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## LECTURES
ON
## AMPUTATION,
AND ON THE
*Nature, Progress, and Terminations of the Injuries for which it is required.*

(Delivered at Sydenham Coll. Med. School.)

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### LECTURE II.

*An inquiry into the value and proper use of statistics applied to surgery and medicine — the nature of their evidence — dangerous character of errors. Mechanical tendencies of the present age—its effects on medicine—good and evil. Importance of including dynamic sources of disease and death, in questions of mortality in amputations—chief objects of inquiry.*

As the most important features of these papers will be developed by statistics, and have reference, more or less direct, to the statistical statements with which they will be accompanied in the form of tables, as the most concentrated mode of giving all results capable of expression by figures, I shall offer a few observations on this part of the subject. Only of late years have statistics been at all scientifically applied as a means of assisting our knowledge of disease; and, like a dangerous poison, it requires to be well understood by those who employ it in man's service.

The real value, force, and proper use of figures, applied to surgery and medicine, is scarcely yet understood. Inasmuch as they form the most incontrovertible of demonstrations in the positive sciences, their results have been somewhat too readily admitted with us, where the circumstances of their application are no longer analogous, forgetting that their evidence may thus be made most fallacious and mischievous. Such has been not unfrequently the result of their misapplication, where writers have been weighing the facts connected with primary and secondary amputation.

Figures have been looked upon too hastily as the truest elements of certainty. They offer great attractions to superficial inquirers, or to minds of but meagre capacity; and we are apt to forget that statistical statements are themselves the result of certain intellectual operations, into which error may glide. As nothing so absolutely, or closely, resembles one figure as another, the utmost caution is required not to compare things essentially different; or which, however similar in appearance, are submitted to different influences, have a different condition annexed to their existence, and are, consequently, no longer the same.

If returns are made up, not including whole series of cases, the conclusions must be incorrect; if they do not give series, under similar external circumstances, the results are fallacious. It may be imagined, that in a thousand cases all these contradictory states and circumstances must disappear, as it were, in the general results of the mass; and that from such large numbers a correct mean average may certainly be gained. This I doubt; it is, at best, a loose mode of arriving at results of such importance to human life. These causes alone, and there are many others, I believe, sufficient to nullify any estimates hitherto made of the relative value of primary and secondary amputations. It is a question which has never yet been fairly tested.

Great, however, as may be the value and utility of statistics in medical science, and in determining the various questions connected with amputation, it will be seen how dangerous their use becomes. Cullen has said, there are more false facts than false theories in medicine, and infinitely more mischievous, nay, fatal, are the former than the latter. The fallacies of a false theory may be detected by close reasoning; and yet if the facts were correctly stated, they may still serve to prove and illustrate sounder doctrines; but if the facts be originally false, no intellectual powers can avail, the very groundwork of sound judgment is wanting; for the facts published are, in truth, so many false premises, the correctness or incorrectness of which it is beyond our powers to determine at the moment, although, by com-

parison with other bodies of facts, their inaccuracy may ultimately be made clear.

For these reasons I shall give all the facts connected with the various questions involved, fully, and in detail, that they may carry with them the full conviction of their perfect accuracy and consistency, which it has been my anxiety they should merit. Nor shall I content myself with a mere detail of physical facts, for that would be to fall into an error on the other side, no less fatal to the true advance of science. The strong tendency of the present day is to reduce all things visible and invisible into the class of material facts, to reduce them to the sensible characters of matter, and then classify and regulate their actions, real or supposed, by certain mechanical laws.

It is truly a mechanical age, and, not content with our wide dominion over earth, air, and water—over all things really material—and the immense accession within the last half century to the physical power of man, we are pushing it now far beyond its natural limits. In considering man's social and intellectual destiny, the dynamic power seems entirely lost sight of; and it seems as though there was an attempt to class his moral and intellectual nature among the mechanical agents to be ruled and developed by mechanism. Medicine has not escaped the evil effects of this prevailing spirit—its professors are not less mechanically disposed; and when we find one of them who gives out a discovery, that, "as the liver secretes bile, so does the brain secrete thought," it cannot be denied that physiology itself is reduced to a state much more closely allied to physics than to reason. Opinions like these would lead us to the persuasion, and to the fatal conclusion that all true science was included in the study of the external, mechanical, and purely material forces—that whatever, in our complex nature, as moral and physical beings, endowed with *vital* powers, cannot be appreciated by study of mechanism—be mechanically investigated and demonstrated by scalpel, probe, and microscope—cannot exist or be understood by the mind. This is materialism in its worst sense, as regards the advancement of physiological and pathological science.

In common parlance, we speak of the machine of society as if it were really constructed, not of so many individuals, each of whom are endowed with an individual, vital, and dynamic force, capable of vast efforts, and the production of effects fatal to the existing state of the whole social machine, but of so many wheels and screws, which could be regulated, worked, classed, and controlled on the same absolute and mechanical principles as physical means and inert matter; so not less common of late has it been to speak of the human body as a machine, and all its various and important organs, instinct with this dynamic and vital power—as so many fragments of a gross and material machine—a steam-engine, which, when once the steam of vital force is applied, can be controlled in all its movements by the finger of a clever mechanician. This is not only truly absurd, but it is, unfortunately, very mischievous and destructive.

Doubtless, in the commencement of this species of inquiry, the close attention which medical men paid to the physical structure of all the tissues and organs, and of the actual and material changes effected by disease in different parts of the frame, was of the greatest value; it served to correct the erroneous opinions, gradually formed upon theories drawn from the operation of the purely dynamic forces, many of which, without the correcting aid of such accurate knowledge, were loose, vague, or altogether contrary to the truth; occasionally, as might be demonstrated, physically impossible. But physical science and mechanical investigation having rendered this service, there should stop within their legitimate sphere, which is almost entirely corrective, very rarely initiative. When it led us to attempt to explain all vital functions and actions by reference only to the physical combinations and construction of the organs, as though each and all were mere mechanical contrivances for a given and definite effect, it carried us into a train of mischievous absurdities, even more to be lamented than those of the dynamic professors; more, inasmuch as it was less philosophic, far more limited and finite in its objects, cramping and controlling our highest intellectual faculties by a subjection to mechanical data, utterly inapplicable and inadequate to the explanation or understanding of all the varied powers, actions, and effects produced in the human system, in its various changes from life and health to disease and death. Hence has sprung up among us mechanical surgeons, mechanical physiologists, and physicians, who prescribe their most subtile remedies upon mechanical principles, and explain fevers by mechanical alterations of capillaries. Hence have sprung the opposite extreme of absurdities, the homœopathists, animal magnetisers, *et hoc genus omne*, especially stamping the medicine of the present day with its two prominent blots and opposing absurdities—the mechanician and microscopists, or those who look on the body as a kind of organic steam-engine, and the followers of a merely speculative philosophy, who aim at all their objects dynamically, and with scorn, for all means that have any appreciable physical quality or power.

Many are the actions, particularly in disease, that spring from the dynamic powers of man's nature, and not the mechanical structure of his frame, totally independent sometimes of the body's mechanism, so far

as any material change or alteration is concerned ; some, doubtless, there are, arising from mechanical causes and physical changes purely, in the first instance, and little, or not at all affecting, for a considerable time, the dynamic powers of the system.

Undue consideration and cultivation of the dynamic influences leads to idle, theoretical, and visionary systems of medicine,—too exclusive an attention to the material structures and mechanical forces and arrangements of the human frame, although they may seem not only less prejudicial at first, but followed by positive benefit and much increase of accurate and available knowledge, are unequivocally more pernicious, and the results are more hopeless. By such means we can never reach the end and aim of medical science, we can only work in the imperfect light and space allowed by mechanical results ; our investigations, and their results, must alike be wanting in the scope, truth, and expansive power of nature's light; we toil with a rushlight, in a narrow and circumscribed space, disregarding the infinite attributes of all nature's efforts, and rejecting the highest aids by which she proffers assistance to our investigations. Nature is not all mechanical, however largely she may and does employ physical means and powers ; there is a dynamic power in all, as there is a design vast and infinite ; there is mind, and its more subtle and more perfect powers are mixed with, controlling and giving rise to, physical results ; often effecting the most startling, stupendous, and rapid of its results, by its own vital force alone, infused into the matter by which some of its visible effects are developed, in a manner as inappreciable as it is invisible, and apparently unlimited in power or extent. Man in this presents a type of all nature ; to dwell on the merely mechanical causes and effects demonstrated by the changes in his frame, is often to search in the dust, or the bowels of the earth, for the sources of the wind, or the centre of the sun's rays.

To define the limits of the dynamic and the mechanical powers in the human frame, and their mutual action on each other, is, perhaps, impossible ; and not less so, therefore, is it to define the limits of these two modes of investigation, which are more naturally combined, intricately and mutually reacting on each other, and through one another; the attempt would be absurd; they are and ought to be indissoluble, for the interests of medicine in a scientific point of view. As I have shown, the whole tendency of the prevailing spirit of the present day is to separate them, by giving a predominant station to the mechanical principle in opposition, or to the nearly total exclusion of the vital ; and, by this unnatural separation, to retard the progress of medical science. The relative importance of each of these will vary in different diseases, and must claim the chief, but never the sole, attention accordingly. Obvious it must be to all, that in the combination of both shall we find the only means of judging and appreciating justly the results of either, for the true advancement of our knowledge.

With these opinions, although I have not scrupled, therefore, to apply the mechanical powers of figures and statistics to the comprehensive and often subtile questions I propose for discussion, yet do I purpose to regulate the conclusions to be drawn from their results by reference, also, to the dynamic powers called into action. Without this precaution, indeed, I should give only a summary most essentially erroneous—results which would seem produced, marshalled, and affected only by mechanical causes ; whereas many of the most prominent are especially produced by dynamic, and the majority by different degrees of union of the two great powers. Here the mechanism controlling the dynamic—there the dynamic paralysing or altering the mechanical structures and functions depending on their integrity. In no question of surgery are the two more forcibly brought into collision or undue predominance ; in none do they so imperatively require to be investigated by the double light of both, and the effects clearly brought forward, as in considering the important and often fatal results connected with amputation, and the severe injuries which give rise to it.

In order to treat the subject of amputation comprehensively, it will be necessary to proceed step by step from the beginning. Doubtless there are dangers attached to any of the injuries for which amputation is ever performed, if treated without operation. There are dangers attached, and in some sense peculiar to each of the three periods at which amputation is practised. Finally, there are dangers attached to amputation singly when no injury has been received, and when there is no pre-existing disease.

The questions then reduced to their narrowest limits, present themselves thus—1. What is the nature of the supervening actions proving the causes of death, and what the proportionate mortality in complicated injuries of the extremities? 2. What the nature of those which make amputation imperative, or indicate it as the best or sole resource? 3. What the nature, progress, and relative mortality of actions supervening on amputation at the three periods—primary, intermediary, and secondary? 4, and finally, What are the supervening actions on amputations simply ; no previous shock of injury having been sustained, and no disease existing at the time to contribute their influence on the results ?

Many secondary considerations and questions will arise out of these as we proceed in the inquiry, but subordinate to the more

general heads. In this order I shall conduct the inquiry, first commencing with a few general observations on the chief circumstances influencing the diseased actions, as indicated in the various statistical returns, and which, in some degree, will be necessary, in order that they may be fully understood.

We shall find ultimately that the questions so long and so ardently discussed, viz., of the relative value of primary and secondary amputation, as a means of saving life, will assume the following shapes:—Are the dangers attached to primary amputation greater, or more fatal, than those attending the injuries when submitted to curative treatment; and those attending intermediary and secondary amputations, rendered compulsory by mortification, ruptured arteries, &c., and where there is, therefore, no choice left? Because, unless greater than these three together, deferred amputation, when the incurability of the injury is decided, must evidently be untenable, as a better and more effective means of saving life; and having only to counterbalance any amount of increased danger that may be demonstrated, the possibility of saving a very small proportion of maimed, if not utterly useless, limbs, which might, by primary and prompt amputation, have been sacrificed.

The loss of life accruing from the three—from treatment—from compulsory, intermediary, and secondary amputations—added together, should be compared with the mortality in primary amputations: this, it will be found, forms the most just test.

But it is not on this single question, however momentous, that I shall chiefly dwell. To the due appreciation and proper understanding of the effect of various classes and degrees of injury, and the question of amputation in reference to periods, states of health, and constitution; external circumstances, modes of operation, &c.; there is a strange want of precise or classified data. The materials I have analysed will have reference to the influence of these states and circumstances upon the ultimate results, whether of injuries treated, or amputated; upon the character and progress, as well as the fatality of the supervening actions, how induced, modified, or controlled, by particular conditions of the system, or external influences. From these considerations, I trust many practical conclusions may be drawn calculated to improve this branch of surgery, by fixing its principles on more sure and accurate grounds.

# LECTURES

## ON THE

## ORGANS OF REPRODUCTION IN THE ANIMAL KINGDOM.

DELIVERED IN THE ROYAL COLLEGE OF SURGEONS, LONDON.

By Professor OWEN, F.R.S.

## LECTURE XVI.—May 26, 1840.

Gentlemen:—Passing in review the organs of reproduction in the vertebrata, the gradations which connect the different classes are so imperceptible, as compared with the invertebrate classes, that it appears preferable to consider at once the male organs in their entire range from the lowest to the highest before proceeding to the female apparatus. This has been done in the preceding lectures, and we now come to the examination of the female organs in the various classes, in the same order, from the lowest to the highest.

Fishes.—The hard roe of fishes is familiar to most persons; it is of a yellow colour; occupies the whole length of the abdominal cavity, and is granular upon its surface; this is the ovary. In the simplest forms of the essential generative organs of the female, this alone exists. In the Lamprey and the Eel, two lengthened and lamellated organs are observed running the whole length of the abdominal cavity, one on each side of the vertebral column; they resemble the essential organ of the male, and like the testis have no efferent duct; the ova burst from the cellular stroma of the ovarium into the cavity of the abdomen, and are expelled from the cloacal opening through the peritoneal canals. In the Lamprey, before the formation of the ova, the ovarium is a simple fold of mucous membrane, invested by a thin fibrous layer, and then covered by peritoneum; in the next place, it becomes puckered and plaited, being, at the same time, increased in breadth and thickness. In this condition it constitutes the plicated organ, so frequently observed in female fishes; afterwards it becomes granular upon the surface, and greatly increased in size by the development of the ova. If the anal opening be examined, a small depression, immediately behind that aperture, is the sinus urethralis, in which the ureters terminate; and directly posterior to the sinus are the terminations of the peritoneal canals. Much question has arisen with regard to the mode of generation of the common Eel; but if one of these fishes be opened in the month of October, these lamellated and granular organs will be distinctly seen, extending backwards, into the tail, beyond the anal aperture.

In the ordinary osseous fishes the ovarie are two elongated capsules, each prolonged