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SCIENCE

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Office of Naval Research

GRADUATE FELLOWSHIP PROGRAM 1986

For study and research leading to doctoral degrees in specified engineering/science disciplines.

Introduction: ONR will award up to 45 three-year fellowships for study and research at U.S. institutions offering doctoral degrees in designated fields.

Eligibility: Participants must be U.S. citizens and receive a baccalaureate degree in 1986.

Objective: To increase the supply of U.S. citizens trained in disciplines critical to the U.S. Navy's mission.

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- Secretary of the Navy Fellowships in Oceanography

For application forms and information contact:

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Only U.S. citizens are eligible.
Application deadline: January 31, 1986
Offers of appointment: April 15, 1986
ONR/ASEE are equal opportunity employers.

Note: Program Details are Subject to Change

HYBRIDOMAS IN BIOTECHNOLOGY AND MEDICINE

March 3–7, 1986

at the

COPLEY PLAZA HOTEL, BOSTON

Sponsored by

HARVARD MEDICAL SCHOOL & DANA-FARBER CANCER INSTITUTE

Director: TIMOTHY A. SPRINGER, Ph.D.

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A distinguished faculty will review the latest innovations and implications of immunology and hybridoma technology and highlight major advances achieved in the biological sciences and clinical medicine. A comprehensive syllabus including selected methods protocols will be provided.

Mon: **ANTIBODY DIVERSITY AND MONOCLONAL ANTIBODIES.** The Genetic Basis for Antibody Diversity, Jonathan Seidman; The Antibody Combining Site, Edgar Haber; Monoclonal Antibody Techniques and Strategy, Zelig Eshhar; Production of Human Monoclonal Antibodies by In Vitro Immunization, May-Kin Ho; Immunochemistry and the Mapping of Epitopes with Monoclonal Antibodies, Peter Parham; Kinetics and Affinity of Monoclonal Antibody Binding, Alan Williams.

Tues: **APPLICATIONS OF MONOCLONAL ANTIBODIES IN BASIC BIOMEDICAL RESEARCH.** Affinity Purification and Characterization, Alan Williams; The Analysis of Human Histocompatibility Antigens with Monoclonal Antibodies, Peter Parham; Leukocyte Adhesion Molecules, Timothy Springer; The Cytoskeleton and Organelles of Human Carcinoma Cells, Lan Bo Chen; Dissecting the Reovirus Hemagglutinin, Bernard Fields; Three-Dimensional Localization of Variable Antigenic Sites of the Influenza Virus Hemagglutinin, Don Wiley.

Wed: **MONOCLONAL ANTIBODIES IN DIAGNOSIS AND THERAPY.** The Human T Cell Antigen Receptor, Ellis Reinherz; Serotherapy and Bone Marrow Transplantation, Jerome Ritz; Manipulation of T Cell Populations to Abrogate Allograft Rejection, Charles Carpenter; Antibodies in Vivo, Edgar Haber; Diagnosis of Acute Leukemias, James Griffin; Monoclonal Antibodies in Diagnosis of Mac-1, LFA-1 Deficiency Disease, Donald Anderson.

Thurs: **USES OF ANTIBODIES IN RECOMBINANT DNA TECHNOLOGY.** Site-Directed Antibodies to Synthetic Peptides, Brian Schaffhausen; Protective Epitopes in Malaria, Victor Nussenzweig; Expression of Cloned Ig Genes, Fred Alt; Production of Human-Mouse Antibodies Using Gene Transfection, Sherie Morrison; Immune Detection with λgt11 and Applications, Richard Young; Cloning Surface Antigen Genes by Transfection and Cell Sorting, Frank Ruddle.

Fri: **T CELL CLONES, HYBRIDOMAS AND THEIR PRODUCTS.** Function of Cloned Human T Cells, Steven Burakoff; T Cell Clones and Their Lymphokines, Frank Fitch; Functional T Cell Hybridomas, Kenneth Rock; Interleukin-1, Interferon-γ, and the Regulation of Macrophage-T Cell Interactions, David Beller; Molecular and Functional Characteristics of the Interleukins, Kendall Smith.

Hybridomas in Biotechnology and Medicine

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☐ Please send me further information.

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COVER

Tidal flats in Minas Basin near Economy Point, Nova Scotia, showing large-scale bedforms carved by strong tidal flows over sand. This is one of the sites being considered for tidal power development. The combination of shallow water and large tides makes this an area of extensive tidal dissipation. See page 69. [Roger Belanger, Fisheries and Oceans Canada, Bedford Institute of Oceanography, Dartmouth, Nova Scotia B2Y 4A2]

Structure of GDP-binding regions

The three-dimensional structure of the binding site for GDP (guanosine diphosphate) on a protein has been determined by x-ray crystallography (page 32). The binding region on elongation factor Tu (EF-Tu) is similar in amino acid sequence and size to guanine nucleotide binding regions of several other proteins, including the *ras* oncogene proteins and signal transducing G-proteins. In the EF-Tu crystal, Jurnak found that the four principal regions of homology (where similar or identical amino acids are found) in *ras* and EF-Tu were positioned near the GDP-binding site, with most of the invariant amino acids interacting directly with GDP. McCormick *et al.* propose a model for the structure of *ras* and G-proteins using their own crystallographic and biochemical data for EF-Tu (page 78). Mutagenesis experiments can now be designed for altering amino acids at defined locations on the molecules. Protein folding and functioning and oncogenesis can then be evaluated as sequelae of such mutations and amino acid substitutions.

Volcanic eruptions on Io

Volcanic activity in July 1984 on Io, one of Jupiter's satellites, was detected and mapped from Earth by two infrared techniques. Io is the only body besides Earth in our solar system on which volcanism has been observed directly. Howell and McGinn, using a new infrared technique, speckle interferometry, observed Io on 2, 3, and 4 July when photometric measurements indicated that a thermal outburst there was nearing its peak (page 63). On 8, 9, and 10 July, Goguen and Sinton made observations using infrared polarization techniques (page 65). Three hot spots on Io's surface (which is illuminated by sunlight reflected from Jupiter) were mapped. The major hot spot was east of the volcanic region named Loki, which is thought to be a large lava lake and is one of the prominent surface features of Io identified by the 1979 Voyager space mission. Ground-based studies such as these will contribute to an understanding of the source and nature of the continuing volcanic activity on Io, to identification of the composition of Io's volcanic materials, and to the design of observations to be carried out during the 1988–1990 Galileo space mission, when once again close measurements of Io's volcanism will be possible.

Animal model for AIDS

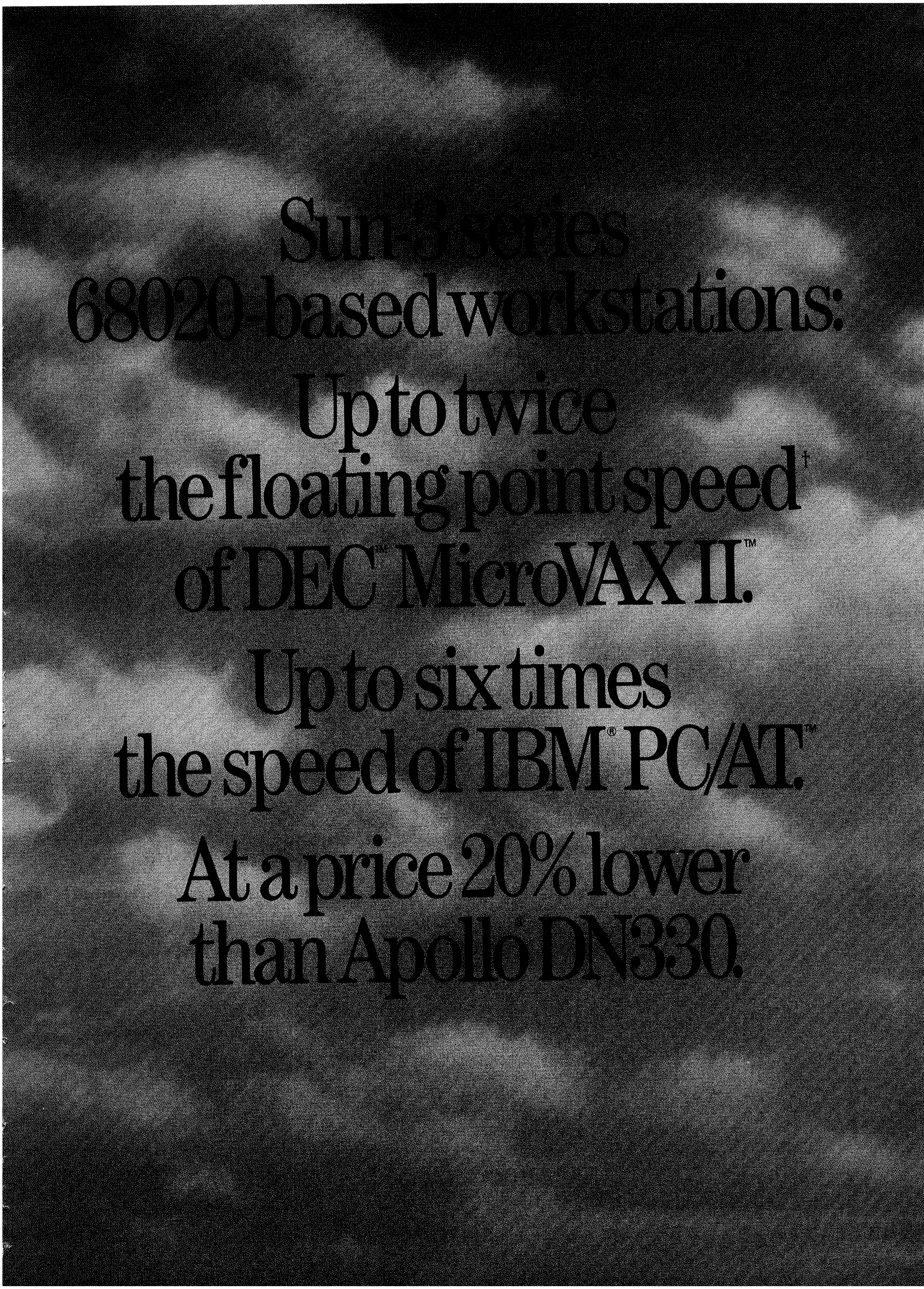
Rhesus monkeys injected with a monkey virus that is similar to the AIDS virus in physical appearance, tropism for T-lymphocytic cells, structural features, and growth pattern, develop a disease that has many of the characteristics of AIDS (page 71). The model differs from naturally occurring macaque immunodeficiency syndrome (simian AIDS) and from other primate models in which the human AIDS virus is the infecting organism. Letvin *et al.* injected the monkey retrovirus STLV-III, originally isolated from a monkey with lymphoma, into six rhesus monkeys. Four rapidly experienced diarrhea and went on to develop a wasting syndrome, opportunistic infections, retroviral encephalitis, and immunologic deficiencies—all of which are also associated with AIDS. (Other clinical features were not common to the monkey model and the human disease.) The many similarities of the infecting viruses and the clinical presentations suggest that the STLV-III model could be a valuable one in which antiviral agents and vaccines for AIDS can be tested.

Swimming without flagella

Single-cell blue-green algae, cyanobacteria of the genus *Synechococcus*, swim through marine waters at speeds of 5 to 25 micrometers per second using an unidentified mechanism that does not depend on flagella (which they lack) or other apparent external structures for propulsion (page 74). The organisms were found in several locations in temperate and tropical regions of the Atlantic Ocean, where they and other cyanobacteria contribute significantly to primary biomass production. The shape of the organisms influenced the form of the movement: long rod-shaped cyanobacteria swam in relatively straight paths; more rounded ones looped and spiraled. Some attached to a glass slide and pivoted, but gliding, a motion characteristic of many cyanobacteria, was not observed. Light did not alter the swimming pattern or direction. Waterbury *et al.* suggest that chemotaxis toward nutrient-enriched areas in the water may be the driving stimulus that initiates the mysterious motility.

Tick-borne disease of cattle

Increasing circumstantial evidence is linking a spirochete transmitted through the bite of a tick to a disease of cattle, epizootic bovine abortion (EBA) (page 85). EBA reduces annual calf production in western rangelands by 5 to 10 percent and has caused financial losses of $5 million to $15 million per year in California alone. Lane *et al.* found immunologic and structural similarities between the putative EBA spirochete and a spirochete causing epidemic relapsing fever, which produces a high spontaneous abortion rate in infected pregnant women. The spirochetes were found in most tissues of larva-, nymph-, and adult-stage ticks and, significantly, in salivary glands of most infected nymphs and adults. Spirochetes in general are sensitive to antibiotics; the incidence of EBA has been reduced by prophylactic field treatments. The carrier tick, *Ornithodoros coriaceus*, feeds on cattle, deer, and humans and has been implicated in the transmission of Q fever to humans (in whom chills, fever, and muscular pain ensue) and to cattle and sheep (in which abortions can occur).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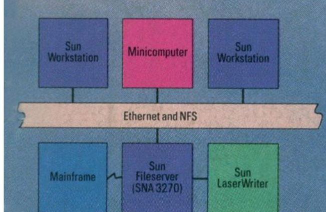

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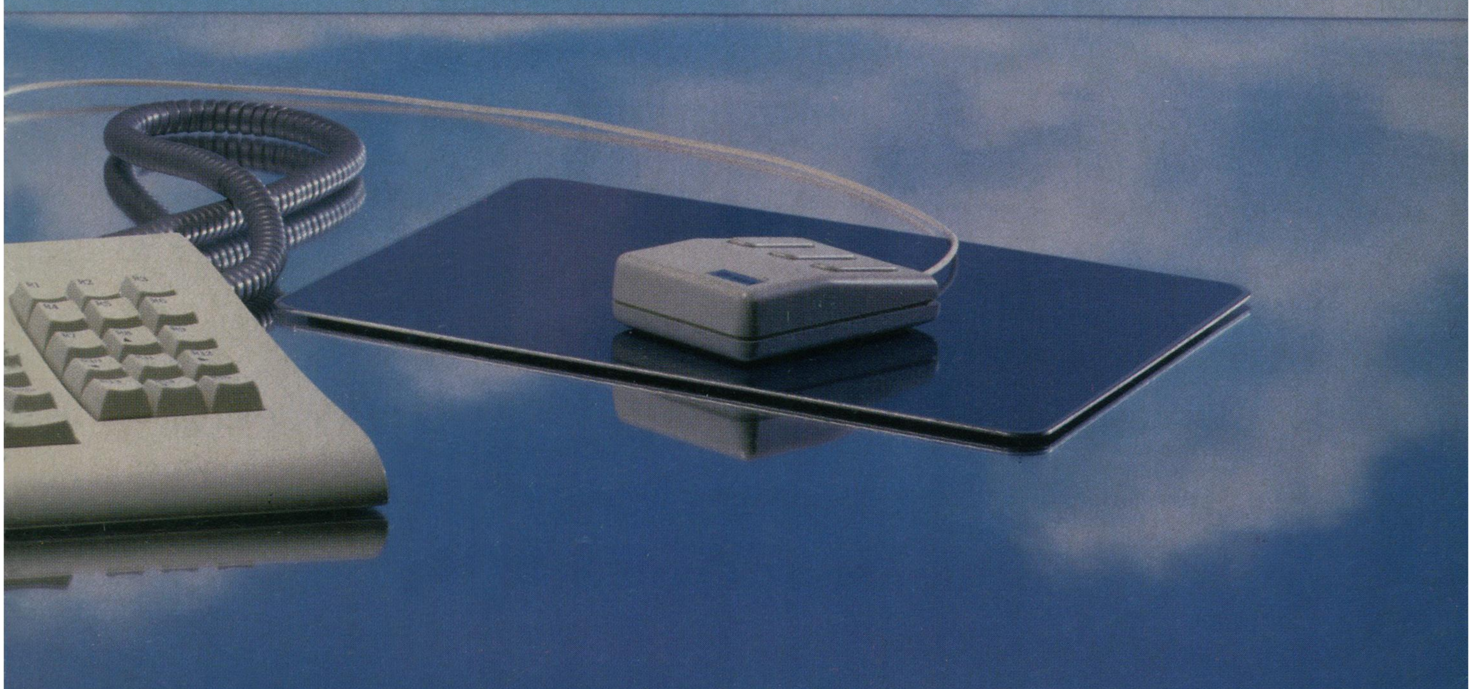

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SCIENCE

The Status of Engineering

The public is much more aware of scientists and science than of engineers and the pervasive role that engineering plays in society. Indeed, society as a whole has little appreciation of the nature of the changes in engineering or the rapidity with which they are occurring.

The media rarely present the scope of engineering and show little interest in the men and women who make engineering their profession. The result is that members of the public know very little about engineering systems although they interact daily with them. A further result is that the public has little appreciation for the engineers who design, produce, or maintain complex systems or how engineering touches every facet of their lives. The public generally is not aware that the interests of engineers lie in efficiency, usefulness, and low-risk industrial processes, plants, and devices.

Does this difference in public awareness matter? In the short run perhaps not, but in the long run very definitely yes, for two reasons. First, society rewards those who are appreciated and well known; the rewards attract talented people who better society as a whole. Only if engineering attracts talented individuals will our modern life be sustained. The second reason is that an informed public will make better decisions in this technological society.

Turn now to the premise that the nature of the changes in engineering is not well understood. At the turn of the century, electronics, plastics, computers, and flight were undiscovered. As a result, student engineers learned how to cast iron in foundries, operate a steam engine, use test machines, build roads, and not much else.

The rapid emergence of complex systems in the 20th century is the major difference between engineering before 1900 and in 1985. An automobile is a relatively simple system but complex enough to illustrate the point. The automobile now is a system of engineering systems, including electrical, hydraulic, mechanical, thermodynamic, and computer systems, all of which must function well at the turn of a key. Engineers today must be well enough informed to apply new materials, new devices (such as computers, robots, and "expert systems"), and new tools (lasers, optical devices, and chemicals) to systems.

We sense that the rate of change in engineering will increase. In recent decades, science through new discoveries has served as a major force driving the changes in engineering. In the future, the new sciences of information processing and biotechnology will bring further changes to engineering. But the force exerting the greatest pressure in the present is the urgent need to increase national productivity. A renewed emphasis on engineering is the only way to increase productivity, and nothing less than the future of the nation depends on how well engineering meets the challenge.

The media can help by approaching the engineering future in two ways: by presenting to the public basic information on the realities of complex systems and then by exploring the possible and probable impact of engineering research and development on these systems.

Educational institutions can help now and in the future through new approaches to engineering. In most colleges and universities, engineering is still very disciplinary in character and exhibits little interplay with science. The workplace, where engineering is critical to corporate progress, now needs engineers with a broad view of systems, technology, and science.

Engineering draws heavily on new science. A fruitful marriage of new science and engineering brought the success of the allies in World War II and the emergence of postwar Japan. Since the United States has no monopoly on scientific or engineering brainpower, we are in peril if we turn our backs and fail to give equal encouragement, support, and recognition to engineering and science.—D. Kenneth Baker, *President, Harvey Mudd College, Claremont, California 91711*