disturbed for six or eight days. I have even attempted to operate on cases at an advanced stage of the disease, without the preliminary establishment of an artificial anus. I confess that I have repeatedly gone too far, and have had ill results in consequence. Of late years my radical operations have been confined to small and movable cancers, and since then my immediate results have been much more favourable.

From 1888 to 1899—that is to say in the course of eleven years—I carried out 125 radical operations for cancer of the rectum. In 60 of these 125 cases excision of the rectum, in 65 cases resection, was performed. Among the 60 excisions of the rectum the coccyx and part of the sacrum were removed eight times, the coccyx alone was extirpated twenty-one times, whilst seventeen excisions were performed without any bone operation. In about half these cases the peritoneum was laid open. Nine of the 60 patients died shortly after the operation. In no case was death caused by either infection, peritonitis, or cellulitis of the pelvis. Seven patients died in collapse, in one case decubitus with an early recurrence and a severe cystitis, and in another an embolus of the pulmonary artery were responsible for the fatal issue.

As regards the 65 resections of the rectum, in nearly all the peritoneum was laid open. On several occasions numerous cancerous lymph glands had to be enucleated from the mesocolon. On two patients among the 65 laparotomy had to be performed, and the carcinoma removed through the peritoneal cavity. One of these patients died of peritonitis, the other is still alive. The remaining 63 cases were all operated on from the os sacrum. The coccyx alone, or the coccyx with part of the sacrum—was removed seventeen times without any osteoplastic operation. Temporary resection of the coccyx was performed eight times, and temporary resection of the sacrum and coccyx thirty-eight times, as has been described by my assistant, Professor Schlange. This radical operation is, it must be admitted, very dangerous, for of the 63 cases, 30 died, all close upon the operation. Thirteen died in collapse after some hours or a few days, eleven later on, two died of after-operations performed three and nine weeks after the primary operation, three died of inflammation of the lungs, one of pulmonary embolus, one of cystitis, five it is true of peritonitis brought on by infection of the wound, and one of pelvic cellulitis. In all the remaining cases—thirty-four in number—this inflammation was prevented by the plugging.

An Essay on Scientific Surgery, THE ANTISEPTIC METHOD OF LISTER IN THE PRESENT AND IN THE FUTURE.

By DR. LUCAS-CHAMPIONNIÈRE,

Surgeon to the Hôtel Dieu, Paris; Member of the Academy of Medicine.

SINCE the year 1868, when I had the honour and good fortune to see the master at Glasgow and to be initiated by him in antiseptic surgery, I have followed him so faithfully in the advancement of his method that I feel authorized to associate myself with his pupils and those experts who, taking advantage of a happy date, have joined together to celebrate it by a written monument.

Lister is a direct follower of Pasteur. Like his forerunner, he has had the good fortune, which is given to so few discoverers, of being able to witness the complete development and success of his own work. He has been able himself to present to his contemporaries the discoveries of his genius, to develop and defend them, to see them appreciated, and, finally, utilized throughout the world.

It is difficult to form a just judgement on such facts, because they are contemporaneous and too close to us; they have not the prestige that time and distance give. Moreover, we are bound to take note of controversies and disputes. After an opposition, which was so fierce at first, we find ourselves face to face with an entire school which maintains that the surgery of Lister is at an end, that it has had its day, and that progress has swept it away.

Yet any one who is really acquainted with the history of surgery in our time knows that the advent of Lister produced a colossal result. It produced in the evolution of our science

such a revolution that we ought to judge it as though centuries had passed. Have we not seen in twenty-five years a progress such as past centuries never made?

In my writings I have maintained that we ought to say that the whole of surgery was born from Lister. The future will ratify this judgement. History will easily show that active surgery—the science of operating—only began with him.

The work of Lister, like that of Pasteur, cannot be compared with any that preceded it.

If, as so many people consider, Lister had only introduced a local application unknown before, and valuable above all others; if he had merely introduced methods of dressing wounds, the formulas for which were happier than those conceived of by his predecessors, he would have ranked among the benefactors of humanity, and have taken a place comparable to that of other illustrious masters.

But that was not his work. In the past centuries—since the time of Aristotle—the existence of infinitely little organisms was often suspected, and the mechanism of their action conjectured. Had he merely affirmed that once more, in his turn, and without proofs, Pasteur would not have made any discovery. But he himself gave a demonstration, experimental, and in a way mathematically exact. He discovered the evolution of the infinitely little, and opened those fruitful paths along which the science of to-day advances.

It was the same with Lister. Before his time the protective influence of certain applications to wounds was well known. The surgery of our day has forgotten too much the practice of the old surgeons, and also the statements of certain contemporaries with regard to the value of some kinds of applications. For a long time some sagacious observers had endeavoured to explain the accidents which befell wounds exposed to the air, and had attempted to protect them from it. But all these strivings towards the truth miscarried because surgery kept itself within the domain of empiricism—in the domain of art, so to speak. The uncertainty of the result kept it in a condition of despondency. The surgeon showed audacity when he dared to expose his patient to events the result of which he could not foresee.

Lister gave a scientific basis to surgery. He made it rest on established truths. He swept away that uncertainty in which the greatest surgeons up to that time had left it. Inspired by the ideas of Pasteur concerning the infinitely little and on fermentations, he conceived the idea that the infinitely little and its germs of all kinds, scattered everywhere in the outer world, strove against the natural efforts of the organism towards repair. His first practical attempt consisted in withdrawing a compound fracture from the action of these germs. He recognized that without cutting off the access of air he was able to transform this compound fracture into a centre in which the process of repair was identical with that occurring at the centre of a simple fracture. He could at will withdraw it from those complications of wounds which he maintained were of a septic nature. To free the wound from germs was sufficient. He removed those which had collected in it, he prevented the introduction of new ones at the time of dressing, and their access during the interval between the dressing and the final cicatrization of the wound.

The use of antiseptic materials—that is to say, materials destructive to germs with which wounds had become infected—became the foundation of his method. For this purpose he recommended carbolic acid, but recognized at the same time that all agents destructive to germs could afford that essential condition—that is to say, asepsis of the wound. The genius of Lister showed itself in this: that, starting from a fundamental observation verified scientifically, he succeeded in determining the general laws of repair.

Happily for humanity, Lister had manifold aptitudes. A scrupulous scientific observer, he succeeded in finding in his micro-biological studies the scientific proofs for which he was searching. An accomplished surgeon and clinical observer, he studied the evolution of a wound down to the minutest detail. He knew how to devise new surgical methods for protection; how to make the local action of antiseptics understood; how to follow the evolution in the soil—that is to say, in the wound; how to make plain the conditions which favoured local protection against germs; and, later, how to protect the wounds from a secondary

invasion. The discoveries of Lister were elaborated in the minutest details, and his method was presented along with a theory of the repair of wounds which was entirely new.

What before him did surgery teach? That all organs, that all tissues had different ways of healing, according to their anatomical construction, and that upon this depended the more or less unfavourable way in which the tissues healed; that the healing of the skin, of cellular tissue, and of muscles was easy; that this process was more dangerous and tedious in bone than in muscle; that the serous membranes were the worst kind of tissue for repair, and that their sensitiveness to injury was such that surgical interference with them was prohibited or only undertaken under extraordinary circumstances; finally, that applications to wounds might differ without that being important, from the all-important fact that different tissues had different methods of repair.

Lister asserted that the ability to repair was the same for all if germs were excluded. They alone were the cause of the difference, because the susceptibility to the invasion of germs differed, but, germs excluded, repair was uniform and constant, so surgery had the same certainty and security whatever the tissue. After these facts had been established the surgical teaching of Lister assumed the aspect of a scientific formula; all that had been uncertain became certain.

Surgery became scientific. Thus was it born from Lister. Eminent observers before his time had been able to form an empirical estimate of the advantages of an operation or of a method, and had bequeathed to us the fruit of their experience, but that experience still allowed to remain all those uncertainties so well expressed in the famous saying of Ambroise Paré, "I dressed him, God healed him."

After Lister it was possible to affirm that no one shall die as the consequence of an operation correctly performed. The unforeseen was no longer to be reckoned among the causes of death. No longer are some patients seen to recover well without any complications and others under apparently similar conditions to die of erysipelas, of purulent infection, or of some of the many forms of septicaemia. No longer do we see some succumb, exhausted by suppuration, while others scarcely suppurate at all. Union by first intention has become the law of surgery whatever the tissues or organs involved. In the course of a case after operation, everything can be foreseen with almost mathematical exactness. The uncertainty is reduced to that due to diathetic defects in the patient; but this element of uncertainty is so small that it has become possible to speak with confidence as to the future of a patient after an uncomplicated operation.

Certainty has been reached in surgical work, and it is found not to depend on any of those causes which had previously been assigned. In vain was the solution to the problem looked for in the environment. It was proposed to operate in the country—to isolate the patient. The large hospital was condemned. Blame was attached to the agglomeration of patients. When the surgeon was unsuccessful he blamed the architect.

Lister shows the causes of failure and their remedy. The environment may be bad, the hospital may be crowded, contagion near at hand, the operation room may be too small or too large; all these things are of small account. The patient operated on will recover because the surgeon is master of the field of operation. This field is quite small. It can be efficaciously protected. Prudence demands that the badness of the conditions under which operations are performed shall not be exaggerated. An evil environment must not be created, but if it exists it can be defied. We shall succeed if we are thoroughly imbued with the theory of the antiseptic method. The invariability of the process of repair is such that if it is disturbed by any complication some fault must have been committed for which search ought to be made.

The consequence of these discoveries is that they dominate the new science of surgery. The scientific basis of Lister's surgery is so well established that all those who after him have sought to innovate or to discover have been forced, in spite of themselves, to submit to the rules which he had established. All those who have followed him scrupulously have benefited by so doing. All those who have turned aside have committed irreparable mistakes which make their work a step backward in the march of surgery which will inevitably compel them to return to a method

which follows more accurately the scientific precepts of Lister.

In passing from the old ordinary surgery to the modern surgery of the viscera, the skull, the joints, etc., it is absolutely necessary to take the theory into account, and to multiply the methods whereby germs may be excluded. All those who have defied this principle have placed themselves at a disadvantage.

The unfaithful followers of Lister have developed two methods which are apparently opposed to each other, and which, having an equal discrepancy with the work of Lister, are destined to equal failure. Some have exaggerated the use of antiseptics, while others have wished to abolish them, seizing on the phrase, "aseptic surgery," which is Lister's own.

From the beginning Lister laid down a principle which many surgeons have too often forgotten; it is this—that "an antiseptic is injurious to the cellular elements of the body as well as to the microbes. The art of the surgeon lies, therefore, in employing it in a sufficient but not an excessive dose." Some surgeons, taking the word antiseptic in a too commonplace sense, have thought that, since the antiseptic is necessary, it is not possible to use too much of it; hence arose an antiseptic debauch quite contrary to the teachings of Lister. This new and simplified practice ought to have conquered the world, for the names of the greatest surgeons were associated with it; but excessive reliance on carbolic acid and corrosive sublimate, combined with a contempt for the minute precautions of Lister, was praised. The great error of the method has already brought about its disappearance.

The faithful followers of Lister have not refused to advance, but have always used powerful antiseptics with moderation, and so as not to disturb the work of repair. It has been found possible to employ new antiseptics (zinc chloride, hydrogen peroxide) to widen the field for the use of the actual cautery and of boiled liquids; but we have always observed the precautions laid down by the master.

For my part, I have been able, while extending surgery to those regions which are most susceptible—the peritoneum, the synovial membranes, the substance of the brain and of the spinal cord—to cause them to bear without any ill-effect the contact of powerful antiseptics, and have never seen any of those untoward events which public report attributes to their use. Untoward effects are due to an error in the method, to an improper use of antiseptics, since if the action of antiseptics has been in excess of that which they ought to produce, it is because they have not been employed scientifically. If certain surgeons still believe in the irritant action of antiseptics, it is because they are still impressed by certain erroneous ideas of our teachers, who confused the irritating action of certain substances with the action of microbes.

Since Lister's appearance the progress of surgery has been very great in respect to operative surgery, which seems to have no limit; but the theoretical ideas have scarcely been modified. It has been proved that the air contains only a few germs, and thus the spray, which was one of the important features in the surgery of Lister, has disappeared. It is, perhaps, not quite true that the germs in the air are so little to be feared. For my own part I am not altogether free from regret at the absence of the spray, which was very beneficial in the dressing of wounds in crowded wards.

The methods of micro-biology have taught us the use of sterilizers, autoclaves, and the boiling of liquids as means of procuring materials for germ-free dressings more easily managed than those formerly at our disposal. This is an advance, for a less constant recourse to strong antiseptics is thus made possible. In a very sensitive part, and when an invasion by very active germs does not threaten, the antiseptics may be moderated as Lister indeed recommended. But these modifications leave untouched the method of Lister, which leads us to employ a strong antiseptic agent to ensure the destruction of microbes and to give us absolute security. Is it possible to act differently, to abolish all antiseptics, and to say, as has been noisily said, that the method of Lister has been abandoned, antiseptics replaced by asepsis? By no means.

Even if this new method were definitively established, the procedure to be followed to produce asepsis of the wound, as Lister called it, must differ from the procedure followed with antiseptics, but the fundamental scientific principle would remain.

The word "asepsis," which was used by Lister, does not alter anything in the theory. The later practitioners maintain that they defend themselves against germs by other means. Their method affects the practice of surgery. It modifies a technique, but it leaves unchanged the theory of germs, which continues to dominate the practice of surgery. Lister has not disappeared; in fact, the technique may be infinitely modified, the antiseptics may be changed, and the strength in which they are used may be changed. It may even be possible, by certain artifices, to abolish them altogether. But all the same, the theory must be obeyed. Aseptic surgery is as much an issue of the discoveries of Lister as is true antiseptic surgery. From a theoretical point of view, therefore, aseptic surgery has not made a new discovery. From a practical point of view it is a considerable step backwards from the practice of Lister.

Previously the method which substituted an irregular antiseptic, corrosive sublimate, for carbolic acid, had modified, by no means favourably, the results of surgery. With asepsis the position is much more serious. This surgery is nothing more than laboratory work. Never before have the architects been more indispensable. The least defect in the condition of an operation room manifests itself by disasters. If the surgeon do not surround himself with impracticable precautions—masks, gloves, etc.—the safety of the patient is imperilled. The old surgical world protested against the easy and regular precautions which Lister took. Modern surgeons, instead of moderating those precautions which might be moderated, introduce new and incredible precautions incompatible with regular practice.

And yet have they altered the results of surgery? Certainly they have caused it to lose its safety. That which Lister assured—the mathematical safety of surgical work done in accordance with the precautions indicated applicable under all circumstances, in all places, with all patients and without lengthy preparation—that security has disappeared. Doubtless the surgeon who devotes so much attention and so large an expenditure to this new task has not gone back to the murderous surgery of thirty years ago, to the customary mortality from erysipelas and purulent infection. But look closely at his surgery. You will see how often little accidents occur, how often breaking down of primary union and secondary suppuration are met with. Even examine the statistics and you will see how many disasters occur from time to time, testifying to the inadequacy of their laborious precautions.

Let us take, for example, the surgery of the joints, so easily infected during an operation. We shall see that it has been sown with disasters which antiseptics averted. Now this surgery of the joints was born out of antiseptics, and its results are sufficient to demonstrate the absolute powerlessness of the surgery called aseptic. The most simple of all operations upon the joints, the suturing of the fractured patella—that marvellous conception of Lister's, first performed by Cameron at Glasgow—remains the property of surgeons faithful to antiseptic methods. It holds out to the others the promise of the disasters which they deserve to encounter. Aseptic surgery, powerless to ensure safety, is reduced to condemn it as a bad operation.

And yet the majority of surgeons, although they talk of asepsis, have continued to make use of antiseptics. But they do not follow exactly the method of Lister, and the accidents they meet with are the penalty of their infidelity to well-established scientific principles. This infidelity to Lister's method has resulted in a number of disagreeable consequences too long to enumerate; one of them—the gradual disuse of the absorbable ligature—is quite easy to verify. The absorbable ligature—the employment of catgut—was a marvellous deduction of Lister's from his general theory. We might speak of it as a corollary to the theorem of the repair of wounds. Lister arrived at the reasoned conclusion that a ligature composed of animal matter, soft and freed from germs, ought to disappear in the tissues without leaving any trace and without causing disturbances during expulsion. His simple directions for preparing it afforded an excellent absorbable ligature. Why do surgeons seek ceaselessly for a modification of this? Why are many of them incapable of making use of this absorbable ligature? It is because they are unfaithful to the doctrine.

It is not on account of my surgical skill that for twenty-five years I have used absorbable catgut without failure, probably oftener than Lister himself has used it. It is due solely to my fidelity to antiseptic principles. I have always adhered to the mode of preparation first introduced. I have indeed completed the sterilization of the ligature by means of a powerful antiseptic, essence of turpentine, and I have used it absolutely according to the principles of the master. Even in the substance of the brain, where I have left them in numbers, I have never seen them expelled. The ligature, which is simply sterilized by physical means, is subjected to a number of sources of infection before, during, and after an operation. The surgery which deprives itself of the use of antiseptics remains always exposed to the infection of the best sterilized ligatures. That surgery which professes to progress is incapable of profiting by one of the most wonderful discoveries which has assured the healing of wounds.

Thus from the smallest things to the greatest the result of the faults that have been committed is an extraordinary recoil in the practice of surgery. The definite result of this recoil is the loss of the absolute safety which should be given by the complete suppression of the germs and of suppuration, which was the object of Lister's surgery. Is this retrogression in modern surgery likely to endure or is it destined to be modified? The new fashion is destined to disappear because it is not the expression of a scientific truth. The return to truth is not perhaps very far off.

Have we any right to be surprised at this denial of justice, at this present day error? Our knowledge of the history of science must be very small if we are astonished at it. Not only are fluctuations in scientific methods customary, but they are necessary to progress. Every return after error is succeeded by a reaction which favours the examination of the error and fresh progress.

Is not this the case with the work of Pasteur? Is it not constantly attacked in the most violent way, yet nothing can shake its scientific truth? The result of the attacks is to cause his disciples to be severe with themselves and severe with those who, in the name of Pasteur, are encumbering science with supposed new facts which are ill established.

Has not the great discovery of Jenner, more than any other, been the object of the most diverse attacks? Humanity has paid a heavy tribute for these attacks, but the great Jennerian verity has survived, and its application has been improved, for it has been practised with less carelessness.

It will be the same with antiseptic surgery, because it is founded on a scientific truth. Already we see the new process of evolution indicated. We see the disappearance from practice of the pretended discoveries by false disciples, who have imagined that to use a new antiseptic sufficed to the making of a discovery. We are now witnessing the disappearance of the excessive use of antiseptics, which has led to the belief that they are harmful. We now see used thoroughly sterilized materials, which simplify the task of the antiseptic, and render it possible to limit their use, following the precepts of Lister. Antiseptics which are new and usefully modified are employed. But, more than ever, it is necessary to follow faithfully the doctrine of the master.

The failure of the modern method without antiseptics makes one thing very clear. It proves the subtlety of the enemies which Lister has taught us to fight against, and the necessity of a direct attack on these enemies with antiseptic substances, which alone are able to protect us without intermission. We can vary them by changing their form or method of employment, but we must return to the methodical use of the only condition which gives us certainty.

A return to the scientific doctrine will enable us to regain that lost security, and will give back to us the surgery which is applicable to all and in all places, and which remains independent of the architect, of the engineer, and of all the intermediaries without whom modern pretensions fail miserably. This return to the doctrine and practice of Lister will again mark a forward step in surgery.

Lister has not only given us a method while destroying the errors of the past. He has given an example. He has shown us the road of discoveries by teaching us to examine with more independence the works of the past, in order to submit them to the scientific law which alone assure definite progress.