The Philosophical Society of Texas

PROCEEDINGS

1977

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PROCEEDINGS

OF THE ANNUAL MEETING

AT GALVESTON

DECEMBER 9 and 10, 1977

XLI

AUSTIN

THE PHILOSOPHICAL SOCIETY OF TEXAS

1978

THE PHILOSOPHICAL SOCIETY OF TEXAS FOR THE COLLECTION AND DIFFUSION OF KNOWLEDGE *was founded December 5, 1837, in the Capitol of the Republic of Texas at Houston, by* MIRABEAU B. LAMAR, ASHBEL SMITH, THOMAS J. RUSK, WILLIAM H. WHARTON, JOSEPH ROWE, ANGUS MCNEILL, AUGUSTUS C. ALLEN, GEORGE W. BONNELL, JOSEPH BAKER, PATRICK C. JACK, W. FAIRFAX GRAY, JOHN A. WHARTON, DAVID S. KAUFMAN, JAMES COLLINSWORTH, ANSON JONES, LITTLETON FOWLER, A. C. HORTON, I. W. BURTON, EDWARD T. BRANCH, HENRY SMITH, HUGH MCLEOD, THOMAS JEFFERSON CHAMBERS, SAM HOUSTON, R. A. IRION, DAVID G. BURNET, *and* JOHN BIRDSALL.

The Society was incorporated as a non-profit, educational institution on January 18, 1936, by George Waverley Briggs, James Quayle Dealey, Herbert Pickens Gambrell, Samuel Wood Geiser, Lucius Mirabeau Lamar IV, Umphrey Lee, Charles Shirley Potts, William Alexander Rhea, Ira Kendrick Stephens, and William Embrey Wrather. December 5, 1936, formal reorganization was completed.

Office of the Society is in the Texas State Library, (Box 12927, Capitol Station) Austin, 78711.

The Philosophical Society of Texas

ON DECEMBER 9 AND 10, 1977, MEMBERS OF THE PHILOSOPHICAL SOCIETY OF TEXAS gathered in Galveston to meet and observe the 140th anniversary of the Society's founding. President Truman G. Blocker, Jr., and the program committee, along with Dr. William B. Bean and the local arrangements committee, provided two days of outstanding intellectual nourishment for the gathering.

Meetings were held in the Galvez Hotel with a banquet at the Moody Medical Library of the University of Texas Medical Branch. On Saturday evening following the meeting, members and guests were invited to a reception at the home of Dr. and Mrs. William C. Levin. From there visitors journeyed to the downtown area for the annual Dicken's-Evening-on-the-Strand.

Galveston's bountiful history and hospitality were enjoyed by all those present. Member Chauncey Leake was in attendance from San Francisco and set the tone for the occasion when he read the following poem at the banquet:

To Galveston, at the Meeting of Philosophical Society of Texas, December 9-10, 1977

Oh, Galveston! Oh, Galveston!
What joy it is
to see your Renaissance!
Oh, Galveston! Oh, Galveston!
What thrill it is
to see your sturdy stance!

To you now come the great
from all the mighty Texian land:
To you now throng the memories
enshrined on every hand.

The stalwart natives, and pirates, too;
the people of long ago
who built you up with high ideals
and made your city grow;
who built your wharves, your railroads, too,
who built your school of health,
who gave you libraries, music, plays,
who brought you world-wide wealth;

who faced their fate with fortitude
when dire destruction struck;
who built anew with courage high
and gambled on their luck.

Oh, Galveston! Oh, Galveston!
You've seen it all, been through it all,
in wars, in politics, in chance;
You've earned your Renaissance!

Oh, Galveston! Oh, Galveston!
Do keep your standards high;
your faith and hope in what's worth while;
let beauty be your goal,
and face your future with a smile.

Oh, Galveston! Oh, Galveston!
Live up to what you really want to be;
Let your rebirth be sure to make
a lasting life of civic pride,
in which we all may happily partake!

Oh, Galveston! Oh, Galveston!
Let glittering glory be your mate!
Oh, Galveston! Oh, Galveston!
Your Renaissance is great!

Old Chauncey Leake,
who still is
a sort of a Galvestonian

A month later, January 11, 1978, Dr. Leake died in San Francisco.

At the banquet President Blocker introduced the following new members of the Society:

William Leland Anderson, Houston
Howard Boyd, Houston
Katharyn Duff, Abilene
Harold Swanson Hook, Houston
Watt R. Matthews, Albany
Malcolm McCorquodale, Houston
Dennis O'Connor, Refugio
Preston Shirley, Galveston
Everitt Donald Walker, Austin

Attendance at 1977 Annual Meeting

Members attending included: Misses Carrington, Cullinan, Duff, Hyer, Porter; Mesdames Dudley, Jones, Knepper, Moore, Randall, Jr., Symonds, Wortham; Messrs. Anderson, Bean, Blocker, Bolton, Brandt, Caldwell, Carmack, Clark, Coke, Crook, Daniel, Davis, Dick, Doty, Dougherty, Doyle, Fleming, Frantz, St. John Garwood, Gordon, Gresham, Hall, Harbach, Harrison, Hart, Harte, Heinen, Hershey, Hoffman, Holtzman, Hook, Hunt, Jeffers, Jordan, Kelsey, Kempner, Jr., Kempner, Sr., Dan Kilgore, William Kilgore, Kirkland, Law, Leake, Levin, Lindsey, Lord, Lovett, McCorquodale, McCullough, McGinnis, McKnight, Mills, Moseley, Moudy, Page, Pate, Pressler, Richardson, Schachtel, Sears, Shirley, Shuffler, Smith, Sprague, Spurr, Topazio, Vandiver, Everitt Walker, Gail Whitcomb, James L. Whitcomb, Platt Wiggins, Wilson, Winfrey, Winn, Winters, Woodson, Worden, Wozencraft, Wray, Wright.

Guests included: Mrs. Thomas D. Anderson, Mrs. William Bennett Bean, Mrs. Truman G. Blocker, Jr., Mrs. Frank C. Bolton, Jr., Mrs. Howard Boyd, Mrs. Edward N. Brandt, Mrs. Clifton Caldwell, Mrs. George Carmack, Mrs. Edward Clark, Mrs. Henry C. Coke, Jr., Mrs. William H. Crook, Mrs. Price Daniel, Sr., Mrs. Morgan J. Davis, Mrs. Ezra William Doty, Mrs. Gerry Doyle, Fred Fason, Mrs. Durwood Fleming, Mrs. Joe B. Frantz, Mrs. St. John Garwood, Mrs. William Edwin Gordon, Mr. and Mrs. James Robert Green, Mrs. Newton Gresham, Mrs. W. G. Hall, Mrs. James P. Hart, Mrs. Edward H. Harte, Dr. Ruth Hartgraves, Mrs. Erwin Heinen, Mrs. J. W. Hershey, Mrs. George A. Hill, III, Mrs. Philip G. Hoffman, Mrs. Wayne H. Holtzman, Mrs. Harold Swanson Hook, Mrs. Wilmer Brady Hunt, Mrs. Leroy Jeffers, Mrs. Mavis P. Kelsey, Mrs. Harris L. Kempner, Jr., Mrs. Harris L. Kempner, Sr., Mrs. Dan E. Kilgore, Mrs. William J. Kilgore, Mrs. Thomas H. Law, Mrs. William C. Levin, Marion J. Levy, Jr., Mrs. John H. Lindsey, Dr. and Mrs. Harry M. Little, Mrs. W. Grogan Lord, Mrs. H. Malcolm Lovett, Mrs. Malcolm McCorquodale, Mrs. John W. McCullough, Mrs. Robert C. McGinnis, Mrs. Joseph W. McKnight, Mrs. Ballinger Mills, Jr., Mrs. Louis Charles Page, Mrs. A. M. Pate, Jr., Mrs. Herman Paul Pressler, Jr., Mrs. H. J. Schachtel, Mrs. William G. Sears, Mrs. Preston Shirley, Mrs. Ralph H. Shuffler, II, Ms. Josephine Sparks, Mrs. Charles C. Sprague, Mrs. Stephen H. Spurr, Mr. and Mrs. Anderson Todd, Mrs. Virgil W. Topazio, Mrs. Frank E. Vandiver, Mrs. Everitt D. Walker, Mrs. Gail Whitcomb, Mrs. James Lee Whitcomb, Mrs. Platt K. Wiggins, Mrs. Logan Wilson,

Mrs. Dorman H. Winfrey, Mrs. James B. Winn, Jr., Mrs. J. Sam Winters, Mrs. Benjamin N. Woodson, Mrs. Sam P. Worden, Mrs. Frank M. Wozencraft, Mrs. James S. Wright, Mr. and Mrs. W. P. Wright, Jr.

Since the last Annual Meeting the following Society members have died:

Robert Emmet Lucey
Tom C. Clark
Fagan Dickson
Marvin Jones
Fred Merriam Nelson
William Richardson White
Merton M. Minter
W. R. Woolrich

SYMPOSIUMS

POST-INDUSTRIAL TEXAS:

What Does the Twenty-First Century Hold for Us?

President Blocker: On behalf of the Galveston members of the Philosophical Society of Texas I welcome all of you to our meeting on the 140th anniversary of the founding of the Society. This also marks the 41st meeting since the Society was revived in 1936. I might point out that the original Society was founded on December 5, 1837, and a year earlier Galveston was established on land purchased by Michel B. Menard.

The purpose of the organization as set forth in the 1937 *Proceedings* has been "to encourage research and the preservation of historical, literary, and philosophical documents and materials." I can assure you that when I was elected to membership I was not aware that scientists were really eligible. And feeling that I had slipped in getting in in an irregular manner due to the influence of some of my good friends including Dr. Edward Randall, Jr. and Mr. Harris Kempner at the time, I tried to make up for the deficit in philosophy in my own makeup by boning up for a whole year on the history of philosophy. So I have done my part. I can give you the definition and things like that. But now that the Bicentennial celebrations are passed and we have embarked on the third century of our country, the members of the Program Committee have assumed the rather nebulous role of prophets as well as philosophers and discuss the future of Post-Industrial Texas and in particular what does the year of 2000 hold for us. Even though many of us will not be around in twenty-two years or else we will be more concerned with our walkers and our wheelchairs, still now I think we are all concerned about the quality of life which will be our legacy to our children and to our grandchildren. The Program Committee which was chaired by Dr. William Bean has worked very hard. As you know from looking at the program we have tried to have three outstanding subjects on the Post-Industrial Texas and What Does the Twenty-First Century Hold for Us? The first panel will be moderated by Dr. Frank Vandiver of the Rice University and he will introduce the speakers and the panel and we expect to hear a good deal about knowledge because it must become our major resource in our twenty-first century. Dr. Vandiver.

I. KNOWLEDGE — MUST BECOME OUR MAJOR RESOURCE

Moderator: FRANK E. VANDIVER, *Houston.* Vice-President and Provost of Rice University.

Speaker: EVERITT DONALD WALKER, *Austin.* President, University of Texas System.

Panelists: JUNE HYER, *Clear Lake.* Vice Chancellor and Provost, University of Houston at Clear Lake.

WILLIAM C. LEVIN, *Galveston.* President, University of Texas Medical Branch.

JARVIS MILLER, *College Station.* President, A & M University.

Frank E. Vandiver: Thank you President Blocker. Good afternoon Ladies and Gentlemen. The future of education is sufficiently a narrow subject so we can get it down in just a few minutes of course. But there are a few background ideas I might suggest to start with. I think that only recently in the United States has education been looked upon as a national resource — it has been and to a large extent still is — considered one of the pillars of democracy. An idea that is reflected in the quotation, "You shall know the truth and the truth shall make you free."

Education has always been fashionable in America — in recent years it has almost become a fetish. The people breaking with an established order, as we did from England, depended on education and religion for answers to questions of survival from the new and often alien world. That new world, the wilderness frontier, demanded changes in old world educational patterns, and so it happened that American education took a practical turn. Science and technology were obviously vital to a nation beginning and struggling for growth. The past of that practical education has led more or less directly to our present specialized system of learning in America. We produce more and better scientists, engineers, physicians, lawyers and all kinds of tinkerers with the physical side of living. And because our schools, colleges and universities excel in producing people especially competent in making and molding things, these schools, colleges and universities have become the envy of the world. So now United States diplomats talk of exporting expertise — don't you love that word expertise — and think of exporting expertise, it has a vaguely lewd sound somehow. But they speak of using our educational system as a foil in world competition and that is a reasonable if possibly self-draining idea. I think just as the philosopher lost his stone, the

theologian lost man's perfectibility. Today's layman has lost much of his faith in science. Much was promised — less was delivered — and what was delivered raised disturbing moral and ethical questions that plague us right now.

America is still fascinated with science — don't get me wrong — look at the popularity of "Star Wars" and "Close Encounters of the Third Kind." But America is also horrified. As machines and materials proliferate, man decreases in importance. I think we may worry about a technologically perfect world in which all these perfect machines — think of it, a technologically perfect world — and one day one machine breaks down and starts a chain reaction of wreckage that leaves the world utterly paralyzed. We may worry even more about a world in which only the human machine ever breaks down or wears out but at rarer intervals if medical science prevails I hope. But worry is the operative word here. Education must look beyond the present to offer hope for the future. Technology will continue in importance obviously, but increasingly difficult problems of ethics, morals and contentment will demand humanistic perspective. There seems to be at the moment an interesting trend toward a melding of physics and philosophy. A quieting of the age old argument between science and religion and perhaps that trend, if it is one, is indicative of one future course of education. But I think education to be a helpful national resource must remain a bastion of our discontent. It must offer the perspective of history to scientists who struggle for DNA's justification. It must offer the poet's understanding to managers of decreasing resources and the artist's harp to the giver of laws. And education must ever seek its own future. It must lead as well as follow. For instance, education probably will and perhaps should call in to question every fundament of society. It's conceivable that educators might even question the sanctity of the rule of law instead of the rule of nature. And to explore these problems and possible questions and enlighten us on the corridors ahead, we have a splendid group of speakers on the general topic of knowledge in post industrial Texas.

Our keynoter for this session is Dr. Everitt Donald Walker, System President and Chief Operations Officer of the University of Texas. Dr. Walker will talk on knowledge in the twenty-first century. Following his address, three panelists, Dr. June Hyer, Professor of Public Affairs at the University of Houston at Clear Lake City; Dr. William C. Levin, President of the University of Texas Medical Branch in Galveston and Dr. Jarvis Miller, President of Texas A & M University will comment on different aspects of the subject.

For the moment then, I have the honor to present Don Walker who will speak to you on knowledge in the twenty-first century. Dr. Everitt Donald Walker.

KNOWLEDGE IN THE TWENTY-FIRST CENTURY

Everitt Donald Walker: It is a very great honor for me to be addressing this distinguished group of Texans today — and an even greater honor to be doing so as one of your newest members.

I must say, though, I don't think it's particularly fair — Asking me to speak at my first meeting is like asking a football coach to win a national championship in his first season. And, believe me, my name isn't Fred Akers.

However, I'll give it the old Texas try.

The subject of my talk today is "Knowledge in the Twenty-First Century."

As we look to the Twenty-First Century and ponder what that future time may hold for us, it's proper that we do it at a meeting where the three major topics of discussion are knowledge — energy — and the quality of life-style. Frankly, these are all interrelated. And they all relate to knowledge.

I understand that The Philosophical Society of Texas was organized in 1837 with such distinguished Texans among its 26 charter members as Mirabeau B. Lamar, Anson Jones and Sam Houston. Its stated purpose concerned ". . . the collection and diffusion of correct information regarding the moral and social conditions of our country, its finances, statistics and political and military history: its climate, soil, and productions, animals, aboriginal tribes, national curiosities, mines, and a thousand other topics of interest which our new and rising republic unfolds to the philosophers, the scholars, and the men of the world!"

This Society was founded then on the premise that it would do all it could to collect and diffuse knowledge among the citizens of Texas and the nation. This knowledge was viewed at the outset as relating to facts and statistics about our state and its resources — and also to the art and cultural qualities that so enrich our lives.

Now, 140 years later, what topics could be more in keeping with the purpose of the founding fathers of this Society than knowledge — and energy — and the quality of life-style? And what topics could be more timely today as we ponder what the twenty-first century holds for post-industrial Texas.

This is both an exciting subject and a worrisome one.

It is exciting because we face a literal explosion of knowledge — knowledge that can cure ancient diseases; knowledge that can explore the mysteries of life and space; knowledge that can create a standard of living which we can barely imagine today.

It is a worrisome subject because there is no guarantee that mankind will have the wisdom to live with such knowledge; wisdom that will permit us to adjust to rapid change; wisdom that will protect us from the undesirable by-products of technology; wisdom, in fact, that will assure our very survival as a race.

I believe we are approaching a turning point in history. We must carefully assess the future and determine how our resources and human energy can best be used. We must not think of next year alone — but of the next decade — and even the next century. We will be challenged greatly — but not more than our forefathers were challenged.

And if we respond to the challenge just half as well as our forefathers did, then our future will certainly be assured.

In the opening paragraphs of her book, *John Adams and the American Revolution,* Catherine Drinker Bowen wrote:

> On the Fourth of July, 1826, America celebrated its Jubilee — the 50th Anniversary of Independence. John Adams, 2nd President of the United States, died that day, aged ninety — while from Maine to Georgia, bells rang and cannon boomed. And on the same day, Thomas Jefferson died before sunset in Virginia.
>
> In their dying, in that swift, so aptly celebrated double departure, is something which shakes an American to the heart. It was not their great fame that made these two seem indestructible. It was their faith, their boundless, unquenchable hope in the future, their sure, immortal belief that mankind, if it so desired, could be free.

I believe the same truth applies today, no less than in our earliest years as a nation: that mankind, if it so desires, can be free.

In considering this, let us reflect for a moment to the early stages of the world.

It has been said that the march to intelligence is inexorable. Those creatures that during the evolutionary process did not become more intelligent — and through that means adapt to changing conditions — instead became extinct. Some of those slow adjustments, occurring over evolutionary time, came as the brain grew in size as the species evolved. Now, as we approach the Twenty-First Century, the adjust-

ments that man must make will be more rapid. Knowledge — the sum of what is known — will increase even faster in the future. And we must use all existing knowledge.

Texas has been blessed with vast resources. These include our land, our climate, our minerals, our fossil fuel reserves, and, most importantly, our people. Perhaps our people have historically been the most important undergirding resource. Some of the resources, such as our fossil fuel, are finite and will be depleted at rates yet to be determined. Other resources, such as the soil and what it grows, are finite, but renewable with good management. There is only one resource that can grow without limit. This one resource — knowledge — will largely determine the kind of future we have in the Twenty-First Century.

Nothing is as permanent as knowledge. It cannot be destroyed by fire, plagues or by wars — unless the world itself is destroyed. It provides the greatest insurance that the future of mankind will not permanently diminish.

Europeans appeared to lose everything as a result of World War II. But they did not lose their knowledge or their ability and desire to use it. In retrospect, the apparent losses were short-lived. Knowledge was the ultimate salvation — although the assistance, interest, and compassion of the Allied victors greatly facilitated the recovery.

We have doomsayers now as we have had in the past. Malthus was one of the original prophets of doom. And his dismal predictions, while not yet realized on a worldwide basis, may yet come to pass — unless, of course, we continually apply our knowledge to prevent it.

In their book, *The Limits to Growth,* a group at MIT predicted the decline of society as we know it based on a mathematical model of the world and exponential growth. Without questioning the dire consequences of unrestrained growth of population or of consumption, we must point to the fact that the models lack feedback which would adjust events with time. With an improved knowledge base, I contend that reasoning individuals can and will adjust what they do so the world will not proceed blindly to an over the brink of disaster. Granted, adjustments and adaptations will have to be made. And these, too, will be made wisely only if we have a good knowledge base to guide our decisions.

I recognize the debate concerning a technological society. And as we move forward in an imperfectly understood world, there will be controversy. Consider the wonderful achievement of Paul Muller, who won a Nobel Prize for the contributions to mankind resulting

from his development of DDT. Some estimate that DDT saved over 20 million lives in the 1940's and has prevented many illnesses since then. Yet, it is now banned in this country and there is fear that this powerful chemical is capable of altering animal growth patterns and so alters the ecology that its continued use is a threat.

There is no magical "Fountain of Knowledge" from which we can drink to expand the sum of all that is known. New knowledge only comes from the creative use of the innate intelligence of each and every person. There is, however, a highly efficient mechanism for creating new knowledge and for continually imparting new and existing knowledge to each new generation. I'm speaking of our higher education system, of course.

I think we are justified in being proud of the record of higher education. We are educating and training more and more people in our universities and health science centers each year. And we believe we're doing it well. Yet, we cannot rest on our past record. We must now, more than ever, look to the challenges of the future — the challenges of post-industrial Texas in the Twenty-First Century.

Traditionally, in American society, universities have been given the tasks of discovering, maintaining and disseminating knowledge. That is a role that universities have accepted and must continue to accept with enthusiasm. That is not to say that universities are the exclusive organizations so charged, but rather that knowledge is the business and reason for existence of universities.

Any organization, including a university, that adopts the objectives of discovery, maintenance, and dissemination of knowledge must also adopt the standard of excellence in its endeavors. Excellence indicates the highest degree of good qualities; that is, qualities that make for special worth or merit. Indeed, to quote John Silber, a former colleague and now President of Boston University, "Excellence is the only standard that can sustain a free society." In a recent speech entitled "Flight from Excellence," Dr. Silber also said, "Our flight from excellence . . . is profoundly philosophical; we have begun to reject the very notion of excellence as a social ideal." If Dr. Silber is right, our society is destined for great difficulty. Although he was speaking to all aspects of life, his points have special importance to the care and nurture of knowledge. Universities must insist on excellence from their faculty, students and administrators — and work to convince the public and the legislature of the essential nature of this standard.

It is often maintained that the only knowledge of value is that knowledge that can be applied to better our quality of life. However,

what is meant is immediate application, and all other knowledge is considered in a derogatory fashion — knowledge for knowledge's sake. Yet, who could have known that Alexander Fleming's observations in the 1920's would result in the antibiotic era? And who would have predicted that studies of linguistics in the early Twentieth Century would permit the development of modern computer science? We have all benefitted from the efforts of scholars who, through their knowledge, have made possible great music, literature, and other aspects of a satisfying life. Sir Isaac Newton was certainly right when he said, "If I have been able to see farther than others, it was because I stood on the shoulders of giants." We are all fortunate to have stood on giant shoulders, but we must recognize that there are giants alive today. These giants will contribute to the lives of our children and grandchildren, and they cannot be stopped or belittled by the ridicule of the uninformed or the demands of the so-called cost conscious to stop the works. Indeed, those of us committed to learning must insist on our leaders continuing to invest in the future by supporting the development of knowledge even when we cannot see its applied value. This is not to say that we should not evaluate creative efforts or avoid choices when choices are necessary, but let us do so with an appreciation of the long-range potential of knowledge.

The final point I want to make is this: Knowledge must be separated from data. Data is essential to knowledge, but it is not knowledge itself. Nor is it wisdom or philosophy.

Our educational institutions must never lose sight of this fact. We must never become so preoccupied with science and technology that we ignore the humanities. Yes, we *are* facing a knowledge explosion, and we must prepare for it. But in gaining the new knowledge, we must not lose sight of the old. And by "old," I mean the basic tenants of western thought. Philosophically — and ethically — we are still drawing upon the Judeo-Christian tradition, a tradition that is more than two thousand years old.

This knowledge does not change — but it is no less vital to our future.

There is a tendency in modern education for students to short-cut humanities. Many students are in such a hurry to become doctors and engineers and physicists and chemists — yes, and managers, too — that they neglect to get an "education" along the way.

A very wise man once said that the purpose of an education ought not to be to learn to get along with other people. "You ought to get an education," he said, "to learn to get along with yourself."

In a very real sense, the *humanities* teach an *entire society* how to get along with itself. And that is something we had better not lose.

We had better be thinking about how we are going to preserve the individual in a society that is becoming increasingly impersonal.

We had better be thinking about how we are going to protect our privacy in a society that has developed the electronic equipment to eavesdrop on anyone, anywhere in the world; that has developed computers which can gather and store every conceivable fact of our lives.

We had better be thinking about what kind of ethics our society wants to demand of its citizens in an age when permissiveness has almost become a religion in itself.

We had better be thinking about how we are going to build bridges of common interest and friendship among nations that are becoming increasingly able to destroy one another with the push of a button.

In short, we cannot escape our destiny. The knowledge explosion is upon us. It is a fact of life.

Let us welcome it; indeed, let us expedite it in any way we can.

But let us also prepare for it — as individuals . . . as a society . . . as a world community

Let us be masters of our destiny, instead of its slaves.

That is the real meaning of education.

Without that, knowledge is worthless.

LEARNING AND LEADERSHIP IN THE TWENTY-FIRST CENTURY

June Hyer: It would be an humbling experience to come before this audience to discuss accepted "knowns," but to explore unknowns borders on folly. For the next few minutes there will be no effort to say things with which either the panel or the audience may agree. In fact, my function is, in part, to play the "devil's advocate," a role with which I am quite comfortable.

As we gaze together into the crystal ball of the future, the soundness of the revelations will be dependent upon the accuracy with which we perceive the present. There are several basic concepts that are taking shape as we rotate the crystal ball. These concepts have a clear identity today, for most of the social and intellectual trends which will launch mankind into the next century are already in evidence.

Perhaps, we have been living in a new medieval period — middle between a rural, agrarian, hand labor era and an urban, industrial,

intensive technological era. The uncertainties, unrest, unknowns of the last three centuries have spurred our people to forge courageously ahead to overcome distances, health plagues, lack of economic opportunity, need for recognition of human rights, and scores of deterrents to the achievement of a dreamed of "land of milk and honey."

The American Dream, with its numerous interpretations, has guided our phenomenal development from wilderness to moon walks. Are we now bordering on a national and personal era characterized by loss of purpose, apathy, anti-intellectualism, insecurity, and a general dearth of leadership? These are dangerous signs for a society that is now scientifically and technologically preeminent. As intellectually developed as we are, we have the knowledge to transform our nation into the most advanced participant in the modern era on which we verge. This transformation depends on you and me and all persons living at this time.

Mankind has never achieved greatness during eras marred by excessive personal greed, too much affluence, too little discipline, and ineffective identification of priorities, both personal and societal. Are these characteristics of the present?

The most complex society that has ever been created is faced today with demographic changes that will alter the entire order of productivity, consumption, and values. The population is getting older. In 1970, 38 percent of the population was under 25 and 19 percent was over 55. Life expectancy for the overall population was 70.9 years in 1970 as compared with 47.3 years in 1900. Between 1900 and 1970 the death rate has been halved. In 1900 only 3 percent of the population was over 65 years of age. Today over 10 percent have lived 65 years or more. The Federal Bureau of the Census has just announced that the median age of the United States has increased from 20.0 to 29.4 in the last six years. The median age will reach 32.5 by the year 2000. Scientists are projecting that children born in the last decade of this century can have a life expectancy of at least 85-90 years; whereas, those born in the first quarter of the twenty-first century can expect to live to be 110 or more. The record of the first 70 years of this century supports the realism of these projections.

Keeping the population alive for more years can create more problems than solutions if, in fact, we do not plan carefully to utilize the capabilities of the total population more effectively. Arbitary commitment of human beings to uselessness by mandatory retirements represents a waste of human resources that is unrealistically intensified by the extension of life expectancy. There is no logic in measuring the effectiveness of older people according to the expecta-

tions for the output by younger people. Plato, Shakespeare, Rousseau — great minds of all ages — have admonished society to use people differently at each recognizable stage of life and to put a premium on the worth of mature wisdom, experience, and leadership. Recent history should have intensified our awareness of these values.

There is a definite trend toward older student bodies in higher education. Between 1972 and 1976, the number of students over 36 years of age doubled while the number between the ages of 18 and 21 years rose 11 percent. A current census analysis further revealed 1/3 of all students in higher education are now 25 years old or older. By 1980, it is predicted 40 percent will be 25 or older. If this trend continues by the year 2000 the high proportion of older students will create serious problems for the young, less experienced, less expensive Ph.D.'s. Who will prepare 65 year olds for their next stage of productive living? Where will society find faculty old enough to be effective with persons returning to the universities for perhaps their third or fourth stints unless we plan now? (Our latest evidence of planning is for the college presidents to lobby against removing the 65 year old retirement rule.)

In this era of instant everything, we are now dangerously near accepting very short-sighted "instant" solutions to our poorly analyzed unemployment problems. There is a frightening hue and cry to reduce the years of education and to try to pre-determine the employment market of the recipients of university education. It requires little genius to know that like all other aspects of life, education at every level is more costly and shall continue to be as long as we support rampant inflation. Too many people are suffering today from the erroneous belief that higher education can be "managed" with simplistic product-oriented methods and evaluated on its immediate dollar and cents worth. Little hard data exists to measure its influence on national productivity, leadership, problem solving, or ability to consume increasingly sophisticated technology.

Never before have human beings faced such momentous decisions with so little preparation as today's high school graduates. None of us is smart enough to counsel this greatest societal resource to achieve its fullest potential. Do we have the courage to make an economic commitment to urge youth to select careers based on currently exciting interests, thus preparing for accomplishments that may be rewarding for only five or ten years with the awareness that a second stage of preparation may be necessary after a future reassessment is made? Are we ready to say to youth "we aren't sure material wealth is as important as we have been conditioned to think"? Are

we ready to create an environment in which personal commitment to ideas and values is honestly demonstrated and rewarded?

In a society that is on the threshold of true greatness we cannot afford the luxury of wasting our single greatest immeasurable resource — our human resources. We cannot accept unfounded myths perpetuated for selfish reasons by single purpose interest groups. There is no way a country can become too educated if we are dedicated to a belief in the improvability of man. For example, today's proclaimed teacher surplus results from a false economy that says, "put the most heterogeneous student population we have ever had in the largest classes and produce the lowest achievement scores in the name of economy." I submit to you we didn't get where we are in technology pinching those kinds of pennies.

Similarly, in higher education, depending upon the funding of graduate work at the expense of students crammed into monster sections during the first two years of college is poor economy. Nationally, we lose about 42 percent of the entering freshmen before they become juniors. If we replaced teaching assistants with faculty of quality, it would cost more in salaries but perhaps there would be a chance to reduce greatly such waste of human potential.

Worse than the college drop-out is our failure to create conditions which prepare our students to be creative enough to "roll with the punches," to develop faith that "tomorrow will be better because I'll do my best to make it so." This was the American Dream that brought you and me to the present — we have lived it. Is this faith worth bequeathing to twenty-first century man?

Many of us are not as sensitive to the deep tragedies that confuse youth on whom the next century will depend. We fault the weakness of our leadership in all walks of life, but we explain it away as human frailty. Youth looks to this same leadership as it formulates its models for success. With actions continuing to speak louder than words, can we be shocked when youth perceives the guideposts to leadership success to be: "promote the ineffective," "don't rock the boat," "surround yourself with only those less qualified," "get to the top as rapidly as possible any way you can." These same youths read studies that reveal the average college graduate utilizes about 10 percent of his individual potential at any one time. Consider for a moment, the level of confusion this combination makes. If we do not use our human potential why do we have it? If we have so much unused potential, why do we have such unsolvable human problems?

The last glance into the crystal ball reveals that we are blessed with the ingredients for greatness but we are faced with hard de-

cisions which will determine whether we achieve greatness. We know what to do, but it requires courage, commitment, and, yes, sacrifice. Are we ready to: (1) plan for the continuous learning of of mankind; (2) balance the scales between rights and responsibilities; (3) recognize that the quality of leadership determines the quality of followership; (4) remember that an enlightened leadership is dependent upon an educated populace; (5) realize that, in the twenty-first century, exploitation of human creativity and ability will be the key to achieving the affluence and quality of life now enjoyed by exploiting the wealth of the earth? The time is now and counting down rapidly. The challenges are ours!

MEDICINE IN THE POST-INDUSTRIAL SOCIETY

William C. Levin, M.D.: The post-industrial society is confronting medical and health care delivery systems with two major conflicting responsibilities. The first responsibility derives from an increasing number of scientific and technologic developments and the second from the *costs* of applying these developments in the care of the sick.

It would require hours to recite even a partial list of the scientific and technological advances; however, to set the stage for discussion of medicine's and society's dilemma, it is necessary to cite some examples.

Within the past five years, computerized axial tomography, commonly referred to as "CAT scanning," has become available to the medical profession. This is probably the most revolutionary and exciting development in diagnostic radiology since the X-ray was first discovered by Roentgen. This device permits the diagnosis, for instance, of specific anatomic defects resulting from head injuries, from intracranial tumors, from disorders of the brain resulting from circulatory diseases and from many other disorders, without subjecting the patient to any invasive studies and without risk to the patient. Ironically, this scientific and technologic marvel has become the center of great bureaucratic concern and the cost of its use is being held up as an example of the heavy economic burden which the delivery of medical care is imposing upon society. Indeed, the mere mention of CAT scanners seems to evoke a Pavlovian response amongst bureaucrats, who claim that the proliferation of these instruments is a major contributor to the escalation of costs of delivery of health care.

Another major medical advance is the treatment of patients with end-stage kidney diseases — patients who died from "uremic poison-

ing" within weeks or months, until renal dialysis was refined and adapted to the care of patients with chronic kidney failure. Such patients today can effectively treat themselves at home with dialysis machines, washing impurities out of their blood three nights a week. These patients now have an eighty percent chance to live at least nine years —a major and almost miraculous achievement. The cost, however, ranges from $15,000 to $25,000 per patient per year — or at least $150,000 per patient over a nine-year period. This is a striking example of how the translation of knowledge into management of disease prolongs productive life, but at the same time adds immensely to the increase of costs of health care delivery.

A major recent advance in treatment of disease is the early diagnosis and early treatment of myocardial infarction, often by highly trained paraprofessionals under telemetered guidance by cardiologists. The surgical treatment of coronary disease has become a commonplace occurrence despite the uncertainty of the value of the procedure on the basis of statistical appraisals. These are both costly maneuvers and contribute to the evergrowing size of the contribution of medical care to the gross national product.

Patients with leukemia and cancer are now living longer and enjoying a better quality of life because of the application of effective — but expensive — surgery, chemotherapy, and radiotherapy.

These and other highly sophisticated applications of knowledge to the treatment of disease have resulted in extension of the useful lives of our citizens but have contributed enormously to the nation's health bill. In the post-industrial era, physicians are facing the dilemma of making these advances available to their patients, while at the same time being confronted by criticisms leveled at them by politicians and bureaucrats who assign to physicians the major responsibility for escalation of health care costs.

Dr. Karen Davis, an economist dealing with the problems of the cost of health care delivery and a major advisor of the Secretary of HEW, Joseph Califano, has addressed this issue as follows:

> One attractive strategy for trying to lower costs over the long term is to emphasize non-medical ways of improving health. This strategy would attempt to reduce long-run costs by effecting health improvements at the individual or community level. Pursuit of good personal health habits, such as moderation in eating, drinking, smoking, and adequate exercise, would be encouraged by public exhortation or financial incentives. Improvements in health through greater attention to occupational health and safety, environmental pollution, hazardous chemicals and additives in food and

> water would be another avenue toward long-term cost reduction. Unfortunately, there is little information available on the effectiveness of alternative ways to induce behavioral change, or on the tradeoffs involved in tighter environmental and occupational health and safety regulations.

While Dr. Davis is wholly correct in suggesting that such educational programs, *if effective,* might reduce the costs of dealing with diseases produced by such environmental factors, she has not taken into account the fact that this segment of the population, having been spared the agonies of emphysema, cancer of the lung and related diseases, will still be eventual victims of the degenerative diseases of aging such as coronary artery disease, kidney failure, and cancer. I doubt that significant cost containment would, in the long term, be effected.

Dr. Davis has suggested also the possibility of cost containment by implementation of national health insurance. She has proposed (and I quote), "By consolidating all 'purchasers' of health care into a single unit, such as through a national health insurance plan, one agency would have the power to bargain collectively with hospitals and physicians regarding a 'fair' level or reimbursement." I would respond to Dr. Davis' suggestion with a challenging question. Has collective bargaining resulted in a decrease in the cost of automobiles, of electric appliances, of the transportation of materials or of any of the other products or services which are presently subject to collective bargaining?

Health care delivery presents challenges to society which must be met directly and pragmatically, if the continuing deluge of scientific and technologic advances are to be implemented in the prevention and treatment of disease. I specifically used the phrase "challenge to society" because, while health professionals must develop and apply such knowledge, society must be responsible for working with physicians in the resolution of the socio-economic problems which are perceived in the form of cost escalation and maldistribution of health services. Society and the professionals (in this case, physicians) must cooperate with each other, and must avoid the development of adversary relationships, which are ultimately counterproductive.

Unless this is accomplished in the near future, the present bureaucratization of medical practice will progress to the point of complete bureaucratic control of the process — with the ultimate result of destruction of the present system of health care delivery and with inevitable escalation in the cost of administration of the system.

Daniel Bell has described this issue eloquently and succinctly. "In the broadest sense, the most besetting dilemma confronting all modern society is bureaucratization, or the 'rule of rules.' Historically, bureaucratization was in part an advance of freedom. Against the arbitrary and capricious power, say, of a foreman, the adoption of impersonal rules was a guarantee of rights. But when an entire world becomes impersonal, and bureaucratic organizations are run by mechanical rules (and often for the benefit and convenience of the bureaucratic staff), then inevitably the principle has swung too far." Dr. Bell has recognized the importance of maintaining the functional integrity of the professional. "The central person is the professional, for he is equipped, by his education and training, to provide the kinds of skill which are increasingly demanded in the post-industrial society. If an industrial society is defined by the quantity of goods as marking a standard of living, the post-industrial society is defined by the quality of life as measured by the services and amenities — health, education, recreation, and the arts — which are now deemed desirable and possible for everyone."

I began this brief discussion of medicine in the post-industrial society by describing the dilemma of the physician faced with an expanding armamentarium of applied knowledge and simultaneously challenged by politicians and bureaucrats to contain costs.

I shall conclude by suggesting that the responsibility for the resolution of this dilemma belongs jointly to physicians and to society, the members of both groups being the beneficiaries of medical knowledge. If medicine and society can address this issue effectively before complete bureaucratization of medicine has occurred, I believe that we can look forward to continuing improvement in alleviation of human suffering from disease, to prolongation of life, and to greater total productivity of our society in the post-industrial era.

SCIENCE, KNOWLEDGE, AND TWENTY-FIRST CENTURY TEXAS

Jarvis E. Miller: I appreciate the invitation to address this prestigious group today. I am not sure why I was chosen — whether your program committee wished to size up the new President of Texas A&M University, or whether they were seeking to initiate serious discussion of some of the critical issues facing Texas. In any case, I welcome this opportunity, convinced that there is far too little discussion and debate about these issues in Texas.

Question under discussion is one that is extremely important to the future of Texas. It is extremely difficult to predict future develop-

ment. A mere ten years ago, the American Academy of Arts and Sciences sponsored a serious discussion of the events likely to occur in the last third of the twentieth century. Herman Kahn had a paper entitled, "Toward the Year 2000." It is interesting to note that no mention was made of the two most significant events shaping our discussions in the last five years — food and energy. This, I believe, is an excellent indication of our inability to predict future developments with any degree of assurance. Nevertheless, I believe that it is safe to say that the future of our state depends very heavily upon the decisions that are being made today. To a very real extent, the future of Texas can be what we in Texas want it to be. We live in an area with what has been characterized as a hostile environment. Serious problems must be overcome in order to develop our resource base. Knowledge is the key to overcoming this adverse environment and to capitalizing upon the opportunities which we have. The great English economist, Alfred Marshall in his *Principles of Economics,* states, "Knowledge is the most powerful engine of productivity; it enables us to subdue nature and force her to satisfy our wants."

In spite of what is becoming a fashionable view, nature is neither benevolent nor bountiful when it comes to food. Marshall wisely perceives what every farmer knows, namely, the niggardliness of raw land and the hostility of nature to agriculture.

Rene Dubos has observed that nature by itself cannot achieve its full potential. He has advocated a symbiotic relationship between the earth and man for the benefit of both. As we move into the twenty-first century, it is important that we seek to develop this relationship.

Improved productivity has been the base for economic development. Improved productivity has come only through the development of technology which has come from knowledge and understanding of basic biological, physical, chemical laws. Increased productivity has freed resources from production of basic necessities and allowed resources to flow into other areas — services, culture, amenities of life. Again, it has been a cumulative process — one discovery has led to another, etc. And, instead of treating symptoms, we approach understanding of the root causes of problems.

The major problems of society will be solved only by a substantial and sustained commitment of resources to develop solutions. The world food problem is a case in point. Food production in the world is *not* the basic problem. Unchecked population growth which outstrips food production is the problem, causing a *decline* in the per capita food supply. Just to maintain current levels of consumption

will require a doubling of world food production in the next twenty-two years. In other words, the farmers of this world will have to learn how to produce again as much food as they have learned to produce since the beginning of time. In less than 25 years!

This will be done *only* through a massive effort to develop and apply new knowledge and new technology.

And yet today, our society is polarized and torn asunder by well-meaning, but ill-informed people speaking without knowledge. We are living in an anti-science climate. The current concern over minimizing risk or even adopting no-risk approaches to the problems of society. T. W. Schultz, the brilliant University of Chicago economist has stated:

> Growth in real personal income has increased markedly the demand for environmental quality. To satisfy this demand, public intervention is necessary. But unfortunately this long overdue intervention exploded with the political force of a hurricane; in its wake there now are many badly formulative legislative acts, a proliferation of overlapping federal agencies, thousands upon thousands of pages of orders in the federal registry, and a large number of judicial mandates. This sudden, massive intervention is beset with extraordinary inefficiency, many inconsistencies, and with little reckoning of costs. It is not surprising that counter political forces should be coming into play. In a real sense the job of upgrading the quality of the environment is much endangered by the many costly mistakes that have been and are being made.
>
> The prevailing political ideas that specify the attributes of an optimum environment are still in a transitory stage. It will undoubtedly take decades before we will have learned the real specifications of a "permanent" environment that equates our resources and our values. The current public thrust to eliminate an ever-increasing number of chemicals and organic compounds used in making insecticides, pesticides and herbicides is a political "experiment" that even a rich country can ill afford in learning what the trade-off is between their use (non-use) and other social and private values. I for one hold firmly to the proposition that low income countries cannot afford to enter upon this "experiment" as we are doing.
>
> Much is at stake in the unsettled environmental question pertaining to our job of adding to the stock of knowledge. The doctrine that there should be zero risk in the application of new knowledge is patently false. It is in the realm of the impossible. Every bit of new knowledge from the beginning of agriculture has been beset with some risk. The strict enforcement of the zero risk doctrine implies that there

> could be no more meaningful food and agricultural research. The enforcement of other less disastrous environmental standards is also impairing on-going research efforts caused by many ill-defined and costly requirements.

We must, if we are to survive and develop, return to a sound understanding of the importance of free inquiry, of the importance of venture and risk. In the words of Schultz, we must practice research entrepreneurship. Those of us in science must develop in the consciences of non-scientists an appreciation of basic science and basic research in the total scientific scheme of things. And, as William Bevan stated recently, "We must reach the place in the public's understanding where basic science is seen as a legitimate activity in its own right and an essential ingredient in a comprehensive national effort in science and technology."

Bevan states that the great intellectual confrontation of the nineteenth century was between science and religion. He states that he believes that before the present century is over, an intellectual confrontation of similar proportion will occur between science and the law.

It is indeed unfortunate that science is being blamed for the ills of society. In my view, the problem is not science or scientists. The problem is our failure to develop institutions to cope with the results flowing from the scientific effort. Mechanization of farming freed millions of laborers to enter non-agricultural fields. The dimensions of the potential problem were well documented prior to its development. Yet, these displaced laborers and their families flooded the cities and caused the massive social problems which persist to this day. To repeat, the blame cannot with justice be laid to the agricultural scientists and engineers, but rather, to a society and a political process that is unwilling or unable to utilize knowledge to anticipate and resolve problems.

So, as we look forward to the Twenty-First Century, the generation of knowledge and its wise use for the improvement of society are the principal issues which we in Texas must face. I repeat what I stated at the beginning of this paper: In a very real sense, the future of Texas, the future of the United States, the future of the world are in our hands.

In the words of the ancient writer:

> "The beginning of wisdom is this: Get wisdom, and whatever you get, get insight." (Proverbs 4:7)

Address

KNOWLEDGE FOR WHAT?

ELSPETH ROSTOW

President Blocker, distinguished Members of the Society and Guests.

My title this evening is taken from a book that perhaps only one other person in this room has read: neither of us profited overwhelmingly from the experience. It was a volume entitled *Knowledge for What?,* published in 1939 and written by the Columbia sociologist, Robert Lynd. The title of the long-forgotten book raises a question which is an appropriate theme for this session: How to use the knowledge explosion with which we are surrounded and which we heard discussed this afternoon.

What I propose to do is to break my discussion of this theme into three parts. (When I was a young teacher, a senior member of my department told me the secret of his success. He said that, over the years, he never failed to put on the blackboard three points, nor did he ever fail to say something under each heading. His students faithfully put down the three points and, no matter how far he rambled, seemed to regard the result as a coherent lecture, thus letting him get out of the room unscathed.)

My three points are rather massive: Knowledge of the Past, Knowledge of the 1970s, Knowledge of the Future. To be more specific, I want to talk first about the debate going on at the present time as to the relevance of the American past. Next, I shall discuss what I believe are the major current problems confronting U. S. society. Finally, I shall try to identify some early glimmerings of the 21st century, which is now hurtling in our direction. (It is worth realizing that our children and grandchildren who are now 22 will be only 45 in the year 2000. They will be vigorous 70-year olds in 2025; we heard today that some of them may live to be 110 — which would take them to 2065.)

Now my first point: The Relevance of the Past. Some of my fellow academics, notably the historian David Donald of Harvard, have said in public that the American past no longer has any lessons for us. Donald wrote recently that he feels a sense of sadness when he stands before his students to teach them about matters which he believes to be of no use to them and which will have no bearing on their future activities. Mr. Donald teaches American history. My

own sympathies go less to him than to the parents who pay tuition for the students who sit at his feet.

Is American history irrelevant? It is true that some hypotheses about our past seem to be exploding. For example, in a book which came out in 1954, *People of Plenty: Economic Abundance and the American Character,* the late David Potter asserted that the American style is based on abundance. Since the seventeenth century we have had enough land, enough mineral resources, and enough time. In addition we enjoyed for many years a Malthusian reversal which provided us (unlike Europe) with ample land and never enough people, thus allowing us to pay attention to each individual, to educate him and to give him opportunities which a more heavily populated society could not afford. (It is interesting to note, by the way, that Thomas Malthus lived in a crowded parsonage in England. I have often wondered if the Malthusian thesis derived from his painfully tight domestic environment.) In any case, we had reverse Malthusianism in America for a long time and it was obviously a tension-releasing factor.

If David Potter was correct in asserting that abundance was the basis for the way America performed, the basis for our educational system, the basis for the way we treated one another, then surely it is worth pondering what will happen to us as our relative abundance diminishes. If you add to the Potter hypothesis Frederick Jackson's earlier contention that an open frontier helped to shape us, then another question must be asked. Now that the frontier has been closed for nearly 90 years and abundance is withering, have we not lost the major factors which we have distinguished our society from other societies? The late twentieth century is teaching us that fossil fuels will not last forever, that energy will not be cheap, that instead of living across a vast open continent, we seem destined increasingly to crowd into urban areas. Will accepting these lessons turn us into different human beings, less generous, less tolerant of one another, less confident and, perhaps, in the end, less effective?

I cannot subscribe to this pessimistic school of thought. In the first place abundance was *not* the basis of life for many Americans in the past. Relatively few in any generation had enough of this world's goods to feel an upsurging sense of self-satisfaction. Most Americans lived harsh difficult lives throughout each century — 17th, 18th, 19th and even the 20th. Thus, although David Potter was correct in saying that *nationally* we were well-endowed as a society it was not necessarily true that each individual enjoyed a

buoyant sense of comfort and opportunity. If this is true, then our national character cannot have been forged from abundance alone. By the same token, many of the factors which we now encounter have been encountered and surmounted in the past.

I would argue then that knowledge of the past is singularly relevant to our troubled present. Since we have lived with hardship in earlier periods there is no reason to believe that a new era in which we talk nationally about shortages and rising costs will alter our national style or change that elusive (and possibly non-existent) factor, our "national character."

Not only is the past continuously relevant but parts of it can provide clues as to current policy alternatives. In the School with which I am most happily affiliated, the LBJ School of Public Affairs, we feel that giving our graduate students some sense of the American past helps render them more effective in dealing with the American future. Studying the past may not guarantee that we will avoid the mistakes made earlier, but it can minimize the risk.

One illustration of this continuum of concern brings me to the second part of my topic, the present decade. Reading the press and the statements of many public figures might lead one to believe that never before have Americans had to fear shortages, nor worried about rising costs. This is an error. My husband, whose absence tonight permits me to talk freely about his ideas, has been speaking and writing about what he refers to as the "Fifth Kondratieff Cycle." Nicolai Kondratieff, a Soviet economist who died in Gulag, observed within the capitalist world a pattern of alternating periods when food and raw material prices are low followed by periods of increasing prices and material shortages. In applying Kondratieff's cyclical ideas to American history one can define the 1970s as the fifth moment in two hundred years when Americans have been nudged from a comfortable period when food and raw material prices were low into the more painful moment when costs rise sharply and supplies are short. In earlier periods a solution to a Kondratieff upswing was achieved by opening new lands to cultivation, by discovering new mineral or other raw material sources. (For example, the opening of the American West had a dramatic diminishing effect on grain costs in the 19th century.)

Can a similar solution be found to meet the problems of the Fifth Krondratieff Upswing? Probably not. This is no longer as flexible and open a world as it was in the four previous upswings. Government policy determines in many areas the direction of investment and the patterns of growth. We must look elsewhere, in short, to

find a solution to what may very well be a period of increasing costs. It should be pointed out that, although this is a situation of which we as Americans are particularly aware, it is not limited to the United States. The energy crisis of the mid-1970s for example, visible to us at occasionally empty gas-pumps, impacted more severely on Indians in villages where cultivation depended upon tube wells powered by diesel oil. With the tripling, or quadrupling, of diesel costs, the potential for disaster within India was more severe than the inconvenience caused by higher prices within this country. Thus the problems of the Fifth Kondratieff Upswing are borne not just by developed societies but, far more accurately, by the Third World.

The 1970s, then, can be interpreted as only a phase in a long pattern of development which fairly regularly has alternated the comfortable periods of abundance with the harsher periods of shortage and inflation. The need for enlightened public policy at the present difficult moment is obvious. For the United States, however, the requirement for skillful, innovative leadership comes to a President who persuaded us to elect him on the grounds that he would *not* assert the very leadership which appears to be needed. In shedding the trappings of the Presidency which Arthur Schlesinger defined as "imperial," Mr. Carter has also come close to shedding the office of the Presidency itself. In Washington we see a President filled with goodwill, who is discovering that the tasks of public policy require the very professionalism which he scorned as a campaigner. You must understand that I say this with sadness as a person brought up to proper republicanism who lapsed later and irreversibly into the Democratic Party. Like all converts, I would like my new faith to be worthy of allegiance. (I might mention that I became a Democrat because of a credibility gap. Having labored as a pig-tailed 12-year old for a New York politician named Thomas E. Dewey, I was delighted when he assembled his young volunteers to thank us for pushing so many campaign leaflets under so many apartment house doors. Mr. Dewey, who understood the value of personal contact, walked around the room thanking each child and each young person. When he came to me, he asked my name and I obliged with my three names, Elspeth Vaughan Davies. Mr. Dewey announced that it was a lovely name and that he would remember it; I felt sure that he was telling the truth. When, a few days later, a letter on heavy bond paper with a Wall Street address came to me I was, at first, delighted. All three of my names were correctly spelled and the text of the letter was flattering; Mr. Dewey assured me that I represented the best in American youth and that he felt

sure that the two of us would work together long and productively in the Republican Party. His signature was firm and impressive. There was only one error: the letter was addressed to Mr. Elspeth Vaughan Davies. Dear Mr. Davies. This was the beginning of my career as a Democrat.)

Trusting public figures is always a risky business. One's impulse to have confidence fights a continuous and often losing battle against evidence. Watergate of course, has accentuated this problem. The dilemma of the seventies is that in the very decade when we must face the problems of inflation, high energy costs, and raw materials difficulties, associated with the Fifth Kondratieff Upswing, we need both innovative and imaginative leadership and the capacity to accept it. The 1970s, in short, is one of those moments when history turns on a hinge, when the decisions taken will color the policies of the long period ahead. For example, it is manifestly clear that by simply pursuing the policies which have helped us out of the depression and through World War II, we are not going to solve the dilemmas of this quite different world of the late twentieth century.

Texas, at least for now, is atypically fortunate. For the time being our energy situation is better than that of the Northeast and the Middle West. For the time being, our unemployment statistics are more comfortable. For the time being, we have the opportunities of growth denied to the older parts of the country. For that reason, I was particularly pleased when the Governor decided to establish a Commission on "Texas in the Year 2000" to examine the options before us and to plot some routes towards a successful solution to what may be anticipated as the problems of this region by the end of the century.

The Sunbelt within which we live may be, for the moment, the most innovative and interesting part of the country. In the Sunbelt it is easier for intellectual innovation to take place because that exercise is stimulated by the atmosphere of an upward curve. Within this country at the moment it is to the Sunbelt that new investment is moving, where increases in population occur, where the heady atmosphere of development is still possible. This relatively fortunate situation, however, imposes upon us the requirement to make the right choices in crucial areas: race, poverty, urban policy, energy, border areas, etc. These are the problems for which there are no easy answers in the back of the book. Since I would argue that Texas is in a leadership position for the rest of this century, the impact of the decisions we make over the next generation will affect not only this region but, indirectly, the country as a whole.

Thus the exercise of participating in public policy-making in the seventies is an extremely valuable exercise. Until the rise in the oil price in 1973 most of our national problems could be solved by doing better what we had done before in comparable situations. But, as we search for new energy sources, struggle to solve problems of human relations which are even more difficult than those in our past, work on the problem of maintaining peace in an unpeaceful world, we might well realize that we face issues the magnitude of which can be compared with the decisions faced in the 1780s. We have had several periods in our national life which historians have called "crucial decades." This is one of them. I would like to hope that those now in universities, when they are around 45 in the year 2000, will think that their country made wise choices in this particular crucial decade.

Thus I believe that this session of the Texas Philosophical Society is addressing precisely the right questions: the harnessing of human intelligence, the question of energy, and the ultimate challenge of maintaining high quality of life.

In an essay written in 1835, Ralph Waldo Emerson pointed to the problems which he saw the country confronting, but stressed the fact that none of them was beyond the grasp of human intelligence. Writing as he did during the Jackson administration, he sensed some of the dilemmas which were to shadow the country in the 1860s. We need not, I hope, go that divisive route again, but we need to listen to Emerson's words. He argued that, out of the challenges of the period, one could derive not only a sense of danger but also the challenge of opportunity. Specifically Emerson wrote that "this time, like all times, is a good one if we but know what to do with it." I am suggesting to you that the lessons of our past are still useful, that our intellectual resources are still abundant, and that the remarkable energies of this continent are unexpended. There is no reason to abandon faith in the American experiment.

The answer to the question posed in my title "Knowledge for What?" is simple. Knowledge for the exciting enrichment of the individual mind. Knowledge for the betterment of an always imperfect society and knowledge which may arm frail human beings against the vicissitudes of an unknown future.

Thank you.

II. ENERGY – ITS SOURCES AND SUBSTITUTES

Moderator: TRUMAN G. BLOCKER, *Houston.* Acting President, University of Texas Health Science Center at Houston.

Speaker: HARLAN J. SMITH, *Austin.* Director, McDonald Observatory.

Panelists: HOWARD BOYD, *Houston.* Chairman and Chief Policy Officer of the El Paso Company.

JOHN L. MARGRAVE, *Houston.* Professor of Chemistry, Rice University.

TERRY (MRS. J. W.) HERSHEY, *Houston.* Environmentalist.

HUMAN USES OF SPACE

Harlan J. Smith

This abstract of a much longer talk omits many important details, and essentially all of nearly 100 slides which make the ideas more graphic and clear. Readers interested in pursuing these matters should turn in particular to the very well illustrated, authoritative and accurate Colonies in Space, *by T. A. Heppenheimer, Stackpole, 1977 (also published as a paperback, 1978), and to the slightly more popular and even more eloquent Pulitzer Prize winning* The High Frontier, *Gerard K. O'Neill, Morrow, 1977 (also published as a Bantam paperback, 1978).*

The L-5 Society, 1620 North Park Avenue, Tucson, Arizona 85719, produces an excellent monthly newsletter pertaining to these developments.

The ideas expressed here come from many sources, but in particular Dr. Peter Glaser of Arthur D. Little Co., Boston, has originated the powersat concept along with many important related developments, and Professor Gerard O'Neill of Princeton deserves primary credit not only for the mass driver idea but especially for awakening us to the 20th and 21st-century, rather than 25th-century, reality of space for mankind.

Energy is probably the principal problem in the material sphere to be faced by the human race over the next 50 years.

Both in physics and common experience, *energy is defined as the ability to do work.* Given enough energy, essentially any imaginable kind of physical task can be accomplished. However, a fundamental problem with energy has arisen, since in this century the world — and especially the United States — has gotten hooked on an energy high with fossil fuels providing our major fix. Projections have been made that the continental United States will be pretty well out of oil and gas by around the turn of the century, and that the world supply of petroleum will last only a couple of decades beyond that.

What are the solutions to this problem? There is an abundance of coal, but unlimited coal utilization involves dangerous consequences, the most serious being the production of carbon dioxide. Several billion years ago the earth's atmosphere was composed largely of carbon dioxide, with almost no oxygen. This carbon dioxide was laid down through the oceans as carbonate deposits, also plant life began to convert carbon dioxide from the air into fixed carbon, depositing it underground as coal, oil, shale, and gas beds. The plants released free oxygen into the atmosphere as a by-product, incidentally making possible the development of animal life. These processes took several billion years, but gradually the atmospheric carbon dioxide was almost completely depleted and replaced by oxygen. Unfortunately, the human race is in effect trying to reverse that process over only a century. When the carbon that comes out of the ground is burned with oxygen, it goes back into the atmosphere in the form of carbon dioxide. But even small amounts of it operate as a highly effective blanketing agent, blocking the escape of infrared radiation thus raising the temperature of the earth. The difference between an ice age and a generally temperate-tropical climate for the earth is only 5 or 6 degrees average change in the earth's temperature, so the amount of carbon dioxide in the atmosphere is critical. The burning of most of the world's gas and oil along with a significant fraction of its coal, over time scales of 50 to 100 years would increase temperatures by a number of degrees. Major direct consequences would probably include expansion and northward movement of the great subtropical deserts, and the beginning of melting of the great polar ice caps with attendant rise in sea level and deep coastal flooding. While much is still controversial, the point is that the human race is already inadvertently playing games with the entire earth. The consequences need to be researched and faced while there is still time to forestall disasters. Another energy-related problem is the increase in real cost of extracting and processing essential raw materials from lower grades of resources. While in principle there are few true shortages, the use of ever lower-grade ores takes more and more energy, exacerbating the energy crisis. Also, modern food production has become immensely energy-intensive in the United States; in order to feed world populations which may reach 10 to 15 billion, a similar further call on energy will presumably occur over most of the earth.

These problems with energy, and a host of others related to overpopulation, have led many doomsday prophets to predict that civili-

zation as we know it cannot last more than another one or two generations.

I wish to suggest that the difficulty with such prophets is not necessarily that they are wrong in their facts or their logic but that their frame of reference is far too narrow. In effect they are still living in the Middle Ages, when people believed the earth was the only material body in the universe. Five hundred years ago the Copernican Revolution finally showed the earth to be only one planet out of many, and that the solar system is an immense place. Over the next few centuries it was discovered that the earth has in fact only a few millionths of the matter in the solar system, and that beyond the solar system there are nearly a trillion suns in our galaxy and nearly a trillion other galaxies scattered around the universe. Yet when human beings look to their future they nearly always tend to perceive the earth still as the center of the universe — to feel that in effect it is the only material body and that we are locked to it forever. A phrase from the Bible comes far closer to the truth; indeed with a very slight rephrasing we might well say, "Let us lift our eyes unto the skies, from whence cometh our help."

With Apollo and Skylab we have proved that we know how to get into, how to survive, and how to work in space for long periods of time. But a major flaw of our space program until now has been its one-shot character, each significant flight ending with the destruction of a $50 million piece of hardware. The solution clearly lies in the directions of building what amount to airplanes that can fly into space, do their work, fly back, land, reload, and repeat the cycle over and over again. The Space Shuttle was designed to make this possible. It will sharply cut the cost of space operations, making them routine missions instead of expensive spectaculars. Unfortunately, because the space budget has been so savagely cut over the last eight or nine years, leaving it with barely a third of the spending power it had ten years ago, many fine and important plans have died. (This is especially ironic, since NASA has outstandingly the best track record of major federal agencies, in honest, efficient operation, achieving ever more difficult missions normally in time and budget.) Nevertheless in 1980 the Shuttle should be in regular operation, opening up a wide variety of new applications including several which in the end will change the course of human evolution as few things have done since the invention of language, of fire, and of science itself.

At this point we return to questions of energy. When we do lift up our eyes, we see that there is not really a shortage. The sun

delivers to the earth continuously some 10,000 times as much energy as the human race uses in all forms put together. In fact, the sun puts out a trillion times more energy than the amount intercepted by the earth. And we know that not only has the sun supplied the earth with essentially all of its energy for the last 4.5 billion years, but that it will continue to do so for at least the next 5 billion years. As the preeminent natural source, solar energy is fundamentally non-polluting, non-destructive of the environment. The conclusion seems evident: solar energy is so overwhelmingly the ultimate energy solution for the human race that we can only wonder why so little has been done with it over the last 25 or 50 years.

Given all its advantages, there are still drawbacks with solar energy. It is diffuse, and at any ground site it is intermittent. Large areas, the size of a city, are needed to capture enough solar energy for the scale of power-plant applications. To be sure, any household roof intercepts enough solar energy to supply the ordinary needs of that house; improved architecture, simple solar water and space heaters, and before long electric roof panels will appreciably alleviate our energy problems. But large-scale electrical plants with power flowing 24 hours a day are necessary to keep our civilization going. It would be possible but immensely expensive to operate these plants with ground-collected solar energy, because of the problems of day-night cycling, clouds, atmospheric absorptions even on clear days, protection from hail and winds, and the need to build traditional standby plants of equal capacity or to build 90 percent oversize solar collectors with giant energy-storage capacity.

Ten years ago the idea was proposed of collecting solar energy in space. Apart from the high initial cost, none of the drawbacks connected with ground-base collectors apply in space. The sun shines with full brilliance at all times with higher effective intensity. Since there is no atmosphere, no protection is needed from wind. Being in orbital free fall, the structures are weightless, and thus can be made out of incredibly light-weight materials. In short, absolutely stupendous collecting structures can be built in space, even using the relatively small Shuttle, to collect solar energy 24 hours a day.

There are also some problems, of course, with solar satellite power. The principal one is how to get the energy to the ground. The most promising solution appears to be to convert the energy into radio waves and beam them to a ground antenna at a low enough density not to be harmful. The power satellite, stationed in a geosynchronous orbit staying fixed over a chosen longitude, would require a surface

area of about 100 square kilometers to collect enough sunlight to deliver 10,000 megawatts to the ground (equivalent to about ten giant nuclear plants). Nearly all of this vast surface would probably consist of a tough gossamer Dupont material called Kapton, much like a very thin saran-wrap stretched between extremely light-weight girders. These Kapton sheets would be coated to reflect the light, and their form would be relatively crude since they need only reflect sunlight into the large central focus where helium gas, heated by the collected sunlight, drives turbines to make electricity just as in a terrestrial power plant. Another method, to be sure hopelessly expensive now, would be to convert the sunlight directly into current with photocells, such as are now used to power spacecraft. Only a modest amount of effort has so far gone into learning how to mass produce the cells; once such techniques are developed the cost should drop dramatically. In particular there are encouraging prospects for turning out, almost like wallpaper, amorphous semiconductors which are able to transmute sunlight into electricity. The electricity generated in space would run through microwave generating tubes, such as the amplitrons in microwave ovens, and the radio power would feed a special antenna called a phased array approximately one mile in diameter. This antenna focuses the beam down to the earth into an area about five miles in diameter. This area would be covered by simple fence-like structures called rectanna, which convert radio waves directly back into electric current. The electricity is gathered into collecting lines which feed it into devices converting it into alternating current at the proper voltage, and put it out over power lines to the consumers. One of the intriguing aspects of this solar power satellite concept is that not a single new invention or fundamental physical discovery is required, although new inventions could certainly help to make the system more efficient and economical. Within twelve to fifteen years the first power satellite could be in operation if work is begun now. In particular, it is urgent to launch a prototype study, to learn whether there are unforeseen fundamental problems, to test the microwave beam for any serious unwanted side effects, and to get more accurate costing.

There has been some hesitation by people to consider making electricity in this way. One of the main problems has been an initial reaction of incredulity, hence the casual rejection of the idea as utter nonsense. Yet building these vast collecting stations in space would not be so difficult. Because of the absence of weight and atmosphere, construction of gigantic structures will be much easier and in principle far cheaper than on earth. For example, a simple machine has

been designed to extrude like toothpaste kilometer-long beams formed out of materials in a Shuttle bay. Aerospace engineers have been working on such problems for years, and have calculated that only about 200 workers could build one of these immense antennas in less than a year.

The basic real stumbling block has been the expense involved in lifting the materials, equipment, people and life-support into space. To solve this problem, NASA has had heavy-lift vehicles — space freighters — on the drawing boards for years, but with the draconian budget cuts of the past 8 to 10 years this project was deactivated. Such vehicles would be able to lift 500 tons, would have automatic controls so that no personnel would have to be on board (as recently demonstrated by the Russians with one of their resupply vehicles), and in the long run the cost of putting payload into space would be reduced from the Shuttle figure of $300 or $400 per pound to only $7 to $10 per pound. Studies in 1976-77 have estimated that once the heavy-lift vehicles are operating and the large prototypes have been tested, the cost of each new space solar power satellite would be only in the vicinity of $10 billion, with the costs likely to go down with continuing improvement of technology. This station cost, even with interest, seems relatively small compared to the sale value of the electricity — around $100 billion — which it would produce over a 30-year lifetime. About fifty such stations would take care of most of the central-station power needs of the United States. Five hundred would serve even greatly expanded needs of the entire world, with ecologically clean power for the whole future of mankind on earth. After the first twenty years of paying the ante to get into this game, the human race has the prospect of stupendous profits and of essentially unlimited power.

Because it will take several hundred people to construct each of these powersats, space habitats will have to be constructed. In the beginning, these must be small and spartan construction shacks. However, as time progresses, they will surely grow in size, complexity, and comfort. Such structures will require thick insulation from the long term effects of cosmic rays present in space, and therefore will be rather heavy. Since it is expensive to launch large masses of raw absorbing material from earth, even with heavy-lift vehicles, the promising solution is to get such materials from space. The moon and certain asteroids are close to the earth. A device called the mass driver would enable small asteroids to be pushed around and material to be lifted from the surface of the moon to designated places in space at exceedingly low cost after the basic system is

built. Such raw materials can be refined in space to yield their roughly 10 percent-each content of aluminum, iron, and titanium, and even greater quantities of oxygen and silicon. In turn, space factories can turn these and other elements into forms which are useful for space construction and space habitats. The high temperature and almost unlimited solar power available in space offer intriguing possibilities for such factories. A fully developed space industrial base, perhaps thirty years hence, relying very largely on materials gathered from space, would construct rapidly increasing numbers of ever more elaborate habitats. Careful attention to ecology should permit the growing of crops, animals, flowers, and grass, leading to increasingly comfortable and self-sufficient environments. Rotation of the structures would use centrifugal force to create pseudogravity toward the outer surfaces, but since this would be zero on the axis of rotation we will see a whole new dimension for weightless recreation and sports. Populations of thousands, then in time millions, of men, women, and children will regard these habitats as home. By some centuries from now, the large majority of the human race should be living off the earth.

The suggestion of building colonies on other planets is often raised, but for various reasons each of the other planets is remarkably inhospitable. Mars is the most habitable of the other places in the solar system, but even it would effectively require underground living until, after perhaps thousands of years, an entire atmosphere could be created for the planet — a truly stupendous task. Other than for scientific, mining, and tourist settlements, the other bodies in the solar system will serve primarily as unlimited sources of raw material. It follows that enormous habitats, built in space to re-create earth-like conditions, will be the choice as the human race begins its long move out to the stars.

We face frightening, in practice perhaps insoluble, problems if we try to visualize an indefinite future of centuries and millenia with ten or fifteen billion people competing for a reasonable standard of living on an earth increasingly depleted and polluted. In contrast, space offers effectively infinite amounts of energy, raw materials, and room with an endless frontier for an unlimited population should that be desired.

We do not yet see clearly the details of how this will be done, any more than Civil War balloonists could anticipate that in only a century the Dallas-Fort Worth airport with its great aircraft flying hundreds of passengers in a few hours direct to London or Hawaii. But we know it will happen. The real questions are: *when, by whom,*

and *will it be soon enough?* Present estimates are that a total of about a $100 billion spent over a period of ten to fifteen years will bring the above programs to the takeoff point, where profits and the initial serious utilizations of space begin to be possible. For comparison, this is substantially less than the cost of a Vietnam War; it is barely 3 percent of the HEW budget over that period, is only a small fraction of what will be spent over that time simply to expand our relatively conventional United States electric power system. The question is not whether we can afford it, but whether we can afford to delay. The great energy and food crises are likely to be upon us within a decade or two; by then we may need the clear promise of the space frontier to give hope and soon thereafter the beginning of fulfillment of that hope. But the time scales to develop space are considerable, and we must begin now in order to be ready in time.

It may be fortunate for the long term future of the human race that at least one civilization, the Russian, has kept its faith in space and is putting ever-growing investments into an increasingly sophisticated program rapidly outstripping our own, including space habitats and powersats in its future; also China has announced a major program in this area. But I believe that Western civilization can do it better, and that we should remain at least up with if not at the lead of this relatively peaceful and constructive competition. I expect rapid growth of the extraterrestrial, deeply Copernican, viewpoint, which sees Earth in its true light as a speck in space, inhabited by a single human race, and that an increasingly international, all-human, development of power, materials and habits will tend to ensue. There is no certainty of peace whichever way we look, but I believe that the prospects for it will improve as world leaders and peoples realize that we all have an indefinitely large bank of future resources on which to draw.

There remains to mention the grim prospects of nuclear or biological or other holocausts being unleashed on the whole human race. Once again I believe the prospects of these are reduced as we develop the peaceful resources of space for all mankind. But should such ultimate disaster ever occur, if by then there are many self-sustaining independent homes away from Earth, the prospect of the survival of our species is that much enhanced. What price tag shall we put on the human race? Some four billion years of evolution have gone into the creation of our kind, with all its faults and yet with its incredible possibilities for beauty, nobility, insight, and happiness. In a real sense our generation may be making the choices which decide whether the human race lives, and goes on eventually

to join its minds with whatever, if any, other intelligences populate the Galaxy. Is 2 or 3 percent of our federal budget too much to invest in this cause?

Beginning before 1900, the great Russian scientist and teacher Konstantine Tsiolkovsky was the first to develop the detailed and correct theory of space flight and utilization. One of his phrases should — and can — be immortal: "The earth is the cradle of man, but one does not live in the cradle forever."

Howard Boyd: Energy — the topic suggested for my comments — is at once so timely, so important, so controversial and so broad, that the strictures of time dictate that I limit myself to a specific aspect of the subject. The nature of my work has provided some acquaintanceship with the field of natural gas, and it is in relation to that aspect of the energy problem to which I would like to address myself. Furthermore, a limited time span should be specified. Inasmuch as my crystal ball is confined to intermediate ranges, I shall not undertake to look beyond the year 2000.

At the outset, let me observe that the importance of natural gas is little appreciated. When mention is made of the energy crisis, do you not immediately think in terms of oil, and picture Arabs dressed in flowing robes riding across the desert in a fleet of gold-plated Cadillacs? Do you not think that the energy crisis stemmed from the oil embargo of 1973? The impression is not totally false, but it is significantly incomplete. It ignores the role played by natural gas in our economy.

The available supply of natural gas began to decline prior to 1970. This had been forecasted by the industry a decade earlier, but few people heard the cry of alarm and fewer still responded to it. At that time natural gas supplied approximately one-third of the total energy consumed in the United States and oil about 40 percent. Over the years the use of gas had encroached upon the use of oil, and the gap between the fuels was closing rapidly. To complete the picture, in 1970 coal provided 19 percent of our energy supply and all other forms combined supplied the balance.

For household and commercial uses, natural gas supplied 20 percent more energy than did oil. What may surprise you is that even in the industrial world natural gas supplied almost twice the amount of energy supplied by oil. The big use of oil always has been in the transportation sector of our economy in which other sources of energy compete hardly at all.

The Arab embargo served a very useful purpose in dramatizing the ever-mounting dependence of the United States on foreign sources of energy. The far-reaching political implications of this dependence became immediately apparent with the embargo, and this was followed soon afterwards by the brutal shock of the economic consequences of such dependence. Whereas this country in the year prior to embargo purchased approximately $4.5 billion of foreign oil, it is now purchasing more than $35 billion per year, and the grim forecast is up, up and up. To the extent that those billions of dollars are not recycled directly or indirectly into our economy, the wealth of this country is impaired.

From the standpoint of dependence upon foreign sources, the gas picture has never been so disturbing as that of oil, and there is no scenario suggesting that it ever will. Whereas domestic oil now meets only about half of our oil requirements, domestic gas on the other hand supplies 95 percent of our gas requirements. In fact, as of today virtually 100 percent of this country's gas requirements come from the North American Continent.

The importance of natural gas is further enhanced by its inherent superior qualities. It is by all odds the cleanest burning of the fossil fuels. It is the most flexible in maintaining constant temperatures when required in industrial processes. It is the easiest to store in huge quantities by injecting it into partially depleted gas reservoirs.

The quality and price of natural gas has resulted in the attachment of that premium fuel to over 40 million homes in the United States which now house more than one-half of the country's total population. Unfortunately, the domestic supply to which this country is now attached has been declining at the rate of 4.5 percent per year. At this rate, interruption of service to Priority One users — the domestic householders — will occur in less than five years.

Natural gas, like the other fossil fuels, exists only in finite quantities. In view of the declining domestic supplies, prudence tells us that other areas and other types of energy should be explored. Exploitation of such unconventional sources of energy as solar plants in outer space, geopressured gas reserves, fusion and breeder reactors, the use of shale and tar sands, and other possible future remedies still in need of scientific and technical development — however desirable and worthy of the effort and money required to serve the future needs of society — will in fact provide little significant relief from our present plight. The lead time in any such effort will postpone beyond the year 2000 any meaningful contribution from such effort. The problem is here and now, and unfortunately there is no

instant cure. The lead time which attends even conventional solutions suggests that the curative medicine should have been applied years ago.

We must recognize the harsh truth that the benefits from conventional drilling, the importation of natural gas in liquid form, the manufacture of gas or oil from coal, and even the generation of electricity from conventional nuclear plants have lead times averaging somewhere from five to twelve years.

Even the conversion in any significant quantity of power plants to coal will require many years. Coal mines must be opened, labor willing to work underground must be recruited, railroads must be built and major alterations of the boilers must be achieved entailing expenditures of tens of billions of dollars. Moreover, electricity — however plentiful — is of little use to 40 million households with furnaces, cook stoves and water heaters fueled by gas.

For emphasis let me repeat — without new supplies, it is forecasted that within less than five years, it will be necessary to interrupt gas service to No. 1 priority customers — that is, to you and me, the householders of this country. Loss of such gas service will be disastrous. Household heating and food preparation will be impossible. The situation will be intolerable.

Still another factor aggravates the problem. Our appetite for energy is increasing at the rate of 2.5 percent per year compounded. Thus, by the turn of the century — now only 23 years away — our energy requirements will be 75 percent greater than they are today. If we are presently incapable of meeting our energy requirements, how frightening is the problem which will confront our children!

In the gas area there are at least three things which should be commenced immediately:

(1) Additional incentive should be provided to encourage greatly augmented exploration for gas in the United States, including the offshore areas of the eastern seaboard and Alaska. The form of this inducement, whether by deregulation or not, is a subject too controversial to discuss in this meeting, but greater incentive is essential.

Although some exuberant producers boast that deregulation of gas prices would put us awash in gas, my personal view, necessarily based upon the expertise of others, is that this country will not again in this century be self-sufficient in gas.

It is of no consequence which of these two views may in the future prove to have been the more reliable. Decisions must be made now and the welfare of the nation cannot be risked on the gamble that increased prices for gas will guarantee discoveries. The whole history

of gas and oil exploration has been one of surprises and uncertainty — some pleasant, some unpleasant. Additional incentive will certainly find *more* gas, but further steps must be taken to assure *enough* gas.

(2) A second course which must be pursued is the gasification of coal, the supplies of which exist in great abundance. The techniques admittedly exist. The problem is one of money. Such plants are highly capital-sensitive and the resulting gas is necessarily expensive — about $4 a million Btu. This, however is still cheaper than utilizing coal or nuclear energy to generate electricity for space heating. Coal gasification plants should be commenced promptly.

(3) One of the certain ways in which our gas supply can be augmented is through the importation of gas from several areas throughout the world where the supply greatly exceeds any foreseeable needs of the area. Countries with exportable quantities of gas include Algeria, Russia, Nigeria, Iran, Saudi Arabia, Qatar, Abu Dhabi, Indonesia, Venezuela, Colombia, Australia, and the Malaysian area. Gas from these areas can be moved in liquid form aboard cryogenic tankers by reducing the temperature to minus 260° F., at which level it is converted into a liquid and shrinks to 1/600 of its volume. In this form it can be transported at atmospheric pressure.

Objections to this source of supply are for the most part based upon misinformation. Detractors of LNG would leave the impression that it is a novel, unexplored procedure attendant with hideous potential for tragedy. In fact, it is a time-proven, extensively utilized procedure around which a major industry is developing throughout the entire world. LNG from North Africa has been delivered into England and northern France for the past thirteen years. From that same area it is now delivered into Italy, southern France, and Spain. Contracts by Germany, Belgium, and Holland contemplate the receipt of LNG as soon as facilities can be built. LNG out of Alaska has been delivered into Japan for the past eight years. That country now imports as much LNG as the rest of the world put together. Aside from Alaska, it receives LNG from Indonesia, Brunei and Abu Dhabi. Japan is building an LNG project from Sarawak and negotiating one from Russia.

In summation, let me repeat that clear warnings of an approaching energy crisis have been ignored beyond the time permitting an orderly solution to the problem. In order to minimize the consequences of this dereliction, we must now inaugurate crash programs involving more or less conventional remedies to tide us over the

remaining quarter of this century. During that very short period of time, we must develop more advanced technologies. Several possibilities exist, but as mentioned at the outset, I will leave that era for discussion by others.

John L. Margrave: Let me talk to you this morning as a chemist and present my viewpoints on the energy problems. Probably I stand somewhere between the first two speakers. Dr. Smith took us over the next 10,000 or maybe 100,000 years and certainly described a tremendous future for civilized mankind. I share his optimism and the "doomsday" prophets don't make me feel worried about the future. On the other hand, as Mr. Boyd said, business is concerned with the present. I hope that in the laboratories and in the research activities of our civilized world we are concerned not only about what is going to happen within the next five or ten years but also, the next fifty or 100 years. I will talk in a general way about energy alternatives and then after I have done this, discuss two or three specific kinds of things that are going on in laboratories now in Texas and in the United States which I think you will be a little bit surprised to hear, especially in the light of the first talk.

Various criteria for ideal energy sources are obvious and some have been mentioned but I would like to enumerate them just for reminder purposes.

(1) We need a powerful and concentrated energy source. Solar energy suffers in this area because it is so diffuse. You can get a lot of energy from the sun but it is spread out over thousands of acres so it is hard to collect and convert it.

(2) We need an energy source that is conveniently attainable. Of course, oil or natural gas gushing from a single wellhead have given us conveniently attainable materials.

(3) We need an energy source that is conveniently used. Nowadays we tend to regard gas and oil as "convenient" but a lot of engineering/science/development have gone into building your car engine, making gas burners that ignite automatically and keep your water hot, etc. Nevertheless, from the viewpoint of a practicing consumer, these matters are conveniently used. If you talk about more exotic chemical materials, or even about solar energy itself, they are not so convenient. You can see the sun; it is warm; and you realize that it can provide energy for use but you know it is not too convenient.

(4) Economics plays a vital role in all of these comparisons. The economic factor, again and again, becomes important although it is not listed as number one and I don't think it should be listed as number one. One has to compare what you really want and what

society wants with the economic sacrifices involved. Finally, there are other practical economic aspects like portability and transportability; for example, LNG is being carried in barges literally throughout the world.

(5) We need interconvertibility. Although you can carry LNG to the spot where you are ready to use it you don't really want to use LNG, you want to use heat. It is better to convert LNG to a chemical material in our world of polyethylene, polypropylene, polystyrene, etc. Those kinds of chemicals also come from oil and from natural gas so interconvertibility, both into various forms of energy as well as into chemical forms which can be conveniently applied for our civilized needs, are important.

(6) Environmental cleanliness and non-toxic materials are a necessity because fuels have to be handled by people and one is very concerned with the effluents which are produced. You have heard many comments about the sulfur content of coal but you may not have heard that in some of the coal-burning European countries because of the high concentration of sulfur dioxide in the effluent gases the rain is actually an "acid rain." The pH can be below 5 and almost literally dissolves cement or carbonate rocks when it strikes. The prevailing winds are such that the coal smoke from England leads to acid rains in Norway and Sweden. The German coal burners cause acid rain further to the East so one doesn't know sometimes where harm is being done. It is someone else that suffers. Problems of this sort are extremely important; they may be environmentally catastrophic. What is the influence of "acid rain" on forests and natural life as well as on the people in the buildings, etc.? This is a very important topic.

(7) Finally, renewability or the availability of an infinite supply is a critical factor. For a short time, when we didn't know too much about our civilization and how it could develop, we thought we had plenty of oil and gas. When I was in high school there was talk of running out of oil, and this has been said for about 40 years that I can remember. The infinite supply of solar energy available from the sun is obviously one solution to our problem, if we can handle it in a scientific manner.

Now that I have reviewed these general criteria, I would like to review the general energy producing systems. You have heard of most of them and I won't say much about those with which you are familiar. Some of the most promising haven't been mentioned yet, and one that I feel may be the most important hasn't been mentioned at all in the conversations I have heard today.

(1) Most familiar among the available energy producing systems are oil, gas, coal and gas from coal, or synthetic fuel from coal. This latter technology which was developed extensively in Europe during World War II, has been further developed by the American oil companies and other companies throughout the world. It is practical now to produce natural gas and synthetic fuels from coal; the promlems are mainly economic and environmental. How much of the country would we have to dig up to get to the coal that is underground? What do we have to do to renew the land after we have gotten the coal? Can we avoid the creation of "strip pits" and wastelands and, instead, leave the area with grazing land or agriculturally significant land?

(2) We have talked about solar energy and I will come back to this in a few minutes.

(3) We have heard about fission energy. I won't say much about this but I will point out that we do have a very high level of technical competence in producing electric power and heat from these plants which make use of uranium, plutonium, and other elements.

(4) We have a program which is almost as far out as Dr. Smith's talk in terms of futurism — the development of fusion energy. This is still a research program even though we have already spent several billions of dollars in the development of fusion programs since 1950 when the hydrogen bomb was first developed. Someone obviously said, "Why have a bomb? Why not have this power liberated over a finite period of time in a controlled way and get the energy in a useful form?" There has been a tremendous effort, particularly in the United States and Great Britain, France, Japan, Germany and Russia to initiate and control the deuterium-deuterium or the deuterium-tritium reactions. These make use of what, in many ways, is an almost infinite supply of potential energy, i.e., the water in the oceans which has a small percentage of deuterium. We can make tritium for our use.

(5) There are still some other energy sources I haven't talked about and you may have thought of them. One of them is the biomass energy source. This means burn wood or cellulose to those of you who want it straight and simple. That is really not a sophisticated way to generate energy but if one were to cultivate certain agricultural crops on land receiving the diffuse solar energy and selected a crop which produced a maximum amount of burnable material per energy unit received from the sun, one can in fact make a competitive argument. The generation of energy by growing burnable material, burning it, then reseeding the plot and doing the same thing the

next year actually makes sense. There are persons who are exploring particular semitropical areas — Houston — and farther south.

Biomass is a very practical way to produce energy and, in addition, one can carry out simple chemical processing like fermentation, pyrolysis and distillation to produce chemicals like methyl alcohol, ethyl alcohol, acetone, etc. One can lay the groundwork for a chemical supporting program along with energy production so that there is a place in the energy problem for the biologist and the agriculturist to "grow energy" as well as food. This is an energy conversion process. It is a tricky way to use the sun's energy and convert it into a burnable material.

(6) Now, let me talk about an argument which I think will rate very high if you grade the energy sources — the geothermal idea, i.e., the use of the heat of the inside of the earth. As one proceeds toward the center of the earth, the average temperature of the rocks increases. This is evident sometimes by volcanoes and hot springs; in California in the Napa Valley, for instance, if you tap the right places you get actual jets of steam or superheated water which come from lower regions of the earth. This geothermal energy resource is fairly extensive in terms of the actual steam sources like the Napa Valley or in Northern Mexico. On the Baha peninsula there is a geothermal conversion plant. Also, at the Los Alamos Laboratories, they have been exploring the idea of making a big crack in the earth — perhaps a foot wide and two or three miles deep — and actually sending water down into this crack, heating it up and bringing it back up as hot water. One can set up a cycle to pump some cold water down into the lower regions of the earth, warm it up, bring it back, and get energy conversion either to generate electricity, run machinery, etc. This idea, including the massive engineering in terms of making cracks and creating subterranean cavities, is possible with nuclear energy. Again, economics plays a role, but there is a possibility that geothermal energy of this latter sort would be important. One nice thing about geothermal energy from this approach is that the crack in the earth can be anywhere, and this is important. Geothermal energy is available everywhere in the world!

(7) Finally, let me discuss the system which received my Number One rating (and being a college professor, I did undertake the difficult and controversial task of grading all of the energy systems). Obviously, I should tell you about the grading chart that I used, and the various rules as stated in Table I. The Number One system, which hasn't been mentioned yet, involves the use of the element hydrogen. Number Two, as you see from the rating scheme,

was geothermal energy; Number Three was solar energy; Number Four was fision energy — uranium, thorium, and plutonium; Number Five was biomass energy; Numbers Six and Seven were oil, gas and coal. The reason for oil and gas being rated so low is not because I don't like their current prices, but we are going to run out. They lose so much in that part of the evaluation that all these other convenient things drop by the wayside. Coal has a terrific set of environmental drawbacks. Last on my list was fusion energy. I put it down there because this is still a frontier research program. Someone may make a breakthrough and take fusion from Number Eight to Number One or Two, but who can predict whether it is $200 billion and twenty years more or a hundred years more? One cannot say!

Among the attractive things about a hydrogen-based energy system are the following: (1) Hydrogen as an energy source is based on water. What one does in a system based on hydrogen energy is to obtain the high energy form, elemental hydrogen from water and then burn the hydrogen to produce energy. (2) One can use hydrogen in lieu of natural gas to pipe around where you want your energy to be used. (3) Elemental hydrogen is a very interesting chemical reactant. For instance, with carbon monoxide, it can be reacted to make methanol (wood alcohol), ethyl alcohol and many other basic chemical materials. One can imagine a system of energy handling, storage and transport based on elemental hydrogen and carbon monoxide, both very available chemical materials. In spite of the claim to fame of CO as a toxic material, it is no more dangerous than many other gases. It is a matter of definition. Is nitrogen from the air very toxic? If this room were filled with only nitrogen, we would all die, because we would have no oxygen. Toxicity is all relative, in some respects and a little bit of everything is sometimes useful. Green plants, for instance, contrary to the usual belief, do not only take carbon dioxide and water to make carbohydrates, but also they exude some carbon monoxide.

I am reminded of a story. In the Loop in the Chicago area some environmental studies were being made of the carbon monoxide concentration during peak rush hours of the automobile traffic, when we would predict a very high carbon monoxide concentration. Very early one morning, in order to get a controlled reference point the same scientists went into the Loop and measured the carbon monoxide concentration but it turned out to be quite significant even then. In order to avoid the possibility that the CO came from inefficient burning of natural gas or other materials by the people living

in the area, the next air samples were taken out on Lake Michigan where one expects the air to be fresh and clean. Samples taken out there also showed high CO concentrations. It turns out that the green plants in Lake Michigan are apparently producing and exuding carbon monoxide in amounts comparable with the CO from the automobiles being driven in the Loop! Before one interprets chemistry or simple tests on any kind of a system, he must be very careful.

Let me comment some more about the hydrogen energy system. One nice thing about hydrogen is that when you burn it in air the product is water, which starts you back in the cycle. One has an endless source of recyclable material which you can use for energy production.

With regard to solar energy I would like to tell you about an experience I had just a couple of weeks ago. After listening to the first speaker this morning I find it important to mention today. Most of you are aware that the "energy arm" of the Federal Government, originally the AEC, then the Energy Research and Development Administration (ERDA) is now the Department of Energy (DOE). There was a real commitment made about two years ago to establish a Solar Energy Research Institute, with a worldwide research and development program. This is not a futuristic thing, it has now been established. There were some 20 competitive proposals to operate this Solar Energy Research Institute, two of which were from Texas. The two Texas proposals were not funded. The Solar Energy Institute, SERI as it is called, is located in Golden, Colorado. It has a budget this year of $5 million per year and in five years it could go up to $50 million a year.

The Solar Energy Research Institute and DOE are currently involved in a number of studies but I would like to tell you about two of them. One is a system using a large number of solar energy collectors, heliostats, on a large field of land to focus the solar energy onto a reactor at the peak of a tower. This is the so-called "tower of power" concept which has been popularized in the *Scientific American* and other news media. One of the leading researchers in the field is Professor A. F. Hildebrandt from the University of Houston. Several others of us who work in the area of high temperature chemistry also are involved. The tower of power which is located in Albuquerque, New Mexico, is 180 feet tall. It collects 5 megawatts of solar energy from a field containing some two or three hundred mirrors, each 25 feet x 25 feet. This energy is incident on a receiving surface and can be used either to prepare super-heated steam and then generate electrical power, or one can do some kind of chemical processing. For example, two of the proposals are to dissociate

water, get hydrogen and produce my super desirable hydrogen economy. Another one of the ideas is to start mining the dirt on earth. Why go to the moon to mine dirt? Average dirt dug up out of the yard contains aluminum, iron, silicon, titanium, vanadium, uranium, and many other elements in every shovel-full. The technology to separate those elements is probably available. Certainly there are elements like iron and aluminum which are now prepared by energetically intensive processes which could make use of solar power. Additionally, mineral extractions could be done with a solar energy device. These are real developments — solar energy is already being applied to various kinds of systems at several U. S. and other sites. Some of the predictions Dr. Smith made about the long-term future may, in fact, be upon us within another decade.

Let me close by making some general comments about what chemists can do about energy problems. We can do many useful things. For example, we can help unravel the intricacies of the earth or the environment when we want to make use of chemical materials. Chemists know that all of chemistry has not been done. We have at least 106 elements and many of the ways of putting them together have not yet been checked out. That is not because we are lazy; some reactions are hard to do and some are very tricky to do in definitive ways. There is a future which is still quite promising in synthetic chemistry. One can anticipate new fuels, new ways to combine atoms, new ways to use atoms and molecules. Thus, one can keep atoms separated and then let them interact under very carefully controlled conditions or even remove some of the electrons and let ions get into the act. The energies of ionic reactions are even higher, more energy is evolved than in atomic or molecular reactions. These are some of the very promising new ideas in the area of chemical reactions.

There is a class of materials called metastable materials. All of us humans are metastable; in our atmosphere of oxygen we should all burn spontaneously to carbon dioxide and water. In other words, we shouldn't be here. There are other examples of chemical materials of this same sort. Some of them are probably on your bathroom medicine shelf. Hydrogen peroxide is a metastable material. It shouldn't exist at room temperature and at ordinary pressure. It should decompose to water and oxygen. If one adds a catalyst to such a material, he can get it to decompose. One of the functions of chemists and chemical engineers is to find catalysts which assist metastable materials to rearrange and liberate their chemical potential energy when you want it and not to do it as in an explosion. Acetylene is another metastable chemical material. Usually one doesn't de-

compose acetylene but burns it. The reason there is such a high energy yield when acetylene burns is because of its metastability.

Lastly, let me talk about materials needs. Mr. Boyd mentioned a few minutes ago that a major problem in handling liquified natural gas was an alloy problem, i.e., knowing what materials — what elements — should be in the alloy. There are many, many problems of this sort and of course more are being recognized every day. For instance, we need better materials for anti-friction applications. One of the reasons we don't get full use of our energy resources is that we have not learned to minimize friction. Other new materials needed for use in energy systems are corrosion-resistant alloys of the sort that we discussed in connection with the liquified natural gas. We also need materials that will survive at higher temperatures. If we are going to have fusion energy from a nuclear reaction that takes place at millions of degrees, it will be necessary to have some super high-temperature materials, and chemists are continuing their search for these kinds of things.

That's the energy field as a chemist sees it at the moment. Of course, one needs to recognize that the "energy problem" is really a "people problem." Total energy requirements are calculated by multiplying individual energy needs times the number of persons alive at a given time. There is clearly a maximum number of persons which our finite earth can support in a given life-style. Uncontrolled, unplanned population explosions will accentuate the energy problem and population control will be an important part of a sensible solution to the problem.

I still think that one needs to be optimistic. In spite of the slow and sometimes bumbling activities of our government, we now have a Solar Energy Research Institute of significant proportions which can become a very important contributor to progress in resolving our energy needs.

In spite of the fact that we already know a lot about the chemistry and physics of materials we are making new discoveries regularly. One can assume that within the next 25 or 30 years there will be discoveries in science and engineering that enable us to bridge the gap and get over into the period when fusion can supply our needs. If we are unsuccessful and have to make an exodus to space, we will at least go into that period of civilization with sufficient sophistication to be able to make the jump.

By the year 2,000, our current energy problem will be history. Science and society will have made another step forward in the evolution of a better civilization!

GRADING CHART FOR ENERGY OPTIONS

CRITERION → / SOURCE ↓	Concentrated	Conveniently Attainable	Convenient To Use	Economics	Inter-convertibility	Trans-portability	Environmental Factors	Renewability or Infinite Source	Future Expectations	Grade
*OPTANE	A	A	A	A	A	A	A	A	A	A
OIL/GAS	B	A	A	A-F	B	B	C	D-F	C	B-
COAL/GAS	B	B	B	B	B	B	C-	C	C	B-
BIOMASS	C	B	C	B	B-	B	C	A	B	B-
H_2/ROH	A	B	A-	A-	B	B	A	A	B	A-
SOLAR	C-	B	C	A	C**	C**	A	A	A	B
GEOTHERMAL	C	B	C	A	C	B	A	A	A	B
FISSION	A+	C	C	B	B	C	B-D	B	A-	B-
**FUSION	A+	D**	C	D**	C	C	B-D	A	A	C/C+

*The hypothetical perfect source

**Still a research field; prototype reactor not available

Mrs. Terry (J. W.) Hershey: There is a mythical beast abroad in the land. Its appearance varies with the perception of the viewer, as does its call, reported to range from an angry shriek to a sorrowful wail. Mythical because it exists mostly in the imagination, it was invented because he was needed as a scapegoat — and perhaps as a conscience of the community. Like Pogo's enemy, he is us — and he is an environmentalist.

Only the hardest core member of the "what has posterity done for me lately" school can disclaim concern for our planets; only the most incurious can ignore increasing evidence of health hazards created by additives to our air and water; only a recluse can remain oblivious to people-jams created by our specie's over-multiplication. We all want a livable quality of life. But if we are all some part environmentalist, why do some of us call others of us "obstructionist no-growth advocates" instead of "realists preoccupied with cause and effect in our ecosystem"? The word "environmentalist" has become a catchall term so general it lacks meaning.

We all share loyalties between the "special interests" from which we obtain our livelihoods and the "public interest" wherein lies the protection of the commons. We all are aware of the dilemma caused by "present money" versus "future quality." But we lessen our commonality when we label some of us "environmentalists" and set these few up as straw men.

When Truman called to ask me to be on this program I was in Colorado minding my own business, picking organic peas and chopping thistles so Jake wouldn't spray herbicides. But Jake was in Houston and took the call. On the theory that I seem to be talking about dire concerns all the time anyway and that I might as well talk about them in Galveston, he accepted for me. When I returned and discovered the topic — energy — I called Truman to proffer someone more versed in the field. He countered with, "I want an environmentalist on the program." (The real clincher was that the program was in the mail.)

The thinking of both these gentlemen, apparently shared by many, is that an environmentalist perceives himself as an instant expert on any topic. The cart is before the horse. When someone is an expert in a field he perceives its hazards clearly. The severest critics of our energy record come from within the ranks. As a thinking citizen I can make the general observations that nuclear is expensive and dangerous; that mining of coal is destructive of the land and air; that fossil fuels are finite, may never work, and fusion uncontained. Personally, I prefer conservation because it is im-

mediate, cheap, and has no moving parts. Then I could spend my allotted time talking about good flood plain management and the federal flood insurance program, about which I have knowledge.

But that would be a copout because, oddly enough in this group, my degree is philosophy. While I object strenuously to an environmentalist being considered an instant expert, I have no such qualms about a philosopher. We are taught to look at the big picture. When civilizations and their cosmic thoughts parade through my textbooks I wonder why, if they were so smart, they collapsed. With only a few exceptions in 6000 years man has not been able to continue a progressive civilization in one locality for more than 30 to 70 generations, or 750 to 1750 years. With over-simplification one can divide the causes of decline into two: socio-political and environmental. I maintain the second is the more important.

For instance, deforestation. Its ravages make a recurrent theme. Cleared uplands for cropland and firewood followed by sister evils, over-grazing, erosion and salinization, probably played central roles in ending the Mesopotamian era. Soil erosion has demonstrated its ability to undermine nations regardless of socio-economic conditions. When the topsoil is gone and the wood to light fires, people starve — or move. Ancient people who did not cope with environmental threats perished as their lands became desolate, or invaded other regions. They threw massive amounts of people and/or slaves into vast public work programs to build irrigation systems and flood control devices. These solutions did not work then and they don't work now.

The extent to which long term water resource, land, agricultural and populations problems can be solved through modern science and technology is speculative. Certainly new inventions, new forms of energy, machinery, medicine, birth control techniques, biocides and fertilizers are not without their limitations vis a vis man and nature. Which brings me back to the topic at hand — energy — and my own peculiar problems with it.

Not only am I a philosopher, I am a frustrated librarian with a vast reluctance to emerge from tree-protected bower into the littered, polluted and congested environment of Houston; ergo I hoard information in my busy room where I dwell among heaps of literature awaiting osmosis. My euphoria persists until someone asks me to talk on something which requires documentation. The knee-jerk reaction is a frantic perusing of unread current periodicals since last year's info is out of date — and a cleaning out of files. This leads eventually to more snippets of information than could be used had I the whole program to myself, a deadline and a sheaf of blank

paper — and neater files awaiting another request on the same subject, at which time the files will again be dated. But this time I am additionally confused as to what an environmentalist is expected to say about energy.

I will start with one which is akin to my water knowledge — hydroelectric power and dams. High dams have been viewed as marvels of technology providing water storage, flood control, recreation and energy. Yet they often create more problems than they solve and are super expensive. Silt, a precious commodity if kept on or returned to the land, fills up reservoirs hindering storage capacity and depressing power generation. The land below the dam, now deprived of its periodic infusion of topsoil, must be replenished with expensive and polluting chemical fertilizers, which take energy to make.

Dams raise water tables; permanently sodden subsoils lead to a fatal buildup of salts. Water is lost to evaporation and seepage. For instance, evaporation at Egypt's High Dam represents one quarter of the normal flow of the mile at Aswan, and seepage has exceeded expectations by 100 percent. Disruption of habitat leads, in humans, to a loss of identity and self reliance. In other species it usually means extinction. In the United States we are struggling with the mitigation philosophy. But who purchases habitat for displaced creatures and where, with over one million of prime agricultural land going out of production yearly, lost to urban sprawl, highway and airport development.

Seismologists have convincing evidence that the weight of massive man-made reservoirs increase the risk of earthquakes. Dams adversely affect coastal fisheries and estuarine protein production. After a few productive years as fisheries themselves, they tend to taper off. Distances to transport hydroelectric power tend to be long and costly. Another problem aggravated by the damming of water courses is the proliferation of water hyacinth and other aquatic weeds. Under controlled conditions, hyacinths have potential for water purification; in excess, they pollute. Perhaps the most productive plant on earth, the hyacinth has spread throughout the world in the still, fertilized waters of lakes and irrigation ditches. A possible source of fertilizer themselves, and perhaps methane gas, they are useful in removing toxic metals were the task of harvesting them less complex. Dams also break. Our monitoring systems have been practically non-existent until the recent dam-breaking-caused fatalities have given new impetus to the CORPS recommended correction work — which will run into billions.

Although the global use of energy has tripled in the last 25 years, in some places the availability of water is even a greater restraint on energy production. A single gasification plant producing seven million cubic meters of burnable gas per day could require as much as 25 million cubic meters of water a year. In America most of our coal reserves — estimated at 437 billion tons — are located in the arid West where the competition for water is already severe. However, Secretary Andrus predicted this year that the bulk of coal production will continue in the short term to come from private and state lands in the East and Midwest.

Although conversion to coal would create new jobs, the health effects of mining include the threat of black lung disease and cancer-producing pollutants when coal is burned. The burning releases sulphur dioxide, nitrogen oxide, benzophyrene, sulphates and 14 toxic metals into the air, and these pollutants are hard to control. One EPA study showed emissions produced in the Midwest turned up in smog over New Jersey. Sulphur dioxide alone is cause for concern, increasing the incidence of asthma, bronchitis, emphysema and lung cancer. It eats away iron, steel and marble and stunts plant growth, even affecting aquatic life adversely. However, an anti-pollution device which would remove more than 90% of the sulphur dioxide was recently revealed in Gary, Indiana. Hailed as an evironmental breakthrough, the process would also recover sulphur and sodium sulphate for industrial reuse. EPA spent $5.5 million developing the technique, and the public service utility company spent $12.5 million installing the equipment and $200,000 monthly to maintain the system. But this will not help the problems generated by carbon dioxide emission, which is predicted could cause enough waste heat to melt the polar ice caps and put New Orleans under water in 60 years and Houston in 170 years. There is still enough time to get out. An all-coal policy is called "tantamount to suicide" — albeit slowly. Carbon dioxide levels have risen 13 percent since the industrial revolution, trapping solar heat normally radiated back into space to produce the "greenhouse effect" that some weather experts claim is raising atmospheric temperatures.

Aside from these problems, and many experts agree that the proposed coal-intensive program could not meet current clear air standards even if BACT (Best Available Control Technology) were used, which would add up to 10 percent of new plants themselves costing into the hundreds of millions. To double the coal production of 1985, the GAO estimates that capital expenditures must be increased to more than $26 billion, and raising that amount of capi-

tal will be difficult. Problems with labor must be resolved and a degree of stability introduced into mine labor. Problems transporting coal from mine to market are complex.

There is no way I can analyze the nuclear problems given the time allowed. Foremost, after a generation of study, the disposal of waste remains unsolved. The GAO estimated that at the end of 1976 3000 tons of spent reactor fuel was stored in pools at reactor sites and by the end of 1983 there will be 13,000 tons. The Nuclear Regulatory Commission is currently considering requests for pool enlargement at 36 reactors and the House Commerce Committee reports that at least 20 reactors may be forced to shut down if storage space is not provided. According to a report prepared for ERDA, there were 18 leaks in one storage unit letting 1.6-million liters of high level waste escape into the surrounding soil and smaller losses reported at 8 other storage areas. When the British discovered 10,000 drums leaking as a result of corrosion in 1976 they removed them from the concrete bunkers and dumped them into the Atlantic at a cost of 250,000 pounds and unknown cost to the marine environment. In his Energy Plan, Carter has proposed buying back spent fuel from foreign reactors fueled with United States uranium.

Water is again a problem. Nuclear generating plants require more of it than steam generating plants powered by coal or oil. There is disagreement about cooling water being contaminated with radio activity; thermal pollution presents a problem. The threat of nuclear to ground and surface waters is alone enough to deter pursuing this alternate.

An estimate based on a computer analysis program says the United States will need 5,000 nuclear power plants of 1000 megawatt size when petroleum ceases to be a viable source in 50 years. In a report to the Club of Rome, the analysis predicts climbing oil prices for the rest of the century to a level approximately 50 percent higher than current prices. Amory Lovins in an address to the Energy Subcommittee to the Government Operations Commission, put it this way: "To supply by nuclear power a mere quarter of the officially projected energy needs by 2000, we would need to order a new 1000 megawatt plant every 4.7 days starting today. This would require 130 billion dollars in capital investment per year." Yet domestic orders, net of cancellations, were approximately zero for several years and show every sign of continuing that way indefinitely. Apparently all reactor vendors, both here and abroad, are losing their shirts, staying in business only by supplementing back orders

with exports paid for by the Import-Export Bank and similar bodies. Nuclear energy simply has not met the test of the marketplace.

In the Texas Pollution Report which came out December 7, New York Assistant Attorney General John Shea warned that taxpayers in Texas could be saddled with a more than $1-billion clean-up bill for every 1000 MW of nuclear power generating capacity brought on line in the State. In an address to the State Bar Energy Symposium, he said that costs of decontaminating and decommissioning (D&D) nuclear reactors and fuel reprocessing plants have not been taken into account at state or federal levels. He alluded to the South Texas Nuclear project and other facilities planned for Texas. Recognizing that reactors have an estimated reliable lifetime of some 30 years, it has been calculated that the D&D cost will be about 245 percent of the cost of the original facility in the year built. Using escalation factors of four, six and eight percent, the D&D cost could be between 78 percent to 241 percent of original cost. Accepting a figure of around $1,300 per KW for construction of a 1000 MW power generating facility, Shea says D&D could range between $1.1-billion and $3.13-billion even though the plan may have cost no more than $1.3-billion to construct and bring on line. He said Texans should take a hard look at some legislation to protect society from the costs and hazards of facility retirement — and perpetual care of the wastes.

The worsening economics of uranium is illustrated by the lawsuit between Westinghouse and 27 United States utility companies who are suing the company for reneging on a 20-year-old contract to sell uranium at $9.50 a pound when the world price is now over $40 a pound and predicted to be $200 to $300 by the mid 1980's. The United States will probably become dependent on imported supplies by 1985.

Probably the greatest hazards of nuclear power is that it is the driving force behind the proliferation of atomic bombs around the world. Nuclear power not only spreads the equipment, knowledge and material needed to make bomb materials, it is also increasing spreading the bomb materials themselves. To make strontium 90, cesium 137 and plutonium 239 more accessible to terrorists is to put the world at their mercy. Plutonium's threat to life is more than the explosions it can produce. A particle the size of a grain of pollen causes lung cancer if inhaled; a typical plant produces several hundred pounds a year, and it takes one-half million years to lose its killing power. The terrible need for security systems this entails is mind boggling — and military-might creating.

There are cheaper, safer ways of getting off the OPEC hook. "Appropriate Technology" is the new call to sanity. The cheapest and quickest is conservation. Waste is the largest untapped energy resource. We waste as much as 50 percent by inefficiencies and non-beneficial application. Anyone who views the blaze after dark or sits in a traffic jam with one-occupant gas guzzlers must agree. But conservation is not easily achieved by urging us to turn out the lights. Rare is the individual who will sacrifice immediate comfort for future good. Two schools of psychology joust as how best to make us do right. One says the only effective strategy is to offer incentives or penalties to change our behavior patterns. This school points to the failure of government propaganda campaigns. In spite of billboards urging us to share a ride and "not be fuelish," Americans are using more gas and electricity than ever. We set an all time record last summer, according to Department of Energy. During the 100-day summer driving period in 1977, some 3.7-billion gallons were consumed, 317 million gallons per day for the 136-million registered drivers, up 3 percent from last year. In the South Central section which contains Texas, some 5-million more gallons were used than in the summer of 1973, and 3-million more than the same period in 1976. So if pleas and higher gas prices don't phase us, let's look at the other school of thought. In contrast to the behaviorists, this school argues that paying people to conserve will compound the problem; conservation will come to depend on external motives and thus be as temporary as the incentives. Only by changing attitudes, accepting conservationist values will people adopt enduring patterns of energy consumption. A third alternative might be to influence groups, rather than individuals.

This is the education versus chaos bit again. Only if we clearly perceive future dangers as greater than present pleasures will we change our ways — and then only if there are mechanisms firmly in place to make those of us who are not so perceptive go along. Everyone seems to agree that price is the greatest persuader, which would argue for deregulation and charging erstwhile "hidden costs" of all processes including clean-up to the product so we could know our options of choice. I have brought along examples of conservation exhortations, one from the Houston *Post,* one from the League of Women Voters, and one from the government. That one is unique in that it extols greenery as energy savings. Much energy can be saved by a return to architecture oriented to the ecosystem — windows that open, insulation, overhangs or sun windows depending on the climate, wind orientation, etc.

Conservation is obviously the most immediate, obvious way to energy independence not only from the Arabs, but from the utility bills as well. President Carter's program leans heavily on conservation with a broad spectrum of initiatives including price reform, subsidies, taxes, and mandatory measures to induce more energy efficient consumer choices.

There is still the "technology will save us" school. Inventing things is more fun, challenging, than turning off the lights and walking. Leading contender is solar energy — and those who blithely dismiss it as "in the future" haven't been doing their homework. It is the original "appropriate technology," the *people* are using it, doing it. My files are rife with articles, pictures, and clippings of solar in action. Even the government, after a slow and underfunded start, is finally getting into the act. ERDA is locating its first solar thermal demonstration project in Barstow, California, which will be operated by a team of utilities.

EPA cost sharing is funding a solar-powered waste treatment plant in Wilton, Maine. The design for this won the Owens Corning Energy Conservation Award, industrial category in 1975. Two Texas cities were among nine competitors for the world's first solar electric power plant — an unusual partnership between a state government and ERDA. Municipally-owned electric companies in Austin and San Antonio sought a 100-million-dollar project which would involve the construction of a sun-powered generating station.

In Waco, Solar King and Baylor University are involved jointly in what may be another multimillion dollar project. In Lubbock, with a $2.4-million contract with Texas Tech and ERDA, a study is ongoing which could lead to a $22-million investment in Crosbyton, Texas to provide a model for smaller towns to harness power from the sun to produce steam for generating electricity. Even tiny Bridgeport, Texas is in hot pursuit of a solar system by the end of 1978. Individual solar homes and buildings are strung out across the state. We eagerly await further refinements in the solar cell. A legacy of the space program, the photovoltaic cell, composed primarily of silicone, conveniently the most abundant element on the planet, has a history of costliness. In view of this, the optimism voiced in recent months by representatives of the semi-conductor industry is extraordinary.

Although solar cells now deliver electricity at a cost of $15,000 per peak kilowatt of installed capacity, it is widely expected that the cost will drop to $1,000 by as early as 1980. That figure would put photovoltaic electricity in competition with nuclear power (which by reliable estimates now costs $1,000 KW or more). DOE is still

more optimistic, having set a goal of $500/KW by 1986 — lower than any existing power source. The consensus is that the goal is realistic. Yet DOE has allocated only $59-million to the photovoltaic research in 1977 — less than 5 percent of the nuclear budget.

The rate at which solar heating and cooling develops will depend on several factors besides technology, such as the price of gas and electricity, construction techniques, building codes, government research and incentives, availability of subsidies, loans and the development of industry-wide standards. Solar power is uniquely adaptable to different scales of economic organization. Solar collectors can be constructed in a range of sizes suitable from a single house to an entire city, thereby avoiding the huge accumulation of capital necessary for conventional power stations. Solar power can also free us from the threat of nuclear weaponry and military control.

Watch for Sun Day, May 3, when the first major celebration of solar energy's potential could turn into a nationwide event to rival Earth Day of seven years ago. Billed as an unbeat, non-controversial, pro-environment campaign, Sun Day isn't *against* anything. It is *for* solar power. Appropriate technology — geothermal, wind, methane, coconut wastes, even gas from eucalyptus trees, sunflower power (80 acres can produce enough fuel to make electric power for Tampa Bay residents), undersea kelp farms (the world's first marine energy farm), laser as the tool for controlling nuclear fusion, these and more await opportunities to lift the energy load. My favorite, however, is "eructation gases from ruminants." One article claims that one cud-chewing bovine can belch up enough methane to heat a house for a family of four. An EPA official read this article and followed it up with research contending that ordinary cow burps may rank as one of the world's major sources of hydrocarbon emissions. In the United States alone, belching cows may spew forth millions of tons of smog-producing emissions each year. Holy Cow!

Energy problems will not be solved by exclusively national decisions. The debate will test willingness of the American people to place broad, long term domestic and international interest before sectional concerns.

For instance, Sweden is the world's largest per capita oil importer at 600,000 barrels a day. The labor coalition now in power is opposing additional nuclear facilities until a safe method is found for disposing of radioactive wastes — they have six plants in operation. Their goal is to keep their annual increase in energy use to 2 percent a year by 1985, and to zero in 1990. They have a 60 cents a gallon tax on gasoline and a gas guzzler tax on autos ranging

from $500 on a VW Rabbit to $1500 on a Chevrolet Caprice. Conservation efforts seem effective because a recent United States study showed that while Sweden and the United States share the highest living standard in the world, the Swedes use only two-thirds as much energy per GNP as the Americans.

At a Council of Europe conference of its 20 member countries in November, the point was made by John Surrey, head of the Energy Programs of the United Kingdom, that so little progress has been made on energy conservation because energy prices are not conveying the right signals to consumers. Key decisions are taken by multitudes of consumers and cut across departmental barriers. Basic infrastructure decisions on motorways, urban transport, and planning do too, and are not responsive to the price mechanism.

Are the American people willing to accept austerity for future gain? The polls vary. Dr. Milton Holloway of the Texas Energy Advisory Council and Dr. John Howell, Director of the Energy Institute of Houston, were pessimistic. At an October meeting with the League of Women Voters, Dr. Howell said, "There is a huge amount of inertia in the present system. We have so much money invested in existing facilities that it will take years to make significant changes." State Land Commissioner Bob Armstrong said, "We don't want to change our life-style, but there is no more easy oil. And as far as gas, we can't afford the luxury of unrealistically low prices."

A recent poll (Marshall, 1966) concludes, "The public, which only now considers environmental pollution a serious problem, still puts other issues first and is reluctant to accept the higher costs and self sacrifices that increased regulation would bring." But a Harris survey differs, concluding that Americans have begun to show a deep skepticism about the nation's capacity for unlimited economic growth and are wary of the benefits that growth is supposed to bring. Significant majorities place a higher priority on improving human and social relationships and the quality of human life than on simply raising the standard of living. This indicates that a quiet revolution may be taking place in our national values. But not in Texas. Ten bills pertaining to energy conservation were killed in the House and Senate this year.

Frequently the charge is made that over-regulation has acerbated the energy shortage. At a recent API meeting in Houston, Frank Ikard, API President, warned that "regulation is becoming one of the growth industries, influencing decisions in matters traditionally the province of a free, competitive society." Secretary Schlesinger countered, "The oil industry loves regulation," noting that the Inter-

state Oil Comp Act Commission and the Texas Railroad Commission are regulatory bodies. "There is a hunger for regulatory mechanisms when supply exceeds demands, which disappears when demand exceeds supply." He added, "We are not asking for a change in life-style; we are simply trying to squeeze the rate of growth in energy demand from 4 percent to 2 percent." At this same meeting, George Bush emphasized the national security items underlying the energy issue and said, "The world is watching and wondering if Americans have become so fat and happy they are unwilling to sacrifice and if this will affect the country's ability to solve the energy problem."

While there is a great deal of disagreement on the merits of Carter's energy plan, it is noteworthy that labor, industry and "environmentalists" dislike it for different reasons. Frank Press, respected geophysicist now head of the Office of Science and Technology, feels that the Carter administration is committed to market pull rather than governmental push technique whenever possible. A geophysicist who holds a Ph.D. from Columbia, Press believes we have a self-correcting society which will respond if we have gone too far in regulation. He feels that government plays three distinct roles — as stimulator, regulator and prognosticator. But he feels that increased pressure for regulation comes from citizens' groups, public interest bodies and various special interest sectors. The guiding philosophy of most regulation today is one that favors the lowest possible risk as opposed to stressing the benefits that might accrue from introducing the substance or item in question. But this dichotomy must be worked out because if the country is unwilling to accept any risks we may find ourselves the victim of paranoia or paralysis that lead to greater problems. Another viewpoint involving regulation with international implications comes from Paul Colvinaux, professor of zoology at Ohio State. His vision of the future includes a slowly mounting population growth and all the problems of overcrowding without the aggressive wars which crowded people have found relief. Technology can probably find enough raw materials and energy, but other resources cannot be stretched much further — space privacy, adventures for the young, the right to sometimes do as you please. When these resources must be rationed there must be more government and bureaucracy. It is true that people have often accepted a dictatorship when resources are depleted, hoping a strong leader can regain for them a lost standard of living.

We must move ahead with a hard-nosed energy scenario for America. Yet, when Carter proferred one, to listen to the criticism

from all spectrums one would have thought he was proposing a plan to benefit him personally at the expense of everyone else, instead of acting in response to an obvious global peril that the earth's finite resources are being consumed at an ever-increasing rate. Nor would one have supposed that the sacrifices being asked for were in any way in the interests of the people asked to make them.

The count is up against the extreme difficulty that attends efforts to cut back on anything at all. People tend to develop an attachment to things that physically exist. Cars, air conditioners, exist somewhere in the process of production. In this lies their political advantage over programs that tend to reduce or eliminate them, even though those programs are in the peoples' best interest in the long run. Business make profits from them; workers earn wages from them, military fattens its budgets and bureaucracies thrive on them. *Not producing leaves a gap. A gap has no constituency.* The energy crisis requires the public to choose absence and loss — gaps — over what is visible and desirable. It is hard to get John Q. Public interested in the future rather than the present. The challenge is to find a mandate for the unseen and unfelt advantages of cutting back.

Can we do it? Can we accept the idea that, to survive, the nation's economic development must be environmentally sound, that consideration of complete environmental costs must preclude all decisions about resource management? We are part of our ecosystem and will stand or fall with it. The American dream of a chicken in every pot and a car in every garage of both our primary and secondary homes while we drive our campers in between must give way to the realities of a finite habitat, or the American Dream will turn into a nightmare.

Senator Gary Hart of Colorado ended a talk to the National Audubon Society with the following words: "The American people and their elected Representatives are engaged in a monumental task. We must refuel our national economy with new energy sources and lessen our reliance on the old. At the same time we must protect and improve our environment to insure our survival as a species on this globe. We must be willing to adjust our life-style, our values, our priorities. We won't change overnight but we can begin. *A healthy public skepticism of environmental scapegoats will help.* I believe that environmental and conservation methods are not only compatible with solving our economic energy problems but are essential ingredients of that solution."

If Senator Hart's view carries and the rest of us learn to love a gap, we may just muddle through.

III. QUALITY OF LIFE-STYLE – CHANGES

Moderator: DIANA (MRS. WILLIAM P.) HOBBY, *Houston.*

Speaker: MARION JOSEPH LEVY, JR., *Princeton, N. J.* Professor of Sociology and International Affairs.

Panelists: CHAUNCEY D. LEAKE, *San Francisco.* Professor of Pharmacology, University of California.

JAMES DICK, *Round Top.* Founder-Director of the International-Festival Institute.

WILLIAM B. BEAN, *Galveston.* Director, Institute for Humanities in Medicine and Harris Kempner Professor of Medicine, University of Texas Medical Branch.

Diana (Mrs. William P.) Hobby: We are here to talk about life-styles, which I suppose, means to most of us change. The most interesting discussion of change which I heard very recently was at a writers' conference in Houston a couple of weeks ago. The writers were responding principally to an essay which Phillip Roth wrote which was published about 1960 in which Roth said that life had become so strange and so violent that it was impossible for a writer or an artist to keep up with it. Most of the writers who spoke with that idea felt that such a view of reality was old hat, was restricted, and was superceded in our day today by acceptance of the truth that reality has always been extravagant, weird, fantastic. The idea that reality or our environment was ever tamed was a modern American idea and today's American writers feel that they are spiritually kin to those of their brothers who saw the world as fantastic, possessed, inexplicable, violent — Melville, Hawthorne, Emily Dickinson and many others. Seeing the world this way, our contemporary writers reflect a scene of fragmentation, disillusion, radical disorganization which has been found terribly distressing by many of us. But it has led to extraordinary works of imaginative creation of our worlds which range from science fiction, future projections and, of course, Dr. Harlan Smith this morning. He is speaking what is science fiction but it is true that science is not fiction.

Our speaker today is an old Galvestonian, Dr. Marion Levy, Jr. who is a Galveston native of a famous family well represented in this room. He has a degree in economics from Harvard and a Doctorate in Sociology. He has been professor of sociology in international affairs at Princeton where he now resides. He is a Chinese cultural scholar, the recipient of Ford Foundation and National Science Foundation grants. He is the author of *The Family Revolution in Modern China* and *The Structure of Society* and many other books including one that I cannot wait to get my hands on called

Levy's Six Laws of Disillusionment of the True Liberal. He is an editor of the *Journal of Behavioral Science* and the *Journal of Asian Studies* and directs a program in East Asian studies. Dr. Levy.

OUR QUEER PRESENT AND ITS FUTURE

MARION J. LEVY, JR.

Talking about the future is the academic equivalent of taking candy from a baby. It is particularly that when social scientists do it. Unless one is a pure seer, one must talk about the future primarily in terms of what we were and what we are. I am going to talk to you largely about that. I am happy to talk on the subject in Texas because, although it is against my nature, much of what I have to say is quite pessimistic, and I find Texas to be the last meaningful stronghold of optimism. Thomas Hobbes phrased the general problem of order better than any other political philosopher. He frightened us all by saying that if we do not watch our steps we shall fall back into a state of original nature — "a state of war of all against all in which life becomes solitary, poor, nasty, brutish, and short." That is not likely to be our fate at all. Our problems are really quite different. For us and for our children life is far more likely to be crowded, affluent, nasty, brutish and long. The problem of our time is an ironic one. It is an interesting problem — can human beings adjust as well to longevity, affluence and even peace as we have in the past to shortgevity, poverty and war?

In this discussion one must talk about modernization — about the modernized world. I mean by that the kind of world that all of us take very much for granted as normal and natural. It is the world of the United States, of the Soviet Union, of Japan and Germany, of England and France. I want to set out three quite simple propositions about modernization. (Incidentally, I do not use the phrase post industrial society. The reason I do not is that I think it evades all these questions by the implications that it is a radical break with its immediate past which is our present and ignores the peculiarities of that past.) Those three propositions have to do with the recency, the solvent effect, and the queerness of modernization.

Modernization is extremely recent. Modernization is a mere blip on the curve of human experience. There have been no societies of this type anywhere in the world prior to some time in the 19th century. Some of the things I'm going to talk about today even postdate World War II. It's a very recent development — it is much more recent than the industrial revolution although it grew out of

the industrial revolution. If you like, I suppose you could say there is an element of truth in Henry Adams. Modernization was fathered by the industrial revolution and mothered, dammed if you like, by the development of the electric dynamo. Humans have had no long period of time to get habituated to these patterns socially, and no where long enough to adjust biologically.

Second, although recency is a matter of degree, modernization has another characteristic that is absolutely new. Once these patterns were developed, never mind how they were developed, but once developed they constituted a universal social solvent, something never before seen on earth. Once these patterns developed it became increasingly probable that people all over the world would come into contact with them. Whenever that contact is made, regardless of how that happens, regardless of whether the people who have these patterns are beastly to others (You should give careful consideration to that word "beastly"; it is an adjective we apply to the conduct of no beast save homo sapiens.) some of these patterns diffuse — some of them are taken up. Those who take them up or are forced to take them up do not necessarily find success or happiness with them, but some changes in the direction of modernized patterns always begin. Moreover, the amount and explosiveness of these changes always seem to bear little relation to any absolute amounts of factories or the like introduced.

The third thing about modernization, and the thing that underlies all the subversiveness that is so characteristic of it, is the fact that the patterns associated with it are so exceedingly bizarre. Many of you in this room have travelled a great deal. Nowadays our children don't even have to travel to see a great deal of the variance of the world. On television they see quite good depictions of customs about the world. For all we've seen we still indulge in the conceit of thinking that if we leave our shores and go abroad we will see bizarre and unusual patterns. What we do not understand is that we at home with the things and habits we take for granted — we are the 24 carat queers of all social history. The things we do are just unbelievably bizarre by contrast with what has been par for the course for human beings throughout time. I don't intend to give you a lecture on methodology. (One of the curses of social sciences is that methods have become an end rather than a means. Only in the social sciences can one take a Ph.D. in method. In no developed science worthy of the name is that possible.) I do, however, believe that you can be really quite scientific about human beings, that you can generalize about them and that without any of the usual non-

sense about the differences between the social sciences and the natural sciences.

If we go into some of these things that are bizarre, that we take for granted, one of the first is that we educate our children for an unknown future. That's really quite extraordinary when you stop to think about it. It never happened before. For all human beings there is a kind of learning curve, and the sharpest part of the learning curve is from birth to three and is lived out by all human beings largely in a family context — that's where all human beings including our own learn to walk, talk, eat, sleep, control bodily functions and interact with other human beings. That's where we still learn to do all these things in spite of the talk about the family going out of existence and similar sociological nonsense. The difference is that everyone before modernization learned practically everything else throughout the entire life cycle in family contexts. They learned about it largely from their parents, grandparents, and great grandparents; they expected life to stretch indefinitely far ahead of them exactly as it had for their parents and grandparents. They were educated for a known future. Sometimes things did change for them, but that was not what they expected. If you draw a circle that represents the total elapsed time for an individual from birth to death, for everyone prior to modernization, regardless of what their culture may have been like, you can bet that well upward of 85%, probably upward of 95% of all human beings who ever lived spent 85% to 95% of all of their hours waking and sleeping within eyeshot and earshot of other members of their own family. You have only to think of what bizarre patterns we have in this respect. We start out as infants and all but a tiny bit of our time as infants is spent in family contexts, but as we get older time so spent goes down. It reaches its lowest point when we are in college. Then it starts up again, but over the whole life cycle it probably doesn't average out at much more than 35% or 40% of our time spent within eyeshot and earshot of other members of our families. The past uniformity for all people on earth breaks down when you get to us. Only we knowingly educate children for an unknown future and, importantly, outside of family contexts a good part of the time. Only we know the term "old fashioned" as a general epithet.

How do you educate children for an unknown future particularly given the state of the social sciences? When the young say, "How was I to know?" — how indeed are they to know? We always address the young in terms of a double set of errors. One is that we can never recall perfectly what it was like to be that age. I need hardly

point out that most of us do not have perfect recall. Even if we did, since things are not like that for them anymore, it is frequently not germane. So we have this as a fundamental new problem. Everyone until the last 150 years educated children essentially for a known future and in a family context with very rare exceptions, and we are not very sure how we go about educating children. All parents used to think they know how. Now only the most arrogant parents feel sure about this.

Closely related to this is another problem, indeed it is but another way of putting the previous problem. We take fast change for granted — we take such fast and such far-reaching changes for granted that we are almost totally unaware of how fast and far reaching those changes are. We can put it another way, demography was mentioned yesterday — in the past everyone had a short range future — but everyone had a long range view of the future. Before modernization life expectancy at birth varied between 27 and 31 years. Now it's true a large part of that had to do with infant mortality, but even if you reached 20, your life expectancy was only another 30 years or so. You in fact had a very short range future, but you had a long range view of the future — you expected life to stretch indefinitely far ahead of you as it had for your parents and grandparents. We moderns have a very long life expectancy. Life expectancy at birth in Sweden is in excess of 77 years. Life expectancy in the United States is slightly longer for females than males but still on the order of magnitude or 70 years. It may have just fallen below 70 years for males. We have a short range view of the future. We expect rapid change; and we get it. Roughly, we get really major changes every two to two and a half decades. Indeed we have not really to educate people for just one unknown future. When life expectancy at birth is in excess of 70 years, you in fact are faced with educating people for at least two or three unknown futures. Incidentally, they seem to get harder to educate as they get farther along this curve. (Our whole educational system is based on a very special conceit. We give the largest rewards in terms of money, prestige, recognition of all sorts, anything you can imagine to people who teach our children in our universities. Other things being equal in terms of income, prestige and power, university professors get more than secondary school teachers — secondary school teachers more than primary school teachers — fifth grade teachers more than fourth grade teachers. We give the greatest rewards to those who teach our children at the flattest part of their learning curves. The *real* explanation of this has to do with academic snobbery but a

mathematician I know has the *best* explanation. He says, "It's hardest to teach them at the flattest part of their learning curves.") Here again, all the world has assumed that any increase in life expectancy was a positive gain, and I don't wish to argue values with anyone just now. There are, however, some interesting implications of what life would be if, say for instance, I were your fairy godmother and waved my wand so that everyone in China could live as long as the people in Sweden with the Chinese population stabilized at zero growth rate (For otherwise they would overrun the face of the earth.). If those conditions prevailed, there would be somewhat in excess of 100 million senile Chinese. If you wheeled senile Chinese past a given point, the parade would never stop. When life expectancy at birth is in excess of 70 years, it is better than an even money bet that everyone will live to become senile.

If I were to ask you how many strangers you have seen today — you might have various views about that. You have been in the Galvez Hotel for most of the day, and most of you know one another well, but under ordinary circumstances you see hundreds of thousands of strangers in a day or in a week. So much is this so that you take it for granted and are not entirely aware of it. You take fleeting casual contacts with strangers completely for granted. Nobody else in history ever did that. You do bizarre things. You get out on places called highways moving at combined velocities, taking traffic in opposite directions, well in excess of 100 miles per hour with combined masses well in excess of two tons — you've never met any of these people before, no previous arrangements of any sort, and the surprising thing is not the number of deaths on our highways, but that anyone survives at all. You go into places called banks; you give them numbers; they give you money; and you go away and complain about being a number, a cipher on a card. If you would really like to be tortured, I would like to set up a situation for you in which you could have none of these negotiations unless you first explained to the individuals concerned who you are and they told you all about themselves. In the common lot of human kind in past history, that is the way it was. Everyone you dealt with practically knew about you from birth and you about them. That is no longer the case nor can it be in our society. It makes anthropologists and sociologists angry if you put it this way but before modernization one's attitude toward strangers was perfectly simple — one of two extremes. You either fete them or eat them. You were either very nice to them or very nasty to them, but you do not take them for granted, and we do, and we are very queer.

We take unusual organizations for granted. I have already stated that everybody in past history did the vast majority of all that he or she did in some sort of a family context. The contacts they had other than with members of the family were limited to villages, friendship groups, things of that sort. One of the greatest errors committed by modern social scientists is to speak and write as if those have become unimportant, which is not the case, but in addition to those common unspecialized organizations, we act in terms of literally thousands upon thousands of highly specialized contexts which we take for granted. We go to banks for money, to stores for purchases, to the hospitals for health care. Each of us knows without knowing hundreds and hundreds of these contexts. We do not give these a second thought. Once again, that is something exceedingly rare. We don't even give any thought to how you balance these off. We usually assume that won't be a problem. Clearly, you couldn't do this if you couldn't have fleeting casual contacts with strangers.

One of the least palatable things I have to say is about something else we take for granted. There is a universally hated word for it — centralization. We take very high levels of centralization for granted. Centralization is very interesting. It is a function of the fact that whether you like it or not modernized societies have become increasingly interdependent, and practically no one is prepared to turn his or her back on that interdependence. We see a great deal in our society of young people who say, "We will turn our backs on this — let us go back to the land; we will form a commune. We will take up some marginal land and farm it by marginal means." But we can afford them, though they are a very special luxury for us. In the past, the few overwhelmingly centralized societies in social history have been those usually of the great military conquerors — Genghis Khan, Tamerlane and the like. Not a single one of those empires long outlasted the death of the charismatic leader who founded it. Incidentally, it is not true as most of us would like to believe that human beings have ever placed a very high value on freedom as that is generally discussed. It is not true that people have in general felt that he or she governs best who governs least. What people have felt is that he or she governs best who governs most locally, and that is quite a different matter. People have taken quite high levels of organization and hierarchy for granted if it was sufficiently local. We are not going to have that, and indeed have created the special political romanticism of our times — a romanticism shared by all points on the political compass. The romanticism is that the cure for "bad" centralization (Bad centralization is whatever form of centrali-

zation we happen to dislike, and all of us dislike most of it.) is decentralization. Alas, that is almost never the case. Incidentally, even among the most convinced supporters of "going back to the good old days" there's hardly a thing proposed that doesn't escalate centralization. Even Ralph Nader nods; he wants some things decentralized; but he wants to make awfully sure the government tells the automobile companies that they must have air bags to protect us from killing ourselves. Almost all of our environmentalists wear decentralization on their sleeves, but cleaning up pollution requires more, not less, centralization. No one is going to clean up the sewage situation in the U. S. by local option. That's how it got the way it is. State and local governments as presently constituted are clearly obsolete. We talk about Japan as a quaint combination of the old and the new. She may be from certain points of view, but since 1868 there have been at least three major reformulations of state and local governments in Japan. We haven't had a comparable reform of the situation essentially since the republic was set up in this country. We have no single problem, domestic or international, that does not have its solution impeded by state and local governance as presently constituted. None of our problems cut neatly along those lines. When we try to get solutions we gerry-build solutions. We have New York Port Authorities, turnpike authorities. One man in New York set up an entire empire, entirely independent of state, local, and federal governments because he found out if you issue bonds you can be independent and set up whole highway systems. If he felt like it, he spoke very roughly to governors and held them in contempt and so forth. He understood that by playing on the interstices of that system of state and local government he could become a force unto himself — his name was Robert Moses. He was quite an extraordinary and effective man, whether harmful or not.

There is another thing about our society that is quite unusual; it crops up in all sorts of contexts. We have taken an unusual form of income distribution for granted. Prior to modernization everybody had a highly skewed income distribution. There were a few very wealthy people; there were relatively few people who could be called middle class in income; and the vast majority of people had very low incomes very close to the margin of subsistence. Again, it doesn't make any difference if you are talking about the Greek city states or China (probably the Chinese were a little wealthier overall than most) or the Trobriand Islanders. That was the form of income distribution. We have a very even form of income distribution that looks more like a bell-shaped curve. Fifteen to 25 percent

of the population, depending on how pessimistic you are, are falling further and further behind the rest, but the most pessimistic of these estimates show income being more and more evenly distributed for the top 70 percent of the population as a minimum. Under these circumstances when one shakes one's fist and says, "Power to the people" — that's the name of the problem. You may not like what we do with it — we may delegate it unwisely, but "the people" is that 70 plus percent, not the disadvantaged minority. You can do something under these circumstances if you wish, via a negative income tax. For example, you could change the shape of this curve and distribute income more evenly for all without pushing everyone to the wall. Under previous dispensations you couldn't do that without wiping out much of the capital formation on which even low-level incomes depended. That's the way it has been all through past history, and it's not that way now for the modernized.

I will mention one other thing and then draw a couple of conclusions about our future. We take peculiar things for granted with regard to sex distribution, sex roles. Here again, let me go back to the learning process for humans. From birth to three or four, little males and little females were (and still are) all handled primarily in a family context. They were handled primarily by the female side of the household. That may have been a cultural trick by a bunch of dirty-minded old men, but it was absolutely universal for human beings, and I might add it goes "further down" the mammalian order; it was also true for lions. The little males and females were (and are) always handled differently, regardless of whether they were handled by Laps or Lithuanians, by Greeks or Romans or Chinese, by Jews or Buddhists or Manichaeans, by blacks or whites or yellows or greens or reds for that matter. Beyond that point at age 4, 5 or 6 the little females were educated for adult female roles by older females, usually their mothers and sisters, and the little males usually by their fathers or older brothers. They were educated and handled on a separate basis. (Some of those peoples cared about chastity; others couldn't have cared less.) Very few things we do are more unusual in social history than coeducation. I am not against it, you understand, but it happens to be quite unusual as far as the human species is concerned.

We do one thing more unusual than that. A funny thing happened in the U. S. on the way into the twentieth century. The vast majority of males came to have the kind of jobs, occupational roles if you like to talk like a sociologist, such that they could not take the little boys with them even if they wanted to. They left the farms and went

into other forms of jobs. When that happened, for the first time in history, the vast majority of both males and females were handled largely by females from birth to adulthood. It happens that the great competing context for the time of young children was the public schools, of course, and all this happened exactly at the point in time that males largely left primary and secondary teaching in this country. Now, if you go out on the street and grab a nineteen year old and hold that nineteen year old up, you have a 50/50 chance of having grabbed a male. If you have grabbed a male, he is an unusual male in social history because here is a male of whom the following characteristics are true; he and his father and brother and all the males he will have had anything to do with would have been reared largely under the direct domination and supervision of women from birth through to adulthood. His mother and his sister and all of the girls that he has to do with will only have had to do with males so reared. That's never happened anywhere before in history; even in this country that hasn't been true on a two-generation basis for more than a decade or so. It is not only true of my son and true of me, but it happens to have been true of my father, but it wasn't true of most males of my father's age. When my father was growing up, a lot of people were still on farms, and of course as long as that was the case, this was not true. No one has ever done so before.

I want to say something in closing about the future. Given the values of most people in this room, the critical problem is what is one going to do about the problem of centralization? I leave aside the technical questions. Very few things are technologically out of the question. The more highly centralized things become, the more interdependent they become, and the greater become the problems of planning. It makes no difference if you are talking about planning in terms of corporate settings or individual settings or government settings. Those problems become greater. For planning to be effective, knowledge must increase — what frightens me is not that we will die the entropy death — we will die so eventually, but that death is millions or billions of years in the future. We have gotten quite excited about the demographic population drowning death. The real problem still is how one is going to handle problems of centralization. Here you have two problems; one is knowledge — do we have adequate knowledge to plan effectively if we must do so. Here I will call your attention to one of the things that Milton Friedman understands very well and most people do not. The market mechanism is one of the most amazing inventions of human kind. It is

the only human invention that has offset inadequate rational knowledge. The great problem is that for an increasing number of our problems no one has been able to devise a market mechanism. You cannot readily devise a market mechanism for public "goods," and what has been demonstrated earlier today is that it is probably even more difficult to devise one for public "bads." We may very well die the stupidity death. We will make the kind of errors that we cannot survive. Will our scientists, social and otherwise, be able to provide the knowledge we already need for adequate planning? No one who follows the social sciences closely can be sanguine.

Even if I could promise you adequate knowledge, I could not promise you the other requisite. That is the problem of our politicians. If I were your fairy godmother and could give you the gift of perfect knowledge, someone would still have to mobilize the will of the public to put it into effect. We don't have any solution, alas, for that either. As most of us who value freedom see this, the problem there is: How can you attain very high levels of conformity with very low levels of coercion? The problem of centralization is essentially the question of whether or not you devise and think about forms of increased centralization that will still enable us to maximize the preservation of the humanities and the civil liberties that we think are important and that we want to preserve. We are going to have increased centralization whether we will it or not! The demographic problem is one about which we may be optimistic in one sense, that is to say all peoples who have modernized have had a considerable fall in fertility. The big problem is whether you can have it quickly enough. But even if we solve it quickly, we will have great increases in centralization if only because of the present increases in the density of the population on the face of the earth.

Finally, we aren't going to solve any of these problems if we turn our backs on concepts of hard striving and progress. I think the Club of Rome represents one of the great academic scandals of human history. When Malthus said the population increases exponentially and our ability to cope with it only arithmetically, he at least had the virtue of committing a very important intellectual error. When the Club of Rome comes along 150 years later and says exactly the same thing, it is stupid. Furthermore, it is the kind of stupidity that gained a great deal of publicity and was played for that, and so it was worse than stupid — it was meretricious. The fundamental motivating force about modernization — the thing that permits its spread with or without the use of force is the following: Always in the past people's horizons of the possible have

been opened only by a crack or two at a time and those cracks were disassociated. But the Pandora's box of modernization is that it opens the horizons of the possible indefinitely greatly for human beings. This may have been gradual for the first-comers to modernization, but it is practically instantaneous and unlimited for late-comers. You are never ever going to get them closed again. No form of conservatism that says human beings must settle for less materially will ever be able to dominate the way in which human beings behave again in history, never again will large masses of people accept a miserable present in hopes of a heavenly afterlife or pie in the sky. Even after you learn that the streets of modernization are not paved with gold or oil, you will think they could have been if only we'd been smarter and better — and our children will always think they can be. Not in your history and not in mine will people forget the hope of betterment in this world. It's inconceivable that you would ever convert Texans to that point of view. We are doomed to seek betterment, progress in plain language. We may hopefully seek a progress that depollutes, but we will seek it nonetheless, and Texans are doomed to seek it hell for leather.

Levy's Ten Laws of the Disillusionment of the True Liberal

1 Large numbers of things are determined, and therefore not subject to change.

2 Anticipated events never live up to expectations.

3 That segment of the community with which one has the greatest sympathy as a liberal inevitably turns out to be one of the most narrow-minded and bigoted segments of the community. (Marion Stanley Kelley Jr.'s reformulation: Last guys don't finish nice.)

4 Always pray that your opposition be wicked. In wickedness there is a strong strain toward rationality. Therefore there is always the possibility, in theory, of handling the wicked by outthinking them.
Corollary one: Good intentions randomize behavior.
Subcorollary one: Good intentions are far more difficult to cope with than malicious behavior.
Corollary two: If good intentions are combined with stupidity, it is impossible to outthink them.
Corollary three: Any discovery is more likely to be exploited by the wicked than applied by the virtuous.

5 In unanimity there is cowardice and uncritical thinking.

6 To have a sense of humor is to be a tragic figure.

7 To know thyself is the ultimate form of aggression.

8 No amount of genius can overcome a preoccupation with detail.

9 Only God can make a random selection.
Corollary one: An omniscient being can tell a random number at a glance.

10 Eternal boredom is the price of vigilance.
Alternate Form: Eternal boredom is the price of relevance.

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Hobby: Our first panelist to respond to Dr. Levy's speech is Dr. Chauncey Leake, also another old Galvestonian. Dr. Leake is the former director of the University of Texas Medical Branch. He has retired to San Francisco and is associated with the faculty there of the University of California at San Francisco. He's a former ecologist, traveler, a former president of the American Association for the Advancement of Science and a long time member of this society, Dr. Chauncey Leake.

Chauncey Leake: I want to ask you to join me in thanks to Truman and his committee for arranging this stimulating and exciting meeting. There is another remarkable feature about it and I think this is characteristic of Texas and that is women are playing a significant part in our proceedings. In Texas there have been magnificent women who have done so much to improve the quality of life and that is what we are talking about. I think of Miss Ima Hogg in Houston of what she has done with art and music — all the cultural facilities that make a community great including mental health, and here in Galveston, Mrs. Northen — these are setting the pace which I am so glad many other women are following. This is different from other parts of the world.

We've had an exciting time, and I have a couple of comments to make — first I note that everybody is a little impressed that we may get to live some time or our children to 110 years or so. I think that's hogwash. There are certain biological constraints. We have pretty nearly come to the limits of them. We may go to 90 but to average 110 — what would it be worth living for — that's our question — can we make the longer life that we certainly are having worth the living? I think we can. It is interesting to note in connection with women and long life. Once there was a matriarchy. Women ran everything — they were the only ones who knew where babies came from. They weren't always sure; but when men began to learn that they knew something about it — this happened around 2500 B. C. or so — they began to learn and they began to throw their weight around and knocking the old matriarchies out. The great Greek myths are in a large part the reflections or tales of episodes in which the burgeoning patriarchy knocked out the matriarchy. I might add perhaps lasted too long. Now we are getting back into balance again. One of the interesting points, I think you all are biblical scholars, and know full well the significance of the fifth chapter of Genesis — that's an interpolation nothing to do with what preceded us or came after. Stuck in as a patriarchal document to make men amount to something. The

begats — not a woman in it so and so begat — always a man begat another man and lived unconscionably long. There is Methuselah 969 years but they counted those years lunar months — the lunation. Amazing that there was such a coincidence that made lunar months so important — if you count the lunar months as years as they did in the matriarchy — this is where the interpolators of the fifth chapter of Genesis forgot what they were doing. You find of course that there are 13 lunations in a solar year. So you divide Methuselah's 969 years by 13 and it comes out 74. There are a lot of people here that are older than that.

Now with regard to the improvement of the quality of life. I've been very interested in looking at a practical philosophy. It's regrettable that in our educational effort we do not give as much attention to a practical philosophy that people can understand. Unfortunately our philosophers are professionals. They develop a professional jargon which means nothing to the rest of us, and they have lost the leadership in thought which comes directly from being able to talk directly to people.

There are certain basic questions that will come up in the practical philosophy. The first is what are we living for — that goes on to what motivates us, what governs our interpersonal relations. What are our purposes or goals in general or in particular or individually or socially? What guides our conduct? What determines our mood and behaviour? Now we are learning from our neurophysiological developments that there are certain built-in mechanisms in our brains that set us in the way in which we go. But the questions that are raised here have had many answers over the many centuries and those are the ethics. The ethics are general principles relating to individual moral action. There is a distinction between morals and ethics. What are we living for? To do everything we can to promote the welfare of the group. Even at personal self-sacrifice. That can be extrapolated as it was by Jesus for example to the whole human race. The opposite to that which is the platonic or social idealism taken over and become what we commonly call the Judeo-Christian Ethic. I think the opposite to that which came along about the same time was Epicurus. He said fine that's wonderful but how about me? Where do I come in on it? That's hedonism — what am I living for — to get as much personal pleasure out of life as I can. These two principles remain in conflict. They were resolved early, however, compromised early. Remarkable, by the Chinese sages, by Buddha, and by Aristotle. Aristotle formulated the principle perhaps most successfully. What am I living for — to be in harmony

with myself and my environment. That has a modern ring. It's pertinent to remember that Aristotle probably developed that in tribute to his father who was a physician and it reflects the Hippocratic ethical position. We have many other ethical principles that have come along. We had unfortunately the Machiavellian principle — what am I living for — to get as much power as I can regardless whether the ends justify any means. This is not in accordance to what we would consider to be good. Nietzsche had the same thing, the super race that he developed. There are then unpleasant, we would think, ethical principles. We had others. What am I living for — to bring about the greatest good for the greatest number which is utilitarianism by John Stuart Mill or as William James put it, that is pragmatism — what works is good — this is the professional ethic. All professionals take that as their stands. All executives are utilitarians. They operate on the principle of trying to work out what's the greatest good for the greatest number, no matter what one's purpose may be. And I think that the Aristotilian point of being with harmony with oneself and one's environment is the sound approach. I mentioned, however, that we are learning some things about ourselves. This has to do with the work that Paul McClain is developing at the National Institute of Mental Health. The built-in cell groups in our lymbic system which is the central part of our brains — part of our reptilian brains in fact. Our evolutionary brains will grow over those primitive brains that all mammals have. But in them is this relay system where all incoming sensory stimuli pass to come for recognition in consciousness and through which all motor impulses go to glands or muscles, there are two built-in cell groups. They are, first for self-preservation — that's the food intake center operating on the glucostat as it was. When your blood sugar goes down, these cells become active and the individual becomes alert, aggressive, muscle tension goes up, the blood pressure rises — you're going after food. When you get it, put it in your mouth, digest it — blood sugar goes up — the stat shuts off. You feel comfortable, satisfied. Children, babies, often go to sleep. Another group of cells comes in a little later. Those have to do with the preservation of the species. You always have to bring sex into the picture. They operate probably on a little different mechanism. The molecules, atoms, are charged; they are ions. Positive ions tend in the metabolism of these cells to move toward the surface, negative ions stay in the center of the cell — becomes polarized. The more highly polarized it becomes the more active. The more the individual is then oriented toward a sex object and

you're after it. Alert, blood pressure goes up, muscle tension rises, you are aggressive — I needn't go on but you understand what happens: What are we living for — to be satisfied — that's built in. These mechanisms are conditionable in the Pavlovian sense. Right from the first meal you took at your mother's breast you seek that feeling of relief, comfort, relaxation, satisfaction. In order to achieve any goal it seems necessary that we have knowledge. What we are after here is to get the "truth." Truth about ourselves and our environment. Today we are talking largely about our environment. Ourselves are important too. I put truth in quotation marks because it is relative. It's always subject to change, always subject to modification as our knowledge increases. This is a feeling of science of course and its great powers dependent upon measurement. It's amazing how little attention is paid to the psychology of agreement. Yet we have to work it out when we come to the same figures — that's it whether we like it or not. That gives science its power. Now in order to apply this knowledge we have about ourselves and our environment to the achievement of our purposes, we have to apply this truth. This field here is of course the logics and the logics have been very well formulated from early times — we are still learning much about how to develop the logics. Now in the application of our knowledge to the accomplishment of our purposes we have an aesthetic problem; that is, the application now of knowledge to the purposes we have — that includes the arts and the technologies. All the technologies of course are direct applications of knowledge to the accomplishment of purposes. We're interested in our quality of life. Here of course is where the humanities play such an important role. They train judgement and it is in connection with judgement that we can most successfully apply the knowledge that we have about ourselves and our environment to the accomplishments of the purposes we may have in mind. And it is in connection with the humanities we are up against creativity — remarkable problem. Creativity means, I think, the ability to perceive and develop relationships between things or ideas that hitherto had not been thought to be related. So creativity and invention are the same sort of things and they are also enhanced by the humanities. We have then a way by which I think we can improve the quality of living. Enhancing our enjoyment in living, benefiting not only ourselves, not only our environment but all those with whom we come in contact. It is that enhancement of the quality of living to which we successfully devote ourselves, and Texans can show the way.

Hobby: Thank you Dr. Leake. Our next panelist is James Dick who is I suppose our most cultivated example of our return to the earth youth group. He is a concert pianist and teacher, founder and director of the International Festival-Institute at Round Top; he is a recipient of first prizes at the Tchaikovsky competition in Moscow, the Busoni competition in Italy, the Leventritt competition in New York and many others. He gives approximately 100 performances a year as a soloist and with the major symphonies. Our back to the earth artist, James Dick.

James Dick: I would like to begin by expressing my great honor and joy that this is the very first meeting I have had the privilege to attend as a member, and I am very pleased it is in this magnificent city of Galveston. If Texas, as we know it today, were an independent nation, as it was from the revolution in 1836 to statehood in 1845, it would rank ninth among countries in the Western World in gross national product. Texas is now the third state in population and three of its largest cities are among the ten most populous centers in the United States. Blessed with extraordinary wealth, its business climate is ranked best in the nation and, industrially, Texas is expanding. If there is a "post-industrial" experience around the corner for Texas, with all the uranium, coal and iron ore just beginning to be tapped, as well as many other natural resources, it does seem that Texas is not being very obvious about it. The facts are staggering and make the old claims about Texas far more real than braggadocio. It has been said before, and I am sure it will be said more often in the future, that Texas is a Nation State, a Nation within the Nation. Texas with its tremendous reputation will, and must, look increasingly toward those matters that help to enrich the dignity, the grace, the quality and the importance of life.

Texas has been called the "quintessential American region" and Texans themselves are often referred to as "Super Americans." That may flatter most Texans and reassure the rest of the nation, but I suggest that circumstances of history and unique ethnic patterns, as well as a vast rural hinterland have combined to create an atmosphere and awareness of Texas, which despite many similarities, differs importantly from all other states. Such differences always and inevitably serve as the primary source of an indigenous artistic inspiration. For me, as a performing artist, the unique patterns of Texas and the very dynamic range of its history and area, are precious resources which should be studied, encouraged and allowed to serve as guideposts in preparation for the twenty-first century and well beyond. It is a concern which should be faced by all, not only indi-

viduals, but all emerging nations, how to be successful and still be yourself.

The European impact on Texas can be traced from the first missions among the Tejas Indians in the late 1600's. The Spanish and Mexican sources of that history still cover more than half of the total span of Texas to the present day. The influence of the Spanish-speaking culture is deep and very real and is felt in every corner of the land. Another most important factor is the lingering attachment to the land. I wonder if, in its deep subconscious, Texas is not still rural with a nostalgia for the frontier past and inspiration derived from its wonderful small towns which play an important role in its sense of self. The rural importance, as well as the Spanish influenced past of the State, combine with an incredible ethnic mix and a very colorful subsequent history to create a most unique consciousness. Indeed, a great feeling of destiny, and being apart from the rest of the nation, was greatly underscored by the fact of Texas' ten year existence as an independent Republic. All these things we may know, but how do we preserve and enhance this consciousness? The answer is certainly not brief, nor is it an easy one. Perhaps it may be found in a firm attention to imbue philosophy in the early education of our young citizens. It seems to me that a systematic and well-guided approach could make a difference for Texas in the twenty-first century. It is relatively easy for technicians to prepare blueprints, for politicians to legislate and for economists to formulate plans. However, the problem of transforming all this into reality is indeed a concern.

There are two avenues which I feel Texas should pursue if it is still to preserve its "national" flavor and substance into the year 2000. First of all, education beginning in the elementary level, should be firmly established on a bilingual foundation. I believe artists and humanists of all types and varieties would have a special relationship to such a proposal. Historically, as we know, the first foundations of Texas rest on Spanish-speaking culture. Texas, in order to further develop a truly indigenous culture, must give effort to re-establishing and actively expanding the cultural ties between Texas and Mexico as well as other Spanish speaking countries. Cross fertilization and hybrid vigor operate in the cultural realm as well as in the biological, and I am firmly convinced that Texas and the nation as well would benefit greatly from a concerted effort to establish a bilingual education so that in the twenty-first century the greatest part of our citizens will be able to read, write and think in both Spanish and English. Education should be deeper, of course,

than just learning to count, or write a simple letter. It should be seen that when literature classes in Texas schools study classics in English, that they also study classics in Spanish as well, and have exams and discussions given in that language. As with anything people endeavor to do, it is not only the expense of the pocketbook that is a major one, it is indeed an expense of will and spirit that is essential. I do not think we should suggest that it would be merely nice to be bilingual in Texas schools and institutions; that it would be attractive to tourists or colorful for visitors. Rather, I think it is essential. It is essential for Texas' best interests historically and politically. If it is neglected today, it will not be any small issue by the year 2000. It will not just go away.

The other avenue that Texas should think about and pursue in education in preparation for the year 2000, and well beyond, should be a lively and vigorous pursuit of the arts. The arts as a universal language of mankind, reach across all national boundaries and by their nature express the self, the individual, and at the same time the wholeness of society, the universal. The classics of all the artistic disciplines should be taught as well as studies in aesthetics required in every school across Texas. A mind that can see the beautiful and is responsive to it, will also not remain indifferent to the ugly and the brutal. Rigorous study of aesthetics and the arts in every level of the schools, throughout Texas and I might add our homes as well, could do a great deal for the quality of life in Texas and more than any other educational program could begin to realize. These are important resources, every bit as valuable as those which can be pumped or mined from the land and best yet, they serve, instruct and inspire *forever.* I feel very optimistic about the twenty-first century particularly if bilingual education and a broad study of the arts and aesthetics would be implemented into our schools today. Speculation on centuries still to come is not a place for escapism today.

I believe we all want the twenty-first century to bring everyone more leisure, more enjoyment, more abundance, more peace of mind, more hope. But if that is so, then all must settle down to more responsibility in the present and start laying some meaningful groundwork beginning in the early schools and at home with our families as well. Our twenty-first century is at hand and it will be no richer in spirit, no more inspired and no more civilized than the quality of ideas and values we all give it today. There have been predictions that the twenty-first century will answer all our prayers. That it

will "free" us, as it were, from all strong ties with the land, nationality, ethnic tradition, and even all strong ties with permanent fixed cities. Other predictions describe humanity awash in an ocean of leisure, working three days a week, lacking no whim or desire. First of all, I think traditional values will remain and become even stronger, as people turn inward to develop their sensibilities and to seek something far more than the mass image of themselves so often promoted wherever we turn. I think we can see this development of man's "inner space" as an emerging pattern today and that the nostalgia of the Bicentennial era is really only the most recent manifestation and perhaps only a good beginning for us. People will express and preserve, quite consciously and with determination, their ethnic origins, traditions, special history and nationality through the performing and creative arts. An increasing and positive acceptance of our developing life styles can be an important enlargement and enrichment of the existing fabric.

We do have special circumstances here in Texas and I am glad some of them were mentioned yesterday and today. The growing affluence and influence make it doubly important that Texas not win a battle and lose the war. Texas must preserve its identity not just into the twenty-first century, but far beyond it. The tradition, the special history and circumstances of Texas must be firmly fixed in the minds of every new generation and where does that happen but in its early education. One of the strongest supports of such a program in addition to the school room and home, it seems to me, is placing the arts in particularly historic and picturesque regions of the State. The project I have the pleasure to work with, the Festival-Institute at historic Round Top, has carefully proceeded to accomplish this at Festival Hill. Audiences and the very talented youth studying there have come from rural and urban backgrounds alike, to enjoy the performance of the arts, intensive study in music and special seminars in humanities; all within the context of their own indigenous history, often expressed by using architecture and its restoration as an enhancement. Everywhere on Festival Hill are woven symbols of Texas and its unique character; from framed documents and posters to the Star of Texas ridge roll on the roofs of the buildings and Galveston herringbone lattice. At the same time it is unobtrusive, quiet and effective. Utilization of historic sites in rural areas of the State where distractions truly are less and people truly are as receptive as anywhere else is a major instrument in the preservation of Texas' self-awareness as we reach toward the twenty-first century. The historic sites serve as the most appropriate forms

for presentation of the creative and re-creative arts, and the indigenous Texas culture.

If attention and action are given to these matters, and it is not difficult to do, then the twenty-first century will see something very beautiful happen to our State. The work and the leisure of our young people and all our people will be a positive and creative work and leisure. Minds imbued with the principles of aesthetics and sensitive to beauty will not flock to spend their hours in degrading places. They will seek out the beautiful and the lasting. The values those young minds cherish will shape the year 2000 and beyond, just as the values of young minds and their continuing wisdom and experience of maturity have shaped every century before us.

It is imperative that Texas in all its vigor be guided by ever higher purposes, higher ideals and a deep sense of history. The performing and creative arts are always the sources of these guides. Texas is indeed taking a center stage role and we must see she plays her part well. Why should there not be poetry readings, chamber orchestras and galleries in every small town across Texas, as well as great museums, symphonies and drama in every city? It can be. Why should not concert halls and museums, restorations, parks and public gardens be filled to overflowing — they can be. And why should not the young cheer intelligent poets, musicians, dancers, their own artists, just as they do for their athletes? I suggest that they will and that such a vision for Texas is at least as practical and far more likely to happen than the mountains of materials we see every day about the advent of outer space colonies or artificial suns to light up the skies at night, cities on Mars or robots attending to our needs — picking up our clothes or polishing our shoes. What we need to explore now is "inner space," the "inner space" of the human spirit to create a way of life in Texas that is not only more comfortable, but more beautiful; not only more convenient, but more meaningful; not only more healthy, but more spiritually creative — and the arts can guide us into that kind of twenty-first century and beyond. Thank you.

Hobby: The last word on our panel today will be given by Dr. William Bennett Bean who was born in the Philippines. He was educated at the University of Virginia, interned at Johns Hopkins, he was associated with the University of Cincinnati Medical College and Cincinnati General Hospital and the University of Virginia. He served in the Marine Corps and has been honored by so many medical societies that I dare not begin to enumerate them. He is the author of several medical books and the editor of several medical

journals. He is now at the University of Texas Medical Branch at Galveston as Harris Kempner professor and director of the Institute for Humanities in Medicine. Dr. Bean.

William B. Bean: Mrs. Hobby, members of the panel, members of the Philosophical Society, guests, brilliant scholars and very seductive teachers. I stand having heard all these things feeling as confident as the bastard at the family reunion. I cannot possibly live up to all the dignity and elegance of what has gone before. Indeed, I am put in mind of a black preacher who found himself delivering a sermon for which, as he said, he had not done any real theologic preparation. And here is what he said as he prayed to the Lord for inspiration. He said, "Oh, Lawd, give Thy servant de eye of de eagle and de wisdom of de owl. Connect his spirit with de gospel telephone in de central skies. 'Luminate his brow with the sun of heaben. Pizen his mind with love for people. But doan prod his cussedness. Turpentine his 'magination; grease his lips with possum oil. Loosen his tongue with de sledge hammer of Thy power and de honey of Thy words. 'Lectrify his brain with the lightning of de gospel. Put 'petual motion in his arms. Fill him plumb full of de dynamite of Thy glory. Noint him all over with kerosene oil of Thy salvation, oh Lord, and set him on fire. Amen." I am hoping for help.

I shall look at my comments not from the parochial point of view of just Galveston and the University of Texas Medical Branch or the provincial point of view of Texas, but looking at it from a broad consideration of the people everywhere and the ones that we all know are people in the United States and North America. I need to tell you what I believe a liberally educated person is, because I am convinced that if we do not find ways to return to a liberal education, we will not be able to make the world of the twenty-first century what it has the potential of becoming. What is it that makes a groundedly learned person? This definition comes largely from Thomas Huxley. I conceive that a person has a liberal education who has been brought up so that the body is the nimble servant of the will. The intellect is a machine for working with logic. Its parts have equal and appropriate strength. It is oiled and runs without a knock. The body does with grace and enjoyment not just work, but all the work the machine is capable of. Like a good electric motor it can be turned to all sorts of work. It can spin the finest gossamer webs of imagination or turn out great anchoring mental concepts. The mind and the memory are facile servers of the will. The mind has on call for instant employment the whole store of the world's knowledge or knows how to get at it if it does not

contain it. But it also is able to deal with the fundamental truths of nature as seen in the everyday world about and in the laws which govern nature's function. Asceticism has no place, for a person must be full of fire and vigor; but the passions are under the control of a strong will. Such a person achieves self mastery because she or he is the ready servant of a firm but tender conscience. Such a person despises violence and loves beauty whether that produced by artists, as we have just heard, or the beauty of nature. Concern for others is a part of such a person. Thus, I feel that somebody with a liberal education will approach as close as is possible in the human condition to living in harmony with nature and nature's creations.

A brief review of education and learning in this country is quite startling because in addition to what we heard from Marion Levy about early education recently being almost entirely in the hands of women, the history of American education is characterized by its almost universal availability. It came about in this wise. In the development of the central portion of this country and later in the rest of it, the Ordinance of 1787, which Thomas Jefferson wrote, made certain that all the states which were formed out of the Northwest Territory would lay aside for education one section of land out of every sixteen. From this arose public schools. From this arose state supported higher education, too. This had never existed anywhere except as something the royalty, the nobility, or the wealthy could obtain. This was the achievement of Mr. Jefferson's educational system in Virginia, beginning with free access for everybody but selecting at each move to the top, those who were intellectually, emotionally and in terms of character qualified to become leaders of the community.

The next thing that happened was startling. Someone from the lofty, ancient towers of learning in Europe, looking down would have seen a strange flowing together of two channels that had been widely separated in the past. One of these was the guilds of the several crafts. They had two functions. One was the control of learning by apprenticeship. The other was regulating who could be in a certain guild or trade unions. They were extremely important at an age when so much depended on craft.

High above were the universities which basically were developed for the intellectually elite to train for the ministry, for law and for medicine. Scholars in medicine, doctors of the long robe, hardly deigned to talk to a surgeon. These two channels had flowed totally separately in Western European culture. But they came together

in this country in the astonishing form of land grant colleges. The land grant colleges saw to it that academia was not aloof from what went on, and that those people who used skills and techniques might have at least part of the same education as those who were to become lawyers, the theologians, teachers and physicians of the country. This happened not much more than a hundred years ago during the American Civil War. Originally it was looked on as a kind of sop to the people for the general handing over to the railroad barons of huge chunks of real estate in the undeveloped country.

A third one was the rather surprising intellectual osmosis that moved from the central portion of North America forward to the Eastern Seaboard and back from the Eastern Seaboard to the Middlewest which ran all the way from Minnesota to Texas. It is interesting to know that when Conant became president of Harvard, he spent a couple of months at middlewestern universities learning the way they were teaching and training their people. We usually think of Harvard as being so totally self-contained that it does not need to look elsewhere for help. But this introduced a surprising transformation in the manner of teaching. The intellectual exchange and cross fertilization were tremendously important.

The fourth, not yet fully developed, is what must become a revivifying of education by a return to the humanities. I do not think it necessarily should go back as far as this statement from a book called *The Education of the Founding Fathers of the Republic,* following a fascinating discourse on the trivium and the quadrivium, the subjects thought necessary for a cultivated and well-educated person to master. Just one of the seven concerns rhetoric. Competence in rhetoric included, and I quote:

> . . . teaching us how to elevate our wisdom in the most amiable and inviting garb; to give life and spirit to our ideas; and to make knowledge of the greatest benefit to ourselves and to others; and lastly how to enjoy those pure intellectual pleasures resulting from a just taste for polite letters, a true relish for a spritely wit, a rich fancy and noble pathos, and the marvelous sublime shining forth in the works of the most celebrated poets, philosophers, historians, artists with beauties ever pleasing, ever new.

I am enormously proud and happy to be in an Institute for Medical Humanities. Beside me, the present staff consists of a professor of medical history, one of philosophy, one of jurisprudence and one combining sociology and religion. It is marvelously appropriate that the field of major interest of the historian, Chester Burns, is the history of ethics, particularly medical ethics in the United

States. Edward Erde, professor of philosophy, brings philosophy to the clinic, bedside and faculty, even as he finds philosophic and ethical problems throughout the medical center. The important thing about this Institute is we do not just try to deal with or help or illuminate undergraduate medical students or nurses but people in the related health sciences and hospital administrators, and I think we know that they need help sometimes. And we do not try to work just with the staff though we believe that many of them could be greatly revivified if we saw that they become groundedly learned in some of the humanities. In addition to the five or six chaplains employed by the hospital who work well with us, Harold Vanderpool has both a Ph.D. in history and a degree in divinity. He is interested in social medicine, not socialized medicine. There are three clearly discernible population elements here in Galveston. The black, Mexican-American and the whites. They may have the same diagnosis of a disease but they are wonderfully different as sick people. They react in different ways to the same disease. This is an important lesson to learn. We have James Speer in jurisprudence, not as you might think, just or even particularly to tend to medical-legal problems, uppermost in everybody's mind today but at the basic principles of law as they influence the whole theory and practice of medicine in all of their broad senses.

In medicine, the problem of learning the techniques has tended to displace these things that are necessary in the development of cultivated people. And so our mission is to change the young into thoughtful and considerate persons. We are trying to see that those who leave the University of Texas Medical Branch campus as physicians are people who are rightly concerned with the marvelous machinery of illness, with the strange and absolutely enchanting ways that we can internally go off the track, but it is a *person* who has these magnificent lesions and marvelous processes running agley. We have in the already bursting curriculum a required course, an introduction to medical ethics; this merely tells students that there are, in the art of medicine, findings and beliefs as important as science. As you can imagine, with the whole hue and cry dealing with abortion, transplantation, the definition of dying, euthanasia, and many other problems which our new scientific skills have not invented but have made more acute, we need to have doctors who understand. I see a vision in the future and it deals with the care and feeding of the intellect. It occurred to me that this Society, the intellectual flame and leading light of this part of the world, should establish a relationship with our Institute for Medical Humanities.

It should encourage in all the decent ways the preservation and restoration of the Ashbel Smith building as the home of the Institute. Perhaps it would be an appropriate setting for the marvelous rare book collection which Truman Blocker has gathered and which is now in the Rare Book Room of the Moody Library. We must foster and continue the inspiration that stems in lineal descent from Chauncey Leake, through Truman Blocker to the Institute's staff. I thought of using the term fairy godmother for the Philosophical Society's role, but that was used quite a bit by Marion, and anyhow fairy has become outmoded by gay and is not such a good word. I thought of using godfather but that now has dreadful connotations. But if we fostered a kind of informal relationship, not necessarily paternalistic, not even paternal or parental but imbued with a feeling of affection, interest and concern for this Institute — it would give us the encouragement and backing of the most stimulating group of people I have ever had the opportunity to learn from.

Quite out of context, I will wind up by telling you how I concluded the Alan Gregg Lecture, which I gave about a year ago in San Francisco. It is a sort of apologia or brief credo. I know full well that I do not always live up to it. When I fall it causes things to go badly for someone else or for me or for both. Since every sermon should end with a devotion, this homily merely emphasizes the importance of commonplace advice. In every opportunity in life for taking action, I should ask a question, "What must I do?" The answer, though simple, is hard and straight. It is "Do what is right." The question can be answered, almost always, on the spot or after a few moments of intense reflection. Almost always. The next question may outline the work of an hour, a day, a decade or a lifetime. "What is the best and wisest way to do what is right?" (Speaking then as a physician) in our profession of medicine the central and essential feature is the patient-physician relationship. (And you will notice that I did not say physician-patient but patient-physician relationship. And if we doctors could keep that in mind there would be fewer lawsuits.) In this relationship, the physician's action would always be decided by determining "For whose benefit?" If it is for the patient, it is good. If it is for the doctor, it may not be. It is as simple as that. The failure to follow these rules is the source of many problems facing physicians today. If we follow the rules, many of our troubles will diminish and some will vanish. And we will see a better future.

I hope the wiser use of the intellect will bring for our descendants and for those younger people here as they go over the next

decimal boundary into the twenty-first century, a life rewarding because the gifts bestowed on us in life, the most marvelous of mysteries, are used to the fullest. I say amen to all the marvelous presentations made before this group. The wonderful diversity of opportunities is here. If we but learn how to use the talents we have, watching and guiding facts into data, data become knowledge, knowledge leads to judgment and judgment leads to understanding which may finally lead to wisdom. If then we are fortunate, wisdom leads to philosophy from which there may emerge grace.

N E C R O L O G Y

MARVIN JONES
1882-1976

MARVIN JONES DIED AT AMARILLO, TEXAS, ON THURSDAY, MARCH 4, 1976, at 94 years of age. The fourth in a family of eleven children, he was born twelve miles south of Gainesville, in Cooke County, Texas, near the town of Valley View, on February 26, 1882. His father Horace K. Jones, was a farmer and he spent his boyhood on a farm learning the basics of agriculture from his father. This training on the farm was later to have a great influence upon his life as a Congressman and as the first Texan to become the Chairman of the House Committee on Agriculture. At the age of 17, he received a first grade teacher's certificate and after teaching a one-room school for a year, he rented some cotton and wheat land and was a tenant farmer for two years. The tenant farmer, with the money he had saved from teaching and raising cotton, then enrolled at Southwestern University at Georgetown, Texas, where he took the four year course in three and received his A.B. degree. He paid all of his own college expenses. To eke out his slender fund he sold stereoscopes all over North and Central Texas during three summers. He next took the three year law course at the University of Texas in two years. Having been licensed to practice law, the young attorney began to cast about for a place to hang his shingle. The country was still suffering from the panic of 1907 and finding a suitable town in which to locate was not easy. The final decision which he made, in 1908, was to locate in Amarillo, then a town of some 8,000 inhabitants. Amarillo was thereafter to constitute his official residence but the greater part of his life was spent in Washington, D. C. After eight years of law practice in Amarillo, in 1916 he made the race for Congress in what was then the 13th Congressional District covering the entire Texas Panhandle and down to the rolling plains below the Caprock, a total of 63 counties. He won the election and went to Washington in December of that year. This was the commencement of his long, continuous and distinguished 24 year career as a Texas Congressman. As the Chairman of the House Agricultural Committee, he sponsored numerous bills — farm legislation — for the benefit of the American farmer. One of the most important was the Farm Credit Administration Act which provided for the establishment of the Production Credit Corporation, for 12 regional cooperative banks and 12 intermediate

banks. He also re-wrote a bill to provide for the expansions of the 12 Federal Land Banks. He was acknowledged by National leaders to have accomplished more for the Nation's farmers than any other man.

On April 9, 1940, he was appointed to the United States Court of Claims and of which he served as Chief Justice from 1947 until his retirement therefrom in 1964. During World War II he took a leave of absence from the Court of Claims to serve as War Food Administrator. In his more than 50 years of government service, he was confidant to three presidents — Roosevelt, Truman and Johnson — consulted constantly on matters of legislative procedure and on matters concerning agriculture.

One of his assistants as War Food Administrator, Ashley Sellers, said of him: "In the language of his beloved Western ranges, Marvin Jones sits tall and straight in the saddle. He has been a patriot but never a goose stepper; dutiful, but never a zealot; unfailingly courteous but never fawning; and kindly and forgiving but always commanding respect and dignity." He was truly a remarkable native son of Texas.

He was survived by a sister, Mrs. Jeff Neely of Amarillo and by a brother, Herbert K. Jones of Lubbock.

—C.S.B.

ROBERT EMMET LUCEY
1891-1977

ROBERT EMMET LUCEY, ARCHBISHOP OF THE ROMAN CATHOLIC Diocese of San Antonio, died in Community Hospital at San Antonio on August 1st, 1977, at the age of 86. He was born at Los Angeles, California, on March 19, 1891, one of five children born to John and Marie Lucey. He was ordained a priest in Rome on May 14, 1916, by the Patriarch of Constantinople, Archbishop Cepetelli. His first appointment as a priest was in Los Angeles. He arrived in Texas in 1934 when he was appointed the second bishop of Amarillo by Archbishop Arthur J. Drossearts. He became Archbishop of the San Antonio Archdiocese in 1941 at Drosseart's death. He retired in 1969 after serving as Archbishop for 28 years.

His life was spent out in front as a fighter for the rights of the poor and the minorities, as an outspoken supporter of organized labor and civil rights legislation. In 1954 he spoke out for racial justice by integrating San Antonio's parochial schools. The plight

of migrant farm workers drew his special attention. He served on President Johnson's National Advisory Council of the War on Poverty. Because of his vigorous stands on social issues, he was invited to speak from time to time before Protestant groups. His utterances and his stands on social issues drew some opposition and criticism from his own ranks of the church; he seemed almost unaware of the same. No one could ever accuse him of making decisions on the basis of popularity.

He was survived by his sister, Sister Angela Clare of Los Gatos, California.

In commenting upon his life and death, a well known Protestant clergyman, a friend and acquaintance through the years, had this to say: "Yes, a warrior is dead. We can acknowledge now his many contributions and eventually history will prove him right on other issues where the jury is still out. I thank God for the ministry of Robert E. Lucey."

—C.S.B.

WILLIAM RICHARDSON WHITE
1892-1977

DR. WILLIAM RICHARDSON WHITE, BAYLOR UNIVERSITY PRESIDENT EMERITUS and Southern Baptist statesman, died on March 24, 1977, in Waco at the age of 84. Services were held at the First Baptist Church and burial was in Oakwood Cemetery, Waco.

Dr. White was born December 2, 1892, near Brownsboro. He was ordained to the ministry before the age of twenty-one. A graduate of Howard Payne and Southwestern Baptist Theological Seminary, Dr. White received honorary degrees from Howard Payne, Baylor, Hardin-Simmons University, University of Alabama and Bishop College of Dallas.

He provided landmark leadership for the Baptist General Convention of Texas as executive secretary during the Depression years of 1929 to 1931, and for Baylor University as president during postwar transition years of 1948 to 1961. He was Chancellor for two years before being named President Emeritus in 1963. He maintained an office in Pat Neff Hall until his death.

A member of the First Baptist Church of Waco, Dr. White served as pastor of First Baptist churches of Greenville, Lubbock, Oklahoma City and Austin, and of Broadway Baptist Church in Fort Worth. First Baptist Church of Waco honored him in 1976 with an appreciation day for his 29 years as a member.

Baylor, which presented Dr. White with the elite Founders Medal in 1972, was the major arena for his educational leadership.

Other educational leadership posts held by him include the presidency of Hardin-Simmons University from 1940 to 1943, and chairman of the board of trustees for Bishop College in Dallas, 1942-65.

His service to Bishop College was a reason for his receiving the Baptist General Convention's Distinguished Service Award in 1976. The award noted his contributions to the Southern Baptist Convention Christian Life Commission and to race relations in education.

The Convention also named Dr. White as Texas Baptist Elder Statesman in 1968. His denominational leadership included BGCT president, 1943; president, Southern Baptist Foreign Mission Board, 1931-35; and editorial secretary, Sunday School Board of Southern Baptist Convention, 1943-45.

His influence spread into national life when he was appointed to the International Development Advisory Board in the Truman and Eisenhower administrations.

Communicative skills enabled Dr. White to relate his experiences and philosophies through books and commentaries. Even during the 84th year, Dr. White was a contributing editor and highly respected Baylor administrator.

Baylor president Abner V. McCall said, "The greatest sermon Dr. White has preached has been his life."

Survivors include his wife, Mrs. Odera White, and two half brothers, John Massey of El Dorado, Arkansas, and Paul Massey of Kilgore.

—P.D.

WILLIS RAYMOND WOOLRICH
1889-1977

WILLIS RAYMOND WOOLRICH, DEAN EMERITUS OF THE UNIVERSITY OF TEXAS COLLEGE OF ENGINEERING, died on February 22, 1977, in Houston, where he had been in a hospital for several weeks following a fall.

Dean Woolrich served 22 years as the UT Austin Engineering dean, 1936-1958. Following his deanship, he continued on the faculty as a professor of mechanical engineering until his retirement in 1966.

An internationally known scholar in the field of refrigeration engineering, Dean Woolrich brought professional recognition to the UT College of Engineering by obtaining accreditation for the various

engineering departments, overseeing the acquisition of UT's Balcones Research Center, advancing the college's research activities and modernizing its curriculum.

In addition to his roles as dean, teacher and researcher, he was director of the Bureau of Engineering Research at the University for 22 years.

Professor Woolrich was the second dean of the College of Engineering, succeeding the legendary Dean T. U. Taylor, who served from 1895 until 1936. Dean Woolrich considered his most important contribution the attainment of accreditation for the college, "thus insuring high quality in all its programs and instilling a desire to do significant research in all departments." Graduate programs in engineering were improved, and the first Ph.D. was offered during Dean Woolrich's tenure.

He set up the first placement office for aiding graduates and alumni in finding professional positions.

Dean Woolrich also was active in his church, University United Methodist Church, and in government programs of all kinds that affected engineering education.

Professor Woolrich was steeped in the history and traditions of engineering education at Texas. The Engineering Foundation published his history of the college from 1884 to 1964, under the title *Men of Ingenuity, From Beneath the Orange Tower.* It was typical of his forward-looking nature that the final chapter bore the heading "Future Prospects for Engineering at The University of Texas."

The noted educator formerly served as president of the American Society of Mechanical Engineers, American Society for Engineering Education, Engineering College Research Council and the Texas Academy of Science.

Following his retirement from the UT deanship, he was the first interim president of the Middle East Technical University in Ankara, Turkey, 1959-60.

Prior to joining the UT faculty Dean Woolrich had been director of the small industries division of the Tennessee Valley Authority for three years and also had several years' experience as a professional engineer in industries in Illinois, Tennessee and Kentucky.

He also was a long-time member of the University of Tennessee faculty, teaching there from 1916 to 1933.

Dean Woolrich served the U. S. government as chief scientific officer and science attache in the American Embassy in London, 1948-49; consultant to the U. S. Patents Board, 1950, and special

consultant for many years to the Department of the Interior on the conversion of salt water into fresh water by the freezing process.

He was the author of more than 125 articles and of books such as *Handbook of Refrigeration, Handbook of Steam Engineering, Processing of Cottonseed* and *Textbook on Airconditioning.*

Born March 1, 1889, in Mineral Point, Wis., Dean Woolrich earned a bachelor's degree in electrical engineering from the University of Wisconsin in 1911 and master's degree in mechanical engineering there in 1923.

He was married to Neena Myhre, who died in 1972. His survivors include two daughters — Mrs. William S. Morgan of Norman, Okla., and Miss Avis Woolrich, Fort Collins, Colo. — and three sons — W. R. Woolrich, Jr., of Houston, Paul F. Woolrich of Kalamazoo, Mich., and Thomas Edwin Woolrich of Waco — as well as seven grandchildren and six great grandchildren.

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* Ira Kendrick Stephens	1936
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* William James Battle	1941
* George Alfred Hill, Jr.	1942
* Edward Henry Cary	1943
* Edward Randall	1944
* Umphrey Lee	1944
* Eugene Perry Locke	1945
* Louis Herman Hubbard	1946
* Pat Ireland Nixon	1947
* Ima Hogg	1948
Albert Perley Brogan	1949
* William Lockhart Clayton	1950
* A. Frank Smith	1951
* Ernest Lynn Kurth	1952
* Dudley Kezer Woodward, Jr.	1953
* Burke Baker	1954
* Jesse Andrews	1955
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Robert Gerald Storey	1957
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W. St. John Garwood	1959
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* Harry Huntt Ransom	1961
* Eugene Benjamin Germany	1962
Rupert Norval Richardson	1963
* Mrs. George Alfred Hill, Jr.	1964
* Edward Randall, Jr.	1965
* McGruder Ellis Sadler	1966
William Alexander Kirkland	1967
* Richard Tudor Fleming	1968
Herbert Pickens Gambrell	1969
Harris Leon Kempner	1970
* Carey Croneis	1971
Willis McDonald Tate	1972
* Dillon Anderson	1973
Logan Wilson	1974
Edward Clark	1975
Thomas Hart Law	1976
Truman G. Blocker, Jr.	1977

*Deceased

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ALLEN, WINNIE, retired archivist, University of Texas Library . *Hutchins*

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ANDERSON, THOMAS D. (LUCILLE), lawyer . . . . . *Houston*

ANDERSON, WILLIAM LELAND (ESSEMENA), retired financial vice president of Anderson, Clayton & Co.; former president of Texas Medical Center, Inc.; awarded Navy's Distinguished Civilian Service Medal in 1945 . *Houston*

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ARMSTRONG, THOMAS REEVES, Armstrong Ranch; former president, Santa Gertrudis Breeders Association . . . . . *Armstrong*

ASHWORTH, KENNETH H., commissioner of higher education, Texas College and University System; former executive vice president of the University of Texas in San Antonio and vice chancellor for academic affairs of the University of Texas System . . . . . *Austin*

BAKER, REX G. JR., lawyer . . . . . *Houston*

BANKS, STANLEY (ANNE), lawyer; former chairman, Texas Library and Historical Commission . . . . . *San Antonio*

BEAN, ALAN L., captain, United States Navy, astronaut; fourth man to walk on lunar surface . . . . . *Houston*

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LESLIE WAGGENER
ALONZO WASSON
WILLIAM WARD WATKIN
ROYALL RICHARD WATKINS
WALTER PRESCOTT WEBB
HARRY BOYER WEISER
ELIZABETH HOWARD WEST
CLARENCE RAY WHARTON
WILLIAM MORTON WHEELER
WILLIAM RICHARDSON WHITE
WILLIAM MARVIN WHYBURN
HARRY CAROTHERS WIESS
JAMES RALPH WOOD
DUDLEY KEZER WOODWARD JR.
WILLIS RAYMOND WOOLRICH
BENJAMIN HARRISON WOOTEN
GUS SESSIONS WORTHAM
FRANK WILSON WOZENCRAFT
WILLIAM EMBRY WRATHER
RAMSEY YELVINGTON
HUGH HAMPTON YOUNG