthy mental exercise. If this should fail, and especially if the first symptoms such as giddiness, and headache, are developing, a large dose of bromide of potash or soda (3i ad ʒii) should

See British Medical Journal
Vol. II. 1880. Page 302.

be at once administered, and repeated every two or three hours if necessary. If notwithstanding this treatment, the symptoms become fully developed, and vomiting supervene, this is best counteracted by administering a dose of solution of atropia hypodermically, in doses of from $\frac{1}{100}$ th to $\frac{1}{25}$ th of a grain.

As Dr Beard has pointed out,* the administration of the bromides may be beneficially commenced a few days before sailing. There will probably be always a few cases of sea-sickness which defy all treatment, but the method which has been indicated

seems the best way at present,
to reduce such cases to a
minimum, and it remains to
be seen whether a specially
constructed class of passenger
ships, may not entirely prevent
the malady.

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