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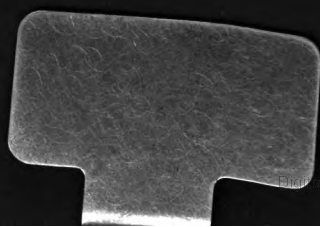
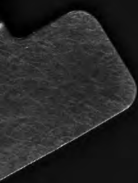
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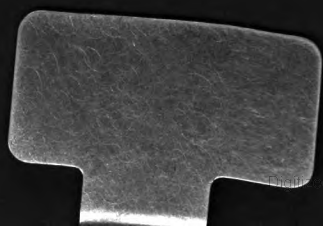
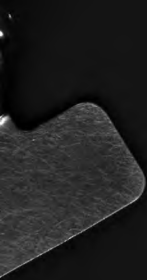
SPASMODIC ASTHMA.

W. E. STEAVENSON.

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SPASMODIC ASTHMA

A THESIS

FOR THE

M.B. DEGREE OF THE UNIVERSITY OF CAMBRIDGE

BY

W. E. STEAVENSON, M.B., M.R.C.S. ENG.

OF DOWNING COLLEGE

HOUSE PHYSICIAN (LATE HOUSE SURGEON) TO ST. BARTHOLOMEW'S
HOSPITAL, LONDON



Cambridge

DEIGHTON, BELL & CO.

LONDON: GEORGE BELL & SONS

1879

151. m. 46-

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SPASMODIC ASTHMA.

THE subject of Asthma has lately been prominently brought forward by several authors, and was the subject chosen for the Lettsomian Lectures of the present year. Considering the rarity of the disease, it seems extraordinary that so many books, articles, and monographs should have been written upon the subject; but when the lives of the authors are inquired into it will be found that several of them suffered from the distressing disease themselves, and this must be my excuse also for writing upon a subject of so little utility; for even if the real cause and a certain cure for asthma were discovered, a very infinitesimal proportion of the human race would be benefited. It appears to me that another reason why spasmodic asthma is a favourite subject for the pen of medical men is because of its extraordinary vagaries. The condition of a patient may be such that he is one day apparently at death's door, with not breath enough to give utterance to words explaining his ordinary wants, and the next day perhaps capable of running a mile or dancing at a ball. I am referring to cases of asthma pure and simple, not those cases of bronchitis and emphysema frequently accompanied by asthmatic seizures. The symptoms and inconvenience of bronchitis and spasmodic asthma are no doubt exactly the same, but

bronchitic asthma is only one of the sequelæ or symptoms accompanying bronchitis ; the cause of the attacks is present at the time in the diseased condition of the lungs themselves, and the asthma is only the result of reflex irritation. Could the lungs themselves be repaired, the asthmatic symptoms would also disappear. But spasmodic asthma is a specific nervous disease, and entirely independent of anything else. The patients attacked with spasmodic asthma among the classes who seek relief at our hospitals are very few in number ; this distressing affection seems in a great measure to be the more exclusive property of the higher and more sensitive classes of the community. The opportunities that I have had of observing the disease have therefore been much fewer than I could have wished, and I shall have to refer to my own case to a great extent. During the ten years I have been more or less connected with St. Bartholomew's Hospital, I find by the Statistical Reports that there have been about 21,892 patients admitted into the medical wards, and only 21 of these patients are recorded as suffering from asthma, making an average of about one in a thousand ; but I find that of these 21 cases, 10 are recorded as having been admitted in the two years 1871 and 1872, so that if these two years are omitted, the average proportion would be about one case of asthma to every 1600, and I cannot help thinking, judging from the other years, that in the two I have mentioned, several cases were included under the name of asthma which were really not true asthma, but in which asthmatic attacks were a prominent symptom ; in fact, to one of these patients

who died, a note is appended which says, "The woman who died of asthma had albuminous urine as well." At the present time, with about 200 medical in-patients and 7000 out-patients, there is not a single case of asthma under treatment.

Having suffered from the complaint myself, its nature, symptoms and progress have always had a great interest for me, and I have seized every opportunity I have had of watching the disease; but I have never been altogether able to agree with the theories explanatory of the attacks usually given in the works on medicine, and my observation of the disease has borne out my already-formed opinion of its nature.

PART I.

ITS ORIGIN AND NATURE.

FLOYER, as far back as 1720, considered asthma due to a contracted state of the bronchia. Wintrich, Bamberger and Lehman considered that tonic spasm of the diaphragm is the chief cause; while Salter, Trousseau, Sir Thomas Watson, Biemer and Thorowgood accept Floyer's theory, and think spasm of the bronchial muscles and constriction of the small air tubes are the causes which produce the symptoms characteristic of the disease.

Some consider bronchial congestion as the exclusive cause. Dr. Blackley found that lying on his back at full length soon brought on a regular fit of asthma, which he attributed to the congestion of the bronchial membrane brought on mechanically by the horizontal position. I have myself experienced the same symptoms. I can never lie on the grass in the sun without feeling that an attack of asthma is imminent, and have to change my position; nor can I lie down at full length on a sofa for any length of time, unless in very good health, without producing a feeling of dyspnoea. But I do not explain the phenomenon by the theory of congestion of the bronchial tubes, but by the extra supply of blood afforded by that position to the medulla, causing increased stimulation of the respiratory centre. When in the recumbent position, asleep

in bed, the rapidity of the circulation is reduced, and by that means equilibrium in supply of blood to the medulla insured. All these authors I have mentioned consider asthma to be a nervous disease, and that the nervous irritation may be central or peripheral. So far I am in common with the generally received idea, but I doubt whether the result produced by this nervous irritation is spasmodic contraction of the smaller bronchi. It has been proved beyond doubt, especially by Todd and Bowman, that the smaller bronchi are surrounded by involuntary muscular fibre, and by Dr. Williams that the lungs and air tubes are contractile under electrical, chemical and mechanical stimuli. No doubt this contractile power is a most essential property of the lungs, for the purpose of expelling air and mucus; but I doubt very much whether it is inordinate contraction of the smaller bronchi which produces asthma. It would seem that instead of being contracted, the whole of the lungs, of course including the air vesicles and smaller bronchi, was dilated and stretched out in every direction; in fact, in a temporary state of emphysema, appearing as if the movements of the chest were arrested at the conclusion of one of the deepest inspirations, and spasmodically held in that position. Therefore I consider the symptoms of asthma are not produced by a spasmodic contraction of the muscles surrounding the smaller bronchi, but, on the contrary, by spasmodic contraction of the muscles of inspiration. The hypothesis of contraction of the bronchi is incapable of proof, it has only been arrived at by a process of reasoning. Experimental physiology does not furnish

us with any authority for admitting spasm of the bronchial muscles, although symptoms seem to justify it. It is argued in this way; first, that there is an inability to inspire, with a loud wheezing obstructive noise at each endeavour. The sounds suggest the idea that there is an obstruction or narrowing of something. Then it has been proved that the smaller bronchi are surrounded with muscular fibres, that they can contract, and so reduce the calibre of the tubes. These muscles are supplied by the pneumo-gastric nerve: and irritation of this nerve, both centrally and peripherally, has been proved to produce asthmatic attacks. But also by a process of reasoning, and an observation of facts, almost an entirely opposite theory can be deduced. The inability to inspire is caused by spasm of the inspiratory muscles, and an already over-filled condition of the air-tubes and vesicles. The loud wheezing noise is simply produced in the larynx, and the sound transmitted by, not caused in the bronchia themselves. The chest is hyper-resonant, the whole thorax dilated, and the circumference increased, a fact I knew many years ago by having to unbutton the upper part of my waistcoat when suffering from an attack, and sometimes I actually could not get it to meet. The area of præ-cordial dulness is diminished, or temporarily obliterated, as in chronic bronchitis and emphysema, the præ-cordial dulness returning a day or two after the subsidence of the paroxysm. The heart itself is depressed, and produces epigastric pulsation, which also lasts until the chest has returned to its normal size. The whole of the diaphragm is contracted and depressed, and with it the liver and

stomach. At the cessation of the spasm the inspiratory muscles become relaxed, and contraction of the thorax commences. The elastic recoil of the lungs sometimes takes three or four days. If these conditions of increased capacity and distention of the chest exist in an attack of asthma, can the theory of contracted bronchia for a moment be maintained? The lungs would perforce follow the chest wall in its distention, and the bronchia and air-tubes be dilated and filled with additional air drawn in through the larynx. When the inspiratory spasm is caused by irritation of the centripetal fibres of the vagus starting from their periphery, the impression is carried to the respiratory centre and reflected as a centrifugal impression to the group of inspiratory muscles. Therefore the part which the vagus takes in causing an attack of asthma only comes into play when the irritation is peripheral; it only transmits a morbid impression to the medulla which is reflected to other nerves, viz., those supplying the inspiratory muscles. In the books I have consulted with a view to writing this thesis, I have read an article written by M. Jaccoud, of Paris, who has already enunciated a very similar theory*, and I have in several places adopted his views.

a. Causes.

The real cause or causes which produce asthma have never been satisfactorily made out. That which produces an attack in one asthmatic patient is totally

* Also Rosenthal and G. Sée (*Nouveau Diction. de Med. et de Chir. prat.* Vol. III.)

inert in the case of another. But from observations of numerous cases several tolerably constant conditions have been found to exist. In the first place it is assumed that all cases depend upon an abnormal excitability of the vagus, or of the respiratory centre, but that that excitability is aroused in different individuals by different causes.

In many cases the affection has been found to be hereditary, or subject to what is called atavism, disappearing in one generation to appear in the next. It is so in my own case; my paternal grandmother suffered severely from asthma, but none of my father's generation experienced it, and I am the only one who suffers from asthma among 14 grandchildren. The disease is commoner in men than women. All temperaments and constitutions seem to be liable to it, but as I have mentioned before, it is to a great extent confined to the higher classes. It may be supposed that in cultivated and sensitive individuals, nerve tissue change goes on more rapidly than in ordinary mortals, and causes which will produce no effect in the one class may be the origin of many different nervous phenomena in the other. In some patients it is always necessary that the irritation should be peripheral; they never suffer from an attack unless the organs supplied by the pneumo-gastric are in some way deranged. This mode of producing attacks of dyspnoea is seen in cases of chronic bronchitis and emphysema, and some patients whose symptoms nearly approach those of true asthma are never troubled with an attack unless preceded by a more or less severe bronchial catarrh. But in my own case I have several

times had somewhat acute attacks of bronchitis without any accompanying fit of asthma.

Since studying the subject of asthma it has often occurred to me that a common cause for its excitation may some day be proved to exist in the electrical condition of the atmosphere, or the electrical condition of the locality, taken in relation with the electrical condition of the patient at the time of the outburst. The influence of electricity upon all the nervous diseases seems to have been too much neglected and ignored by our profession. The electrical condition of the human body is seldom taken into account as a factor in explaining disease, but we are taught by our works on physics that we are at different times and in different places differently electrified; that even the kind and intensity of the electricity differs at different hours of the day and night. I have seen it stated in works on medicine, but I know not with what truth or on what foundation, that in rheumatic affections the electricity of the human body is reduced to zero; that most people are positively electrified, and that in women it is more frequently negative than in men; that its intensity is greater in the evening than in the morning. Referring to what is at present known regarding the variations of atmospheric electricity, I have been led from observations on my own case to consider that the negative variety has a deleterious influence.

From a few hours after sunset, the amount of free positive electricity in the atmosphere begins to decrease, and is very feeble about sunrise. As this amount of positive electricity approaches its lowest

point, namely, in the small hours of the morning, my attacks, and the attacks of most asthmatic patients, commence, and continue in augmenting severity until some hours after sunrise, when, as the amount of positive electricity again increases, the attack passes off, and about eleven o'clock in the morning, when the electricity attains its first maximum, I am often free. If not relieved then, the attack lasts on me until the following day at about eleven o'clock, or sometimes two or three days; but however long its duration it invariably leaves me during the forenoon. Dr. Hyde Salter has also observed that there is no doubt that the forenoon is in every respect the most favourable time for asthmatics.

Then again as the amount of positive electricity rapidly decreases after noon, I have an exacerbation of the dyspnœa, if at the time suffering from an attack, and even if tolerably well I often feel indisposed and wheezy for several hours in the early part of the afternoon. A few hours before sunset, when the electricity attains its second maximum, and for several hours after that, I feel quite well again, or the attacks undergo some remission; and it is at this time of the day that a symptom has often been noticed in me as in other asthmatic patients, viz., an abnormal buoyancy of spirits premonitory to an attack which will come on in the early morning.

Whether these relations between asthma and the electrical conditions of the atmosphere are accidental coincidences or not remains to be proved, but that they do coincide in most cases, and in my own, there is no doubt. It is only fair to remark that these daily

electrical variations correspond with variations in the barometric pressure. But when watching the effect of the changes of the barometer on my attacks of asthma for several months during last summer, I could not find that they bore any relation the one to the other. It has often been remarked that true asthmatic patients do not seem to be deleteriously influenced by a fog, while a fog causes most intense dyspnoea to those subject to bronchitis and emphysema; in fact, many asthmatic patients are better in a fog, and above all in a London fog. Here again we are told that in foggy weather the electricity of the air is more strongly positive than at other times.

Again, the differences of locality which appear most markedly to affect my own case seem to be subject to the same laws. Becquerel, when experimenting for the purpose of finding out the causes of the atmospheric electricity, found "that in the neighbourhood of a river, even at some distance, the land and objects placed on the surface possessed an excess of negative electricity." It has also been proved that on rising ground the amount of positive electricity increases according to the height. On high ground, some distance from a river, I always experience the greatest immunity, such as in Edinburgh, or where my school was placed at Ipswich; but in the Thames valley near Chertsey, where I sometimes try to stay in a house situated on the lower Bagshot sand, I am never free from asthma.

But in considering the different effect locality has upon different individuals, I think it would be necessary always to bear in mind that there must be some centre

in the human body for producing electrical separation ; how otherwise are we to account for the nerve and muscle currents which undoubtedly exist ? In the torpedo the fourth cerebral lobe has been proved to preside over the apparatus for producing electrical separation. And if such a centre does exist in the human body, we may suppose that in some individuals its action may be carried to an abnormal extent ; and possibly so in such purely nervous diseases as asthma, hysteria and epilepsy. The relation which exists between these three disorders has been recognised and commented on by many authors. I will here quote a significant fact mentioned by Sir Thomas Watson in his lectures, when speaking of the treatment of asthma. He says, "Galvanism was once in fashion. The only patient who ever tried it under my own eye was this same friend. He insisted on being galvanized when his fits were quite absent—galvanism brought one on immediately." I am told that a German professor, at present in London, who suffers from asthma, always relieves his attacks by placing himself on a stool with glass legs and connecting himself with an electric machine which is worked until he is able to emit sparks from the end of his fingers. I will also quote another significant paragraph from Dr. Hyde Salter's article on Asthma in *Reynolds' System of Medicine*. "There is one peculiarity in the state of the asthmatic after the paroxysm that is especially worthy of remark, and that is the diminution of the asthmatic tendency that he then experiences—the almost certain immunity, for the time being, from a repetition of the attack. There are many things that he dare not do at other times without

the certainty of bringing on a paroxysm, that immediately after an attack he may do with perfect impunity. It seems as if each fit were a sort of 'clearing shower,' as if the tendency to fall into the asthmatic state accumulated in the intervals, and was, so to speak, discharged by the paroxysms. Certainly the fact, which we frequently see in asthma, that the longer the time that has elapsed since the last attack the more particular must the asthmatic be in not exposing himself to the ordinary exciting causes of the disease, and the more sensitive of their influence does he become, is compatible with this idea. We see just the same thing in "the nerve storms of "epilepsy." And again, when speaking of the resemblance between asthma and epilepsy, he says, "Both of them affect the same nervous temperament, both of them are markedly periodic, and in both each paroxysm seems to act as a sort of thunderstorm, and to discharge or work off some particular state which constitutes the liability to the condition, and which accumulates in the intervals and reaches its maximum immediately before the fit."

But to substantiate this theory of the influence of electricity upon asthma, and make the observations I have mentioned of any value, it would be necessary to devote much time and trouble, and carry out an enormous number of experiments with the electroscope and other instruments: these I have not had the time or opportunity of doing. In these days all the energy and time of young men is dissipated and absorbed in preparing for and passing innumerable examinations.

β. Exciting Causes.

Until some common cause for asthma has been proved to exist, under which all the now seemingly diverse influences can be explained, it will be necessary in treating of the disease to mention some of the most commonly recorded exciting causes.

When speaking of the influence of locality, it has been found that although there are some places which seem suitable for a large majority of asthmatic patients, still there are some which are suitable for one patient and not for another; and this would seem to negative at once the idea that atmospheric electricity has anything to do with the subject. But before dismissing the theory as unworthy of any consideration, it must be borne in mind that these electrical conditions vary within a very limited area. I have never heard that asthmatic patients who have found that localities influence them in opposite ways have ever really resided in the same house, and then I also claim that their own nervous condition must be taken into account. To shew that the electrical changes, independently of locality, are very great, I will quote an extract from the Meteorological Report in the *Times* of April 17th last, referring to the electrical condition of the atmosphere for the preceding week. It says: "Electrical changes were large and rapid for a few hours on Thursday morning, but subsequently the charge became entirely negative and remained in that state for the greater portion of the day. Negative electricity was again in the ascendant on the 12th

and 14th, while yesterday morning the variations were of considerable magnitude in both directions."

The capriciousness of asthma has been a subject of interest to the physician from the earliest ages, and the peculiarities of the circumstances which influence different patients have afforded a wide field from which they have gathered numerous amusing and inexplicable anecdotes.

Sir Thomas Watson tells of a college friend of his who could sleep at the Eagle, formerly in Bene't Street, but not at the Red Lion, in Petty Cury, without an attack of asthma, or *vice versa*, and who could not sleep in the back room of an hotel in Paris, but never suffered if he slept in the front room; and of a medical man who resided at Newmarket in peace, but never felt certain he would not be assailed in the night by his well-known enemy if he attempted to sleep in a strange place. I, on the contrary, lived more or less at Newmarket for fifteen years, and when there was hardly ever free from asthma; at school at Ipswich I enjoyed perfect health, but on the approach of the train to Newmarket, on my return for the holidays, I felt a return of my asthma. At the time when the system seems ripe for an outburst of the disease, any little error in diet will produce an attack. In fact, indigestion is a fruitful exciting cause; some articles in particular in many asthmatic patients are more obnoxious than others, such as wine, beer and sweets. It is also a very dangerous thing to go to sleep after a meal before digestion is accomplished. Asthmatics feel an inclination to do so like many other mortals, but they awake with a more or

less severe attack of dyspnœa. Supper is also a very bad thing ; but perhaps it would not be worse for asthmatical patients than for others if they did not go to bed and to sleep for several hours afterwards. As I have said before, ordinary pulmonary catarrh or bronchitis is the invariable exciting cause of an attack of asthma in some patients, and others suffering from cardiac disease have often well marked attacks. There is no doubt that certain winds, especially an east wind, act as an exciting cause in some cases, and cold feet independently of any thing else are said to bring on attacks.

Many vegetable emanations as from hay, privet, and ipecacuanha produce attacks in persons predisposed to them, also the smell of certain animals, as dogs, cats, rabbits, guinea-pigs, a sweating horse or a menagerie. Dust of all sorts may also become an exciting cause. I never dare brush my own coat, unless I feel particularly well, without paying a severe penalty ; and the dust from blankets is particularly objectionable to me. Often when an attack of asthma has passed off sufficiently for me to have my bed made, a return has been induced by a too active shaking of the blankets.

A case is detailed by Dr. Thorowgood in his Lett-somian Lectures, in which an immoderate fit of laughter produced in a patient his first attack of asthma ; he explains this by supposing that the expiratory effort emptied the lungs, and then the bronchial spasm came on ; but in an attack of asthma the lungs are not emptied. Would it not be a better explanation if we supposed that the immoderate fit of laughter produced spasm of the diaphragm, and by that means increased

the chest cavity, producing over distention of the lungs and an inability to empty them ?

Dr. Thorowgood also quotes another case of a lady who when suffering from hay catarrh, indulged in a fit of excessive laughter, after which she could not get her breath and became subject to asthma.

Spasm of the diaphragm would, it might be supposed, be a very likely condition to follow an immoderate fit of laughter ; I have often had an attack produced by this cause.

Certain conditions of the mind have also a great effect both in producing attacks of asthma and in causing their sudden relief ; such as anxiety or grief or sudden joy. Often if the mind can be influenced by some circumstance calculated to produce pleasure and entirely divert the attention, an attack of asthma will pass off.

Absence of employment calculated to interest and excite the mind is a fruitful cause of the continuance and return of many nervous diseases.

I have never been prevented by an attack of asthma from going in for and completing any examination ; but when completed and the strain on my mind relieved, it has always been followed the succeeding night and day by a severe attack.

PART II.

ITS PATHOLOGICAL ANATOMY.

OF the pathological anatomy of asthma there is really very little to be said, the disease being of a purely nervous character. Therefore in uncomplicated cases nothing abnormal is found after death. In some very rare cases the vagus or phrenic nerve has been found altered by the pressure of tumours. Autopsies on cases of old standing disclose the consequences of asthma, viz., emphysema, bronchial catarrh, bronchiectasis and lesions of the heart and aorta.

Death during a fit of pure asthma I should suppose never occurs; the very act of dying relieves the spasm, and the patient recovers. In long continued and very severe cases, when the bystanders have expected death every minute, and when the patient himself, having struggled in agonies for several hours, is at last exhausted and breaks down utterly overcome, the very fact of his utter exhaustion produces a relief; there is not vitality enough in him to sustain the spasm, and from this point he rapidly improves.

PART III.

ITS SYMPTOMS AND PROGRESS.

a. Access.

IN some cases the attacks of asthma are quite sudden, but in others, and by far the more numerous, there are some premonitory symptoms, not constant for every case, but known by experience to the patient. These are chiefly •unusual buoyancy of spirits and mental excitement, or depression and a feeling of chilliness, a sensation of irritation in the air-passages, vague pains, headache, an irresistible sleepiness, flatulent distention of the stomach, and a tendency to pass large quantities of very light coloured urine of low specific gravity; as is also the case in hysterical women before a fit. If the attack takes place in the night while the patient is asleep, his sleep becomes disturbed, he shifts his position constantly and has a general feeling of malaise, and finally wakes up with a fit strong upon him. In the afternoon, after an early dinner, another favourite time for an attack to come on, it commences with a slight sense of constriction of the chest, a short dry cough and a tendency to wheeze, an increased girth of the chest necessitating the loosening of the clothes, and an alteration in carriage by the shoulders being raised higher than usual.

When the attack is fully developed, the sense of suffocation is terrible. The patient sits up in bed with the elbows fixed and shoulders raised, sometimes leaning forward with the hands supporting the head, sometimes with the head thrown back resting on the pile of pillows he is obliged to have at his back to prop him up. Nothing comforts a patient struggling with a fit of asthma so much as having these pillows arranged nicely, so as to support the whole back and particularly the head. Sometimes the patient will get out of bed and lean forward on some piece of furniture high enough to support his elbows, as a chest of drawers, and will stand like that for hours in nothing but his night-shirt, disregarding the cold and everything around him ; or he will kneel against the bed or a chair, avoiding any movement. I have never felt any inclination, nor have I ever seen a patient who exhibited any inclination, to rush to the window, open it, and hang out of it for hours in search of fresh air, as described in most accounts of asthma : generally the paroxysms are too severe to attempt the slightest exertion. The perspiration pours off the face from the violence of the respiratory efforts, and at the same time the extremities are icy cold. Another favourite position for patients suffering from an attack of asthma is to sit in a high backed arm-chair without any cushion, with the elbows fixed on the arms of the chair, and the head thrown back resting against its back, so that the cervico-thoracic and cervico-scapular muscles may have their moveable points at their lower attachments. A patient will thus sit all night, unable to attempt the exertion necessary for ascending to his bed-room. The

countenance is anxious and haggard, and generally pale, there is turgescence of the cervical veins, and sometimes pulsation in the jugulars. Speech is almost impossible, the patient answering only by gasping out a syllable at a time, or replying by signs. There is no rise of temperature during the attack. The diaphragm is lowered to its maximum, and there is epigastric pulsation. The chest assumes a barrel shape and is fixed in the position of deep inspiration, the fixity itself causing the feeling of suffocation. The lungs are full of air, but the air cannot be renewed, the chest feels as if bound with iron, and that relief would be felt if it could only be cut open. The efforts of the patient to introduce air exaggerate the condition still more; all the auxiliary muscles which are strangers to ordinary inspiration are called into action, but all these exertions render inspiration impotent, and there is a feeling of impending death. The muscles tug at the ribs, but the ribs refuse to rise and refuse to subside, and there is very little movement. All this time the pulse is little affected, being generally small and quick, but in some rare cases it intermits, the intermission taking place at each effort to inspire. The respirations themselves are not hurried, in fact, do not exceed the normal number, but the relative duration of expiration and inspiration is altered; the expiration is slower and more prolonged than natural, the peculiar wheezing and whistling sound being commenced after completion of an attempted inspiration, and sharply completed by the active contraction of the expiratory muscles. The wheezing is more marked at the second half of inspiration. These phenomena

are not explicable by the theory of bronchial spasm, and they exist from the access of the attack to the point of its giving way. There is no turgescence of the mucous membrane or secretion which can hinder the outgo of air, so as to check it and make it noisy.

The wheezing sound which is heard in asthma is produced in the glottis and larynx; the orifice is constricted spasmodically, and begins to become constricted at an early stage in the seizure; in fact a somewhat noisy wheezing expiration is one of the earliest signs of an approaching attack. All breathing sounds in the lungs are reduced in intensity, at some places absent, at others a weak vesicular murmur is heard. These characters change; at intervals breathing sounds can be heard at a place where they formerly were absent, and *vice versâ*. This paucity of intrathoracic sounds is to be accounted for by the small amount of fresh air admitted into the lungs, and the small amount of interchange which takes place. Of course the noisy wheezing sounds produced in the larynx and glottis are easily transmitted through the open tubes, and are heard almost as loudly over any part of the chest as over the trachea, and they vary with the variations of mucus in the larynx or tubes. The amount of secretion in the bronchial tubes is very small, and therefore does not much alter the sound; this dryness of the tubes combined with their patency and increased calibre accounts for the small amount of modification the laryngeal sounds undergo.

At the acme of the attack, when the pulmonary distention is extreme, the paucity of the secretion can be explained by the diminished amount of blood in the

pulmonary capillaries ; the walls of the air vesicles are so tense that nearly all the blood is squeezed out of the vessels, but as the distention diminishes, more blood finds its way into the capillaries and secretion takes place, and expectoration is sooner or later established.

In ordinary respiration, as examined by the laryngoscope, during inspiration the glottis is widely open, and at each expiration the arytenoid cartilages approach each other so as to narrow the glottis. But in the laboured respiration accompanying an attack of asthma, the glottis is fixed in the condition of expiration, that is, the glottis is narrowed and the air enters and is expired through the same narrow space ; in fact, the glottis assumes the position which is natural for expiration, as if inviting that act which it is almost impossible to perform. This fixtured position of the glottis in the expiratory position causes the wheezing and whistling noise which is so characteristic of the complaint. Often one of the first premonitory symptoms of an attack of asthma is the assumption of this expiratory position by the glottis and the presence of slight wheezing accompanying the inspirations. It has been suggested that the depression of the diaphragm might be due to a semi-paralytic condition, but this can hardly be the case, because the thorax is distended to an abnormal extent, and there is every evidence of an increased atmospheric pressure upon the thoracic parietes ; the supra-clavicular regions are drawn in, the skin appearing quite tense over the extraordinary muscles of respiration which stand out like thick cords ; the intercostal spaces are also made more apparent. If the diaphragm was in any degree paralysed, would

not the pressure of the atmosphere acting upon the abdominal walls force up the diaphragm and soon insure a re-establishment of the respiratory rhythm? Yet although this pressure upon the abdominal walls is present, no impression is produced upon the diaphragm.

In some cases the abdomen is enlarged by the descent of the diaphragm, but in the greater number of cases, although the diaphragm is depressed, the exertions which are made by the abdominal muscles are so great that the abdomen becomes retracted; this takes place by an increased pressure upon the abdominal viscera.

β. Percussion.

The chest to percussion is hyper-resonant throughout, owing to a temporary or simulated emphysema, which is present in all cases. There is permanent emphysema in inveterate cases.

γ. Auscultation.

There is a general weakness of the respiratory murmur, almost masked by the loud wheezing and whistling transmitted from the larynx. At some points all respiratory murmur is absent; this is because no interchange of air is taking place. During an attack, if rhonchus be present, it can only be attributed to some block in a small tube; but later on, when secretion begins to take place, little by little râles of a moist kind are developed.

δ. Termination.

This secretion is owing to the exhaustion of the nervous excitement, and is the advent of decline. The

respiration becomes more free, and the agony and cyanosis decrease. There is no expectoration during the growth and height of the attack, but as it subsides, tough, semi-transparent pellets of mucus of a pale grey colour, resembling albumen or boiled tapioca are coughed up; this character of the expectoration is peculiar to asthma; there is no admixture of pus nor is it frothy as in bronchitis. These mucous pellets are generally coughed up for a day or two after the attack.

The duration of the attack is often only from two to six hours, followed by sleep, and the patient wakes up in perfect health, or has for a day or two sibilant respiration with dyspnoea on the slightest exertion. But sometimes the attacks have an accumulative character lasting for four or five nights. The interval between the attacks varies, but there is perfect organic integrity of the respiratory and cardiac functions as long as the asthma is uncomplicated, which proves the diagnosis of a nervous disorder. The duration of the organic integrity is limited by the number of attacks. Unless asthma is banished, habitual catarrh and emphysema are established; the respiration is no longer free between the attacks, and the ordinary complications and consequences follow, viz., chronic bronchitis, dilated right heart, tricuspid incompetency and dropsy. As these organic changes take place, in some cases the peculiar characters of the asthmatic seizure are gradually effaced.

Asthma can be recovered from, though rarely, but the progress is always slow and without influence on the duration of life.

PART IV.

ITS TREATMENT.

HAVING suffered from asthma from my infancy, I have tried numerous drugs for its relief experimentally, both at the suggestions of others and on my own account. In the present state of our knowledge no means have as yet been suggested for eradicating the disease. Our treatment must therefore be to prevent attacks and to relieve them when present.

a. In Intervals.

Our treatment during the intervals, for the prevention of attacks, can be arranged under three heads, viz., locality; dietetic; and the avoidance of exciting causes. With regard to locality each patient must seek out for himself a place which suits him, and I believe the sites vary within very narrow limits; but when once this desirable locality has been discovered the effect is permanent as long as he remains there. There is nothing hap-hazard or irregular about this influence of locality; a patient knows that if he goes to a certain place he will be well, and that if he goes to another place he will have an attack; and if repeated twenty times it is always with the same result. I know that Edinburgh and the city of London suit me, and I know that when I can sleep in Downing College

in this town I shall be free from asthma, but I also know that if I try to sleep in Downing Street I am very liable to have an attack. This effect of locality is also immediate. A few months ago a friend of mine was travelling to Hastings, and at Charing Cross Station a man was helped into the carriage in an apparently dying condition, but as the train arrived nearer and nearer to Hastings he gradually recovered, and on alighting was quite well. This gentleman, who lived at Hastings on account of his asthma, explained that he had been called to London that day on business, and that when he started in the morning he was quite well, London always having the effect of bringing on a most violent paroxysm of his disease. Dietetic treatment involves the avoidance of all indigestible food, heavy meals, and late suppers, and particularly those things which by experience have been proved to be provocatives of attacks, as, in some cases, alcohol, pastry, and all kinds of sweets. The avoidance of other exciting causes would include hay and animal emanations; and I should have to add, in my own case, examinations; the mental strain, anxiety and suspense involved in examinations always produced an attack of asthma.

In the intervals between attacks everything should be done calculated to restore and preserve the health in as robust a condition as possible. The continental waters and baths are recommended, varying according to the temperament and disposition of the patient. Several drugs have been recommended as beneficial in warding off attacks. I took for two months, at the suggestion of the late Dr. Anstie, rather large

doses of arsenic three times a day; I did not have an attack during that time, but I was residing in the city of London, a locality which suited me. I have also taken strychnine for varying periods, but I am not aware that it influenced me in either way. I have been recommended valerianate of zinc, and took pills containing this substance for some time, but it did not keep off an attack when I went to a place obnoxious to me. The arseniates of soda and iron have also been tried, as well as belladonna, cannabis indica, bromide and iodide of potassium, but with varying results. Of course, if the asthma is produced by bronchitis, benefit would accrue from treating and alleviating it. When warning phenomena are experienced, an attack may often be warded off by calming the excitability of the vagus by fumigation with nitre paper, smoking tobacco or stramonium. If the patient is robust and suffering from abdominal plethora, a brisk purgative will often suffice, followed by light diet and repose for two or three days. At the commencement of an attack the patient should be raised, or placed in an arm chair; if in bed, he should be supported comfortably by pillows, the room warmed, clothes loosened, and all wants anticipated without the patient being obliged to ask; for when the attack is severe he can hardly articulate. Cutaneous irritation is often very soothing, as the application of a mustard and linseed meal poultice to the chest, or simply brushing the hair for some considerable time.

β. During Attacks.

When the attack is fully developed, the same capriciousness which is so characteristic of the disease is observable in the means which will relieve it. The different modes of treatment are divided by Dr. Hyde Salter under three heads, viz., Depressants, Sedatives, and Stimulants. Among depressants are placed emetics of all sorts ; and nothing proves more conclusively the nervous character of asthma than its certain relief by emetics, not by the emetics emptying the stomach, but before this when the first sense of nausea and faintness is experienced, the relief is immediate ; and although the attack may only be relieved for a few minutes, still this effect of emetics is invariable. *Lobelia inflata* is also said to relieve attacks when carried to the extent of producing nausea and faintness. Sedatives and anti-spasmodics I should consider the most serviceable drugs, and many of them have been used with beneficial results ; but above all in value I should place the hypodermic injection of morphia. This has never failed to relieve an attack in myself, and I have never seen it fail in other patients. The objection to it is, that if often used, the dose must be increased ; but it is better to increase the dose of morphia than suffer the agonies of asthma and allow those organic changes in the constitution to take place which I have described when speaking of the pathology of the disease. I have now used morphia for five years, but my attacks are so quickly relieved and so reduced in frequency that I have never yet had to

increase the dose I commenced with, namely $\frac{1}{2}$ gr. Smoking tobacco I often find relieves me when an attack is threatening, and patients who are not inured to its effects by continual use, I should think would be considerably relieved by it. But this drug, in common with others which are directed to be used by smoking, is only available when the attack is not very acute, for when very severe, patients have not breath enough to smoke. *Datura stramonium* and *datura tatula* are both very efficacious drugs in some cases. I have tried the stramonium and obtained relief from it, but it produces such an intolerable headache that I now seldom have recourse to it. A powder called *pulvis stramonii co.*, when burnt and the smoke inhaled, is said to act as a charm in some cases. I have lately procured from America a powder called Popham's Specific for Asthma, which appears to be a plant of the *datura* species mixed with nitrate of potash. It has relieved my attacks whenever I have tried it, but I hardly want any other remedy so long as I have my syringe and solution of morphia. Chloroform never fails to subdue a paroxysm, but its effects are as evanescent as the drug. Hydrate of chloral I have tried, but instead of relieving me it has added to my already unhappy condition by inducing delirium.

Ether in the form of Hoffman's Anodyne often gives temporary relief, and chlorodyne will also often relieve a spasm.

In some cases, ingestion of fragments of ice has been found by Romberg to produce almost instantaneous improvement.

I have tried nitrite of amyl, but the relief is only

temporary, the effect lasts for about ten minutes, when the dyspnoea gradually returns.

Nitre paper is a most valuable remedy and useful in the great majority of cases, but whether it is right to class it under sedatives I am not certain. Some asthmatic patients dare not go to bed without first filling their chamber with nitre fumes; they then sleep in safety.

Among the third class of remedies—that of stimulants—coffee has always had a great reputation, but it must be taken on an empty stomach, and it has to be used strong, so that if taken during the process of digestion, the tannin it contains precipitates the peptones, and thus impedes assimilation, adding another exciting cause of the attacks. Galvanism was once used, but if I were to try electricity I should prefer the Franklinic or statical kind, and I believe if properly applied it would relieve attacks. Sudden emotions both of a pleasurable and painful character, besides being occasional causes of asthma, will also produce instantaneous and abiding relief; this is also a strong proof of the essentially nervous nature of the disease.



