Who moved my heart? Adaptive responses to disruptive challenges

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A

remarkable little book was published in 1998 titled *Who Moved My Cheese?*¹ written by a physician named Spencer Johnson. It has been on the *New York Times* bestseller list since that time. In the foreword, Johnson notes:

The four imaginary characters

Depicted in this story—

The mice: “Sniff” and “Scurry,” and

The Littlepeople: “Hem” and “Haw”—

Are intended to represent the simple and

The complex parts of ourselves, regardless of

Our age, gender, race or nationality

Sometimes we may act like

Sniff

Who sniffs out change early, or

Scurry

Who scurries into action, or

Hem

Who denies and resists change as he fears

It will lead to something worse, or

Haw

Who learns to adapt in time when he sees

Changing leads to something *better!*

Whatever parts of us we choose to use,

We all share something in common:

A need to find our way in the maze

And succeed in changing times.*

We do have challenges, or perceived threats, as cardiothoracic surgeons in 2003 that will require change—change in attitude, behavior, priorities, training, relationships, self-image, and rewards. We must adapt to these potentially disruptive challenges in a mature, constructive manner, embracing our core values yet setting new expectations and directions. We must have some sense of shared values and unity of vision because without such a common focus, we risk confusion, the lack of supportable operational plans, and certainly retraction, if not possible disintegration, of our specialty. Probably more important than any other single factor necessary for our ultimate success is to understand not only the art but also the science of leadership. Without such an understanding of leadership, we have the same potential to fall into the similar quandary that beset many of the unfortunate

*From Johnson S. *Who Moved My Cheese?* Published with permission of the Penguin Group (USA) Inc, A Pearson Company, copyright 1998.

TABLE 1. Potential disruptive threats to cardiothoracic surgery in 2003

Clinical
Diminishing case volumes
• Disruptive technology from other specialties
• Decentralization of cardiac surgical care
• Healthier population
Waning effects of managed care
Emphasis on cost containment
Escalating malpractice costs
Erosion of reimbursements
Loss of societal respect
Sense of pessimism pervading specialty
Educational
Diminishing volumes for education
Vulnerability of academic medical centers
New work hour restrictions for our residents
Increased noneducational demands on faculty
More factual knowledge to master and disseminate
Increased pressure on faculty for quality and results
Historical pressure for the triple threat
Training is already too long and getting longer
Academic
Lack of volume for clinical research
Local administrative roadblocks to research
• IRB, informed consent, HIPAA
National governmental regulation of research
• FDA and SoCRA
Perceived diminished funding of surgical research
Loss of cardiothoracic study section at the NIH
Lack of competitive research preparation during residency
Potential loss of creativity because of older age
Overreliance on technology for advances
Pessimism of industry about cardiothoracic surgery's future as growth industry

IRB, Institutional review board; *HIPAA*, Health Insurance Portability and Accountability Act of 1996; *FDA*, Food and Drug Administration; *SoCRA*, Society of Clinical Research Associates; *NIH*, National Institutes of Health.

technology start-up companies who did not adapt to change and ultimately failed. This talk, then, is about vision, adaptation to change, and, ultimately, leadership.

Before I discuss these challenges, I should clearly mention my background. I believe it is quite important to understand any prejudices which might slant this discussion. My perspective is one of a university faculty member who is primarily a cardiac surgeon located in a state academic medical center (AMC). I must admit to but hope to justify any such biases.

I have decided to use the strengths, weaknesses, opportunities, and threats format, in a somewhat convoluted order, to lay the framework for discussion and to introduce my concerns, many of which you are already acutely aware of.

What, then, are some of the obvious disrupting threats cardiothoracic surgery faces in the new millennium, at least on the cardiac surgical side (Table 1)? I will organize my remarks by first discussing the clinical issues, followed by the educational and academic arenas.

In both in the academic and the private arenas, we have seen clinical volumes in most individual programs and in the surgical discipline overall diminish for the last few years. This is particularly true for coronary artery bypass grafting and congenital heart surgery. Reasons for this decline must include alternative technologies, a decentralization of cases, and an overall healthier population. The rapid evolution of new percutaneous technologies, such as transluminal angioplasty, intravascular stents, or, now, drug-eluting stents, has been impressive. This type of technology evolves rapidly, changes frequently, and therefore tends to emphasize short-term innovation to the point of obscuring the long-term clinical or economic outcomes. The second factor impacting volumes is the persistent and increasing trend to decentralize cardiac surgical care away from the more centrally located, usually academic, medical center. In the state of California in the year 2001 there were 118 cardiac surgical centers, each averaging under 300 cases total per year, of which 81% were coronary bypass grafts.² Similarly, in the single city of Chicago there are over 51 cardiac surgical programs, with even worse low-volume numbers.

In the state of Washington since 1989, when I took over the program at the University of Washington, 6 new cardiac surgical programs have been authorized, and 3 new ones are presently being evaluated. The state of Washington's population is under 5 million people, and there were already 12 surgical programs in the state before this most recent wave of decentralization. Only 1 of the new programs has met the minimal 250 caseload volume required by the state. Decentralization is a particular threat from my academic perspective, as will be noted later. Pressure from smaller hospitals to obtain the prestige and in-hospital revenues from cardiac surgery, as well as the continued pressure from interventional cardiology to back up angioplasty, both under the guise of lower costs due to increased competition and better local access, have clearly affected this trend. Finally, volume may be impacted by prevention strategies: there are better therapeutic and preventative medical strategies targeting hypertension, diabetes, and cholesterol; there are more readily available patient education programs targeting smoking or obesity; there is better access to care; and there is an overall healthier, exercising population.

The emphasis on primary care and the gatekeeper concept is slowly waning but still has a tremendous effect on cardiac surgical practices. As a specialty, we are having difficulty figuring out how to extricate ourselves from the wrong end of the decision-making algorithm; thus, we have little ability to influence therapeutic choices based on durable data rather than simple control. Emphasis on cost containment has gradually increased, and, with this focus, we have gradually seen a concerning trend of looking at short-term outcome variables, such as length of hospital stay, as

indices of quality. This observation may change as technologies become more expensive and hospital remuneration decreases. Little emphasis in this discussion will be placed on variables that we cannot easily control or that have been discussed previously, such as malpractice costs or reimbursement. The loss of societal respect is not insignificant and may have originated during the business emphasis that followed the introduction of coronary artery bypass grafting and the passage of Medicare reimbursement legislation. Both events led to a growing perception of our specialty more as a business commodity than a professional jewel. Finally, without optimism, direction, or vision, our daily presentation of perceived frustration further erodes our leadership image.

In the educational arena, what, then, are the immediate threats (Table 1)? Once again, the case volume issue is critical, particularly for the AMC. As we decentralize cardiac care, much of the increase in local volume is achieved by redistributing cases that were once done in the more centrally located AMC. The secondary effect is a concentration of fewer, but more complex, tertiary or quaternary surgical cases, which may not be as optimal or appropriate for educational purposes. The AMC is also vulnerable to low volume because of its basic organizational structure and priorities, which must carry the educational and academic burdens into the marketplace. We now face the 80-hour work week for residents, the impact of which is starting to seriously disrupt our cardiothoracic residencies, particularly those with active transplantation programs. This has already shifted more clinical responsibility upward to faculty. If such work hour restrictions are transferred to faculty themselves, as they already are in Europe, we face a monstrous threat to resources, manpower, remuneration, and surgical expertise. These 2 powerful disruptive concerns are occurring at a time when faculty already have more day-in and day-out administrative responsibility, more factual knowledge to master and impart, more roadblocks to research, and more pressure to deliver outstanding short-term clinical outcome variables and still must be the consummate mentor and educator. In other words, we still value the mythical triple or quadruple academic superstar, yet in the real marketplace this is an unrealistic concept. On top of everything else, the training is already perceived as too long.

In the academic arena, what are the perceived threats? Once again, the lack of volume in our AMCs limits the type and scope of clinical research that can be done. Without a robust and diversified faculty and without consistent clinical revenue, clinical research contributions from US AMCs become increasingly limited. If one looks at the advances in clinical cardiac surgery over the last few decades, most have originated in more centralized systems of care outside the United States: Tyrone David and Bill Mustard in Canada, Alain Carpentier and Francis Fontan in France, Donald Ross

TABLE 2. Potential strengths and weaknesses in cardiothoracic surgery in 2003

Strengths	
Leadership character traits	Vision, courage, perseverance, and work ethic
Strong national database	
Strong national and regional societies	
Defined national curriculum	
Ongoing noncardiac thoracic growth	
Withstood the scrutiny of national trials and regional CQI initiatives	
Durable solutions	
What we do is special	
Weaknesses	
Very short historical foundation	
Unidimensional: great doctors	
Less-skilled administrators, business acumen, investors	
Perception of misplaced priorities	
Pride, fame, and fortune	
Lack of unity of purpose	
Currently feel threatened	
Unclear how to adapt to change	

CQI, Continuous quality improvement.

and Magdi Yacoub in the British Isles, and A. D. Jatene and Ronald Batista in South America. Each made their important clinical advances in environments where the patient populations are more captive, the care provided is more central, the regulatory environments are less restrictive, and clinical research is easier. Presently, any new technology or new pharmacologic drug is first trialed outside the United States; we then become the validation and publication center. In the United States, the Cleveland and Mayo Clinics have dominated the clinical contributions by maintaining volume because of long-standing corporate strategies designed to attract national and international support rather than just regional or local support. Creating and sustaining either clinical or basic science research efforts is not simple in our current regulatory environments. What was accomplished with daring vision and perseverance during the inception of our specialty would no longer pass even the simplest of institutional review boards today. Support for large-animal descriptive physiology has been replaced by small-animal mechanistic molecular and cellular biology, so extramural financial support trends toward PhDs rather than surgical scientists. In addition, we are barely represented as a specialty on any of the National Institutes of Health (NIH) study sections in 2003.

This dangerous academic trend is compounded by the fact that we may not be appropriately training our residents to be competitive for this type of extramural support, as I will document later in this discussion. When residents do finish their training to become new faculty, they are 38 years old, have a family that has already sacrificed, and have, on average, \$150,000 in debt. The reality of family financial

survival displaces the yearning for abstract creativity. The final concern might be framed by noting that we have relied heavily in recent years on technology development for clinical advancement. This approach places heavy emphasis on partnering with industry for product development and clinical advancement. Unfortunately, industry may not look on us any longer as a growth industry, putting in jeopardy those long-term, mutually beneficial relationships we have relied on in the past.

What are the obvious impacts of these threats? There certainly appears to be concern (backed up by real data) and the danger that we are no longer attracting the best and the brightest into cardiothoracic surgery; we are definitely not appealing as a specialty to women, who now represent 50% of the graduating medical school class; we do not seem to be appealing to the generation X medical school graduates, for lifestyle reasons; and our graduating residents face an uncertain job market.

In the face of these threats, let us quickly look at our possible strengths and weaknesses more generally and then focus on opportunities more specifically (Table 2). If we think back to the not too distant past, very smart philosophers and physicians thought the human heart was an organ that would never be amenable to surgical intervention. After a short span of approximately 50 years, there are now very few congenital or acquired cardiac pathologies that cannot be improved or cured with surgical approaches. This success is based on several strengths. First is leadership character traits. Cardiothoracic surgeons have classically had vision, charisma, tenacity, perseverance, a focused work ethic, and, certainly, the courage to move ahead when the future was not visible or clear. We have a very strong national surgical clinical database for benchmarking, evidence-based research, and quality assurance. We now have over 600 participating sites in the Society of Thoracic Surgeons database, over 2,000,000 patients enrolled, and over 25 publications published—all generated by this database. Dr Fred Grover, of this organization, deserves tremendous credit for the success of this effort. Our national and regional surgical societies have been strong, flexible, and willing to adapt to changing priorities. They have led efforts at malpractice reform and improved remuneration schemes. We are one of only a few medical specialties that have a defined national educational curriculum, thanks to significant efforts by the Thoracic Surgery Directors Association (TSDA). The TSDA just recently completed an internet-based prerequisite and requisite curriculum online, which I highly recommend for residents and practicing cardiothoracic surgeons. Noncardiac thoracic surgery has experienced unprecedented growth with the introduction of video-endoscopic approaches to pulmonary and esophageal disease, lung volume reduction surgery, lung transplantation, pulmonary thromboendarterectomy, and, maybe most

importantly, the promotion of national credentialing standards for the subspecialty. We have withstood the scrutiny of prospective national clinical trials such as the Coronary Artery Surgery Study and the National Emphysema Treatment Trial and of the publication of our clinical results in such prestigious publications as the *New York Times*. Our results are durable in almost all comparisons. Most importantly, on any relative value scale, what we do every day has to be considered special, rewarding, and important.

It may be harder to admit any weaknesses. Medicine has classically been widely criticized for its inflexibility and resistance to change, particularly when compared to industry. It is very difficult to evaluate cardiothoracic surgery's adaptive potential because our existence is so short when put into a much bigger historical perspective. Fifty to 75 years of experience simply does not give much perspective, particularly because we have been minimally challenged by disruptive threats in the past during this meteoritic rise to prominence. I believe we can mention a couple of perceptions out there that might be mistaken as weaknesses: First, we are potentially 1-dimensional in that we might be superb comprehensive physicians, but we may be viewed as significantly less skilled administrators, businesspeople, or investors. Second, our priorities may be misplaced, with an overemphasis on pride, fame, and fortune, as was eloquently described by Tom Gadacz in a recent issue of the *Bulletin of the American College of Surgeons*.³ And finally, we may lack a unity of purpose in dealing with the challenges in front of us. If you have sat at the top of the heap for a long time, either in prestige or remuneration, why would you want to change? Change for change's sake is not acceptable, and change for meaningful advancement is desirable and necessary, but change simply due to threat will not be as durable as change imbedded in culture. You can decide for yourself whether you believe that those potential weaknesses are real or imagined. I suspect we might have other weaknesses, but I am not willing to admit them, particularly in front of my family and faculty.

Whenever there is apparent chaos, there is usually real opportunity.

Are we in real trouble as a specialty? Probably not. Are there constructive methods to adapt to these disruptive challenges? There are many. Will we need to change? Yes.

First we must define a strategic vision that is responsible and reasonable; then we must develop or adjust operational approaches that are effective. I am not a great mission-statement designer, but I think it might be worthwhile redefining some priorities as we prepare to look for opportunities. I would respectfully emphasize the following simple concepts:

1. Be the caring physician first and foremost, with all its responsibilities and virtues
2. Emphasize values of respect and trust

3. Understand and respect past leaders or accomplishments

But we cannot be prisoners of the past

4. Embrace the present

But we must be architects for the future

5. Adapt to meaningful change

6. Continually redefine leadership, innovation, and quality

7. Be lifelong learners

If we can accept this strategic vision or one similar but better expressed, then we must articulate and prioritize a set of realistic short-term and long-term goals and operational systems that will allow us to see such rewards. Let us delve a little deeper.

What, then, are the clinical opportunities and responsibilities (Table 3)? The first clinical opportunity and responsibility we have is to preserve the value and mission of the AMC in a highly competitive marketplace. Research, innovation, and technology development are absolutely critical to our future. The collaborative triangle among basic science, clinical practice, and industry has been a foundation of creative value for the United States for years. In addition, the connection among clinical practice, education, and academics must be preserved. The vulnerability of the AMC must be recognized, and its diminution in cardiovascular care must be avoided; therefore, its strengths must be built upon.

How can the viability of the AMC be preserved for cardiothoracic surgery? We cannot continue to choke the breath and life out of teaching institutions by persistent decentralization of cardiac services. We must be present at Certificate of Need hearings to clearly define the short-sightedness of decentralization of cardiac surgical care camouflaged under the promise of lowering costs by increased competition. No study to date has shown that decentralization of complex, technologically driven care reduces costs—or improves quality, for that matter. In fact, costs usually rise as technology is applied more liberally, particularly if the overall national economy is healthy. If the interventional cardiologists want to follow our misguided example of proliferating into smaller communities, their technology is certainly of such quality in 2003 as to not require in-house surgical backup any longer. The American College of Cardiology, with their practice guidelines, is coming close to this conclusion as well.

If we absolutely must decentralize cardiac care, we should have the vision and leadership to create networks led by the AMC, where data can be shared, case-mix challenges can be directed to sites of optimal expertise, clinical research can be embraced, and the biggest historical picture of value can be followed. Smaller hospitals must also recognize that the financial windfalls seen in the past by cardiovascular services will not persist as the technologies become

TABLE 3. Potential adaptive responses or opportunities in cardiothoracic surgery in 2003

Clinical challenges
Preserve the viability of the academic medical center
Resist decentralization
More horizontal population-based planning
Redefine expectations of our medical colleagues
Not simply backup support
New alliances with hospital administrations
Embrace advanced cardiopulmonary disease
Retrain our clinical skills
Educational priorities
Raise the bar at the RRC for quality in TS
Decrease the number of programs
Decrease the current large programs
Improve job satisfaction of the current program directors
More definitively abandon GS ABS certification
Appeal to medical students early
Re-emphasize the importance of mentorship
Keep thoracic and cardiac surgery together
Academic responsibilities
Recognize resident interest in academics
Improve the quality of clinical research
Re-emphasize basic science research commitment
Realize dangerous trends in research funding
Reinvest in surgical research
Redefine/renew/rekindle

RRC, Residency review committees; *TS*, thoracic surgery; *GS*, general surgery; *ABS*, American Board of Surgery.

more expensive and remuneration diminishes for the hospital in the future, as it has recently for physicians. This concept of tiered levels of expertise, a sort of hub-and-spoke organizational structure with the more centrally placed AMC as the hub and the related spokes of regional affiliation, might allow more responsible use of expensive technology for higher-risk interventions, easier algorithms to perform prospective clinical research, and a refocused definition of appropriate care for our elderly or those with more advanced cardiothoracic disease. Such horizontal, population-based planning requires regional collaboration and cooperation between hospitals and physicians and will not be easy, as illustrated by the attempted collaboration between the University of California-San Francisco and Stanford a few years ago or, more recently, between Mt Sinai Medical Center and New York University in New York city. Combining 2 hubs might be more difficult than creating a hub and spokes. Ultimately such collaboration between a central hub facility and the community must occur unless the economy explosively rekindles and even greater health-care resources are allocated. This certainly appears unlikely in the short run. Health-care expenditure must decrease, particularly the big-ticket items, yet quality must be maintained or improved. We know from multiple studies of quality, such as the leapfrog initiatives, that complex—not necessarily routine—procedures are done best in higher-volume cen-

ters. One could similarly argue from the biggest historical perspective that very high-cost technology is also better centralized.

We must develop new relationships with our medical colleagues. It is inevitable that treatment options for atherosclerotic coronary artery disease will continue to evolve and will continue to shift away from the surgical community unless we fundamentally change our educational algorithms. Obviously, we must continue to emphasize the durability of our solutions and the quality of scientific scrutiny our surgical specialty has endured, but the reality is that intraluminal technology continues to change, continues to mature, and appears less morbid. Cardiologists are also the cardiac surgeon's gatekeepers and are unlikely to give up that role easily. On the other hand, coronary bypass surgery is unlikely to go away in the near future.

The role of bypass surgery, however, will change. Interventionalists will not completely overcome vascular biologic adaptation to injury when the intima and media of arteries are disturbed; stents, whether drug eluting or not, may not be optimal for diffuse, smaller-vessel disease in diabetics or patients with left main coronary artery disease or, certainly, when bypass surgery is combined with other treatment modalities, such as valve replacement, transmyocardial laser revascularization, or atrial fibrillation ablation. Similarly, we as surgeons will also evolve: minimally invasive off-pump bypass surgery will continue to improve and may be more widely accepted, or the systemic effects of cardiopulmonary bypass may be ameliorated, making the surgical options less morbid, more durable, and more attractive. Certainly interventionalists will not dominate this apparent challenge on the basis of cost alone and, in fact, may actually be disadvantaged because of the substantial costs of their evolving technology. In this regard, our relationship with hospital administration will work to our benefit as administrators struggle with cost containment. It does us no good to become defensive, competitive, or angry; we must take the high road and collaborate for the betterment of the population, as hard as that might be to say or execute.

In this evolution of relationships, then, the treatment of advanced cardiac and pulmonary disease has a real opportunity to be led by the surgical community. The 5-year mortality of patients with congestive heart failure remains at 50%. The etiology of heart failure remains multifactorial, but the treatment options are also frequently multipronged and surgically driven: arterial revascularization, valve repair or replacement, transmyocardial revascularization, ventricular remodeling surgery, atrial or ventricular arrhythmia suppression, mechanical left and right assist-device support, and transplantation. Similarly in pulmonary disease, the treatment options are often surgical: lung volume reduction, pulmonary thromboendarterectomy, extracorporeal membrane oxygenation, and lung transplantation. All of these

treatment modalities are tied in to industry device development, as well as basic science understanding. We must lead these efforts clinically, educationally, and academically.

In order to accomplish this transition, we must retrain and develop new skills. We cannot depend on myocardial revascularization alone and must develop new dimensions of surgical expertise. New skills may include acquiring more experience in valve repair or replacement, off-pump bypass techniques, atrial fibrillation ablation, transmyocardial laser revascularization, or even robotics. We must look for opportunities to be trained or credentialed in interventional techniques, particularly in vascular surgery, where the gatekeeper role is less clear. In addition, though, new skills must involve clinical trial design, grant-writing training, basic science investigative interest, administrative training, or business degrees such as an MBA.

They "moved my cheese."

How about educational opportunities and responsibilities? Since Fred Crawford,^{3a} the chairman of the University of South Carolina Department of Surgery, spent the majority of his presidential address at the 2003 Annual Meeting of The American Association for Thoracic Surgery discussing the need for restructuring our educational priorities, I will not place as much emphasis in this talk on that subject, even though it is close to my heart as an educator and recent president of the TSDA. I will simply state the obvious and re-emphasize some of Fred's conclusions: for the short term, we now face an excess of incoming residents into the workforce with a contracted job market. Senior surgeons ready for retirement during the economic boom of the late 20th century are now back in the workplace and not ready to move aside. Expansion of subspecialty services, as noted by Richard Cooper, MD, that parallels the growth of the Gross National Product is not occurring.⁴

At least for the immediate future, faculty and private practitioners will not be limited to 45-hour workweeks, which would mandate immediate expansion of the workforce. Surgical volumes are diminishing. Training programs and the residency review committees responsible for thoracic training in the United States must change. We cannot simply arbitrarily decrease the number of training programs because of antitrust issues. It is clear, however, that at least for the short run, we must decrease the number of graduating residents coming into the clinical workforce and increase the number of senior faculty going out. The only easy way to decrease the number of graduating residents entering the profession is to raise the bar for quality in thoracic training. I believe that this is a priority of the current residency review committee headed by Doug Mathisen. Programs chronically on probation or with persistent director transitions should voluntarily withdraw from the business of resident education or quickly have their accreditation withdrawn. Three thoracic programs have lost

accreditation in the last 2 years. New program applications or applications for resident expansion will be critically scrutinized for quality.

We might even need to consider decreasing the size of programs with more than 2 residents per year, although size and quality must be separate as values. We also must find ways to improve program director satisfaction. Over the last 2 years, 36 of 91 program-director positions have changed leadership in the United States. Think of that impact on the continuity of resident education leadership for over one third of the programs in the United States. This must be unacceptable from a quality point of view.

Our relationships with general surgery will evolve and ultimately change. Even though the Joint Council of Thoracic Surgical Education has recommended dropping American Board of Surgery certification as a prerequisite to American Board of Thoracic Surgery certification, most cardiothoracic training programs will find it hard to embrace either an integrated 6-year program coming out of medical school or an undefined 3/3 or 4/3 relationship with general surgery. To date, applicants still must complete an accredited general surgery training program in the United States even if they elect not to sit for the general surgery board examinations. Ongoing concerns related to curriculum reform include: the anxiety of responsibility, all aspects of a thoracic surgery resident's education directly out of medical school, the fear of being treated as second-class citizens by General Surgery Program Directors, the lack of upper-level resident general surgery responsibility, and the splitting of our own specialty between thoracic and cardiac surgery. One compromise many of us hoped would occur would be that the American Board of Surgery and the General Surgery Residency Review Committee would adapt a compromise 4-year standardized curriculum (Early Specialization Program) for subspecialties that would lead to dual American Board of Surgery and American Board of Thoracic Surgery board certification. Unfortunately, this does not look like it will occur in the near future, based on recent pronouncements from both of the general surgical organizations. Ultimately, I believe that general surgery will see the benefits of such increased flexibility for their own growth and development, but those changes are not forthcoming.

If we believe as a specialty that 39 years old is too old to start a career, that 5 years of a prerequisite surgical curriculum is too long as presently configured, and that a 3-year curriculum in thoracic surgery is optimal, then we must be willing to take the responsibility for changing. We will have to appeal to medical students much earlier in the process and take more overall responsibility for surgical education all the way back to medical school. We must understand mentorship scientifically and make it a personal responsibility.

We still will be challenged to keep cardiac and thoracic surgery together.

The 80-hour workweek may appear to be a threat to service, but if we are creative and innovative, this may also be an opportunity to change constructively: to deal with the gender issues, to deal with the impeding lifestyle issues, and to redefine our rewards and priorities. We must become more flexible and more adaptive if we want to continue to attract the best and the brightest into our specialty.

Finally, what about our academic opportunities and responsibilities? The final component of this discussion on opportunities to change is the importance of getting our academic house in order. Once again I will reveal my biases about maintaining our academic centers strong.

The first area of what I would call "research preparation" overlaps both education and academics. The TSDA recently concluded a survey of 90 program directors in thoracic surgery, 265 current residents, and 117 recent graduates of cardiothoracic training programs. Fifty-five of the recent graduates were in academics, and 48 were in private practice. Our specific interest was to look at the role of research in current training algorithms (Figure 1). As might be imagined, 65% of program directors "strongly agreed" or "agreed" that prior basic science research was important as a selection criterion for their program, 78% believed that clinical research was important, 83% believed that those with prior research time were better prepared for a cardiothoracic residency, and 87% would preferentially choose the applicant with research in his or her background. Of the current resident class, 63% did research, averaging 1.9 years in duration, prior to starting their cardiothoracic residency; 68% overall desired an academic career as a long-term goal, and that number increased to 89% if the resident had any prior research training. Research preparation is part of our heritage and culture. Unfortunately, the reality, based on that same survey, is that for a graduating class that exceeds 150 residents, less than 20% of the current training programs have available academic faculty positions because of volume or financial constraints. Approximately one third of those available positions are in thoracic rather than adult or congenital heart surgery, and some are in private affiliated hospitals. The interest in adding value above and beyond predominantly clinical care is there, but the opportunity, of late, is not; we must find ways to increase that opportunity.

We must have the commitment and systems to perform well-designed evidence-based clinical research rather than simple observational case studies. To do prospective randomized trials, patients must be available, researchers must be organized, and a climate of support must be created. We recently performed our own small observational study to look at the type and origin of research published in *The Journal of Thoracic and Cardiovascular Surgery* and in *The Annals of Thoracic Surgery* in the year 2002. A total of 737

Figure 1. Role of research in current (2003) cardiothoracic training programs. Strong A, Strongly agree; No Op, no opinion; Strong D, strongly disagree.

articles were reviewed: 498 from *The Annals of Thoracic Surgery* and 239 from *The Journal of Thoracic and Cardiovascular Surgery*. We excluded all editorials, case reports, and brief communications. Each article was categorized into subspecialty sections, site of origin, and research design. The distribution of articles by area of interest certainly must represent relative percentages of the articles received. Of the articles published, adult cardiac surgery made up 40%, general thoracic surgery 25%, congenital heart surgery 13%, cardiopulmonary support 16%, transplantation 3.5%, and others, mostly "evolving technology," 2%. When further analyzed by research design, only 13% of the articles were hypothesis-driven basic science research, and 8% were clinical prospective randomized control-type studies. Over 70% of the articles were retrospective or observational studies. Only 6% of the studies were funded by national peer-reviewed organizations such as the NIH. Only 38.5% of the accepted articles originated from the United States. In addition, only 47% of the basic science (46/98) and 17% (10/59) of the prospective trials originated from American centers. If one accepts the thesis that hypothesis-driven or prospective clinical research is optimal scientifically, our research effort is clearly an area of op-

portunity to adapt and improve. Designing multicenter prospective trials through our societies, through regional networks, or by new collaborations between medical centers with concentrated volume such as those in New York must be considered more carefully.

If we look at the common acute and chronic clinical problems we face as cardiothoracic surgeons every day, many of them are very basic biological phenomena: ischemia/reperfusion injury, systemic amplification of local inflammatory events, cellular necrosis or programmed cell death (apoptosis), vasomotor disturbances, coagulation imbalances, intimal proliferation, tumor biology, and even atherosclerosis. What is intriguing is that the cellular and molecular mechanisms involved with each of these processes are very similar in a variety of cell types: endothelial cells, neutrophils, monocytes, alveolar macrophages, pneumocytes, and cardiomyocytes. Understanding the mechanisms of activation, proliferation, and destruction might lead to markedly different approaches to cardiomyocyte transplantation or xenotransplantation, tissue engineering, lung cancer, or even cardiopulmonary bypass.

Financial support for research is essential, and our young surgical scientists must be part of these investigatory efforts.

If not, we will continue to be at the end of the food chain of research as well, rather than leading and being on the cutting edge. However, they must be prepared properly and early to ensure long term success.

In 1988, Paul Ebert, in his presidential address to The American Association for Thoracic Surgery,⁵ showed that in 1987, 147 cardiac surgery projects in which the principal investigator was a cardiothoracic surgeon were funded by the NIH (Table 4). The total awards then were \$31 million. In 1987, the overall budget of the National Heart, Blood, and Lung Institute was approximately \$820 million. Therefore, cardiac surgery research received approximately 3.8% of that budget. He also stated that there were 15 grants funded by the National Cancer Institute (NCI) where a cardiothoracic surgeon was the principal investigator, at an amount of \$1.8 million. The overall budget of the NCI in 1987 was \$1.1 billion, so we received approximately 0.15% of that budget in 1987. In the year 2001, the budget of the National Heart, Blood, and Lung Institute had increased to almost \$2 billion and that of the NCI to almost \$3 billion.⁶ The NIH cannot now give the exact number of cardiac or pulmonary surgical grants. We have carefully gone through the Computer Retrieval of Information on Scientific Projects/National Institutes of Health (CRISP/NIH) database and comprehensively canvassed all 91 program directors; we determined that in the year 2001, 14 years after Dr Ebert's observations, only 35 cardiac surgery projects, for a total of \$29,423,091, and 2 pulmonary surgery projects, for a total of \$905,000, were funded. This analysis does not include cardiothoracic investigators listed as co-principal investigators, but it does include PhDs working in our divisions. The analysis also does not include support from local funding agencies, philanthropy, departmental funds, or industry, but then, neither did Dr Ebert's data from 1987.

It is also interesting to note that in the TSDA survey of recent resident graduates who entered academics, only 2 of the 55 junior faculty who responded to the survey had received any national or societal extramural support for research. As you can see, our ability to compete or interest in competing for nationally supported extramural funds for research has diminished over this very brief time period of 14 years. I believe that this is a dangerous trend. We are neglecting our academic responsibilities for all the obvious but maybe not the best reasons: increased administrative loads, the pressure to build or maintain cardiac surgical volume in an increasingly competitive marketplace, perceived difficulties in obtaining extramural funding, and inadequate preparation for grant writing and scientific design. We must change this direction. Maybe we should consider the surgical scholars training program as implemented in Canada a few years ago, where over 90% of the scholars who completed the program remain in academics.

TABLE 4. National Institutes of Health cardiothoracic funding data: 1987 versus 2001

Year	No. CT recipients	Specialty	Awards	Budget
1987	147	Cardiac	\$31,000,000	\$826,200,000
1987	15	Thoracic	\$1,814,000	\$1,107,000,000
2001	35	Cardiac	\$29,423,091	\$1,975,945,251
2001	2	Thoracic	\$905,000	\$2,780,676,337

CT, Cardiothoracic.

What does this picture equate to? Well, Richard Anderson of this society, in 1992, in an excellent presidential address titled "Change and Thoracic Surgery,"⁷ described the decade of the 1960s as the decade of innovation, the 1970s as the decade of clinical expansion, and the 1980s as the decade of increasing constraints. Dr Anderson and I recently discussed how we would describe the decade of the 1990s, and we both agreed it might be described as the decade of consolidation. I believe that the first decade of the 21st century will really be the decade of change. Our clinical worlds will be threatened and in upheaval, our educational worlds more restricted, and our academic worlds very different from the foundations we established this specialty on 50 to 75 years ago. Change cannot be an abstract concept; it is very real, and how we adapt to these disruptive challenges will define our future.

I have become fascinated with leadership over the last couple of years as I have thought about this address and our future, and I believe that leadership is a skill, not just an inherited, individual gift which surfaces in times of great upheaval or opportunity. Certainly there are those Leaders (with the big *L*) who step up individually and show remarkable courage, clarity of vision, charisma, and strength. Two of my favorite leadership examples are Joshua Chamberlain, who was at the Battle of Gettysburg during the Civil War,⁸ and Ernest Shackleton, who led the ill-fated Antarctic expedition of the ship *Endurance*.^{9,10} As depicted in Sharma's remarkable book *Killer Angels*,⁸ Chamberlain was forced to adopt a few downtrodden renegade Maine soldiers who were earmarked for the brig or firing squad; instead, he fed them, listened to them, showed respect for them, encouraged them, inspired them, led them, and successfully partnered with them to defend the vulnerable flank of Little Round Top. Most people view that particular battle as the turning point in the Civil War. Similarly, Shackleton intended to lead his team to a secure camp at the South Pole only to endure the destruction of his boat in the middle of the desolate Antarctic wilderness and bitter cold. Shackleton had the leadership to recognize that his initial goal was unrealistic and doomed to failure and would most likely lead to the deaths of his entire team. Someone had moved his cheese, and he needed to rapidly adapt. He changed directions, and over a strenuous 9-month journey, he then

led his men back to civilization with minimal loss of life or limb. Both are wonderful examples of adaptation to stress and the need to redefine resources or change directions or priorities.

Leadership with a small *l* is a skill or maybe even a science which we, as cardiothoracic surgeons facing a real disruption to our self-image, our resources, and our income, must understand and embrace. Ronald Heitfetz, in his insightful book titled *Leadership Without Easy Answers*,¹¹ made a number of statements worth pondering, but I will include only the two I think most appropriate:

Imagine the differences in behavior when people operate with the idea that "leadership means influencing the community to follow the leader's vision" versus "leadership means influencing the community to face its problems." and

For a social system to learn, old patterns of relationship—balances of power, customary operating procedures, distributions of wealth—may be threatened. Old skills may be rendered useless. Beliefs, identity, and orientating values—images of justice, community, and responsibility—may be called into question.

He also defined 5 strategic principles of leadership, which I have tried to weave through this presentation today:

1. Identify the adaptive challenges
2. Keep the level of distress within a tolerable range for doing adaptive work
3. Focus attention on ripening issues and not on stress-reducing distractions
4. Give the work back to people, but at a range they can stand
5. Protect voices of leadership without authority

The second book I found useful in consolidating my thoughts was John Kotter's book titled *Leading Change*.¹² In that book, he defines an 8-stage process of creating change, which I also believe will be useful as we mature through this next decade:

1. Establish a sense of urgency
2. Create a guiding coalition
3. Develop a vision and strategy
4. Communicate a change of vision
5. Empower broad-based action
6. Generate short-term wins

7. Consolidate gains that produce more change

8. Anchor new approaches in the culture

By understanding the process of change and the need to adapt to disruptive challenges when someone moves our cheese, cardiothoracic surgery will continue to grow and flourish. We all must understand leadership without authority and bring that to our individual environments, whether it be in private practice or academics; whether it be in education, research, administration, or clinical practice; or whether it be to our personal lives. Thank you for the opportunity to speak from my heart.

"Change is the process by which the future invades our lives."

Alvin Toffler¹³

"There can be change without progress but not progress without change."

Anonymous¹³

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