

SURGERY AND SCIENCE *

By WILDER PENFIELD

THERE is a river not to be found on any map of this terrestrial globe, yet a river well known to all the sons of men, and never very far from any of us. It flows in the Realm of Time. It is Lethe, the river of Oblivion. What memories of noble persons and heroic deeds, what words of wisdom and what glorious thoughts have been engulfed in that dark, remorseless tide!

"To retrieve, if it may be, from its 'watery labyrinth' and to preserve something of the character, the appearance, the thought, and speech, the little unremembered acts—of our heroes and benefactors, as well as to keep bright the story of their life work, is the object of such orations as this——."

These are not my words. Don't be so far encouraged. These words which, by their beauty, will survive the "dark remorseless tide" of oblivion, were the words of John Stewart. These were his thoughts in the prelude of the first Listerian Oration before the Canadian Medical Association at Ottawa in 1924. In my turn, I shall do my simple best to recall to you something of the character and thought of Dr. John Stewart and of his friend and master Lord Lister, for he who would recall the one recalls the other.

There could be no better introduction to a consideration of the relationship of Surgery and Science. These men may have drunk the waters of oblivion for themselves according to the Greek myth. We in this world cannot know that for certain. But for us, they constitute a legend of growing power.

It is an honour which moves me deeply to stand before you as the John Stewart Memorial Lecturer, playing thus a role in the Centennial Celebrations of The Medical Society of Nova Scotia, of which Stewart was once the President, and sharing the pleasures and benefits of the 27th Annual Refresher Course of the Faculty of Medicine of the famous Dalhousie University. For the moment, I know, I must wear the mantle of Stewart.

Each Doctor of Medicine discovers that he wears a cloak of authority and wisdom in the eyes of his patients, if not in the eyes of his family. It covers the nakedness of our shortcomings. It causes us to stand up straight and tall, each one according to the stature God gave him.

*The John Stewart Memorial Lecture presented before the Dalhousie University Faculty of Medicine Annual Refresher Course October 7, 1953.

It would appear that this mantle of ours, which embarrasses some of us not a little, was once worn by Apollo the god of purity and of the well-being of youth. According to the writings of Homer, Apollo was physician to the gods on Mount Olympus. Aesculapius was the son of Apollo, and it would seem that the father handed on his mantle to his son, for Aesculapius healed the sick with great success, such success in fact that soon there was a serious shortage of shades in Hades. So it came about that Pluto, waiting hospitably by the river Lethe, was filled with alarm. He laid this sad state of affairs before the Father of the Gods. And so it was that Aesculapius was himself destroyed by a thunderbolt from the hand of Zeus. Alas for the good physician!

Let this be a warning to Professor Willard Thompson. He may be a prominent graduate of Dalhousie University and President of the American Geriatrics Society. But let him consider the dreadful consequences if he and his fellow specialists should find the cure for old age! How tiresome this world would seem with no way out except by a motor crash. How sad if we were deprived of the drowsy blessings of senility by which the doors, that once stood open to the world around, are closed so softly one by one.

Pluto had much reason in his argument. "Let it be as the psalmist said: 'Man goeth forth unto his work and unto his labour until the evening'."

Now after the death of Aesculapius physician-priests built numerous temples to him and the faith they had in his power cured the Grecian multitudes.

In due time Hippocrates must have worn the mantle of Aesculapius and adorned it greatly.

John Stewart of Halifax was one who could wear the mantle without embarrassment and he has, I am sure, handed it on to other distinguished men here. "He set before us," to quote George H. Murphy, "the best ideals of our ancient calling." And if I may borrow again, I shall take the editorial words of another Haligonian, H. B. Atlee: Stewart was the "beau ideal of our profession . . . It was character," Atlee wrote, "that made him the man he was, that placed him so high above us. . . a gentle man as well as a strong one. . . the most illustrious of members, past and present, of the Nova Scotia Medical Society." High praise indeed.

In giving this lecture I wear the mantle of Stewart proudly for a little time, here in the City that he loved and before the

friends who have not forgotten him. He served this University well as Professor of Surgery and as Dean. There are, no doubt, many patients who remember him, and many who could speak with greater authority than I.

When Lister left Edinburgh to accept the chair of surgery at King's College Hospital, London, he took with him his house surgeon, W. Watson Cheyne, and his senior clerk John Stewart. Sir St. Clair Thompson was an undergraduate medical student at King's at the time and he has given us the following description of the two young men.

"They were, each in his way, typical specimens of two races which are found in Scotland north of the Grampians. Watson Cheyne with his red hair and honey-coloured beard showed the Scandinavian origin of the inhabitants of Shetland. . . Stewart was a splendid specimen of the black-haired Highlander: tall, stalwart, handsome, dignified, gracious with courtly manners and soft clear speech."

Fraser-Harris has said that, "Stewart's admiration for Lister almost amounted to worship. The Quaker and the Highlander," he pointed out, "were cast in the same mould, for both were conscientious, intellectually honest, reverent and deeply religious."

There the identity stops. Stewart was a disciple. His contribution to our profession consisted in his advocacy and his practice of the new gospel, the introduction of antiseptis in surgery. Stewart returned home, to the seaport town of Pictou.

It was eleven years earlier, at the age of twenty, that he had sailed for Scotland with Captain Waters of Pictou. That was 1868, the same year that the Medical School of Dalhousie was opened. He remained in Scotland three years, working on a farm and putting in a year's attendance at the University of Edinburgh. Then he had returned to enter medicine at Dalhousie but finished his course at Edinburgh.

So it was, from New Scotland to Old Scotland, back and forth. He continued these trips all through his life, twenty-two crossings in all.

One may imagine him clerking in the wards for Lister, a gangling medical student following the great Professor at the most exciting period of that discoverer's career. It was then that Professor Lister was demonstrating, before the eyes of an unbelieving world, that wounds could be made to heal without infection, that pus was not laudable, that a surgical hospital was not a place to be shunned but instead that it could be made

a place where hippocratic healing by first intention was the rule, a place where a thousand undreamed operations might now be devised to solve, for suffering humanity, a thousand unsolved problems.

This revolution was brought about, you might say, by a bottle of carbolic acid and a carbolic spray. No wonder experienced surgeons laughed in disbelief and no wonder the little group of assistants who rallied about Lister, seeing the miracle that his science had wrought, became his disciples and devoted their lives to the spread of a new gospel. In my mind's eye I can see Stewart in the Royal Infirmary, an acolyte holding aloft the spray maker and Lister bending over a bed dressing an open wound while carbolic vapour surrounds him like an aura, a halo it would seem in the light of the lamp that shows the line of waiting beds beyond in the long dark ward on a late afternoon in Edinburgh. What a theme for stained glass!

Perhaps one might marvel that Stewart returned as he did to Pictou, leaving behind him the wards and the laboratories, the experimentation, the discussions and the doubts of Edinburgh and London.

Pictou in 1879 was a proud little seaport town. It seemed to turn its back on the rest of Canada sprawling in the new-formed union across the continent behind her. Quebec, Ontario, Manitoba, British Columbia! Their problems seemed foreign and confederation futile. Even New Brunswick was far away.

But Pictou looked out over the sea, in the direction of the sunrise, toward Old Scotland. It was not far off except for the time it took. The town might have been placed in the Hebrides instead of being planted on another continent for all the notice they took of the distance. It was Old Scotland and New Scotland and there was one people and Edinburgh and Halifax were two highland capitals.

Stewart practised surgery in Pictou. He took an interest in the lives and the pastimes of his people and remained there 15 years. Then, coming to Halifax, he became the perfect teacher, the admirable example, the beloved practitioner. He was a scholar, a gentleman, an excellent surgeon. Having listened to a voice of authority he undertook the care of the sick. The practitioner is, of course, the flower of our profession and I am glad to see this recognized by Dalhousie in the proposed award of an honorary degree to Dr. R. A. MacLellan.

The difference between Stewart and Lister, two men said to be cast by nature in the same mould, is that the one accepted

authority and went to work among his people. The other doubted as he worked and put his doubts to test again and again. Surgery for the one and surgery with the pursuit of science for the other.

The difference in these two men is the subject of my address on Surgery and Science.

What was it that made Lister a scientist as well as a surgeon? Let us look for the answer in the story of his early life.

On graduating in medicine from London's University College, Lister became house surgeon to Ericksen, author of the most popular current textbook of surgery. The book was called, hopefully; "Science and the Art of Surgery." But Ericksen was not to be considered a scientist according to my definition.

Young Lister passed his F.R.C.S. examinations at the age of 25 and so he was qualified for his practice. There had been prizes. It was all proper and highly satisfactory. The time had come for him to tour the clinics of the continent to take his wander year before setting himself up as a London surgeon. He had money enough to do as he liked.

But Lister was depressed. He looked at the surgical wards—what a lottery of life and death! Infection dogged the surgeon's every incision and seemed to leap from bed to bed. He turned back to the laboratories of University College, to William Sharpey. Sharpey was a scientist. He concerned himself with basic mechanisms in medicine. His pupil Michael Foster writing years later said of him that he was, at the time of Lister's student days, the only pure physiologist in England.

Sharpey was a Scot and he suggested to his young and discontented pupil that he should go to Scotland to visit Syme who was then Professor of Surgery at Edinburgh and old friend of Sharpey's. Syme was honest, his words few, his surgery unexcelled for that period. So, Lister went for a month's visit, but he remained 7 years, beginning all over again as Syme's house surgeon.

This tall, thoughtful young man was somehow different. He had known culture as a boy. His father, Joseph Jackson Lister, although a wine merchant from the age of 14 when he had to leave school, had "contrived, by early rising and otherwise to supplement the school education." More than that he eventually did work of great value on the theory and construction of achromatic lenses for microscopes. Indeed because of this, he became, in his own right, a fellow of the Royal Society.

The son Joseph had a boyhood desire to become a surgeon.

But his father, recognizing the value of what he himself had missed, like many another father, sent him for a preliminary course in arts at University College, three years leading to the degree of B.A. before he should undertake the study of medicine. Lord Lister in later life was in the habit of advising this for young men who were considering medicine and who could find the time and money.

But at the close of his study of arts there came an unplanned interlude. He seemed to have a depression. It was called a "nervous breakdown" then as it is now. And so he was given an extended holiday in Ireland; a place of beauty that was reasonably free of intellectual distraction, a place to relax—where a man might laugh and not be asked the reason for it.

Joseph Jackson's letter written to his son at this time, in the intimate phraseology of Quaker intercourse, gives insight into the son's state of mind:*

"It is indeed a mistake. . . .to believe thyself required to bear burdens on account of the states of others. . . .and believe us, my tenderly beloved son, that the proper part now is to cherish a pious cheerful spirit, open to see and to enjoy the bounties and beauties spread around us:—not to give way to turning thy thoughts upon thyself, nor even at present to dwell long on serious things. Thou wilt remember how strongly Dr. Hodgkin cautioned thee on these points."

Thus although he had his B. A. at 20 years, he did not begin medical studies until he was 21 after this period of idleness. Lister had a tendency to stutter, particularly when tired or embarrassed. His hands, as pointed out apologetically by his biographer, were not long and beautiful like his mother's, hands thought then, and since, to be clever and artistic. On the contrary, Lister's hands were square and thick and the fingers short, like those of many an expert carpenter and artisan, the hands of Hunter and Kocher and Halsted and Finney and Cushing.

So it was that Lister had a year for reading and reflection. A time to doubt his own abilities and to look at life. Such periods may profoundly alter character. Edward Archibald, McGill University's greatest surgeon, had such a period of nearly 2 years during a cure for pulmonary tuberculosis. When he returned to surgery he had, as I think in consequence, a unique

*Lord Lister by Sir Rickman Godlee, Macmillan & Co., London, 1917, page 16. Godlee who was Lister's nephew has written an excellent biography and a fascinating story. Godlee himself made history when he was first to carry out a temporarily successful operation for brain tumor at Queen Square 1884.

turn of mind. He was reflective, perceptive, different. One of the whimsical little sprites that are only found in silent places had crept into his heart. An even more dramatic change was wrought in William Halsted by a similar period as I shall describe later.

Being more mature than his classmates, Lister, even before he left medical school, turned his attention to original work in basic science. In physiology his earliest writings had to do with muscle histology, blood vessels, circulation, nervous control of blood vessels, coagulation of the blood. In the field of pathology and bacteriology, he contributed original work on inflammation, and eventually the new germ theory.

He was not interested, as many surgeons are, to make large collections of pathological specimens. How different he was from John Hunter in this respect. He did not begin by publishing a long series of cases in which the patients had been treated in a standard manner. Instead he published one case of bony exostosis removed by Syme from the humerus of a young girl, analyzing the formation of cartilage and the biological mechanism of laying down bone in it. He reported a single case of carbuncle from the practice of Professor Syme! Think of that ONE CARBUNCLE! But he took it as a text for an enquiry into the pathology of infection and inflammation.

In 1860 at 33 years of age he was made a Fellow of the Royal Society, not as a recognition of his distinction as an assistant surgeon but because of his original work in the biological sciences that are basic to surgery. He chose the unsolved problems that the practice of surgery had presented to his mind.

In the same year he left Edinburgh to accept the chair of the Regius Professor of Surgery in Glasgow, the chair now occupied with distinction by Professor Illingworth, who honours us by his presence here tonight.

At 38 he conceived the true explanation of sepsis and devised a method of treatment called antiseptis.

During those seven years in the clinic of Syme at Edinburgh and the succeeding 5 years in Glasgow, before he picked up the clue to his great discovery, he was a busy surgeon like other surgeons. But he was something more, a scientist, he was a scientist by virtue of his habit of thought.

He turned from patient to current medical literature and back to the patient. But he did not accept the pronouncements and the explanations of the surgeons and physicians about him

or who had gone before him without critical consideration of the evidence. He recognized no authority of name or position.

Instead he looked at clinical problems with the eye of one who has himself done original work on microscopic structure and who has made his own enquiry into living mechanisms. He went from the patient to his simplified laboratory experiments and back again seeking cause and effect. He depended on those things that could be proven. Thus his thinking about clinical problems was scientific rather than authoritarian.

Here is the crux of the whole problem. When he looked at an osteoma he recalled the growth of cartilage and the change to bone that he had seen with his own eyes. The element of cause of local tumor growth he must have recognized as a continuing mystery. That element remains a mystery to us today while we wait for someone to pick up a clue, perhaps from new work in some other discipline of science. We are waiting for a Lister in the field of cancer, for the evolution of Science in Surgery.

He looked at a carbuncle, understanding the swelling, the redness, the central disintegration of tissue in terms of his own basic observations of inflammation and structure and circulation. He was clear about one thing—namely that the ultimate causal agent was unknown and current surgical reasoning was wrong.

I like to think that he took a special interest in Pasteur's work on putrefaction in wine because of his affection for his own father the wine merchant. Pasteur at that time had seemed to destroy minute organisms in the wine by heat. Lister knew he could not use heat in surgery. That would kill his patient. Sepsis in a wound resembled putrefaction. There must be micro-organisms at the bottom of the process.

He thought long about the problem. He tried zinc chloride, also sulphites, but without success. Then an item of apparently unrelated information came to him. The city of Carlisle was using carbolic acid to combat putrefaction in sewage. That must have seemed a far cry from the operating room but his scientific mind had narrowed the problem down to a search for something that would kill a hypothetical living organism without killing the patient. Other clinicians still believed in spontaneous generation of life and they taught it. But Lister found their proofs inconclusive!

Pasteur had shown that micro-organisms could reach his cultures through the air. And so it was that Lister converted carbolic acid solution into a vapor to cleanse the air about the

wound as well as the wound. The scheme succeeded and so it was that antiseptics won the first round against infection.

We realize now that Lister's discovery was only a step:— It is always so in science—a step toward the whole truth and the final solution.

Aseptic techniques were to follow, associated with antiseptic sterilization of the skin. A little later, at the time of the first world war, wounds were again to be treated with antiseptics such as the hypochlorite solution of Dakin. Still later the antibiotics were to appear destroying micro-organisms selectively on the basis of a new principle, without harm to the patient.

There are at least two surgeons who preceded Lister and who may be compared with him because of the value of their contributions, Ambroise Paré in the 16th century and John Hunter in the 18th century. Neither of these men had any such primary scientific training as Lister. It was far too early for that to have been possible. But both men were like him in one regard. They refused to accept traditional teaching as final authority, preferring to turn to nature itself for evidence.

Paré was a country barber's apprentice who acquired some experience as a dresser in the Hotel Dieu de Paris. He became an army surgeon without passing through the medical schools of the period and, after long and trying experiences on the battle fields of France, he came to defy tradition in the treatment of wounds. He was guided by fearless compassion for the suffering of his patients and by practical experiment. Thus it was that he established better methods of treatment and forbade gratuitous interference, enunciating the principle that God would heal if the surgeon provided care and protective dressings.

For example, at that time the common practice was to treat gunshot wounds by a first dressing of boiling oil. But fortunately his supply of boiling oil gave out one night. He compared the results by the two methods and the treatment was abandoned. Such was the level of experimentation in the 16th century.

Paré was a magnificent technician, devising many splints and new procedures. He was beloved by the people and yet treated with contempt by established physicians of his time. Paré was the only "Protestant" to be spared by royal mandate at the massacre of St. Bartholomew. But he was protestant in medicine as well as in religion.

John Hunter was born in 1728, a hundred years before Lister. He had been called, with good reason, the founder of scientific

surgery. This is not the place, nor is there time, to give an account of his life and contributions.

Hunter was a surgeon, an experimentalist, a collector of everything that had to do with his changing interest in the human body. The 13,000 specimens which he gathered together and studied were passed on to the Royal College of Surgeons and I am myself convinced that his restless iconoclastic spirit still lurks in the Hunterian museum there. When at the College in Lincoln's Inn Fields, I think I have heard his cynical laughter as students walk through the collection with books in hand peering about to see the things that the text books say they should see.

He was tireless, irascible, intolerant, lovable, fervent. He seemed to be born with the urge of a collector, but he turned from his collecting with apparently inexhaustible energy to put the questions that presented themselves to the experimental test. Experimentation also seems to have been, in him, an inborn turn of mind. All knowledge in the field of surgical pathology was his goal but he took the body of man and the bodies of animals living and dead as the text for his authority.

No man was ever less bound by the teaching of the past. Indeed he was, to a large extent, unhampered by traditional teaching because he seemed to be ignorant of it. He did not come to surgery with a mind trained by study of basic science as Lister did. Instead he came to anatomy and to surgery with a critical and enquiring mind and created a body of basic facts which formed the beginning of surgical pathology. He showed surgeons that each of them, whatever their training, might contribute to this science and add to the collection that he left to the profession, provided he continued to look for final authority in the structure of the body and the experiments wrought there by disease.

I could choose many examples of how surgeons have brought science into their surgery. But I shall only refer to one more master surgeon, William Stewart Halsted. He is perhaps the only man to found a school of surgery on this continent unless such a claim could be made for Harvey Cushing. But Cushing, in a very real sense, was Halsted's pupil.

Halsted was Professor of Surgery at the Johns Hopkins University for 33 years from the foundation of its Medical School in 1889. He taught his pupils a new type of delicacy in the handling of tissue, introduced the use of rubber gloves in the operating room and gave an example of thoughtful scholar-

ship in his approach to surgical problems that has had a profound effect on American surgeons.

A tragedy and a period of enforced reflection changed him as a young man and made of him the shy studious Professor that I knew when I was an undergraduate at the Johns Hopkins. As a young man, Halsted returned from study in Germany to the thundering turmoil of New York, the most urban and in many ways the most challenging city of the world. He was hailed as a rapid, brilliant operator, a popular teacher, a promising surgeon in the best tradition of New York's Roosevelt Hospital.

Then there came upon him the tragic addiction to cocaine long guarded as a secret by his friends. It had been acquired while testing the newly discovered drug upon himself before the dangers of habituation were understood. The result was a gradually increasing confusion of thought that for a time puzzled all who knew him. An unworthy medical article appeared under his name at that time which bears testimony to his strange mental breakdown. His close friend, the pathologist William Welch, recognized the cause of the trouble and came to his rescue.

Together they went off on a long sea voyage out to the Windward Islands and back. It was heroic treatment in that tiny schooner which carried these two heroes of American medicine through the stormy solitude of the sea. There followed nine months of seclusion in the Butler Hospital, and then at last Halsted emerged—cured but changed. There was a transitional period in Welch's Laboratory. Then he took over the Department of Surgery as Osler did the Department of Medicine.

The tragedy and the period of solitude made him different. We might all of us do more meaningful work, make more strategic approach to problems, if we turned aside to seek a distant perspective.

I have talked tonight about the heroes of our profession. Hero-worship is good and I have no doubt that the students who graduate from Dalhousie are marked by the high tradition of John Stewart. A student may gather his heroes by personal contact, by hearsay or through his studies, but a professional man is poor indeed who has no heroes. They go with him through life. They may sit with him when he is alone or in time of doubt. But he has no right to claim them, and they are not truly his own, unless they have marked his life and moulded it in some way.

Science for a physician is the same as science for a surgeon, with no more than a change in emphasis. It makes little difference whether a man is physician or surgeon when he studies the basic science of the respiratory system, the gastro-intestinal tract, the reproductive or the nervous system. Practice is different, very different, but our scientific preoccupations are essentially the same.

Few can make such a successful adjustment between surgery and science as Joseph Lister did. Many have not had the advantage of preliminary training in the arts. Many could not indulge in the long period of monastic contemplation that came to Lister and Archibald and Halsted. Many never thought of carrying out original work of their own until after graduation.

All of us must begin to practise our profession in the light of traditional teaching and current reading. That is what surgery is, and medicine too. Much is demanded of us. The surgeon, for example, must master special operative skills, as well as all the other systems of knowledge that are listed as prerequisite in the catalogue of medicine.

But there is much more than that. Each surgeon and physician must understand the meaning of compassion. Being alert to the hopes and the fears of his patients, he must qualify as their confidant, councillor and judge.

There is a sort of flush of conscious knowledge that comes to the graduating medical student along with his doctor's diploma. But, alas, that consciousness is all too brief. Once entered into practice, he faces his failures. There will always be some who take these failures as a challenge. The medical man, who is made of the stuff that scientists are made of, will then set out to find what is wrong for himself. He will realize that final authority is not to be found in Professors' lecture notes nor yet in text books. And so he will turn at last to Nature and recognize that final authority is lying in the bed, before him, with the patient.

Thus, it may be that a day of second graduation will come to him—when he has studied his unsolved problem during life and in death, on the operating table and afterward, with patience and with determination. Then he may pass through the gates of science into another world. He will find himself a member of the most honored company of explorers—and he will feel a new excitement like a cool wind coming down to him from the mountains of the unknown land.

Some will be worthy to wear the mantle of John Stewart and some perhaps the mantle of Lister.