PAST IS PROLOGUE—TWO THEO'S AND A FRIEND: 1977 PRESIDENTIAL ADDRESS, AMERICAN BURN ASSOCIATION MEETING

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The realization that living microorganisms are the usual cause of suppuration in surgical and traumatic wounds revolutionized surgical practice. The antiseptic system, as preventive measures were called, was soon superseded by its natural offspring—asepsis—which is regularly attainable in many clinical settings. One hundred years later, even operations upon the human heart have become safe and routine.

However, pathogenic bacteria already exist in or rapidly colonize traumatic or other contaminated wounds with which modern surgeons must frequently deal, and although asepsis is therefore unachievable its rituals are nevertheless still forlornly carried out in the naive hope that somehow their performance will induce substantive change in the adverse circumstances.

Infection is the great unresolved problem in the treatment of extensive burns; the mortality from these injuries is today essentially what it was for compound fractures in the mid-nineteenth century and—for the same reason—sepsis originating in the wounds. Then the diagnoses were erysipelas, pyaemia, or hospital gangrene instead of "burn wound sepsis," and the offending organisms usually streptococcal or staphylococcal instead of the Gram-negative ones that so frequently kill today, but these differences are trivial. We are often forced to accept persistently high wound bacterial densities in tissues that are normally sterile. Extraordinarily, some of our patients actually do survive, if just barely, but too many of them do not.

The difficulty of the challenge encourages a pessimistic outlook. The lugubrious definition of burns as: "infected wounds caused by heat," which cynically emphasizes the inevitability of infection, is still a generally accepted one. "The bugs" it is said, "are smarter than we."

My view is far more sanguine. The prospects are in fact exhilarating, or so I believe. The story that follows is meant to help explain what might seem to the skeptics among you to be an attitude more suited to Pollyanna than a burn surgeon who has, as have you, often presided helplessly over septic death.

A knowledge of history provides perspective. As Newton put it, knowing history, we "stand on the shoulders of giants." Alternatively, it may be helpful to recall that it has also been said that "knowledge keeps no better than fish."

If, as you will see, Medieval or Renaissance surgeons who knew nothing of bacteria or their role could, on the basis of clinical observation alone, propose and practice tenets that harmonize perfectly with those of contemporary scientific surgery, and if a bookish Victorian surgeon, about whom you will also hear could, using simple expedients, translate with extraordinary success the early bacteriologic discoveries of the great Pasteur to his clinical practice in Glasgow, the conclusion is inevitable that the ideal of achieving consistently effective antisepsis, or—and why not?—of perfect asepsis in even the most extensive burn wounds is indeed an attainable one. Vexatious problems have a way of seeming embarrassingly simple in retrospect, after their solutions are known. "A problem solved is no problem at all—it just disappears."

The names Salerno and Monte Cassino have grim overtones to those of us old enough to remember the bloody fighting there during the last Great War. But the peaceful seaside resort of Salerno was in fact the site of the first medical school in Europe. Under the aegis of the Benedictines from the neighboring monastery at Monte Cassino, Salerno, strategically located near the center of the civilized world and a port of call for Crusaders en route to and from the Holy Land, became a repository for the accumulation of Greco-Roman, Egyptian, Sumerian, and Arabian medical knowledge that
was so nearly forever lost during that curious period of intellectual hibernation known as the Dark Ages.

Salerno's most illustrious faculty members were surgeons: Roger Frugardi of Palermo and Roland Capelluti of Parma, whose writings, later commented upon by the celebrated "Four Masters," would, with few exceptions, dominate surgical thinking for hundreds of years. Roger, Roland (and after them the Four Masters) by their great influence did much to perpetuate the erroneous Galenical doctrine, which they espoused, that pus was a normal manifestation of wound healing; and so, when wounds drained (as they often did), the phenomenon (and hence the pus) was termed "laudable"—praiseworthy. It would require six more centuries to divert this purulent river, much of it iatrogenic at the source, in which countless wounded and ill would needlessly succumb.

A few hundred miles northeast of Salerno, and some years after that school had reached its zenith, a medical school was begun at Bologna. The University had unenthusiastically incorporated Medicine into its curriculum, characterizing it as "the last born and ill-favored child of knowledge." But here it was that the forgotten Hippocratic concept of primary wound healing was rediscovered and antiseptic surgery was reborn.

It has been said that the battlefield is the surgeon's best school. Ugo De Borgognna (Hugh of Lucca) was a military surgeon who had participated in the Crusades. Ugo later became a University Surgeon, one who never published a paper. But perish he did not, in exception to the epigram. Fortunately, one of his sons (it is uncertain whether the relationship was only professionally symbolic and not actual) recorded the substance of "Master Hugo's" surgical teachings. This was Theodoric, later Archbishop of Cerva.

Theodoric's Surgery (1267) is the one of the great surgical books. (There is an excellent English translation by Eldridge Campbell and James Coulton. [Ref. 8].) It emphasizes unequivocally the importance of hemostasis and of gentleness to tissue, two of the master words in the liturgy of technical surgery. There is even a suggestion of a germ theory of wound infection, a shrewd guess indeed for a surgeon who knew nothing of fibroblasts, leukocytes, or bacteria. (Remember that Von Leewenhouk would not describe his microscopic "creatures" for several centuries yet and it would not be until the 19th century that their role as pathogens was appreciated.)

Theodoric's book is full of sensible advice:

"It behooves practitioners of surgery... to frequent the places where skilled surgeons operate and to attend their operations diligently—let them be farsighted, gentle, and circumspect with the greatest deliberateness and gentleness they can, especially around sensitive parts—and ticklish places, because all the things which are necessary to the art cannot be included in a book, cannot easily be foreseen and many of these frequently happen to the operator. They must needs be well read—I scarcely think that anyone can understand surgery without schooling."

Halsted's greatest contribution was the surgical school of thought he fathered, and Theodoric's tone is unerringly Halstedian, I think you would agree.

But the most famous passage of the book is this:

"For it is not necessary, as Roger and Roland have written, and as many of their disciples teach, and as they and modern surgeons profess, that pus should be generated in wounds. No error can be greater than this. Such a practice is indeed to hinder Nature, to prolong the disease and to prevent the conglutination-consolidation of the wound."

Theodoric clearly is stating here that healing by first intention is the norm. Unfortunately, except for the contribution by his pupil de Mondeville, the antiseptic concept would again be lost for some 300 years, much of this because of the influence of Guy de Chauliac, whose surgical works passed through more than 50 editions during succeeding centuries; Chauliac unfortunately had reaffirmed the erroneous Galenical doctrines.

Simplicity is the hallmark of Theodoric's wound management: "Master Hugo was accustomed to treat and consolidate almost all wounds merely with wine and tow and a well-fitted bandage—and brought about excellent scars without any ointment." Reasonable advice this—a mild antiseptic and an occlusive dressing will indeed suffice for many wounds—provided that they are not severely contaminated and that the immunologic responsiveness of the patient is intact.

The importance of nutrition in patients with major trauma is today well appreciated. But
the concepts of the Calorie and of the Organism as a Machine would not evolve until centuries after Theodoric's time. Listen to Theodoric, whose ideas sound an unequivocally modern chord. Remember, they were based solely on clinical observations, as experimental medicine was a science still unborn.

"Since Nature cannot operate properly, whether in large or small wounds without nourishment, which generates the good blood, we ought to administer to our patients laudable food generated with good chyme, as is said, so that Nature may become capable of the generation of flesh for the purpose of uniting the wound and restoring its continuity."

A wry commentary follows:

"... stupid surgeons ignore this, for they prescribe diet and abstinence for the wounded."

The tenor of the book is charmingly modest, although Theodoric is occasionally overenthusiastic. Speaking of Master Hugo he says, for example, "No one whom he cured of a wound or of a hot abscess was ever left with a corded scar."

Hypertrophic scars, we would agree, sometimes occur even in wounds that heal primarily and that are tended by Master Surgeons.

The next antisepctic surgeon of Ugo's stature would not be born for more than 200 years. Like Theodoric and Hugo, he was also a University Surgeon, temporarily at least: "Academic medicine, however, did not satisfy me," he later wrote with characteristic bluntness:

"I found that the medicine which I had learned was faulty, and that those who had written about it neither knew nor understood it. They all tried to teach what they did not know."

But unlike Theodoric, the retiring cleric, and the silent, professional Hugo, we know a good deal about this brash antisepctic surgeon, both from his own voluminous writings, which (rebelliously) were generally in vernacular low German instead of the prescribed Latin, and from the writings of his contemporaries from whom his abrasive impatience often evoked an emotional response. His turbulent, nomadic life was only in part devoted to surgery, which then was still practiced mainly by itinerant quacks, uneducated barbers, or even by rude and ignorant hog-gelders.

There are few men whose names become a common noun, as has his (or probably has, at least, as the origin of the word is still questionable).

"Bombast: stuffed, turgid or inflated language," says the Oxford dictionary. This unique man stands, as the one antisepctic surgeon of note between Theodoric and Lister. Alchemists, necromancers, exorcists, Rosicrucians, other mystics and even practitioners of the black arts have also found sustenance in his writings, at times unjustifiably.

Aureolus Magnus Theophrastus Bombastus from Hohenheim, he called himself, "Doctor of both medicines [that is, of both medicine and surgery] and of the Holy Scriptures." The names and titles roll sonorously off the tongue, you must admit. Paracelsus, he immodestly called himself for short: that is, the equal or superior of the great Roman physician-scholar. In retrospect, it was an underestimate.

Paracelsus was born in 1493 near Zurich, the son of a learned physician who was also an experimental chemist and who possessed a fine library, rare in that day before printed books could be cheaply had. As was then the custom, when Paracelsus began university life, he wandered from one European school to the other, gleaning what he could from each of them. He studied variously at Heidelberg, Cologne, Tubingen, Vienna, Paris, Montpellier, and finally at Ferrara. Whether he ever was awarded a medical degree is moot: his detractors later in fact accused him of quackery. If so, he must rank as the world's champion quack-salver. But at the age of 19 he eschewed university life: "at all German schools you cannot learn as much as at the Frankfurt Fair," he wrote scornfully.

During the next 16 years he wandered: "to Granada, Lisbon, England, Brandenburg, Prussia, through Lithuania, Poland, Hungary, Walachia, Transylvania, Croatia and other lands, more than I need mention," he wrote, "and everywhere I sought certain and experienced knowledge of the art. I did not seek it from the learned doctors alone; I also asked shearmen, barbers, wise men and women, exorcizers, alchemists, monks, the noble and humble, the smart and the dumb."

He served several tours as a military surgeon with both the Spanish and Venetian armies and traveled in remote Russia, in Turkey and in the Middle East as well, where he apparently procured his famous sword with its hollow handle in which it was said that he kept his analgesic laudanum which was in fact a crude
opium extract. It was also rumored that he had come into possession of the legendary "Philosophers’ Stone" somewhere in his travels. The conception of the Philosophers’ Stone had originated from the Neoplatonist doctrine of man (microcosm) in a universe (macacosm). Each individual was thought to have within him a bit of the infinite Essence: thus man could influence the stars and the stars man. The discovery of principles or essences which could transmute base metals into gold, or— even— cure all disease, was theoretically possible by such a conception.

Paracelsus was famous throughout Europe by the time he was 30. He was appointed Professor of Medicine at Basle in his native Switzerland in 1534, although he so stirred the conservative burghees there that he was soon dismissed, amid his own charge that his academic freedom had been impinged.

The prospectus he wrote for his course at Basle still exists. It gives a measure of a man, whose obsessive passion for knowledge and trust and the power they yield made his life a model for the then-evolving legend of Doctor Faustus later brilliantly dramatized by Marlowe and Goethe. His reliance on personal observation and experiment, and his bold rejection of those speculations of the Ancients that he found to be at variance with his own observations, unmistakingly caps his thinking with the panache of the Renaissance.

"Theophrastus Bombast of Hohenheim, doctor of both medicines and professor, greetings to the students of medicine. Of all disciplines medicine alone, through the grace of God and according to the opinion of authors divine and profane, is recognized as a sacred art. Yet, few doctors today practice it with success and therefore the time has come to bring it back to its former dignity, to cleanse it from the leaven of the barbarians, and to purge their errors. We shall do so not by strictly adhering to the rules of the ancients, but exclusively by studying nature and using the experience which we have gained in long years of practice. Who does not know that most contemporary doctors fail because they slavishly abide by the precepts of Avicenna, Galen, and Hippocrates, as though these were Apollo’s oracles from which it is not allowed to digress by a finger’s breadth. If it pleases God, this way may lead to splendid titles, but does not make a true doctor. What a doctor needs is not eloquence or knowledge of language and of books, illustrious though they be, but profound knowledge of Nature and her works. The task of a rhetorician is to bring the judge over to his opinion. The doctor must know the causes and symptoms of the disease and use his judgment to prescribe the right medicine.

"Thanks to the liberal allowance the gentlemen of Basle have granted for that purpose, I shall explain the textbooks which I have written on surgery and pathology, every day for two hours, for the greatest benefit of the audience, as an introduction to my healing methods. I do not compile them from excerpts of Hippocrates or Galen. In ceaseless toil I created them anew upon the foundation of experience, the supreme teacher of all things. If I want to prove anything I shall not do so by quoting authorities, but by experiment and by reasoning thereupon. If, therefore, dear reader, you should feel the impulse to enter into those divine mysteries, if within a brief lapse of time you should want to fathom the depths of medicine, then come to me at Basle and you will find much more than I can say here in a few words.

"To express myself more plainly, let me say here, by way of example, that I do not believe in the ancient doctrine of complexities and humors which has been falsely supposed to account for all diseases. It is because of these doctrines that so few physicians have correct views of disease, its origins and its course. I bid you, do not pass a premature judgment on Theophrastus until you have heard him. Farewell, and come with a good will to study our attempt to reform medicine."

What an interesting fellow he was! He may have had rickets, judging from the near-pathognomonic cranial contours in several contemporary portraits. There have also been suggestions (perhaps apocryphal) that he was an eunuch, the result of an encounter with a wild boar or (as others would have it), of a war wound. Baldness of course would be contrary evidence, as eunuchs do not often become alopecic, but his apparent aversion for women might support the castration hypothesis: "He did not care for women and I believe he never had doings with any," his secretary wrote of him. In fact, Paracelsus never married.

Paracelsus publicly burned the revered Canon of Avicenna to flamboyantly symbolize his disregard for the ancients. He had little patience for his traditionalist contemporaries as well, of whom he would say, in reference to the popular practice of the diagnosis of disease by inspection of the urine: "Their ignorance is fantastic. All they can do is gaze at piss."

Opinonius, who would afterward publish the Fabricia of Vesalivus, served for a time as Paracelsus’ secretary. Opinonius later wrote with a
curious blend of approbrium and admiration that conveys the complexity of his master's personality,

... As to Paracelsus, he has been dead for a long time and I would hate to speak against the spirit of his death (as the saying goes). While he was living I knew him so well that I should not desire again to live with such a man. Apart from his miraculous and fortunate cures in all kinds of sickness, I have noticed in him neither scholarship nor piety of any kind. It makes me wonder to see all the publications which, they say, were written by him or left by him but which I would not have dreamt of ascribing to him. The two years I passed in his company he spent in drinking and gluttony, day and night. He could not be found sober, an hour or two together, in particular after his departure from Basle. In Alsace, noblemen, peasants and their women-folk adulated him as a second Aesculapius. Nevertheless, when he was drunk and came home to dictate to me, he was so consistent and logical that a sober man could not have improved upon his manuscripts. I had to translate them into Latin and there are several books which I and others thus translated. All night, as long as I stayed with him, he never undressed, which I attributed to his drunkenness. Often he would come home tipsy, after midnight, throw himself on his bed in his clothes wearing his sword which he said he had obtained from a hangman. He had hard time to fall asleep when he rose, drew his sword like a madman, threw it on the ground or against the wall, so that sometimes I was afraid he would kill me. I would need many days to tell what I had to put up with. ... 

... He was a spendthrift, so that sometimes he had not a penny left, yet the next day would show me a full purse. I often wondered where he got it. Every month he had a new coat made for him, and gave away his old one to the first comer; but usually it was so dirty that I never wanted one. ... 

In the beginning he was very modest, so that up to his twenty-fifth year, I believe he never touched wine. Later on he learned how to drink and even challenged an inn full of peasants to drink with him and drank them under the table, now and then putting his finger in his mouth like a swine.

The Great Surgery Book, published in 1535, was an instant success. Its unequivocal adaption of the antisepsic principle and its rejection of the fallacy of laudable pus places it with Theodoric's Surgery as virtually the only significant contribution to antisepsis until the mid-19th Century.

The book should be particularly interesting to burn surgeons, as it contains what may be the first illustration of the treatment of a burned patient. "If you prevent infection," Paracelsus wrote "Nature will heal the wound by itself."

In an age when innumerable plaisters, concoctions, and ointments were recommended at every hand, Paracelsus would write that:

"A surgeon should not interfere with Nature's workings; he must protect it. Flesh possesses an inner balsam which heals, and every limb has its own cure in it—wounds need nothing." Or, "the surgeon should know not that he but Nature is the Healer." ["I dressed him, God healed him," Paré would later phrase it.] Or again, "surgery consists in protecting Nature from without that she may proceed unchecked in her operations."

Here, like Theodoric, he seems to have recognized that external factors were responsible for the vicissitudes that so commonly affected traumatic or surgical wounds.

And again,

"A physician who thinks that he heals does not understand the art. You may understand for what purpose there is a physician. He provides the shield for Nature and protects the injured parts against its enemies, so that the foe without may not retard, poison, or injure the forces of Nature, but may preserve its vital power. He who takes good care of wounds is a good surgeon."

Admittedly, his work is full of garbled contradictions and patent absurdities, as well as shrewd insights, but these only add to its interest.

Paracelsus also contributed significantly to the beginnings of the sciences of chemistry, physiology, and psychiatry. Medieval and Renaissance surgeons tended strongly toward descriptive anatomy, which Paracelsus scorned; he was a physiologist in spirit: "You will learn nothing from the anatomy of the dead; It fails to show the true Nature, its working, its essence, quality, being and power. The true anatomy has never been dealt with. It is that of the living body, not of the dead one. If you want to anatomize health and disease, you need a living body."

Instead of dissecting cadavers, he in fact devoted much time throughout his career to laboratory chemical experimentation, to which he had first been introduced by his father. Listen to this contrapuntal description, which still suits persons all of us know: evidently there
were obvious differences in personality, motivation and even in mode of dress between the Town and Gown physician in the 16th century as well.

"I praise the chemical physicians. They do not consort with idlers or go about in gorgeous satins, silks, or velvets, with good rings on their hands. They tend their work by the fire patiently by day and night, see their recreation in the laboratory, wear plain leathern dress and aprons of hide to wipe their hands. Sooty like blacksmiths, they make little show and do not gossip with their patients. Nor do they praise their remedies; for they well know that the work must praise the master and that chatter does not help the sick. But they busy themselves at learning the steps of alchemy-distillation, solution, putrefaction, extraction, calcination, reverberation, sublimation, fixation, separation, reduction, coagulation, tincture."

After Paracelsus' death in 1543, there were few significant contributions, either theoretical or practical, to antiseptic surgery until the monumental one made by the last surgeon about whom you will hear. This is of course, Joseph Lister, England's greatest surgeon. As Weir Mitchell said of Lister,

"Surely in all the great story of surgical progress, there has been no one man who has given to his fellows a gift so great."

Lister (born 1827) was a humble, quiet man of Yorkshire lineage who was raised as a Quaker. His father, an affluent wine merchant, was a natural scientist of talent who was awarded fellowship in the Royal Society for his contributions to the theory and design of the achromatic lens and to the development of light microscopy.

Lister from his youth desired nothing but to be a surgeon. He grew up in comfortable circumstances at Upton House in what is now East London. Lister attended a private Quaker School. By the age of 14 he was already following his natural bent. He wrote to his father, "when Mama was out I was by myself and had nothing to do but draw skeletons, so I finished the cranium and named the bones of it, and drew and painted the bones of the front and back of the hand and named them."

He attended University College Medical School in London and afterwards gravitated to Edinburgh to work with the brilliant Scots surgeon, James Syme, whose daughter he eventually married. (Syme himself is of special interest to burn surgeons, as he established the first known facility solely devoted to the care of burned patients.) In Syme Lister found a brilliant clinician, who soon recognized the potential of the young Quaker and gave him his head. But Lister had private doubts: "as to brilliant talent" (he was thinking perhaps of Mr. Syme) he wrote to his father "I know I do not possess it; but I must try to make up as far as I can by perseverance." Lister had great admiration for John Hunter; like Hunter he was a gifted and meticulous experimentalist. In fact, throughout his long career Lister set aside time for laboratory bench research which he conducted personally, often in the small morning hours, as his careful notebooks indicate.

His early scientific papers gained him a considerable European reputation. His first work was on the involuntary muscle of the iris and on the anatomy and innervation of the pilo-erector apparatus, illustrated with his own precise drawings. During the next few years he became intensely interested in the process of inflammation and in the mechanisms of hemostasis and thrombosis. These problems occupied much of his time in the laboratory.

When an opportunity arose, he applied for and finally, but not without acrimonious political maneuvering, was appointed to the Regius Professorship of Surgery at the University of Glasgow. By 1861, his work on inflammation had already convinced him that pus in a wound meant tissue decomposition and that this was somehow dependent upon but not due to the air.

Lister was by no means an encyclopedic reader. He was, for example, unaware of Semmelweis' contribution, which had preceded his own by some years, and, although he had passable French, he was also unaware of Pasteur's work until a colleague at Glasgow apprised him of it; by then the pertinent reports were already three or four years old. Pasteur had brilliantly proved that putrefaction is the result of microbial growth and that infectious microbes are wafted on dust particles in the air.

It had also been learned that heat, filtration, and certain chemical substances could rid air of its undesirable properties. The evidence was incontrovertible that tissue putrefaction was produced by living and multiplying microbes. Although Pasteur's work had attracted great
attention, its now obvious implications to surgical practice had been strangely unappreciated.

As Szent-György has aptly said:

"Science is to see what everybody has seen and think what nobody has thought."

Claude Bernard's well known observation that chance only favors the prepared mind is also pertinent; Lister's example is a classic one. As was said of him: "he was a scientist by virtue of his habit of thought. . . . 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 depended on those things that could be proven. Thus his thinking about clinical problems was scientific rather than authoritative."

Pyaemia, septicemia, and hospital gangrene, all variants of post-traumatic or postoperative sepsis, were then rampant on the wards at Glasgow. Lister correctly deduced from Pasteur's work that the chemical treatment of cutaneous wounds and, during surgical procedures, of the air to which they were exposed, afforded the most straightforward and practicable solution to the septic problems that harassed him and all other surgeons. (He later chuckled at the tale of the fantastically successful Yorkshire veterinarian, who, on his deathbed, finally cackled the secret of his long success with the words: 'I biles me tools!') Lister knew that phenol had been used at Carlisle to disinfect sewage, although he was unaware that Lemaire in France had already employed carbolic acid in clinical practice.

During 1865, Lister treated 11 cases of compound fractures by swabbing the open wounds with carbolic-soaked lint; after the bones were set, dressings of carbolic acid were employed, which were rewet daily. He soon realized, however, that pure phenol was histotoxic, correctly recognizing and distinguishing between chemical tissue necrosis and that caused by bacterial action. He therefore compounded a sort of putty made of painter's whitewhich served as a vehicle for the phenol. Trauma surgeons had always been salve surgeons (and still are), but this was the first wound salve that was based on the results of pertinent experimental data.

The results were spectacular, or Lister at least thought so. Ten of 11 consecutive cases had survived; not a single case of pyaemia, erysipelas, or hospital gangrene had occurred. In his original communication, which was painstakingly conceived, he wisely stressed the principles involved and not the means by which they were attained. Its carefully chosen title was: "On a New Method of Treating Compound Fracture, Abscesses, etc., With Observations on the Conditions of Suppuration." This paper was followed shortly by another one entitled "On the Antiseptic Principle in the Practice of Surgery."

There was immediate controversy. Much of it dealt with claims of precedence in the unimportant issue of who had first used carbolic acid; and there was carping over the lack of statistical significance in Lister's data, but this was an arena, secure as he was in his observations, that he refused to enter.

"Well, Sir," he wrote "I have been often reproached for not having published statistics, and it has been hinted, and the hint has been lately prominently repeated, that I have suppressed statistics because I had none which I should not be ashamed to produce. Sir, the truth is that life is short, and that when every day begins one has to consider which is the occupation that is most likely to be valuable; and feeling, as I do, I have felt that there was every day something both more congenial and, I hoped, more profitable to do than to compile statistics."

Despite the considerable personal abuse he received, Lister with few exceptions held his peace; he simply continued to improve his methods. For example, the famous "Donkey Engine," a cumbersome, noisy device, which he later characteristically refined, was used to spray droplets of carbolic throughout the surgical amphitheater. This contraption made him the butt of many jokes, all of them now forgotten. His continual modifications of antiseptic methodology were taken by the least perceptive of the skeptics as evidence of a fundamental flaw, but Lister simply kept working. Within ten years, the battle was clearly won, although there were clinics where antiseptic or aseptic methods were not practiced until well after the turn of the century.

The foregoing has been presented to make it clear that in the special problems of the prophylaxis and treatment of burn wound infection, solutions will inevitably be found that are far more satisfactory than those that exist today. Whether these therapeutic measures will follow comparatively traditional lines, that is, the
introduction of more efficient and less toxic antiseptic agents or antibiotics, or even, as it may soon be, by manipulation of bacterial genes, or whether the solution will include as well specific stimulation of impaired host defense mechanisms, or even other still unthought of approaches, it is of course impossible to say. The important thing is that those involved in burn treatment reject futilistic, counterproductive and, as I have tried to show you, historically naive attitudes and work enthusiastically and with a basic sense of optimism toward the elusive goal. We are smarter than the bugs and by stubborn persistence, to remember Lister's example, we can widen the advantage steadily. To borrow Hunter's famous admonition: "I think your solution is just, but why think? Why not try the experiment?"

SELECTED REFERENCES
2. Paracelsus: Der grosse Wundartzney, das Erst Buch. fol. Augsburg, Heynrich Steyner, 1537
3. Paracelsus: Der grosse Wundartzney, das Andrer Buch. fol. Augsburg, Heynrich Steyner, 1537

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