The breakdown of young soldiers under training explained, by Surgeon Major F. Arthur Davy; three papers originally published separately as

Three Papers dealing with the Evils of the former System of Recruit-Training; the first of which appeared in the A.M. Blue Book for 1876 (published in 1878) under the title —

"A Contribution to the Etiology of Heart disease in the Army".

Any further communication on this subject should be addressed to—
The Secretary,
War Office,
Whitehall,
S.W.1,
and the following number quoted.

War Office,
Whitehall,
S.W.1.

6th December, 1923

Dear Colonel,

The Director-General has asked me to pass the enclosed papers to you for the College Library. I find that Lieut-Colonel F.A.Davy to whom the papers belonged, died in 1919.

Yours sincerely,

R B. Ainsworth

Colonel C.B.Martin, C.M.G.,
R.A.M.College,
Grosvenor Road,
S. W. 1.

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General Sir William Leishman, K.C.M.G., F.R.S.,
War Office, Whitehall, S.W.

My dear D.G.,

Ten years ago Keogh and I tried to get some little recognition for Colonel Francis Arthur Davy, R.A.M.C., but while we were in the middle of our efforts the war broke out. Davy however sent me the enclosed papers at the time, but these, by some accident, have remained amongst my huge collection of literature, and I have only just found them. What has happened to Davy I do not know, nor have I got his present Address, if he is alive. I think therefore that I had better send you all the documents which he gave to me, in case you may like to put them into the library of your College at Millbank; and I do so herewith. He certainly did very valuable work.

Hoping that I am not troubling you unduly,

Believe me with compliments,
Yours sincerely,

Ronald Ross

Encls.

This is the only remaining copy of this booklet. The address to which it is to be returned is

Abbotsford
St. Margarets-on-Thames

2 Spring Terrace
Richmond
Surrey

1816 Limp Cloth

THE BREAKDOWN

OF

YOUNG SOLDIERS UNDER TRAINING

EXPLAINED:

BY

SURGEON-MAJOR F. ARTHUR DAVY, M.D.

~~13 Templeton Place~~
S.W.
Richmond Club
S.W.

WOOLWICH:
PRINTED BY F. J. CATTERMOLE, 20 & 21, ARTILLERY PLACE.
—
1883.

PREFACE.

I have been led to print, for private circulation, the three papers contained in this pamphlet in consequence of the difficulty of late experienced in obtaining recruits for the Army.

The perusal of General Sir Lintorn Simmons' paper in the July number of the "Nineteenth Century" will convince anybody that our first concern should be to seek for the causes of the waste of the Army, which he aptly likens to pouring water on a sieve. Men join, and within ten or twelve months are gone again in enormous numbers. This points, as far as desertion is concerned, to discontent with the life they have recently chosen.

The papers that follow are printed in order to draw attention to one special cause of discontent, and not only of discontent, but of disease: a cause of which the sufferers themselves are ignorant. I allude to the training to which young soldiers are subjected: a training presumed, and believed by the men to be a perfect system; but which is, nevertheless, a false and a disease-producing system.

It may seem bold to say this: and many, if they read so far, may think that it will be scarcely worth while to read further. They might grant me that no system is altogether perfect, and that as improvement in everything is progressive, so with recruit-training; but they cannot assent to the doctrine that radical defects exist, that have long been overlooked, in our training of recruits. Such persons will but read this preface.

Still, it is best to be candid, and to say that the contention of these papers is that we have been injuring the men we would benefit, and invaliding thousands who, under a proper system of training, would have well served the State. A few will read these papers to the end. To those who content themselves with the preface I would say that some very special reasons should be assigned to account for a discontent, among recently-enlisted men, represented by such figures as those given by Sir Lintorn Simmons, from whose paper I quote the following paragraphs. After giving in detail the figures representing the waste of the Army in its different branches, and the cost to the State of that waste: and after stating that these figures are obtained from the published returns "which cannot be repudiated by the Authorities," Sir L. Simmons sums up the waste by saying—

"The general result for the whole army is that out of 186,469 men who "enlisted during eight years, 47,648, or one-fourth, had disappeared before the "end of the year succeeding that in which they enlisted; and 54,993 before the "end of the second year, with an average of little more than ten months' "service. These men had cost the country the enormous sum of £3,150,000, "without yielding any return, the whole sum having been entirely wasted. "After making due allowance for death and disease, and for dismissal for "misconduct, it is clear that 45,000 fewer recruits would have been required "during these eight years to keep the Army up to its strength: and if waste at "subsequent periods of service were included, it could be conclusively proved "that from 7,000 to 8,000 fewer recruits would be required annually, if only the "men were contented, and remained in the Service during the periods for which "they engage to serve. As the actual number of recruits enlisted below 19 "years of age during the last 9 years has been only 58,898, it is evident that if "this costly and useless waste could have been prevented, it would not have "been necessary to enlist any of these youths, and the army would still have "been complete to its establishment. This is a clear and definite answer to "those who say we cannot keep the Army full without enlisting boys."

Again he says—"The young soldiers by thousands yearly purchase their "discharges, or desert, while many break down under training, and return to "their homes without pensions, to drag out a miserable existence, and earn their "living as best they can, as invalids." And, in a foot note, "5581 men under "21 years of age have been discharged during the three years 1880-81-82; and "7,177 deserted during the same three years, having less than one year's "service."

In another place he says—"There can be no doubt from the General Annual "Returns presented to Parliament that, during the last ten years 150,000 men "have quitted the ranks of the army, and returned to civil life, who almost to a "man will give it a bad character, and whose testimony would act as a powerful "check to the blandishments of the recruiter. These are exclusive of men who "have gone to the reserve."

"The conclusion"—writes General Sir L. Simmons—"arrived at from the "foregoing considerations is that the outflow of men from the army must be "stopped without delay;" and his important paper ends with a warning that, if nothing be done, we shall quickly come within measurable distance of conscription.

The most grudging critic will surely allow that the training *may* have something to do with the discontent, and therefore may be worth examining into. For, what is more likely to influence men, to make them content or the reverse, than the details of their new calling? Are these details all they should be? Can they be improved? Is the invaliding of young soldiers in any way connected with the system of training to which they are subjected? Is the desertion of the men from the ranks brought about by it, even in a small degree? Is it dislike of the restraint of discipline that makes them desert, or is it something in the training that makes them physically uncomfortable? (They cannot earn their living at *anything* without some kind of rules and regulations and discipline.) At all events how you train a man will affect him *somehow;* and these questions are worth the trouble of considering. Young men are being invalided, and are deserting, in great numbers: Should we leave a stone unturned to find out why? No: Then let us turn this stone—their training.

For the information of those who do not know the extent to which the heart and lung diseases of young soldiers contribute to "the waste of the Army," I give what the late Dr. Parkes says, in his "Hygiene," on the subject.

"Out of 100 men discharged (*i.e.*, invalided) under two years' service, heart and lung disease together constituted in one year 47·85 and in the other 40.59." (The period referred to is from 1st July, 1860, to 30th June, 1862.) "In order "to form a standard of comparison which cannot be obtained from the civil "population (as deaths only are recorded in the Registrar-General's returns), I "compared this amount of heart and lung disease among young soldiers with "the same diseases among the invalids of all ages at Fort Pitt in two years. "The following numbers came out:"—

	Percentage of heart-diseases as causes of Invaliding.	Percentage of lung diseases as causes of Invaliding.
Invalids of all ages - - -	7·7	19·8
Invalids under two years' service	14.23	29.99

"Heart and lung diseases, therefore, form a much larger percentage among "the young soldiers; and this would have come out more clearly still had the "number of young soldiers been deducted from the number at all ages."

"How is this to be accounted for? The recruits are carefully examined; they "have no heart or lung disease," &c.

On the same subject Professor Maclean said, before a Meeting of the Royal United Service Institution:—"I had not been long in the position I have the "honour to fill in the public service before I became profoundly impressed with

"the vast losses sustained by the prevalence in the army of consumption, and "diseases of the circulatory system, that is, of the heart and great vessels. "Within the last three years, excluding those who die in regimental and depôt "hospitals, and those of the Household Troops (I exclude all invalided in "Ireland, of whom we at Netley see nothing), no less than 1,344 men have been "lost to the Service from consumption alone . . . . . From the date "of my assuming charge of the medical division at Fort Pitt, in April, 1861, to "the end of last year, no less than 883 cases of diseases of the circulatory "system—in other words, a number nearly equal to the strength of a battalion— "have passed under my observation, and been lost to the Service, and this from "one class of disease; the great bulk of the cases being young men returned to "the civil population (that is, cast upon their parishes), and incapable of earning "their bread in any active employment. The pension allowed to such short- "service men is but a pittance, and that pittance is granted only for a limited "period. Let me remind you again, that in the figures I have given, the invalids "of the Royal Artillery, the Guards, and the troops serving in Ireland, are not "included: *they* were discharged without being seen by us at all."

"Surely, gentlemen, you will agree with me, after hearing a statement so "startling, that it behoves us to look narrowly into a question involving such an "amount of suffering, costly invaliding, and inefficiency, with a view to the "adoption of a remedial measure."

A grave and startling statement assuredly. And matters are no better to-day. Why? Because the same unphysiological, and therefore disease-producing "training" that obtained in those days, obtains now. No real remedial measure was adopted, because the evils of the training were not recognized. Evils! It was not supposed to contain any, but to be beneficial to the soldier in every way.

The first of these papers was published in the Army Medical Report for 1876. The second and third papers were submitted for publication in subsequent reports, but, for want of space, have not been published. I was fortunate to obtain a place for the first, however, which deals with the chief evil of the training: for, as a military paper truly said, on the issue of the Blue Book containing it—it is nothing short of a "revolution" that my reasoning points to. Such a programme—I did not undertake it lightly—will turn aside many a reader; but it will be allowed, I think, that nothing short of a revolution of some kind will check the waste of the army shown in the Official Returns. There are revolutions for the better.

The "advantages of the Army" are proclaimed by the Authorities in vain while the outflow of young men continues at its present, or anything like its present, rate.

Any and every possible cause of discontent, and of breakdown in health, should be looked to: and why not the training?

F. ARTHUR DAVY, M.D.,

Surgeon-Major, A.M.D.

Woolwich,

July 18th, 1883.

A CONTRIBUTION

TO THE

ETIOLOGY OF HEART-DISEASE IN THE ARMY.

(from Appendix to Army Medical Report for 1876.)

Mr. Myers has done good service in bringing into prominence, by means of his essay—the "Alexander" Prize Essay—the causes which, in his opinion, are at work in the production of heart diseases in the army: for, the disability under which the army has laboured, in this respect, and continues to labour, is very great indeed. He points out the much greater prevalence of heart affections of all kinds among soldiers than among the civil population, although soldiers are most carefully selected:—and after giving due prominence to such influences in the production of organic and functional cardiac diseases as Bright's disease, acute rheumatism, abuse of alcohol, syphilis, excessive smoking, &c., he rightly sums up that some other cause—to account for the excess—must be at work which is not at work among the civil population; and that that cause is to be found in the mechanical obstruction to the circulation which is exercised by the tightly-fitting clothing and accoutrements of the men. I am fully sensible of the importance of that conclusion; and it is much to be regretted that the soldier's dress, as now regulated, does not allow that complete freedom from constriction, which, when work is expected of him, he ought to enjoy. But taking, as I do, mechanical obstruction to the circulation, and excessive strain on the heart, to be the causes of the excess of heart diseases among soldiers, I think it is to be regretted that, in the admirable essay alluded to, the conditions by which mechanical obstruction and excessive strain may be brought about, are not more fully considered. One condition, or rather set of conditions, which exercises a powerful influence in the causation of heart disease in the army has not been discussed. It will be the object of this paper briefly to point them out. I allude to the manner in which the early training of the recruit is conducted. Mr. Myers' book has only the following paragraph on the subject. He remarks on the severity of the drill, but does not say in what the severity of it consists; and no solution is offered of the exhaustion induced by it:—"The training of recruits should extend over a longer period, and, like gymnastics, should not be severe at first. I have often seen recruits perfectly exhausted after their morning's drill, and I am led to believe that the course of instruction they undergo is, owing to its severity, particularly obnoxious to them, and it is one which, with the present uniform, is very apt to lay the

foundation of much heart disease in the army." This exhausting drill is not further considered, but Mr. Myers' remarks constitute strong evidence against it. Training ought not to result in exhaustion; if it does it is bad training. I hope to make it plain, in the few short paragraphs which I can devote to the subject, that cardiac irritability, resulting from deranged innervation of the organ, irregularity of rhythm, inequality in strength in the cardiac contractions, as well as hypertrophy and dilatation, with their possible consequences to the efficiency of the valves and to the aorta, have their starting point in a great proportion of the cases invalided in the orders of the drill-sergeant; and that in obedience to him mechanical obstruction and strain are imposed on organs (especially on the heart) the integrity of which it should be the object of all training to preserve.

2.—It will be well to state, at the outset, that I base the claim of the argument on a consideration of the degree in which the physiological conditions, under which the heart and lungs perform their functions, are altered by the treatment which the recruit undergoes from the commencement of his career; and that the resulting mischief bears a definite proportion to the degree of this alteration in each individual recruit. Those are most injuriously affected who most accurately carry out the orders of the drill-sergeant. Now, I do not say that tight uniforms and ill-adjusted accoutrements do not aid in producing the unhappy result; their adverse influence has been amply demonstrated: but I do say that if the clothing exercised no injurious influence whatever, mechanical obstruction to the circulation and excessive strain on the heart can be brought about by other means. I will now consider the means to this end provided in the drilling of the recruit.

3.—The improvement of the physique of the recruit being the object in view, the following is one of the modes in which it is attempted to attain it. He is made to stand bolt upright, his head well back, and his chest, being dilated to the fullest inspiration, is *kept* as much as possible so dilated. I need not specify this attitude of "attention" further; an attitude useful for no kind or description of work. This artificial dilatation of the chest is the point on which I wish to fix special attention. I will show good reason for calling it artificial later on. Now, let it first be conceded that the regulation drill-sergeant regards this expanded condition of the chest as the chief object to be attained in the recruits standing before him. He calls it "setting-up drill." The drill would not deserve the name without it. Any recruit in the squad who does not keep his chest thrown prominently forward, and fully expanded, soon has his attention called to the fact. For anybody who will not concede this point, the following remarks will have no weight. I believe the surgeons of the army will concede it. We have, doubtless, all remarked the manner in which the soldier dilates his chest, and keeps it dilated, when he is about to be examined with the stethoscope: much to the annoyance of the surgeon. It is the lesson taught him when he joins: he is to the manner trained, not born; for in examining men for enlistment, I have never seen this dilating of the chest resorted to; as civilians they do not think about their chests. Need I add that the caricaturist of the soldier never omits to represent

him with an abnormally large and prominent thorax. Perhaps even such a fact may point to an important truth. But without any remarks like these, I think it will be allowed that the condition described is forced on the recruit by the "setting-up drill." Though conceding the point, an objector may ask, "What harm results; the training is supposed to be beneficial; and large capacity of chest is an advantage?" To that matter I shall come presently; now merely remarking that increased capacity is of no advantage when obtained at the expense of mobility. But I may reply for the moment by asking how (if no harm results) is the "severity" of the drill which Mr. Myers proclaims, but does not explain, accounted for: or the exhaustion which he has seen, as I have, result from it? If merely prolonged drilling produce it, say under a hot summer sun, how is it that the drill-sergeant is not overcome or "exhausted"? He has the additional work of vociferating loudly all the time. If his being older has anything to do with it, so much the more reason for dealing gently with the recruit. No doubt he exemplifies in his own person the attitude he wishes the recruits to assume, but he does so only occasionally and momentarily. They are compelled by him to *maintain* this attitude, while he walks abouts with his hands behind his back. By an application of the law of survival, or rather non-invaliding, of the fittest, he remains to victimize as he has been, perhaps, victimized, to some extent himself.

4.—Let us now approach a body of dilated recruits as they are being drilled and examine one of them. The first thing to be noticed is that there is the great elevation of the ribs of full inspiration, even the scaleni muscles being in action. There is also great depression of the diaphragm; and the sternum is thrown forward. Our eyes are just being attracted to the abnormal character of the heart's impulse, when we mark with surprise that this distended condition of the lungs does not give place to a properly performed expiration; that little descent of the ribs occurs, or adequate elevation of the diaphragm: in other words, that the act of expiration is, to a great extent, in abeyance. This, because the recruit knows that he must, at all risks (discomfort notwithstanding, in most cases it does not amount to more at first), keep his chest expanded. Now, what consequences must certainly follow when this so-called training is persisted in day after day. I shall not speak of the heart just now; the consequences to it, of this training, are direct and immediate, as well as indirect. We know how inter-dependent the heart and lungs are; how influences affecting the heart soon affect the lungs, and *vice versâ*; but it must at once occur to the mind that, not only will the forces by which the important act of expiration is to a large extent accomplished in health (the elastic recoil of the lungs and of the chest walls) be, by repetition of this training, gradually diminished in power; but that, as the man stands before you, the blood in his lungs must be undergoing a deficient aëration. For as the diminution in size which takes place in the thorax when expiration is properly performed does not occur, it must follow that the air in the lungs charged with carbonic acid is not expelled to the usual extent, to be replaced by new air from without. Now in active

exercise of any kind, it is of the last importance that expiration should be efficiently performed. Under these circumstances, a greatly increased quantity of carbonic acid having to be got rid of by the lungs, the respired, or charged, air needs to be expelled by strong expiratory movements, and fresh air inspired. In other words, the elastic power of recoil of the lungs and of the chest wall needs to be unimpaired. In very few soldiers have I found it so. The drill which the man before us is undergoing cannot be described as active exercise, and that is the only reason why the position is tolerable at all. Further reasons, showing that the chemical functions of the lungs are impeded by the maintenance of this attitude, will appear when the effect of it on the heart is being considered. Before proceeding to the latter I must add —what we should have noticed when inspecting the recruit at his drill—that in the gradual weakening of the forces by which expiration is normally performed, the overstretching to which the abdominal muscles are subjected by the training, is a very important factor. In normal expiration, the contraction of these muscles diminishes the cavity of the chest by pressing the viscera against the passive diaphragm, and so elevating it. In the artificial condition I describe, they are not only weakened by overstretching for this work, but their action is antagonized by the diaphragm being *kept* depressed.

5.—I think it will be admitted, from the foregoing account (which I might extend by a full review of the mechanism of normal respiration —if this were necessary), that the degree in which the physiological conditions under which the expiratory act is performed in health are altered, is great. This alteration cannot take place with impunity. Pathological states commence when physiological conditions are departed from :—but I doubt, as concerning the result to the lungs, that the word "pathological" will be admitted by all. For myself, I am convinced that vesicular emphysema, to some extent, occurs in nearly all the men—during the period of this training—from the continued and excessive distension of the air vesicles. Hypertrophy of the elastic parenchyma of the lungs might be expected to occur on the "ubi stimulus ibi fluxus" principle; but if it does it will not be compensatory and tending to the restitution of expiratory power; but will cause pressure upon, stretching of, and partial obliteration of, the functional blood-vessels,—the pulmonary capillaries. I conclude, then, that you may increase the measurement of the recruit's chest rapidly in this way; but that you do so at the expense of its mobility—at the expense of vital capacity: and that the recruit is thereby more or less unfitted for active exertion—one reason for which result I have already given.

6.—It has been shown that, sooner or later, the drill becomes distressing to the recruit. He is distressed, but still uncomplaining. It will be right now to inquire why it should so distress him. If good reason can be shown why it must distress him, and in some cases (as Mr. Myers has it) even "exhaust" him; it being at the same time admitted that exhausting, or even distressing, drill, cannot commend itself, on due consideration, to any well-regulated mind—then I consider that a claim will have been established to have this injurious drill

discontinued. We noticed when inspecting the recruit at his drill that the cardiac impulse was abnormal. We must now see more minutely what is taking place. We cannot hear his heart beat as we stand before him—I daresay he hears it himself and feels it too—but we can learn a great deal by watching the cardiac region narrowly. The organ, as I said, suffers early; and even before the man thinks of complaining a pathological condition has commenced.

7.—I propose, then, 1st, to describe the abnormal manner in which the heart acts in the dilated chest; 2nd, to give the causes of its abnormal behaviour; 3rd, to state why both one and the other (*i.e.*, the effect and its causes combined) produce exhaustion, or distress, or discomfort, or a mere feeling of irksomeness, as the case may be. Lastly, to consider the pathological states of the organ which may be induced.

8.—Now, I shall be excused undertaking for a few moments this task, which is the chiefest part of the inquiry in hand, in order that I may disclaim any intention of exaggerating the consequence of this "training." A cause loses much by being over-stated: more especially a cause like this, with tradition, prevalent mistaken notions of what "physique" means, military views, popular ideas, all against it. I would even take lower ground than Mr. Myers takes in the paragraph which I have quoted from his essay, lest it should be thought that I merely argued from the true and weighty statement which he makes, and leaves unsupported. It will be understood that I raise an issue quite distinct from the question of tight uniform and accoutrements, to which I shall, however, just allude presently. Now, pathological processes of great importance may proceed very quietly, and attract at first no attention on the part of the sufferer. Let us say the average recruit—speaking of those who withstand it best—would describe his dilating drill as merely irksome; or he might call it discomfort: I do not think he would often call it distress—at least in the earlier days. Some find themselves much distressed. But when the course of drill is over, he is just in the condition of heart (as we shall see) to be most injuriously affected by the next part of the training. For now come the pack, and the straps, and the rifle—too soon; for of the many hearts whose irritability or actual hypertrophy, established in the drill-field, had not been so great as to cause complaint to be made, what a large proportion will rebel at the additional load. If only an interval of rest had been given for that great power of recovery which the heart, in common with all other organs, possesses, to come into play, very many who are ultimately invalided, or who die, might be saved to the service. Officers in whom this "chest" drill induces this condition—about to be more fully described—are saved at this stage. There is no pack for them. They are free to recover—the private is not. Further, I would not be understood as saying that, in a short time, the men who suffer break down utterly, and become unfit for duty of any kind. This is the result to many of them. But I am sure that in the great majority of cases of heart complaints invalided (other than those brought about by rheumatic fever, Bright's disease, &c., of which the history is to hand), the early link in the pathological chain was forged on the drill-

field. There has preceded the date of appearance at hospital a long period of uncomplained-of discomfort, often distress; consisting of breathlessness on slight exertion, headache, and "beating." Now exertion has become unbearable. A man who never knew he had a heart (an expression many a soldier has used to me), becomes aware of his possession after a few months' dilating drill. He blames his recently-donned pack and traps for his trouble; forgetting that as a civilian he could have carried them manfully across country for ten or fifteen miles. Now, has this man been enlisted by mistake? Or have we made him what he is?

9.—This has proved more of a digression than was intended. To return: We find then, firstly, that in the distended chest the cardiac impulse is lower down, and nearer to the middle line than it ought to be—the site of impulse often varying in successive beats: its area appears to be increased; it can be even *seen* to be abrupt and jerky, and in many instances there is marked epigastric pulsation. On placing the right hand firmly against the cardiac region, and the left on the back, we find the cardiac systole to be much more powerful than is natural; so much so sometimes that it shakes the body visibly. We are surprised at this, for the man has been only standing; and this excited action exceeds what would be expected even during active exercise. The condition of the walls and floor of the chest is maintained as before described; the respiration (shallow, and therefore increased in frequency), being performed by deficient elevation of the diaphragm (complete relaxation of it being prohibited) and very slight descent of the ribs; followed by the only further enlargement—by way of inspiration—that can take place: and this is very small, for lateral expansion has already been attained almost to the uttermost limit. The heart contracts about 110 times in the minute, the rhythm being irregular both in time and force, in many cases. The right ventricle is found to be acting unduly. The respirations average 40 in the minute. There is a curious mixture of anxiety and resolution visible in the recruit's countenance. The man before us may have no hypertrophy as yet; and no murmurs indicating valvular inefficiency can be heard.

10.—Now, secondly, the state of heart just described points to impediment—to obstruction to the circulation. We shall now see how the obstruction comes about. Tight clothing, &c., may well be a cause of obstruction from without. I shall show that the attitude which the recruit is compelled to assume and *maintain* (for here lies the mischief) is a cause, more powerful, of obstruction from within. Let it be remembered that "as the thorax is a closed cavity, in which a partial vacuum is produced by the act of inspiration, whilst its contents are compressed by the act of expiration, the former state will favour the movement of blood from the large veins on the exterior of the cavity towards the heart, whilst the latter condition will retard it." This quotation is from Carpenter's Physiology. This author then proceeds to detail an experiment (to quote again) "showing the suction-power of the inspiratory movement, and the expellent force of the expiratory act." I will, further, copy the sentence next following

in this well-known work. It is this :—" On the other hand the expiratory movement, while it directly tends to cause accumulation in the veins, will assist the heart in propelling the blood in the arteries." Can any one question the importance of these (or of any other) physiological laws? What, then, if the act of expiration be, to a great extent, in abeyance? A disturbance of the balance, which exists in health, between the pulmonary and the systemic circulations. This is the inevitable result—as we shall see. But will not the balance be restored as soon as the recruit is free from his tormentor, and allowed to breathe as nature would dictate? Yes, the balance will be gradually restored, and the heart will become quieter, only to be disturbed again at the next drill-hour. This is the manner in which we produce " physique "—the synonym for looking formidable on parade, and being useless for work: or else for doing the work in a condition of discomfort, distress, or exhaustion, as the case may be. I regret that I am betrayed into remarks such as these; but the British soldier is very brave. No man likes to " give in " less than he does. It is nothing short of pitiful to see him trained to break down, when the necessary " physique " might be secured by a little judicious padding, instead of at the expense of the heart and lungs. Considering that he is selected for being likely to prove efficient, I hold that—in time of peace at all events—the chances as regards heart disease are in his favour, rather than in favour of the civilian. I cannot now discuss this point. I am endeavouring to confine myself to the question of the artificial dilatation of the thorax embodied in the order " Swell your chest "; and just now to the manner in which the balance of the two circulations is disturbed by it—but I commend it to the serious consideration of the surgeons of the army, as being a tenable position, if only we would allow the soldier to breathe at all times physiologically as the civilian does—tight clothing and weight-carrying, in both cases, notwithstanding. The inspiration, then, a deep one—which the recruit takes at the word of command—produces physiologically an acceleration of the movement of blood from the large veins on the exterior of the chest towards the heart, which movement of blood towards the heart *had been retarded by the previously-occurring and duly-performed expiration.* Now, as expiration is not, after the word of command, again duly performed, and as the position of the thorax is one of deep inspiration and remains so—the diaphragm doing little to diminish the size of it, and the elastic recoil of the lungs and chest-walls being overcome by voluntary effort, does it not follow that, in a given time, a larger quantity of venous blood will have passed into the right side of the heart, than would have passed if the check, or retardation, which the expiratory movement properly performed exercises, had been imposed? I do not quite contend for a " vis a fronte "; if that were established for a moment, it would soon be disestablished. The right ventricle contracts vigorously, but the blood it drives forward for aëration cannot part with as much carbonic acid, or receive as much oxygen, as if respiratory movements were normally succeeding each other all the time. The degree in which the exhalation of carbonic acid suffers hindrance is in direct proportion to the impurity

(CO_2) of the air in the ultimate air-vesicles. This air is only changed (if it can be spoken of as being changed) by the law of diffusion of gases; but in the absence of efficient expiratory movements this law is at a considerable disadvantage, for the purpose required. If the recruit be now required to double—and when he is, he must maintain the same dilated state of chest, or be struck by the drill-sergeant below the epigastrium with a pace-stick—the dyspnœa is quite urgent. The right ventricle is much embarrassed. Now, this training causes dilatation in some, hypertrophy in others, both in most of those who suffer. Some do not appear to suffer. On inquiry you find these latter are nearer twenty-four than eighteen years of age. Even these may be the worse (without knowing it) for the drill. I would once more recall Mr. Myers' remarks to notice—the "severity" of the drill—the "exhaustion" he has seen. I think dyspnœa would be a good name to give to the exhaustion. Without saying more, it would call up the conditions which give rise to it. Dyspnœa in the recruit's drill-field means obstruction to the circulation, and obstruction to the circulation means excessive strain on the heart. This, again, means pathological changes in the shape of hypertrophy, with or without dilatation; and this, further, *may* mean (though, perhaps, it rarely does) inefficiency of the valves—for, if the orifices increase in size, the valves do not.

11.—Now, the systemic circulation is also injuriously affected, for the engorgement of the lungs, arising as described, must, however slight, result in a retardation of the current of blood in the pulmonary veins, which is taking place towards the left heart: and not only so, but the arterial blood reaches the left ventricle insufficiently oxygenated and also in deficient quantity. For not only is the lining membrane of the pulmonary veins extremely sensitive to the passage of impure blood, but a most important movement—which is, perhaps, one of the chiefest aids to the advance of the arterialized blood towards the left auricle—the expiratory movement, is being held in check. The force of the right ventricle may be said to be expended in sending the venous blood to the pulmonary capillaries, and as some obstruction is already there, the pressure exercised normally on the pulmonary veins in expiration is much needed to maintain the circulation in them. The right ventricle does all it can, and hypertrophies, that it may do more by and bye. The left ventricle receiving blood deficient in quantity and in degree of aëration, the wants of the system are not duly supplied, and the muscular and nervous structures of the heart itself must suffer. But the contraction of a deficiently-filled ventricle is mischievous to the ventricle, as is also that of an over-distended one. And distension of one side, and an insufficiently-filled state of the other, constitute, it must be admitted, a disturbance of the balance of the two circulations. Can we wonder, then, that when examining the recruit at his drill, we found his heart in the condition described? Is there not ample cause for it? The fact is, that expiration is forgotten (what does the drill-sergeant know about it?), and the erroneous opinion prevails that the man with the dilated chest is a fine, able, soldierly, fellow, although he might not be able to blow out a candle at a distance of two and a-half feet.

12.—We shall see, on a little further inquiry, that the "swelling" of the chest, ordered by the drill-sergeant, is totally indefensible; and nothing but evil can follow it. It should be recognized that the full powers of expansion of the lungs should never be exerted by an effort of the will—except under peculiar circumstances. For instance, the singer—in anticipation, not of the requirements of the system, but in order that he may have the requisite amount of air to expire for the execution of a passage which would suffer in effect if broken by a fresh inspiration—expands his chest to the full extent, to contract it again gradually but *immediately by a correspondingly deep expiration*. We take the same precaution in reading aloud, if we do not wish to draw our breath in the wrong place. It is for such requirements as these that the respiratory movements are placed so much, in the human subject, under the control of the will. But who will show that the breathing of the soldier on parade, marching, or doubling, should be conducted otherwise than automatically? The chest movements ought to vary in extent in accordance with the amount of blood sent into the lungs for aëration; which amount of blood, again, ought to be regulated by the natural forces which accomplish the movement of blood in the veins: but they ought not be impeded by attention being in any way directed to them. Much less should they be grievously hampered in the way I have described. The movements of inspiration and expiration (to put it more plainly) increase in depth, when the body passes from a state of rest into one of activity, for two reasons. Firstly, because the blood reaching the pulmonary capillaries is now flowing towards them more rapidly, owing to the pressure exercised, by the muscles, on the veins throughout the body. Secondly, because the demand for oxygen by the system is increased, owing to the increased chemical changes which take place as a consequence of muscular contraction. Now, the degree of chest-expansion which the recruit, as he stands to be drilled, is made to assume, is greater not only than would be automatically dictated by the conditions in which he is placed, but is even greater than that occurring as the physiological consequence of active exercise:—a degree of expansion, indeed, which *ought* to imply that vigorous muscular aid to the venous circulation was obtaining, and that, too, accompanied by movement of (as against a stationary state of) the body. Let us add these two conditions, making the man double—remembering that the chest *must still be kept* fully expanded—and what do we produce? At the very least we produce, as already shown, lung congestion, embarrassment to the right ventricle, and the consequent troubles which I will not again write of.

13.—We come, thirdly, to the manner in which the recruit's distress is brought about. I find I have written diffusely, and that, under the previous headings, I have, perhaps unavoidably, shown that dyspnœa is a certain consequence of the respiratory movements being impeded. I need not now repeat how: but I will say once more that expiration is as important as inspiration. For four hours a-day is that important act, to a great extent, in abeyance—and that for a period of about six months—for the recruit. Dyspnœa then, according to its degree, involves exhaustion, distress, discomfort, or a mere feeling

of irksomeness, as the case may be. I have said that those who most accurately carry out the drill-sergeant's orders suffer most. Now, some men can attain, owing to their figure in general assisting the effect, a degree of thoracic prominence sufficient to please the military eye, without any very great hyper-distension of the lungs with air. Even for these the word "irksomeness" would, as a rule, but feebly express their sensations. There are other men who, being less shapely—being indeed, younger and unformed—can escape rebuke (and such rebuke! consisting of blows over the solar plexus, and very hard words) only by distending the chest with air to such an extent as speedily induces almost a doubling of the pulse-rate: of which result the deficient supply of blood to the left ventricle is the explanation. *These* men are distressed urgently, *in a few minutes*. An order to "stand easy" has not yet restored the disturbed balance of the pulmonary and systemic circulations, when this unphysiological process is commenced anew. This is obstruction to the circulation from within. It is worse than that (of tight uniform or accoutrements) from without. For, in the latter case the cause of the mischief is apparent to the sufferer—he can, and does in the fight, remove it. But he cannot know—and if he does he cannot remove—the disability inflicted on him in the drill-field: the existence of which it only required a little extra work and weight-carrying to make manifest. I say "a little" advisedly: for before enlistment has not the recruit either laboured all day in the field, or worked at his trade all day long with impunity? He must have done so, or he would not have been enlisted. The results of acute rheumatism to the valves we know:—the palpitation and irregularity of heart's action due to anæmia, general debility, or hysteria, we also know: but what is this? It is the result of the recruits being "perfectly exhausted by their morning's drill," and afternoon's drill too, day after day. Even if it could not be shown to be injurious, does not common sense disavow such a mode of training? Mr. Myers condemns it from this point of view, giving no reasons. It may well be that he thought they were unnecessary. He holds this mode of training to be "one, which, *with the present uniform*, is apt to lay the foundation of much heart disease in the army." Now, in support of Mr. Myers' opinion to a certain extent, and in continuation of, or deduction from, my argument, I will state that the training of the recruit as now carried on is—with, *or without*, the present uniform—*certain* to lay the foundation of much heart disease in the army. Dismissing this important subject in a few lines, Mr. Myers says: "The training of recruits should extend over a longer period." This would be quite unnecessary, as far as regards their well-being: the cause of the distress being pointed out, remove the great element in the training which induces it. Mr. Myers proceeds: "and, like gymnastics should not be severe at first." It should not be severe first or last. Train a man for severity, but, in the training, stop short of severity. I am now alluding to natural fatigue—the result of healthful work or training—which, of course, should not be excessive, except for urgent military reasons.

Fourthly, and lastly, what pathological changes may be induced by recruits' drill?

It is too much the habit to say that cardiac affections are merely functional, when we do not happen to hear cardiac murmurs. Functional disturbances of cardiac action may be and often are accompanied by murmurs; but, when do we see such a case in the soldier? The fact is that, examine as we may, we cannot find the organ, or decide upon the general condition—say of anæmia or plethora—which is to blame for this so-called "functional" disturbance, in the soldier. The case, at first sight, looks much less urgent, much less serious, than functional derangement, properly so called. Look, then, for organic disease. What other name can you give to hypertrophy? This is not to say that you cannot have a case of irritable, or "soldier's heart," without manifest hypertrophy; but neither is it to say that "soldier's heart" does not result from organic changes in the organ. Hypertrophy is very common in the army, and the manner in which it is certainly brought about by this drill (commencing in the right side) has been shown. Now (without repeating how), we saw that the blood reaching the left side of the heart was deficient, not only in degree of aëration, but in quantity, during the drill. The coronary arteries, then, convey more or less impure blood, in a deficient stream, to the muscular and nervous tissues of the heart. We also saw that the expiratory act is a powerful aid to ventricular contraction (Carpenter). The conditions of healthy ventricular contraction being so much altered, is it to be wondered at that rhythmical irregularity—due to partial arrest of the ventricular contraction—may be produced by a disturbance of the balance of power between the pneumo-gastric and the cardiac ganglia? Or, more commonly (Dr. Fothergill says), between the opposition offered to the blood to be driven and the power to drive it? Rhythmical irregularity is frequently associated with dilatation—though not necessarily so. We have a case of it now in hospital, of which the immediate exciting cause appears to have been very excessive muscular effort, in that much-to-be-condemned sport called "tug of war." (May I remark that when the tug of real war comes, such supreme muscular efforts are not wanted: staying power; weight-carrying power; presupposing an unimpaired condition of the heart and lungs—these are the qualities we look for.) There was no tight clothing in this case; but the right ventricle suddenly received more blood than it was able to dispose of, by the general and excessive muscular pressure on the venous system. This by the way. Valvular deficiency, though the valves be healthy, may result from distension of cardiac orifices. It would be beside the object of this paper to allude further to the possible consequences of the mischief commenced on the drill-field. It is right to say, however, that the great majority of the soldiers do not *complain* of recruit's drill. They endeavour to adapt themselves to, and to put up with, their new life and the inevitable distension; knowing that the better they do it, the sooner will they be delivered from the tormentor. Now, I will say again—though much repeating myself, I fear—that albeit the pack and other accoutrements may bring the mischief to light, they have only aggravated what they have been supposed in all cases to originate; *i.e.*, the

excess of heart disease which obtains in military as compared with civil life.

I submit that I have shown that the mode of dealing with the recruit's chest is artificial, being in contravention of physiological laws; that it is injurious, and that to the most important organs of the body: that the causes of the visible embarrassment of the recruit's heart under training have not, in his interest, been sufficiently considered: that the embarrassment of the heart itself, which the training infallibly induces, has not been suspected of a significance that its continuance for many months for three or four hours daily might (as it does), induce organic disease;—in a word, that the recruit is the victim of the drill-sergeant's ignorance and superstition. I will add (though I deprecate making any remarks that may appear to be beside the question), that the evil is all the greater because it is done in the name of good. It is difficult to root out errors that have long prevailed, and the army is very conservative. But this expiration question ought to be attended to. The remedy is quite a simple one. It could be effectively detailed on one of these sheets of paper—and handed, if authority were given—to every sergeant or corporal who henceforward drills a squad of recruits. The men would work well because they would feel well; they would go through thrice the amount of actual exercise, and return to their barrack-rooms undistressed and un-"exhausted." For, were they not selected only the other day as in all respects eligible? This point does not receive the attention it deserves. We ought not to treat it as inevitable, or say, in an indifferent, off-hand, way, "better invalid him," when we find a young soldier of only a few years' service—who has yet had none of the vicissitudes, but the contrary, of military life—never abroad perhaps, better off in, than ever he was out of, the Service—suffering from hypertrophy or dilatation, or both, or these combined with and causing valvular insufficiency. There has been no rheumatism or Bright's disease. He may have had syphilis. (Comparatively, how few heart affections can be put down to this cause?) Why is his heart hypertrophied? Why is he breathless except when at rest? Because he has been a "man of war" (without seeing war), for a year or two? What would have been the chances against his finding himself in his present plight if he had remained a civilian? Shall we put it all down to the tight tunic and accoutrements, or shall we pay any attention to what has preceded the wearing of them; namely, the distress and "exhaustion" of recruit's drill (according to Mr. Myers' testimony); the departure from the physiological conditions of the circulation and of respiration, which I have shown that drill to entail. What shall we assign as the cause of hypertrophy already developed in recruits not yet "dismissed drill," and who have been "trained" in a loose serge frock? I have several cases of this kind now under observation. Some of them complained of "beating," others were discovered accidentally. Will it be admitted that a case is made out for the recruit? or are we to fall back on tobacco, alcohol, excesses of any kind, except excess in military chest-making—for causes of this most common disability? Courts-martial are frequent. Do we not all know

the soldier, who says he is "all right," whom, when we examine, before writing the required certificate, we find in the condition I describe? I am sure that if this mischief were not so universal, I would have modified the certificate many a time when I have not done so: and I might be slow to confess that I have often certified men to be fit for hard labour, trusting that, if it were awarded to them, they would, when in distress, appeal to the medical officer of the prison; if I were not obliged to reflect that discipline must seriously suffer if men, who state that they are "all right," were shielded (as it would *appear*) gratuitously. We are aware what a striking contrast would appear if the state of the heart of, say, 50 civilians were compared with that of 50 soldiers—taking those who have never been known to complain of cardiac trouble—and taking any civilian men haphazard of about the soldier's age. The soldier ought to have the advantage here. But he has not. The civilian can accomplish the distance, and carry the weight with less distress than the soldier. Why? Because the soldier has been trained. Mr. Myers compares the amount of heart disease in the Foot Guards with that in the Metropolitan Police, with the usual result. The soldier suffers most. Now, I confess I do not know whether the tunics of the police can compare in degree of tightness with those of the Foot Guards. They seem trim enough, and tight about the neck. Their accoutrements, too, may be less of a load; but may I not suggest that there is a great difference in the amount of "chest-drill" performed by these two bodies of men. Although I make these remarks, I do not want them to be regarded as more than supplementary. The position I have tried to maintain is that the recruit is compelled to outrage physiological laws, and that he must, and so must the Service for making him, pay the penalty. This is higher ground than has yet been taken in view of clearing up the question of the excess of heart disease in the army. I trust the surgeons of the army will take the matter up.

There are a few points, which I will not now touch upon, having an important bearing on the training of the recruit. These involve a consideration of the influence on the heart of "extension motions," done by the arms, while the chest is fully expanded and the body stationary; of gymnastics; and other matters of lesser importance:—If there should appear any inclination on the part of the military authorities to abandon the present evil way of drilling recruits, these points can be quickly stated at another time, together with plain directions as to the manner of avoiding the injury to the heart and lungs now being inflicted. I am now glad to dismiss the subject—hoping that I may have succeeded in directing to it the anxious consideration which, I am convinced, it deserves.

Vue du Lac, Guernsey,
August 22, 1877.

A Paper concerning the Evils of our Present System of training Recruits for the Army: being a sequel to, and to be read in connection with, a Paper entitled—"A Contribution to the Etiology of Heart Disease in the Army," which appeared in the Army Medical Report for 1876, issued in January, 1878.

In concluding a former paper, wherein I pointed out the injury inflicted on the recruit by the drill-sergeant, in so far as the artificial dilatation of the chest and the interference with the act of expiration were concerned, I stated that there were some other points in the training of the recruit—some other practices of the drill-field—which ought to be inquired into; in order that a conclusion may be arrived at as to whether they should, or should not, be considered henceforward as helping to constitute a beneficial mode of training. I do not pretend to treat the matters now to be touched upon exhaustively: it will accomplish my object if this short paper succeed in drawing the attention of those most concerned to them: but I believe that enough will appear to show that, in the training of the recruit, he is called upon to obey orders which, though of course meant to benefit him for himself and for the State, are founded in error; and defeat the very ends they have in view. If the Authorities are only convinced that this is the case there can be no doubt that steps will be taken towards having the necessary changes made. I trust that the evils of distending the chest, as already pointed out, will be considered demonstrated; and that those now to be discussed—of minor importance comparatively, though nevertheless important—will be admitted to be evils, and abandoned accordingly. But if anybody can defend those practices of the drill-field which I now proceed to condemn, let him do so. Let him show wherein, say, temporary efficiency is increased by them: or beauty, or grace, in the human form divine. If, on the one hand, they can be shown to be opposed to natural laws, and therefore injurious: and if, on the other hand, no one can defend them as expedient, though admittedly injurious; then no reason exists why they should be any longer countenanced by the Authorities.

The best way of commencing will be to take the objectionable portions (as I consider them) of the orders respecting the "position of the soldier"—*attitude* of the soldier is meant—which are contained in Sec. 1. Part 1 of the drill-book, and to criticise them by the light of anatomy and physiology. This I shall do briefly. Other objectionable portions I shall consider later on.

After giving some preliminary directions regarding the "position of the soldier" which do not call for comment, this section orders that "*the hips*" are to be "*rather drawn back, and the breast advanced but without constraint*—what safe guidance for a drill-sergeant—*the body*

straight and inclining forward, so that the weight of it may bear principally on the fore part of the feet." The knees are to be "straight" and the heels together. Now, in these instructions the part to which I wish to call attention is that which directs that the weight of the body may principally bear on the fore part of the feet. I cannot help remarking at the outset that even before looking into the matter, there seems something very unnatural in telling a man the manner in which he is to dispose the weight of his body. If a member of the monkey tribe could understand your language, and you proceeded to advise him as to the best way of disposing the weight of his body, he might well stare at you: and would probably intimate, if he could, that he was not aware he had need to be told it. Every man who is free from all brain disease may be said to know—though knowledge is not the word for it—the best way of disposing the weight of his body: and every such man may also be said to be quite unaware that he knows it. We must presume, of course, that the order I have quoted, which it is attempted rigidly to enforce, was drawn up with some definite object in view—perhaps several objects. What can these be? It is quite a simple matter to stand straight: but to keep your "body straight and" yet "inclining forwards"—the feet being together and immoveable, with no flexion of the knee-joints—is not by any means an easy thing to do: you have to bring your muscles strongly into play to prevent yourself from toppling forward. This must be one of the objects in view, let us suppose—the development of the recruit's muscles. Or, a man in this attitude may be thought to convey the impression that he is a very formidable fellow—much more formidable than if he merely stood straight. Or again, this order has for one of its objects—indeed I am at a loss to imagine what can be further advanced as a plausible justification of it. Section 5. of the drill-book, in introducing the extension motions, which form a part of the recruit's training, gives a *resumé* in a few lines of what it is desired to attain by their means. But section 1, on the attitude, or "position, of the soldier," is silent as to the advantages of the same. Has it any advantages? Is it right that recruits should be instructed to make the fore part of their feet bear the principal part of the weight of their bodies? I shall now show that this order is altogether wrong: and the idea that the muscles of the lower limbs can be properly developed by carrying it out, will be shown to be erroneous—not that I imagine for a moment that the muscular development of the recruit was thought of when these instructions of sections 1. were being drawn up. Later on something will be said on the "position of the soldier" in regard to the opinion commonly held of it that it is a manly, or a beautiful attitude or "position," for which it would be advisable to put aside the minor question of health—*i.e.*, efficiency.

Writing of the "thorax as a whole" Quain's Anatomy has the following remarks. They are observations in which (it may be said) all anatomists *must* agree. "Its longitudinal axis is directed upwards and slightly backwards. Its transverse diameter at its widest part greatly exceeds that from before backwards. The latter is shortened in the middle line by the projection of the vertebral column; but on

each side of the column a considerable extension of the cavity is produced by the backward direction of the posterior parts of the ribs, *and thus the weight of the body is thrown further back and more equally distributed round the vertebral column.*" In another place the curves of the spine are spoken of as "connected with the maintenance of the erect posture," and as assisting in preserving the equilibrium of the body. Milne-Edwards, in his Zoology, speaks of the *erectores spinæ* muscles as being "intended merely to raise the body upright *and to counterbalance the weight of the viscera situated in front*," (the italics are mine). Now, what is all this but to show that nature endeavours to make the maintenance of the erect posture depend on mechanical means, and not on the employment of vital means. In other words the aim, as evidenced by the form of the skeleton, has been to secure the maintenance of the erect posture with the least possible expenditure of muscular force. If, let us say, the thorax were all in front of the vertebral column, then this would necessitate the lumbar spine taking a somewhat different direction:—the pelvis would have to be more forward in order properly to transmit the weight: or else it would necessitate the occurrence of strong and continuous muscular action on long feet to prevent the body from falling forward. Now, if a man be made to incline the upper part of the trunk forward, without being allowed to bend either his back or his knees, or to advance his pelvis or to move a foot, he is made to overcome the tendency to fall forward—in fact the law of gravitation—by means of his muscular power. And, so long as he remains faithfully in this attitude, whatever muscular effort is required has to be kept up continuously—both feet on the ground, and one limb not relieving the other. The degree of muscular effort required to keep the body from falling forward in these circumstances will vary, of course, with the weight of the body, and with the degree in which it is inclined from the perpendicular. Young recruits commencing to practise this attitude may be seen constantly toppling forward out of the line, or putting one foot out to preserve their gravity. This stage does not last long. They are not allowed to keep on repeating these *faux pas*. How does the recruit deal with the difficulty, then, of having to assume an unnatural attitude? This point will now occupy us. Before discussing it I shall give an extract from Milne-Edwards' Zoology, showing how false to nature the position of the soldier is. "Para. 284. *Station or Standing.* With the exception of serpents most animals rest on the soil by means of limbs or extremities. They stand by means of the action of the extensor muscles: and thus standing for a long time erect becomes more fatiguing than walking, for in this the flexors and extensors are used alternately." Para. 285. "But the body must also be *in equilibrio*, or balanced on its base of sustentation, and the point around which all its movements are performed is called the *centre of gravity*. Now, to support the centre of gravity it is necessary that the base of sustentation be situated vertically below the centre of gravity. The wider, then, the base of sustentation the more secure the position: thus, we stand safer on two feet than one: on the sole of the foot than on the toes or heel, &c.: for in proportion to the extent of the base of sustentation, so may the centre of gravity be displaced

without risk of its falling beyond that base. The law holds good for all heavy bodies, &c." We now return to the question, how does the recruit deal with the difficulty of having to assume an unnatural attitude? Now, by careful observation I have noticed how he effects a compromise between the drill-sergeant and the drill-book on the one hand, and his natural inclination as to the disposition of the weight of his body on the other; so as to appear to obey and yet not obey this order implicitly. He soon finds that to obey it implicitly means great, because continuous, strain on the muscles of the calf of the leg during, sometimes, many minutes: not on those of one leg at a time—as in running or walking—but on both together; no period of repose being given for the nutrition of the muscles. He would like much to ease them by letting the calcaneal end of the longitudinal arches of the foot support its portion, *i.e.*, the greater portion, of the weight: but to do this would be to cease to incline the body as directed, and to make the heel bear the principal part of the weight; which common sense, backed by Anatomy, says it ought to bear; but which the drill-sergeant, backed by the drill-book, says it ought not. To relieve his muscles being the urgent matter, the recruit allows the pelvis to go a little forward: which movement—although the weight is still on "the fore part of the feet"—has the effect of making a very slight arch of the whole body, and so lessens the expenditure of muscular power required to maintain the attitude: for the quadriceps extensor femoris, previously in strong action, is now relieved; and the patella drops down from its position in contact with the femur. That the men resort to this expedient of advancing the pelvis is well known to drill-sergeants, who combat it by blows on the abdomen with the pace-stick, and telling words, such as they deem descriptive of the appearance produced by it; and calculated to awaken in any nice-minded recruit the determination never to resort to it again: —not to speak of the more powerful persuasion of the pace-stick. The pelvis must be kept back, while the chest is kept forward. What can the recruit do now? The uneasiness produced by the prolonged strain on the muscles—of the calf especially—as well as by the overstretching of the posterior ligaments of the knee-joints and about the insertion of the hamstring tendons, makes him decide to bend the knees somewhat; or rather to allow these joints to pass into a position of less complete extension. I have noticed this frequently. But, as this gives little relief the pelvis again comes forward, in spite of the man: and while it is only a little, this attitude constantly passes without comment from the drill-sergeant. When in front of the line he does not easily notice it. But when he goes to the end of the line to see to the "dressing," he notices the general arching, and being now much irritated, he walks quickly along the line sharply striking every prominent abdomen, until these wretched recruits are driven to adopt the only remaining expedient—which the drill sergeant is only too willing they should adopt, for is it not part of the "training"?—of further dilating the thorax (in the manner and with the results I described in a former paper) so as to appear as if the body were inclining forward, and to appear as if the weight of it were being all the time borne by the fore part of the feet. Here then, is an additional incentive to thoracic

dilatation in the drill-field. Of what avail to say the chest is to be advanced but "without constraint." What does a drill-sergeant understand by that expression? It is a case of one evil producing another greater evil, because we will persist in believing that the moment a man puts on a red coat the disposition of the weight of his body must be removed from automatic control, and he himself in other respects from the provisions of natural laws—laws, too, affecting the functions of the most important organs of the body.

Irrespective, however, of what it thus leads to, this order for the disposition of the weight of the body is wrong, firstly, from an anatomical point of view—involving, as it does, the adoption of an erect standing posture not contemplated by nature. As we have seen, it renders nugatory to a certain extent the provisions of nature for an easy erect posture. It is wrong, secondly, from a physiological point of view, because the immediate consequence of its being obeyed is the occurrence of muscular contraction of a kind which interferes with the proper nutrition of the muscles: that is, in so far as the order is obeyed, continuous contraction. Now, continuous contraction of a muscle is not meant to take place. It is unphysiological; for it quickly induces painful fatigue of the muscle so contracting. Indeed, continuous muscular contraction is properly viewed as disease, if it take place independently of the will. I speak of the voluntary muscles in general. It cannot be said, in this sense, to take place independently of the will in the soldier who is put into this attitude; but continuous muscular contraction occurs necessarily in consequence of the assumption and maintenance of it. If it does not occur the body falls forward. In healthy muscular action, relaxation quickly follows contraction. Apart from our consciousness that a set of muscles cannot be kept long contracting without harm, physiology points out that every fibre of a contracting muscle is not constantly in action:—so important is it that the chemical changes between the blood and tissues should proceed uninterruptedly. It seems needless to me to press this point. Even the heart has its period of repose for its nutrition. In the near approach of death by asthenia, when the pulse becomes very frequent or uncountable, the factor in the case now chiefly determining death is this:—that the pause between the cardiac contractions is of so short duration that the nutrition of the organ well-nigh ceases, and so it quickly becomes unable to maintain the circulation. I shall quote in this connexion a short paragraph from Milne-Edward's Zoology. (Para. 258) namely; "*Duration and force of muscular contraction.* The contraction of the muscular fibres is a phenomenon essentially intermittent: they relax and contract alternately. Even the heart does this; but the voluntary muscles require a much longer period of repose." I would add, too, that muscular action to any great degree, ought to result in movement; and when the muscles of the lower limbs are thus acting, in progression: and this should be especially true for the training of the soldier: but here we have muscular action, strong and continuous, to maintain a motionless erect posture; which nature arranged to be maintained with the least possible expenditure of muscular force. Finally, this order for the

disposition of the weight of the body is wrong, from a mechanical as well as from a physiological point of view, because, in so far as it is obeyed, it does away with the advantages of the arches of the foot, and in time actually flattens them. Writing lately (9th March, 1878) on the subject of high-heel boots, the Lancet says :—" It does not need a knowledge of anatomy to convince the shallowest thinkers of the sex which worships the idol of Fashion, that the foot is forced into a wholly unnatural position, and distorted, by the heel being raised, *and the body made to rest on the ball of the toes.*" Italics mine. " It should be unnecessary to explain that this disturbance of the foundation throws the whole superstructure out of gear, and deranges every mechanical function." It may be said that this is not a question of high-heel boots. No : but it is a question—which the Lancet treats in the above general way under that heading—of the use or abuse of the arches of the foot ; the ligaments and fasciæ supporting which are overstretched by the unnatural, because continuous, strain imposed by the " position of the soldier : " and, moreover, so overstretched in many cases as to produce flattening of the feet in men who were not flat-footed when they enlisted. Men are rejected who present flattening of the arches of the feet : the Medical Regulations laying it down that " the feet are to be arched, not flat." For, not only is this flatness necessarily accompanied by deficient spring and facility of movement, but it is one of the signs of a general inferiority of, perhaps, life-long standing ; and not brought about during recent years by any special cause acting on the feet of the individual offering himself for enlistment. Yet how frequently do we find soldiers, and young soldiers, whose plantar arches are so little marked, or almost absent, that we would have rejected them if they had presented the condition a few years before. It may be objected, again, that the soldier is not directed by the drill-book to raise his heels off the ground in assuming the " position of the soldier : " and this is true as far as words go—though in some regiments the drill-sergeant convinces himself that the heels are actually raised off the ground, by trying whether he can pass a piece of card-board or paper under the heels or not—but let any one who raises this objection try for himself, whether, in the carrying out of the order to make the fore part of the feet bear the principal portion of the weight of the body, the heels are not practically off the ground, if not actually so. I mean to convey that if this trial be made it will be found that *no* weight is borne by the heel-end of the longitudinal arches in this attitude, which is called the " position of the soldier." The weight is not " principally " but altogether thrown on the fore part of the feet, so long as the soldier keeps trying to do what he is ordered—and it is surprising to what an extent the men carry out these injurious follies :—but even if it were possible to avoid exceeding the order when it is attempted to obey it ; even on that supposition the order is wrong. *Both* the piers of an arch are meant to bear the super-imposed weight ; and in the human subject the calcaneal end of the longitudinal arches is meant to bear by far the greater portion of it.

It may occur to some to say that in walking up even a long flight of steps many persons never put the heel down : or that it is possible to

walk and to run on the toes for a considerable time without experiencing any fatigue or sensation of overstretching : and that therefore it may be that I have overdrawn this matter. Now, it is exactly for the alternate strain (or action) and rest which these conditions involve that the muscles, ligaments, and fasciæ, are fitted. Not only is there time, in such exercises, for the repose and nutrition of the muscles of one limb while those of the other are contracting, but there is the period, for each limb in turn, during which the ligaments of the joints are no longer on the stretch. It is a very different thing indeed to make a man *maintain* the motionless " position of the soldier " for, say, two or three minutes. The cases are not similar ; and I only introduced what might appear a difficulty to some, in order to put it aside. It will always be true that muscles are not meant for continuous contraction, and that ligaments are not meant for continuous strain. If we stand chatting carelessly, we change the limb bearing the weight of the body every half minute or so, being scarcely conscious that we do so. Continuous strain and undue fatigue are thus avoided. The man who performed the great dancing feat, recently recorded, of waltzing unceasingly for some 12 or 14 hours—I am not sure that it was not many more—would have failed to stand faithfully in the attitude or " position " in which the soldier is placed for a twentieth part of the time. The fact is, no *real* work, labour, or exercise of any kind, requires the maintenance of the attitude ordered in the drill-book. Not being contemplated by nature the body is not fitted for such a standing attitude, and therefore the body is injured by adopting it. These remarks apply to that portion of the order for the " position of the soldier " (Sec. 1) which I undertook, in commencing, to criticize.

We now come to the Extension Motions—contained in Section 5. of the drill-book. It will not be necessary to say much about them. The very words in which they are introduced—" in order to open his chest, and give freedom to his muscles, the soldier will be practised in the following extension motions "—condemn them utterly. It was shown in my former paper to what the opening of the recruit's chest amounts. It is so quietly taken for granted that to " open his chest " is a highly beneficial operation that it is not surprising that question as to its advisability has not arisen. The drill-sergeant, taking the drill-book as his infallible guide, argues, no doubt (judging by the results), that if it be a good thing to " open his chest," the more it is opened the better. And, for the end in view, he could not be provided with more potent means. I had thought of copying out all these extension motions, but it would take too long. Let it suffice to say that the end they have in view—the opening of the chest—is a bad one, as we have seen : and that they are admirably calculated for the attainment of it. And the means devised for giving " freedom to his muscles " result, not in their freedom or due exercise, but in overstretching of, and continuous strain upon, them and their tendons of insertion ; as well as upon the ligaments of the joints. While, however, I commend to the reader for perusal at length the extension motions of the drill-book,

I may draw attention to one or two points more particularly. The "first practice" has the following:—"On the word *Two*, throw the hands up, extending the arms smartly upwards, palms of the hands inwards: then force (I would call attention to the wording) them obliquely back, and gradually let them fall to the position of attention (!) *elevating the neck and chest as much as possible.*" It is fair to say the italics are mine. After this comes the apoplectic amusement in which the recruit bends forward to accomplish the trying task of touching the ground with his finger-tips, knees unbended; to resume, at the discretion of the drill-sergeant, his attitude of "attention," with his mouth open, gasping for breath, with prominent eye-balls, and a purple face. I admit—if when a soldier picks up anything from the ground—say a rifle—it is absolutely necessary that he should do so without bending his knees—I admit, I say, that in that case this practice might be defended from a military point of view. But it is not the rule to prevent the men from bending the knees in such a case. When, therefore, will a man be required to put himself into such a ridiculous posture (to say no worse of it) as this is, for any useful purpose? Never: and if never, why ever put him into it. Again, there is the following in the "third practice:"—"On the word *Three*, swing the arms round as quickly as possible from front to rear." In this the arms are extended and the fists clenched. Now, when is the soldier likely to be called on to perform a feat of this kind for any useful end? Even the railway porters, who use their arms for signals, and throw them on occasion very wildly about, are exempt from any wearying preparations of this kind. What I wish to press is this: that instead of wasting time at exercises which are not only hurtful but useless, recruits should be made to practice such work as they will have to do in the field. It may be said—"We cannot make a man march correctly without these preliminary exercises." Well, with them you make him march with his heart in his mouth, and you cannot know how he may be made to march without them until you try. It may be said again, "without these extension motions, and this setting-up drill we cannot get men to take the regulation length of step." I reply by asking whether anyone seriously thinks that the attainment of this, which is altogether a matter of habit, of practice, is facilitated by the over-stretching of muscles and ligaments. I do not admit that all the men we pass into the Service require this "pulling into shape,"—supposing for a moment that it can be attempted to be done in this way without injury. Many of the men enlisted are, no doubt, of clownish appearance, and walk with slouching gait—one shoulder lower than the other perhaps—or who display some trick of attitude the reverse of smart. And I, of course, agree that all this should be corrected in the men who are admitted into the Army exhibiting such departures from soldierly symmetry. But it can be done without injuring these men. It has often surprised me that the attitude I have seen British man-of-war's men assume, when about to be inspected by the captain of the ship, would not be tolerated in a soldier, nor even in a marine! It is not sufficiently "attentive." A post-captain does not object to it, but a colonel would not hear of it. The men stand

straight and look to their front—as the military books have it—looking like men, and unlike puppets, thoroughly unconstrained and comfortable : their respiration unimpeded, and no unusual muscular action going on to support an unnatural attitude. This will not be allowed to be sufficient for the soldier; but can any one advance any *real reason* why it should not be held sufficient? Surely a man can stand erect, look to his front, keep his shoulders square, and look "every inch a man," without infringing natural laws. It is with diffidence I write such a very unquestionable fact. Indeed, I am surprised that this "training" should need to be written about at all for condemnation. If men are not told to "swell their chests;" and if they are not told to make the fore part of the feet bear the principal part of the weight of the body : and if, moreover, they are not told to do extension motions, which have the laudable object in view of "opening" their chests; we may rest assured that they will do none of these injurious things.

I had almost omitted something of importance with regard to the extension motions : namely, that they are practised when the body is, and has long been, stationary; and at a time when the balance between the pulmonary and systemic circulations is disturbed, as already described in my former paper : at a time, that is, when the considerable muscular action they involve adds much to that disturbance. The muscles, too, of the lower limbs are kept in a state of well-nigh continuous contraction in order to prevent the body from falling forward : there is no even occasional flexion of the knee-joints, or of the thighs upon the trunk, such as would occur if ground were being gained, and such as would indirectly aid the ventricles : but while the recruit swings his arms round "as quickly as possible," until the drill-sergeant chooses to stop him, and until his hands are blue from venous congestion—for the centrifugal force thus produced affects the return of the venous blood—there has been no more *movement* of the body than the slight swaying motion backwards and forwards which the weight of the swinging arms occasions. I press it that muscular effort to this degree ought to be accompanied by movement, by progression, of the body : which would ensure the needed period of repose for the nutrition of the great extensors of the limbs when the flexors are in action; and for the flexors when the extensors are in action. Instead of this, as regards the lower limbs, you have the muscles overtaxed by continuous contraction to maintain the erect posture against gravitation, in so far as the recruit obeys the order to incline the body forward—which continuous contraction causes a continuous, instead of an intermittent, compression of the deep veins, and by interfering with the nutrition of the muscles (to the same degree in which it does so), embarrasses the capillary circulation. The extension motions, then, are admitted by the drill-book to have in view an object which I demonstrated in a former paper to be bad : and, otherwise, they are directly injurious to the circulation in the circumstances in which they are practised : inasmuch as they require for their execution considerable muscular exertion at a time when, in consequence of the inefficient manner in which the respiratory movements are being performed, the slightest exertion only adds to the

embarrassment of the heart. They are further injurious to the circulation because they impose the adoption and maintenance of positions, and of movements, which are calculated to hinder, in a manner in which legitimate work or exercise never does, the return of venous blood to the right side of the heart. This has been already spoken of in the centrifugal force brought into play by the swinging arms; and in the stooping attitude (with extended knees), which brings about rapidly a great amount of venous congestion of the head and neck, accompanied by a sensation of fulness or bursting. If it be said that they can produce these results to no very injurious degree, is this any justification for permitting their continuance? In what manner, in these enlightened days, do we wish to have the evils of venous obstruction demonstrated, before we are willing to give up the things that produce it? Is not a gasping recruit with a purple face sufficient: or must we wait for vertigo or apoplexy before we apply that dreaded remedy—common sense? As a matter of fact, vertigo is very frequently complained of by men undergoing "training." They speak of it as "reeling round," as "dizziness," and as "losing the sight of their eyes." We may safely presume that many suffer in this way who do *not* complain. Disturbance of cerebral circulation induces this giddiness; and if a young soldier comes to you from the drill-field, telling you that he first felt it there, to what conclusion—in view of these extension motions and attitudes—are you driven? I only want the military authorities to allow that the soldier would be better off without these "exercises." The abandonment of them would necessarily follow.

I would now call attention to a matter which has already occupied us in order to point out that, even on the supposition that there was nothing injurious in the "position of the soldier," the soldier is kept standing still much too long. As we have seen already, standing still for a long time erect becomes more fatiguing than walking. Now, this is true even of standing in an attitude of ease; of an attitude assumed unconsciously, if so be that this attitude is not frequently altered by changing the limb bearing the weight of the body—which one does without mental effort, automatically, every minute or so. If then this be true in this case, how much more fatiguing must it be to remain long in the attitude of the soldier? I have watched the proceedings of drill-sergeants very often in order to ascertain their discretion in this matter. While a troublesome recruit is being distorted the remainder of the squad stand fast as already placed by them: and, as regards the "setting up" of the men, the length of time they are kept standing appears to depend on the number of men being "set up." There is no such thing—and I have looked for it—as allowing the recruits whose attitude passed muster, to abandon it and *move about*, while their less prominent next-door-neighbours are being attended to. Not that I recommend any such miserable compromise. As will be seen, I recommend for the training of the soldier the practice of any and every such hard work and exercise as he is ever likely or liable to be called on to perform in the field; to the complete exclusion of the evils I condemn. Such a programme will fit him, and not unfit him, for

his calling: and will surely, if adopted, bring the heart disease of the army down to below that obtaining in civil life. For—let the advantages the soldier enjoys in time of peace be remembered. (I speak of time of peace). What is there that is not done for him? And this, too, after he has been carefully selected as sound in all respects.

To gymnastic exercises—for the improvement of the recruit's powers; the powers of youth and health which he brings with him into the Service—I turn with pleasure. It is a relief to reflect that here at least, in the gymnasium, the soldier has no orders given him (excluding the extension motions) obedience to which involves a breach of natural laws. It may be that some of the exercises which are here practised are the means of wasting time which might be better spent—at aiming drill, say, or judging distance, or bayonet exercise, or *anything* a man will be called on to do in the field. For the day has gone by when supreme muscular efforts were the means by which fields were won: and I question the advisability of making soldiers gymnasts *to any great extent*, simply on account of the waste of time involved, and the misdirection of energy:—nothing could be more reasonable, however, than to set about making them pedestrians—but, at least, a gymnastic course can have nothing said against it, if it be conducted carefully, as it is supposed to be in the army. The men generally speaking like it, and most of them view it in the light of a recreation. Their hearts and lungs are not artificially interfered with: they may be said to be *working at ease* in the gymnasium; and if the work itself be sometimes hard, there is nothing to prevent the heart and lungs of healthy men from rising to the occasion, so to speak. And they do rise to the occasion and are thus strengthened and improved. It is unnecessary for me to speak of gymnastic exercises further. I only introduced them, indeed, in order to say one thing; which ought to be now self-evident: namely that recruits who are undergoing the system of chest-drill which I denounced in my former paper—those of them, at least, who do not succeed in evading the drill-sergeant's orders; and though many do evade them, none are supposed to—must necessarily have their troubles aggravated by gymnastics or *any* considerable exertion. They require rest; so that nothing may postpone the restoration of the balance between the pulmonary and systemic circulations, disturbed by the drill: for, as we well know, if irritability be once established, with or without manifest hypertrophy, it may result in months of rest in hospital being required; and then probably in the invaliding of the subject of it. The surgeons of the army know how these cases keep on reappearing at hospital. Though apparently all right when discharged, no sooner is any work expected of these men than back they come to hospital. The reasons why exertion in this condition aggravates the existing mischief, and so brings it to light, I gave in my former paper, and also when writing of the extension motions. I do not wish to repeat them. Gymnastics must be said to be good, and chest-drill is shown to be bad: but, *if they are practised together*, *then* gymnastics are bad. This is, of course, only another way of saying that the recruit has been rendered unfit for gymnastics by the unnatural treatment he

undergoes in the drill-field. I mention this because I find the following in the Queen's Regulations, sec. 10, para. 8. "The Gymnastic training of recruits is to commence simultaneously with the squad-drill:" to which there could be no objection if the drill were shorn of its injurious portions. While these are retained—and it seems absurd to suppose they will be retained—the gymnasium is to be avoided. But it is needless to say that I do not suggest that the gymnasium should be avoided, but that the evils of the drill should be discontinued altogether. I trust that due thought will be given to this matter without delay; and that the benefits to which our knowledge as medical men enables us to point, will be extended to the soldiers on whose behalf we write. To what end, indeed, is the education of medical men for the army, if their advice and recommendations be not attended to. I appeal for action in this matter, not on the strength of an opinion merely stated as such; but on the strength of the fact that a system of drill is now in operation which is proved to be bad, and which is chiefly responsible for the excess of heart-disease in the army. If any one objects to the latter portion of the sentence just written for the army at large, it must at least be admitted to be true for the young soldiers who are invalided, and for those now in hospitals, for irritability, hypertrophy, and palpitation, within a short time after joining. Or else the objector must take the onus of accounting on clearer ground for the prevalence of these affections in men who have been drilled in a loose serge frock, and who have never worn a pack, or a strap, or a tight tunic—the things which bring the condition, hitherto bearable, to notice. Surely we are entitled to expect that, if it be decided not to abandon the mischievous portions of the drill, *some* justification, from a military point of view, shall be put forward for retaining them. If they can be defended as being military necessities—for to these we must bow—let them be so defended. Until that is done they constitute a blot in the training of our soldiers. The Medical Department at least has done all it can to have that blot wiped away: and it will not be our fault if it be said, as doubtless it will be said, if nothing be done, that anatomy and physiology are branches of learning which exist in vain for the soldier. For him the word is "discipline:" he must do what he is told, even though it injure his heart and lungs; and, like the Irish recruit who once told me, as if dreading to complain of it, that the discipline in his regiment was "*very severe*"—meaning (as I had some difficulty in discovering from him) that the "setting-up" drill and all that pertains to it was what he understood by the word discipline—the soldiers generally regard this drill, this "discipline," as something not to be spoken against. As pointed out elsewhere, they firmly believe it to be a training which will eventually prove beneficial to them in every way —especially as to there new calling!

Considering the importance of the subject I shall be excused if I here allude to some recent utterances of Mr. Hardy's in the House of Commons,* on the subject of recruits. It seems there had been complaints about the *youth* of the men joining at Aldershot: and, in order

* Delivered in March, 1878.

to arrive at a just estimate of the real state of matters, Mr. Hardy "had a table prepared" (I quote from Mr. Hardy's speech) "first of all as regards men under one year's service, but dismissed drill. These were taken from 21 different corps, and I (Mr. Hardy) find there were 1452 men whose average weight was 10st. 7lb., average age 20 years and 1 month, and average chest-measurement 35 inches. Though some of these are boys—not many—you have not in these regiments a bad class of recruits. [*Quoted from newspaper report*] (hear, hear). And taking the recruits still at drill, you have the same averages I have just given. The Commander-in-chief went down this morning to inspect the men, and he has written to me to express the great satisfaction which he felt at what he saw. *He was very much struck with the men who have passed the drill*, and he is quite sure we have a good class of recruits. (hear, hear.) I hope the committee will consider that this is not an unsatisfactory state of things; though I still feel it is a great misfortune that the men are so young; and I think it is also a misfortune that men should come into the army saying that they are older than they really are. *However, they are of that class which will make good soldiers, because they become physically stronger after they have entered.*" I have taken the liberty of underlining two passages in this extract from Mr. Hardy's speech, which appeared to be received with satisfaction. I read this extract with dissatisfaction and regret, knowing the kind of training about to be adopted to make them "physically stronger." I shall be credited with only a good intention in having ventured to draw attention to it: for I do so only in order more forcibly to point out how deeply rooted in the public mind is the idea that a bolt-upright, dilated recruit, whose expiratory act is ignorantly discountenanced in order to increase the measurement and the degree of prominence of his chest, is an object for admiration! The Commander-in-Chief (see Mr. Hardy's speech delivered in March, 1878), "was very much struck with the men who had passed the drill; and he is quite sure we have a good class of recruits." And good to look at, in the popular sense, they may be said to be—after they have passed the drill. An examination of their hearts, however, would show, by comparison, how much better they were in reality on the day of enlistment. Now, the best test of the power of a soldier for undergoing physical exertion is to be found in the condition of his heart and lungs under such exertion—in the condition of his circulation: for the lungs are a portion of the circulation. It is quite impossible to judge of a man's powers of endurance by simply looking at him. He may look striking and big-chested, which, if he be a soldier, should incline one to decide unfavourably concerning him beforehand—but, to test the matter, let him—after a march, in marching order, of 10 to 15 miles—be told to throw off his pack and double four hundred yards up an incline, rifle in hand, and carrying 25 to 30 rounds of ammunition; and commence firing at once at a target 300 yards distant. (I do not suggest anything that might not be constantly required of him in time of war.) It will be admitted by those who know, that these are duties to perform which without distress, mobility of the chest, full and unweakened expiratory power, as well as an unimpaired, un-hypertrophied, un-irritable heart, are essential. Suppose we make new recruits practise

such an exercise as the above (leaving out the ball-firing which they have not yet been taught) and beginning with one of about half the difficulty. Let this be done every second or third day, and on the intervening days let them be taught military manœuvres and movements, *instead of sending them to the dilating-sergeant.* This would be a more reasonable system of preparing them for what they will some day have to do than that now obtaining of sending them to practise distressing, exhausting, and unnatural, exercises which they will never be called upon to do. Or suppose that, in view of scepticism—in view of objections on the part of people who regard whatever is as right, and who cannot easily believe that the enormons invaliding of soldiers under two year's service, for heart disease, has been brought about by the evil practices of the drill-field—an experiment be suggested. Hand over any given number, say 200, of new recruits, to be dilated as heretofore by drill-sergeants; and on the same date hand over a similar number to be exercised in such legitimate work for the soldier as I have above suggested, Sections I. and V. being for these a dead letter: and, at the end of three or four months, or more, let the marching powers, the weight-carrying powers, the capability of doubling, of these two bodies of men, be compared:—which cannot be done by looking at them. And not only so, but let their hearts be examined, and a comparison instituted. If it be objected that this would not be a fair test, because the men sent to the drill-sergeant have not yet had the practice of the others—they have merely been having their chests attended to:—I reply that the only inference to be drawn from such an objection is that time has been wasted, *even if the chests had received no damage.* We all know how the British soldier will push on, breathless, and bathed with the cold dews of exhaustion, rather than give in: though more fit to lie down than to march. Is devotion of this kind—or call it what you like—to go for nothing in the consideration of this question? Rather than that the authorities should remain in doubt on this important question, let the experiment I have suggested be tried. I do not abide the issue of it merely on the point of the comparative number of the two bodies of men who would "fall out"—and this would be striking enough, if anything more than child's-play were made the test:—but also on the point of the distress endured by the maltreated section, in their struggle against "giving in."

But, let us say something about these complaints respecting the youth of the recruits joining at Aldershot, into which Mr. Hardy made an inquiry; of which he gave the results in the House of Commons. From what do these complaints arise? From the fact that so great a number of young soldiers are discharged as invalids (after spending months of their short service in hospital) soon after joining. And, without doubt, the younger a recruit is—you may say as a general rule—the more likely is he to be injured by the false system of physical training to which he is now subjected. I dwelt on this point in a former paper. Now, men whose growth is completed, or nearly completed, when they join, are found not to break down in such numbers: and therefore it is not to be wondered at that complaints arise if none but beardless lads are forthcoming. The conclusion

jumped to is that these last break down under "military duty" only because they are young! The training, which is injurious to full-grown men, is not suspected of having anything to do with it. I am, certainly, no advocate for boy-soldiers for the British Army. Soldiers should be at least 22 or 23 years old when they go to India, or to other tropical countries: and, of course it must be remembered that a great part of their service will be abroad, and chiefly in hot climates. But supposing it to be possible to keep men at home until they have attained an age at which they may be safely sent to tropical service—and this should be possible—then, on that supposition, I cannot see why we should not be very glad to get healthy, promising, lads of 18 years of age. They will not break down if properly treated: they only break down, as they do, because they are maltreated: maltreated, I know, with the best intentions. This would open up a question, however, which does not concern me now: but I would just add that, in any calling in life, the younger a man joins it, the more likely is he to be fitted for it; or else there is no meaning in such expressions as "He was a man of war," or anything else, "from his youth"—or the like. This being the rule, I, for one, should not care to be allotted the task of showing that the profession of arms is an exception to it. It all depends on how you treat these young and immature men: and on what you expect from them. If you expect them to cover the distance and carry the weight side by side with men many years older, you must expect also to be disappointed. This is not to say that we would not do well to take men young, and treat them rationally. But our present plan is to spend six months giving them hypertrophy and irritability of the heart, as well as emphysema, and other mischief of the lungs, and then, without delay, to apply the pack, straps, and rifle, so as to bring the mischief that has been done to light; to render a man's condition unbearable, drive him to hospital, and thence out of the service, damaged for life—a burden to himself, his friends, and the country. This is literally true, and therefore we cannot be surprised that those in authority consider it, as Mr. Hardy said, "a great misfortune that the men are so young." For such, indeed, it is: but only on account of the "training."

There remains, then, this practical problem for solution:—Medical Officers pass men as recruits for the Service who are expected to become efficient soldiers. But it would appear to be a settled matter in the military mind that the civilian shape won't do in uniform. These men must be altered somehow to fit their new clothes. They must be changed in appearance. They must be provided with an appearance—and a condition of heart—which would have caused their rejection had they presented it when being examined for enlistment:—The practical question, I say, in view of the untold suffering to the men and loss to the Service and State now obtaining, is: Can the required soldierly bearing or presence be attained without prejudice to the well-being of the soldier? The answer to this depends on what the Authorities regard as a soldierly bearing: on whether the dilated, prominent, thorax—for this is the

chief evil—is a *sine quâ non*. To medical men the question is whether a man is efficient or not: whether he can carry his accoutrements; march and double with them; do a hard day's work, such as he might be called on to do in the field—hewing wood, or drawing water, for instance—endure exposure within reasonable limits, and so on; or whether he can not. In their view a soldierly presence presupposes soldierly powers, powers of endurance; capability of "enduring hardness as a good soldier." To military men, to commanding officers of regiments, who look on the outward appearance, the question is a different one: and no wonder; for when a soldier breaks down, at home or on service, they see no more of him. He goes to the hospital, is eventually invalided; or, perhaps, he dies before there has been time to invalid him. The remainder are "well-set-up," as the phrase is, and *look* fit for anything: so did the invalid until *he* broke down:—and so, appearance, attitude, being everything, the civilian is stretched and dilated into the soldier. This, at least, has been the system hitherto. But, if military men will forswear the dilating or "opening" of recruits' chests, and treat them in the light of common sense, then the question I have put may be answered affirmatively. They will have self-contained men to order about, and not puppets who, or rather which, with thumping hearts and disturbed cerebral circulation, with difficulty can give their attention to the orders shouted into their bewildered ears. It will be asked what does my recómmendation—or rather what would the following out of my recommendation involve as regards the appearance of the men. It would involve the substitution of an easy, though "attentive" natural, attitude, for the present irksome, sometimes distressing, sometimes exhausting, unnatural, attitude or "position of the soldier" as defined in the drill-book. This point will be again alluded to. Not one of the evil practises discussed would be admitted to form a portion of the attitude of attention. Enough has been said on the *real* merits of the question. It will be well now to justify an alteration in the orders for the "position of the soldier" on the ground of appearance. I take it for granted that the abandonment of the bad points in the training of the recruit is admitted to be called for, according to the representations I have made concerning them. But while it is admitted that there would thereby result a gain in health, that is, efficiency; military men would consider that there would be a loss in the matter of appearance. Now, I do not admit that there would be any loss in this direction. On the contrary there would be—indeed I can say there *must* be—gain. For, if a position or attitude be unnatural, even if it were not injurious—as things unnatural invariably are—it cannot be honestly described as manly, elegant, beautiful, or by any other fine adjective. I have shown it to be unnatural. I am now alluding especially to the dilatation of the chest. It may be striking, but it is a deformity; and as I have shown, an actively injurious one—which cannot be said of most deformities. And the idea that it is not a deformity, but the reverse, now so generally received, is one of those mistaken notions which must be given up. It is a very common notion in the Army, that the possession of an abnormally large and prominent thorax

constitutes sufficient qualification to permit of its owner being described as a man of "fine physique." What is thus called "physique" is in reality deformity; in the same way that undue prominence on the opposite side of the chest constitutes another deformity—hunchback. Now, suppose we considered that hunchbacked soldiers would make a formidable array! and suppose also that it was in our power to make them, as we can make the hunch-chests; then, it would be good policy for the Service, the State, and the individual, to make the men hunch-backed instead of hunch-chested, *provided always we could perform the former feat without injuring important organs.* I have shown before that we cannot perform the latter without such injury. The whole thing is distortion—argument too, if you will—but I only wish to suggest, as strongly as I can, that, if in training men to be soldiers natural laws must be departed from, it would be as well to depart from them in a direction, if such could be found, which would not involve quite so much loss to the Service, the State, and the individual soldiers, who are most concerned. On the ground of appearance, then, this puppet-like attitude should be abandoned. It can scarcely be necessary for me to combat the insane idea, which largely prevails nevertheless, that training must be so toilsome and laborious as to be quickly fatiguing, if it is to prove beneficial to the human body: that the more the ligaments of the joints, and the tendons in their neighbourhood, are painfully stretched the better. The strange part of the matter is this: that the very people who hold these false ideas with regard to "training," would be scandalized if, without urgent reason shown, the additional *legitimate* fatigue of, say, 8 or 10 miles extra in the length of a march were imposed on a regiment of soldiers. They regard marching as work, and this so-called training as a kind of beneficient recreation. The soldiers do not take this view, however. *"Setting-up drill" is regarded by them with abhorrence, and they would rather do any real hard work than go through this drill, even though the latter should continue only a third of the time of the former.* I make this statement after very careful inquiry—a statement, the truth of which it is, I submit, important that the authorities should ascertain for themselves.

What can be done to remedy the existing evils? I advise that the subject be considered by the military authorities from the commencement:—The surgeon of a recruiting district says—"Here are 100 young men, all thoroughly examined, and found in good health; they ought to prove good soldiers." By which he means that, being sound, they are fit for hard work—able to break stones all day, dig all day long, follow the plough, carry weights within ordinarily reasonable limits; without breaking down. By which he means that he does not anticipate that any of them (much less that many of them) will be sent forward for invaliding within a year or two. Here is the material, then. What is to be done with it? We have seen what has been done with it hitherto: and, to quote the words of the late Dr. Parkes, the result has been that "out of a hundred men discharged (invalided) *under two years' service*, heart and lung disease together constituted, in one year 47-85, and in the other 40-59. "How" he asks, "is this to be accounted for? The

recruits are carefully examined: they have no heart or lung disease: how is it that such diseases are developed during their first two years' service, and indeed, more during the second year than the first?" A very serious question indeed: for there is much hesitation about invaliding men who have only recently joined, and for whose sudden break-down there is no adequate explanation.—What ought to be done with these 100 newly enlisted men? Now, my reply, and recommendation, is this:—Let the military authorities reflect carefully on all the various kinds of real work and real duty that the State is ever likely to demand that the soldier shall perform in times of war and of peace: and having satisfied themselves that they have an exhaustive list before them of everything that the soldier ought to be able to do—according to the arm of the Service to which he belongs—then let them direct that he shall be made to practise all these things. It does not matter what they are, so long as they are things which may be at some time or another required of soldiers in the presence of the enemy, or for the proper performance of their duty at home. It matters not what they are so long as they are real military necessities. No medical objection can be fairly raised to any real military necessity. For instance, in action a man will have to fire his rifle, and use his bayonet; while he will not have to "swell his chest," or remain standing on his toes. Let him, then, practise the former, and not the latter—for the latter are useless even if they were not injurious. Again, the soldier may be required some day to march as much as thirty or forty miles in twenty-four hours, or to go through as much work in the field as that distance represents in work, while he will not be required to swing his arms about, or to double himself in two. Let him be practised at marching, then, until he gives good promise of being able to accomplish long distances and let him eschew all useless antics. He will be called on to run also, and the earlier he begins the practise of it, and pedestrianism, the better. In short, whatever the soldier may be called on to do in the shape of real work, according to the decision of the military authorities, under any circumstances; in all these things let him be practised. If a young soldier break down at such work, then a mistake was made in taking for a soldier a man who cannot do soldiers' work: but at least he cannot be said to have been maltreated, as soldiers are maltreated now. For, he was only sent to practise the legitimate work which he undertook to do; and to do which he was certified fit by a medical man. We are all liable to make mistakes; but, with regard to the pitiful way in which young soldiers break down, I would say—on behalf of the surgeons of the army—that the medical certificate they give does not suppose any maltreatment. It will, of course, be found that the men we pass into the army will not break down as they now do, if they are only treated henceforward rationally: and called upon to do only real work; and to do it in a manner in which it would be considered well done in the field. As regards men yet to join, and who have only quite recently joined, the Service, this is what I contend for:—that they shall not be introduced to the evil practices which I have pointed out: that they shall never have their attention directed to their chests, or

to their breathing: that they shall never be told to swell their chests, nor to do extension motions to "open" them. That they shall never be spoken to about the manner of disposing the weight of their bodies; but be allowed to stand as nature meant them to stand. That it shall be impressed firmly, by distinct instructions, on the minds of all drill-sergeants, that no good is attained but, on the contrary, evil, by keeping men long standing still, even though the posture be that known as standing "at ease": for, in this it is not allowed to change from time to time, the limb bearing the weight of the body. There cannot be ease without freedom of action in this particular. That—for the future—*military movements shall, as much as possible, take the place of military standing still.* This is important: more so than it may seem. And finally, that, having been selected as fit to do it, recruits should be called on to do any hard work that is to be done in camp or quarters; and any *legitimate* military excercise; *to the exclusion* of this "training," falsely so called.

That soldiers should possess a manly bearing, and be free from any unsightly trick of attitude, is a proposition in which all must agree. It is scarcely necessary to remark that, in the men selected by the examining surgeons for the army, any such trick or peculiarity can be remedied without injury to the men exhibiting it. I alluded to this before: but it may be well to say a few words further on this point now. Suppose a really well-built strong young fellow, who should make a useful, enduring, soldier, to have the disadvantage of carrying one shoulder lower than the other; or of holding his head badly; or of walking in a shuffling, slovenly manner. Now, such a man does not need, in order to make him presentable on parade, to be maltreated by chest-dilatation, extension motions, &c. One might hesitate about stating so self-evident a proposition, only that there is so much at stake. His gait, his want of symmetry, can be corrected without keeping him standing motionless for an unconscionable time in an attitude shown to be distressing and unnatural. Why not direct his attention to his fault, whatever it be; and not his chest? Need it be said that there is no objection to a drill-sergeant telling a recruit that he holds his shoulders at an unequal height; nor to his directing him to stand straight with his shoulders square? If there be some who think it impossible to make a man look manly and soldierly, in the proper sense of these terms, with such simple directions as these, I tell them they are wrong in so thinking; and I challenge them to show they are right. Surely, the attitude of an individual conscious of his strength is not that which the soldier is now taught to assume. For indeed this latter is a most unstable attitude, as we have seen. When ever did painter delineate, or sculptor model, the figure of an athlete or warrior in anything even remotely approaching the attitude of a soldier at attention? Stability of the body at least should be a first consideration. I feel it is needless to speak further on such a proposition as that men can be improved in appearance without injury to their heart and lungs.—As regards the men already in the Service the matter is not so simple. In spite of the distress occasioned by the drill, it has become an article of their soldierly faith that the drill-book is right; and that so also are the sergeants who administer

its provisions. These last believe that the swelling of the chest is of much advantage every way ; and so of the other evils. To them it should be made known that a better light is now thrown on this treatmeant of soldiers in the drill-field ; that, as a matter of fact, a man need not be reminded that he has a chest at all ; and that as for "swelling" it, that is all a mistake. The abandonment of the other points shown to be wrong is also called for, as just given. Now, it is certain that if these things were thus frankly avowed, further mischief of the kind in question would be altogther avoided, though not perhaps immediately. The great majority of the men would quickly forget orders which they ceased to hear repeated : but at the same time there would be some who, from force of habit, would for a time continue to keep the chest distended with air when on parade. The number who would do so might be considerable. Thus, the matter is not so simple as in the case of men not yet joined, or only quite recently joined ; who have never heard of these injurious things. Now, for these cases, it is expedient that I should, for the moment, appear to abandon, to go contrary to, my own recommendation ; which is, that a man's attention should not be directed to his chest or his breathing at all. Nevertheless, if—after it was made known that the present attitude or position of the soldier was wrong, and that it was now in process of practical modification by the omission of the injurious portions—men were still found who, from force of habit, kept up the dilating of the chest ; then it would be necessary in these cases (which would quickly become quite exceptional) to tell the men concerned a good way of getting out of this bad habit. I admit that the advice I have to give involves what is to be deprecated : namely, any directing of the attention of a man to his chest : but it is better to do this, as it will quickly cure the acquired habit, than to leave the man to himself ; and any necessity for it will soon die out altogether. I shall formulate the advice and then state why it is, in the circumstances, safe advice. It should be said to him "the best way for you to get out of this habit of keeping your chest swelled—a habit no longer required of you—is to endeavour to keep it in the form it assumes when the breath is out of your body." The safety of this advice lies in the fact that, while expiration is secured, inspiration to the necessary or physiological extent is sure to occur. It is to be regretted, of course, that such an expedient has to be proposed in the interest of men who have already undergone this injurious training—it applies to none other of course :—but it would have a good effect on the comparatively few men whom it would be necessary to advise to adopt it : and, as I said, any necessity for having recourse to it would very soon disappear—in a fortnight or so.

The ideas that have prevailed as to the preparation of the soldier for the work he will have to do, are false ideas ; and the invaliding returns prove this : the sooner they are recognized and admitted to be false ideas the better. Thousands of recruits are now joining the Service ; the drill season is commencing ; and I hasten to lay this paper before the authorities in a more hurried and a less complete form than I could wish, hoping that no time may be lost ; and that no delay may be made about abandoning a false system. I beg their attention to

this subject, taken in connexion with my former paper (contribution to Etiology of heart-disease in the Army) which appeared in the Army Medical Report for 1876, issued in January 1878; in which it is shown that heart-disease is certainly produced by the training which the recruits undergo.

I conclude by repeating the plain directions by which injury to recruits can be altogether avoided :—

1st.—Start from a basis of real military necessity: sending the men to practise only such work and exercises as they are liable to be called on to do: excluding the artificial evils I have spoken of: namely,

a. Chest dilatation.

b. Directing attention to the manner of disposing the weight of the body.

c. Extension motions for opening chest.

2nd.—Abandon the false idea of human perfection of figure, as it is now supposed to be exemplified by the "position of the soldier": and instruct the drill-sergeant to improve the faulty symmetry of awkward looking men, by directing their attention, not to their chests, but to the fault—whether unequal height of shoulders, head held too much forward—whatever the fault may be.

3rd.—Corrections of the above kind to be made not exclusively when men are standing, but *chiefly* when they are practising military movements and evolutions: for thus the great disadvantage is got over of keeping men long standing still.

4th.—As the soldier is a man whom we select, and whom having selected, we are bound to further prepare, for hard work, let us see that he practises it—making marching and running the chief items in the training—but that he does so under natural and not artificial conditions: under conditions, above all, which allow of no interference with the important functions of the heart and lungs.

These simple directions apply to men already in the Service as well as to recruits now joining and yet to join. To the first, however, it will be necessary to admit that what they had been taught was wrong. I do not see, at least, how such an avowal is to be avoided: for, doubtless, the drill-book will be altered. To any men who were noticed to continue, from force of habit, the dilating of the chest on parade, the advice before given should be offered.

It has been the duty of medical officers to select the men who compose the army; and it has been their duty to watch over the surroundings of these men :—the sanitary condition of their barracks; the ventilation of their rooms; everything, in fact, whereby their health might be secured. But—I think I speak fairly when I say—medical officers have not felt at liberty to follow the soldier into the drill-field: for all that is done there has been supposed to be dictated by military necessity; and military necessity, when real, may not be interfered with. It is, of course, in our province to point out sources of disease or inefficiency from whatever cause arising: but the chest-swelling, and general maltreatment of the soldier on parade, have been supposed to be eminently beneficial to him! And suspicion that a thing is evil does not readily arise if it be done in the name of good. It is only in this way that I

can account for the fact that an attempt has not, until now, been made to show the evil.

Perhaps another reason why this mischief has not come earlier to light is that heart-disease may be far advanced, and yet give rise to little trouble : the sufferer being even able, though with distress, to go through a considerable amount of exertion. And the gravest forms of heart-disease are known to be long compatible with considerable interest in, and enjoyment of life. I recall just now two cases which I shall give briefly. In a boy of 10 years, whose heart I examined when a student, with the view of learning the normal sounds, I heard what I could not at the time appreciate ; but what indicated aortic regurgitant disease. Knowing that something was wrong, but without knowing the gravity of the case, I brought it to the notice of a physician who told me what it was. The boy grew, continued his education, and never complained until many years later : and he could not believe that there was anything the matter with him. To compensate for the valvular deficiency the heart hypertrophied enormously, and maintained the circulation until he was 21 years of age. Thus, for 11 years from the date at which the disease was discovered, and discovered accidentally, he lived in comparative comfort, was able to enjoy school-boy life, though of course advised to avoid active exercise; and never complained except during the last year or so, when the great force of the cardiac impulse troubled him, and produced occasional bleeding from the nose. The other case was that of a soldier of nearly 21 years' service, who came to hospital complaining of breathlessness ; was examined by me, was found to have aortic valve disease, was admitted, and died in 9 days. He said on arrival that he could not understand what had come over him, that he had felt very well until two days before, when he became breathless. He had not been in hospital for years, and never for any heart affection. Nevertheless, this disease *must* have been of long-standing : for his heart was about three times its proper weight. It weighed thirty-three ounces and a half : and two segments of the aortic valves were as if curled up short, and thickened. There was also calcareous degeneration of the coats of the ascending and transverse portions of the arch of the aorta. I need scarcely say that I do not cite these cases for the reading of medical men, who know these things. I trust military men, who may help towards having something done, will read this paper : and I give these two cases only to show them that much mischief may be present in men who look all right, who look "striking" in the eyes of the inspecting military officer as he walks along the line. A pain in the bowels, a cold in the head, a sprained ankle, a blistered foot—any of these things will decide a man to go to hospital ; but how many men are suffering from heart disease—I allude chiefly to hypertrophy and irritability of the organ ; for, happily, valvular affections, though very frequent, do not form the prominent feature which the former affections do in the army—who never complain. I hit upon the right word when I used the expression "*untold* suffering." Let those young men be remembered who, after an army experience of one or two years, in peace time, are invalided as being useless ; having spent months of their short

service in hospital: and who are sent back to their friends damaged for life in the name of military necessity. All acknowledge real military necessity: it is because I have been able to show that the practices herein considered cannot be properly described by that name, that I have undertaken to condemn them as false, unnatural, and injurious. Is it not due to the Service and to the public that the necessary changes should be made without delay?

King's Road, Guernsey,
April 15*th*, 1878.

POSTSCRIPT.

I think it well to add a few lines to what has preceded, lest, owing to the hurried manner in which this paper has been prepared, misconception on one or two points should arise.

Firstly, it may possibly be objected to my having spoken of the order for the disposition of the weight of the body as involving an unnatural attitude, that this is not so; inasmuch as any position or attitude the body is capable of assuming cannot be said to be unnatural. This would be hyper-criticism; but it would be fair, if I have not made it sufficiently plain that I was not dealing with a momentary attitude, or an attitude the immediate preliminary to movement; but with the *standing* position of the soldier; the position in which he is *kept*. A momentary attitude, no matter what, could have been no mark for criticism at all. We know that recruits *are kept standing in this attitude*, and that so also are old soldiers of 20 years' service, when at "setting-up" drill: and this in accordance with the terms of the drill-book (Sec. 1). It was in this sense that I called the "position of the soldier" unnatural.

Secondly, it may seem bold to have attempted to set aside altogether the portions of the two sections of the drill-book (Secs. 1. and 5.) with which I dealt. It may be thought that it would have met the case to say merely that extension motions are *over*-practised by the men, and that if the time were limited, say to ten seconds at a time for the swinging of the arms "as quickly as possible," and such like recommendations for the other extension motions, no harm would be done. And similarly of the standing attitude of the soldier at attention; if a time-limit were fixed for it, which, I must remark is impossible in practice, all would be well. In short it may be said that if I had proposed a time-limit in respect of the standing position of the soldier, and of the extension motions, instead of advocating the total abolition of the latter, and the removal of the evils of the former, I would have proposed something, if not more practical, at least more practicable. No time-limit is given in the drill-book, and I should be sorry to suggest any such thing:—Of course men must stand erect while they are being told what they are to do, and this may take a considerable time: they must stand in an attitude of attention. I do not want this to be different from what it is now, except in respect of chest-swelling, and the thing which, as shown, is an additional incentive to chest-swelling; namely, the order directing that the fore part of the feet is to bear the chief portion of the weight of the body. I recognize, of course, that it is not possible for military officers to address men, much less to put men in motion, who are standing anyhow. There must be attention and uniformity. All I ask for is that the attention and uniformity shall not include the two objection-

able things just mentioned. And concerning extension motions, a time-limit in regard to most of them would be practically useless: for instance, the "first practice," containing the direction to "force" the arms backwards, and to "elevate the neck and chest as much as possible"—a bad order, meant to open the chest. Then, again, the stooping extension motion—which I regret having styled the apoplectic amusement, for the matter is serious enough—what time-limit will any one venture to suggest for that? I did not adopt the course I have indicated because to have done so would have been equivalent to pointing out the right road, and then deliberately recommending that the wrong road should be taken. These are the things which commit the recruit to the discretion of the drill-sergeant, the things which—with the bodily suffering and mental irritation induced by them—have caused him before now to run his tormentor round the parade-ground at the point of the bayonet; *and which the men believe to be the chief cause of the desertion of recruits from the Army:* a belief in which I concur. The recommendation which I have made—that soldiers should be practised in soldiers' work, meaning real, legitimate, work, and real military exercises, and in no other—is a safe recommendation. Some may say it is insufficient, even with the gymnasium which all approve. I only ask, will not the sterno-clavicular and shoulder joints, and the muscles attached to and arising from the scapulæ, be amply brought into play by bayonet exercise, fencing, swimming, digging, cricketing, etc., without the swinging of the arms in the manner ordered in the drill-book? When some *work* is found to require this swinging, then it will be time to practise it.

I have to acknowledge much want of system in the arrangement of this paper; and, in parts of it, much perhaps unnecessary verbosity. But the case is a good one: and if I thought it needed a more careful statement in order to ensure for it the attention it demands, I would not hesitate to re-write it. If, however, the truth of the matter is allowed I shall not object to criticism of the manner in which it is stated.

F. A. D.

A Paper concerning the Relation of Aortic Disease, of Aortic Aneurism, and of destructive Lung-lesions, in the Army, to the Artificial Chest-dilatation which forms a portion of the physical training of the Men.

In the following remarks an endeavour will be made to connect the setting-up drill, which soldiers undergo—and which was treated of in former papers—with the diseases named in the heading. I consider that such a connexion can be established. Setting-up drill being, as I have already proved, capable of inducing morbid conditions of the heart itself, it is reasonable to suppose that other parts of the circulation beside the central organ, may be adversely affected by it: and I think enough can be advanced towards convicting this drill of being an important determining cause of the above-named diseases in the Army, to make what I have to say worthy of consideration. I do not believe that the Medical Department regards as satisfactory the present state of our knowledge of the etiology of the circulatory diseases of military life: in which term I include the destructive lung affections—viewing the lungs as that expanded portion of the circulation in which the venous blood is spread out, as it were, for aëration: and I am sure that anything deserving the name of a contribution to the subject will be willingly received. For, if there be anything special producing the great proportion of these diseases which is found in the Army, it is of the greatest importance that that special thing should be pointed out. And particularly so if the cause be removable. The view here put forward is that there is in the Army a special cause which will largely account for the excess of circulatory diseases; and that that cause, as shown in a preceding paper, is removable. But I would remark that even if it should be concluded that I have established no connexion whatever between the setting-up drill and the diseases named in the heading,—that the attempt to establish that connexion has proved a failure, I nevertheless claim that action be taken upon what I have previously shown: namely, that setting-up-drill produces, *per se*, and independently of dress and accoutrements, soldier's irritable heart and hypertrophy of the organ. And if the case can be made no better against it, it is surely good enough already. It will, at least, be allowed that a hypertrophied or a dilated heart cannot be good for its aorta, or for the lungs. The intention of this paper is very limited. It is not a paper on aortic disease, aortic aneurism, and destructive lung lesions, in the army. Its object is merely to show the manner in which the prevalence of these diseases is so greatly favoured by the artificial chest dilatation, which forms a portion of the physical training of the men:—

Taking first, and taking together, aortic disease and aneurism of the aorta—the lung affections to be taken briefly afterwards—it should be said that the question of the causation of these affections in the Army

has received much attention. In two consecutive years, between April 1867, and April 1869, no fewer than thirty-six cases of aortic aneurism were treated at Netley Hospital. Two principal causation-views have been advanced in order to account for the remarkable prevalence of this disease (aortic disease and its common sequel aneurism) among soldiers : and these views may be summed up, I think fairly, thus. One is that the excess of the disease is due to the constriction of the chest, which the soldier suffers in his tight dress and accoutrements—the causes in fact which have been regarded as productive of the excess of heart-disease. The other view is that constitutional syphilis is at the root of the mischief, producing disease in and weakening of the aortic coats. I think I am right in stating that those who have advocated the one of these causation-views do not set aside the other: but, while admitting both, they attach a special importance to the causation-view of their choice, and regard the other as being of comparatively minor importance. Rheumatism and alcoholism are put in the back-ground, and, I think, for the young soldiers, properly so. Those who favor the obstruction-by-tight-clothing view admit, of course, that an aorta weakened by syphilitic, or other disease, will give way before the increased blood-pressure of hypertrophy, more readily than a sound vessel: and those who regard preceding disease of the aortic coats as a *sine quâ non* (at least for the majority of cases) grant, in return, that the hypertrophy produced by tight clothing or other external constriction, is of much assistance in determining the occurrence of aneurism. But these latter cling to the opinion that arterial *disease* almost necessarily precedes any giving way of the vessel-wall—certainly so (I take it) when it is a question of a sacculated aneurism. Thus, then, the two causation-views, although opposed, help each other out to explain the great prevalence of aneurism in the Army. So to put it—there is plenty of syphilis and plenty of tight-clothing, and therefore plenty of aneurism. And there the matter rests. But it should not be allowed to rest there.

Now, the constriction-by-tight-clothing view of the causation of aneurism, would appear to be favoured by such a consideration as the following. Let us say a civilian of about the soldier's age contracts a hard chancre. He has secondary symptoms in due course—cutaneous eruption, or throat ulceration. He consults a surgeon, but not before the signs of constitutional taint have shown themselves. Suppose the treatment he now undergoes to be judicious; does the Surgeon who prescribes it contemplate as a likely, or, I might almost say, a possible eventuality, the death of this man by aortic aneurism as a consequence of his hard chancre? He certainly cannot think that aortic disease is already set up: but does he contemplate aortic disease for his patient at all? Suppose the treatment to be injudicious, or ineffectively carried out:—or suppose no treatment whatever. Then, of all the places in which constitutional syphilis may locally declare itself, may find a site, does it occur to the mind that the aortic coats of this civilian are in danger of being attacked? No: the practitioner looks for syphilitic disease in its most horrible outward forms; he looks for absorption of bone, and even for grave diseases of the nervous system,

not excluding hemiplegia, paraplegia, ataxia, and insanity, before he contemplates, if he contemplate at all, the dire misfortune of aortic disease for his patient. Now, the soldier, as has often been said, has far more chance of early and appropriate treatment than the civilian—at least, than the civilian of the class of life from which the soldier, as a rule, comes. Nevertheless, he must run a risk of aortic disease and aneurism which the civilian does not run. Such a consideration, I say, *appears* to favour the causation-view adopted by Professor Maclean and by Mr Myers—the writer of the "Alexander" Prize Essay on heart disease in the Army. I mean that it appears to favour that view as against the syphilitic-view—if I may so call it.

On the other hand, however, we have the unquestionable fact that, in the Army, syphilis and aortic aneurism are intimately associated. In a very able paper, to be found in the Army Medical Report for 1873, Mr. Welch proved this association: and there is no doubt that what Mr. Welch describes as syphilitic disease of the aortic coats *is* syphilitic disease. He showed from the pathological records at Netley that "Aneurismal dilatations are associated with syphilis to the extent of 60 per cent, and without it (they are found) to the extent of 4·4 per cent., and that aortic disease tending to dilatation is very rare otherwise than with it." Concluding the paragraph I am quoting he says—"It seems an incontrovertible deduction that syphilis must be put down as a very potent cause in the production of aortic disease and its sequel aneurism." I remember that this view did not find much favour in the eyes of the members of the Medico-Chirurgical Society before whom, some years ago now, Mr. Welch read a paper embodying it. It would have been surprising indeed if it did not meet with hostile criticism at the hands of civilian medical men. These latter see plenty of syphilis, and very little aneurism traceable to it: but, while they considered it too great a jump from a hard chancre to aneurism of the aorta, they did not, if I recall correctly the discussion on Mr. Welch's propositions, call his pathological investigations into question!

These, then, are the two antagonistic views—Syphilis on the one side—tight clothing on the other. Mr. Welch demonstrates syphilitic disease in the aortic walls; but his opponents, civil and military, cannot get over the fact that in civil life the aorta escapes. Now, of these two causation-views, I regard that which attributes the great excess of aneurism in the army to syphilis as the more correct. In other words I consider that constitutional syphilis is more to blame for aortic aneurism in the army than tight-clothing. I concur also, of course, in the proposition that hypertrophy, if brought about by tight clothing and accoutrements (as it may be) will tend to produce aneurism: for this hypertrophy would be the immediate cause, perhaps, of the dilatation of that portion of the vessel which had been most weakened by preceding disease (syphilitic or other): which dilatation, I may add, might not have taken place, even in a diseased vessel, under ordinary blood-pressure. But, with Mr. Welch, I regard *preceding* disease of the aortic coats as essential, in almost all cases, to the production of aneurism: for post-mortem examination supports this opinion. And I must add—although

I advance no reason just now for the statement—that the idea of a healthy aorta having a sacculated aneurism (this form largely predominates) formed in it simply by the distending influence of blood sent forward by a hypertrophied left ventricle, does not commend itself to my mind. It cannot be denied of course that such a thing is possible. But, as I said, with Mr. Welch, I consider preceding disease of the aortic coats an essential in almost all cases for the occurrence of aneurism.

It will be plain now that what we want to arrive at is an explanation of the association of syphilis with aneurism in the army. We must admit this demonstrated association, but we admit it unwillingly, because we find no such association in civil life. And here I must point out that the constriction-by-tight-clothing view does not afford this explanation. Indeed, it has never been contended that it does. It has been contended that tight-clothing and accoutrements by inducing hypertrophy, may produce aneurism of the aorta: and it has been contended that *if* the vessel be diseased their influence will be all the more likely to have this result. But it has never been contended that the faulty clothing of the soldier affords any explanation of the remarkable association of syphilis and aortic aneurism in the army. In what way, then, may this association be satisfactorily explained? Why does syphilis so frequently select the aorta of the soldier, and pass over that of the civilian? In answering these questions I hope to show the relation in which aortic disease stands to the artificial chest-dilatation of the drill-field. I do not say that chest-dilatation can directly produce disease in the aorta, but I do submit that, in the presence of constitutional syphilis, it can *determine*, as I shall endeavour to show, *the development of syphilitic disease in this unwonted site.*

The argument—I trust it will be allowed to deserve the name—is founded on the relation which exists between structure and function: on the fact that any considerable alteration in the amount of function required of a part is necessarily followed by some alteration in the structure of that part. And this is true of a gland, of a muscle, of a ligament, of the skin, when all the co-existing conditions are physiological. Now, I propose to show that the demand upon the functional qualities of the aorta (if I may be allowed the expression) is very much greater during the chest-drill than it is when the chest-movements of inspiration and expiration are being normally performed—unhindered by the attention being directed to them. If this drill can entail hypertrophy of the heart, as I have shown, what may it entail on the aorta?

To avoid repetition I must refer the reader to the paragraphs of my first paper on this drill-question, which describe the manner in which the balance between the pulmonary and systemic circulations is disturbed by the drill: asking his attention especially to the fact that, in consequence of the pulmonary congestion quickly induced by it, the left ventricle receives a deficient supply of blood: deficient both in quantity and in degree of aëration. This results in a considerable rise in frequency of the pulse, which, the body being motionless, cannot be accounted for as being due to the exercise being undergone. The ventricle, having less to contract upon contracts more frequently—for the system requires

the blood. But the supply to the ventricle through the pulmonary veins being lessened—the rise in the pulse-rate being the measure of this lessening—and the condition of the chest which brings about obstruction in the lungs being kept up—expiration in abeyance—it follows that there is less blood in the arterial system than usual; and this is defective in degree of aëration. Now, the aorta must accommodate itself to this abnormal state of things. Above all arteries it is the artery most likely to be injured (the word will not be taken literally) by the withdrawal of accustomed support within it. This elastic vessel is called upon to maintain due pressure on its diminished contents: and, of course, it does maintain pressure on the blood passing through it. But the pressure is insufficient; and its insufficiency duly to maintain the pulse-wave is revealed in the small and jerky radial pulse found in almost every recruit drawn up in the regulation attitude. While I would guard against its being concluded from what I have said that I conceive the diminution in the quantity of blood in the systemic arteries to be anything very remarkable, I nevertheless press the importance of the point under consideration, viz.: diminished support, from deficient blood-supply, in the systemic arteries. The muscularity of all smaller arteries should, however, be mentioned as tending to lessen the degree of this diminished support within the aorta. This muscularity comes into play, aiding in the production of the characteristic pulse already noticed.

Not only, however, is the aorta thus placed at a disadvantage in regard to its function of exercising due pressure on its contents—a disadvantage the extent of which will be appreciated when the special anatomical characters of this vessel are remembered—but, being thus placed, it receives from the ventricle blood which has been ejected more abruptly, and, as hypertrophy is induced, more forcibly, than under normal conditions. A necessary consequence, then, of the chest-dilatation of the drill-field is an unusual and abnormal demand upon the functional qualities of the aorta. This demand is in truth both unusual and abnormal; and cannot be compared with that arising as a consequence of natural active exercise or work, during which the movements of respiration are unimpeded. A moment's reflection will cause this point to be conceded: for, although it may be said, truly, that very active exercise, continued long enough to cause great breathlessness, can bring about a disturbance of the balance of the two circulations: yet it must occur to the objector that the origin of the congestion of the lungs and right side of the heart in the latter case, is not, primarily, the same as it is in the chest-drill—the expiratory act being unhindered, with all that that signifies. I am tempted to repeat points already dealt with: but will only add that setting-up drill is not active exercise; requesting a reference to the 11th and 12th paragraphs of "A Contribution to the Etiology of Heart-disease in the Army," (Appendix No. VI. of Army Medical Report for 1876), without which reference the argument may, I fear, appear somewhat incomplete to the reader.

I might, perhaps, at this point safely ask the reader to allow that the adverse influences above spoken of are capable of occasionally producing aneurism of the aorta. Indeed, the occurrence of aneurism

is at present put down to less potent causes. I shall not ask so much, however. I do not even ask that these influences shall of themselves be allowed to be sufficient to produce disease of the aortic coats. All I shall contend for is that these adverse influences are—in as much as they involve increased and abnormal functional activity for the aorta—certain to originate an alteration in the nutrition of the coats of the vessel, tending to tissue-growth: and that this tissue-growth will be most active in those parts of the vessel most experiencing unaccustomed functional strain—whether this increased strain arise from diminished support within the aorta, or from the powerful contractions of a hypertrophied left ventricle; or eventually from both of these causes combined. I am within my logical right in that contention. I will allow, too, that the intention of this tissue-growth is beneficent in the circumstances. Alas! of course, for the circumstances. I hope the reader will admit that the conditions described are sufficient to produce intersticial thickening—tissue-growth—in the aorta. Let him remember that embarrassment of the heart is certainly brought about by the holding in check of the act of expiration, and let him reflect on the consequences of this to the aorta, not merely as regards irregular or excited cardiac action, but as regards the partially-checked passage of blood towards the left side through the pulmonary veins. To arrive at the cause which originates this tissue-growth,—damaging to the elasticity of the vessel, even if it never became degenerate—is the end of this inquiry. I hold that the artificial chest-dilatation, now taught, long taught, to the men, produces this growth in the first instance; and I think enough has been said to gain the assent of the reader to this opinion.

We have now got as far as a beneficent tissue-growth in the aorta, and shall here repeat the question—Why does syphilis so frequently select the aorta of the soldier and pass over that of the civilian. The answer is—because that of the soldier is the seat of tissue-growth: because it is the seat of active nutritive changes, such as are comparable neither with those ordinarily taking place, nor with those of growth from youth to maturity. The vascular supply of the coats of the aorta is increased and tissue-formation is active. Now, my position is that the presence of this tissue-growth in the aortic walls can, if the subject of it contract constitutional syphilis, determine the selection by the syphilitic poison, of the aortic walls for its local manifestation—that an abnormal growth of normal tissue-elements constitutes a weak point in the economy in which blood poisons are likely to set up disease.

The relation in which aortic disease in the Army, as well as its common sequel aneurism, stands to the chest-dilatation which the men undergo, will now be apparent. I trust the view put forward will be regarded as helping to explain the striking association of aortic disease and aortic aneurism with syphilis. It is certain that there is some hitherto unexplained reason why syphilis should select the aorta of the soldier as it does—some reason why aneurism in the army should be associated with this disease "to the extent of 60 per cent., and" be found "without it to the extent of 4·4 per cent., aortic disease tending

to dilatation being very rare otherwise than with it." The question for the reader is—Is chest-drill to blame? If he decide in the negative, then let him not merely declare himself unconvinced: let him seek to reveal a cause or causes more likely than the obstruction to the circulation described in my first paper (published in Blue Book for 1876) to affect the nutrition of the aortic walls, and to determine the site of development of the syphilitic poison: for *something* determines it. I mean that it is not sufficient, it is not satisfactory, to be told that, given constitutional syphilis, there is no organ or tissue safe from its ravages. This is true, no doubt: but instead of opening discussion such a smooth saying checks it. We want to account for the frequency of syphilitic disease in the aorta after a more definite fashion than that.

But if the reader withhold his assent to the view advanced, it becomes necessary in some way to account for the tissue-growth of which I have spoken. And I commend to him, with this end in view, the following extract from Mr. Welch's valuable paper (A.M. Report for 1873) already alluded to. Indeed the whole paper should be carefully read: on which account I shall refrain from quoting many passages which favour the argument now offered. "The evidence "furnished by the records of this hospital (Netley) clearly shows that "it is impossible in pathology to separate the arterial disease from the "dilatation known as aneurism, the former being the precursor of the "latter: and this is seen, not only in those examples coming under the "category of aneurism, and classified as such, but also in those cases "of disease elucidated only *post-mortem*, the cause of death being "otherwise than the arterial lesion, but in which the lesion is present, "though not sufficiently advanced or pronounced to give it a maximum "importance in the determination of death. From the fibrous "formation between the internal and middle coats to the aneurism is a "connected chain, which commencing in a tissue-growth abnormal in "origin, leads, through a degeneration of the formed material, to "impairment of the resiliency of the arterial walls, and so under "internal blood-pressure to dilatation." (A very important foot-note occurs here which is too long to transcribe.) "That the degradation "of the vessel coats is no mere result of age-changes is clear from the "death-age of the individual cases adduced in this series: that a "tissue-growth precedes the degradation is unquestionable; hence the "important point in *etiology* is to find out the *causation of the growth*, "*the conditions which originate the germination of the deeper layers of the* "*internal and contiguous layers of the middle coats of the aortic walls*, for "the subsequent fatty and caseous degeneration to which it is liable, "and which brings it under the category of atheroma, is a phase "common to most abnormal growths, and some normal structures." The italics occur in the original. It is plain that Mr. Welch thinks, or thought when he wrote the above, that the causation of the growth had yet to be discovered.

There is another paragraph in Mr. Welch's paper which is well calculated to stimulate inquiry. It is the following:—"That the "syphilitic virus, as an exciting agency of the end-arteritis is generally

"dispersed in the Service, equally as is aneurism, will be seen by "referring to my table on the relative prevalence of secondary disease "throughout the Army, in the Blue Book 1872, p. 389. The end-"arteritis is shown at page 384 Blue Book, 1870, to be the most "commonly observed sequel of infection, and I am inclined to think "that, although not limited to any one period of virus-evolution, it is "generally one of the earlier produced lesions of the internal "structures, and this is in consonance with the comparative absence of "gummatous nodules in the viscera of the cases of aneurism adduced, "the vascular lesion killing before the so-called tertiary lesions had "had time to become developed in the internal organs." Non-military surgeons regard this, of course, as very astounding doctrine; and although it is true for the soldier, they refuse to believe it. As I said, it is, for them, too great a jump (as it should be for us) from a hard chancre to aortic aneurism. Something, they think, must be in the back-ground: and they are right. More justice would have been done by the Medico-Chirurgical Society to Mr. Welch's valuable researches in the post-mortem room, if some such attempt as I now make had been made by him to show cause why syphilis should select the aorta of the soldier. There would at least have been another factor in the case with which his critics must needs count.

It may further tend to stimulate inquiry if I quote also the following from Mr. Myers' prize-essay—"To this (disease of the aortic coats) I "shall now proceed to allude, and in the first place may state my "belief that very few specimens of thoracic aortas in a perfectly "normal condition are to be found in soldiers who have died after "eight or ten years' service." That is a remarkable, if a somewhat vague, statement. I do not like to put a construction upon it such as it may not fairly bear; but perhaps Mr. Myers means by "very few" 30 or 40 per cent. I cannot help thinking that would be an exaggeration. He must have had some grounds for making that statement, however: and, taking it in conjunction with Mr. Welch's carefully-drawn conclusions from post-mortem examination, it is deserving of consideration. But suppose we say that 50 per cent. would meet Mr. Myers' view when he says "very few specimens of perfectly normal thoracic aortas are to be found in soldiers who have died after eight or ten years' service"—even then some very generally acting cause must be at work. Would not the idea of 50 per cent. of more or less diseased aortæ being found *post-mortem* in men of the most unhealthy trades and habits be scouted as utterly improbable; more especially if the death-age were limited to 32 years of age. Most soldiers have completed "8 to 10 years' service" long before that age. He attributes the abnormal conditions of the vessel to two causes—syphilis, and mechanical obstruction to the circulation, meaning that produced by tight clothing and accoutrements.

For an account of the pathological appearances I must refer the reader to Mr. Welch's paper: noting here, however, one point insisted upon by him: namely, that "the condition of the vessel at the onset "of the disease is not that of dilatation, but on the contrary it is "thickened with its calibre encroached on."

I beg to repeat the words—thickened with its calibre encroached on :—Let that be read in connexion with what I have previously shown—that the systemic arteries contain during the chest-drill a less than the normal amount of blood, the aorta having to accommodate itself to this unusual state of things (see *Ante*). If altered function means alteration in structure, surely alteration in structure will occur here : for the aorta is not a muscular but an elastic vessel.—If the surgeons of the Army will not have it that the drill is to blame in the manner I have tried to point out, there is certainly ample inducement in the paragraphs I have quoted, from Mr. Welch's paper and Mr. Myers' Book, to make them set about finding out what *is* to blame. The matter should not be allowed to rest. I do not, of course, claim to have proved anything in this paper. I have contended for a reasonable view, giving the reasons. A view supplementary to, and giving force to, Mr. Welch's opinions. And, practically, it is a safe view : for it only seeks further to condemn what is now admitted to be wrong—the chest-dilatation—the persistent ignoring of the act of expiration—taught in the drill field.

Now, although I am not concerned to support the syphilitic origin of aortic aneurism apart from some explanation of this origin such as I have given, yet I cannot help, before concluding this portion of the subject, alluding here to a piece of criticism, adverse to Mr. Welch's views, to which some weight appears to be attached. It has been said that among all the cases of aneurism brought forward by him there was no example of syphilitic heart-disease. But the very point of Mr. Welch's contention is here lost sight of. He was careful to state that the early death-age often precluded, and also that the rapidity with which the vascular lesion killed, often precluded the possibility of the so-called tertiary lesions becoming developed in the internal organs. (See the whole paragraph already quoted.) Mr. Welch's cases showed extension of syphilitic aortic disease to the aortic valves, and in one instance to the mitral, but his critics want gummatous nodules in the muscular substance of the heart at a period long antecedent to their development in more usual sites—liver or testicles. To take him to task, to account, according to his view, for the comparative infrequency in the Army of arterial disease in vessels of less calibre than the aorta, would have been more to the point. It might have had the effect of raising the issue which I now raise. But allowance must be made for Mr. Welch's critics as well as for Mr. Welch—there being a factor in the case ignored by both one and the other. The members of the Medico-Chirurgical Society objected to being told that "this (aortic) end-arteritis is the most commonly "observed sequel of (syphilitic) infection," because it did not at all accord with their civilian experience, and Mr. Welch did not tell them why it did not so accord. He gave them pathological facts : but we only like to admit facts to be facts when we see reason for the admission.

2.—It is time, however, to turn to the destructive lung diseases of the army. Will the chest-drill help to account for their prevalence ? I

shall not have much to say on this point that might not be inferred from what has preceded. I said in my first paper that pathological states may be expected to commence when physiological conditions are departed from. This should be true of the important organs of respiration. I showed that the heart-embarrassment begins by lung-embarrassment; and that the latter begins in congestion of the pulmonary capillaries, due to interference with the act of expiration. How this periodically-repeated congestion may affect the walls of the functional blood-vessels; how the elastic parenchyma of the lungs may be affected by this congestion: how the *nutrition* of the lung parenchyma itself may be influenced by the increased and uncalled for function thrown upon it; while at the same time the air-cells are over-distended by forced inspiration, and (for want of due expiration) the air in the ultimate air-vesicles is not duly changed—are points into which it is not necessary for me again to enter. But I contend here that the increased functional call we impose on the elastic structure of the lungs, in the drill-field, results in intersticial changes tending to hypertrophy of that elastic structure. To quote a few lines from my first paper: "Hypertrophy of the elastic parenchyma "of the lungs might be expected to occur on the *ubi stimulus ibi fluxus* "principle: but if it does it will not be compensatory, and tending to "the restitution of expiratory power; but will cause pressure upon, "stretching of, and partial obliteration of, the functional blood-"vessels—the pulmonary capillaries."

But, it will be said, this is a long way off from destructive lung-lesions: a long way from the various forms of phthisis pulmonalis which prove fatal, some very quickly, some slowly; but which admittedly cause a great mortality, and a greater invaliding. Well—be it so. For I have not ventured to say that chest-swelling can at once produce organic disease of the lungs, ending in hæmoptysis and disorganization. But let us see what *has* been advanced to account for the destructive lung-lesions of the army. While there are destructive lung diseases in the world we shall have them in the army; but to what cause have we hitherto been putting down the great excess of these lesions in carefully selected soldiers? To impure barrack-air. "This" (writes Dr. Parkes) "is the conclusion to which the Sanitary Commissioners for the army "came in their celebrated report, after assigning all probable influence "to exposure on duty, intemperance, and a somewhat faulty diet"—Impure barrack-air. Dr. Parkes agrees in this conclusion. He gives a table in his work on Hygiene showing that out of every 100 deaths 35·77 are caused by destructive lung lesions for the army at large. But, he says, "there is an astonishingly disproportionate number of cases of tubercular disease in the Foot-Guards, which is still as remarkable as it was twenty years ago." And Dr. Parkes goes on to say—"It may "be safely concluded that the larger part of the men invalided will "shortly die, and their deaths will swell the mortality from tuberculosis "of the civil population. The table shows in fact"—continues Dr. Parkes—"that there must be a large amount of phthisis *generated* "in the army, and in the Foot-Guards it would seem to be nearly four "times as much as among the civil male population of 25 to 45 years

"of age." The air breathed by the Foot-Guards must be exceptionally bad. That is a fair deduction. There is no other reason given why the Foot-Guards should specially suffer. They are selected in a very particular manner for a very particular corps. But I say that the deduction is not only fair—it is accurate. I do not say that their barrack-rooms are less airy and roomy than those of less favoured corps; why should they be? But the air they (as a body of men) breathe must be exceptionally bad. The amount of chest-drill required of the Foot-Guards may not exceed that required of other corps as regards the number of hours of its daily practise, but it is carried out with exceptional strictness: the proportion of men who succeed in evading the drill-sergeant's orders being less considerable than in the line generally. I beg permission to quote shortly from my first paper. "The inspiration, then, a deep one—which the recruit "takes at the word of command—produces physiologically an "acceleration of the movement of blood from the large veins on the "exterior of the chest towards the heart, which movement of blood "towards the heart *had been retarded by the previously-occurring and* "*duly-performed expiration*. Now, as expiration is not, after the word "of command, again duly performed, and as the position of the thorax "is one of deep inspiration and remains so—the diaphragm doing "little to diminish the size of it, and the elastic recoil of the lungs and "chest-walls being overcome by voluntary effort, does it not follow "that, in a given time, a larger quantity of venous blood will have "passed into the right side of the heart than would have passed if the "check, or retardation, which the expiratory movement (properly "performed), exercises, had been imposed? I do not quite contend "for a *vis a fronte;* if that were established for a moment it would "soon be disestablished. The right ventricle contracts vigorously, "but the blood it drives forward for aëration cannot part with as "much carbonic acid, or receive as much oxygen, as if respiratory "movements were normally succeeding each other all the time. The "degree in which the exhalation of carbonic acid suffers hindrance is "in direct proportion to the impurity (CO_2) of the air in the ultimate "air-vesicles. This air is only changed (if it can be spoken of as being "changed) by the law of diffusion of gases; but in the absence of "efficient expiratory movements this law is at a considerable dis-"advantage for the purpose required, &c." . . . . Now, so far, we are not out of accord with the Sanitary Commissioners for the army. Impure air has some of the blame to bear, but not altogether the barrack-room air. There is dyspnœa, distress, and even exhaustion, due to imperfect respiration in the *open air*. I grant, of course, that sleeping in a close barrack-room is bad for health. It is not only bad for the men undergoing this drill, but it is worse for them on this account than it would otherwise be. But if, with the Sanitary Commissioners for the army, we must blame barrack-room air for the excessive prevalence of destructive lung-lesions, shall we pay no heed to the dyspnœa, distress, and exhaustion, of the drill-field, due to the imperfect respiration taught there? Is the imperfect respiration which even induces grave disturbance of the circulation less injurious

than that which does not? Must we take care that the men have pure air to breathe, but also take care that they are first rendered more or less unfit to breathe it?

But I do not merely contend that the impurity of the air in the ultimate air-cells (whether owing to insufficient ventilation of barrack-rooms, or to the holding in check of the act of expiration, or whether owing to one and the other) is sufficient of itself to account for the mischief that ensues. I contend for something more specific; namely, that nutritive hypertrophic changes are induced in the lung-parenchyma of many of the men who have to make more than usual efforts to satisfy the drill-sergeant's demand for thoracic prominence. This altered amount of function will induce altered structure in the direction of *growth*. It is trite that the persistence of functional derangement is certain to induce organic change. I might say organic disease. I shall not say organic disease: but how easily may organic change become organic disease, (in lung structure especially) in the presence of blood poisons—syphilitic, rheumatic, or alcoholic. Will not the predisposition, also, be greater to low inflammatory attacks from ordinary causes? Will not the common causes of bronchitis and pneumonia be more likely, under the conditions I have endeavoured to describe, to produce these diseases, with their too frequent sequelæ in military life—destructive lung disease?

In truth, we have hitherto been putting down the circulatory diseases of the army, constituting together the disability of the army which produces the bulk of the mortality and invaliding, to totally inadequate causes.

Let it not be said that I claim too much for this especial cause of loss to the Service and the State. Let it not be said that I try to prove too much, or that if what I say be correct the mischief ought to be much more universal even than it is: I have elsewhere stated that very many, especially the older recruits, do not appear to suffer: that there are many whose figure requires a minimum of chest-distension to satisfy the drill-sergeant: that those who do suffer suffer by no means equally. Further, that very many of those who suffer even considerably (I mean, in whom a condition of much dyspnœa is induced while at recruit's drill, in the *standing* attitude of the soldier at attention) recover sufficiently to make no complaint whatever. And further, other conditions for the degeneration of tissue-growth, if it occur, into destructive disease of the same, may be wanting: the body has great powers of recovery. Every man does not get secondary syphilis. And if every man got it, every man could not get it at the critical time. Let the critic who thinks I spoil my case by proving too much, undertake to explain the causes of the mortality and invaliding, for circulatory diseases (including lung destructive lesions) of the Foot Guards. Would he be rash enough to leave out of account the system of setting up-drill? I think I may fairly say that I have not overstated the matter.

In conclusion I wish to add—although it in no way affects what has preceded—that in India there is, *compared with at home*, little seen of

circulatory diseases. There are several reasons. An examina
held of all men about to proceed on foreign service. By it r
kept back who have the "soldier's heart," but who have not c
of it: as well as many who had been admitted to hospital
trouble, with breathlessness on slight exertion. This pre
amination is very necessary. But it is strange that it sh
the case of young soldiers who have not served abroad be
still that these latter should furnish the greater numb
This examination is conducted with regard chiefl
thoracic organs—with regard to the
Beyond the matter of age,
for India. The *temperament* o
At enlistment it is as well known a
hot climates is pretty sure to be t
examination is, however, necessary, as m
"broken down under drill!"

Then, again, the men who do come out to In
do so much setting-up drill. There is less constrain
as well as bodily. The conditions imposed by necess
cognized in this climate, and many useless things are, as
left undone. And yet, how stands the case of the Europe
India, as regards the matter in hand? The Report of th
Commissioner with the Government of India, for the year 1876,
to be before me. According to the Sanitary Commissioner the num
of deaths from heart-disease, and destructive lung disease, taken together was, in that year, 123. That is, 61 from heart-disease, and 62 from phthisis pulmonalis. In the same year there were 134 deaths from cholera:—these figures are for the whole of India. There is no argument, of course, intended, in putting these figures in contrast. I merely so put them just to draw attention to the considerable loss by circulatory diseases even in India. We think it, and indeed it is, appalling to lose 134 British Soldiers in one year from cholera; but to lose 123 in the same period from heart and destructive lung disease, even with all our precautions and examinations, seems less terrible. Yet, in reality, the loss to the European Army in India by destructive lung-disease *alone* (excluding heart-affections) was, in the year 1876, greater than the loss, of 134 men, by cholera. The Sanitary Commissioner does not give the number of admissions to hospital for heart diseases, but he does give the admissions under the heading phthisis pulmonalis. They were 468. Now, my experience of the service has been—and if it be not the general experience I trust I shall be put right—that to return a man as suffering from phthisis pulmonalis is a thing that is never done without long consideration of the case. It is, therefore, very unlikely that the diagnosis will be often incorrect. But let us suppose that only 300 of the 468 were really cases of phthisis pulmonalis. We are told that of these 62 died in the country. What became of the 238 remaining? They were, of course, invalided to England. Considering the large deduction, of 168, already made for possible error of diagnosis, it would be great hopefulness to conclude that 38 returned to duty, or to light duty. (I am putting the case most favourably). So that 200 would

than thav discharged in England, to die of phthisis as "civ on:" pure air v how long they lived, the men, after the fin g, are more or lessservice. The loss of European Soldiers ir holera,

But I do s equalled the loss by destructive lung uring in ultimate air-c same period. But if we add the lo no died in rooms, or to th year, of heart-disease; and tak ount the in- owing to one arthis head, (the deaths alone alr he deaths by mischief that ensuchat our loss of 134 lives in 1876 is in- that nutritive hypertr with our loss by circu ases in the same of many of the men who ave to

the drill-sergeant's demand for thoracic prov tuitously compared amount of function will induce altered otner. I admit this. But I *growth*. It is trite that the persiste; and I do not consider the com- certain to induce organic change. a, I felt bound to make *some* allusion not say organic disease: but ha. But, it is at home that this disability organic disease, (in lung stre to see mitigated, and which can be miti- poisons—syphilitic, rheu has now come when the teaching of physiology also, be greater to sregarded in this training of the soldier. But it is Will not the comat only by a long experience of the pathological con- under the condi we arrived at the conviction that physiological laws diseases, with raged with impunity.

lung disease

In truth, K, PUNJAB,

of the *June*, 1881.