Today I would like to reflect, sine ira et studio, about the status of cardiothoracic surgery by critically asking what has changed during the past decades. I shall conclude with some suggestions as to how we might adapt to these changes in order to carry forward the remarkable development of our speciality and to retain its attractiveness for those who follow in our footsteps.

First, I shall comment about the environment in which we work and the expectations and demands medicine in general is facing. One need only to read current newspapers to recognize that there is ever growing public opinion expressing the belief that health care is too expensive and yet not meeting the needs of patients. The exponential increase of health care costs largely started in the 1990s, although it could be argued that it actually began earlier and merely came to widespread public attention at that time.

In the 1990s, politicians and insurance companies began a concerted campaign to control the entire health care system, largely by confronting the medical community with reproach. They alleged that doctors were self-serving and greedy.

Concurrently new tools, such as the Internet, increased public awareness and superficial knowledge about medicine and health care. With enormous rapidity, medicine seemed to become what might be called ‘everybody’s competence.’ A ‘know-it-all’ attitude, that included criticism and scepticism about research, developed at a time when the health of many was threatened by the emergence of new and dangerous diseases such as AIDS. It was not surprising that the public vigorously demanded immediate solutions, meanwhile blaming the scientific research community for being unprepared and lethargic.

From this series of events, one realizes that our professional criteria of success and the public’s criteria of success are often not the same. How can we explain this dichotomy? Society wants medical research to generate new and effective therapies quickly and medical science knows that this cannot easily be achieved despite best efforts. Economists, who have the ear of everyone, point out that the better the practice of medicine becomes, the more success it has, the longer people live and that the result is more patients with greater needs and ever increasing costs. Professor Krämer [1], a well-known German economist, describes that phenomenon as the ‘progress trap of modern medicine’.

In the continuing interaction between the medical community and the public, medicine has become more transparent than ever before. One might say there has been an invasion of the mighty ‘ivory towers’. The media have eagerly acted as vehicles for this invasion, broadcasting sensational news about innovative drugs, procedures, techniques and technologies. ‘Big mouth’ promises that turn out to be rapidly bursting bubbles sell newspapers and television time, without leaving a residue that is beneficial to patients. Such distortions reflect poorly on health professionals. Those of us who are privileged to lead in health care deplore such happenings, but they also provide us with opportunities to learn. Let us not miss these opportunities by remaining silent when our voices should be heard.

I choose to refer to the present as the ‘new era’ that is forcing us to see medicine predominantly as a business, governed by the laws of the marketplace. The new era focus is on selling medical expertise in order to erase deficits in the hope of becoming profitable. ‘Profitability’ has become a part of our professional lexicon. My concern is that for some among us, ‘profitability’ may have become the idol they serve primarily!

As the business model of medicine developed, we became ‘providers’. The title doctor was sidelined, and our patients were called consumers or clients. The sacred doctor—patient relationship was replaced with the language of business. In keeping with business models, increasing attention was paid to costs and this resulted in relentless decreases in health care resources. Workforce allowances and research funding were among the cuts. I submit that these changes challenged the quality of medical care. De-facto rationing shook and continues to shake the very foundations of medicine! Simultaneously competition, the very foundation of business,
created a new strange atmosphere of uncertainty in the practice of medicine and in academic medicine. New terminology like 'benchmarking' crept into the vocabulary of medicine, albeit in ways to measure quality and outcomes that were lacking.

How did these changes effect the practice of medicine? Full responsibility for budgets were assigned to clinical departments, evoking a surge of administrative tasks and imposing an enormous, time-consuming load on the shoulders of those who previously devoted themselves primarily and in variable proportions to patient care, teaching and research.

This evolution was vividly described in Kenneth Ludmerer’s book entitled 'Time to Heal' [2]. Ludmerer notes and documents how there has been a drastic reduction in time available for direct patient care and time to think, reflect and to indulge in curiosity. The business of health care has deprived professionals of the freedom they need to be creative! Moreover, these changes have made clinical medicine less attractive to practitioners as well as to students considering careers in medicine. Thus, in response to my initial question as to what has changed, I submit that an externally induced 'paradigm shift' has triggered an earthquake for virtually everybody in medicine. Professionals are required to do more work for less pay while the social standing of physicians and surgeons has been eroded. I believe these are the main reasons for the young generation’s decreased interest in medicine as a career. As a consequence of these changes, it could not be a surprise that a highly specialized field such as cardiac surgery has become less attractive despite the fact that excitement and satisfaction in cardic surgery remain at the highest level.

Let us look at some facts. Only about 50% of medical students now graduating from Heidelberg University strive for a career in practical medicine. Germany is becoming short of doctors, and yet many young physicians are leaving the country, hoping to find better working conditions and career options elsewhere [3]! Many approved positions in cardiothoracic surgery residency programs in the USA remain unfilled [4]. The top students are no longer choosing medicine. The number of active cardiothoracic surgeons has decreased between 1995 and 2005. Ours is the only speciality to suffer attrition! A future shortfall is expected!

One of the most serious consequences of all these changes is the decline of academic medicine. All branches of medicine, in many European countries and in North America are affected. The National Institutes of Health have recognized the problem and they are desperately seeking resolution.

Desmond Sheridan, Professor of Cardiology at the Imperial College of London stated in The Lancet in 2006 [5]: 'Academic cardiology is declining in Europe and as a result clinical innovation has been weakened'. He continued, 'We are facing the loss of a generation of young scientists, who should have been our research leaders in the future. With this loss of talent, the conversion of basic scientific discoveries into innovation, that benefit patients has declined, and this decline is causing widespread alarm'.

In 2005 the British Journal of Medicine published an initiative of a group of academics, called 'International Campaign to Revitalize Academic Medicine' (ICRAM) [6]. This group, representing 14 countries, has examined several possible scenarios: 1. Academic Inc; 2. Reformation; 3. In the public eye; 4. Global academic partnership; 5. Fully engaged. In the debate arising Jocelyn Clark, the associate editor of the British Medical Journal has posed a series of penetrating and pertinent questions [6,7],

- Is there sufficient academic freedom?
- Is academic medicine lacking vision and leadership?
- Is there not enough money, not enough talent flowing into academic medicine?
- Is there a lack of appropriately trained clinical scientists and of career-structure to support them?
- Is academic medicine a less attractive career option?
- Are the overall changed structures responsible?
- Is there less access to a range of good laboratories, appropriate facilities and infrastructure and investigational resources?
- Is the staff in medical schools tired for other purposes, as clinical remunerative procedures and grant generating enterprises?
- Is there an increasingly complex legal and ethical governance?

I think we can agree that most of these questions can be answered in the affirmative with a resounding 'Yes'! The responsibility or blame for problems in health care is generally attributed to health systems administrations. Incontrovertibly, however, the entire medical community is held culpable for having tolerated the deterioration of widely revered traditions and methods of medical practice and for jeopardizing the ethical pillars of medicine.

Undergraduate and graduate medical education are in the midst of the debate. For example, Dr Perlroth, professor of medicine at Stanford University had said: "Certainly medical schools and other academic institutions must remain committed to a basic curriculum of human biology and clinical experience" [8]. Income from tuition cannot fully pay for delivery of the curriculum, and so the universities are, at least in part, pirating the time of faculty and staff whose intended responsibilities are otherwise. For example, doctors whose job it is to carry out clinically remunerative procedures and scientists who are supposed to be competitive in garnering grants and doing research are tapped for duties other than their primary responsibilities and the work they love. This creates a conundrum wherein the individual must choose between his or her primary work and duties of teaching. Reality and human nature being what they are, teaching suffers! This is a matter of concern for all of us, the leaders of today and leaders of future generations.

It is therefore imperative, even mandatory, that we think and act now with regard to reorganization and restructuring. We must somehow adapt to the changing conditions I have described. It is incumbent on us to seek and to find ways to adapt as smoothly as possible, and to optimize the current health care working conditions. In the process of change, we must take care not to jeopardize those aspects of present health care and health education that are working successfully.

Our goal must be to protect the integrity of medicine in general, to maintain the identity of our speciality, and to preserve its functional capacity. We cannot achieve this goal with blind and slave-like obedience, – howling with the
Zacher [9] was quoted as saying: 'The researchers, the President of the Max Planck Institute in Germany, Hans
interests. I submit that we have the responsibility to do this, and to stand for more than our own immediate self interest.
We owe this to future generations in our profession on behalf of their patients. In keeping with these ideas, the former
President of the Max Planck Institute in Germany, Hans Zacher [9] was quoted as saying: 'The researchers, the scientists have a democratic responsibility for taking care that the public opinion, the politics, and the law develop in the right sense of research'. He continues, 'The quality of research is at first a question of the ability and competence of the researchers and the genius of the best among them. How efficient researchers however can be, depends on the structures they work in, on the available resources, and on the freedom, provided to them in the conflict with other values, goods, and interests'.

All specialties in medicine are relatively young, but in comparison to venerable specialties like general surgery, thoracic surgery is still a child, and cardiac surgery remains an infant. It is fair to say that no other field developed more rapidly than cardiac surgery, and that our specialty grew more quickly and more vigorously than any other. Many of us who are still actively working were witnesses and participants in the short history of modern cardiac surgery.

During our careers, there has been enormous progress in the understanding of disease mechanisms, and the development of surgical therapeutic options. Many surgical techniques as for example 'cross-circulation' and 'extensive surface cooling' that were born during our time have either been replaced, or lost their once horrifying high risks. It is now common to be able to offer patients a high level of security and confidently to promise a good or excellent outcome. The book of cardiac surgery contains many chapters of remarkable success, but change and challenge can be expected for the future!

'Panta Rhei' — 'All is Flux'!

In 1972 Andrew G. Morrow, in his Presidential Address to the American Society of Vascular Surgery described the status of cardiac surgery [10]. He outlined the work and research environment he considered desirable for cardiac surgeons, giving credit to Guy de Chauliac, the 'Father of Surgery', for his famous 'Ars Chirurgia' [11] of 600 years prior in which de Chauliac said, 'The surgeon should be learned, expert, ingenious and adaptable'.

The desirability of these attributes for modern surgeons stand fast. Dr Morrow proceeded to expand de Chauliac's criteria. He entitled his paper 'What the cardiac surgeon ought to be', and he presented his views about curriculum and structural patterns that would allow cardiac surgery to flourish. Dr Morrow stated, 'The cardiac surgeon ought to be a physiologist'. He explained that all patients of cardiac surgeons have abnormal cardiac and circulatory physiology, and so their operative and postoperative management is facilitated by a thorough understanding of physiology. He concluded: 'If the cardiac surgeon is also a physiologist, he will be a better surgeon'. Morrow proceeded to say, 'The cardiac surgeon ought to be a cardiologist'. He deployed 'systems in which the role of the cardiac surgeon is that of an 'effector organ'. That is, the surgeon is asked, or often told, to carry out a specific technical task based on the decisions related to nature and severity of the lesions, made by the cardiologist. To correct this imbalance, Morrow said, 'The cardiac surgeon ought to be a skilled cardiologist who can also perform operations upon the heart'. He explained that this meant that the surgeons must be able to interpret, by himself, all the data of electrocardiography, heart-catheterization, angiography and other diagnostic methods and techniques and ... he should be able to make his own judgement ...'. He insisted, 'Finally in the postoperative period the cardiac surgeon ... should direct and be responsible for the patient's care ...'. Morrow's next point was that, 'The cardiac surgeon ought to be an investigator.' In his view, an exposure to research, even for surgeons, predominantly focused on patient care, is important.

To summarize, Morrow espoused a thorough understanding of normal and abnormal physiology as well as of cardiology for all cardiac surgeons; and a well-structured period in an appropriate basic science environment.

Many of my contemporaries and currently practicing cardiac surgeons have followed the paths described by Morrow, including spending considerable time in research. The current conditions of practice and education force us to ask whether the criteria desirable for cardiac surgeons in 1972 have become obsolete today. To examine that, let's have a look at structures first. Since the 'early days' of cardiac surgery, when thoracic surgery universally included the sub-specialties of cardiac surgery and general thoracic surgery, general thoracic surgery has tended to separate from cardiac surgery in many European countries.

I believe these changes were short sighted! They have lead to multiple small units that struggle to be kept alive on an independent basis and that require inordinate energy to be protected from becoming victims of the management forces of current business models of medicine that I described earlier. An even greater detrimental effect of separating cardiac and general thoracic surgery is the loss of synergism between two very closely related subspecialties of cardiothoracic surgery.

One of the issues that spans all of the subspecialties of cardiothoracic surgery is that of postoperative care.

Today intensive care medicine is, to varying degrees, 'outsourced' in many departments of cardiac surgery worldwide. 'Anaesthetists', 'Intensivists' 'Cardiologists' have taken over. Often, they are exclusively responsible for postoperative management, and the cardiothoracic surgeon is considered a guest in terms of decision-making in the postoperative intensive care unit. In fact, the surgeons may lack authority to give binding orders. If the task of the cardiac surgeon is limited to operations, an important source of knowledge disappears. If young cardiac surgeons become 'back-seat drivers' in the ICU, they relinquish crucial opportunities to widen their understanding of surgical pathophysiology. They miss out on direct observations of
adverse effects of surgical procedures, and this limits their ability to engage personally in developing new strategies that might preclude such adverse consequences. Also, as ‘back-seat drivers’ in the ICU, young surgeons might dampen their feeling of responsibility for their patients. If the cardiac surgeon relinquishes his responsibility for surgical patients to colleagues in other specialties, the surgeon is left with only very limited experience and a loss of his or her expertise in postoperative pathophysiology. The danger in allowing this to happen is that eventually the surgeon will no longer be considered the expert. This could and would lead to situations wherein the surgeon may not even be consulted when a difficult postoperative problem occurs. Ladies and gentlemen, if we allow that to occur, we would have permitted cardiac surgeons to be relegated to a position not unlike that of the barber surgeon of yesteryear.

Extracorporeal circulation is another battlefield. Since its introduction by John Gibbon in 1953 extracorporeal circulation is a fundamental tool of cardiac surgery. It is absurd that in some countries it has left the domain of cardiac surgeons and migrated into a separate discipline exclusively managed by technicians who are supervised by anesthesiologists. I urgently and most strongly believe that all technologies used in cardiac surgery as integrated components of treatment must be under the control and supervision of surgeons. Surgeons know, or at least should know, how best to use technology on behalf of their patients.

Perhaps the most pressing conundrum we are facing is that of ‘Surgical Research’. My reasons for this sweeping statement are diverse: as previously described, economic pressure and reduced resources in general limit access to laboratories and to government funding for cardiothoracic investigation. Investigations in cardiothoracic surgery tend to be labelled as applied research. In the push and pull for resources the use of money for beds and facilities is generally favored over allocation for experimental and clinical research. Also, in the competition for grants, basic research is usually more attractive to review panels than applied research [12]. I find cellular and molecular research fascinating and attractive, just as you do. It offers more opportunities to get grants and to publish one’s work in journals with high impact factors than most surgical research topics. However, I think that it makes no sense for a cardiac surgeon to spend one year or more in immunology or molecular biology, learning highly specialized laboratory techniques, which he or she will not use later. These basic science techniques are much better handled by basic scientists. Small ‘Mickey-Mouse’ molecular biology units within clinical departments are, in my view, preposterous! However, I do not want to leave this topic before offering a realistic strategy. It is imperative for cardiothoracic surgeons to learn the language and to understand the basic principles of molecular biology. We must find and nurture mechanisms that will allow and encourage cross-fertilizing dialogues between basic science and clinical science and help to move pertinent basic science discoveries into clinical practice.

Innovation today will continue to drive the field forward and become the new therapies of tomorrow! Pressures seeking ‘productivity’, a modern catchword, have limited the time available to clinicians for creativity and curiosity, and the surge in activity in molecular science has led to a substantial reduction in applied and clinical surgical science. I am concerned that this is severely detrimental to our specialty because it is clear that we need active and innovative clinical and basic science investigation in order to thrive. We must acknowledge these trends in order to react to them appropriately and constructively.

In keeping with this axiom, Professor Markl, former President of the Max Planck Society said (Rede des Präsidenten der Max Planck Gesellschaft, 1996): ‘If somebody wants to lose weight, he shouldn’t start this process by reducing the brain volume!’

Now I shall examine how well we, as modern cardiothoracic surgeons, understand ourselves. I will particularly emphasize cardiac surgery, my own subspecialty. Do we retain the fundamental belief expressed so well by Morrow in 1972 that a thorough understanding of physiology and pathophysiology, as well as a broad basis in cardiology and training in research are desirable? Have the changes of recent decades that I described earlier and the working conditions of modern cardiac surgery made that belief obsolete? Is it still realistic to expect the modern cardiac surgeon also to be an experienced, skilled cardiologist?

I start addressing these questions by looking at modern cardiology. Diagnostic endeavours are still the domain of cardiologists. This defines cardiologists as the main gatekeepers that determine the treatment paths of patients. The cardiac surgeon, even if he or she is involved during the initial management stages, usually accepts what has been found and generally follows the cardiologists’ recommendations rather closely. Often there may be relatively little opportunity for independent preoperative surgical judgement. It appears that at the practical every day level we still have not fully achieved Morrow’s stated goal of combining the knowledge and expertise of the cardiologist and the cardiac surgeon in the decision making process. However, if any of us, or a member of our family, were the patient faced with heart disease that requires surgery, the complete cardiac surgeon who was Morrow’s ideal is exactly what we would seek. How then can we find balance between one extreme wherein the cardiac surgeon is a technical tool of the cardiologist, and the other extreme of time consuming repetitive interdisciplinary consideration of all therapeutic options? Teaching and learning how to find the optimum balance point between these equally unacceptable extremes is the essence of excellent structured education for cardiologists and cardiac surgeons alike! I am speaking in favour of partnering between cardiac surgery and cardiology on an ‘eye to eye’ level such that each partner respects the other.

Specialized knowledge and expertise in each realm should insure constructive discussions without rancour and competition. For purposes of carrying this theme forward, I will continue to use the term ‘perfect balance.’ This concept is supported by Dr Benfield’s statement, addressing the view of the scientific community [13]: ‘When I asked the Education Committee of the Thoracic Surgery Directors Association to study cardiothoracic education from the viewpoint of establishing priorities for funding of research projects in education, one of the foremost recommendations was funding projects that would demonstrate how to educate ‘hybrid’ or ‘interdisciplinary’ surgeons who would be able to work smoothly with partners in allied disciplines’. Active
research is one of the best ways to achieve the perfect balance in the care of cardiac patients.

In 2004, Meßmer [14], one of the most prominent surgical research workers in Germany, defined the specialty of ‘surgical research as a golden pathway to the understanding of pathophysiology and physiology in general, and surgical pathophysiology in particular.’ He said, ‘It would be tragic for the development of surgical science, if enthusiasm for surgical research and special institutions for surgical research would become lost’, … and he spoke in favor of surgical research as a pillar of scientific education and training.

Despite all the progress made, there remain boundless opportunities for research in cardiac surgery. We may not climb a tree on a tortuous path like the ‘famous zebra’ … the ground still hides treasures and secrets that are waiting to be discovered!

These opportunities come to our attention when we face clinical problems that we do not fully understand during our everyday work. We must stimulate inquisitiveness and encourage investigation as part of our structured training programs. This is enormously important for the future of our specialty and the ever-improving care of our patients. I have asked several colleagues to comment on the value of research experience during their training. I want to share Andy Wechsler’s statement (personal communication, 2007) on that question with you … ‘Exposure to research during my surgical education, in retrospect, has impacted everything I have done subsequently. I learned that research in applied science is a quest for truth and process on the mind that impels one to question dogma, to examine everything in the light of new knowledge and to pose and solve problems. These lessons are as relevant to the practice of contemporary cardiothoracic surgery as they are to the investigative laboratory. The research experience rewards one with a set of tools that enable the quantitative interpretation of experience and provides a method for the testing of hypotheses capable of altering practice’.

Marc de Leval [15] said ‘Academic Surgery does not exist without active and longstanding commitment to research’.

Daniel Loisance (personal communication, 2007) addressed the issue of research training for young surgeons under the title of ‘Train the Brain’ by stating several conditions he considers indispensable for modern cardiac surgeons.

‘Research:

- stimulates curiosity and mental alacrity
- permits a good understanding of the problems
- gives the tools for asking the good questions and getting the right answers
- will permit the surgeon to regain the leadership in the management of cardiac diseases:
  - selection of the patients
  - definition of the optimal protocols
  - responsibility in the patients management’.

I personally would like to add what I consider indispensable for good ‘translational research’ in cardiothoracic surgery: it is advantageous for the clinician to catch the spirit of research, to learn about the methodology necessary for conducting experiments and clinical studies, to learn about limitations of modern instrumentation, and most importantly to understand basic physiological mechanisms better, including as many complex regulations as possible.

It is remarkable how much these actual statements, resembled the conditions, defined by Morrow in 1972! Thus, while much has changed, and we must adapt to change, perhaps the present is not as different from the past as we thought?

I close my remarks of today about surgical research with a quote from Gerald Buckberg (personal communication, 2007), which exactly catches the spirit of research, ‘Nature has created ‘Why’, humans find out ‘How’. If ‘Why’ is not explained by ‘How’, we have to find another ‘How’.

Medical school and postgraduate education as currently comprised cannot offer the young cardiothoracic surgeon an adequate basis to understand physiology and pathophysiology at the level required. Most graduating residents have insufficient ability to transfer theoretical knowledge to the operating room and bedside. Therefore, it is truly a serious matter that so few young surgeons are now willing to invest their valuable time in cardiac surgery residencies or fellowships, and even fewer young people are willing to invest the extra time needed to learn at least the language and the concepts of research. Something must change!

Many of us have tried to defend the status quo of cardiac surgery education, but I believe such an approach is doomed to failure. Others, caught in myopia, have welcomed the shrinking body of cardiothoracic surgery. They argue that a more confined smaller specialty would leave more room for what they consider to be truly surgical activity, i.e. the mastering of new surgical skills. Although I agree that the development of new surgical techniques is desirable and necessary, I am convinced that cutting off important parts of the body of cardiac surgery would leave it with a torso which has lost its head. I do not want to see cardiac surgery unable to think and perhaps even without legs upon which to stand erect. Those who argue in favor of constricted cardiac surgery may miss the arms, … they are in the operating theatre!

I believe we are now at a crossroad. We must decide either to maintain the integrity and identity of our specialty in its strong, independent position, based on the foundation we have carefully built with hard work, or to capitulate to a future of shrinking body of cardiothoracic surgery. They argue that a more confined smaller specialty would leave more room for what they consider to be truly surgical activity, i.e. the mastering of new surgical skills. Although I agree that the development of new surgical techniques is desirable and necessary, I am convinced that cutting off important parts of the body of cardiac surgery would leave it with a torso which has lost its head. I do not want to see cardiac surgery unable to think and perhaps even without legs upon which to stand erect. Those who argue in favor of constricted cardiac surgery may miss the arms, … they are in the operating theatre!

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want to address a few words about clinical studies of new methods and products; these are in order.

Innovation has always been a powerful word, but now we should elevate it to the status of a magic word! Curiosity, genius, and receptiveness to new concepts and discoveries, are the intellectual substance of innovation.

Translational research tends to be about specific, clinically relevant problems that are poorly funded by public research monies. With shrinking government funding, there is increasing pressure on academics and independent practitioners and allied health professionals to attract industry support. Today we can hardly imagine applied and clinical research without industry funding. Money from industry salts most departments. We owe it to our patients to take advantage of all available resources on behalf of continuing improvement in their clinical care. Translational research wherein there is honest cooperation between surgeons and industry can be very productive and fruitful for the researchers and industry and beneficial for patients.

Binding international guidelines for moving discoveries, innovative procedures and new products into practice do not exist. Important efforts in this direction have been made. The Helsinki Code of Ethics for Biomedical Research [16] pointed out, that 'Concern for the interest of the subject must always prevail over the interests of Science and Society'.

In 1994 the American College of Surgeons stated: 'It is essential however that the value and safety of a new procedure be established before it is widely used on patients'. In addition, E.A. Zerhouni, Director of the NIH says '… we may expect that, before a therapy, an innovative product, is approved for clinical use, it must be studied carefully in the laboratory to understand how the treatment works, how effective it is, and what the risk is' [17].

The common denominator among the messages of the American College of Surgeons, the Code of Helsinki and Zerhouni is the prevention of unsound procedures, techniques, and technologies entering clinical application. Otherwise stated, we must avoid burdening patients with unacceptable 'learning curves'. Potential investigative endeavour that originate from industry are often in danger of adequate basis in morphology, physiology and pathophysiology. Although surgeons could be very helpful to brain trusts and industry by assisting them with fundamental knowledge in surgical science early in the process of exploring and developing new ideas, our input has rarely been sought at the outset of the consideration of new ideas. Thus, at times, industry prototype products, or even products that are alleged to 'work', and to be ready for clinical trial, are without sound advice from surgeons. Academic support for industry is urgently needed!

Our drive to lead and to innovate prompts many of us to seek to be the first, or at least among the first, to use new products, new devices, or new procedures. New, optimistic preliminary results are frequently presented at our meetings whereas negative results and outcomes are rarely published or disseminated.

In my opinion, an example of this was the 'Transmyocardial-Laser-Revascularization'. This technique invaded hospitals worldwide despite absence of a sound idea, or evidence, as to how it might work. All postulated explanations were, in my view, artificially constructed and they all failed. Vast amounts of money were spent on this technology. The method survived for years, and in a few places it is still being used, probably for reasons that are more pecuniary than medical. Another so-called innovation that moved to clinical use without a sound basis, and without adequate experimental testing, was 'the myocardial splint'. Still other examples are the 'panty-girdle' for the heart, the 'percutaneous mitral posterior annuloplasty-clasp', and also the 'drug eluting stent'. The telemanipulator too was premature when it entered clinical practice. A common denominator among these techniques is initial positive study reports, followed by advertising that claimed a revolutionary innovation in the absence of critical evaluation. I submit that such methods of bringing new products and methods to the public constitute misdirection. Surgeons, cardiologists and industry share the blame for premature clinical application of innovative procedures and products that lack a sound, well-studied basis.

New data that suggest a small but significant increased risk of stent thrombosis in patients, who have drug eluting stents have recently been released by the Food and Drug Administration (FDA) (Circulatory System Devices Advisory Panel Transcript for December 8, 2006, meeting (accessed February 15, 2007) http://www.fda.gov/ohrms/dockets/ac/cdrh06.html#circulatory) and ref. [18].

The President of the German Society of Cardiology, Professor Dietz, in his, Presidential Address of 2007 [19] said, 'With the drug eluting stent we have willingly accepted and released a technology not supported by mid-term and long-term results respectively'. Belatedly, he called for a registry, controlled by the Society and the use of such a registry for outcome research. Dietz continued, 'We want, … we urgently need, translational research — but we are short of translational researchers', he said.

These few examples vividly show, that adequate translation apparently is a not well-ordered process. Too frequently it lacks expertise in the conduction of clinical studies, and adequate knowledge or respect of the basic rules of research. Thus, not infrequently, how the evaluation was done, more than the innovative method or product, that evokes criticism.

What are the reasons for substandard translational methods in industry and surgical science? To address this crucial question I return to my opening theme about change with the passage of time. Fairly independent institutes for surgical research developed and helped during the maturation process of cardiothoracic surgery. These institutes were instrumental in moving cardiothoracic surgery from an art to a science. Now, they are almost gone from the 'radar screen' of clinicians. Quite a number of very famous institutes have been closed, e.g. the 'Pulmonary Cancer Research Institute of Chiba University' in Japan where induction of chemotherapy for lung cancer originated nearly half a century ago, the Institute of Surgical Research at Munich University, which has contributed a lot to surgery in different fields.

These professional research facilities have been replaced by laboratories that depend on specific academic departments that are inadequate to meet the high scientific standards. Simultaneously with the closing of formerly well-funded surgical research institutes, as I mentioned earlier, the number of young cardiac surgeons willing to dedicate their life to the profession is declining. Today, only a few young surgeons are ready to invest enough time to education...
and training in research because they are unwilling to sacrifice personal and family considerations to the same degree as many of their predecessors. So, I dispute the allegation that the current generation is less talented than previous ones, and I suggest that the change in the number of researchers available now is a reflection of the enhanced emphasis on life-style and on the overall deterioration of working conditions. I also absolve the younger generation from total blame because at least some of the leaders of today do not concede professional research the prominent place, it deserves. The loss of professional guidance and leadership from mature and well-established cardiothoracic surgeons in many areas of research is obvious.

The methodology of the translation process is also a matter of concern. Mr de Leval [15] is right when he says: ‘The pure scientist will maintain that a prospective, randomized, clinical trial is the only scientific way to compare therapeutic strategies’.

J.W. Jones from the Department of Surgery at the University of Missouri addressed this important topic in his remarkable article, entitled ‘Ethics of rapid surgical technological advancement’, published in the Annals in 2000 [20]. He stated: ‘New technology has developed faster than the profession’s ability to provide evidence based data ….’. This position is comprehensible for reasons mentioned by Dr Loop [21] when he said: ‘The half life of new technology is currently 3–5 years and it is becoming shorter and shorter. New treatments are obsolete before their long-term results are known’.

Further adding to the complexity of challenges to research is the increasing difficulty of ‘Outcome Research’, as expressed by Dr Blackstone [22]: ‘A rational more stable higher statistically powered approach to outcome would involve continued patient surveillance. Unfortunately, to do so required additional resources, and increasingly in the USA but also in other western countries, the specter of invasion of privacy and need for informed consent’.

Aside from an increasing ethical pressure, legal hurdles are set up. Consequently we are facing the risk of over-regulation, threatening the development of new therapies. Does this mean, that we are going to burn the bridges between research and development on one side, and clinical practice on the other? How can we break the deadlock? The success of new operations or new medications depends on their effectiveness in dealing with complicated physiologic or pharmacologic interactions. Thus, innovation requires input from more than one discipline and we must find a compromise whereby to merge the different positions and priorities of the pure researcher and the clinician. We must find a modern way to evaluate a new idea on its theoretical basis first and then to test a sound working hypothesis. This is by no means an easy matter. For example, to test new implants, in vitro tests must evaluate the properties and biocompatibility of materials and physiologic measurements must be made to test the validity of design and construction concepts. The latter requires using suitable animal models, employed by well-trained, independent surgical researchers. In a fourth step, the translation to clinical practice under solid scientific, well-monitored control along with adequate analyses and honest reporting must occur. Each of these stages requires a solid professional background. Following such a sequential protocol in an honest scientific way might allow recognition of flaws and strengths of meaningful innovations in the early stages of development, thereby reducing the number of ‘trial and error’ approaches to innovation in clinical medicine.

How can we move ahead to improve the process of moving discoveries to clinical practice? Cardiothoracic surgeons educated clinically and in research will come to fore in the scientific community, including bodies or committees that make funding decisions. Today, worldwide, only a few cardiothoracic surgeons are members of such committees, thereby placing young cardiothoracic surgeons at a disadvantage in the competition for research support.

My message is that we must remain aware of the methods and of the importance of transitional research, taking care not to forget or to ignore broader and more basic research.

To restore the image of the cardiothoracic surgeon as a scientist, the scientific community must be convinced about the scientific quality of highly trained surgeons. I consider it important to not strictly separate academic medicine from practical clinical medicine. Where we insist on such a separation and arrogantly consider academic medicine superior to medicine in the community we would be heading into a ‘blind alley’ that would not be beneficial for us or for our patients! Synergistic activities are demanded urgently! Attentive clinical observations in the operating theatre and at the bedside result in the identification of disease. Thus surgeons who work primarily, and perhaps exclusively, as clinicians are also researchers. The operating theatre allows unique direct evaluation of acute geometrical changes and other functional aberrations plus the opportunity immediately to observe response to external manipulation and surgeon-induced change.

Before I close, I return to the reality of the enormous economic pressure we are experiencing in cardiothoracic surgery and how these pressures threaten our freedom. We must defend our freedom to learn, to understand and to be creative. We must breed a new generation of clinicians and academics who respect each other’s work, recognizing that each plays an important and complementary part in providing excellence in healthcare. This process has to be started by changing medical school curricula to acknowledge the importance of specialties to one another and of research to clinical work. I am convinced that accomplishing this overall goal would also create a clear path of career progression in surgery, thereby regaining our attractiveness to the ‘best and the brightest’ among our young people. There is support for my contention. Dr Clark, co-editor of the BMJ is claiming [7]: ‘… more support is needed for researchers at all stages of their training and long-term support should be available so that clinical research scientists can undertake their research activity and continue to participate in routine patient care’.

According to Charlton [23], the Editor of ‘Medical Hypotheses’: ‘We urgently need a specialized system of experimental applied translational research to evaluate the underlying theories and the value of innovative methods, techniques and technologies prior to overall clinical use. Its role would be to generate and critically evaluate ambitious and potentially important theories, techniques, treatments and technologies’.

In October 2006 Elias Zerhouni, Director of the NIH, launched a national consortium in order to reform clinical and translational research [24]. He said: ‘‘that consortium will transform how clinical and translational research is conducted; ultimately enabling researchers to provide new treatments more efficiently and quickly to patients. . . . Working together, these sites will serve as discovery engines that will improve medical care . . .’’.

Finally, in closing, I wish to suggest a noble and rewarding future task for an innovative ‘‘EACTS Research Committee’’. We should design a desirable curriculum for the cardiac and thoracic surgeon, wherein research is allocated the place it deserves. We should outline and define a bridge to span the gulf between discovery and practice. In addition, we need to guide the translation process first by educating high quality surgeon scientists and also by developing appropriate registries, serious outcome reporting, and well controlled expert auditing. This would be a big step in the right direction!

I consider these steps imperative for opening what some have considered a closed shop. In my view, this is the way to get comprehensive and independent valid data about the performance of innovative procedures, techniques and technologies. Such an approach would help to enhance the reputation of both surgical research and cardiac surgery as a science, and to reduce the imminent risk of external non-professional over-regulation. Our best defence against bureaucratic efforts to control us and to restrict our resources is our leading in the development of solid scientific knowledge and the refinement of therapeutic approaches. I am absolutely convinced that potential innovators will not be intimidated by such an approach. In fact, I am sure that it would stimulate and encourage the accumulation of scientifically valid data of vital interest to academic and community surgeons.

I hope that my remarks have been provocative and constructive. If so the objective of my address will have been achieved.

I thank you for the honour of serving as your president. I will not close without expressing my deep gratitude to Professor John Benfield for his unique commitment, advice and most valuable support in editing this address. Thank you!

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