ADDRESS IN SURGERY

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THE EVOLUTION OF SURGICAL PRINCIPLES.

WHEN the British Medical Association met in Newcastle twenty-three years ago the office that now has fallen to my lot was occupied by an able and distinguished surgeon, no longer in our midst. The recollection of the vigorous and eloquent address which Dr. Heath then delivered, a recollection which I doubt not, even at this distance of time, is shared by all who heard it, increases the responsibility of the task I have undertaken. That the Council of the Association, which has grown so much greater and more powerful in the interval, should again have appointed as reader of the Address in Surgery a local surgeon, can be interpreted only as a tribute to the traditions and acknowledged position of surgery in this portion of the kingdom, and by no means to the individual prominence of the representative selected. And deeply sensible as I am of the great honour inherent in the office, and reflected from the illustrious names of those who have filled it in the past, my sense of inadequacy and of diffidence in undertaking it are only thereby increased. When I turn to the fulfilment of my task, not the least difficulty is that which meets me on the threshold of selecting a train of thought on which to address so important an assembly. Engaged in the work of a large general hospital, and gathering experience from its varied service, I turn with readier interest to the broad principles of general surgery than to the elaborated details of any of its specialised departments. But in this I am guided towards a choice. And I have found further suggestion in an event which has already claimed the attention of English surgeons. This year they they have been invited to celebrate the centenary of John Hunter, who, before and beyond all others, laid the foundations of surgical science. And the year is not only the centenary of John Hunter's death, it is also the centenary of the publication of his *Treatise on the Blood and Inflammation*, which Hunter looked on as the crowning work of his life, and of which his death came too quickly to permit the necessary revision. The year, therefore, carries our thoughts naturally to the principles which underlie and give stability to our work. It is our frequent boast that surgery has become, and is becoming, more scientific, and by an appeal to our results we justify the claim. But the science of surgery—and by the phrase we mean the principles of surgery—is nearly altogether the growth of the century that has followed Hunter's death, and its growth has been by no means one of continuous or steady progress—rather, as is usually the case in the development of scientific truth, it has been by fits and starts. The greater part of the work has been done in our own generation. And now, with regard to much of the art of surgery, it rests on principles so worked out and firmly established that the claim to scientific position can be made good. But with regard to much also we are still only struggling towards scientific truth. In speaking therefore of the development of surgical principles I shall endeavour to illustrate both classes—both those principles which, being in a sense perfected, have issued in enhanced success; and those also towards which we are still groping, and by which we have not yet been guided out of difficulty and uncertainty.

The "principles of surgery" is one of those elastic phrases which carry to our minds a fairly exact meaning, but to which we find it hard to give a concise definition. We certainly do not use it as the equivalent of theory. The surgeon who, thinking himself well versed in surgical principles, and therefore prepared to act in the best manner for the best reasons, would not consider himself justly described as a man of theory. And yet theories which become the motive or suggestion of surgical action are surgical principles, and these may be sound or unsound according to the character of the views upon which they are based. In so far as surgery is

applied science, the data from which surgical procedures spring are in the strictest sense scientific principles; and we find that surgery advances by precisely the same methods as all other practical sciences. We have our inventions, our appliances, our practical details upon which an ever-increasing ingenuity and industry are expended. We have also sometimes our discoveries in medical or collateral science, which become the inspiration or rallying point of great practical advances. But the phrase covers more even than scientific data. The definite ends or objects of surgical action which are proper under given circumstances belong to the principles of surgery. So also do rules of procedure which the gathered experience of the past and present prescribes or sanctions. The mode of formation of surgical principles is therefore a double one. They may arise like a superstructure upon a foundation of scientific knowledge, or they grow down out of experience to be themselves part of the foundation. They are the mainsprings of action; and so far from being alien to practical efficiency, they are at once its inspiration and guide. One of the not least important surgical principles dictates scrupulous attention to the minutest practical detail; and he who, knowing that a life may hang on the integrity of a stitch, concerns himself anxiously about the method or material of a suture is only acting in faithful obedience to surgical principle.

INFLAMMATION AND REPAIR.

The mode of growth of scientific principles can find no better illustration than in our modern doctrines of surgical repair. The beginnings of these doctrines may be traced far back in the history of surgery. But it was by Hunter's work and in the pages of that *Treatise on Inflammation*—which, though pondered and laboured through many previous years, as was Hunter's way, was not published till the year of his death—that the real beginning was made. Hunter's statement that "primary healing takes place without inflammation" contains the germ of what we believe and act upon now. It did not, of course, go far enough. It defined the relationship between what was then, as it is now, ideal healing and inflammation, in the sense that no relationship can or does exist between them at all. But there is no such definite expression to be found in Hunter's writings with regard to the modes of secondary healing. Hunter, I think, believed, as did most of his successors down to the last few years, that a certain degree of inflammation was necessary for these delayed forms of healing. Indeed, from Hunter's time there was a falling away from the faith, and we find the most philosophical surgical opinion as represented by Travers holding that a "subdued state of inflammation favours healing," and that to "supersede it would effectually retard or preclude" the process of repair.

I am sure, Sir, that to many in this audience it may seem to demand an apology that I should even mention in their hearing the name of inflammation. I may appear to be abusing my opportunities in carrying them back to their earlier days when inflammation was the bugbear of their surgical studies, a true surgical *pons asinorum*. But I plead in excuse that down to a recent period the ideas of healing and the ideas of inflammation seemed in the very nature of things to be inseparably interwoven. It turns out that they were only needlessly entangled, and ideas which in the time of their confusion belonged mainly to the region of theory have since proved to be matters of the most eminent practical importance. The process of disentangling began in and proceeded with the elucidation of the true nature of inflammation and its consequent suppuration. There was a time when the four classical symptoms of pain, heat, redness, and swelling, summed up nearly all that was known of the process of inflammation. Then followed the anatomical era, the time most fruitful of bewilderment to the student, in which, thanks to rapid improvement in the methods of microscopical investigation, attention was concentrated in the blood stasis, the changes in the tissues and on the vessel walls, and on the out-wandering of the white corpuscles. An intermediate stage followed this in which, clinically and experimentally, the suppurative processes were recognised to be infective in their nature. And this culminated in the period in which we now find ourselves when the whole process is demonstrated to be due to the agency of micro-organ-

isms. One point, however, remains to be cleared up. Is the febrile access which follows an aseptic operation, sometimes sharp in degree though short in duration, to be looked on as the result of inflammation? There is no ground for supposing it to be an infective process the same in kind and differing only in degree from that which always tends to suppuration. If different in nature it should also be distinguished in name, and there is much to justify the proposal to restrict the word "inflammation" to those changes which result from the action of septic organisms, while the other and simpler process under some such title as traumatic reaction demands further examination for the clearing up of its intimate character. Such a defined use of the term would end the confusion which has hitherto attended the conception of inflammation as a disease, and would rest the idea to which the word corresponds on the sure ground of etiology.

Naturally with the true knowledge of inflammation and suppuration have come clearer and more accurate views with regard to the process of repair. Not alone in primary adhesion but in all forms of healing it is seen that inflammation is never a help, and can only be a hindrance, and that if it occurs repair must take place in spite of it, or be delayed until it has passed away. We have gone back upon Hunter's dictum, only we have given it a more extended, or rather an unrestricted, application. The surgeon's part, therefore, is now not to treat but to prevent inflammation and suppuration, and the practical side of the scientific evolution I have briefly sketched is the antiseptic system.

ASEPSIS AND ANTISEPSIS.

It has sometimes been made a reproach against the system of wound treatment, by the introduction of which Lister created an epoch in surgery, that its methods and details have undergone constant change. But through all the alterations of detail which the desire for greater simplicity or increased security have prompted, there has been no deviation of principle. The dependence of suppuration and septic diseases upon organisms, and the prevention of these diseases by destroying or getting rid of the cause, is the principle on which the treatment rests, and it is one which admits of some latitude in its application. The aim can be achieved in two ways. Either reliance is placed mainly on the germicidal powers of chemical agents, or the surgeon prefers to trust rather to the removal of the minute organisms along with the soil in which they flourish. The two roads to the same end we know under the names antiseptic and aseptic; and fortunately we are able in this case to travel on both at the same time. So far as our work is concerned, we have thoroughly learned the lesson that cleanliness takes no second place, that it is the highest virtue in surgery. Therefore we cannot err in sparing no pains to remove every particle of dirt from the area and all the accessories of an operation; and in addition we will not deny ourselves the further security which the use of some germ-destroying agent can give.

Those of us who have worked through the whole of the antiseptic period can in looking back trace with some interest the different phases through which the method has passed. I shall not trouble you with detail in a matter which is already chiefly of historical interest. But I may point out that the main changes in the *technique* of the treatment have owed their origin to changing views as to the sources whence danger of infection might be expected to arise. Under the guidance of his earlier experiments, and in accord with the work of Pasteur and the investigations of Tyndall on the floating matter of the air, Lister devised his measures for the avoidance of atmospheric contamination; hence we had sealed wounds, and later the spray. Gradually the belief strengthened that the air as a source of danger might practically be neglected, and we parted with the spray, with a sigh of relief. It had come to be admitted that our own hands and the skin of the patient, besides the instruments and sponges which had always been cared for, were most often at fault; and as a result even the most orthodox believers in the potency of carbolic acid or corrosive sublimate became scrupulous cleansers.

I have said that the antiseptic system admits of latitude in its application; it is open to every one to elaborate his

own *technique*. The worst surgery, indeed, is the stereotyped surgery; the best is that which, working faithfully from sound principles as a science, encourages as an art fertility and variety in their application. But with whatever variety of method there ought to be now no grades in the standard of work sought to be accomplished. An ideal of healing which was only occasionally attainable by the many, or more consistently reached by the few as the result of fortunate circumstances, or the reward of strenuous care has become a generally accepted obligation. No one now is ever heard to speak of laudable pus; no pus is considered praiseworthy; but, on the contrary, if it appear in a wound for which the surgeon is responsible, and in making which he had the control of all the conditions, it is always a thing to be ashamed of. Healing without suppuration, therefore, is the end aimed at in all operation wounds, and in a sense it is an extended description of union by first intention. It applies to wounds healing by granulation, or by the organisation of a blood clot, as well as to those uniting by primary adhesion. For all alike Hunter's description holds good: "If a wound heals by first intention all keeps quiet as if nothing had happened." And, by way of emphasising the position that with such wounds inflammation in any of its stages has nothing to do, I will set with this classical quotation the description of primary healing wounds given by von Volkmann, one of the most distinguished and thorough of the German followers of Lister: "A primary healing wound several days after the operation ought to look exactly as if had just been stitched; no swelling and redness; no heat; no pain."

ILLUSTRATIONS OF REPARATIVE SURGERY.

From trusting more, because knowing better, Nature's powers of repair, it has followed that the range of reparative surgery has been greatly widened. It is not now thought sufficient in bringing wounds together to pass our sutures through all the tissues at once, but each layer is separately stitched—muscle to muscle, fascia to fascia, skin to skin. This is one of the lessons which, if it did not at first teach us, abdominal surgery has been forward to utilise. The gain in abdominal operations is in a greatly strengthened cicatrix and the avoidance of ventral hernia. In general surgery the gain is in promoting healing by the obliteration of "dead spaces," and the consequent less frequent need of drainage. That the ends of divided muscle if brought accurately together will be reunited by proper muscle tissue, and not by interposed connective tissue, as was formerly supposed, is a fact of recent acquisition, but of some practical importance. In operations on the abdominal wall—especially in certain operations for the radical cure of hernia in which, as in Halsted's, the muscular layers are freely divided—their unimpaired reunion is essential for the success of the operation. It is necessary, therefore, that the muscles should be cleanly incised, and not haggled, and that they be afterwards exactly sutured; and the cases in which such plans of operating are the least likely to result successfully are those in which the repair of so complex a structure as muscle is interfered with by suppuration.

I pass now to a still more attractive illustration of the reparative powers of Nature. Skin grafting, according to the method of M. Reverdin, has long been a valued resource in hastening the cicatrization of granulating surfaces. But the method known by the name of Thiersch makes larger demands on tissue vitality, and is of wider usefulness. When a portion of the skin—it may be as large as an inch square—is detached and transferred to a recent and aseptic wound, it retains its inherent vitality until it becomes penetrated by blood vessels advancing into it from its new bed. It is thus fully adopted and incorporated in its new position. As if to explain the eager readiness with which the vessels and proliferating cells of the wound surface enter into and constitute an organic union with the new part, Thiersch has advanced one of those theories which, whether they prove in the long run to be well or ill founded, give by their aptness a special kind of mental satisfaction. By a legitimate scientific use of the imagination he supposes that a store of proliferating energy exists in the tissues which, in their intact condition, is kept in check by the mutual pressure of their elements. The constituents of the tissues, in other words, do not grow beyond a certain point for want of elbow

room; but when this mutually restraining pressure is removed by a breach of surface their proliferating energy is set free, and by their liberated activity they become competent to carry out the work of repair. In its practical application the whole of a large open wound can be covered by this method of skin grafting, so that the wound shall heal by first intention. The size of the area that can be so dealt with is only limited by the possibility of obtaining grafts, which may be taken either from the same or another individual, or from a quite recently amputated limb. It is not necessary in removing the graft to take the whole thickness of the true skin. A portion of the corium left behind will, by obviating cicatricial contraction, lessen the sacrifice for that surface which is the donor, without diminishing the value of the gift to the recipient. In plastic operations on the face, and in operations for malignant disease which have involved free removal of skin, the method has found useful application. But I would draw attention to a class of cases which have hitherto been as troublesome as they were uninteresting to the surgeon, and for which Thiersch's grafting holds out a welcome hope of cure. No class of minor surgical ailments gives more trouble in their treatment, or more certain disappointment in their relapses, than cases of chronic ulcer of the leg. For these the method of skin grafting can be made available. Bearing in mind the necessity of an aseptic condition of the bed upon which the grafts are to be placed, it is requisite, by paring the edges, and by thorough scraping of the surface with the sharp spoon, as well as by the use of antiseptic solutions, to surgically cleanse the ulcer. To get rid of the irritating effects of the antiseptics, they should be washed away by sterilised water before the application of the grafts. So treated, an ulcer is brought into the condition of a recently made wound, and success entirely depends on the thoroughness with which this transformation can be effected. A sufficiently extensive trial of this method enables me to say that its success is not uncertain; and that in the saving of time and in the excellence of the cicatrix, which contrasts strikingly with the attenuated and unstable scar left by the ordinary process of healing, it has advantages that commend it to your notice.

In the grafting and reimplanting of bone the incorporation takes place, no doubt, in the same manner as in the skin. We have learned, also, that the breaking up of the bone into small chips is not always necessary; at least that it is not necessary in the case of the discs removed in trephining the skull. Provided these be of moderate size, they can be replaced whole. In a recent case of extensive fracture of the skull, I removed with Macewen's trepan three discs $\frac{3}{4}$ inch in diameter, and they were reimplanted without being broken up. Notwithstanding some neighbouring suppuration from breaking down of an extensive hæmatoma, the reimplanted bone lived, and no trace of the trephining, so far as the skull is concerned, remains.

When we pass to a higher and more complex structure—that of the nerves—I think it will be granted that the process of their repair is still imperfectly understood. In the direct suturing of the divided ends of nerves it may be supposed that immediate reunion of axis cylinders with restoration of function may take place. But when a graft several inches in length is interposed between the widely separated nerve ends, and sensation returns in thirty-six hours, what is the anatomical and physiological condition of the graft? Can it have become so vascularised, and have its axis cylinders acquired such intimate union with those of the nerve ends as to make it in so short a time capable of conducting impressions? Where return of function has followed at a later date it has been supposed that the graft acted merely as a platform along which new axis cylinders developed; and this view has gained countenance from the claim which has been made on behalf of other structures, such as strands of catgut or portions of connective tissue, that they also have sufficed to re-establish functional continuity. The whole subject appears to call for further investigation; and much also would be gained by greater and more explicit detail in the records of cases. Too much value appears generally to have been attached to the return of sensation as an indication of success, whereas only restoration of motor power and the arrest of trophic changes can be accepted as unequivocal evidence of restored function.

Thus far I have endeavoured to trace and to illustrate some of the applications of the great principles of surgical repair. The phenomena which this title covers have in their real character so little that is morbid that they constitute a well-defined department of surgical physiology. When now I turn to pathology, and seek to illustrate from that department the evolution of principles of action from scientific knowledge, I am faced by the whole range of surgical disease. It is only a truism to say that in the absence of a knowledge of its morbid appearances and of its cause no disease can be satisfactorily treated. But what is true in the abstract usually has its truth set in sharper lineaments when looked at in the concrete. I therefore select for illustration two disease groups—tubercle and cancer—especially on this ground, that they present instructive points both of similarity and contrast. If we follow the history of the pathology of tubercle we shall find it divided into periods which correspond to those already referred to in the history of inflammation. There was the period of physical form, when the name was given to whatever was a tubercle in feel and outline; there was the period of minute anatomy, when the disease consisted of special cells and cell groupings; and there is now the period which, since in it we have learned the essential cause of the disease, may be called the stage of real knowledge.

Before the microbic origin of tubercle was known surgery was becoming more aggressive in the treatment of so-called scrofulous disease. Scrofulous glands, for instance, were excised many years ago, at first against the protest of those whose minds were wholly influenced by the supposed constitutional origin of the complaint. The surgery of strumous joints also had long been both more conservative and more successful. But from the new light the surgery of tubercle has gained immense encouragement. The commencement of the disease in a locally-infected area has modified and restricted the conception of a constitutional tendency. The constitutional origin has been changed into a constitutional vulnerability; and, undeterred now by an idea which weighed upon him just in proportion to its vagueness, the surgeon undertakes the treatment of local manifestations of tubercle by local measures. In consequence the surgery of tubercle has undergone great extension. Affections of the skin, of the glands, of the bones and joints, of the urinary organs, of the peritoneum, wherever the disease can be reached and wholly removed, or its action favourably modified, it is submitted to local treatment. And the extension has been in the direction not only of new applications, but of greater thoroughness. The knowledge of the infective character of the disease, and of the liability to local relapses, or even general infection as a consequence of incomplete removal, has led, for example, to the excision of every affected gland or of every diseased focus in a joint. And the guidance afforded by pathological knowledge is even more explicit with regard to other points of treatment. The important question of general infection has light thrown upon it by what we know of Nature's endeavours to imprison by a wall of granulation tissue a tuberculous focus. When by an incomplete operation we break down this wall or cause it to crumble by infecting it with pus microbes, without entirely removing the tuberculous disease, we open the way for the passage of the tubercle bacilli into the system. Hence the extreme necessity of keeping our operations free from sepsis, as well as of making them thorough. The success of the treatment of cold abscesses by evacuation, scraping, and flushing, and closure of the incision—the method known by the name of Mr. Barker—is only intelligible when their true pathology is known. Such a treatment could have no *raison d'être* in the old idea that they were, as the name implies, pus-containing cavities. But when we know that they do not contain pus, but only the liquefied and broken-down products of the tuberculous process, we see the *rationale* of the proceeding, and we understand also the extreme danger of admitting secondary pyogenic infection into such cavities.

The substitution of arthrectomy for formal excision has its motive in the removal of all diseased foci and surfaces with the least possible interference with the integrity of the limb. Its occasional failures to effect lasting cure are explained by the readiness with which scraps of diseased tissue or tuberculous foci in the bone, may be left behind: and I anticipate in

the future a partial return to the older and more searching operation. On every point in the treatment we derive guidance from the pathology of tubercle; and we better understand also the limitation of our success. The nature and condition of the disease are such as to render at present inevitable frequent failure; but even failure is made more tolerable when we can trace its cause. The knowledge we already possess carries hope also for the future; hope that possibly in some combined surgical and special treatment we may find means that are more successful than the present; and hope of fulfilling one day a still higher function than that of curing, namely, that of preventing the disease.

The whole disease picture presented by cancer offers so many points of resemblance to that of tubercle, that the probability of a parasitic origin of it also has at present taken strong possession of the minds of pathologists. The occurrence of minute organisms of the class of sporozoa in connection with cancer is, I think, held to be demonstrated; but any causal relationship between them and the disease has not been proved. We have as yet nothing beyond the nature of conjecture as to the essential cause of cancer; and as to many facts of secondary, but still great, importance in the natural history of the disease, we have to own that our knowledge is so vague as to be little better than ignorance. What can we affirm with certainty as to its local contagiousness, as to its contagiousness from individual to individual, as to its hereditariness, as to its prevalence in groups of cases due to endemic influences? On these and other points we are able to cite fragmentary evidence, but of any cogent array of facts which would suffice to definitely settle any one of them we are as yet destitute. On one point of importance there is agreement and a growing readiness to act upon it. Due largely to the influence of Mr. Jonathan Hutchinson, a precancerous stage of cancer is recognised; and it follows from the recognition that surgery ought to interfere during this period of suspicion. Another point of practical moment is brought out by the observations of Dr. Sims Woodhead and Mr. Harold Stiles on the channels of lymphatic infection, and referred to by the former in his Morton Lecture last year. These observations were made on cancer of the breast; and it is shown that whenever irritative or effete material has to be dealt with in large amount a special filtering tissue is developed. This, which consists of a growth of adenoid material, is formed in the connective tissue along the lymph channels, and is produced still more strikingly by the transformation of the small lobules of fat in the axilla. One of the great difficulties of dealing with cancerous disease is that we have no means of knowing when lymphatic infection first takes place. As the lymph circulation is always going on there is no reason why infection may not occur in the very earliest stage of the primary growth. If we are to trust cases of removal of the original cancer with no subsequent recurrence—that is, cases of cure—it may never occur at all. We do know that the infection may lie dormant for months or even years before it gives any gross indication of its presence. In dealing with it, therefore, we are meeting an enemy whose first invasion is invisible, and whose strength at any time we cannot even guess at; but all we know of its nature—both the old knowledge and the new—only points to the necessity of free removal. It indicates, I think—and my own experience is strongly in favour of the proceeding—the removal of the next group of glands along with the primary cancer, whether they show gross enlargement or not; and when an operation wound for excision of the breast and clearing out of the axilla can be healed by first intention under one dressing, there should be the less objection to extensive operations for malignant disease if only some additional security can be gained. The rules, then, enjoining early and free removal, and their application also to recurrences, so long as these are removable, are the broad principles which surgeons accept in dealing with malignant disease; they are the results of experience, and are confirmed rather than in the first instance dictated by scientific knowledge. To no subject in the whole range of medicine has there been devoted a greater patience in observation, a more continuous labour in inquiry than to the subject of cancer. The terrible character of the disease, the obstinacy with which it has refused to yield up the secret of its origin, the unsatisfactory results of its treatment, have at

once fascinated and stimulated inquirers. The hope of now solving the problem by demonstrating its parasitic origin has enlisted a fresh band of workers whose skill and tenacity in their investigations will surely lead to some definite result. Our already accumulated knowledge about cancer needs only the central fact of what cancer is to fall into order and to become productive of practical good, and out of a then completed pathology we shall hope to forge some weapon of attack or defence which shall reduce cancer to the list of curable diseases.

It is infrequent now that from topographical anatomy comes any suggestion for a fresh advance in surgery. But now and again a corrected misrepresentation or reading of anatomical facts, a new point of view or hitherto unthought-of relationship will lead to a change in surgical practice. You will at once think, in illustration, of the rapid creation of the surgery of the cæcum and appendix, in part under the impetus of the general development of abdominal surgery, still more as the rational outcome of that corrected view of the anatomy of the parts with which we associate the name of Mr. Treves. A yet more striking instance of a change in procedure, abrupt as a revolution, effected from the anatomical standpoint, is the revival in our time of the high operation for stone. Until the publication of Garson's careful observations on the position of the pelvic organs and on the effect produced by their distension on the suprapubic interval, lateral lithotomy continued to be practised with a success which made it, as ovariectomy has since become, the boast of surgery. Cheselden, notwithstanding his 85 per cent. of recoveries, had abandoned the high operation for the still greater success of his method of lateral lithotomy; and Cheselden's operation, virtually unmodified, was that still practised. The publication of Garson's observations and their introduction to the notice of surgeons by Petersen and Sir H. Thompson, with the practical measures based upon them, led to a reversal of Cheselden's decision, and to the general displacement of lateral lithotomy by the high operation. The new facility in the performance of the latter afforded by the use of the rectal bag along with distension of the bladder—again, the bias given by the growing interest in abdominal surgery, and the tendency in the present day to prefer open operations in which the parts dealt with lie well exposed to both hand and eye—all these contributed to the rapid adoption of the change. Perhaps fashion, also, is not without influence in surgical matters; and it would be interesting as well as helpful, after fifteen years' experience of the revival, to learn from figures gathered in a sufficiently wide area whether the old standard of success has been maintained.

CANONS IN SURGERY.

In thus dealing with the evolution of surgical principles and in tracing them, as I have so far done, to the three trunk roots of anatomy, physiology, and pathology, I am not unmindful that surgery as a practical art must needs get sap for its nourishment from whencesoever it can be drawn. It has, therefore, rootlets into every branch of physical science; and there is, moreover, a large body of surgical principles which spring almost purely from observation and experience—not experiment, so far as English surgery is concerned, for that source of knowledge has been so hedged round with obstacles as to be nearly valueless. In this sense of principles derived from experience we use the word as implying not a fundamental fact in science on which action is based, but a rule of action adopted because it has been found, or thought to be, the best, and stamped with the authority of general acceptance. Necessarily such rules are apt to vary, but for the most part, as time goes on, they find their justification in some subsequently proved fact in diagnosis or pathology. The phrase "canons in surgery," used long ago by John Bell and revived a few years ago by Mr. Hutchinson, very aptly covers these rules of experience. Their character and mode of formation will be best shown by an example. The question of amputation in senile and diabetic gangrene of the foot seems to be in course of settlement in favour of operation. The condition is almost certainly fatal, and is fatal often after a period of lingering and intense suffering. As a measure for its relief or for the saving of life, amputation has almost uniformly failed when it has been done in the lower part of the leg. The gangrene seizes upon the flaps, and if the limb be reamputated higher up the stump is

again attacked. But it has been found that if the leg be taken off in the first instance above the knee a fair proportion of cases recover. About one half, according to the most recently collected figures, have been successful, and in a condition so hopeless and usually so painful, such a result is better than the certain issue of non-interference. Let me enforce the point, and at the same time refer to an interesting pathological fact which, in some instances at least, provides its explanation by quoting a case. A man, aged 56, had spreading gangrene of the toes, with severe and constant suffering. The circulation of the whole foot was very imperfect. No pulsation of the posterior tibial was to be felt, but that of the popliteal was distinct. The leg was amputated immediately below the knee, and recovery was marred by slight sloughing of the flap edges and a good deal of pain in the stump. In the end the case did well. The artery, which had been severed high in the popliteal space, presented an interesting condition. Due to chronic arteritis, and not atheroma, there was thickening of the coats to the extent of complete occlusion of the posterior tibial behind the malleolus. A thrombus nearly filled the artery in the calf, and above the bifurcation of the popliteal there was a great narrowing of the vessel. This narrowing close to the bifurcation has been noted in similar cases. It is an old observation that tendency to degeneration in consequence of strain is greatest close to an arterial bifurcation; and the frequent occurrence of serious narrowing at the point referred to explains in a proportion of cases the ill success of amputations through the leg for gangrene. The happily limited sloughing and protracted recovery of my patient teach—as the consequences of breach of rule ought to do—the advantages of obedience; and I leave the case as testimony, so far as it goes, in favour of the establishment of a surgical canon, to this effect: In spreading gangrene of the foot, amputate through the thigh.

An old and familiar surgical canon formulated by our predecessors as the result of experience, enjoined on the surgeon the duty of operating, "when in doubt," in all cases of hernia. We greatly need the guidance of some equally definite rule in cases of internal obstruction. Upon the question of operation surgeons are, if not divided into two parties, at least biassed in contrary directions. Some would operate in all cases of complete obstruction so soon as they have the opportunity; others would try other measures, see what Nature will do, and operate as a last resource. And strong arguments are to be found on either side. The surgeon who would always operate, and had always an early opportunity of doing so, would unquestionably achieve the best results possible, although he would operate on a certain proportion of cases that could spontaneously recover. But unfortunately no one is brought in contact with even the majority of his cases in an early stage. And hence arises the force of the contrary arguments. The circumstances which militate against the success of operation for internal obstruction in the fully established or later stages of the complaint are twofold. In the first place, in nearly all cases, secondary changes speedily ensue, which hinder the search for the obstructing cause, and which may nullify attempts at its removal. And in the second place the patient often passes, it may be at an early period, into a condition mainly due to poisoned blood in which he trembles on the brink of collapse, and in which operation is badly borne. Add to these the fact that a not inconsiderable number of cases, even when there is stercoraceous vomiting, do recover, whose chance of recovery would disappear under the shock of an operation; and we have what I think is a fair statement of the reasoning against operating in all cases. Where are we to look for guidance? Mainly, the question must be settled by experience; it is a case to which the maxim "*Solvitur ambulando*" applies; and I think experience will aid by bringing to us the ability better to discriminate between the different causes producing obstruction, and to appreciate the prognosis to be attached to each. In a syllabus of intestinal surgery recently published,¹ a list of eleven different causes of intestinal obstruction is tabulated. When we have learned more accurately to distinguish between these at the bedside, we shall be much nearer to the acknowledgment of a surgical canon or rule to guide our interference.

¹ Dr. Byron Robson in May No. of *Annals of Surgery*.

I shall trespass on your attention with one more surgical canon, but it is one whose propriety is so obvious—nay, whose observance is so imperative—that it ought to need no enforcing. The magnitude of many modern operations carrying surgical interference to the verge of what the human body can sustain, makes it more and more incumbent on the surgeon to avoid, or as far as possible to minimise, shock. And yet I doubt if this important duty receives generally the systematic attention it deserves. We do not know the exact pathology of the condition; probably several different conditions are included under the name. But we are very familiar with its symptoms. We know that the patient becomes cold, that the heart's action is depressed, and that all the nervous functions are lowered. We know also that it is induced or aggravated by prolonged operation, by chilling of the surface, by hæmorrhage, whether this take place rapidly or by continuous oozing in small quantity for a long time. I should like to add also that the giving of chloroform on successive days lowers the patient's resisting power. All this supplies hints enough for its prevention and treatment. Something can be done in anticipation of the operation in the way of propping both the physical and moral courage of the patient. Much can be done after the operation in rallying from the condition; and I have believed that a very small, stimulating, hypodermic dose of morphine has proved then of greater use than the same measure employed as a prophylactic. Transfusion with normal saline has so wonderful a power of rallying from shock, though so far as my experience goes its good effect has been disappointingly transitory, that its use will now not be neglected. But most is in our power in the way of prevention by guarding our patients against all those causes which produce shock or aggravate it; and therefore the surgical canon which in this matter claims not formal acknowledgment but systematic observance is: Avoid or as far as possible minimise shock.

But time, and the fear lest I should exhaust your courteous patience, warn me to conclude. In the survey I have given I have had before me the wish to illustrate the growth of surgical principles, and the necessary linking between these and practice. In fearing that much that I have brought before you must have seemed elementary and commonplace, I am conscious that the fault has lain not in the choice but in the handling of my subject. No inquiry into the manner in which knowledge is acquired, or is turned to practical account, ought to be without interest or helpfulness. And, for the most part, we are so engrossed with practical details, knowing how much in surgery depends on these, that we have little time and thought to spare for scientific principles. We may, therefore, profitably remind ourselves that our art is better just in proportion as our science is broader; that for true progress the two must go forward abreast; and that, though great things have been accomplished in our time, much more remains to be done.

AN ADDRESS

DELIVERED AT THE OPENING OF

THE SECTION OF ANATOMY AND PHYSIOLOGY.

*At the Annual Meeting of the British Medical Association held in
Newcastle, August, 1893.*

By THOMAS OLIVER, M.A., M.D., F.R.C.P.,

Professor of Physiology, University of Durham, and Physician to the
Royal Infirmary, Newcastle-upon-Tyne.

PHYSIC AND PHYSIOLOGY.

It is more from my association with the teaching of physiology in this College than from any special fitness for the office that I have been invited to preside over the deliberations of this Section. I do not regard a meeting of the British Medical Association as the best place for the discussion of subjects of a purely anatomical and physiological nature, and yet, as there are many at this meeting whose duty it is to superintend the education of those who are entering the medical profession, there are side issues con-