that the early techniques for detecting PKU showed a disturbingly high rate of false positives. As a result, a number of infants who did not have PKU at all were put on phenylalanine-restricted diets which can be harmful to normal growth because this amino acid is essential to brain development.

Not long after PKU screening became the norm in most states, researchers perfected techniques for the mass screening of sickle cell anemia and the sickle cell trait. This scientific advance occurred at a time when civil rights were very much on everyone's mind, and the inclination to screen all black children and young people was too strong to resist. As with PKU, some state and local jurisdictions made sickle cell screening mandatory.

The history of sickle cell screening teaches profound lessons about the dangers of rushing headlong into any kind of program, however well intentioned, involving people's genes. Frequently individuals who were told they carried the sickle cell trait were confused by the information. Some felt stigmatized by the knowledge and believed they carried a "bad gene" that, if passed on to their children, would cause sickle cell anemia. Insurance companies associated the relatively harmless sickle cell trait with the active disease—sickle cell anemia—and refused to insure trait carriers at the usual rates. The problems surrounding mass screening for sickle cell disorders were compounded by the fact that there is no cure for the disease. It was very much a case of giving people complicated and frightening information about which they could do very little.

Bearing the PKU and sickle cell screening experiences in mind, the NAS committee decided not to recommend any mass screening (except for PKU for which the problems seem to have been ironed out). Instead, it set forth detailed guidelines on how to go about setting up and, importantly, evaluating new programs in genetic screening. (These days, reports of newly developed techniques for detecting genetic disorders appear so frequently as to be commonplace.)

The committee is emphatically opposed to any laws or regulations that make screening mandatory and would implicitly like to see existing PKU legislation modified accordingly. It would like to see screening, as it matures, become a part of general medical practice—an activity carried out by a physician in his office, not by a health worker in a school gymnasium or church auditorium. And it believes screening should be carried out only when high standards for scientific accuracy and patient follow-up are met. The committee is aware of the importance of giving individuals thorough and understandable information before and after they have been screened, but it also recognizes the pitfalls that exist in this regard. (Several studies have indicated, to the disheartenment of geneticists, that, even after careful counseling and oral and written information have been made available, people can still become confused about what they have been told about their genes.)

Perhaps one of the more significant of the NAS recommendations about genetic screening is one dealing with public involvement in setting up programs. Noting that a program that might be acceptable to one community might be offensive to another, Childs and his committee call for a good deal of citizen participation. Following the current vogue for establishing commissions, the committee recommends that commissions or "screening authorities," that would be composed of researchers and lay members, review all proposed new screening programs to determine in advance a number of questions, among them the following:

- Is the public interested in and prepared to accept screening for the disease in question?
- Will public facilities, such as laboratories, be needed? If so, what will the cost be?
- Will the public need to be educated about the nature and consequences of a particular program? If so, how?
- Is the proposed screen scientifically accurate? What treatment can be offered to persons identified as having the screened-for condition? Are the treatments effective?

It is the committee's opinion that, even if all of the potential problems—legal, ethical, and medical—can be worked out in pilot screening programs, a decision about adopting a large-scale screen remains in the domain of the screening authority which has the option of deciding against it. "This decision," the NAS report says, "will be determined in part by the successes or failures observed in the pretest, but also in part by those evidences of public and medical acceptance and sense of need that were considered in the beginning." Thus, even the conservative NAS is now going along with the idea that just because the research community is interested in pursuing some idea is not reason enough to go ahead with it. One needs the consent of the community.

—BARBARA J. CULLITON

Futurism: Gaining a Toehold in Public Policy

We cannot go on letting the future just happen to us.—EDWARD CORNISH, president of the World Future Society

Grand visions of the future issue easily from politicians and policy-makers. But systematic strategies for getting there from here are another matter altogether. That is what applied futurism is all about. Futurism (or "futuristics," for those who want to make it into a science) has flourished for years in think tanks; in recent years this discipline—it would be more accurate perhaps to call it a mode of thought—has been emerging from the hothouse academic environment into the realm of public policy.

This was evident at the Second General Assembly of the 9-year-old World Future Society (WFS), held in Washington, D.C., last month. The meeting, intellectually dominated by the likes of Herman Kahn, Daniel Bell, and Alvin Toffler, was heavily attended—by planners, philosophers, professors, small businessmen, computer programmers, and the generally curious. According to WFS followers, this year's assembly differed from the first, held in 1971, chiefly in that the proportion of utopians and "characters" is declining (there was no astrology booth this year). Moreover, there was higher participation on the part of the normal, stodgy people, the bureaucrats, and people responsible for injecting thought into government—a reflection of futurism's growing appeal in various crannies of the federal government.

Applied futurism is a combination of planning and prognostication. As a discipline it differs from long-range forecasting in a particular field, or statistical

extrapolations of past and current trends, in that it is, ideally, comprehensive and multidisciplinary. Fundamental to futurism is the concept of "alternative futures," a term that has gained currency only in the past few years.

According to Joseph Coates of the Office of Technology Assessment (OTA), futurists are optimistic: they believe nothing is absolutely inevitable, but that there are a number of directions the world can take in the next century, all of which are conceivable extensions of the present. They believe humankind has the technology, both social and scientific, to anticipate and influence future directions; and that we have the moral obligation to do the necessary navigation. "The rest is detail," says Coates. He says "serious" futurists (as opposed to "earnest" ones) tend to think in 30-year time frames because this is about the turnover time in American society. Since World War II, for example, the country has seen a revolution in transportation, communications, housing, and urban life. Now, there is a shift in consciousness toward recognizing the fact of global interdependence. With resource depletion, economic dislocations, shifts in international political power, and scenarios of famine and holocausts engaging the popular imagination, the world is turning, as they say, into a whole new ball game. Futurists want to help build some sound rules into the game.

It is only within the past decade that the idea of consciously influencing the future has started to become institutionalized.

The federal government, despite increasingly frequent, tortuous attempts at reorganizing itself to deal with new exigencies, is still a long way from reexamining its values or attempting to orchestrate general policies according to a larger vision—a desired rate of economic growth, for example; optimum patterns of population distribution; or decentralization of government. "Energy self-sufficiency" is about the only government-wide maxim, and this goal was more political rhetoric than the product of a comprehensive analysis of global, social, economic, political, and environmental impacts.

Nonetheless, there is movement, particularly in Congress, toward the institutionalization of systematic long-term thinking. The OTA, set up in 1973 to advise Congress, is an exercise in applied futurism. Newer developments include the budget amendments passed in 1974 that will require the federal budget, starting in fiscal 1977, to include 5-year revenue and expenditure projections. The amendments also created a large new Congressional Budget Office with an eventual staff of about 200, which is to supply recommendations to congressional budget committees and assess the long-term budgetary impacts of new legislation. Another forward-looking measure is an amendment to House rules (incorporated in the reforms of the Bolling committee) introduced by then-Representative, now Senator John C. Culver (D–Iowa). This requires all House committees to develop futures research and forecasting capabilities [the Committee on International Relations has already formed a futures subcommittee, headed by Representative Lester Wolff (D–N.Y.)]. To assist this effort, a new futures branch has been set up within the Congressional Research Service of the Library of Congress.

Impact Statements

While it is too soon to evaluate these developments, it may be that the greatest single infusion of futuristic thinking into government has been the passage of the National Environmental Policy Act. NEPA established for the first time the precept that an agency is responsible for impacts outside its mandated area. The requirement that an environmental impact statement be filed for any major federal project affecting the environment has forced project people into long-term, ecological (in the sense of social and economic as well as biological interdependence) thinking. Since social and environmental impacts cannot be separated, NEPA has led to the incorporation of requirements for social impact statements in some new laws. Too many impact statements are designed to support a priori decisions; the exercise nonetheless has its own value.

Futurists are also infiltrating the executive branch of government, although at this point it is impossible to say where this kind of input is affecting policy-making. Military and national security bodies have long been in the business of scenario-making. Agencies such as the Census Bureau and the Bureau of Labor Statistics and the Agriculture Department are accustomed to making long-range projections in their fields. A recent example of expanded futurist activities is the Aviation Forecast Branch of the Federal Aviation Administration. This group is busy identifying "alternative aviation worlds" for the year 2000 that anticipate various combinations of factors including the gross national product, energy costs, future regulations, and technological advances. The group works with five scenarios: "limited growth," "expansive growth," "individual affluence," "hardship world," and something in between them all called "median." Futurists are sprouting up here and there in other agencies—the National Science Foundation's technology assessment program probably has the heaviest concentration—but, as one Senate staff man said, the federal government cannot yet be said to have futurism "in the blood."

Since such a small proportion of federal resources goes into futures research, those involved in it in government sometimes feel isolated. In order to stimulate discussion and acquaint government people with the field, Richard Wakefield of the National Institute of Mental Health and

National Medal of Science Winners

The White House has announced the National Medal of Science winners for 1974. The award, established by Congress in 1959, is the highest award of the federal government for distinguished achievement in the mathematical, physical, biological, or engineering sciences. President Ford, assisted by the President's Committee on the National Medal of Science,* selected the following 13 recipients.

Nicholaas Bloembergen, Harvard University; **Britton Chance**, Johnson Research Foundation; **Erwin Chargaff**, Columbia University; **Paul J. Flory**, Stanford University; **William A. Fowler**, California Institute of Technology; **Kurt Godel**, Institute for Advanced Study; **Rudolpf Kompfner**, Bell Telephone Laboratories; **James Van Gundia Neel**, University of Michigan; **Linus C. Pauling**, Stanford University; **Ralph B. Peck**, Consulting Foundation Engineer, New Mexico; **Kenneth S. Pitzer**, University of California, Berkeley; **James A. Shannon**, Rockefeller University; and **Abel Wolman**, Johns Hopkins University.

*Members of the committee for the 1974 awards: Charles P. Slichter, University of Illinois (chairman); Hubert Heffner, Stanford University (deceased); William Lear, Wm. Lear Enterprises, Inc.; Nathan Newmark, University of Illinois; Ivan L. Bennett, New York University; Theodore L. Cairns, E. I. du Pont de Nemours & Co., Inc.; Robert H. Dicke, Princeton University; Keith R. Porter, University of Colorado; John D. Baldeschwieler, California Institute of Technology; R. H. Bing, University of Texas; Ivar Giaever, General Electric Co.; and William D. McElroy, University of California, San Diego. Ex officio members are H. Guyford Stever, National Science Foundation, and Philip Handler, National Academy of Sciences.

Ford Nominates Alabamian to HEW

Forrest David Mathews, the 39-year-old president of the University of Alabama, has been nominated by President Ford to succeed Caspar W. Weinberger as Secretary of Health, Education, and Welfare (HEW). Weinberger recently resigned to return to California amid persistent rumors that he plans to run for office.

Mathews is regarded as a tough administrator who has done a lot to revitalize University of Alabama programs since he became president in 1969. He received his undergraduate degree in history and classical Greek at Alabama in 1958, and a master's degree in education there a year later. He has a doctorate in history from Columbia University.

Mathews seems to have a special concern over the delivery of health care, which may be among the reasons Ford nominated him to be HEW Secretary. The University of Alabama has a new College of Community Health Services in which Mathews has taken notable interest. Its purpose is to recruit and train a broad spectrum of health workers who can participate in innovative programs to deliver medical services to rural and other underserved areas.

Thus far, there is no reason to think Mathews' nomination will run into real opposition in the Senate, which must confirm him, unless Republicans balk because he is said to be a liberal Democrat.—B.J.C.

several other officials set up an informal Ad Hoc Interagency Futures Group 6 years ago. The group, which meets monthly, last year completed a 2-year exercise in formulating alternative federal budgets for the year 2000. This year they are doing a survey on "the future of governance." Using the Delphi technique,* they have already done a pilot study of two small groups—81 high-level bureaucrats and 100 preregistrants to the WFS meeting—who have been asked to rank the desirability, likelihood, and importance of specified developments in such diverse areas as space, bioethics, the political process, family life, and transportation. The group now seeks financial support so it can tap a sample of about 1200 high-ranking bureaucrats. It is hoped that the project will result in a published document useful to anyone interested in what such officials think about the future of government.

While the ad hoc group is an exercise in grass-roots futurism, several members of Congress are trying to get the futures bandwagon rolling into high visibility.

At a speech at the WFS meeting, Senator Edward M. Kennedy (D–Mass.) announced that he is drafting several pieces of related legislation. One would create a National Institute of Policy Analysis and Research, a "semi-autonomous think tank" that would supply the legislative and executive branches of government with "independent, objective policy analysis with a focus on future trends and options." He also proposed "an experimental futures agency to serve as a national showcase for promising new technologies" and—the public participation part—a program for financing citizens' associations so they could intelligently address the heavy environmental and technological issues of the day.

On a much grander scale is a bill introduced in May by Senators Hubert Humphrey (D–Minn.) and Jacob Javits (R–N.Y.), entitled the Balanced Growth and Economic Planning Act of 1975. The bill would represent the first attempt at centralized national planning since the 1930's, and as such is guaranteed to cause quite a stir in the coming months. It would create an economic planning board in the Executive Office of the President whose task it would be to formulate a general long-range plan, to be reviewed every 2 years, to guide federal policy and supply local governments and private industry with information so they can make policies in accordance with national goals. The board, with the aid of an advisory committee made up of Cabinet members and other high officials, would establish criteria for monetary policy, maximum acceptable unemployment levels, desirable rates for housing starts, and so on. A complex machinery would be set up providing for all levels of government to pass judgment on the plan with the aid of public hearings. Sponsors of the bill have no illusions of its being passed in its present form—several days of hearings are planned monthly over the next year. The chief purpose is to generate a national debate over where this country is going and what to do about it. Although adherence to the plan would be voluntary, the idea is that it would guide legislation relating to economics, science and technology, industry—that is, most legislation.

Futuristics is such an amorphous and ill-defined field that it is impossible to say where the action is in terms of its growth as a discipline. Everyone is hewing his way through uncharted wilderness, borrowing predictive and analytic tools from a variety of disciplines.

Modern futurism was spawned at the Rand Corporation after World War II. The first big question addressed, with analytic techniques developed for military use, was the probability of war. Early post-war futurism, which quickly spread to the Hudson Institute and Stanford Research Institute, among others, concentrated on heavily technological issues such as the future of arms control, weapons development, automation, space exploration, and scientific breakthroughs.

Futurist thinking is moving from high- to low-technology enterprises. In the retail business, for example, companies whose planning was based on short-term market surveys are now basing their strategies on long-term trends in life-styles, demographic shifts, and developments in the international marketplace.

Hindsight reveals where a little futurism could have saved a lot of trouble. A striking instance is the failure of American automobile companies to anticipate the demand for smaller, more efficient cars. They could not have foreseen the oil embargo, but if they had spent more time devising scenarios instead of tail fins, there surely would have been some account taken of rising fuel prices. A futurist might have helped them perceive rising imports of small foreign cars as a message rather than a temporary threat.

Theodore Gordon of The Futures Group in Glastonbury, Connecticut, points out that a broader vision on the part of the aerospace industry might have spared the country the phenomenon of 700 aerospace engineers answering one Los Angeles electric utility's advertisement for meter readers. The moon landing program, Gordon observes, is a splendid example of successful fulfillment of a long-term technological goal and dismal failure to anticipate the possible social dislocations created in its wake.

The message is coming through in many states and municipalities where public and private groups, uneasy about swift changes in their areas, have, over the past decade, set up commissions to assess the impact of

* The Delphi method, controversial and widely used, was developed at the Rand Corporation as a way to incorporate subjective judgments into prognostications. A Delphi usually involves the distribution of questionnaires. Answers are tabulated and included in subsequent duplicate questionnaires. The feedback element has the effect of narrowing the range of opinion, so that the results of the third go-around amount to what is regarded as a usable consensus.

these changes and figure out if where they are going is where they want to go. A number of states have commissions on the year 2000—Hawaii's is one of the oldest—and other groups have bloomed with names such as Alternatives for Washington, the Commission on Minnesota's Future, Goals for Dallas, and California Tomorrow. Since the need for decentralization of decision-making and the possible formation of new regional groupings that correspond better to area needs is a strong component of futurist philosophizing, it is conceivable that the real impetus for adjusting institutions to match future conditions will come from the countryside rather than the federal government.

As things look now, futuristic thinking may lead not only to the establishment of foreward-looking components of government agencies, but to a profound restructuring of government itself. Several speakers at the WFS meeting observed that the current structure is no more than an elaboration of a system set up for, and ideally suited for, the agrarian society of the 1800's. Now, as Joe Coates puts it, "We are trying to shoehorn the most complex society that ever existed into obsolete structures." Alvin Toffler, author of *Future Shock*, reflects the views of many in his argument that bureaucracies are becoming obsolete. Hierarchical, homogenized, centralized bureaucracies reflect the shape of an industrial society. Now that we are "postindustrial," the need is for diversity and decentralization, he says.

President Gerald Ford seems to be tuning into these concerns. At his first meeting, in mid-June, with the White House Domestic Council, a proposal was outlined whereby the President would travel around the country conducting a series of "administrative hearings"—a variation on "town meetings" held by Vice President Nelson Rockefeller when he was governor of New York—to educate and solicit the opinions of the citizenry on long-range domestic problems.

Whether holistic visions and solutions are better arrived at through primary emphasis on centralized (from the top down) or network-like (from the bottom up) planning structures is a question for endless debate. Since public participation in decision-making is one value that futurists do not question, the first step will have to be the generation of continuous policy debate among all segments of the populace.

Perfection of communications techniques is therefore crucial to applied futurism. The Committee for the Future, a group that started with the idea of fostering galactic harmony by setting up colonies in outer space, is making its contribution through huge meetings called Syncons, where panoramic unity and enlightenment is sought by having everyone talk about everything simultaneously. The committee is said to be making strides in the use of audiovisual technology to organize and expand communications. Another, more sophisticated approach is "computer conferencing," devised at the Institute for the Future at Menlo Park, California. This enables people to conduct international discussions from the comfort of their home terminals. The method saves travel cost, allows participants to duck in and out of the discussion, to have portions of the talk played back when they want, and to insert opinions anonymously or confer privately with each other. One can readily see its application to Middle East negotiations.

Most people seem to want futuristics to evolve into a distinct discipline. Robert Lamson of the National Science Foundation laments the lack of "quality control" in the field. He points out that futurism has no tradition, its terms are ill-defined, and there is a lot of "sloppy thinking being expressed in sloppy language." They must forge ahead nonetheless. The old ways aren't working very well, for, as an anonymous stock analyst has observed, "The future is no longer what it used to be."

—CONSTANCE HOLDEN

A Conversation with Dixy Lee Ray

In the colorless Nixon years few federal officials cut so distinctive a swath as Dixy Lee Ray, the biologist from Seattle with a mobile home and two famous dogs, Jacques and Ghillie. As a member, and later chairman, of the Atomic Energy Commission, Ray established herself as a public person of substance who spoke her mind and had no compunctions about tangling with congressmen or her colleagues in the Executive Branch. It seemed almost inevitable that a collision would come in her new job as Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs.

Congress, largely at the urging of Senator Claiborne Pell (D–R.I.), had, in October 1973, thrust a new bureau for oceans, the environment, and science on a State Department charitably described as uninterested. The level of Administration enthusiasm was indicated by an 18-month delay in naming an assistant secretary to run the bureau.

Ray, nevertheless, says that when she took the job last January she and the bureau were assured that they would be the "principal voice and forum" of science-related matters in the State Department. "I had nothing in writing," Ray added at a hearing Pell called on 26 June to discuss her resignation 6 days earlier.

Ray said her troubles had begun within a week of her arrival—new funds and staff proved unavailable and Secretary Kissinger's staff tended only to call on the new bureau for concurrence with its views. Moreover, Ray said, she had little taste for the "infighting" necessary to carve out a niche for the new bureau. "People in responsible positions should be able to focus on their jobs" she told Pell.

It was plain too that, since the disbanding of the AEC, she had grown a bit homesick for Seattle and the 65-acre enclave on Fox Island in Puget Sound that she and her four sisters own. The following conversation, edited from a 40-minute tape, took place early on the morning of 26 June amid a busy schedule of appearances on television and Capitol Hill, and packing. "I want to be on the road tomorrow," Ray explained. And she was.—ROBERT GILLETTE [*Transcribed by Scherraine Mack*]

Q: Public resignations in Washington are rare.

RAY: Yes, they are.

Q: Why, basically, did you resign, and why did you decide to go public?

RAY: I quite realize that the normal course is to resign quietly, say nothing, and go home. My purpose, besides having come to the conclusion that I had done all I really could, was to call attention to the problems as they really are.

Maybe I had better put it this way: I believe so deeply in the importance of having good scientific and technical advice in the making of foreign policy—and this has not yet happened in the State Department—that I believe anything I can do to assure that it happens would be of benefit. And I felt the only way I could really draw attention to the problem was to take the course I have.

Q: What were the problems, as you saw them?