

**Section I:**

**Activities in the Reform of Undergraduate Education  
Since Volume I of *Shaping the Future***

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## Introduction

During the review of undergraduate education by NSF Advisory Committee for Education and Human Resources, the deliberate process of acquiring information from a broad cross-section of the undergraduate community ensured a broad level of participation by many educators, administrators, employers, and students. This process occurred during April 1995 to June 1996, and culminated in three milestones in the summer of 1996:

- (1) the publication of the Committee's report *Shaping the Future: New Expectations for Undergraduate Education in Science Mathematics, Engineering, and Technology* (NSF 96-139);
- (2) the publication of the National Research Council's report *From Analysis to Action: Undergraduate Education in Science, Mathematics, Engineering, and Technology* (National Academy Press, 1996); and
- (3) a major conference in Washington DC to air key findings and recommendations in these reports, and to continue discussions about how to implement their recommendations. ("Shaping the Future: Strategies for Revitalizing Undergraduate Education," held during July 11-13, 1996). The proceedings of this Conference are available at NSF Division of Undergraduate Education Web site (<http://www.ehr.nsf.gov/EHR/DUE/start.htm>).

It was the intent of the Committee from its inception to write a living report, stimulating an active and vigorous process of reviewing, debating, and improving undergraduate education in science, mathematics, engineering, and technology (SME&T) in all types of post-secondary institutions across our nation. This chapter reviews the types of activities the Division of Undergraduate Education (DUE) has undertaken with the undergraduate SME&T community following the July 1996, national conference on *Shaping the Future*. Additionally it provides a bibliography of studies, reports, and recommendations that have been published during the past several years on the same theme. Because these activities had been underway even before the summer of 1996, this overview extends from March 1996 through July 1997.

## Shaping the Future NextSteps

The activities have the underlying similarity of engaging educators, academic administrators, and employers in discussions of methods to improve undergraduate education in SME&T. Generally, the efforts sponsored by DUE have identified and disseminated information about needs and opportunities to improve undergraduate student learning—particularly opportunities for developing effective teaching practices—and overcoming barriers to the widespread adoption of these practices.

The basic thrusts of these activities are:

- promoting greater understanding, and identifying ways to improve student learning;
- designing further improvements in courses and learning experiences to improve learning by all students;
- supporting interdisciplinary course and curricula development work by faculty from different SME&T disciplines working collaboratively;
- strengthening internal connections across departments (within all types of academic institutions) in support of improved undergraduate education for future teachers, and students

majoring in non-SME&T disciplines, and students preparing to enter technical fields and the professions; and

- expanding links with SME&T “communities” (government agencies at all levels, schools, scientific societies, professional associations, policy makers, public interest groups, and employers):

The Division of Undergraduate Education (DUE), assisted by members of the Advisory Committee for NSF Directorate for Education and Human Resources (EHR), has addressed the need for such improvements in a variety of ways. Some of these are:

- Providing the full-time support of the Division Director (on assignment from the Division of Undergraduate Education) Dr. Robert Watson, to the task of disseminating important information to the national undergraduate SME&T community from November 1996, through November 1998. During this period he has been leading and participating in workshops at regional events and scientific and professional meetings.
- Leveraging professional staff attendance at scientific and professional society meetings as occasions to disseminate findings and recommendations in *Shaping the Future*.
- Inviting academic institutions to host regional or local workshops in order to discuss and actively encourage faculty to participate in reform of undergraduate education in SME&T, with some logistical and financial support from NSF.
- Encouraging scientific and professional societies to continue to address the issues raised in *Shaping the Future*.
- Suggesting that NSF grantees participate in these same types of outreach efforts on their own or jointly with NSF program directors.
- Incorporating principles enunciated in *Shaping the Future* in the DUE Program Announcement, and seeking to evolve our programs in directions considered to be most fruitful to further the recommendations of *Shaping the Future*.
- Forming an alliance with major corporations and foundations through a Memorandum of Understanding, with the purpose of seeking their advice, counsel, and support.
- Continuing to fund the Institution-wide Reform initiative through FY 98.
- Emphasizing in all DUE programs the need to educate *all* students, especially those preparing to be teachers or to join the technical workforce armed with greater flexibility and enhanced skills.

### **External Assignment of Dr. Robert Watson**

A key feature of the past several years is that these objectives are being pursued not only programmatically through NSF’s competitive grant process, but also through extensive outreach activities by NSF/DUE program officers and principal investigators. The external assignment of Dr. Robert Watson, Division Director (on assignment) from the NSF Division of Undergraduate Education, has provided many professional groups assistance in accomplishing the objectives of encouraging improvements and reform in undergraduate SME&T education at the national level.

Dr. Watson accepted a two-year special assignment during the period November 1996, to November 1998: as visiting scholar at The American University in Washington, DC (where he is serving as Scientist-in-Residence) and at the National Research Council, where he is working with the leadership of colleges, universities, education associations, scientific and professional organizations, and with groups representing employers of college graduates (business, industry, school systems, and governments).

The primary purpose of this assignment has been to inform, encourage, and assist colleges and universities to implement key national improvements that have been developed, and to engage them actively and comprehensively in the reform of undergraduate SME&T education. The principal blueprint for these goals is the report of the EHR Advisory Committee, *Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics, Engineering, and Technology* (NSF 96-139), however other reports—notably the National Research Council’s *From Analysis to Action: Undergraduate Education in Science, Mathematics, Engineering, and Technology*—and materials from NSF-supported projects and programs also are providing valuable examples and information about ways to achieve successful reform.

A key strategy has been to engage scientific societies, professional associations, and educational associations in order to take advantage of their wisdom, and the great leverage and access that they have to many sectors concerned with undergraduate education. Dr. Watson has been engaged in doing this both directly and collaboratively with the assistance of NSF professional staff and members of the advisory committee to NSF’s Directorate for Education and Human Resources responsible for writing the *Shaping the Future* report.

The recommendations of both *Shaping the Future* and *From Analysis to Action* have been discussed and presented in large national and regional meetings sponsored by these associations and societies, and also in planning sessions with their leadership. Increasingly, these societies are themselves publicizing *Shaping the Future* and sending copies of the report to their membership and to others with a stake in improving undergraduate education. Members of the societies and associations are expressing interest in hosting regional workshops at their campuses.

Campus-based regional workshops utilizing the report to directly promote reform serve as a second emerging mechanism. These workshops typically involve teams from institutions coming together to learn of national trends, of the work that others are doing, to share such information, and to develop their own plans.

As word of these activities has spread, individuals have requested advice and assistance at an increasing rate in their own efforts to improve SME&T undergraduate education. In most cases these are not inquiries about potential NSF support, but rather, requests for help in identifying best practices, invitations to on-campus or in-state promotion of education reform, and nomination of others to provide this type of assistance. As one example of this, a university leader called to ask for advice and assistance on the proposal that they are preparing for submission to the legislature.

### **Regional Workshops for “Shaping the Future”**

The regional versions of NSF’s July 1996 “Shaping the Future” conference are particularly noteworthy. The purpose of these regional workshops is to:

- facilitate specific regional and institutional plans to achieve widespread improvements in undergraduate education; and

- provide information to faculty and administrators on NSF programs and national activities to support undergraduate education reform.

The design of these workshops is determined by what is considered most effective by the host institutions with respect to their unique circumstances. The planning of these workshops generally embraces the following features:

- participation of institutional teams, representing faculty, administration, students, and business partners;
- significant involvement of employers of undergraduates;
- participation of public policy makers to engender public support for undergraduate education;
- development of institutional plans for reform of undergraduate education;
- exhibits of innovations in undergraduate education; and
- sessions to assist participants in developing projects and proposals.

Institutions have been encouraged to seek other academic hosts to share in the planning and design of regional workshops. Follow-up activities for the participants are also expected to be an important part of the workshop planning.

### **Strengthening Participation by Corporations and Foundations**

During the last several years, NSF has strengthened efforts to increase participation by members of the business and foundation community in undergraduate education reform. A Memorandum of Understanding, representing commitment to cooperation for revitalization of the nation's undergraduate education has been crafted for this purpose. It reads:

*In these rapidly changing times, the demands placed on the educational infrastructure of the nation, at all levels, are enormous and growing. This pace of change will continue to encourage cooperative relationships between all of those involved in, and all those who provide support for, the undergraduate education enterprise in the nation.*

*We, the undersigned, are committed to nurturing the evolution of the highest quality undergraduate science, mathematics, engineering, and technology (SME&T) education, and to catalyzing working relationships between all parties involved in its delivery, and its support. Towards this goal we intend to cooperate with our colleagues in other private, government or industry oriented funding organizations that support undergraduate education in the nation. We intend to share information about our funding plans and funding profiles, to work towards common and complete assessment of our funded projects, to encourage the widest possible dissemination of project results, and, when appropriate, to support these projects through cost sharing partnerships. We intend to meet as a group periodically to share successes and to cooperate in developing national strategies in education. Through cooperation, we intend to amplify the impact of our individual efforts.*

As of August 1997, the following signatories have joined this alliance:

<i>AirTouch Communications</i>	<i>Lockheed Martin</i>
<i>Bayer Corporation</i>	<i>Lucent Technologies</i>
<i>Belcore</i>	<i>Microsoft Corporation</i>
<i>Boeing</i>	<i>Motorola</i>
<i>Business-Higher Education Forum</i>	<i>Pew Science Program</i>
<i>The Camille &amp; Henry Dreyfus Foundation, Inc.</i>	<i>Shodor Education Foundation</i>
<i>DuPont</i>	<i>Society of Manufacturing Engineers Education Foundation</i>
<i>Exxon Education Foundation</i>	<i>Stratagene Cloning Systems</i>
<i>General Electric Fund</i>	<i>Technology Assessment and Transfer, Inc.</i>
<i>Global Wireless Education Consortium</i>	<i>Texas Instruments</i>
<i>Hewlett-Packard Company</i>	<i>Toyota</i>
<i>Howard Hughes Medical Institute</i>	<i>Wolfram Research</i>
<i>International Business Machines</i>	

### **Working Through Scientific Societies and Professional Associations**

Scientific societies, professional associations, and associations of colleges and universities are key to effective dissemination of the recommendations of *Shaping the Future*. Consequently, one of the key focal points of the “Shaping the Future NextSteps” campaign has been to reach these organizations through the active assistance of Dr. Robert Watson and members of the Advisory Committee for Education and Human Resources at NSF.

The following organizations have participated in or otherwise sponsored activities in the reform of undergraduate education through the NextSteps campaign:

- Accreditation Board for Engineering & Technology Inc. (ABET)
- Affiliated Colleges & Universities Office (ACUO)
- American Association for the Advancement of Science (AAAS)
- American Association of Community Colleges (AACC)
- American Association for Higher Education (AAHE)
- American Association of Physics Teachers (AAPT)
- American Association of State Colleges & Universities (AASCU)
- American Chemical Society (ACS)
- American Council on Education (ACE)
- American Geophysical Union (AGU)
- American Institute of Physics (AIP)
- American Mathematical Society (AMS)
- American Physical Society (APS)
- American Society for Biochemistry and Molecular Biology (ASBMB)
- American Society for Engineering Education (ASEE)
- Association of Community College Trustees
- Association for Women in Science (AWS)
- Consortium of Social Science Associations (COSSA)
- Council of Colleges of Arts & Sciences (CCAS)
- Council on Competitiveness
- Council of Scientific Society Presidents
- Council on Undergraduate Research (CUR)
- Education Commission of the States (ECS)

Institute of Electrical & Electronics Engineers (IEEE)  
 Mathematical Association of America (MAA)  
 National Academy of Sciences (NAS)  
 National Research Council (NRC)  
 National Association of State Universities and Land Grant Colleges (NASULGC)  
 National Council for Accreditation of Teacher Education (NCATE)  
 National Council for Resource Development (NCRD)  
 National Science Teachers Association (NSTA)  
 National Society of Black Engineers (NSBE)  
 SEMATECH  
 State Higher Education Executive Officers  
 Sigma Xi  
 Society for the Advancement of Chicanos and Native Americans in Science (SACNAS)

### **Chronological List of Conferences Sponsoring Workshops & Presentations in Support of “Shaping the Future NextSteps”**

The following chronological list indicates many of the meetings, conferences, and workshops that have been employed by DUE staff to facilitate widening awareness and increased momentum towards improved undergraduate education in SME&T. Members of the Advisory Committee have often joined the DUE staff in these activities for Education and Human Resources. This list is not complete, but is representative of the breadth of activities undertaken. It extends back to March 1996, because by then many of the findings and recommendations of *Shaping the Future* were being discussed in draft form, in advance of the report’s official release in July 1996.

#### **March, 1996**

- 1-3: Meeting of the Education Committee of the Geological Society of America (GSA), Boulder, CO
- 21-23: “The Genetics Revolution: A Catalyst for Education and Public Policy,” a meeting for community college faculty sponsored by American Association of Community Colleges (AACC), local colleges, and Exxon Education Foundation, Dallas, TX
- 24-26: 211<sup>th</sup> annual meeting of the American Chemical Society (ACS), New Orleans, LA

#### **April, 1996**

- 13-15: Annual meeting American Association of Community Colleges (AACC), Atlanta, GA
- 16-18: Meeting of the Government-University-Industry Roundtable, Seattle, WA
- 26: Special meeting (invited address) with a number of private firms, Phoenix, AZ

#### **May, 1996**

- 2-5: Annual Washington, DC joint meeting of the American Physical Society (APS) and the American Association of Physics Teachers (AAPT)
- 7-10: International conference on Acoustics, Speech, & Signal Processing sponsored by the Institute for Electrical and Electronic Engineers (IEEE), and the Signal Processing Society, Atlanta, GA
- 20-22: Spring meeting of the Geological Society of American (GSA), Baltimore, MD

#### **June, 1996**

- 1-6: Annual meeting of the American Society of Biochemistry and Molecular Biology (ASBMB), New Orleans, LA



- 13: Introductory Physics Reform Conference: An Undergraduate Faculty Enhancement (UFE) Project, Joliet, IL
- 16-18: Conference on publishing strategies sponsored by DUE, Hampshire College, and Saunders Publishing Co., Amherst, MA
- 27-28: The 6<sup>th</sup> biennial national conference of the Council for Undergraduate Research (CUR), North Carolina Central University, Durham, NC
- 30-July 5: Gordon Research Conference - Innovations in College Chemistry Teaching, Plymouth State College, NH

#### **July, 1996**

- 11-13: National conference, Shaping the Future: Strategies for Revitalizing Undergraduate Education, Washington, DC
- 13-15: EHR annual Partnership Conference, Washington, DC
- 27-30: Annual meeting of the American Society of Plant Physiologists (ASPP) and site visit to Trinity College, San Antonio, TX
- 31- August 3: International Conference on Undergraduate Physics Education (ICUPE), College Park, MD

#### **August, 1996**

- 4-7: 14<sup>th</sup> Biennial Conference on Chemical Education, Clemson University, SC
- 4-8: 47<sup>th</sup> Annual meeting of the American Institute of Biological Sciences (AIBS), Seattle, WA
- 5-10: Summer meeting of the American Association of Physics Teachers (AAPT), College Park, MD

#### **September, 1996**

- 25: Meeting of the Texas Association of Schools of Engineering Technology (TASET), Austin, TX
- 28-29: Meeting of the American Society of Biochemistry and Molecular Biology (Human Resources Committee), Washington, DC

#### **October, 1996**

- 4: American Society for Engineering Education (ASEE) regional meeting, Fargo, ND
- 7-8: Meeting of the National Visiting Committee for the University of Cincinnati - American Chemical Society (ACS) project "Advanced Technological Education in Chemical Technology," Silver Bay, NY
- 11-12: Annual meeting of Mathematical Sciences Department Chairs, Rosslyn, VA
- 16-19: National Association of Biology Teachers (NABT), Charlotte, NC
- 25-27: Project Kaleidoscope (PKAL) Workshop on Interdisciplinary Approaches to Teaching Science and Mathematics, Colby College, Waterville, ME
- 30: American Association of Community Colleges (AACC) Task Force on Academic and Student Affairs, Arlington, VA
- 31-November 1: Annual meeting of the Accreditation Board for Engineering Technology, Inc. (ABET), San Diego, CA

#### **November, 1996**

- 2: Mathematical Association of America (MAA), DelMarVa section, Frederick, MD
- 3-5: Regional meeting of the American Society for Engineering Education (ASEE), Fargo, ND
- 5-8: Institute of Electrical & Electronic Engineers (IEEE) meeting, Denver, CO

- 6-9: 26<sup>th</sup> Annual meeting of “Frontiers in Education,” Salt Lake City, UT
- 7: Annual joint meeting of the Alabama College Chemistry Teachers Association, Columbia, AL
- 7-10: Mathematicians and Education Reform (MER) workshop on "Teacher Education and Mathematics Departments," University of Illinois at Chicago, IL
- 8: Regional meeting, Issues in Gateway Chemistry Courses, University of Maryland, Baltimore County, Baltimore, MD
- 8-10: Project Kaleidoscope (PKAL) workshop, “Revitalizing Undergraduate Biology,” Morehouse College, Atlanta, GA
- 12: NSF Forum on Distance Learning, Washington, DC
- 12-17: Meeting of the American Mathematical Association of Two-Year Colleges (AMATYC), Long Beach, CA
- 13: Industry-University-Government Roundtable, Bethesda, MD
- 14: American Chemical Society (ACS) meeting, University of Maryland, College Park, MD
- 14: Annual meeting of the Council of Colleges of Arts and Sciences (CCAS) - Deans, Philadelphia, PA
- 14-17: NSF sponsored Task Force on "Educating the Next Generation of Information Specialists," Omaha, NE
- 15-17: "Spheres of Influence: Shaping the Future of Earth Systems Sciences Education" Meeting, American Geophysical Union (AGU) headquarters, Washington, DC
- 21-22: Meeting of the Institute of Electrical & Electronic Engineers (IEEE) Computer Society Education Board, Pittsburgh, PA
- 22-23: Workshop on the programs of DUE and key aspects of proposal preparation, Inter-American University, San Juan, PR

#### **December, 1996**

- 10: "Results of NSF Review of Undergraduate Science, Mathematics, Engineering and Technology (SME&T) Education," National Technological University (NTU) Faculty Forum (via live national satellite broadcast)
- 15: Meeting with American Council on Education (ACE), Washington, DC
- 28-30: Annual meeting of the Society for Integrative and Comparative Biology
- American Association of Community Colleges (AACCC) Presidents' workshop, Washington, DC
- Annual meeting of the American Society of Cell Biology (ASCB), San Francisco, CA
- National Council for Resource Development national conference, Washington, DC

#### **January, 1997**

- 4-10: Annual meeting of the American Association of Physics Teachers (AAPT), Phoenix, AZ
- 7: SUMMA (Strengthening Undergraduate Minority Mathematics Achievement) meeting, San Diego, CA
- 9-11: *NextSteps* presentation at the 6<sup>th</sup> annual meeting of the American Mathematical Association (AMA) and the Mathematical Association of America (MAA), San Diego, CA
- 15-19: *NextSteps* presentation at the meetings of the American Association for Higher Education (AAHE), San Diego, CA
- 28: Regional *Shaping the Future* workshop sponsored by the University of Washington and Bellevue Community College, Seattle, WA

- 30-February 2: Louisiana Collaborative for Excellence in Teacher Education regional workshop on *Shaping the Future*, Baton Rouge, LA
- 31-February 1: Oakton Community College workshop on *Shaping the Future*, Oakton, CA
- Joint annual meeting of Mathematics Societies, San Diego, CA

#### February, 1997

- 1-3: SEMATECH annual conference, Austin, TX
- 9-15: American Society of Limnology and Oceanography (ASLO), Santa Fe, NM
- 25: Annual meeting of the American Council on Education (ACE), Washington, DC
- 26: Meeting with the executive officers of the American Physical Society (APS) and the American Association of Physics Teachers (AAPT), with the staff from the American Institute of Physics (AIP), College Park, MD
- 28: Meeting of the American Psychological Association (APA), Washington, DC
- 27-28: Annual meeting of the ACM Special Interest Group in Computer Science Education (SIGCSE) and the ACM 50th Anniversary, San Jose, CA
- 27-28: Annual meeting of the National Visiting Committee of NSF Los Angeles Collaborative for Excellence in Teacher Preparation (LACTE), Los Angeles, CA

#### March, 1997

- 4: Meeting of the Federal Interagency Chemistry Representatives (FICR), Washington, DC
- 6: National meeting of the Association for Practical and Professional Ethics, Alexandria, VA
- 6-8: Annual conference of Sigma Xi, New Orleans, LA
- 10-11: North Louisiana Research Conference, Louisiana Tech University, Ruston, LA
- 13-19: Symposium, New Developments in Education in Analytical Chemistry, held at the 'Pittsburgh Conference' on Analytical Chemistry and Applied Spectroscopy, Atlanta, GA
- 14: Workshop II of Curriculum Development in Analytical Sciences, Atlanta, GA
- 14-16: Regional workshop on *Shaping the Future*, hosted by California State University at Los Angeles, Los Angeles, CA
- 14-16: Alliances for Minority Participation (AMP) - Teacher Preparation meeting, Puerto Rico
- 16-17: Meeting of the national conference steering committee for A National Urban Summit: Creating a Techno-Literate Workforce Through Major Policy Change - Forging Communication Among Business, Education, and Government for Strengthening Technical Skills Among Urban Students, Chicago, IL
- 16-19: The Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Atlanta, GA
- 23: Meeting with the Consortium for Social Science Associations (COSSA), Washington, DC
- 27: Meeting with the Delaware Community College System, Dover, DE
- 27-30: National Society of Black Engineers national conference, Washington, DC

#### April, 1997

- 7: *Shaping the Future* presentation at Washington & Lee University, Lexington, VA
- 10: *Shaping the Future* presentation at University of California, Davis, CA
- 11-12: The Council on Undergraduate Research (CUR) April Dialogue meeting: The Teaching-Research Connection, National Institutes of Health, Bethesda, MD
- 11-12: The Modular CHEM and ChemLinks consortia pedagogy meeting, Berkeley, CA
- 13-17: 213<sup>th</sup> National meeting of the American Chemical Society (ACS), San Francisco, CA

- 17-18: Meeting of principal investigators and evaluators, Systemic Change in Chemistry Curriculum project, Menlo Park, CA
- 18-19: *Shaping the Future* regional workshop, co-hosted by University of Missouri, Columbia, and St. Louis Community College, St. Louis, MO
- 18-19: Spring meeting of the MD/DC/VA Section of the Mathematical Association of America (MAA), College of William and Mary, Williamsburg, VA
- 18-21: Joint annual meeting of the American Physical Society (APS) and the American Association of Physics Teachers (AAPT), Washington, DC
- 20: Arizona State University faculty retreat, Tempe, AZ
- 24-26: National Council for Resource Development (NCRD) Regional IV Conference, Savannah, GA
- 24-27: Phi Theta Kappa International convention, Dallas, TX

#### May, 1997

- 8: Sigma Xi/A\*DEC Town Meeting video conference on *Shaping the Future*, "Undergraduate Education to Meet Societal Needs in the 21<sup>st</sup> Century," Research Triangle Park, NC
- 8-9: Regional workshop on *Shaping the Future*, "Revitalizing Undergraduate Mathematics and Science Education: A National Dialogue," Michigan State University, East Lansing, MI
- 8-9: Edu.Tech@Work97 Conference and Expo, Bellevue, WA
- Meeting of the education board of the Association of Computing Machinery (ACM), Atlanta, GA
- 10-11: Regional workshop on *Shaping the Future*, "Revitalizing Undergraduate Mathematics and Science Education: A National Dialogue," The University of Michigan, Ann Arbor, MI
- 16: Presentation to the North Carolina Community College System, "Leading the Nation: Opportunities for Two-Year Colleges," Smithfield, NC
- 16-17: National Institute for Science Education (NISE) Workshop on Collaborative Learning, Madison, WI
- 19-23: 96<sup>th</sup> Annual meeting of the American Society for Microbiology (ASM), New Orleans, LA
- 24-25: 11<sup>th</sup> International *C. Elegans* research conference, Madison, WI

#### June, 1997

- 5-7: Program workshop, NSF Collaborative for Excellence in Teacher Preparation (CETP) program, attended by 10 Collaboratives, California State University, Dominguez Hills, CA
- 11-13: Meeting of Mathematics Across the Curriculum (MATC), Villanova University, Philadelphia, PA
- 15-17: Annual meeting of the American Society for Engineering Education (ASEE), Milwaukee, WI
- 18: Regional workshop on *Shaping the Future*, Central Washington University, Ellensburg, WA
- 20-21: 6<sup>th</sup> Conference on the Teaching of Mathematics, Milwaukee, WI
- 22-27: Unidata Workshop, Using Instructional Technologies and Satellite Data for College Level Education in the Atmospheric and Earth Sciences, sponsored by the University Corporation for Atmospheric Research (UCAR) and the National Center for Atmospheric Research (NCAR), University of Colorado, Boulder, CO
- 30-July 2: McNU 97, Northwestern University, Evanston, IL

#### **July, 1997**

- 10-12: 1997 Reunion of Research Opportunity Award (ROA) participants
- 14-17: Annual meeting of the Society for Industrial and Applied Mathematics (SIAM), Stanford University, Palo Alto, CA
- 19-20: Project Kaleidoscope (PKAL) workshop, Research-Rich Environments for Undergraduate Education, Washington, DC
- Annual meeting of the American Association of Medical Colleges, Washington, DC
- 22: Presentation of *Shaping the Future* recommendations to reviewers at the annual NSF DUE panel reviews of proposals submitted to its Course and Curriculum Design (CCD) and Undergraduate Faculty Enhancement (UFE) programs, Arlington, VA
- 24-26: 2<sup>nd</sup> Association of Computing Machinery (ACM) International Conference on Digital Libraries, Philadelphia, PA
- 29: *Shaping the Future* Workshop at Chautauqua Institute, Chautauqua, NY

#### **August, 1997**

- 23-28: ASBMB (American Society for Biochemistry and Molecular Biology) satellite meeting "2001: Biochemistry Education for the Millennium," organized by the Human Resources Committee of the ASBMB, University of California at San Francisco, San Francisco, CA.

#### **September, 1997**

- 16: Symposium on "Shaping the Future of Undergraduate Education and The Role of University, Industry and Government in the Development of Human Resources," The Inter-American University of Puerto Rico - Metropolitan Campus (IAU-M).

#### **October, 1997**

- 4-5: Project Kaleidoscope's annual workshop, "Reforming Earth and Planetary Science Curricula: What Works," Whitman College, Walla Walla, WA.
- 8-11: The 1997 Convention of the NABT (National Association of Biology Teachers) overview of *Shaping the Future*, Minneapolis, MN.
- 17: Workshop on "Shaping the Future: The Role of Two-Year Colleges" at the ACCT (Association of Community College Trustees) annual conference, Washington, DC.
- 24 - 25: Regional *Shaping the Future* workshop hosted by Drexel University, Philadelphia, PA.
- 25-27: Geological Society of America, GSA's *Shaping the Future*, Salt Lake City, UT.

#### **November, 1997**

- October 31-Nov 2: Project Kaleidoscope Workshop on "Enhancing Learning-Centered Environments: The Biology of the Future," University of Wisconsin, Madison, WI.
- 14: State of Maine Regional Follow-Up to *Shaping the Future*, Bates College, Lewiston, ME.

#### **December, 1997**

- 4: District of Columbia Section of the American Society of Mechanical Engineers, "Shaping the Future" and its implications for the mechanical engineering profession, Washington, DC.

#### **January, 1998**

- 4-8: Gordon Research Conference on Innovations in College Chemistry Teaching, Ventura, CA.

- 6-10: The annual joint meetings of the American Mathematical Society (AMS) & Mathematical Association of America (MAA), Baltimore, MD.
- 16 - 17: Workshop on the New Traditions Chemistry Initiative, Madison, WI
- 22: Maryland Collaborative for Excellence in Teacher Preparation Workshop on "Shaping the Future of Mathematics and Science in Maryland," College Park, MD.

#### **February, 1998**

- 14-15: Shaping the Future Follow-Up Conference, hosted by Birmingham Southern College, Birmingham, AL.
- 19-20: South Carolina Shaping the Future Conference, hosted by the University of South Carolina, Columbia, SC.

#### **March, 1998**

- 20: A Regional Conference on "Transforming Undergraduate Education in SME&T," hosted by New Jersey Institute of Technology, Newark, NJ.

#### **April, 1998**

- 3-4: A Regional Shaping Conference, hosted by Northeastern University, Boston, MA.

#### **May, 1998**

- 1: Meeting of the Governing Board of the Hispanic Association of Colleges and Universities, Washington, DC.
- 1-2: A Regional Conference "Shaping the Future with Core Curriculum Reform: Guiding Undergraduate Education in SME&T," Colorado State University, Fort Collins, CO.
- 6: Meeting of the Education and Human Resources Committee of the Semiconductor Industry Association (SIA), Washington, DC.
- 8 - 9: A Shaping the Future Regional Conference, "From Dialogue to Action: Improving Instruction, Collaborations, and Partnerships in Mathematics and Science for All Students, A Workshop for Stakeholders in the Future of P-16 Education," hosted by at Clark Atlanta University, Atlanta, GA.
- 8 - 9: Regional New York Shaping the Future Conference, New York City, NY.
- 11 - 13: The North Dakota planning conference, "Reforming Undergraduate Science and Mathematics Education," Bismark, ND.

### **Bibliography of New Publications in Support of Shaping the Future of Undergraduate Education in Science, Mathematics, Engineering, and Technology**

A much longer bibliography of material that influenced the preparation of Volume 1 of *Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics, Engineering, and Technology* (NSF 96-139) is available at the end of Volume 2. The following bibliography is provided as a separate listing of those published books and articles that appeared after the conclusions and recommendations of Volume 1 had been prepared.

Paul E. Adams and Gerald H. Krockover, "Beginning Science Teacher Cognition and Its Origins in the Pre-service Secondary Science Teacher Program," *Journal of Research in Science Teaching*, Vol. 34 (1997), p. 663.

- The Boyer Commission on Educating Undergraduates in the Research University, (Shirley Strum Kenny, Chair) "Reinventing Undergraduate Education: A Blueprint for America's Research Universities," 15 May, 1998. Available from <http://notes.cc.sunysb.edu/Pres/boyer.nsf>
- Marvin Druger, "Preparing the Next Generation of College Science Teachers," *Journal of College Science Teaching*, Vol. 26 (1997), p. 424.
- D. Fulker, S. Bates, and C. Jacobs, "Unidata: A Virtual Community Sharing Resources and Technological Infrastructure," *Bulletin of the American Meteorological Society*, Vol. 73, No. 3 (1997).
- Jerry Bell and Alphonse Buccino (editors), *Seizing Opportunities: Collaborating for Excellence in Teacher Preparation* (Washington, DC: American Association for Advancement of Science, 1997).
- William E. Campbell and Karl A. Smith, *New Paradigms for College Teaching* (Edina, MN: Interaction Book Company, 1997).
- James Cooper and Pamela Robinson, *Annotated Bibliography of Science, Mathematics, Engineering, and Technology (SMET) Resources in Higher Education* (Working Draft, California State University - Dominguez Hills, 1997).
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