Notre Dame

REPORT

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1990-91

Fall Enrollment Totals 10,026

Enrollment for the 1990 fall semester at the University totaled 10,016, down 0.1 percent from the 1989-90 academic year. This is the second consecutive year that fall enrollment exceeded 10,000 students.

Undergraduates numbered 7,545. The freshmen class makes up 23.9 percent of the undergraduate student body. Sophomores make up 24.7 percent; juniors, 24.8 percent; seniors, 25.0 percent; and fifth year students, 1.5 percent.

The College of Arts and Letters enrolled 2,558 students. The College of Business Administration enrolled 1,526; Engineering, 939; and Science, 799.

Postbaccalaureate students totaled 2,481. Graduate School enrollment was 1,409. Law students totaled 566 and graduate business students 517.

Women, numbering 3,648 Notre Dame students, make up 36.4 percent of the student body. Minority students make up 13.1 percent of the undergraduate student body and 5.7 percent of postbaccalaureate students. International students compose 2.1 percent of undergraduate students and 19.1 percent of postbaccalaureate students. Catholics make up 86.6 percent of the undergraduate student body and 39.7 percent of postbaccalaureate students.

Deloitte & Touche Support Accounting Activities

The University has received a $500,000 commitment from the Deloitte & Touche international accounting and consulting firm. The commitment will bring to $800,000 the firm's endowed fund in Notre Dame's Department of Accounting. The Deloitte & Touche Endowed Fund in Accounting is used to support research, curriculum development and other activities of the department's faculty and students.

Daniel J. Kelly, vice chairman of Deloitte & Touche and a 1957 Notre Dame graduate, believes that the continued involvement of the academic community in accounting research is a critical factor in the vitality of accounting.

The Deloitte & Touche commitment represents the firm's participation in the University's $417 million Strategic Moment fundraising campaign.

Lilly Establishes Teaching Fellowship Program

In the 1991-92 academic year a new teaching fellows program in the College of Arts and Letters will be established through a $135,000 grant from Lilly Endowment Inc.

The program, to be directed by college fellow Frank J. Bonello, associate professor of economics, will select five junior and one recently tenured faculty in the college to work for one year with senior mentors on a teaching-related project of their own design and to participate in monthly discussions.

The duration of the fellowship will be one year. Those applicants chosen as fellows will be entitled to one course reduction and a summer stipend. As fellows, they will prepare an innovative teaching project that may include the development of a new course of revision of an existing course by altering teaching materials or methods.

Fellows will invite a senior faculty member of their choosing to serve as their mentor during the fellowship year. These mentors will enrich fellows' understanding and knowledge of teaching, either in general or in a fellow's own discipline.

Financial Aid Awarded to Students

Sixty-nine percent of Notre Dame students receive some form of financial aid, according to a report released by the University's Office of Financial Aid.

This percentage remained stable in the two years compared in the report (the 1988-89 and the 1989-90 academic years), while the average aid per student grew about 10 percent.

The volume of dollars reached an all time high of $61,203,814 in the more recent of the two academic years, 1989-90, reflecting a 12 percent growth. During that same academic year the University administered 1,886 scholarships totaling $5,449,413, an average of $2,889 per award. Outside scholarships numbered 1,498 and totaled $2,945,579, an average of $1,966 per award.

Additional non-federal funds—in the form of alternative loans, grants-in-aid, remissions and University student employment—brought the total of non-federal financial aid to Notre Dame students to $32,637,704.

Federal assistance programs aided 7,641 students a total of $21,260,419, averaging $2,782 per award. ROTC scholarships were given to 606 students for a total of $7,305,691.

During the 1989-90 academic year, the unduplicated number of students aided was 6,894, up from 6,770 in the previous year. The unduplicated average aid provided was $8,878, up $8,063. Percentage of students aided was 69 percent in both years.

Contributions Exceed $1 Million per Week

Cash contributions to the University exceeded $1 million a week during fiscal year 1990 and amounted to $53.8 million for the year, the highest total in the University's history.

The record giving level, which excludes pledges of future gifts, more than doubles the total five years ago and represents a $9-million increase over fiscal 1989, according to the annual report of the Department of Development. In reaching the new high, the University achieved record results in virtually every giving category—planned giving, total foundation and corporate support, and the Annual Fund.

Included in the record total is $2.4 million in corporate matching funds for fiscal 1990, the second consecutive year the University has reached the $2-million mark. Notre Dame was just the fourth university—after Harvard, Yale and Princeton—to achieve that level of matching funds.

A study by the Council for the Advancement and Support of Education during the year marked Notre Dame's development program second in the nation in terms of both actual versus projected fund raising success and in annual gift income as a proportion of the institutional budget.

In fiscal 1990, planned giving commitments—including bequests, trusts, insurance and other estate gifts—totaled a record $27 million, $5 million more than in the previous year and four times the level of giving just three years ago. Membership in the Badin Guild, established for benefactors who include the University in their estates, reached 340, and the total calculable commitments of guild members passed $74 million.

Foundation and corporate support totaled more than $18.5 million in fiscal 1990, and new gifts and commitments for the first time exceeded $5 million more than $1 million over the previous year's total. The Annual Fund, posting its sixth consecutive record-setting year, for the first time exceeded $10 million in gifts. Its final total of $10.8 million for the year placed the fund among the most successful in the nation. The fund also achieved a record number of gifts—more than 47,000—and a record increase in giving of almost $2 million over the previous year.

The Sorin Society, the Annual Fund's flagship program whose members each contribute a minimum of $1,000 annually in unrestricted gifts, raised more than $4.5 million during the year, its first time exceeding the $4-million mark. The society enrolled 834 new members during the year—its largest-ever annual growth.

Steinfels to Speak at Commencement

Margaret O'Brien Steinfels, editor of *Commonweal* magazine, will address the 146th Commencement Exercises to be held May 19.

The first woman to edit the nation's most influential Catholic magazine, Steinfels has headed the *Commonweal* editorial staff since 1988. The lay-edited Catholic journal of public affairs, religion, literature and the arts is in its 66th year of publication. Previously, Steinfels had been editor of *Church*, a publication of the national Pastoral Life Center; executive editor of *Christianity and Crisis*; editor of the *Hastings Center Report*; a reporter and columnist for the *National Catholic Reporter*, and a movie reviewer for *Today*.

A Chicago native, Steinfels was graduated from Loyola University in 1963, studied art and film history at Columbia University and took courses at the Sorbonne in Paris before obtaining a master's degree in American history from New York University in 1971. She is a member of the National Center for the Laity and a former board member of the Catholic Press Association.

UND Press Book Named Outstanding by the Myers Center

A University of Notre Dame Press book, *Poorest of Americans: The Mexican Americans of the Lower Rio Grande Valley of Texas* by Robert Lee Maril, has been named one of the 1990 Outstanding Books on Human Rights by the Gustavus Myers Center for the Study of Human Rights in the United States.

In his book, Maril, a faculty member at Oklahoma University, uses statistical data to describe the plight of a community of people who "by almost every quantifiable measure which describes poverty" are poorer than those of any other region, rural or urban, in the nation. Examining the region's history from Spanish colonization to the present, he shows how the development of a two-class system has affected the valley's political and economic development; how its powerful citizens maintain control over its vulnerable citizens through a pervasive system of patronage; and how that oppression has resulted in a two-tiered system of health care, education, employment and public services.

The Gustavus Myers Center at the University of Arkansas in Fayetteville, Ark., was established "to identify, reward, and publicize outstanding books about all kinds of intolerance in the United States."

Department of Energy Supports Energy Analysis and Diagnostic Center

An energy analysis and diagnostic center to serve local manufacturers has been established by the University of Notre Dame with the financial support of the U.S. Department of Energy.

The center, which serves small- and medium-sized manufacturers within a 150 mile radius, will help manufacturers identify and apply technology to reduce energy consumption and lower costs.

Notre Dame engineering students, under the immediate supervision of Notre Dame faculty, will visit plants, analyze process operations and energy use, and provide both energy management information and technical assistance to improve efficiency of energy use.

Organizers hope the program will increase plant efficiency, resulting in a stronger climate for economic development in the region. Based on similar centers operating elsewhere, savings of at least $3,000 per plant are expected. When fully operational, organizers hope to perform about 30 analyses per year.

The program is designed to serve industrial firms within the Standard Industrial Classification Code 20-39, who meet at least three of the following criteria:

- A maximum of $1.75 million per year in energy costs at a particular plant;
- A maximum of $75 million per year in gross sales for a particular plant;
- A maximum of 500 employees at a particular plant;
- Or a lack of in-house professional expertise in energy use and a need for conservation at the particular plant to be served.

The center director is John Lucey, associate professor of aerospace and mechanical engineering. William Berry, professor of electrical engineering, is the assistant director.

Faculty Notes

Honors

Michael G. Bowen, assistant professor of management, and F. Clark Power, associate professor in the Program of Liberal Studies, received the runner-up award from the Ethics in Business program and Alling Institute for Business Ethics at the Graduate School of Business at Columbia University for the case "Exxon's Knee-Deep in the Bib Muddy."

Francis J. Castellino, dean of science and Kleiderer/Pezold professor of biochemistry, received the "Method to Extend Research in Time" (MERIT) award from the National Heart, Lung, and Blood Institute, National Institutes of Health. This prestigious award is given for a regular research project grant application that is deemed highly meritorious, including a past record of scientific achievement and demonstrated leadership in the research area addressed by the grant application, and an area of research of recognized importance or of special promise.

Daniel J. Costello Jr., chairman and professor of electrical engineering, was named as an overseas adviser to the Japanese Institute of Electronics, Information and Communication Engineers Transactions on Fundamentals of Electronics, Communications and Computer Sciences.

Anthony N. Michel, McCloskey dean and Freimann professor of electrical engineering, was appointed an associate editor-at-large of the *IEEE Transactions on Automatic Control.*

Leonard E. Munstermann, associate faculty fellow in biological sciences, was appointed chair of the standing committee on International Affairs by the Board of Governors of the Entomological Society of America, 1991-92.

Asokendu Mozumder, faculty fellow in chemistry and biochemistry and in the Radiation Laboratory, has been nominated to the International Advisory Committee for the "International Conference on Liquid Radiation Detectors: Their Fundamental Properties and Applications" to be held in Tokyo in April 1992.

Morris Pollard, Coleman director of the Lobund Laboratory and professor emeritus of biological sciences, has been designated chairman of the fourth annual Cancer Symposium sponsored by the Coleman Foundation of Chicago, Ill. The symposium will meet at Notre Dame, Ind., Nov. 23-24.

John J. Powers, adjunct associate professor of American Studies, received the 1990 Hoosier State Press Association Award for Distinguished Editorial Writing, becoming the first Hoosier ever to win that honor three times. The spotlighted entry, Little Orphan Andy, was printed in the *South Bend Tribune* on March 4, and concerned the CBS suspending commentator Andy Rooney and then reinstating him under pressure.

Kwang-tzu Yang, Hank professor of aerospace and mechanical engineering, was elected program chairman of the 1992 ASME winter annual meeting, coordinating all technical activities of the 36 technical divisions and six ad hoc committees of the society, to be held in Anaheim, Calif. Yang was also elected to serve as a member-at-large of the Operating Board of the ASME Basic Engineering Group consisting of the Divisions of Applied Mechanics, Heat Transfer, Fluid Engineering, Bioengineering and Tribology for a three-year term.

Activities

Panagiotis J. Antsaklis, professor of electrical engineering, presented a paper on "Optimal Stabilization of Discrete Event Systems" at the 29th IEEE conference on Decision and Control in Honolulu, Hawaii, Dec. 5-7. He was an invited panelist in a discussion on "Perspectives on Intelligent Control" at the same conference.

Subhash C. Basu, professor of chemistry and biochemistry, gave the invited speeches "Regulation of Glycosyltransferases Studied *in vitro*" and "DNA Chain Initiation by Polymerase- /Primase Complex" to the Department of Biochemistry and Nutrition at the Medical Science Campus in San Juan, Puerto Rico, June 26-27. He gave the seminar talk "Initiation of DNA Chain by DNA Pol- /Primase Complex" to the Cleveland Clinic Foundation in the Department of Molecular Biology in Cleveland, Ohio, July 28.

Howard A. Blackstead, associate professor of physics, presented the contributed talk titled "Magnetic Resonance in Gd123" by D.B. Pulling and "Microwave Dissipation in Crystalline BSCCO and YBCO" by Paul J. McGinn, assistant professor of electrical engineering, at the Midwest Solid State Conference in Lincoln, Nebr., Nov. 9-10.

Hsueh-Chia Chang, chairman and professor of chemical engineering, presented "Enhancement of Heat Transfer by Chaotic Mixing" at the EPRI workshop on Application of Chaos held in San Francisco, Calif., Dec. 4-9.

Michael J. Chetcuti, associate professor of chemistry and biochemistry, presented an invited lecture for a symposium titled "Activation of Small Molecules by Polynuclear Metal Complexes" at the S.E./S.W. ACS meeting in New Orleans, La., Dec. 5-7.

Rev. Austin I. Collins, C.S.C., assistant professor of art, art history and design, gave the competitive sculpture exhibition "Midwestern Sculpture Exhibition" at the Century Center Art Center in South Bend, Ind., Oct. 28-Dec. 30. He gave the invitational sculpture exhibition "Assemblages" at Wabash College in Crawfordsville, Ind., Oct. 29-Nov. 20. He gave an invited solo sculpture exhibition at King's Col-

lege in Wilkes-Barre, Pa., Nov. 2-30. Collins delivered the invited slide lecture titled "Narrative Sculpture" at Wabash College in Crawfordsville, Ind., Nov. 26.

Rev. James T. Connelly, C.S.C., adjunct assistant professor in the Arts and Letters Core Course, was an invited participant in a consultation on a history of the Roman Catholic mission outreach from the United States sponsored by the U.S. Catholic Mission Association and held at the Overseas Ministries Study Center in New Haven, Conn., Dec. 1-2.

Daniel J. Costello Jr., chairman and professor of electrical engineering, presented the paper titled "A Hybrid M-Algorithm/Sequential Decoder for Convolutional and Trellis Codes" at the 1990 international symposium on Information Theory and Its Applications in Waikiki, Hawaii, Nov. 28.

Jean A. Dibble, assistant professor of art, art history and design, was invited to show two monoprints in the "Invitational Works on Paper" exhibition at Clarke College in Dubuque, Iowa, Nov. 26-Dec. 31.

Dennis P. Doordan, associate professor of architecture, presented "Designing an Aluminum World: Industrial Designers and the American Aluminum Industry" at Industry and Anti-Industry: An International Design History Conference held at the Victoria & Albert Museum in London, England, Dec. 7-9.

Alfred J. Freddoso, professor of philosophy, presented a paper titled "A Suarezian Model of Efficient Causality" to the Philosophy Department of Purdue University in West Lafayette, Ind., Nov. 29.

Dolores Warwick Frese, associate professor of English, presented "Chaucer's 'Thynne' Pilgrims: Visual *Mouvance* and the Order of the *Tales* in the First Collected Edition of 1532" at the seventh international congress of the New Chaucer Society in Canterbury, England, Aug. 8. She presented "Goddess Myths and Female Sovereignty in Some Medieval British Fictional Texts" at the conference on Women and Sovereignty sponsored by the Traditional Cosmology Society of Edinburgh University and held at the University of St. Andrews in St. Andrews, Scotland, Sept. 4. She presented "Names of Women in the *Canterbury Tales*: Chaucer's Involucral Art of Nomenclature" at the international conference on Women in Medieval English Literatures and Chaucer at the University of Liège in Liège, Belgium, Nov. 30.

Mohamed Gad-el-Hak, professor of aerospace and mechanical engineering, chaired a session and presented a talk titled "On the Nonlinear Dynamics of a Rotatable Cylinder-Splitter Plate Body" at the annual meeting of the American Physical Society Division of Fluid Dynamics in Ithaca, N.Y., Nov. 18-20.

Kimberly A. Gray, assistant professor of civil engineering, chaired a session titled "Theory and Application of Radiation Processes for the Destruction of Hazardous Compounds" at the annual meeting of the American Institute of Chemical Engineering in Chicago, Ill., Nov. 13. She gave the invited seminar "Influence of Natural Organic Material on Water Treatment Processes" at James M. Montgomery Consulting Engineers in Walnut Creek, Calif., Nov. 30.

Wiliam G. Gray, chairman and Massman professor of civil engineering, gave the lecture titled "On the Equations for Describing Unsaturated Flow " to the Department of Hydraulics, Soil Physics and Hydrology at the Agricultural University of Wageningen, The Netherlands, Nov. 15.

Alexander J. Hahn, professor of mathematics, gave the colloquium lecture "Quadratic Groups and Quadratic Forms" to the Mathematics Department of Miami University in Oxford, Ohio, Nov. 29. He lectured on "The Number Theory of the Quadratic Group" to the Algebra Seminar in the same department, Nov. 30.

John D. Halfman, assistant professor of earth sciences, presented "Cyclic Sedimentation in Lake Turkana, Kenya: New Data and Chronologic Controls" co-authored with T.C. Johnson, B.P. Finney, P.J. Hearty and T.K. Hagelberg at the American Geophysical Union 1990 fall meeting in San Francisco, Calif., Dec. 6. He co-authored "Rare Earth Elements in East African Rift Sediments (Lake Turkana)" with **Annette M. Olivarez,** assistant professor of earth sciences, and T.C. Johnson which was presented at that meeting.

Nai-Chien Huang, professor of aerospace and mechanical engineering, presented the paper titled "Self-Similar Solution in Problems of Hydraulic Fracturing" at the ASME winter annual meeting held in Dallas, Tex., Nov. 25-30.

John G. Keane, Gillen dean of business administration and Korth professor of strategic management, was the moderator of the Pacific Basin Outlook Session at the academic symposium of the Korea Economic Institute of America held at the University of California in San Diego, Calif., Nov. 9.

V. Paul Kenney, professor of physics, presented a paper titled "Bose-Einstein Correlations in Antiproton-Proton Collisions at 1.8 GeV" at the 25th international conference on High Energy Physics in Singapore, Aug. 2.

Lloyd H. Ketchum Jr., associate professor of civil engineering and member of the Center for Bioengineering and Pollution Control, presented an invited talk titled "Undergraduate Research at the Elkhart Environmental Center" for the College of Engineering at Valparaiso University in Valparaiso, Ind., Dec. 4.

Faculty Notes

Charles F. Kulpa, associate professor of biological sciences, visited the Argonne National Laboratory in Argonne, Ill., Nov. 12. He gave the invited presentation "Microbial Metabolism of TNT in Liquid Cultures and Soil Slurries" at the symposium on the Use of Genetic Engineering and Natural Selection in Pollution Control at the NIChE national meeting held at the Palmer House in Chicago, Ill., Nov. 12.

Gary A. Lamberti, assistant professor of biological sciences, was an invited participant in the workshop "Biological Monitoring of Freshwater Ecosystems" sponsored by the International Society of Limnology and the U.S. Environmental Protection Agency held at Purdue University in West Lafayette, Ind., Nov. 29-Dec. 1. He presented the seminar titled "Landform, Disturbance, and the Structure of Stream Ecosystems" at the Kellogg Biological Station of Michigan State University in East Lansing, Mich., Dec. 7.

David C. Leege, professor of government and international studies and director of the Hesburgh Program in Public Service, gave an address to the Consultation on Small Christian Communities in U.S. Parishes held at Notre Dame, Ind., Oct. 1. He was an invited participant in the conference on Religion and the Open University sponsored by the Institute on Religion and Public Life held in New York, N.Y., Oct. 11-12. He delivered a paper and co-chaired a roundtable on Measuring Religiosity in Studies of Political Behavior at the annual meeting of the Society for the Scientific Study of Religion in Virginia Beach, Va., Nov. 9-11.

Paul J. McGinn, assistant professor of electrical engineering, presented the talk "Textured Microstructures in YBa_2Cu3O_{6+k} and Related Compounds by Zone Melting" and "Transport Properties and Flux Pinning in Grain Textured YBa_2Cu3O_X" at the Materials Research Society annual meeting in Boston, Mass., Nov. 27. He gave the invited talk "Melt Texturing of High Temperature Superconductors" at the American Superconductor Corp. at Watertown, Mass., Nov. 30.

Martin F. Murphy, assistant professor of anthropology, served as co-organizer and chair of two invited panels "Science, Materialism and the Study of Culture, Parts I and II" at the American Anthropological Association meetings in New Orleans, La., Nov. 27.-Dec. 2.

Leonard E. Mustermann, associate faculty fellow in biological sciences, gave the invited address "Colonization Patterns of *Aedes albopictus* Inferred by Genetic Differentiation of Geographic Populations" co-authored with **William A. Hawley**, assistant faculty fellow in biological sciences, in the symposium titled "*Aedes albopictus* in North America, Present and Future Directions" at the 39th annual meeting of the American Society of Tropical Medicine and Hygiene in New Orleans, La., Nov. 5. Mustermann and Hawley presented a research paper titled "Sampling and Genetic Evidence for High Abundance but Limited Migration in Southeast Asian *Aedes albopictus*" at that meeting. Mustermann organized, moderated and introduced a half-day symposium titled "The Deadliest Insect Genus—*Anopheles*" co-sponsored by the Medical Entomology Section and the International Affairs Committee of the Entomological Society of America at that meeting. He also chaired the first meeting of the newly constituted Standing Committee on International Affairs and organized an "International Affairs and Entomology" Information Booth with Hiram Larew of the United States Agency for International Development (State Department.)

Annette M. Olivarez, assistant professor of earth sciences, presented "Rare Earth Elements in East African Rift Sediments (Lake Turkana)" and served as session presider for "Sedimentary and Low-Temperature Geochemistry" at the American Geophysical Union in San Francisco, Calif., Dec. 3-7.

James S. O'Rourke IV, associate professor of management, presented "Executive Language Skills in the Public Sector" to the U.S. Department of Agriculture, Agricultural Research Service, Financial Management Division, at the Financial Council Conference in New Orleans, La., Sept. 21. He served on the panel discussion "Megatrends and the International Business Climate" at the Indiana Chamber of Commerce Regional Business Briefing in Elkhart, Ind., Sept. 25. He presented "Communication Strategies for Senior Leaders" at the 1990 Senior Public Affairs Officers Conference at the Defense Information School in Ft. Benjamin Harrison, Ind., Nov. 1. He presented "Communication Skills and Your Management Style" and "Listening as a Management Tool" to the H.J. Heinz Corporation District Managers Conference at the University of Notre Dame, Notre Dame, Ind., Nov. 5.

Samuel Paolucci, assistant professor of aerospace and mechanical engineering, presented the papers "Stability of Natural Convection Flow Along a Heated Plate Immersed in a Stratified Environment" and "Compressible Flow of a Two-Phase Mixture Between Finite Vessels via an Abel-Noble Gas Expansion" at the 43rd annual meeting of the Fluid Dynamics Division of the American Physical Society meeting held at Cornell University in Ithaca, N.Y., Nov. 18-20.

Morris Pollard, Coleman director of the Lobund Laboratory and professor emeritus of biological sciences, was an invited participant in the Focus Giving Symposium sponsored by Johnson & Johnson, Inc., in Brunswick, N.J., Nov. 27.

Karamjit S. Rai, professor of biological sciences, presented a paper titled "Distribution and Copy Number of 18S and 28S rRNA genes in mosquito genomes (Diptera:Culicidae)" co-authored with A. Kumar at the annual meeting of the Entomological Society of America in New Orleans, La., Dec. 4. Three other papers were co-authored by Rai and were pre-

sented at that meeting: **Srinivas Kambhampati**, assistant faculty fellow in biological sciences, presented "Mechanisms Influencing the Evolution of rDNA Nontranscribed Spacer in *Aedes albopictus*"; Rex E. Thomas presented "Inheritance of Dengue-1 Transmission Barriers among United States Populations of *Aedes albopictus*"; and Christopher Bosio presented "Transovarial Transmission of Dengue-1 Virus in Geographically Distinct U.S. Strains of *Aedes albopictus*."

Frank K. Reilly, Hank professor of business administration, presented "Using Cash Flows and Financial Ratios for Predicting Bankruptcies" at a high yield conference sponsored by Nomura Securities in Tokyo, Japan, Nov. 15.

Jonathan Sapirstein, associate professor of physics, gave the invited talk "Paricle Physics Implications of High Accuracy Analysis of Parity Nonconservation in Cesium" at Fermilab in Batavia, Ill., Dec. 11.

James H. Seckinger, director of the National Institute for Trial Advocacy and professor of law, served as program coordinator and a faculty member for the NITA/Fish & Neave Law Firm Deposition Program in New York, N.Y., Nov. 8-10. He gave a lecture to the faculty on Effective Teaching Techniques. He was program coordinator and a faculty member for the NITA/Gunster, Yoakley & Stewart Law Firm Deposition Program in West Palm Beach, Fla., Nov. 15-17. He gave a lecture to the faculty on Effective Teaching Techniques.

Donald E. Sporleder, professor of architecture, met with the National Council of Architectural Registration Boards, Master Juror Committee, in New Orleans, La., Nov. 15-16. The committee field tested the Architects Registration Examination—Building Design Division and developed grading criteria for the examination to be administered in December 1990 and in June 1991.

Carl L. Stam, associate professional specialist, director of choral music and concurrent assistant professor of music, conducted the 25th annual Open Sing of Handel's *Messiah* in Chapel Hill, N.C., Dec. 8. The event was sponsored by the Wesley Foundation and FOCUS, the graduate student chapter of Intervarsity Christian Fellowship, at the University of North Carolina at Chapel Hill. The performance included orchestra, soloists and a chorus of 250 singers. Stam had conducted the Messiah Sing in 1979, 1980 and 1981.

James P. Sterba, professor of philosophy and faculty fellow in the Institute for International Peace Studies, gave the presidential address titled "Reconciling Pacifists and Just War Theorists" at the annual meeting of Concerned Philosophers for Peace held at Notre Dame, Ind., Sept. 21-23. He presented a principal paper titled "Liberalism and Conceptions of the Good" at the meeting of the international association for Philosophy of Law and Social Philosophy, the American Section, held at Salt Lake City, Utah, Oct. 25-28. He gave the paper titled "Cultural Values or Universal Values?" at the international symposium on Moral Education for the New Millennium held at Notre Dame, Ind., Nov. 7-10.

Stephan A. Stolz, associate professor mathematics, presented "Manifolds of Positive Scalar Curvature" at the State University of New York at Stony Brook, N.Y., Oct. 25. He presented "HP^2-bundles and Elliptic Homology" at Massachusetts Institute of Technology in Cambridge, Mass., Oct. 22, and at Ohio State University in Columbus, Ohio, Dec. 3.

M. Katherine Tillman, associate professor in the Program of Liberal Studies, gave an expanded version of the paper "*Phronesis* at the Economies of Reason" to the Theology Department Colloquium at the University of Notre Dame in Notre Dame, Ind., Oct. 30. She presented a paper on "Newman's Idea of a University" at St. James Church in Chicago, Ill., Nov. 1. She presented the paper "*Phronesis* and the Economies of Reason" at the international Newman Centenary Conference held at St. Louis University in St. Louis, Mo., Dec. 1.

Rev. Joseph L. Walter, C.S.C., chairman of Preprofessional Studies and associate professor of chemistry, as the national president of Alpha Epsilon Delta, was the installing officer for the 160th Chapter of AED, the honorary premedical society, at Western Florida University in Pensacola, Fla., Dec. 7.

John P. Welle, associate professor of romance languages and literatures, gave a paper titled "On Translating the Dialect Poetry of Andrea Zanzotto" at the American Literary Translators' Association annual conference in San Diego, Calif., Nov. 18-21.

Eduardo E. Wolf, professor of chemical engineering, presented the seminar "Transient Studies of Methane Oxidative Coupling" to the Department of Chemical Technology at the University of Twente in Enschede, The Netherlands, Oct. 26. He presented the seminar "The Macro/Micro Structure of Pt Supported Catalysts Studied by Infrared Thermography and Scanning Tunneling Microscopy" at the Rhone-Poulenic Centre De Recherches Auvervilliers in Paris, France, Oct. 29. He presented "Scanning Tunneling Microscopy Studies of Pt Supported on Graphite" co-authored by K. Yeung, "Catalytic Deposition of Carbon on Carbon Composites" co-authored by P. McAllister, "Infrared Thermography Studies of Pt and Rh Supported Catalyst" co-authored by J. Kellow, and "Reactor Simulation Studies During Methane Oxidative Coupling" co-authored by J. Santamaria and Z. Kalenik at the annual AIChE meeting in Chicago, Ill., Nov. 11-16. He also chaired a session on general papers at the same meeting in Catalysis and on Fundamental Catalysis. He assumed the chair of the 1 program of area 1B on Kinetic Catalysis and Reaction Engineering of the AIChE Program Committee.

Activities

Michael P. Kenahan, director of Foundation and Corporation Relations, presented "Grant Writing and Major Gift Proposals" at the conference on Philanthropy: For Fun and Non-Profit in Tucson, Ariz., Nov. 15-16.

Adele Lanan, assistant director of Student Activities, presented the paper "The Times They Are 'A(Hardly)' Changing" with **Ken Durgans,** director of Minority Affairs, at the 1990 Minority Student Today Conference sponsored by the University of South Carolina held in San Antonio, Tex., Oct. 30. She presented "The 'Fine Lines' of Broadcast Advising — Hands On, Hands Off, Hands Up!" at the 1990 Associated Collegiate Press/College Media Advisers held in Washington, D.C., Nov. 1-4. She presented "Multiculturalism: The Present Realty" at the Understanding Cultural Differences Workshop sponsored by the Family and Children's Center of South Bend at the University of Notre Dame, Notre Dame, Ind., Dec. 5.

Rev. Peter D. Rocca, C.S.C., assistant vice president for Student Affairs, gave two workshop addresses on "Liturgy: Back to the Basics" to Catholic school teachers of the diocese of Fort Wayne-South Bend in Fort Wayne, Ind., Oct. 19, and in Mishawaka, Ind., Oct. 26. As general editor of Paulist Press Ordo, he has recently published his fourth edition of *The Order of Prayer in the Liturgy of the Hours and Celebration of the Eucharist, 1991,* which is used by every diocese and archdiocese in the United States, as well as by a number of religious communities.

Timothy L. Truesdell, director of Development Research, presented "Development Research: Setting Up an Office" at the 1990 District Five Council for the Advancement and Support of Education annual meeting in Chicago, Ill., Dec. 18.

Corrections to *Notre Dame Report* #4

JAMES D. PETERSON, *Assistant Professor of Communication and Theatre.* B.S., Univ. of Wisconsin, 1979; M.A., ibid., 1982; Ph.D., ibid., 1986. (1986)

JAMES D. PETERSON, *Assistant Professor of Finance and Business Economics.* B.B.A., Univ. of Wisconsin, 1985. (1990)

Institute for Pastoral and Social Ministry Search Committee

December 18, 1990

Dear Colleagues,

Father Robert Pelton, C.S.C., director of the Institute for Pastoral and Social Ministry, has tendered his resignation effective May 29, 1991. Father Pelton has provided valuable leadership to IPSM and its component centers over the past five years and we hope to see a continuation of the sound direction he has set.

The provost, Timothy O'Meara, has asked me to chair a search committee to recommend a new director and has appointed Lawrence Cunningham, Robert Krieg, C.S.C., and Thomas O'Meara, O.P., to that committee. We consider your input necessary to the search process and invite you to submit nominations for the position as well as sources that might be of assistance in the search.

Since IPSM plays a unique role within the University some background information may be helpful to you. As its name indicates, the institute strives to enhance the effectiveness of pastoral and social ministry in the American Catholic Church by acting as a bridge between the University and the local churches of North America. It coordinates a variety of University programs in service to the Church through the Office of the Director as well as through its five component centers: Center for Pastoral Liturgy, Center for Continuing Formation, Center for Social Concerns, Program for Church Leaders and Retreats International. While each of these has its own director, the director of the umbrella organization IPSM necessarily has to be familiar with the work of each: liturgy, social justice, adult education, spirituality and ministerial renewal.

In addition to a sound academic background, therefore, the director must have broad experience of local church communities, an understanding of the issues affecting those communities and an awareness of current developments in ministry. As an administrator, the director has to collaborate with the directors of the centers, interface with an Advisory Council and have some fund raising ability. The selection of a new director for IPSM will have great impact on the future of this institute and its component centers.

We ask that you submit your recommendations in writing to a member of the Search Committee by January 28.

Thank you for your assistance and cooperation.

Sincerely,

Sister Kathleen Cannon, O.P.
Associate Provost

University Committee on Libraries
November 15, 1990

The meeting was called to order at 2:30 p.m. in the office of the Director of Libraries by the chairman, John Lucey. Also in attendance were Harvey Bender, Leo Despres, Maureen Gleason, Robert Miller, Michael Morris, James Robinson, Dan Sheerin and secretary Melodie Eiteljorge.

The minutes of the meeting of October 19 were approved as written.

Robert Miller distributed an article on issues in research libraries.

The first agenda item was a draft resolution distributed by Dan Sheerin on use of space within the Hesburgh Library for purposes unrelated to the mission of the library. It was agreed that the committee should express concern about this issue to both the provost and the faculty. After some discussion it was decided that John Lucey will recast the proposal and present the revised version at the next meeting.

The next agenda item was a letter from a faculty member on confidentiality of records in disclosing borrowers' names. Miller distributed a copy of the libraries' current policy on confidentiality of circulation and related records, LPP:82:11 rev. January 19, 1989. After a discussion, Harvey Bender made a motion that one line be stricken from the policy, thus eliminating the current practice of providing a borrower's name to faculty, staff or students when a title is needed immediately. This motion was seconded and carried unanimously. The new policy will go into effect January 1, 1991.

The next item was a proposed policy on service to special users. Most of the practices in the document have been library policy in the past, but there were some additions. The document would expand borrowing privileges to spouses of students and would provide summer borrowing privileges to returning students who are not enrolled in a summer course. Miller noted that this second addition would need further approval from the administration. After reviewing each item, the committee unanimously approved the policy as stated in the document.

Miller next reported that there was a demonstration of Multiple Database Access System (MDAS) in the Hesburgh Library last week. This system would link external databases into UNLOC. He will be following through with Don Spicer on possible means of funding.

There being no further business, the meeting adjourned at 3:40 p.m. The next meeting is scheduled for December 13. The main agenda item will be a follow-up on the revised resolution on space in the Hesburgh Library.

Respectfully submitted,

Melodie Eiteljorge
Secretary

Report on the Status and Quality of the Campus Water Supply

by the Environmental Issues Committee

October 26, 1990

SUMMARY

During the past few years concerns have been raised about the safety and general quality of the campus water supply. These appear to stem primarily from what are perceived to be undesirable taste characteristics of the water in some of the older buildings on campus. Among the buildings for which complaints have been received are the Main Building, Haggar Hall and several dormitories. Local contamination of ground water by solvents and other toxic substances can be a serious problem in this geographic region. This has raised the awareness of the potential for water supply problems within the campus community.

Water for the campus is pumped from six wells that are distributed around the University. The Notre Dame wells draw water from a major, glacially derived aquifer that forms part of the Lake Michigan basin. The water generally is hard and its iron content often is regarded as objectionably high. The city of South Bend and Notre Dame water supplies have similar ranges of common ground water-supplied inorganic constituents.

Since no comprehensive data on ground water movements in the immediate vicinity of the Notre Dame campus are available, conclusions on ground water movements on or near the campus represent educated conjecture rather than established fact. Most of the surface and probably the subsurface flow from the northern part of the campus is directed toward Juday Creek, whereas the remainder of the campus drains toward the Notre Dame lakes or the St. Joseph River. The campus probably is protected from contaminated ground water in the Granger area by distance and by Juday Creek. With no active public landfills or known areas of contaminated ground water near the campus, the most serious threat to contamination of the campus water supply would appear to come from improper disposal of waste materials on the campus itself. Campus sewage is piped to the South Bend Wastewater Treatment Plant for treatment by the city of South Bend. Disposal of chemical wastes and toxic substances is regulated by the Notre Dame Risk Management and Safety Department. Over the past few years all buried tanks containing fuel or solvents have been tested for leakage and most have been removed or replaced by environmentally safe tanks. Any contaminated soil resulting from prior leakage also has been removed. The fire that destroyed St. Michael's Laundry in 1989 did not result in leakage of dry cleaning solvents from underground storage tanks, and these tanks have been removed. Most surface runoff from the campus is directed to the Notre Dame lakes or to a low area east of Eddy Street between Edison Road and South Bend Avenue (SR 23). Test wells have given no evidence of ground water contamination in this area and the distance and location of this site with respect to campus wells make contamination of the campus water supply from this source unlikely. Another possible source of ground water contamination is from leakage of gas and oil from vehicles parked on grassy areas of the campus during football games and other campus events. However, no evidence of contamination from this source has been detected. The recent paving of some of the grass parking areas that are used most frequently should lessen this as a potential problem. However, on the negative side, the campus may serve as a major ground water recharge area. Thus, altering the water balance through extensive paving, destruction of vegetation, or redirection of surface flows ultimately could impact ground water availability and quality in this area.

Within the last year, the campus water supply has been analyzed for inorganic constituents and for both inorganic and organic contaminants. The concentration of each of these substances has fallen well within the safe concentration level established by the Safe Drinking Water Act. The concentration of coliform bacteria also is regularly determined for the campus water supply. The campus water supply consistently has fallen below the maximum concentration level for coliform bacteria specified in the drinking water standard. Therefore, chlorination of the campus water supply is unnecessary and is not performed.

Water samples taken from the Notre Dame Main Building contain relatively high concentrations of iron and zinc. This probably is due to the leaching of these minerals from the old galvanized iron pipes in the building. This is not unexpected, considering the age of the building and its plumbing and probably is typical of other older buildings on the campus. As is typical of other water supplies in the region, the campus water also is extremely hard. Hard water may form lime scale in pipes and appliances. Hard water and high concentrations of iron in water supplies pose no known health threat to humans. However, many people find that water with significant iron content has an objectionable taste. It is likely that iron removal by oxidation and filtering or by softening the drinking water in some older buildings would improve its flavor. However, the addition of sodium to the water through the softening process could adversely affect individuals on sodium-restricted diets. This makes oxidation and filtering systems a more desirable alternative for iron removal. Since it appears that the most important source of iron in the campus water supply may be its plumbing, any attempt at central removal is likely to be ineffective.

Our examination of the quality of the campus water supply has revealed no evidence of contamination or other indication that it poses a threat to human health. Use of bottled water on the campus cannot be justified on any but aesthetic grounds.

We recommend that the following measures to improve the taste and appearance of the campus water supply be considered:

1) All major renovation projects in buildings more than 40 years old include replacement of water pipes.
2) Replacement of water pipes to drinking fountains in buildings with high iron content be considered where feasible.
3) Water mains more than 40 years old serving the interior of the campus be replaced as feasible.

INTRODUCTION

In many respects the University of Notre Dame operates as an independent municipality. As such, the University is responsible for providing services and utilities including power, sewage disposal and water. Some utilities are subcontracted to other municipalities or firms. For example, the disposal of sewage produced by the campus is subcontracted to the city of South Bend. Electrical power for the campus is provided primarily by the Notre Dame Power Plant, but is augmented by electricity purchased from Indiana Michigan Power Company. However, since its establishment, the University has assumed the full responsibility for the campus water supply. This includes the maintenance of wells and the water distribution system, and monitoring of the water quality. This report summarizes the findings and recommendations of the Environmental Issues Committee on the University of Notre Dame campus water supply.

The campus water supply provides water for domestic, irrigation and laboratory uses throughout the University. It also serves as the source of water for campus fire hydrants. The maintenance of campus wells and the water distribution system is one of the responsibilities of the Notre Dame Director of Utilities, John DeLee. Monitoring the quality of the campus water supply is one of the responsibilities of the Notre Dame Risk Management and Safety Department, headed by Robert Zerr. The regulation of the quality of domestic water supplies is provided by the following federal statutes: the Public Health Service Act (1944), the Safe Drinking Water Act (1974), the Safe Drinking Water Act Amendments of 1986 and the Lead Contamination Control Act of 1988. The campus water system is classed as a public water supply system by the Safe Drinking Water Act because it has more than 15 service connections and regularly serves an average of at least 25 individuals daily during at least 60 days of the year.

The Safe Drinking Water Act Amendments of 1986 established an initial list of 83 substances and required that maximum levels for these substances be established by June 19, 1989. The administration of this federal law is the responsibility of the U.S. Environmental Protection Agency with much of its authority for monitoring and enforcement delegated to the states and administered in Indiana by the Indiana State Board of Health.

CAMPUS WATER SUPPLY PROBLEMS

During the past few years concerns have been raised about the safety and general quality of the campus water supply. These appear to stem primarily from what are often perceived to be undesirable taste characteristics of the water in some of the older buildings on campus. Among the buildings for which complaints have been received are the Main Building, Haggar Hall and several dormitories. Local contamination of ground water by solvents and other toxic substances can be a serious problem in this geographic region. This has raised the awareness of the potential for water supply problems within the campus community.

SOURCE AND DISTRIBUTION

Water for the campus is pumped from six wells that are distributed around the University. Five of these contribute to the general campus water supply and the sixth is dedicated for irrigation of the Notre Dame Golf Course. The depth of these wells generally ranges from 175 to 200 feet. The pressure of the water supply is maintained by regulating the level of water in the water tower located near the Notre Dame Power Plant. Controls located at the power plant automatically turn on as many pumps as are necessary to maintain proper pressure in the system based on consumption rates. The principal arteries of the water system are composed mostly of 10" pipes that form a closed loop through the campus and along its periphery to U.S. 31 (Michigan Street). The ages of the wells and water mains vary from location to location with newer facilities generally on the periphery of the campus and in areas of recent construction.

Notre Dame wells draw water from a major, glacially derived aquifer that forms part of the Lake Michigan basin. The Lake Michigan basin has the greatest ground water potential of any Great Lakes basin. Buried bedrock channels 300-400 feet deep filled with unconsolidated glacial sediments along the St. Joseph River can support wells yielding as much as 1,000 to more than 2,500 gallons per minute (gpm). Unsustained yields from 6-inch or larger diameter wells in the area typically exceed 500 gpm.

GROUND WATER COMPOSITION AND QUALITY

Chemical quality of ground water within the sand and gravel aquifers of the Lake Michigan basin ranges from good to poor. Total dissolved solids (TDS) usually are in the 100 to 2,000 milligrams per liter (mg/l, also called parts per million or PPM) range. The water generally is hard, ranging up to 1,000 mg/l, and its iron content is regarded as objectionably high in much of the basin. Chloride and sulfate concentrations generally are less than 50 mg/l, except where bedrock water contaminates shallow unconsolidated aquifers. Normal ranges of common inorganic chemical constituents of the Quaternary aquifers of the St. Joseph River basin in Indiana are summarized below.

Hardness (mg/l as $CaCO_3$)	225-400
Sulfate (mg/l)	10-150
Chloride (mg/l)	1-50
Iron (mg/l)	0.1-7.5
TDS (mg/l)	250-500

Water supplies drawn from these aquifers reflect the chemical composition of the ground water. For example, the city of South Bend and Notre Dame water supplies have the following ranges of common ground water-supplied inorganic constituents.

Source	South Bend	Notre Dame
Hardness (mg/l)	270-450	330-349
Sulfate (mg/l)	38-150	77-91
Iron (mg/l)	0.02-1.30	0.05-2.92

Pollution of aquifers by the introduction of man-made contaminants or by man-caused migration of natural contaminants may be a serious local problem in this area. Septic tanks, leaching fields, well disposals, land fills, spillage and leakage all have the potential to add waste contaminants to sand and gravel aquifers near the land surface. No comprehensive data on ground water movements in the immediate vicinity of the Notre Dame campus are available. Thus, conclusions on ground water movements on or near the campus represent educated conjecture rather than established fact. Movement of ground water often approximates the flow of surface water in this region, although significant departures are common. Divides separate drainage basins for surface flow, with their underground counterparts termed "phreatic" divides. Most of the surface and probably the subsurface flow from the northern part of the campus is directed toward Juday Creek, whereas the remainder of the campus drains toward the Notre Dame lakes or the St. Joseph River. The campus probably is protected from contaminated ground water areas in the Granger area by distance and by Juday Creek. This stream originates near the St. Joseph Farm in St. Joseph county near Granger. It flows through Notre Dame property just north of Douglas Road and intercepts a portion of the upper ground water flow from the northern part of the county and diverts it directly to the St. Joseph River. The confluence of Juday Creek and the St. Joseph River occurs north of and down-river from the Notre Dame campus.

With no active public landfills or known areas of contaminated ground water near the campus, the most serious threat to contamination of the campus water supply would appear to come from improper disposal of waste materials on the campus itself. Campus sewage is piped to the South Bend Wastewater Treatment Plant for treatment by the city of South Bend. Disposal of chemical wastes and toxic substances is regulated by the Notre Dame Risk Management and Safety Department. Over the past few years all buried tanks containing fuel or solvents have been tested for leakage and most have been removed or replaced by environmentally safe tanks. Any contaminated soil resulting from prior leakage also has been removed. The fire that destroyed the St. Michael's Laundry in 1989 did not result in leakage of dry cleaning solvents from underground storage tanks, and these tanks have been removed. Most surface runoff from the campus is directed to the Notre Dame lakes or to a low area east of Eddy Street between Edison Road and South Bend Avenue (SR 23). This area was at one time used as a landfill by the City of South Bend and currently serves as a disposal site for fly ash generated by the Notre Dame Power Plant. Test wells have given no evidence of ground water contamination in this area and the distance and location of this site with respect to campus wells make contamination of the campus water supply from this source unlikely. Another possible source of ground water contamination is from leakage of gas and oil from vehicles parked on grassy areas of the campus during football games and other campus events. However, no evidence of contamination from this source has been detected. The recent paving of some of the grass parking areas used most frequently should lessen this as a potential problem. However, on the negative side, the campus may serve as a major ground water recharge area. Thus, altering the water balance through extensive paving, destruction of vegetation, or redirection of surface flows ultimately could impact ground water availability and quality in this area.

CHEMICAL CONSTITUENTS OF THE CAMPUS WATER SUPPLY

The Safe Drinking Water Act requires periodic biological and chemical monitoring of water supplies. Current statutes require monitoring and reporting of the chemical constituents of water supplies at least once every three years. Two sets of federal standards exist for public water supplies. The first set, termed "Primary Drinking Water Standards," includes maximum concentration levels of substances in water supplies that are necessary to protect public health and safety. The second set, termed "Secondary Drinking Water Standards," represents unenforceable federal guidelines regarding the taste, odor, color and

certain other non-aesthetic effects of drinking water. The U.S. Environmental Protection Agency recommends them to the states as reasonable goals, but federal law does not require water systems to comply with them. In general, public water supplies that exceed the secondary drinking water standard suggested levels pose no threat to public health, but may have color, taste or odor characteristics that the public may find objectionable.

Analyses of inorganic chemicals and potential pollutants in the campus water supply have been conducted for more than a decade. Within the last year, the water has been analyzed for inorganic constituents and for both inorganic and organic contaminants. Potential contaminants include toxic metals such as Cadmium, Chromium, Lead, Mercury, Selenium and Silver; and volatile organic compounds such as Benzene, Carbon Tetrachloride, p-Dichlorobenzene, 1,2-Dichloroethane, 1,1-Dichloroethylene, 1,1,1-Trichloroethane, Trichloroethylene (TCE), Vinyl Chloride, and Trihalomethanes. The concentration of each of these substances in the campus water supply consistently has fallen below the lowest detectable concentration measurable by the analytical procedure used. This lowest detectable concentration always is much lower than the primary drinking water standard, ranging from 1/5 to 1/1000 of the maximum concentration level set by the standard. Detectable concentrations have been measured for Arsenic (0.0002 mg/l), Barium (0.05-0.06 mg/l) and Nitrate (0.7-1.5, <0.1 mg/l most recently). The maximum concentration levels for these substances established in the primary drinking water standard are 0.05 mg/l, 1.0 mg/l, and 10.0 mg/l, respectively. Thus, at least an order of magnitude of concentration separates the campus water supply from the maximum concentration level for each of these substances set by the Safe Drinking Water Act.

The concentration of coliform bacteria also is regularly determined for the campus water supply. The presence of coliform bacteria in the water supply does not in itself pose a threat to public health. However, the presence of these organisms may indicate contamination of the water supply from animal wastes or domestic sewage. Since such contamination could introduce viruses and other disease organisms into the water supply, the primary drinking water standard allows for not more than 1 coliform bacterium per 100 milliliters (ml) of sample. Chlorination can be used to purify water supplies with high bacterial counts. Recently, however, chlorination has been shown to be a double edged sword with respect to public safety. Consumption of drinking water with chlorine residuals within an order of magnitude of those found in community drinking water systems has caused an increase in serum cholesterol and produced indications of myocardial hypertrophy and arteriosclerosis in rabbits and pigeons reared on a diet marginal in calcium. Limited human clinical studies suggest that consumption of chlorinated water increases the serum cholesterol levels in a dose-dependent way in volunteers given a diet marginally deficient in calcium. There also appears to be an increased risk of bladder cancer associated with lifetime consumption of chlorinated water that may account for about 25-30 percent of the occurrence of this form of cancer in adults residing in communities with chlorinated drinking water supplies. The campus water supply consistently has fallen below the maximum concentration level for coliform bacteria specified in the primary drinking water standard. Therefore, chlorination of the campus water supply is unnecessary and is not performed.

Substance	Units	2nd Std. (suggested)	N.D. Campus	Main Bldg.	South Bend
Alkalinity	mg/l $CaCO_3$	no maximum	230-238	240	200-300
Chloride	mg/l	250.0	30.0-47.0	—	20-70
Copper	mg/l	1.0	0.02	<0.02	<0.02-0.1
Hardness	mg/l as $CaCO_3$	500.0 as TDS	338-349	330	270-450
Iron	mg/l	0.3	0.05-2.57	2.92	0.02-1.3
Manganese	mg/l	0.05	0.03-0.3	0.15	0.02-0.3
pH	pH units	6.5-8.5	7.3-7.5	7.6	7.0-8.0
Sodium	mg/l	no maximum	14.0-23.2	—	10-35
Sulfate	mg/l	250.0	77.0-91.0	90.0	38-150
Zinc	mg/l	5.0	0.02-0.03	1.27	0.1-0.3

The campus water supply contains measurable concentrations of some inorganic substances included in the secondary drinking water standard. The table above summarizes typical values for the South Bend city and Notre Dame water supplies.

The concentrations given above apply to cold water only. Hot water distributed throughout the campus is chemically softened. This involves the exchange of the monovalent cation sodium for the bivalent cations calcium and magnesium. Thus the hot water supply would be expected to be lower in calcium and magnesium and higher in sodium. Some iron and manganese also are removed in the softening process, so lower concentrations of these chemicals are expected in the hot water supply. The relatively high concentrations of iron and zinc contained in water samples taken from the Notre Dame Main Building reflect leaching of these minerals from the old galvanized iron pipes in the building. This is not unexpected, considering the age of the building and its plumbing and probably is typical of other older buildings on the campus.

CHARACTERISTICS OF CHEMICALS IN THE CAMPUS WATER SUPPLY

Following is a brief discussion of the taste and odor characteristics and known health effects of each of the chemicals found in significant concentrations in the campus water supply. Where possible, the probable source of the chemical also is indicated.

ALKALINITY

Alkalinity is a measure of the amount of carbon dioxide (CO_2) in water. It occurs in four principal forms: as gas dissolved in water; as a weak acid, carbonic acid, obtained by a chemical reaction between CO_2 and water; as the bicarbonate ion (HCO_3^-); and as the carbonate ion ($CO_3^=$). The relationship among these ions is shown in the following formula:

$$CO_2\uparrow + H_2O \leftrightarrow H_2CO_3 \leftrightarrow HCO_3^- + H^+ \leftrightarrow CO_3^= + 2H^+$$

The equation is driven to the left under conditions of low pH and to the right under conditions of high pH. The carbon dioxide system serves as a buffer in water supplies. The CO_2 buffer system generally consists of the weak acid carbonic acid (H_2CO_3) and its salt, usually calcium bicarbonate ($Ca(HCO_3)_2$). Buffers are important in mitigating the effect on pH of additions of acids or bases. For example, in water of moderate to high alkalinity, addition of acid will result in the production of carbon dioxide gas with little noticeable change in pH; whereas additions of bases yield insoluble $CaCO_3$ that precipitates out of solution as limestone or chalk. Under conditions of very low alkalinity, water tends to be slightly acidic (due to the presence of carbonic acid) and poorly buffered. Acidity in water supplies may be undesirable, because acidic water may dissolve toxic metals such as lead and cadmium from solder in pipes. While high alkalinity poses no threat to human health, the precipitation of calcium carbonate lime deposits in pipes can have serious economic consequences for both domestic and industrial water supplies. While not included in either the primary or secondary drinking water standards, the recommended range of alkalinity for public water supplies is 30-400 mg/l. With concentrations of less than 100 mg/l most desirable. The alkalinity of the Notre Dame water supply, while over 100 mg/l, easily falls within the 400 mg/l limit and is typical of other water supplies in this area.

ARSENIC

Arsenic is an element that occurs naturally in many rocks, minerals and soils. The toxicity of arsenic to humans is well known. It can accumulate in the body and causes arsenosis. Arsenic, when ingested, can be carcinogenic and also is known to affect the liver and heart. The federal limit of arsenic in drinking water is 0.05 mg/l. Arsenic concentrations of 0.0002 mg/l have been found in the campus water supply. At this concentration, it poses no known health threat.

BARIUM

Barium is a trace element that often occurs in low concentrations in water. In high concentrations it may have toxic effects on the heart, blood vessels, and nerves. Barium does not appear to accumulate in human bone or tissue, so there is no danger of a cumulative effect. The federal drinking water regulations limit barium concentrations in drinking water to 1 mg/l. The highest concentration found in the Notre Dame water supply is 0.06 mg/l. At this concentration, it poses no known health threat.

CHLORIDE

While chloride is a relatively minor element on the earth, it is a major dissolved substance in many waters. The concentration of chloride ion in the ocean averages about 19,300 mg/l. Chloride concentration in fresh water typically ranges from less than 30 mg/l to more than 1,000 mg/l, with lower values associated with humid areas, and higher concentrations in arid regions. Chloride concentrations greater than 250-500 mg/l may impart a salty taste to water. This maximum concentration level of 250 mg/l set in the secondary drinking water standard is based on taste considerations. Chloride is not regarded as a health threat in concentrations of less than 1,000 mg/l. The highest concentration of chloride detected in the Notre Dame water supply is 47 mg/l. At this concentration it imparts no taste and poses no known health threat.

COPPER

Copper is both essential and beneficial to humans and its absence can lead to nutritional anemia in very young children. Adults require about 3 mg per day. In general copper is readily passed from the body in waste, although in high concentrations, it may accumulate in the liver. Concentrations of copper in water in excess of about 0.05 mg/l are generally the result of pollution, either from industrial or mining wastes or the corrosion of copper plumbing. Copper sulfate is used to control plankton and rooted aquatic vegetation in the Notre Dame lakes. Some cases of ground water contamination from this source are known. The federal drinking water standard maximum concentration level of 1.0 mg/l for copper, is based on taste rather than health considerations. The highest concentration of copper found in the campus water supply of 0.02 mg/l is well below the taste threshold, poses no known health threat, and suggests little or no contamination from copper plumbing or the copper sulfate used for algae control in the Notre Dame lakes.

HARDNESS

Hard water and soft water are relative terms that are derived from the effect of the bivalent cations calcium ($Ca^{+}+$) and magnesium ($Mg^{+}+$) on soaps. Soap does not clean efficiently in water with high concentrations of $Ca^{+}+$ and

Mg^{++}. Hard water also leaves insoluble residues in bathtubs, sinks, and clothing and forms scale in water heaters, boilers and pipes, reducing their capacity and heat-transfer properties. In the United States hardness is generally reported as the concentration calcium carbonate ($CaCO_3$) in grains per gallon (gpg) or mg/l, with 1 gpg equal to 17.12 mg/l. While the concept of hardness is relative and somewhat subjective, waters with hardness values of up to 17 mg/l or 1 gpg are generally considered soft, whereas those with values greater than about 180 mg/l or 10 gpg are considered very hard. By this standard, the ground water of this area, which typically has a hardness of 225-400 mg/l, would be classed as exceptionally hard. In 1962, a study by the U.S. Geological Survey, which examined the chemical composition of water supplies in the 100 largest American cities, found the highest concentration of calcium and bicarbonate ions (145 mg/l and 380 mg/l, respectively) in the water supply of South Bend, Indiana. The hardness of the Notre Dame water supply is around 350 mg/l as $CaCO_3$, with calcium and magnesium ion concentrations of 85-90 mg/l and 28-30 mg/l, respectively. In this area, hardness typically contributes 80-90 percent of the total dissolved solids found in drinking water.

Despite its effect on laundry and pipes, even extremely hard water does not pose a health threat to humans. In fact, $CaCO_3$ scale may reduce the leaching of copper, lead and cadmium from water pipes and solder joints into water. Water can be softened by substituting monovalent cations such as sodium (Na^{+}) and potassium (K^{+}) for calcium and magnesium. Hardness commonly is reduced through the use of ion-exchange water softeners. An ion-exchange water softener consists of a tank containing an insoluble plastic resin that has a negative charge with positive sodium ions attached to it. The resin has a stronger affinity for Ca^{++} and Mg^{++} ions than it does for Na^{+}. Therefore, when hard water is passed through the resin, calcium and magnesium are exchanged for an equivalent amount of sodium. Once all of the sodium attached to the resin has been replaced by calcium and magnesium the softener resin must be recharged. This is accomplished by passing a concentrated solution of sodium chloride (NaCl) through the resin. The calcium and magnesium released during the regeneration process must be disposed of as liquid waste. Commonly this is included as part of domestic sewage. Since the water softening process increases the sodium content of the water, the resulting soft water may be less healthful for persons on sodium restricted diets. In homes with water softeners, it is a common practice to run unsoftened water to the cold water faucet of the kitchen sink for use in drinking and cooking, and soft water to all other faucets in the house. The hot water supply distributed throughout the campus is chemically softened. The cold water supply of the campus is untreated.

IRON

Iron compounds are common in rocks and soil and easily are leached by water. It is not unusual for natural waters to have dissolved iron concentrations of up to 5.0 mg/l. Two forms of ionic iron are commonly present in water. Under neutral and alkaline pH conditions oxidized ferric iron (Fe^{+++}) tends to form insoluble colored (red-brown) deposits. Reduced ferrous iron (Fe^{++}) is more soluble, tends to appear in higher concentrations in water and is colorless. Except under low pH conditions, ferrous iron is easily and quickly converted to the ferric form by the addition of oxygen to water. Several groups of so-called iron bacteria (e.g., Crenothrix, Gallionella, Leptothrix, Ochrobium, Siderocapsa), can derive metabolic energy through the conversion of ferrous iron to ferric iron. These organisms may be responsible for rusty water in water supplies and can form a slimy coating in toilets, pipes and pumps.

High concentrations of iron in water supplies pose no known health threat to humans. However, many people find such water has an objectionable taste or color. Concentrations in excess of 0.3 mg/l can cause staining of laundry and utensils. Potatoes boiled in iron rich water may turn black and tannins in tea and coffee may combine with iron resulting in a black inky appearance and an objectionable taste. The secondary drinking water standard gives a recommended concentration limit for iron of 0.3 mg/l based on taste and aesthetic criteria. However, the threshold for metallic taste in drinking water from iron to humans may be as low as 0.1 mg/l. The concentration of iron in the Notre Dame water supply varies substantially with the age of plumbing. This suggests that iron is being leached from older iron water pipes and cast iron water mains on the campus. Drinking water drawn from most newer buildings on the campus does not have a metallic taste to most individuals. However, many people find the taste of drinking water in the Main Building and other older buildings on campus to be objectionable. Iron is relatively easy to remove from water. Ferrous iron may be removed by converting it to its oxidized ferric form and then filtering out the insoluble precipitate. Reduction of hardness through ion exchange water softening also can reduce iron. Unfortunately, centralized iron removal from the campus water supply would not be effective if significant amounts of iron are being derived from old water mains and plumbing. However, installation of iron removal systems or water softeners combined with replacement of pipes to drinking fountains could be effective in buildings served by old water mains. Replacement of old campus water mains and water pipes in older buildings on campus as part of any major remodelling operation probably is the most effective long term method of reducing the iron content in the campus drinking water.

MANGANESE

Manganese and iron in water have many similar qualities and often are treated together in discussions of water quality. Like iron, manganese occurs in both oxidized and reduced states, imparts an undesirable taste to water, and has a variety of other aesthetically unpleasant attributes. The presence of moderate concentrations of manganese in water is not known to pose a health threat to humans. The maximum concentration level of manganese recommended by the secondary drinking water standard, 0.05 mg/l, is based on taste and aesthetic considerations. Upon oxidation manganese concentrations in excess of 0.2 mg/l precipitate and form black deposits on food and utensils during cooking, and black stains on plumbing fixtures and laundry. The taste threshold for manganese in water is 0.5 mg/l. The process of manganese removal from water supplies is similar to that of iron. The concentration of manganese in the Notre Dame water supply varies throughout the campus, but generally is close to or exceeds the recommended limit in the secondary drinking water standard. It may contribute to the unpleasant taste characteristics of drinking water in some areas of the campus.

NITRATE

Nitrate (as N) has been found in the campus water supply in concentrations of 0.7 to 1.5 mg/l, although the most recent analysis indicated less than 0.1 mg/l. While it is a major component of the atmosphere, gaseous nitrogen generally is inert. Chemically combined forms of nitrogen such as nitrate, nitrite and ammonia in water normally are the result of biological processes or additions of fertilizers. These may enter water supplies from shallow wells or surface contamination. Nitrate concentrations in excess of 10 mg/l can cause the disease methemoglobinemia in infants. This is the basis for the maximum concentration level set in the primary drinking water standard. High concentrations of nitrate and chloride in water supplies may be an indication of contamination of the water supply by animal wastes. There is no evidence of this type of contamination in the campus water supply.

pH

pH, an abbreviation for the potential of hydrogen, is a measure of the hydrogen ion (H^+) content of water on a scale of 0 to 14, with 7 being neutral. Pure water in equilibrium with the atmosphere tends to be slightly acidic (pH <7) due to the presence of carbonic acid that forms from dissolved carbon dioxide. Acidic water tends to be somewhat corrosive and can dissolve toxic metals from pipes and solder joints. Waters with high alkalinity, such as those of the campus water supply, tend to be slightly basic (pH >7) and are well buffered. This means the pH will remain relatively stable with modest additions of acids or bases. The secondary drinking water standard suggests a pH range for domestic water supplies of 6.5-8.5. The range of pH found in the campus water supply (7.3-7.5) is ideal for drinking water.

SODIUM

Probably all natural waters contain some sodium. Sodium tends to be very soluble in water and is precipitated only under extraordinary circumstances. Sodium may be introduced into water supplies through softening. The small amount of sodium in drinking water appears to pose no health threat to humans, and is usually a minor contributor to sodium in the diet compared to most foods. Because of the relationship between sodium and hypertension, addition of even small amounts of sodium to drinking water by softening may be undesirable for some individuals placed on sodium-restricted diets. While there is no maximum concentration level specified for sodium in the primary or secondary drinking water standards, levels in excess of 20 mg/l must be reported. Sodium levels in excess of 500 mg/l in combination with chloride give drinking water a detectably salty taste. The amount of sodium found in the unsoftened campus water supply of 14-23 mg/l is typical of water supplies in this area.

SULFATE

Many sulfate compounds originating from the oxidation of sulfite ores are soluble in water. Sulfate also is common in rain water and sedimentary rocks and may appear in ground water in relatively high concentration. Sulfate can produce a detectable taste in water at concentrations of 300-400 mg/l. The taste becomes bitter at concentrations of 500 mg/l and may be cathartic at concentrations in excess of 600 mg/l., although most people develop some resistance to its laxative effects with time. The secondary drinking water standard recommends a maximum concentration level for sulfate of 250 mg/l. The Notre Dame water supply, with a sulfate concentration of 77-91 mg/l, falls well within the standard.

TOTAL DISSOLVED SOLIDS (TDS)

The total dissolved solids (TDS) content of water is determined by weighing the residue after 105°C evaporation of a filtered sample. The TDS include both salts and organic residue. Some confusion exists about the relationship between hardness and TDS. The secondary drinking water standard for TDS of 500 mg/l sometimes is called hardness. Hardness, which is a measure of the amount of bivalent cations Ca^{++} and Mg^{++} in water expressed as mg/l of $CaCO_3$, is the major contributor to the TDS in most public

water supplies. However, since other inorganic and organic substances also contribute to the TDS, the hardness of a water sample nearly always is an underestimate of the TDS value. In this area, hardness typically accounts for 80-90 percent of the TDS. Therefore, while the TDS of the campus water supply has not been determined, it almost certainly falls well under the maximum concentration recommended by the secondary drinking water standard. The TDS of water has no relevance to public health. It is the chemical composition of the dissolved substances in drinking water that is important.

ZINC

Zinc salts are used in galvanizing and in paint pigments, pharmaceuticals, cosmetics and several insecticides. Except at very high concentrations, zinc has no known adverse health effects on humans and is an essential micronutrient in the diet. High concentrations of zinc may result in an objectionable taste and can cause the water to appear milky. The secondary drinking water standard recommended maximum concentration level for zinc of 5.0 mg/l is based largely on taste considerations. The general campus water supply contains very low concentrations of zinc (0.02-0.03 mg/l). However, higher concentrations (1.27 mg/l) have been found in the Main Building. The most likely cause of the relatively high zinc concentration is a gradual break-down of the galvanized interior coating of old water pipes in the building. This hypothesis is consistent with the high amount of iron also found in water drawn from this building.

CONCLUSION AND RECOMMENDATIONS

Our examination of the quality of the campus water supply has revealed no evidence of contamination or other indication that it poses a threat to human health. High concentrations of iron and manganese in some parts of the campus may make the water unpalatable to some individuals, but this does not represent a cause for concern in terms of public health. As is typical of other water supplies in the region, the campus water also is extremely hard. Hard water may form lime scale in pipes and appliances. It is likely that iron removal by oxidation and filtering or by softening the drinking water in some older buildings would improve the flavor of the water. However, the addition of sodium to the water through the softening process could adversely affect individuals on sodium-restricted diets. This makes oxidation and filtering systems a more desirable alternative for iron removal. Since it appears that the most important source of iron in the campus water supply may be its plumbing, any attempt at central removal of iron is likely to be ineffective. Use of bottled water on the campus cannot be justified on any but aesthetic grounds. It is unfortunate that the human palate is incapable of serving as a reliable detector of water quality. Water that tastes unpleasant to some individuals because of relatively high concentrations of iron or manganese may in fact be quite healthful; whereas water containing toxic amounts of lead or cadmium or disease-producing organisms may taste perfectly fine. Continued biological and chemical monitoring of the water supply is essential to protect the health of the campus population. The best solution for improving the aesthetic quality of the drinking water in older parts of the campus is to replace the interior plumbing and water mains whenever there is an opportunity to do so.

We recommend that the following measures to improve the taste and appearance of the campus water supply be considered:

1) All major renovation projects in buildings more than 40 years old include replacement of water pipes.
2) Replacement of water pipes to drinking fountains in buildings with high iron content be considered where feasible.
3) Water mains more than 40 years old serving the interior of the campus be replaced as feasible.

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COLLEGE OF BUSINESS ADMINISTRATION

Finance and Business Economics

Balvers, Ronald J.

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RADIATION LABORATORY

Carmichael, Ian C.

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Awards Received and Proposals Submitted

AWARDS RECEIVED

In the period November 1, 1990, through November 30, 1990

Category	Renewal		New		Total	
	No.	Amount	No.	Amount	No.	Amount
Research	3	168,400	2	117,869	5	286,269
Facilities and Equipment	0	0	1	354,233	1	354,233
Instructional Programs	0	0	1	40,000	1	40,000
Service Programs	0	0	8	7,386	8	7,386
Other Programs	0	0	3	52,258	3	52,258
Total	3	168,400	15	571,746	18	740,146

PROPOSALS SUBMITTED

In the period November 1, 1990, through November 30, 1990

Category	Renewal		New		Total	
	No.	Amount	No.	Amount	No.	Amount
Research	10	2,078,957	25	2,655,024	35	4,733,981
Facilities and Equipment	0	0	4	404,380	4	404,380
Instructional Programs	0	0	0	0	0	0
Service Programs	0	0	0	0	0	0
Other Programs	0	0	3	2,226,710	3	2,226,710
Total	10	2,078,957	32	5,286,114	42	7,365,071

Awards Received

In the period November 1, 1990, through November 30, 1990

AWARDS FOR RESEARCH

Department or Office	Principal	Short Title	Sponsor	Dollars Months
Center for Bioeng. Pollution Cnt.	Irvine	GANNP Scholarships in Environmental Research	Department of Education	100,000 12
Civil Engineering	Irvine, Kulpa, Gray, W.	Radiolytic Destruction of Organics	Occidental Chemical Corp.	29,900 12

Civil Engineering	Gray, K.	Removal of Algal Material: Treatment Techniques/Mechanisms	Lyonnaise des Eaux	38,500 12
Civil Engineering	Spencer, Sain	Robust Feedback Control of Structures	National Science Foundation	80,169 24
Mathematics	Dyer	Geometry of KAC-Moody Groups	National Science Foundation	37,700 24
		AWARDS FOR FACILITIES AND EQUIPMENT		
Electrical Engineering	Bernstein	IBM Technical Gifts Program	Intl. Business Machines	354,233 12
		AWARDS FOR INSTRUCTIONAL PROGRAMS		
Economics	Bartell	Transition to Democracy in Paraguay	Ford Foundation	40,000 12
		AWARDS FOR SERVICE PROGRAMS		
Center for Social Concerns	McNeill	Center for Social Concerns	Various Others	193 1
ND Center for Pastoral Liturgy	Bernstein	Notre Dame Center for Pastoral Liturgy	Various Others	1,035 1
ND Center for Pastoral Liturgy	Bernstein	Notre Dame Center for Pastoral Liturgy	Various Others	1,680 1
Inst. Pastoral and Social Ministry	Pelton	IPSM Dynamic Parish	Various Others	2,444 1
Inst. Pastoral and Social Ministry	Pelton	Shaneen Bishop's Leadership	Various Others	46 1
Inst. Pastoral and Social Ministry	Pelton	IPSM - Parish Consultation	Various Others	75 1
Latin/N. American Church Concerns	Pelton	Latin and North American Church Concerns	Various Others	35 1
Programs for Church Leaders	Kelly	Programs for Church Leaders	Various Others	1,878 1
		AWARDS FOR OTHER PROGRAMS		
Aerospace and Mechanical Eng.	Lucey, Berry, Jerger, Sen, Yang	NDEADC	University City Science Center	48,750 11
Economics	Bartell	Cuban Visiting Fellow	Ford Foundation	3,250 12
Philosophy	Morris	Pascal's *Pensees:* Faith, Reason and the Meaning of Life	National Endowment for the Humanities	258 12

Proposals Submitted

In the period November 1, 1990, through November 30, 1990

Department or Office	Principal	Short Title	Sponsor	Dollars Months
		PROPOSALS FOR RESEARCH		
Aerospace and Mechanical Eng.	Atassi	Aerodynamics and Aeroacoustics of Nonuniform Flows	NASA - Lewis Research Center	68,513 12
Aerospace and Mechanical Eng.	Paolucci	Stability of Mixed Convection Flow	American Society Mech. Engineers	30,571 12
Aerospace and Mechanical Eng.	Batill	Flow About Cables and Cylinders with Surface Irregularities	Department of the Navy	42,211 12
Aerospace and Mechanical Eng.	Paolucci	Formulation of Boundary Conditions	National Center Supercomputing	0* 12
Anthropology	Murphy	Social Change and Economic Models in Post-Trujillo Dominican Rep., 1961-90	Wenner-Gren Foundation	9,086 2
Anthropology	Murphy	Social Change and Economic Models in Post-Trujillo Dominican Republic	Social Science Research Council	17,047 12
Anthropology	Bellis	An Archaeological Assessment	Indiana Dept. of Natural Resources	74,262 13
Biological Sciences	Saz	Intermediary Metabolism of Helminths	National Institute of Health	256,765 12
Biological Sciences	Martin	Cellular Differentiation	National Science Foundation	488,812 36
Biological Sciences	Kulpa	Degradation in Anaerobic Films	Amoco Chemical Research Center	84,595 12
Biological Sciences	Lamberti	Stable Isotope Analysis of Stream Food Webs	National Science Foundation	48,381 24
Civil Engineering	Gray, K.	Transfer of PCBs within Stream Sediments by a Periphytic Biola	US Geological Survey	215,673 24
Civil Engineering	Silliman	Thermal Profile Interpretation	US Geological Survey	99,759 24
Civil Engineering	Ketchum, Silliman	Expert Systems for Operation and Engineering	US Geological Survey	350,000 24
Civil Engineering	Babic	Simulation of Granular Chute Flows	American Society of Civil Engineers	47,673 12
Chemical Engineering	McCready	Evolution of Flow Disturbances in Cocurrent Gas Liquid Flow	Department of Energy	312,634 24

Chemistry and Biochemistry	Helquist	New Methods in Organometallic and Synthetic Organic Chemistry	National Science Foundation	71,000 12
Chemistry and Biochemistry	Thomas	Radiation Chemistry	Corp. Research Lab./3M	113,760 24
Communication and Theatre	Falkenberg	Desert Slacks	American Film Institute	20,000 9
Communication and Theatre	Falkenberg	Shifting Frontiers	Rockefeller Foundation	35,000 10
Earth Sciences	Halfman	High Resolution Paleoclimatic Studies of Lake Turkana, Kenya	National Science Foundation	101,183 24
Earth Sciences	Neal	Megacryst Petrogenesis	National Science Foundation	85,139 24
Economics	Marsh	Mean Square Reduction: Principal Elements Regression	Department of the Air Force	161,042 24
Economics	Marsh	Mean Square Error Reduction: Principal Elements Regression	National Science Foundation	163,438 24
Electrical Engineering	Choudhary	PEXAFS Studies/Interface Formation and Adsorption on Semicondors	National Science Foundation	323,803 36
Electrical Engineering	Alcock	New Oxygen Sensing Systems	General Motors Corporation	67,850 12
Electrical Engineering	Lemmon	Multiagent Search Algorithms for Estimation and Decision Making	Inst. Electric/ Electronic Eng.	47,673 12
Electrical Engineering	Stevenson	New Nonlinear Filter Structure	Inst. Electric/ Electronic Eng.	47,673 12
Mathematics	Hahn	Quadratic Forms and Classical Groups	National Science Foundation	74,142 24
Mathematics	Wilczynski	Topology of 4-dimensional Manifolds	National Science Foundation	44,188 24
Mathematics	Smyth, Xavier	Problems in Differential Geometry	National Science Foundation	204,503 36
O.S.I.P.A.	Borelli	Minority High School Student Research Apprentice Program	National Institute of Health	15,000 12
Physics	Shephard, Cason, Ruchti	Experimental Research in Elementary Particle Physics	National Science Foundation	399,285 12
So. Bend Center Med. Education	Olson	Hormone Metabolism for Fish Gills	I.U. School of Medicine	340,142 36
So. Bend Center Med. Education	Kingsley, T., Kingsley	Age-related Changes in Adrenomedullary Function	I.U. School of Medicine	273,178 36

PROPOSALS FOR FACILITIES AND EQUIPMENT

Earth Sciences	Neal, Rigby	Development of Instruction in Geological Sciences	National Science Foundation	75,118 12
Electrical Engineering	Bernstein, Minniti	An Innovative Approach to Teaching IC Fabrication	National Science Foundation	127,345 31
Physics	Blackstead	Electronic Devices Lab Upgrade	National Science Foundation	157,617 12
Physics	Bunker	Supplement to EXAFS Studies of Semiconductor Microstructure	Department of the Navy	44,300 10

PROPOSALS FOR OTHER PROGRAMS

College of Arts Letters	Loux	An Endowed Chair for the Humanities	Natl. Endowment for the Humanities	1,200,000 26
Kellogg Inst. Intl. Studies	Bartell	Latin American Consortium	Indiana Univ., Bloomington	82,602 12
University Libraries	Jordan	Medieval Institute Microfilming Project	Natl. Endowment for the Humanities	944,108 36

* Computing Time

Notre Dame REPORT

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