

**Design Area Four:**  
**Health Research, Health Cost Explosion and Quality of Life**

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COLE: Well, we turn now to the fourth design area, "Health Research, Health Costs, Explosion and Quality of Life." And this is a central concern to the national innovation system. While public support for biomedical research shows little sign of declining – and I think for that we do have some interesting data produced by Research America and various other polling and survey agencies – there is growing concern for health expenditures, which until very recently were exploding and which seemed to be putting great stresses on the system. And those rising costs seemed to be calling for some possibly significant design changes. For those who work in research universities, we're all familiar with the transformation and the relative costs of building up the health, science, research enterprise, relative to some of the basic sciences.

It used to be that outfitting a physics laboratory was considered highly expensive. Now we turn to the health sciences, and we see multiples of that very often. The size of the budgets at the research universities that are associated with the health sciences complexes have become enormous in relative terms. And their growth has been relatively faster than other areas of research universities.

We are fortunate to have very distinguished people with us this afternoon. The first design presenter will be Dr. Kenneth Shine, who is the president of the Institute of Medicine of the National Academy of Sciences, and professor of medicine emeritus at the University of California, Los Angeles. And he is UCLA's School of Medicine's immediate past dean and provost for the medical sciences. He is surely an expert in this area, and he is going to share his thoughts with us this afternoon. It's a pleasure.

SHINE: The fall of the Soviet Union called for a new paradigm for science policy in the United States. We still don't have that paradigm, but I believe that there is a critical need for a coherent concept, shared broadly by the scientific community in the health and non-health sciences, in order to make the argument for federal funding. The economic prosperity argument is useful but incomplete, and it will make us vulnerable when it comes time for cost accounting in particular areas. Moreover, it leads to the potential risk of deciding which areas of fundamental science are most likely to produce that economic prosperity, something we don't know how to do and which we must clearly avoid. Poverty, poor jobs, pollution, and disease are every bit as dangerous as the evil empire. Creating a healthy population and prospering in a sustainable environment is every bit as good a goal as dealing with military preparedness.

Whatever the new paradigm for science policy may be, we as a scientific group have to come to some closure as to what the message is. Economics can be a piece of it, but to stake the whole

argument on economic prosperity means that there will be many, many members of society – the environmentalists, those who don't share in the results of the stock market, and a whole variety of other people – who are not going to buy in.

The health science enterprise is, relatively speaking, very successful. At the federal level, of the \$70 or \$75 billion invested in R&D, perhaps half of that is truly basic research, and over a third of that is in health. That portion is going to grow. The pharmaceutical and medical device industries are increasing their investment. Discussions with pharmaceutical houses clearly demonstrate that well over 90 percent of their investment is in drug development, with ten percent or less is in what anyone would call basic science. Even now, they're using new nomenclature, which I've heard from Pfizer, Bristol Myers, Squibb, and others: they say "directed basic research," or "targeted basic science."

The notion that these industries are going to provide support for basic science on an industry level is naive. Moreover, in the health care industry, it has been possible to say that good basic science policy is good industrial policy. There are many reasons why the National Institutes of Health receives large increases in its budget. One is that many in Congress identify with health. In terms of public understanding of science, health and health sciences are areas in which they haven't the foggiest idea about what goes in terms of molecular biology, but they do think they know something about cancer.

I am always amused by the discussion about the disease orientation of the health sciences community in raising money. Note that 78 percent of the electrical engineers in the United States were trained under a budget designed to deal with war, which is as good a disease as any. And in fact, the conquering of that disease created a problem for the Department of Defense.

Coming back to the NIH budget, Congress has some understanding about health. There is a broad constituency in science that works hard with letter writing, testimony, meetings, and contacts. But, interestingly enough, one of the key determinants of the budgetary increases for NIH is that representatives of the bio-technology industry have gone to Congress and said, "Our development as an industry occurs in basic science laboratories, funded by the NIH. Fund the NIH." That kind coalition is critical in all areas of science, and the challenge is to develop a means to put together those kinds of coalitions in other areas.

I'm going to make a couple of general observations about health science. Then I will outline some of the major developments in the health care environment, and what I believe their implications are for universities and academic health centers.

I think the 20<sup>th</sup> century, which began with things like x-rays and Einstein, and went through the atomic bomb and space program, was a century of physics, physical sciences, and engineering. The 21<sup>st</sup> century is the century of the life sciences. Not just health, but also agriculture, fisheries, and chemistry, where the chemical industry will be producing through biological organisms many of the compounds formerly made by chemists. The work to clean up the Exxon Valdez is but one example of the usefulness of biological strategies to solve problems once left to the chemists.

That momentum, both in terms of funding and of intellectual direction, is imperative for finding ways in science to bring physicists as well as behavioral scientists together with health scientists and biological scientists to solve new problems. By physicists, I mean people who have a concept about the way physics can interface with biological systems. There is plenty that will happen in the life sciences that will do that. Moreover, the social and behavioral sciences will emerge as the health care system matures, because there will be money in it. I will return to this point later.

The message that I want to convey is that the role of the health science enterprise will increasingly become the role of the university. And the separations between faculties in physical, chemical, and behavioral sciences and those in the academic health center will have to be overcome. In some cases, these changes will come by force, by changes in the health care system.

In broad sweeping terms, the health care system is going from a cottage industry in which individual practitioners did for patients what they remembered in the last successful case they treated, with limited numbers of records and no capacity to analyze in the aggregate the impact of their work (with the exception of certain surgical procedures), to a system of organized health care delivery plans. In fact, health is becoming, and has become, an industry. The impact of this has been to create remarkable consolidation among providers, insurers, and others. In the early 1990s, I predicted that most major metropolitan areas in the United States would, by the end of the decade, have between two and six principal networks of providers for about 80 or 85 percent of the population. I had the direction right but not the number: six is too many. Even in New York, it may be closer to four.

In any case, there will be a limited number of systems of care. Those systems of care will continue to consolidate, in terms of trying to deal with excess capacity, and take advantage with regard to issues of scale and information systems. Those systems will, for the first time, offer some real opportunities to practice health scientifically, because it will be possible to collect data about what happens to both individuals and to groups of patients.

For the first time, it will be possible to think about the health of populations, and come to grips with the most difficult scientific question in health, how to adjust for risk. In an environment in which you want to pay for health, and you'd like to pay for as many people as possible, how do you figure out ways to pay the right amount for people who are at very low risk for illness, versus those at very high risk for illness?

These systems also will provide opportunities to do serious research on the outcomes of care and to develop improved quality of care. Our own research suggests that quality of care is not improved by individual providers, it's improved by enhancing systems of care. That requires organization.

That sounds good, but there are a few problems with this scenario. First, the driving force in all of this activity is cost. None of these organizations wants to pay any more than it has to, particularly those that are providing a return on investment to shareholders. The biggest single challenge in this system is how to prevent these organizations from doing too little, too late, by

not making information available and not providing the kind of services that ought to be provided.

I predict that states will pass extensive health care regulations, and that the federal government will have to get involved in order to rationalize the different regulations begin imposed by the states. In an environment in which cost is the driving factor, there is very little opportunity to support research and education. That is where the biggest challenges exist for our research enterprise.

There are other challenges as well. For example, consolidation in both medical schools and hospitals. Administrators, understandably, want to achieve economies of scale. There may also be changes in what the federal government will fund. Where once it funded a particular unit, one per institution, what happens to the two federally funded activities when two units are merged?

There is a whole series of questions that arise, but none is more important than the culture of the institutions. Moreover, for many of these institutions, there is a fundamental need to identify their true core competencies. Many of these institutions are spinning off, consolidating, and changing the health care delivery side of the operation. Don't think they aren't going to change the science side, as well. In some cases, it will involve consolidations of basic science departments with basic science departments in the general campus.

Consolidation models are beginning to percolate around the health care system. That's what I was referring to when I said there was going to be juxtaposition of science and the health sciences on the university campus to a far greater extent than anyone would have imagined a few years ago. As funding sources shrink and reorganizations take place, those kinds of reassessments will occur.

Health care dollars have contributed between \$800 million and \$2.5 billion a year to research in the United States. This funding supports between 15 and 30 percent of biomedical research. It supports clinical studies and basic science.

What are the policy implications? I strongly support instituting an assessment on health care premiums to support research – something on the order of one to 1.5 percent, and an all-payers plan in support of research and education. I also want to emphasize my belief, which is not shared by all scientists by any means, that those funds ought to go to clinical research. That is, research involving disease states.

My reasons are as follows: First, I think insurers, patients, and health care providers understand that putting money from the health care dollar into experimentation and trials can improve care directly. Second, public policy in this country has been such that Congress has supported the basic science budget of the National Institutes of Health. If a stream of money from the health care system is used to support basic science, I believe Congress will stop providing direct appropriations and turn to the health care system for the money. Third, what I hear from the managed care organizations, both for-profit and not-for-profit is, "Why should we support research? We pay our taxes, and the taxes go to the National Institutes of Health." My answer is, "You're absolutely right. Your taxes to go the National Institutes of Health for fundamental

laboratory research. But we're talking about clinical research, which you need to improve the quality of services in your organizations. And finally, if you're all paying one percent, nobody gets a price advantage.” Under those circumstances, I believe one can encourage such a policy.

Let me then conclude by indicating some of the likely changes affecting academic health centers and the research enterprise. First, there will be an increasing emphasis on core competencies in research. I predict that in the next eight to ten years, the number of truly comprehensive academic health centers doing research in all areas will shrink dramatically. Increasingly, they will have to decide what areas they want to be preeminent in, what are the critical masses required, and how to make investments in them.

Second, there will be increasing differentiation of faculty in these institutions. Some of them may even spin off research institutes with faculty who get full compensation from funding agencies for their salaries and cannot expect to get clinical dollars for this purpose. At the same time, there will be other individuals in the health care delivery business who will be primarily involved in the care of patients.

A relatively small number of individuals will be needed as bridges, clinical investigators who will have to submit protocols for research. These proposals can be within the National Institutes of Health, but if the investigators are using money from the health care system, the proposals should be peer-reviewed by the institutions themselves. Today, if you have human subjects approval, you can do research in most institutions. That cannot continue. Institutions must look at the quality of the research being conducted with health care dollars, decide what is the most important research, peer review it, and make sure the resources are used in a significant and important way.

Outcomes and research and technology assessment will be key in this cost-oriented environment. Here academic centers have a great deal to contribute. However, in the area of drug trials, for example, there is a budding industry in the private sector to evaluate drugs. For those pharmaceutically-oriented activities to continue in academic health centers, the centers will have to develop a methodology as competitive as the private sector's. Some are trying to do that. Others will decide that is not central to their scientific mission.

The ultimate effect of such change will be to take the health care delivery portion of the enterprise farther from the university, and the research and academic health center portion closer to the university, with the exception that health services research, outcomes research, and technology assessment must be a part of both.

In sum, we need a coherent message. I believe that the message must relate to a public understanding of what we do in terms of its outcome and not necessarily a public understanding of the details by which we do it. We need a funding stream that will allow expansion of the life sciences.

I believe this is feasible. It will take a number of years, but it is possible. Making the case for the need can produce support. We must maintain the alliance with industry. In the health area,

this alliance is clear. In other areas, it needs to be developed and nurtured. In areas outside of health, such alliances have been developed already.

We must make sure that the effects of consolidation of the health care system on research are very carefully monitored. This needs to be studied, and we need to develop policies to respond to what are almost certainly going to be negative impacts. That doesn't mean there won't be positive impacts, but undoubtedly there are clearly going to be negative impacts as well. We need to monitor the changes closely.

Academic health centers must be more responsive to those who use them. This relates to how technology and care are evaluated, as well as the kind of clinical research they do. If we do that appropriately, and if we deal in a realistic way with these changes, I think the health care enterprise can emerge stronger than ever.

COLE: Our second presenter will be Nathan Rosenberg, well known to many of you, who is the Fairleigh S. Dickinson Professor of Public Policy in the Department of Economics at Stanford University. Professor Rosenberg has served as chairman of the Stanford Economics Department, one of the great departments in the country. He's a member of the board of directors of the National Bureau of Economic Research. He's been chairman of the advisory board of the UN Institute for New Technology and a fellow of the Canadian Institute for Advanced Research. Nate's primary research activities have been in the economics of technological change, and his publications have addressed both the questions of the determinants and the consequences of technological change. It's a great pleasure to have him back at Columbia. We welcome you, Nate, and are looking forward to your remarks.

ROSENBERG: I start out with the intention of playing the Devil's advocate. I collected a series of propositions that the Devil might state on the topics of health research, health cost explosion, and quality of life. It has been a rather disconcerting experience: I found out that I personally believe, or at the very least half believe, most of the Devil's observations.

“We have the idea of a health cost explosion totally out of perspective,” says the Devil. The rising cost of medical care is a phenomenon that the United States has been sharing with most other affluent nations. In fact, if we go back a few decades to 1960, it turns out that our medical care costs have not been rising much more quickly than that of other OECD countries. Then why all this breast-beating over a health cost explosion?

Indeed, if we look at the annual rate of increase in real per capita health spending for OECD countries between 1960 and 1990, the Devil has a point. The U.S. is by no means at the top of the list. Our rate of growth at 4.8 percent was not very much higher than that of Germany with 4.4 percent. It was well under that of France and Italy with 5.5 and 6.1 percent, respectively, and far below that of Japan, which headed the list at 8.2 percent. And although there may be many features of the Canadian health system that are admirable, cost containment is not one of them. Although their health spending did not grow as rapidly as America's 4.8 percent, it was, in fact, as close to the American figure as you can get; it was 4.7 percent.

These figures, extending over a period of three decades, strongly suggest that there are some widely pervasive common forces at work driving up expenditures on medical care.

Technological change in medicine, the product of our huge past expenditures on health research, is one such common force. I will focus on that connection.

What really distinguishes U.S. health care spending among OECD countries is not its rate of growth, but its level, roughly 14 percent, substantially higher than other OECD countries.

Here the Devil – if he's a Devil, and if the Devil is a he – has an incisive and powerful riposte. Why should that be a cause of national concern? What is wrong with the richer country choosing to spend a larger share of its income on medical care? Our population is aging, largely as a product of some of the spectacular successes of earlier generations of health researchers. In view of these demographic changes, what could be more appropriate than committing more of our affluence to healing the sick and alleviating various discomforts and disabilities of the aged? Indeed, the Devil here can cite very powerful econometric scripture for his purpose. A number of careful econometric studies have shown that there is a high income elasticity of demand for medical care.

The truly disturbing thing is not how much we spend, it's that the U.S., with its huge spending on medical care, does not rank very high internationally on the basic measures of health care status: life expectancy, infant mortality, et cetera.

We seem to be in the position of spending more and benefiting less; we are getting very little bang for the marginal medical buck. Experimental studies by the Rand Corporation have confirmed this at the family level. The Rand Health Insurance Experiment studied two groups of families, one with full medical coverage and the other with a large deductible. The families with full insurance coverage spent 40 percent more on health care than did the families with a large deductible. However, the researchers were unable to detect any measurable health benefits associated with the 40 percent of additional spending for the families with full insurance.<sup>1</sup>

Now here again, the devil has a powerful response. That is, there are obviously many determinants of health that have little or nothing to do with medical care. While everyone or almost everyone besides the devil is opposed to purely wasteful expenditure, it is naïve, says the devil, to expect a close association between spending on health and health status. Consider the startling mortality differentials, he points out, between two contiguous states in the United States, Nevada and Utah.

The states are quite similar in many respects: access to medical care, climate, and schooling. Nevada's income is actually slightly higher than Utah's. Yet infant mortality in Nevada is 40 percent higher than in Utah, and comparable differences in premature mortality exist for both males and females and higher age levels. Victor Fuchs pointed out that it is difficult not to attribute much of the difference to the fact that the population of Utah is 70 percent Mormon.

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<sup>1</sup> Funded by the Department of Health, Education, and Welfare, the RAND Health Insurance Experiment was a 15-year, multimillion-dollar effort that to this day remains the largest health policy study in U.S. history. The study's conclusions encouraged the restructuring of private insurance. For more information, please visit RAND's Health Insurance Experiment at [www.rand.org/organization/health/researchnav.html](http://www.rand.org/organization/health/researchnav.html).

Mormons abstain from tobacco and alcohol, and have a much higher level of marital stability. It is not surprising to find that Nevada has the highest incidence of smoking related deaths among U.S. states and Utah the lowest. I've done a little further research of my own on this intriguing topic. I discovered that Utah has the highest birth rate of any American state but is the lowest in terms of unwed teenage mothers. Somewhat outside of the immediate range of our present interests, it also turns out that Nevada has the second highest student loan default rate in the United States, while Utah is very, very close to the bottom. Nevada also has one of the highest incarceration rates in the United States, whereas Utah has one of the lowest. I could continue.

I'm not quite sure what the devil would have to say about this Nevada/Utah comparison, but it seems obvious that conducting one's life so that it is constant with certain behaviors may make a great difference to health status.

Finally, there can be little doubt that a great deal of the justifiable American concern over health care is that its high cost makes proper medical care much less accessible to the poor. Even the devil has to concede that. More equitable access to medical care is both highly desirable and, I believe, politically inevitable. But even here our devil has one final parting iconoclastic shot: one should not expect universal access to health care system, whatever exact form it may take, to make very much difference in terms of measures of health status. The devil cites the powerful counter-example of the British National Health Service introduced in 1948.

The main rationale for its introduction was to remove the financial barriers to access to medical care in the belief that this would drastically narrow the huge inter-class health differentials that existed in Britain at the time. Although the NHS did indeed provide universal access to medical services and although mortality rates in all social classes subsequently declined, the gradients in mortality across social classes did not narrow. They are as wide now as they were in 1948, suggesting at least the persistence of strong socioeconomic and behavioral differences as dominating determinants of health status.

So the devil walks away with his tail between his legs, but he's heard to mutter something about the inevitability of unfulfilled expectations over any future reforms that provide universal access in the confident expectation that such access will eliminate inter-class health differentials. Well, so much for the devil.

I will now narrow my focus to the connection between medical innovation and the cost of medical care. We do not need the devil to inform us of the mixed nature of our blessings. That, for example, the genuine wonders of modern medical technologies come with higher price tags attached to them. Although it is not impossible to find new medical technologies that are cost-reducing, there can be little question that the vast majority are used in such a way as to increase costs. One of the most careful students of the subject, Joseph Newhouse, estimates that more than 50 percent of the growth in medical care costs has been due to technological change.

The rising costs are fairly obvious in the case of medical imaging technology such as magnetic resonance imaging (MRI). An MRI machine costs about \$2 million to purchase, another half million dollars to install, and another million dollars or so per year to operate. Surgical procedures such as coronary artery bypass surgery are now performed hundreds of thousands of

times in this country each year. But the rising costs also come in more subtle forms such as antibiotics, certainly one of the great glories of 20<sup>th</sup> century medical research. Antibiotics may be thought of as wonder drugs that provide low cost cures for infectious diseases, but they also keep elderly people alive long enough for them to require lengthy periods of costly treatment for some chronic or incurable conditions.

Sixty years ago, they would have died quickly and cheaply of pneumonia, which was once known as the old man's friend. So death, to put it brutally, makes little demand on medical budgets. The availability of AZT and other drug treatments for HIV means that the lives of HIV victims are prolonged. But from a purely budgetary point of view, it also means that they now become candidates for extremely costly treatment regimens. In short, when the medical profession acquires the competence to do things it could not do before, medical costs are likely to go up and not down.

Now, the way this occurs is sometimes rather subtle, and therefore worth looking at a bit carefully. Think of laparoscopic cholecystectomy, one of the most widely practiced forms of laparoscopic surgery in America. The percent of gall bladders removed by laparoscope in 1987 was zero. By 1992, it had risen to 83 percent of the total and currently it's over 90 percent. This procedure is widely acknowledged to offer many advantages including cost reduction. It involves only small incisions rather than opening up the abdominal cavity, it causes less discomfort, more rapid recovery and consequently, much shortened hospital stays and a more rapid return to work for the patient.

According to an article in the Journal of the American Medical Association that reported on the experience of a very large HMO in the Philadelphia area over a five-year period, 83 percent of its patients with diseased gall bladders were opting for the laparoscopic procedure by 1992 (Legorreta et al. 1993). According to the HMO, the cost of each operation had decreased by about 25 percent over the period under review. Nevertheless, the HMO's total expenditures for gall bladder surgery rose by 18 percent. The reason was simple: associated with the 25 percent reduction in cost per patient was an increase in the number of gall bladder removals of no less than 60 percent. How do you account for this? Apparently, the less invasive procedure has made it possible for doctors to remove the diseased gall bladders of patients who, due to the frailties of age or the existence of comorbidities, had previously been regarded as too high a risk for the traditional operation. Moreover, the laparoscopic procedure led to an increase in cholecystectomies in younger patients who are only mildly symptomatic. Since the new procedure was not nearly as big a deal as the old one, the doctor or patient or both interpreted the risk/benefit ratio in terms that were more favorable towards surgery.

Indeed, it appears as if some of the increase may have been prophylactic in nature; that is to say, gall bladders were removed from some patients who were totally asymptomatic. In these patients, it was accidentally discovered while exploring for another problem that the gall bladder problem existed.

In economic language, this experience suggests a greater elasticity of demand for medical services than is commonly believed. But this is because the nature of the service being delivered has undergone substantial change. In the case of gall bladder surgery, a downward shift in the

supply curve and associated lower cost brought with it an outward shift in the demand curve for the removal of diseased gall bladders. The critical point is that the large increase in demand was a reflection of a significant qualitative improvement in the surgical service that could now be supplied. So that cost savings on a per patient basis – and there are cost savings on a per patient basis – have been more than offset by the increase in the use of the new medical technology.

This experience is far from unique. Indeed, I suggest that it may provide a prolegomenon to the future economics of medical care in affluent societies, reinforced by the aging of their populations. Expectations of new technologies offering the prospect of expenditure reduction are likely to continue to be disappointed for the excellent reason that the quality of medical care is also likely to continue to improve.

Very similar stories could be told in the category of coronary medical care. Angioplasty was once hailed as a cheaper alternative to coronary bypass surgery. In fact, what seems to have happened is that subsequent improvements in bypass surgery led to an extension of the procedure to both angina pectoris and congestive heart failure. Moreover, many patients were also given both procedures since the rate of failure of angioplasties due to rapid restenosis has been very high so that the total expenditures for both procedures rose very rapidly throughout the 1980s.

By the late 1980s, both angioplasty and bypasses were being performed in significant numbers in the over-80 years of age population. Again, this was partly due to significant improvements in the new technologies. Nevertheless, difficult ethical as well as economic concerns have emerged. It is estimated that 20 percent of this age group suffers from some form of coronary heart disease, but when subjected to either of the two procedures, death rates are several times higher than when those procedures are performed on people in the 65-69 years age bracket.

At the other extreme of the age spectrum, neo-natologists have made quite remarkable progress in saving the lives of extremely premature babies, even those weighing 2 pounds or less. The availability of lung surfactants now offers protection for immature lungs, which had been a leading killer of premature infants. But the evidence is now compelling that such infants will go on to suffer a much higher incidence of mental retardation, chronic lung disease, cerebral palsy, and severe visual disabilities than less premature infants.

Recent research suggests that two-thirds of such infants will never emerge from an extreme state of dependency and will require life-long treatment at enormous financial cost. Putting aside all financial considerations for the moment, a medical technology that is improving but still highly imperfect poses profoundly disturbing ethical questions of the kind I think we have to worry about. Is the most aggressive therapy, even therapy that borders on the experimental, always justified? When formulating a course of therapy in which the prospects are so uncertain, how is it to be decided when aggressive therapy is justified? What are the appropriate criteria? And not least, who is to decide?

I have deliberately cited situations from the extremes, extreme old age and extreme prematurity, in order to underline a general point: improvements in medical technology, however welcome, inevitably bring with them difficult ethical questions, questions that previously did not have to be confronted and from which there is now no escape. Once you know how to do something,

should you do it? The questions are difficult not only because they require that momentous decisions be made in situations characterized by poor information and a high degree of uncertainty, but also because the downside risks are so devastating when unfavorable outcomes occur.

However ironic it may be, the conclusion to which I am drawn is this: a major reason, perhaps *the* major reason, for the so-called explosion of health care costs is a steady upward drift in the technological capabilities of the medical profession, combined with strong economic incentives, at least until very recently, to utilize these capabilities in a highly aggressive way. It remains to be seen whether the growth of managed care will change these incentives very much.

In the meantime, is it plausible to try to control this explosion by setting new priorities for the National Institutes of Health peer review process? One suggestion that has received some attention is that technology assessment might be systematically introduced in the early stages of the development of new medical technologies so that judgments of the probable cost implications of the emerging technology can be formed at an early stage. While this suggestion has some merit in principle, I think it founders on a single observation, which is that the history of medical technology ought to make us very skeptical of our ability to anticipate the eventual uses and eventual impact of new medical technologies. The uncertainties that dominate this realm are so great not only at the level of fundamental research, but even at the clinical level, that such an assessment approach will be quite simply unworkable.

Nevertheless, I do believe some form of technology assessment is inevitable and that if a high priority is attached to cost containment, it may be of use in determining what fields or what disease categories warrant a high research priority. Consider the fact that in 1993, the cost of caring for Alzheimer's patients was estimated to be \$90 billion a year, consisting mostly of nursing home costs. Should not the possibility of reducing such a huge financial burden through geriatric research raise the priority of Alzheimer's disease within the nation's medical research budget? Because in fact, geriatric research remains a small research specialty and the National Institutes of Health currently spends about ten times as much on AIDS research than on Alzheimer's disease. I've become more convinced with each passing year that our criteria for allocating resources to health research devotes insufficient attention to the problems of the elderly.

COLE: Thank you, Nate. Our first panelist is Annetine Gelijns, a doctor who is the director of the International Center on Health Outcomes and Innovation Research and an associate professor in the Department of Surgery of the College of Physicians and Surgeons and at Columbia's School of Public Health. Her current research focuses on the factors driving the rate and direction of innovative activity in medicine, technological change and its relation to health care costs as well as measuring the outcomes of clinical interventions. It's a pleasure to have her with us today.

GELIJNS: I would like to begin by complimenting the speakers on their very thought-provoking papers and in turn compliment their remarks by adding some thoughts on the future of biomedical research policy. The current restructuring of the health care system, with its shift towards managed care and its new emphasis on cost reduction, is dramatically changing the

incentives for medical innovation. Moreover, these changes, as well as broader societal concerns such as the federal budget deficit, are adding new pressures on the biomedical research enterprise, which makes today's session very timely indeed. In my response, I will focus on three major players in the biomedical research community – the NIH, industrial firms, and universities – and will raise some further questions about research funding and the need to set research priorities.

First, the NIH. Following four decades of unprecedented growth, during which the budget increased 40-fold in real terms, the NIH may now be moving into an era of steady-state funding. Even the more optimistic forecasts would not predict a return to the rate of growth in the 1960s and 1970s, and the prediction of many is that the budget will remain constant in real terms. Thus, the NIH must address the question of how best to support research at a time when resources are increasingly tight.

I agree with Dr. Rosenberg that the centrality of uncertainty makes it very difficult to anticipate the health benefits and the costs of individual research projects. Who for example would have anticipated that aspirin now takes a central place in the management of cardiac disease or that the laparoscopes that were first introduced as diagnostic tools would later become the central components of minimally invasive surgery?

Despite these uncertainties, however, a cost-conscious health care system does raise some difficult and I think very contentious issues about the need to set priorities among broad categories of research. And I believe that Dr. Rosenberg touched on some very important issues here that we might want to return to in the discussion.

Of course, pressures on the federal research budget not only raise questions about setting priorities within that budget, but they also raise questions about what the appropriate role should be of the private sector versus the public sector. Since the pharmaceutical and medical device industries now invest far more in R&D than the NIH, about \$15 billion, the patterns of R&D activity in the private sector are of fundamental importance to the nation's medical research effort. Public policies, such as those concerned with patents or FDA regulation as well as the health care financing system in general, obviously have a very great influence on the incentives of the private sector to invest in R&D. And indeed, if we look at the current restructuring of the health care system, we can already see an important redirection of industrial R&D activities.

Some of these changes I think are highly beneficial. Let me just mention two. First, the direction of research has shifted towards more emphasis on cost-reducing technologies. For example, less costly alternatives to widely practiced clinical procedures such as radical prostatectomies are becoming preferred R&D targets. Second, cost pressures are encouraging efforts to increase the efficiency of the R&D process itself. A case in point is the introduction of so-called combinational chemistry techniques that allow for the rapid, automated synthesis of thousands of experimental substances for drug screening. Similarly, the development of new statistical methods – for example, those that allow large-scale, low-cost clinical trials to be conducted – are likely to improve the efficiency of the clinical evaluative process.

Not all of the effects of the current health care restructuring, however, are desirable. For example, small firms in the medical device and biotech industries are confronting greater financial and regulatory uncertainties and might be driven out of the industry. This may be of particular concern because these small firms traditionally seem to generate a disproportionately large share of major breakthrough innovations. But perhaps more critical in the long run are the pressures within health care and within managed health care for the greater standardization of medical practice and the exclusion of experimental technologies.

Historically, much innovation has taken place within or in close symbiosis with actual medical practice, often in academic medical centers. This important source of medical progress is in jeopardy, and I think we need to discuss creative policies to preserve it. Academic medical centers, as you all know, have traditionally garnered the majority of NIH research funds, and they are well recognized for their major achievements in basic biomedical research. At the same time, these centers are involved in a wide variety of other research activities. They develop new procedures and new products. They also have been the sites for pre-marketing and other clinical testing. And finally, they actively reshape and refine emerging technologies. In fact, it is probably their unique position at the boundary between the laboratory and the clinical setting that makes them so well situated for these kinds of research.

I think that it has sometimes not been sufficiently well recognized in policy circles that to achieve medical progress, we need to support both clinical as well as basic research. Obviously, basic biomedical research is the source of new clinical interventions. However, introducing them into clinical practice and studying them at the bedside often leads to unexpected discoveries that generally pose new questions for basic research. For example, the unexpected discovery of new indications of use after a drug has been introduced into clinical practice is a very widespread phenomenon.

This means that realizing the payoffs to basic research involves acknowledging and resolving uncertainties that may first emerge in the clinical context. In this sense, the payoff to basic research is not independent of our commitment to clinical research.

Now, as Dr. Shine indicated, much clinical research – and I'm here including outcomes research and technology assessment – has traditionally been heavily dependent on cross subsidies from patient care revenues. But with the major current changes in the health care system, the margins for such cross subsidization are diminishing. Now, how will we support this critical part of the research enterprise? Dr. Shine suggests that all payers, including managed care organizations, be taxed one to two percent of health care premiums to support clinical research and education. I believe that some such proposal is an important step in the right direction.

These payers, with their large populations and vast databases, are in an excellent position to participate in evaluative research. Moreover, they should have a strong interest in the results of clinical research because it facilitates the timely adoption and cost-effective use of medical technology. I believe that this ultimately, although it's not the case right now, will be an important competitive advantage in their industry. But because clinical research is to a certain extent a public good, payers now tend to underinvest in it. Dr. Shine's proposal circumvents this problem by taxing all payers.

However, I believe that there are some very major issues of infrastructure – such as who shapes the research agenda, who conducts the research, who sets standards – if we're going to set any standards for evaluative research that require further discussion in this room and outside of this room. The most important question of these probably is who will shape the research agenda. In other countries that have created a fund for evaluative research, its management includes government, payers, and industry. This is because all these three actors have very different perspectives and would select different technologies to study based on their own interests.

As Alan Garber recently observed, government agencies, for example, might sponsor a study of the use of aspirin in the prevention of heart attacks. But industrial firms probably would not because aspirin is a generic product and the results of the research would not accrue to these firms. Similarly, payers might not sponsor such a study because their expenditures for aspirin are insignificant – except of course if they expected that aspirin would significantly change their expenditures for heart disease.

In closing, let me emphasize that the achievements of biomedical research throughout the course of the 20th Century have been truly spectacular. Nevertheless, one consequence of the expansion in medical capability has been to drive up health care expenditures. Rational decisions regarding health care resources will increasingly need to depend on research that determines what works and what doesn't work and at what cost. One of the major challenges in the coming years, therefore, will be to design a system that adequately supports clinical research. However, investing in such research will not eliminate the need to make choices at an exceedingly painful level, as Nate Rosenberg just discussed. That is part of the price that is exacted by scientific and technological progress. Thank you.

COLE: Thank you. We're rounding into the home stretch, and we've got a person who is a very good stretch runner to finish for us. Dr. Herbert Pardes is vice president for health sciences and dean of the faculty of medicine here at Columbia, as well as chairman of the Department of Psychiatry. He's was director of the National Institute of Mental Health, and he was president of the American Psychiatric Association. He's the current chair of the AAMC, and he's a member of the Institute of Medicine. More importantly, for me, he's been a fantastic colleague here at Columbia. He has produced a renaissance within our school of medicine. He's a prototype of a person who does understand the links between disciplines, between arts and the sciences, between the professional schools and medicine, and acts upon that. He is probably the most effective lobbyist I know of in Washington for health care and for biomedical research. A great, great privilege for me to introduce Herb Pardes.

PARDES: Thank you very much, Dr. Cole, and thank you for the privilege of being on a panel as distinguished as this with Doctors Shine and Rosenberg and Gelijns. I must say that when I saw I was the last speaker today, a twinge of anxiety hit me. I recall the episode in which a speaker walked in to give a presentation and found one person in the audience, and debated internally for some time as to whether to proceed with the talk, and finally felt that he owed an obligation to that person. So he gave the hour and a half talk, and at the conclusion, went down into the audience, approached the man, thanked him profusely and said, as an expression of appreciation,

he would like to take him out for a drink and for dinner. And the man responded, sit down, I'm the second speaker. (laughter)

I don't think that it will take long for the audience to detect slight differences in perspectives, and maybe that will create a kind of nice, warm, and lively discussion period. I will start by saying that this topic is introduced in the program with the notion that while health research still enjoys vast public support, high costs, weakened institutional capacity, and increased focus on effectiveness of clinical interventions may mandate a reconsideration of the system. And a question too is raised in the program as to whether research necessarily improves the quality of life.

I associate myself with Dr. Shine's comments, that it sounds remarkable to suggest we change dramatically something that has been one of the nation's outstanding successes, the NIH and the associated academic medical centers and research institutes around the country and the world. All we do should be under constant scrutiny and subject to reconsideration, I agree, but the issues are complex, and they involve the whole of academic medicine.

And I would therefore like to put forth some propositions and then elaborate on those propositions. First of all, high-quality health research is productive and a valued social good. Second, medical research has reduced costs in the past and may be one of our best options for containing ominous cost increases associated with an aging population and the diseases that afflict that population. I agree with Dr. Rosenberg that there are many instances in which technology fuels higher costs, but I would suggest that there are other instances that go the opposite direction.

Third, medical research is a primary contributor to the quality of life. Fourth, the research setting undergoing maximum stress is the academic medical center, where much of the basic research and research on causes and mechanisms of disease are conducted. And fifth, these same academic medical centers make other major contributions to the social good, including the training of outstanding doctors, the setting and sustaining of a level of quality of care, and the rendering of more than half of the nation's care for indigent populations.

Sixth, these centers are experiencing declining revenues, due to managed care, state and local government financial cutbacks, and the general contraction of revenues available throughout the nation for discretionary programs. These declines threaten the existence of some of these centers as well as their collective ability to sustain these public goods.

And seventh, explicit actions can and should be taken and are being considered to prevent the unraveling of the collective group of academic medical centers. Were that unraveling to occur, it would have in my opinion a devastating impact on the nation's medical research, quality of life, and economic benefits secondary to academic medical centers. Let me elaborate.

Medical research has vastly changed the nature of human existence. Infectious diseases such as polio, diphtheria, pneumonia, which once caused havoc, have been brought under control. New technologies for the treatment of heart disease have afforded countless people additional years of useful and productive life. Neonatal techniques have saved hundreds of thousands and possibly

millions of babies who were born prematurely and at low birth weight. Diseases for which there was little treatment and little hope such as cancer, serious psychiatric disease, and others, are being met with increasing success by a variety of therapies. While non-medical factors contributed heavily to the improvement in life expectancy, medical research has played an important role in changing life expectancy for the average individual from some 50 years at the beginning of the century to something in the neighborhood of 75 to 80 years toward the end.

The American people viewing these results tell us how high a priority they assign to finding relief from diseases that affect them and their families and to attempts to find answers and treatments. If you ask the American people in what areas of research would they want an increase in support, they overwhelmingly select medical research. In one illustrative survey, 66% chose medical research, 18% environmental research, and the remaining 16% were scattered amongst a variety of other areas of work. Some 50% would even endorse higher taxes to pay for medical research. I submit that the notion that medical research is a productive and valued social good is a proposition that is rather widely supported.

There are many examples of reduced costs due to medical research. Senator Harkin, with a flourish, showed an iron lung machine at a recent hearing, pointing out that expenditures for that industry had been eliminated with the introduction of the polio vaccine. Fluoridation has had a massive effect on expenditures related to dental care. Lithium saved more money than all the money ever invested in the research budget of the National Institute of Mental Health.

Some, as Dr. Rosenberg indicated, claim that new technology in medicine costs more because more people use it. The problem is that all costs are not necessarily measured in the same context. Thus, new methods of ambulatory surgery, laser treatments, and other more effective treatments may cost more because more people use those treatments, but the result and impact in reduced hospitalizations and reduced numbers of second procedures is substantial and may offset the increased costs secondary to more widespread use.

The use of lithium kept millions of people out of state hospitals. The recent introduction of Clozapine saves tens of thousands of dollars for every individual with schizophrenia placed on this medication rather than requiring multiple hospitalizations, which vastly increase costs. Furthermore, as we face the explosion in medical costs related to the aging of the population—and here I think Dr. Rosenberg and I come together – research offers answers.

The Census Bureau estimates that Americans over 65 will expand from 31.2 million in 1990 to 37 million by the year 2005. That means larger numbers of people with Parkinson's disease, Alzheimer's disease, arterial cirrhosis, et cetera. Any advance in our ability to delay or perhaps even eliminate Alzheimer's disease could save billions of dollars, as Dr. Rosenberg pointed out, in the economy, secondary to reduced use of nursing homes and other institutional settings. Such a possibility is increasingly likely because the remarkable advances in brain research work on memory and work on the contributing factors and treatments for Alzheimer's disease. In fact, it was just a few weeks ago at the Columbia University that studies showed that estrogen treatment may delay or prevent the onset of Alzheimer's disease.

Medical research has developed so many interventions that it would seem hard to imagine there would be many questions about its importance for the quality of life. Just think of some: sedatives, pain killers, anxiety reducers, antidepressants, vaccines, antihistamines, and countless others. Patients with AIDS are coming to hospitals less in this city and living longer because of recent development in AIDS treatments. One can decide whether that's good or bad, I guess my bias is, it's good. Further, the quality of life has also vastly improved due to hearing aids, cataract surgery, other techniques for improving vision, the general ability to transplant hips, hearts, livers, kidneys, lungs, and increasing number of other body parts.

The goal for medicine, I think, has been articulated by Robert N. Butler, as living one's full life whether that be 85, 90 years or whatever number of years with little in the way of dysfunction followed by as rapid and as comfortable a passing as possible. I am sure we can all think of an endless number of people who have survived an enormous array of diseases and gone on to have many more productive years and others who while having the illness have received tremendous relief from the symptoms.

It's hard for the population, however, in general, to understand what an academic health center or an academic medical center is. The nation's 125 such centers are confusing entities to the general public. People understand doctors, hospitals, they know that medical schools educate physicians. They know that research is done not only in pharmaceutical company labs, biomedical companies, intramural NIH, but also at medical centers around the country. But not well articulated nor understood by the general population is the unique fabric understood as the academic medical center.

In such a setting, students, residents, fellows, and others, learn; patients are treated; and research on disease and the basic sciences of biology and behavior as they pertain to the normal and abnormal function of human beings is conducted. What is poorly understood is the extraordinary value secured by co-mingling these functions. By training a student in a setting where clinical care is rendered, a student receives concrete hands-on examples of theories expounded in formal didactic settings. Medicine comes alive. Concurrently, studies show clinicians are more excited and pleased to work in a clinical setting where education takes place. The joy of passing one's knowledge to the next generation makes the doctor a happier clinician and in turn elevates the quality of clinical care in that setting.

Further, the student trained in a context where an investigative perspective is present is a student more likely to be alert to that which is new. We don't want practitioners whose level of medical knowledge becomes fixed at the date they graduate from medical school or residency. A good physician is compassionate and knowledgeable, constantly asking questions and educating herself or himself regarding the best of medicine so in turn they can provide that to their patients.

If we dismantle these efforts, the fabric which has established American medicine at its best, at the very best, and I'm not saying there aren't problems with it, would be severely if not mortally wounded. It is critical for the nation to understand that the accomplishments of medical research in this country are critically dependent on the vitality of the medical schools and academic medical centers in which much of this research is done. Other entities play important roles, too. The pharmaceutical industry, the biotech industry. But the gene for colon cancer was found by

Johns Hopkins academics. The virus for Karposi sarcoma was found by Columbia scientists. The pioneering work on liver transplants was done at the University of Colorado Medical Center and subsequently followed up at Pittsburgh. There are many other examples.

Put simply, if the United States values its medical research and high quality of medicine, it must likewise value its academic medical centers. Beyond serving as agents for medical research, however, these centers also train some of the best physicians in the world. Some 40,000 applicants seek the 16,000 positions in American medical schools. It's not surprising that students and patients from all over the world seek education on the one hand and care at the other at American institutions. This is not to say there are not good physicians in many other countries, but collectively, United States physicians are excellent.

Take, for example, the consultation being requested of Dr. Michael E. Debakey by Mr. Yeltsin. It is the medical schools in the United States that have produced the doctors who serve in those institutions. Beyond the research and the training, academic centers do more indigent care than any other group of institutions in the country. One of the most attractive social policies brings together the best of academic and American medicine in urban academic health centers, with members of the population whose means are meager if not non-existent. For-profit hospitals cannot afford this. The record shows they do trivial amounts of such care by comparison to that provided by academic centers.

Academic centers also set a quality standard for care in their geographical area. Continuing education programs, specialized experts available to health care practitioners in the community, increasing use of information technology, all mean the presence of an academic health center in the area generally increases the quality of medical care. Beyond that, the prominence of academic medical centers in the United States has important spin-offs of new knowledge, patents, products, and the like.

One of the derivatives of the superior nature of American medical research is the explosion in biotechnology. Nobelist Joseph Goldstein in the talk given at the AAMC one year ago, took note of the fact that there were 1,311 biotech companies in the United States employing 103,000 individuals with product sales totaling some \$7.7 billion. Their market capitalization was \$40 billion to \$41 billion, with an estimate that in the year 2000, biotech companies will be spending in excess of \$50 billion a year for research and development. A survey in New York showed \$2.3 billion total annual spending impact from the academic medical centers in New York, and a similar study of all the members of the AAMC, the Association of American Medical Colleges, revealed that they boost the economy of the country by some \$185.6 billion annually.

So whether measured in terms of medical research, training of excellent doctors, providing of a quality standard, rendering of care for the indigent, benefit to the economics of the nation, academic medical centers clearly provide a social good. It's not easy to secure current financial appraisals of academic medical centers. No academic medical center is excited about being portrayed as an institution in trouble. Such a public perception can have negative effects for fund raising, recruitment and retention of scientists, solicitation of investments. Thus, we are only beginning to see indications that academic medical centers are in trouble.

One can divide academic medical centers into many subgroups, and I will focus for the moment on public and private institutions. Each receives money from clinical care, medical research, and tuition. Beyond that, the public institution receives support from state, local, and federal administration sources with less in the way of fund-raising and tuition. Private institutions receive less state and local government support and more in the way of private philanthropy and higher tuition. Managed care is reducing the amount of income coming to academic medical centers, and the degree of the reduction appears to be in part a function of the degree of penetration of managed care in that area. Costs of research increase by virtue of more sophisticated technology. Recent increases in NIH are not quite keeping up with the increased costs of research.

Further, the NIH by virtue of fiscal squeezes is doing more cost shifting to medical schools. There have also been marked changes in indirect cost policies so that medical schools and universities do not fully recover the administrative costs of research. For graduate students, NIH now is expecting medical schools to pay more of the overall costs, and yet graduate students are critical to the nation's pipeline of scientists as well as the needed hands in the laboratory for conducting research.

The necessary institutional financial support to make the center run, to help retain scientists, buy the new piece of equipment, is being squeezed by a retreat, too, of foundations from supporting medical research, by the elimination of general supports of medical schools, such as the biomedical research support grant which provided for these purposes in the NIH, and a tightness in pharmaceutical company spending. States have cut back support, the Veterans Administration is contracting support, hospitals by virtue of constrained finances are finding themselves less able to support the academic and medical school mission.

Securing more revenue from tuition is unlikely. Students face accumulating debts of \$75,000 to \$100,000 and over, with anticipated sharp cuts in physician incomes in the future. There are medical schools already in jeopardy by virtue of the inability of their clinical systems to sustain positive financial bottom lines. In other instances, part of the health care enterprise of an academic center are being offered for purchase to outside investors for the apparent benefit to the university rather than to the medical center.

In a report on August 18 in *The Washington Post*, the hurt to medical schools was recounted by multiple individuals including NIH director Varmus. Professor John Eisenberg stated, "Either another source of funds has to be identified or the research and teaching missions will be compromised."

So I have stated that health research is a productive and valued social good, that such research reduces costs, and it makes a primary contribution to the quality of life, that it is carried out in large part in academic health centers, that the centers make many other contributions to the social good, and yet they face dramatic reductions in funding, which will undermine the functions mentioned earlier to the disadvantage of the entire society.

What's to be done? Everything should be done to facilitate collaborations between academic medicine and industry. Giving industry special tax breaks dependent upon contributions to

academic medical centers is worth considering. Certainly the kind of policy which allows universities to take advantage of the knowledge development emanating from government-sponsored research and work with industry to gain revenue streams from licenses – is a critical policy to be sustained into the future.

Methods by which industry could partner with academic medical centers and perhaps with federal government to support the training of researchers are being considered by the NIH Committee on Clinical Research. The Hatfield-Harkin Act or something like that, which would provide for a stream of money from a source other than annual appropriations, is worth considering. This must not jeopardize the support for increases and appropriations. Senators Hatfield and Harkin would forecast a substantial boost in medical research budgets through a separate stream of money, which might be garnered from a gasoline tax, tobacco tax, and not be subject to annual review.

Another approach is that of Senator Moynihan, who has introduced a bill suggesting a trust fund to support education and training in academic medical centers. This would require an assessment, as Dr. Shine pointed out, of all health care premiums to medical education. Senator Moynihan said he wanted to protect – in his own words – the jewels that academic medical centers represent. Most likely, this trust would come about as part of an overall Medicare bill, which will be on the docket for the next Congress.

The idea that managed care companies will voluntarily supply substantial dollars for medical educational research is illusory. Only by mandating that all health care systems shoulder some responsibility, can one bring everybody in. It's noteworthy that Congressmen Archer and Thomas, Republicans, suggested similar revenue streams in 1995, and the prospects with Democratic and Republican leadership in the two houses makes the possibility of such an effort more attractive and more possible.

This support would help even the playing field for academic centers with their extra functions as they go head to head against health care institutions with no extra function. It is worth considering providing special protection for academic centers of excellence such that they receive an appropriate amount of clinical activity through managed care. Also government, business, and other leaders should encourage foundation leaders to follow the example of Howard Hughes. The Hughes Institute, recognizing the current stress on medical schools, has provided special financial grants for continued recruiting and developing of young basic scientists, the same as you've heard before are needed for clinical research. The NIH Clinical Research Committee again may come up with suggestions along those lines.

Other enterprises, such as the managed care industry, the pharmaceutical industry, the insurance industry, should be encouraged by leaders from President Clinton on down, to help support medical research and education efforts of this country. Those who provide philanthropy for private institutions and public institutions should be given far greater attention and commendation by government and media. They should be held out as examples for other individuals of means who can help medical schools. The Woodruff Foundation just donated \$297 million to the Endowment of the Emory Medical School, as an example.

Medical schools should interact even more with other partners in the overall academic and scientific enterprise. This includes other parts of the university, the community, other academic medical centers, other hospitals – the richer one makes the scholarly fabric, the better the resulting products. The pipeline, both of young basic and clinical scientists, has to be protected. Thus, either the NIH has to contribute more for the training of such young scientists or other sources, perhaps by virtue of collaboration with industry, have to be found to help the medical schools that are being increasingly called upon to cost share, while they're also being asked to carry all kinds of additional expenses.

An attention to seed money, discretionary money is critical. These should not be denigrated as slush funds. It should be recognized as the necessary glue that enables medical school leadership to clinch the recruit, make the retention, sustain the individual, during times of interrupted funding, purchase the extra piece of technology, and help renovate the labs to make them modern so one can keep scientists and bring in new ones. The BRSG (Biomedical Research Support Grant) Fund I mentioned before is one fund which might be considered for new funding.

Finally, this has to be seen as a collective responsibility of more than medical school faculty and leadership. This is a crisis in the making with ominous ramifications for all citizens. The United States has been too ready to relinquish leadership of other enterprises. Other countries are more than willing to take over leadership in medical research and education. They are already making greater investments in some instances than the United States. And certainly the academic medical centers, as Dr. Shine indicated, have to make their own efforts to reengineer, reduce expenses, and pursue as diversified a funding base as possible. Schools should find efficiencies as have so many other societal enterprises.

Often, in this country, we wait for a problem to intensify in order to secure widespread consensus that something has to be done. Academic medicine will not survive that stance. If we wait until the problem is pervasive, it will be too late. Allowing these institutions to unravel cannot be offset subsequently by some rapid action or fix. There may be no way to prevent a few medical schools from closing or perhaps in a positive way from consolidating with others. The more worrisome possibility from the perspective of the country is a pruning of sufficient cream off the top of every one of the most distinguished of the academic medical centers to convert A-plus enterprises into C-minus enterprises.

Johns Hopkins has a superb Urology Department, Columbia has an outstanding Neurology Department. These programs are sustained by faculty, residents, fellows, and other staff, a critical mass that focuses on advancing our knowledge and treatment of a given disease area. If you take away 20%, 25%, whatever percentage funding from each and every one of the institutions, one contracts each of these critical masses. As a result, we may convert pioneering research enterprises with quality clinical and educational components to pedestrian programs that merely supply clinical services, do some teaching, but do not have the resources to push the frontier. Nor may they have the resources to create very much in the way of a quality educational experience.

I don't believe the American people want this. I don't think they recognize yet that it's happening. The interconnected issues of quality of life, improved health care, attention to the

needy, contribution to the economic good, and elimination of disease with cost savings to research all argue for a dedicated policy. This policy should begin with the next Congress and with the society as a whole to reverse these dangerous trends and to reestablish our academic medical centers and medical schools on the firmest possible footing. Thank you.

COLE: Thank you, Herb. If you want to see an encore performance from Herb tomorrow, he'll be playing middle linebacker for Columbia against Harvard, and we expect him to make many tackles. I notice a few people lining up, and we will have a few questions entertained.

DEVINS: My name's Sam Devins from Columbia. Nathan Rosenberg sort of followed the devil as the devil's advocate – well, I'm going to follow Nathan Rosenberg. The question I pose is, why is it when one talks about health, whether it's research or it's treatment, one always talks about it in terms of cost and deficit and never in terms of what it produces? Any numbers against health are red ink whereas numbers against, say, the burgeoning cost of electronics is always – well, it's a burgeoning production of electronics in the country. Now why is the reason? Is it because the people who pay and the people who receive the benefits are different? Is it because there's no option? One usually thinks of medicine as an expenditure beyond one's choice, although I believe medicine does have electives these days. Is it because it's not exportable? Where is the value of medical treatment recorded?

COLE: Thank you, Sam. I think Nate Rosenberg wants to respond.

ROSENBERG: If you ask an economist to come and talk about a particular subject, you mustn't express surprise when he talks about what something costs. I did not say it wasn't worth it. You will recall that the words I put in the devil's mouth were that richer societies are spending higher shares of their gross national product on medical care.

COLE: Let's have a couple more from the folks who I know are anxious to speak.

MALE VOICE: This is such an important issue, I do want to make a comment about it. Everybody's right. We spend too much. It's clear that the bypass rate in Texas is one-and-a-half to two times that in New York, with no evidence that health is any better in Texas than New York. On the other hand, up to now, we've had no way of measuring value, and the commentator is absolutely right. This is not about cost, it's about value. The biggest development, and I made some reference to it although time didn't allow, was indexes – quality-adjusted life years, disability-adjusted life years – in which you can begin to talk about function, disability, and performance, and create a denominator to go with the cost.

The problem is, up to now, we've never had the information systems by which to do it. And I'll also point out that our great academic health centers had none of this data. Our great academic health centers can't even cost-account the equipment that they put in when they put a new monitor into the coronary care unit, so that we've got work to do on both sides.

MERRILL: Steve Merrill, National Research Council. First, a wild assertion and then a heretical question.

The assertion is that the changes underway in the health care market, the way the stakeholders are behaving, seem to me dwarf the changes underway in the public military equipment market, which has preoccupied the discussion for much of the earlier part of the day. If that's the case, what we heard today was a whole variety of ways in which that is going to ripple through the innovation system, affecting companies, research performers, the National Institutes of Health, biomedical research policy at the federal level.

My question is, if that's the case and the changes are driven in part by attack on what is perceived to be excess capacity, why don't we have to confront the question of whether steady-state biomedical research funding isn't an appropriate response?

MALE VOICE: I have two observations. I'm triggering on Mr. Robinson's comments this morning when he talked about allocation of R&D resources, basically using the biomedical field, and gave what seemed to me to be a manual on how you actually got more from the government. We ought to remember that since the Second World War, certainly in civilian R&D, it could be argued that biomedical research in the life sciences has gotten a disproportionate amount of the public resources available.

The problem you face is that every interest group comes before the government, saying that this investment will pay off in some way down the road, and so everyone has this idea that this is not the cost but cost for benefit down the road. And I would suggest just gently that in a time when we're facing a decreasing federal R&D budget, it seems to me that biomedical research is particularly vulnerable in terms of the past history.

Secondly, just one caution: there have been a lot of discussions about set asides, taxes, dedication to the system, that have to be looked at in terms of how the tax system works and how the R&D system works. It is a very dangerous thing, it seems to me, to start dedicating particular taxes to particular areas because what you're doing is siphoning off that particular area from what I consider healthy competition for R&D funds in a limited budget.

ROSEN: My name is Steven Rosen, I'm head of the Scientific Careers Transitions Program funded by the Alfred P. Sloan Foundation, working with the career problems of scientists, physicians, and attorney. This is a blip on the radar screen, but there's been a very significant increase in the number of physicians who are seeking to move outside of medicine or within medicine and change their career directions. Among the scientists, it's because there's a surplus. Among the physicians, it seems to be career distress or dysphoria.

MALE VOICE: Just a very brief comment. I want to express my disappointment with the tenor of some of the discussion in this last panel. I'm disappointed because we're basically discussing the problems of a system where the traditional funders of R&D are not going to be funding that R&D anymore. It looks like we're going to be cutting back in R&D on the order of 15% to 20%, depending on whose numbers you look at, over the next few years.

As Dr. Robinson pointed out earlier, the health sciences in particular have a relatively privileged position within the hierarchy of R&D in this country, that was purchased through a very astute and clever political strategy, but one that worked.

And so what's the response? What do I hear for the last 45 minutes? Well, don't cut us back... you know, those other guys, their funding is going away, but don't cut us... not only don't cut us back, send more money, it's really worthwhile.

Now, I have no objection to the idea that there may be considerable social value to doing these things – although I would observe that many economists say the fundamental problem is that the people receiving the benefits are different than the people paying the bills, there's a disconnection between the benefits and the bills. But it seems to me that if the U.S. scientific community is to disintegrate into a bunch of interest blocks each arguing, don't cut us, cut the other guy, in fact, send us more money, then we're not going to make much progress towards solving the problem that this conference is ostensibly concerned with.

LUBELL: This is Michael Lubell, I'm professor of physics at C.C.N.Y. and director of public affairs of the American Physics Society. This last comment leads directly into what I would like to raise. Twice today, it has been suggested that the 20th Century was the century of the physical sciences and the 21<sup>st</sup> Century will be the century of the life sciences.

I think the entire characterization is incorrect. If you look at what has happened during the 20th Century, our theoretical understanding has brought us down to a microscopic level, quantum mechanics, quantum chemistry, molecular biology, biochemistry, biophysics, chemical physics. We have made tremendous progress. The tools we use, even in the life sciences in the medical area, lasers, electronic microscopy, fiber optics, computers, MRIs, spectroscopic analysis, and so on and so on.

I think science is becoming one, and what we need to do is talk about science in that fashion. It was suggested that in fact, if we don't, the political system is not going to be responding to it in a rational fashion. We will slit our own throats, and the country will be much the loss for that.

PARDES: That's quite a rich array of comments. First of all, I want to associate myself with Sam's anguish. There is a tremendous value there, and I think that the American people will vote that way.

Second, somebody talked about the privileged role of biomedical research. I agree with the comments that we should not fight a bunch of scientific disciplines; that's not the point I was trying to make. I would associate myself with improvement in funding for science across the board. But privileged position for medical research? The country spends almost \$1 trillion in health care costs, and the federal government investment in the NIH is a grand total of about \$12 billion. I think my calculation comes out to that being about 1.2%. What industry do you know of that would be satisfied with a 1.2% interest in R&D?

So this is not an argument to denigrate the extraordinary value of other sciences. It's to say that there's been a value in medical research over the years, and I don't think the bite should come out of our scientific colleagues. I do feel, however, that I'd rather have my dollars go to a new medication rather than to a new bomber. It's as simple as that. And I would associate myself with

the 50% of people in the survey who say they'd even be willing to pay a few more dollars for research monies.

We can easily reduce ourselves to squabbling within the scientific, academic, medical, and concerned populations. I think there's a broader fight going on, and it's simply to what will this nation ascribe? Either catering to those who would walk away from the problems of other people and be happy to see the federal government reduced to nothing in the way of capacity, or to those who feel the government can do something and there's a reason to try to make our civilization better for everybody. And my association's obvious. Thank you.

SHINE: I started my remarks by trying to talk about the notion of an overall science policy. That was deliberate because I don't believe that we're talking about one versus the other. What I'm saying is that I believe that the traditional way that many elements of the scientific community have made the case for the support in their area is weakening for a variety of reasons and needs to be reconceptualized.

Secondly, I don't accept the principle that there should be or that there even will be a progressive decrease in the federal investment in basic research. I simply don't accept it. I believe the issue is, how do we make the kinds of arguments so that that doesn't happen.

I will remind you that both the administration and the Republicans projected decreases in the NIH budget last year and this year. It didn't happen. I believe there are other examples of areas in which that investment can be maintained or increased, and I think the notion that the investment in basic research is critically important for the country is one that we can't walk away from. The question is, how do we articulate that, and I think it's the articulation part that's important.

I'm not going to get into an argument about the importance of the various sciences to the biological sciences – of course, it's been enormous. The message I'm trying to convey is that – in spite of the notion that in a variety of areas, people will appropriately try to produce intellectual advances, whether it's in particle physics or in a whole variety of other places – the forces that drove 20th Century science were the kind that we've described. And I'm arguing that we have to develop a different agenda. I'm not deprecating the role of, for example, physics in contributing to that. I'm saying, is there a way to make it part of the overall argument rather than the intellectual argument that each of us tries to make for our own discipline. And I think that's where both Herb and I would want to see something happen.

A lot of the technology that's been developed has been developed by engineers. And I'll remind you that every health care expenditure is somebody else's income and the industries we're talking about are important industries – when you get past Boeing, our balance of payments is profoundly influenced by what we export in terms of pharmaceuticals, devices, and a variety of other things. So one could make the economic argument that this portion of the economy is helped in a very substantial way in terms of this investment.

COLE: Thank you. I want to thank the presenters, the panelists, and I want to thank the participants. It's been a long day, I think it's been an interesting day, we will adjourn now.