On strain and over-action of the heart / by J.M. Da Costa.

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THE TONER LECTURES

INSTITUTED TO ENCOURAGE THE DISCOVERY OF NEW TRUTHS FOR THE ADVANCEMENT OF MEDICINE.

LECTURE III.

ON STRAIN AND OVER-ACTION OF THE HEART.

BY

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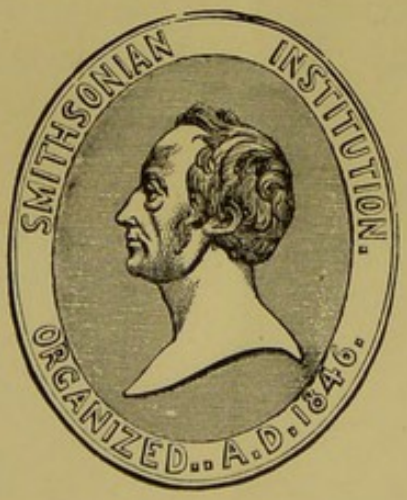

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JOSEPH HENRY,
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SMITHSONIAN INSTITUTION,
Washington, August, 1874.

practice of medicine can fail to appreciate how very prevalent the latter are, and the question is worthy of the deepest study, What causes them, and can we by any means materially lessen their increasing frequency? Again, is there anything in our habits and mode of life, in our work, our amusements, which can be so altered as to avert them? Of many we know the origin to be either an inherited trouble, or an attack of acute rheumatism, or those changes in the muscular structure and in the coats of the great vessels, which go hand in hand with general decay. But these sources of cardiac disease are so well understood that nothing would be here gained by their description. I desire rather to speak to you of a cause very little appreciated, to some scarcely known—the production of disease of the heart by strain and over-action. Strain and over-action may go together, or they may not, and the former may or may not precede the latter. While thus there is a close connection, at times nearly an identity, between the two, it will be convenient, in a general way, to limit the idea of strain, unless the contrary is stated, to an acute strain, an injury by sudden, violent effort; and to think of over-action, over-exertion, or over-work—for these terms may be employed almost synonymously—as a persistent excitement and derangement produced by less rapidly acting causes.

Now, a strain may rupture the muscular walls of the heart, and though there is the greatest doubt whether it can do so unless they are previously diseased, there is none as regards the rupture under strain of fatty or otherwise enfeebled walls. But I pass this by to speak of breaks and tears in the valvular apparatus and great vessels, clearly the result of sudden disturbance. A person, for instance, is seized quickly, after unusual exertion, with pain in the heart. He is recognized to have a distinct murmur, which never leaves him, and sooner or later the typical phenomena of valvular disease will show themselves, varying, of course, as this or that valve has been the

one damaged. No matter what valve be the seat of the accident, severe pain, occurring suddenly, and returning in paroxysms, is apt to be a symptom of valve tear, and often the patient will remember that just preceding the first attack of pain he has felt something give way within the chest. The valves which suffer most frequently from injury are the aortic and the mitral valves. A segment of the mitral has been often observed torn from its attachment; but the same thing may happen at the tricuspid. Thus a case was brought to my notice by Dr. Thomas F. Wood, of Wilmington, N. C., in which in a man, forty years of age, severe paroxysms of cardiac pain happened at irregular intervals, and were attended with distinct venous pulsation. This was, however, also noticed independently of the cardiac distress; though only markedly while this lasted, or just before, or soon after. At the autopsy the heart was found to be enormously hypertrophied; one of the papillary muscles of the tricuspid valve was torn from its attachments both from the walls of the heart and the tendinous cord; and a piece was really found floating in the pulmonary artery. The right auricle and ventricle formed a continuous pouch filled with coagulum. The muscular structure of the heart was not examined microscopically; but to the eye it did not appear fatty.

You have, in the class of cases just alluded to, the result of muscular strain, or violent muscular exertion. But the same result, I am sure, may happen from extraordinary mental emotion or shock. Let me give you some instances.

Mrs. B., a woman of intelligence and character, about thirty years of age, was awakened one night in September, 1862, by a noise in her house, and in getting out of bed she came in contact with a strange man. She was very much frightened, but succeeded in getting him out of the door. Listening, still greatly alarmed, she overheard a conversation that the party would return when the moon went down. Her husband was

absent, and on the spur of the moment she started, with one child in her arm, and leading another by the hand, across the fields and over fences to the nearest neighbor, a distance of about one-quarter of a mile. Her previous health had been excellent, but after this perilous night journey she began to be troubled with shortness of breath and severe beating in her chest. The physical signs of an aneurism of the aorta gradually became evident, and she died a few months since by the external rupture of an aneurism which had corroded the sternum.*

This case cannot, perhaps, be adduced as a pure one of mere agitation and fright leading to rent or injury, since it is possible that the violent exertion in carrying her children may have led to the accident. But even if it did so, it happened when she was previously much excited, and the alarm continued during her flight. In the instance I am about to detail to you there was no severe muscular effort that accompanied the nervous shock:—

Some years since a blooming girl of eighteen was brought to my office by her mother, to consult me with reference to palpitation and shortness of breath on exertion, which had developed themselves suddenly. I found a well-marked aortic, regurgitant lesion. She never had had rheumatism, had been, indeed, in perfect health until a certain day, and had been remarkable for the ease and endurance with which she rode and walked long distances. But one night—it was in the midst of the troublesome times in the border States during the civil war—while she and her mother were alone in the house, which stood some distance from any neighbor's, and the father was known to be far away with the army, two men entered the dwelling, and, notwithstanding the entreaty of the mother, slowly ascended the

* The case will be reported in full in the October number of the American Journal of the Medical Sciences by my late clinical assistant, Dr. Webb.

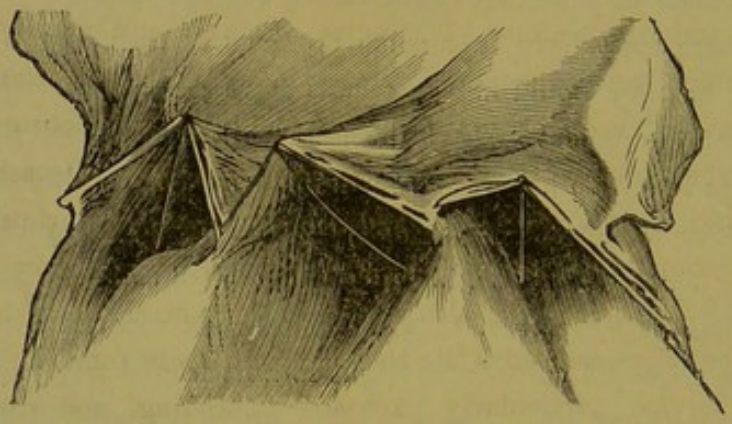
wide staircase. The girl was beside herself with agitation and alarm—the mother, resolute, told them not to advance or she would fire. The warning was unheeded; the flash of the pistol followed. The fire desperately wounded one of the invaders; the other fled. But from that fatal night the girl was a wreck; the palpitations never left; and after a few years, I am sorry to record, the cardiac trouble led to death.

You see, then, in these cases the effect of strain and over-excitement of the heart in producing organic lesion. You will say there must have been some previous disease of the structures, or they would not so readily have given way. But the ages of the patient are not those at which degenerative tissue-change is apt to happen. Moreover, I find in the literature of medicine similar cases mentioned which have occurred in very young children. Thus, in the *Boston Medical and Surgical Journal* for November, 1866, Dr. Hitchcock records a rupture of the tricuspid valve from fright in a little girl two years and nine months of age. She was often nervously excited by loud noises, and when in the middle of the night the steam fire-whistle was suddenly and protractedly sounded near her window, awoke in terror screaming and panting; and it was hours before she could be quieted. Her breathing remained labored, and at her death, seventy-eight hours after the fright, the right auriculo-ventricular valves were found to be lacerated and broken in their substance, as were also several of the columnæ carneæ, and chordæ tendinæ.

The explanation of cases like these has been attempted on the supposition of a rapidly developed endocarditis. Yet where is the proof of this? There may be more likely, after all, in many instances some imperfection which is the cause of the break. But this does not always appear to the naked eye, and even with the microscope the difference from health is not invariably of pronounced character. Clinically it is undoubted that the violent agitation produces the first evidence of disease,

and that without this agitation normal life will not be interfered with. But before passing on to the consideration of other matters, let me, in confirmation of the idea that there may be a slight alteration, under ordinary circumstances innocuous, but becoming serious under strain, tell you that I have occasionally, in *post-mortem* examinations, found valves with slight fissures in them. In this drawing (Fig. 1), taken

Fig. 1.



from a specimen now in the Museum of the Pennsylvania Hospital, I show you such a state of the valves—not a lesion, you perceive, which, under ordinary circumstances, would have occasioned marked disorder, but sufficient to have produced a rent under any strain, or severe and sudden abnormal working of the organ.

We have thus examined into the effect of strain or violent agitation in developing rapidly organic disease of the heart or its great vessels. Let us now investigate another part of the subject, and study the functional excitement of the heart and its consequences, when the excitement acts through a longer period of time—when we have, therefore, continued over-action and over-work. There are various groups which present themselves here to view, but as it will not be possible to do more than examine a few of them, I shall endeavor to

look with you at those which shall best illustrate the general argument of the lecture.

There is, first, the "irritable heart." This is a condition which became familiar to many of you during the late war; and I shall but very briefly recall its main features—the more briefly as I may refer you to a full description of it I published in the *American Journal of the Medical Sciences* for January, 1871. It consists chiefly in extremely rapid action of the heart, attended with pain in the chest, dizziness, and oppression. The pulse is small, and readily compressible; its frequency is greatly lessened by the recumbent posture. The impulse of the heart is extended, abrupt; the first sound is short, the second very distinct. Occasionally the first sound is replaced by an inconstant murmur; the respiration is not hurried or frequent in proportion to the pulse. The general health often appears good, or at least it may be fully restored while the cardiac malady remains. Hard field service, particularly excessive marching, and diarrhœa act as the predominant causes. Digitalis and rest are, on the whole, the most successful remedies.

Here you have a short statement of the irritable heart of soldiers. But it is my object now to call your attention to the phenomena you meet with in your ordinary professional life, and in so doing I take the opportunity of supplementing my observations on the irritable heart of soldiers with observations on the same malady as I have encountered it in private practice. In truth, excepting that the disorder is less violent, and the cardiac pain usually less severe, the malady is identical. I have noticed it in persons who, without previous training, had suddenly undergone great and sustained exertion, as pedestrians, or in climbing. Handfield Jones, in his work on *Functional Nervous Disorders*, in commenting on the cases I have described, mentions that he had had personal experience of the malady; for after making a long mountain

excursion when he was out of condition, he became extremely fatigued, and was ill and sleepless the following night, and some days later was attacked by severe præcordial distress, with sensation of impending death, which harassed him for a considerable time. Now, if in cases of the kind the violent exertion is maintained for a longer period, we have the typical irritable heart developed.

But we may have it also coming on suddenly under circumstances of particular excitement, and then persisting. Of this I encountered an instance some years since in a man who had served in the army to the end of the war without the least evidence of cardiac distress, and joined in 1866 the marine corps, being at the time in excellent health. He was sent to Alaska, and on the return voyage a heavy storm occurred that necessitated his remaining on duty for forty-eight hours, all of which time he was greatly excited and alarmed. Palpitation developed itself, and annoyed him so much that, three weeks after the storm which so upset him, he applied to a physician for relief from the severe cardiac beating. I saw him in 1869, and his case was a typical one of irritable heart; the action was excessively frequent; the beats of the pulse not even; the respirations were only twenty-four, and he was not much troubled with difficulty in breathing excepting in going up stairs. There was a soft systolic murmur near the apex. Rest, digitalis, and belladonna improved his condition very much, and the cardiac murmur disappeared; but though he was under treatment for six months, the frequent and irregular action of the heart did not entirely leave him.

Violent excitement may thus give rise to an irritable heart, which may become a very obstinate condition. But such cases bear no proportion to those in which the exciting cause acts more gradually and over a long space of time.

Of causes that are very commonly the starting point of irritable heart, and with which I know observation has made you familiar,

I may mention irregularity or excess in eating and in drinking, sexual disorders, long matrimonial engagements, the abuse of tea, of coffee, of tobacco. There is, of course, a great deal to be said about individual peculiarity favoring the development of the complaint, and one person may do that or take that with impunity which in another is sure to produce disturbance. Thus, malt liquors alone give rise to irritability of the heart in one, certain wines in another; and in some families there runs a strong tendency to palpitation, which is readily developed by causes influencing the heart that are without effect in others. Of the sources of irritable heart alluded to, tobacco is one of the most common. Its use not only produces irritability of the organ, but immensely aggravates an existing tendency to palpitation; and one of the traits of the irritable heart due to tobacco is that irregularity of the action, shown by intermission or irregularity of beat, is a very ordinary feature.

Yet another cause I may mention as giving rise to a persistent excitement of the heart, and favoring its over-action, are preceding febrile seizures, whether malarial or of continued fevers. And cases thus originating may last for a very long period. I saw recently one in a lady in whom the cardiac disorder began in a severe attack of typhoid fever twenty years ago. But it is, perhaps, not fair to speak of these instances as due to mere perverted action of the organ; there is often a coexisting structural change in the muscle; for we find in many of these fevers by careful examination, certainly in typhoid, in typhus, and in yellow fever, a granular degeneration of the muscular fibres of the organ.

One of the most interesting circumstances connected with the forms of over-action or over-excitement of the heart we have been glancing at, is, that however purely functional this shall have been at the outset, organic disease of the heart may grow out of it. In the paper on the irritable heart of soldiers, and previously in one forming part of the Medical Memoirs of

the U. S. Sanitary Commission, issued in 1867, I have published a number of cases proving this view. To these I could add others traced out since the publication of these investigations. But as already indicated, I prefer here to draw my illustrations from the records of private practice, and doing this, will cite these examples in further proof of my proposition.

First. The case of a lady with very bad prolapsus, and other uterine trouble. When I first saw her she had simply a functionally disturbed, rapidly beating heart. I lost sight of her, and when, after about a year, she consulted me again, the impulse had grown heavier and more forcible, and there was beginning hypertrophy. Another year passed, a year which had brought with it much mental worry and during which she had paid very little attention to her health, and I found that the slight cardiac enlargement had become marked dilated hypertrophy.

Secondly. The case of an inveterate and most extensive user of tobacco in a man thirty-six years of age, who, in addition, had great strain on him from continued attention to business. The heart's action, at first, was rapid and intermittent; there was palpitation, with occasional cardiac pain. These symptoms gradually lessened, the action became more regular, but some dilated hypertrophy ensued. The percussion dulness is at present very marked, the impulse only moderately strong, and the tendency to dilatation may in time be greater than to hypertrophy. Now there is a distinct, systolic, functional mitral murmur, and no increased second sound.

To these cases I could add a list in which cardiac overexertion in special occupations has led to heart-growth and distension, but we shall presently have to examine this part of our subject at some length, and the examples there adduced will strengthen what I have just endeavored to make clear. Let me here, however, say that no matter what the starting-

point of the functional disorder, should it pass into an organic malady the physical signs are always the same—an increase of the percussion dulness and of the extent of the impulse, which, as the vast majority of instances lead to hypertrophy rather than to pure dilatation, is forcible, and becomes associated with a prolonged, dull, first sound, and a second sound which gradually loses its exceeding distinctness. At times a softish, inconstant murmur over the left ventricle replaces the altered first sound, and these instances are very apt to be regarded as mitral organic disease, which they are not. But whether with or without murmur the action of the heart becomes less rapid, and cardiac pain diminishes.

I have now indicated to you how a functional disorder from excitement or over-action of the heart, no matter how produced, may end in organic trouble. But you will ask me, in what manner does the first derangement originate? Is it in the muscular structure of the heart itself, or in its nervous apparatus? In the latter, I believe, in the vast majority of cases; and the perverted innervation is either primary, or more usually the disturbance is reflected to the heart. But if you tell me to show you what nerves are, in individual instances, at fault, I shall have to say that I do not think that a satisfactory and quite trustworthy answer can always be given. Our knowledge of the nerve-supply of the heart, and of the part each nerve plays, is not so positive that we can unhesitatingly expound all clinical facts by it. Still it is, even with our present knowledge, admissible to regard the constant pain so common in irritable heart, as a hyperæsthesia of the sensory nerve-fibres; and assuming the antagonism between the pneumogastric and the sympathetic to be correct—that the former slackens or suspends the action of the heart and the latter quickens it—you will at once understand how anything which exhausts the controlling action of the first, gives the power of the other full play; and how thus many instances

of irritable heart and functional disorder, in connection with cerebral, or spinal, or gastric maladies, may be explained. But I incline to accord to disturbance of the sympathetic elements of the cardiac plexus the chief part in leading to the manifestations of distress. Moderate irritation, Moleschott proves stimulates their action, and this irritation may originate in them, but is much more likely reflected to them, as from the great abdominal sympathetic ganglia; and thus you have the probable explanation of the functionally disturbed heart of gastric and of uterine affections. Further, from the perverted innervation comes altered nutrition, and thus heart disease may grow out of heart disorder; as we now know that structural alteration of the skin, or of the joints and other parts of the economy, may result from abnormal nerve influence. Nay, in the light of these remarks, we can understand how even mental emotion, acting through the nervous system on the nerves of the heart, may produce real trouble, and how the worry of life, and strain on the feelings, when long kept up, may give rise to conditions which, in figurative language, we ca "heart-weary," and "heart-sick," and which, not as a figure of speech, but in truth, may be the beginning of actual cardiac malady.

But it would lead me too far to pursue this matter here any further. I merely looked at it incidentally in trying to make clear that excitement and over-work of the heart first disorder the function, and then may produce organic change, and in attempting to explain how this happens; and shall call your attention to a subject of great and wide interest which has the closest connection with what we have been discussing—the effect of certain occupations, nay, of our amusements, in leading to cardiac trouble from the constant strain and over-work thrown on the heart, partly in the gradual manner just described, through perverted nervous action—but partly, also, by directly causing inflammatory and other tissue change.

For instance, in soldiers we have, owing to their occupation, heart disease as a very common affection, originating in the way already mentioned. But also there may ensue, as I have had occasion to note, and as is ably brought out by Dr. Maclean in the British Army Medical Reports, and by Dr. Myers in his recent interesting work on the Diseases of the Heart among Soldiers, by the direct strain on and over-distension of the aorta, alteration of structure, leading to aneurism or aortic valve trouble; and, as Dr. Maclean has shown, that white patches on the pericardium, the result of inflammatory, or at least nutritive tissue changes occur, it is very likely that the same or kindred alterations may be produced in the arterial coats. How far the dress and accoutrements of the soldier, and the mechanical obstructions to free circulation which they may occasion, determine the malady; how far it is the heavy exertion which his calling may necessitate that brings it on, is not a question for discussion here. The fact alone of the occupation causing the affection is being commented upon. Then, as we know from Dr. Peacock's observations in his Lectures on Valvular Disease of the Heart, men who work in the tin and copper mines, and return to the surface by ladders, are particularly subject to heart disease; and the same authority tells us that disease of the aortic valve is more commonly the result of over-exertion than is disease of the mitral. And another well-known physician, Dr. Allbutt, in an essay published in the Clinical Society Transactions for 1873, states that he found, by *post-mortem* examination, that men who had worked at heavy employments, such as bargemen, porters, strikers in iron-foundries, often present evidences of such exertion in an increased volume of the heart itself, and in marks of chronic inflammation, old or recent, in the first portions of the aorta. In truth, all occupations such as those mentioned, or in which continual lifting is required, favor the production of dilated hypertrophy, or aneurism, or valvular disease, or valvular rup-

ture; and the latter brought about not only by sudden efforts, but likely determined also by the gradual textural changes previously caused.

Let me cite you a case in which, I think, the valvular disease was produced by inflammatory alteration. Only a few days ago a miller came to my office troubled with cardiac pain, and presenting a distinct mitral organic murmur. He had at one time been in the habit of shouldering enormous bags, and of attempting to run when thus weighted. For the last eight years he has only been able to lift the bags very rarely, being annoyed with beating of the heart and shortness of breath—indeed, the latter had become a symptom existing even without any exertion. Previously to the time mentioned he remembers to have suffered from severe pain in the heart for three or four days after his lifting freaks, and on one occasion very greatly.

In examining into the question of the effects of occupation, we find further that excessive expiratory efforts produce affections of the heart or its great vessel. Disease of the coats of the aorta and aneurisms may be thus caused. For instance, in the museum of the Jefferson Medical College is an aneurism taken from the body of a celebrated cornet player. And among glassblowers I have been astonished to find how common are cardiac disorders. I call your attention to this table of 24 men examined, and procured for me by the kind exertions of Dr. Webb. They were not specially selected, did not apply for medical advice—and, indeed, the only care taken in obtaining them was to get mainly those who had been for some time in the business. Irrespective of the facts which the table discloses, I learned, by conversing with the men, that large numbers of their fellow-workmen were troubled with pains across the chest, and with piles. And, as regards this table, we find among the 24 men only one-half who, on a fair estimate, may be considered as presenting healthy hearts.

Among the 12 with abnormal signs are 3 more or less well-marked instances of hypertrophy; 7 of the remaining 9 had some cardiac symptoms in addition to the physical evidences of disorder, and several of these showed typical irritable hearts. One of the cases of hypertrophy might be set aside on the ground of the very free use of tobacco; and the same may perhaps be said of two of the cases of functionally disturbed heart, leaving still 9 out of 24 in which the occupation of glass-blower—chiefly, I think, on account of the respiratory efforts—has led to cardiac affection.

Table showing the State of Health of 24 Glassblowers, with special reference to the condition of the Heart.

Name.	Age.	Length of Time a Glass-blower.	General Health and Habits.	Whether he Suffers from Palpitation and Shortness of Breath, etc.	Physical Signs.
Edward T.	34	18 years.	Excellent; never uses tobacco.	No.	Cardiac percussion dulness normal; rather heavy first sound. Pulse 75; respirations 18.
John N.	26	6 "	Good; uses tobacco freely.	Occasional palpitation and shortness of breath, the latter especially after exertion; pain in right side.	Percussion dulness normal; first sound of moderate volume, occasionally beats are unequal. Pulse 64; respirations 24.
Jefferson H.	38	20 "	Often feels weak; uses tobacco moderately.	No.	Percussion dulness normal, though rather large; impulse somewhat feeble; first sound feeble. Pulse 116, irregular; respirations 20. Heart irritable.
Charles L.	34	17 "	Good; uses tobacco moderately.	No.	Percussion dulness normal; first sound short; second distinct. Pulse 90; respirations 18.
A. C. F.	26	9 "	Good; is a hard smoker.	Not troubled with palpitation, but often with shortness of breath and neuralgic pains in right side.	Percussion dulness increased; impulse slow and heavy; first sound dull. Pulse 60; respirations 20.
Frank S.	23	4 "	Good; uses tobacco moderately.	No palpitation; occasional shortness of breath; pain on both sides of lower part of chest, particularly on the left; never rheumatism; spat blood 16 months ago after blowing.	Percussion dulness rather large; impulse strong; faint systolic murmur over left ventricle; second sound distinct—slight dilated hypertrophy. Pulse 114; respirations 20.
Daniel G.	38	22 "	Is not very strong; uses tobacco to excess.	Palpitation on rapid walking and on blowing, yet rarely shortness of breath, has pain in left side.	Percussion dulness normal; impulse of moderate strength; first sound short; second very distinct. Pulse 66; respirations 18.
William L.	18	3 "	Good; does not use tobacco.	No; occasionally has chest pain.	Percussion dulness normal; impulse distinct; first sound rather heavy. Pulse 72 and full; respirations 18.
William D. F.	25	10 "	Good; does not use tobacco.	No.	Diameters and sounds of heart normal; first sound well marked. Pulse 74; respirations 20.
F. L.	25	8 "	Good; uses tobacco moderately.	Yes, on blowing; has also at times pain over region of heart.	Percussion dulness large; impulse strong, extended; first sound heavy; second sound moderately distinct. Pulse 66; respirations 18.
David McG.	31	12 "	Fair; uses tobacco moderately.	Yes; but suffers more from palpitation than shortness of breath; has occasionally attacks of giddiness.	Percussion dulness normal; impulse not forcible; first sound short, second distinct. Pulse 110; respirations 20. An irritable heart.
Frederick H.	35	18 "	Fair; uses tobacco freely; is constipated, has piles.	No.	Cardiac dulness normal; first sound short; second sound distinct. Pulse 112; respirations 22.

Table showing the State of Health of 24 *Glassblowers, etc.*—Continued.

Name.	Age.	Length of Time a Glass-blower.	General Health and Habits.	Whether he Suffers from Palpitation and Shortness of Breath, etc.	Physical Signs.
John S.	30	11 years.	Uses tobacco to excess; enjoys good health.	No; has occasional chest pains; his work is very heavy, though only 4 hours a day.	Cardiac dulness normal; first sound short; second sound distinct; beats irregular, uneven. Pulse 90; respirations 26.
George S.	42	27 "	Excellent; uses tobacco moderately.	No.	Cardiac dulness normal; impulse extended, jerky; first sound short; second very distinct. Pulse 98, intermitting every third and fourth beat; respirations 21. A typical irritable heart.
Henry E.	30	9 "	Fair, but is a dyspeptic and suffers from piles; uses but little stimulant.	Occasional chest pains; no palpitation.	Cardiac dulness normal; first sound fair; second sound distinct. Pulse 78; respirations 18.
Benjamin D.	31	7 "	Good; uses tobacco rather freely.	No.	Cardiac dulness normal; first sound well marked; second good. Palse 66; respirations 18.
Samuel N.	28	9 "	Good; uses tobacco freely.	No; but has chest pains.	Cardiac dulness normal; first sound rather short; second good. Pulse 90; respirations 18.
John N.	27	6 "	Good, but has dyspepsia; uses no liquor and but little tobacco.	Yes, both.	Cardiac dulness normal; first sound short, indistinct; second moderately distinct. Palse 90; respirations 18.
William W.	32	10 "	Excellent; a moderate smoker.	No.	Cardiac dulness normal; first sound moderate; second distinct. Pulse 78; respirations 20.
George K.	39	22 "	Good; uses tobacco very moderately.	Has shortness of breath and chest pains.	Cardiac dulness normal; first sound sharp, short; second very distinct. Pulse 92; respirations 22.
Harvey W.	40	16 "	Excellent; uses tobacco moderately.	No.	Cardiac dulness normal; first sound moderate; second distinct. Pulse 70; respirations 18
Harry F.	28	7 "	Good.	No chest pains or palpitation; has shortness of breath.	Cardiac dulness normal; beats of heart unequal; first sound sharp; second moderately distinct. Pulse 86; respirations 19.
William B.	33	13 "	Good; uses tobacco and liquor moderately.	No; occasional chest pains.	Cardiac dulness and sounds normal. Pulse 72; respirations 18.
Joseph P.	22	1 year (a very moderate blower.)	Health fair; uses tobacco to excess.	Occasional palpitation.	Cardiac dulness normal; impulse extended; first sound short, sharp; second very distinct. Pulse 96; respirations 21.

Next to the question of occupation as influencing cardiac disorder, concerning which, if time permitted, much more might be said, I shall briefly call your attention to the effect of some favorite amusements. There is *dancing*, which I have known over and over again, when excessively indulged in, lead to very great irritability of the heart. A lady whom I attend, whose devotion to society is largely due to her fondness for dancing, has always a functional disturbance of the heart at the end of a winter season, is better in the spring, but is sure to come home in the autumn from a watering-place with considerable over-action of the heart. Nay, the disturbance of the organ from dancing may pass, as all the forms of cardiac excitement we have been examining, into organic trouble; especially may it do so in lads and young girls. Here is an illustrative case:—

James M., twenty-two years of age, came under my observation in 1868, with marked dilated hypertrophy; the impulse was very extended and forcible; both ventricles, especially the left, were much enlarged; the valves were sound. Careful inquiry could detect no cause for the complaint excepting the one to which the young man steadily attributed its origin six years since—excessive exercise, dancing violently for an hour and a half every night for six months. There had not been the least palpitation, shortness of breath, or disturbance in health previous to the six months' dissipation. These symptoms have become persistent.

The influence of *rowing* in producing disease of the heart has been of late years much debated. My experience with reference to the matter amounts to this: If there be a tendency to irritable heart, or to any cardiac affection, even to angina, it is aggravated by rowing, but otherwise, and not too steadily followed, this exercise is beneficial. I am glad to be able to record this as the result of observation; for anything that, on grounds but the most sufficient, interferes with manly pastimes

and exercises, does great harm, especially in a country where our young men, as a class, are too apt to neglect them. Much of, or all the injurious effect could be, in any case, avoided by the oarsman consulting a careful physician prior to his taking up boating as his chief amusement, and by having his heart examined from time to time. Nor can I find that the health of many has been injured, in after life, by active rowing in their youth; and for confirmation of this view I refer you to an admirable and much fuller examination of the subject than I have been able to make—to the interesting book of Dr. Morgan, lately published, entitled, "University Oars," being a critical inquiry into the after-health of the men who rowed in the Oxford and Cambridge Boat Race from the year 1829 to 1869.

The physical consequences of *base ball* are in this country matters worthy of careful attention; for base ball is our national game; it is to our young men what the game of ball and foot racing were to the Grecian youths, or what cricket still is to the scholars of Eton and Harrow. And I am glad to report that I have seen it responsible for but few disorders—not even for as many cardiac affections as might be supposed. True, I have known some for which it is chargeable, and usually in growing lads who had indulged in it immoderately. Here are a couple of cases in point that applied for relief at the Jefferson College clinic:—

T. S., sturdy and small, twenty years of age; never had palpitation before he began to play base ball violently four years ago. After a time he noticed shortness of breath in playing; but, nothing daunted, he continued until, after three or four years, he found it impossible to take an active part in the game. His habits, in all respects, were good; he was a moderate tobacco chewer; not a smoker. The heart was very much hypertrophied, without valvular trouble. Considerable

improvement followed under aconite given with gentian, but not a cure.

B. K. (Case-book, p. 96, April, 1874), age 14, had been playing ball for four years. Two years ago began to notice palpitation after running; and, for a short time previously, shortness of breath on active exercise or on going up stairs. The impulse of the heart was found to be very extended; the first sound dull and heavy; the percussion dulness measured transversely $3\frac{3}{4}$, perpendicularly $3\frac{5}{8}$, obliquely $5\frac{1}{4}$ inches.

Now these cases of dilated hypertrophy were undoubtedly due to the constant exertion, and, as with rowing, any one having a tendency to palpitation, or finding it induced, ought to stop playing, or play very seldom. Instances like those quoted would thus become still rarer than they are. Under all circumstances, in the not too steady addiction to the game, in the intervals of rest, lies the secret which makes the violent exercise beneficial and not baneful. To study further the effects of the game, I have carefully examined a club of professional base ball players, who, of course, only play at certain seasons, and even then not incessantly, and I found their cardiac condition, as well as their general health, excellent. This is the record:—

A. J. R., age 34; height 5 feet 6 inches; weight 148 pounds. Has been an active base ball player for seventeen years; a professional player for ten. He chiefly plays second base, or acts as a fielder. His general health is excellent. After severe exertion he has at times a sharp twitch in the region of heart, but he never suffers from palpitation or shortness of breath. He has a wide chest; the respirations are 22 in the minute; the pulse is 72, firm, and strong. The impulse of the heart is rather forcible, and is felt in two intercostal spaces. The first sound is weighty, but on percussion the diameters of the heart are found to be normal.

John E. C., age 23; height 5 feet $7\frac{1}{2}$ inches; weight 170

pounds. Has been a professional player for eight years, chiefly as catcher; played occasionally before. Though he runs a great deal, is never troubled with palpitation or shortness of breath. His health is, indeed, excellent. The chest measures 35¾ inches in circumference. The pulse is 75, and full; the respirations are 18. The impulse of the heart is only felt in one intercostal space; the sounds and the percussion dulness are normal.

E. B. S., age 24; height 5 feet 8½ inches; weight 155 pounds. Has been a professional player for four years; for four years before played considerably. In the present club acts chiefly as third base, or short stop. Has always been in good health, but his health has been particularly good since he has been a base ball player; he never suffers from palpitation or shortness of breath. The chest measures 33½ inches in circumference; the pulse is 72, rather full. The respirations are 22 in the minute. The impulse of the heart is felt in two intercostal spaces, but is not very forcible. The first sound is well defined, somewhat heavy, the second distinct; the percussion dulness, though well marked, is not abnormal.

J. V. B., age 21; height 5 feet 10½ inches; weight 169 pounds. A professional player for one year—mostly second base—but has played for eight years in all, and actively for five. Lives largely on bread and molasses; is always in excellent health; has neither palpitation nor shortness of breath, not even after playing. He states, however, that he "blows" if he chews tobacco, and knows of many others who do the same. The chest measures 35⅝ inches; the pulse is 60, and full; the respirations are 16. Diameters of the heart and impulse are normal, the latter is of moderate force; the first sound perhaps a trifle weightier than common.

A. W. G., age 24; height 5 feet 9 inches; weight 155 pounds; the left field of the nine. He has been a professional player for five years; has played in all for eight. Attributes

his good health to the ball exercise. Six years ago he recovered from an attack of typhoid fever, two years ago from cerebro-spinal fever. Never suffers from shortness of breath or palpitation. The width of his chest is 33 inches; the pulse is 72, and full; the respirations are 18. The impulse of the heart is felt in two intercostal spaces; its force is moderate, and the percussion dulness, though large, is not abnormal; the first sound is, however, decidedly heavier than usual.

W. M. McG., aged 23; height 5 feet 8 inches; weight 152 pounds. Acts as short-stop or as catcher, and his fingers are jammed up from the force of the balls. Has played for eight years, three of which as an amateur. Suffers at times from dyspepsia, and has then occasionally palpitation; but this not during or after playing. Does not use tobacco or liquor, and excepting from the attacks of indigestion, has not been sick in his life. The measure round the chest is 34 inches—on full inspiration 36½. The pulse is 78; the respirations 20. The sounds of the heart and percussion dulness are normal; the impulse is well marked.

J. D. McB., age 29; height 5 feet 9 inches; weight 142 pounds,—the pitcher, as such, does much hard work, and has, he thinks, been pitcher longer than any man in the country. Has been a base ball player for thirteen years; enjoys excellent health, particularly during ball season, and never feels much fatigued after playing, nor has he ever shortness of breath or palpitation; is not a user of tobacco. The chest measures 33¾ inches. The pulse is 72; the respirations are 18 in the minute. The impulse of the heart is neither strong nor extended; the first sound is short, indistinct, somewhat murmurish at apex, yet there is no distinct murmur; the second sound is very sharply defined; the diameters on percussion are normal.

W. D. F., age 30; height 5 feet 6 inches; weight 138 pounds. Plays either second or first base; has been a professional

player for seven years, but has played ball since a boy. For the last few years has not been in as good health as usual, being at times a dyspeptic, and subject to biliousness—also to a winter cough, for which he spent a winter in the South. There is, however, no organic disease of the lungs discernible, though the facts mentioned may account for the cough, the shooting pains on the left side of the chest, the palpitation and shortness of breath noticed occasionally after running, but never lasting more than a few minutes—nor, indeed, appearing until resting after the match. The chest is well developed; the pulse 84; the respirations are 22 in the minute. The impulse of the heart is felt in two intercostal spaces, is of rather more than average force; so is the first sound heavier than usual, the second sound is distinct, but all are still within normal range, as is the well-marked percussion dulness of the cardiac region.

A. C. A., age 22; height 6 feet $2\frac{3}{4}$ inches; weight 206 pounds, with a full chest, measuring 36 inches; a splendid specimen of a man. He plays right field or third base, and has been a professional player for four years, but has been devoted to ball since boyhood. Never feels short of breath, even after a long match, and is always in perfect health. The pulse is 72; the respirations are 18 in the minute. There is nothing about the impulse, the sounds, or the size of the heart requiring comment. The pulse at the wrist does not seem so strong as the distinct cardiac impulse would imply.

From the statements made you will draw then this conclusion, that as regards the effect on the circulation, all active, even violent exercise, is only injurious when too steadily persevered in; and that it is the intermitting which protects, and which is the cause why these exercises and pastimes are less productive of cardiac affection than the hurrying and impeding of the circulation, occasioned less palpably, but more constantly, by certain occupations. Of course, in persons in ad-

vancing years, or when degenerative tissue changes are taking place, violent exercise, even short, may be the cause of a tear or injury; but I am speaking chiefly of the effect produced at an age at which such exercises are usually resorted to. Still, even then, as you have seen, there may be mischief, and you will have learned how a number of occupations, and many of our amusements, may lead to cardiac affection, sometimes by textural alterations, produced in any part of the heart or great vessels, but more usually by functional disturbance first, which, in its turn, ends in dilated hypertrophy. A valve trouble, when caused, is usually connected with the former class of cases. Yet I believe that the dilated hypertrophy of the second may terminate in valvular disease by the valve having become incompetent to close the enlarging orifice, which stretches as the cavities of the heart dilate and the muscular walls thicken. That this really happens you will see from the case I am about to relate to you, which, though it is not apposite as regards the cause of the dilated hypertrophy, is so as to the subsequent development of valve disorder.

B. L., a colored boy, thirteen years of age, was admitted in January, 1874, into the Pennsylvania Hospital. He stated that he had pneumonia about four years ago, and that during convalescence he was seized with acute rheumatic fever, which, though it greatly crippled his joints, did not confine him to bed. After his recovery he resumed his occupation of a farm hand, and notwithstanding that he began to suffer from shortness of breath and palpitation for two months before he sought admission into the hospital, worked laboriously for six weeks more, until his feet began to swell. When examined he was found to have considerable œdema of the extremities, much distress in breathing, and a frequent, irregular pulse. The præcordial space was notably prominent, and the impulse of the heart heaving, and distinctly visible even at a distance. The size of the organ was greatly increased; the transverse

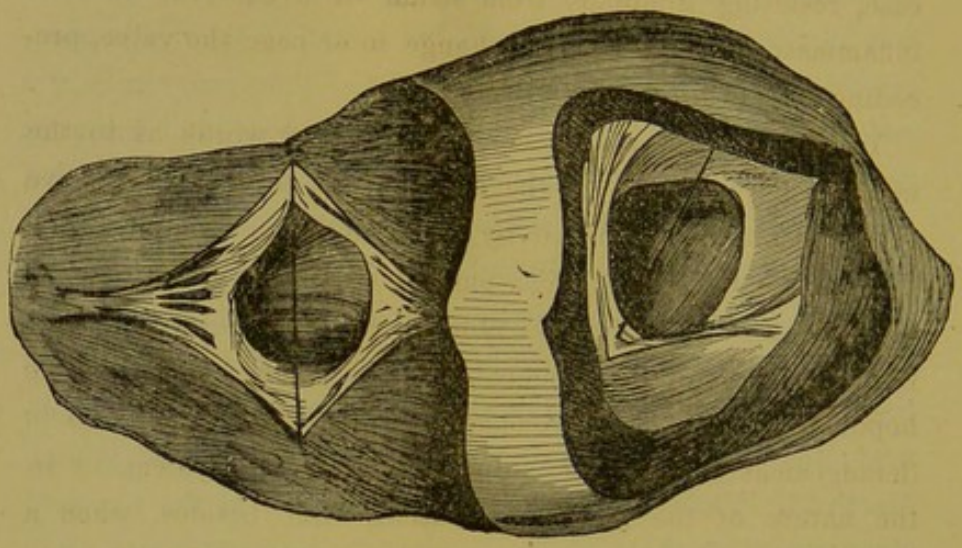
percussion dulness extended from beyond the right edge of the sternum to the axillary line. A systolic murmur was heard all over the cardiac region—and, in truth, over the whole of the left chest. Its point of intensity was at the apex, where it was distinctly musical. The second sound at the aortic cartilage was somewhat obscure; that at the pulmonary cartilage well pronounced—indeed, accentuated. The veins of the neck were swollen, but did not pulsate. A considerable effusion existed in the right pleural sac; the urine was scanty, of high specific gravity, but not albuminous.

Under treatment, chiefly by digitalis, scoparius, and iron, the boy was for a time greatly relieved, and the watery swelling almost disappeared. But the improvement was not permanent; the dropsy became very general, and he died exhausted, March 27. There was no difference to record in the physical signs excepting that, late in the case, the murmur lost a good deal of its musical character.

The autopsy, made five hours after death, showed considerable effusion in the abdomen and in the pleural sacs, an enlarged, nutmeg liver, a spleen firm, small in size, and very black, and the left lung adherent to the pericardium. This, with the inclosed heart, was found to occupy the whole of the lower part of the mediastinum, and to prevent either lung from being visible. The layers of the sac were tightly adherent, especially around the base, where the false membrane was very thick. The heart was enormously increased in size, the cavities were all dilated, especially those on the right side. The walls of the right ventricle were thin, in some places not more than a line or two in thickness; the walls of the left ventricle thickened. The valves of the aorta and pulmonary artery were found to be sound; those of the tricuspid valve, thin, flexible, and without roughening, still appeared competent to close the dilated tricuspid orifice. Not so with the mitral; they too were healthy, though not quite as thin and yielding as the tricuspid,

but they were inadequate to close the enlarged mitral opening. In the accompanying drawing (Fig. 2) the heart is laid open

Fig. 2.



along the septum, and the flaps are turned back, so that the valvular apparatus between the auricle and ventricle of each side shows. The valves are stretched with bristles, but it may be seen how utterly insufficient those on the right hand side of the drawing, representing the mitral valves, are to close the gaping orifice.

This case proves that dilated hypertrophy may lead to valvular disease. And no matter how the enlargement of the heart is brought about, the same effect may follow. Now, as we have found that dilated hypertrophy may succeed functional disorder from over-work or strain of the organ, we perceive the links of a chain, at one end of which is merely deranged action, at the other valvular affection; and for the latter to ensue, the stretching and increase of the heart must happen first. But you will ask me, does this often occur? I answer, no. Functional disorder of the heart from excitement of the organ is very common; organic changes in the walls and cavities, especially what is technically known as dilated hypertro-

phy, consequent to the over-action and strain, not uncommon. Yet this is, on the whole, not often followed by valvular imperfection. Probably the majority of instances of valve disease, resulting gradually from strain or over-work, have an inflammatory or other tissue change in or near the valve, preceding the affection.

You must allow me, in conclusion, a few words as to the management of some of the disorders of the heart we have been considering, produced by strain and over-excitement of the organ. Of course, I can only do so in very general terms, and not with the details of a clinical discourse. It is evident that the cause of the trouble must be removed if we are to hope for permanent improvement; whether that cause lie in derangement of the liver, stomach, or nervous system, or in the nature of the patient's vocation. But besides, when a heart is over-worked, or over-excited, we find certain agents to produce a most salutary effect. One of these is rest in the recumbent position. You know that there is a natural difference between the movements of the heart in the standing and lying posture. But, unless you have carefully noted the matter, you will scarcely believe how great the difference is in an excited organ. Its action may become twenty, thirty, forty beats in the minute slower. If, then, your patient rest on his back two or three hours a day, he will help himself materially; and, circumstances favoring, a day or two spent in bed, will not be time thrown away. Ice, applied to the præcordial region, is another agent that benefits, and will prove of service in some stubborn cases. Of medicines, I have found digitalis, belladonna, and the bromides, to be the most generally available; while in cases of beginning hypertrophy, no drug, in my experience, compares with aconite, steadily employed. But, I repeat, to endeavor, in any form of the affection, to remove the cause, is a prerequisite for success.

Yet the greatest gain from the study of the subject, its most

brilliant results, will come, if by the knowledge acquired of the manner of the production of heart-trouble, we can prevent its increase. The public, in the matter, err through ignorance, and it is our place to show them that the heart will not, any more than the brain, endure incessant and exhausting labor and excitement; that there are heart-weary as well as brain-weary persons; to point out how some occupations predispose to the disorder more than others, and how, therefore, the dictates of science, humanity, and true economy, alike demand that they be less continuously pursued; to make clear to them that certain habits—such as bolting the food, and constantly rushing after cars—may lead, indirectly or directly, to consequences little thought of; and how it may be the heart that bears the brunt of the irregularity and abuse, and not the organs which would appear the ones most likely to suffer. And you and I must make it part of our duty to impress these truths, and thus to prevent those slight beginnings of ailment which we both know may have grievous endings.