

Special Facilities and Programs

Biochemical Processing Institute Schrenk Hall

Athanasios I. Liapis (*Director*), Neil L. Book, Roger F. Brown, Ronald L. Frank, Daniel Forciniti, Paula M. Lutz, Barbara R. Patterson, Donald J. Siehr, and Oliver C. Sitton.

The Biochemical Processing Institute promotes instruction and research in process involving bio-chemical separations, and microbial and enzymatic technology. It serves as a resource for the state of Missouri by supporting the industrial development of biochemical processes. The Institute is multidisciplinary in nature and brings together faculty members from several engineering and science departments at UMR.

Bioseparation research studies include the areas of freeze drying, affinity chromatography, chromatography, perfusion chromatography, liquid-liquid extraction, ultrafiltration, membrane separations, adsorption, ion exchange, and gross protein separations. All of these processes are used by the chemical, pharmaceutical, food, energy, and other biochemical industries and will provide for increased interaction between these industries and UM-Rolla.

Research in enzyme technology includes isolation and purification of enzymes of commercial interest from microbial sources, and the use of immobilized enzymes and microorganisms for the production of chemical feed stocks from biomass. Also, research studies in cell cultivation and biomaterials are currently conducted by members of the institute.

The institute enhances the opportunities for successful research in biochemical processes through increased interaction of UMR students and faculty with industry.

Program for Aging Studies Humanities-Social Sciences

Nicholas Knight (*Director*)

The Program for Aging Studies was instituted October 1, 1981, as part of the Missouri Gerontology Institute of the University of Missouri and Lincoln University. The purpose of the program is to encourage, teach, coordinate research on, and provide services for the elderly. The Ozark region ranks second only to Florida in expansion of this fastest growing segment of the population. Program activities include gerontological curriculum development, research in gerontology, and education of the elderly. Educational areas include humanities and the arts, psychology of aging, economics of aging, computers, transportation and management, and the arterial flow of the elderly. The program also offers instruction in languages, literature, and linguistics. The program assists and coordinates the obtaining of grants from international, federal, state, private, personal, University, and campus funds for work with the aging.

Wei-Wen Yu Center for Cold-Formed Steel Structures Butler-Carlton Civil Engineering Hall

Wei-Wen Yu (*Founding Director*)

Roger A. LaBoube (*Director*)

In order to meet an ever-increasing demand for technical assistance from steel and construction industries and to create more economic designs and applications, the UMR Center for Cold-Formed Steel Structures (CCFSS) was established to provide an integrated approach for handling research, teaching, and technical services on cold-formed steel structures at the University of Missouri-Rolla. The Center brings together technical resources from universities, trade associations, research laboratories, steel producers, manufacturing companies, consulting engineers, building officials, governmental agencies, and others.

The Center is currently co-sponsored by the American Iron and Steel Institute, Metal Building Manufacturers Association, Metal Construction Association, Rack Manufacturers Institute, Steel Deck Institute, Steel Stud Manufacturers Association, and the University of Missouri-Rolla.

Since 1968 UMR has conducted numerous research projects on cold-formed steel structures. These projects have been supported by the American Iron and Steel Institute, National Science Foundation, the American Society of Civil Engineers, Metal Building Manufacturers Association, Metal Lath/Steel Framing Association, the Steel Deck Institute, the Chromium Centre in South Africa, The Nickel Development Institute in Canada, the Specialty Steel Industry of the United States, and individual companies.

With regard to teaching, UMR is one of few universities to offer a graduate course on cold-formed steel structures. In addition to the regular course, UMR has regularly conducted short courses and international specialty conferences to provide continuing education programs for the engineering profession.

Center for Environmental Science and Technology 105 USBM Building

Virgil J. Flanigan, Ph.D.; P.E. (*Director*)

Senior Investigators: C. D. Adams (*Civil Engineering*), K. Chandrashekhara (*Mechanical Engineering*), D.E. Hagen (*Physics*), S. Kapila (*Chemistry*), J.W. Sheffield (*ME & AE and EM*), P.D. Whitefield (*Chemistry*), Gerald Wilemski (*Physics*).

Research Investigators: N.L. Book (*Chemical Engineering*), J.G. Burken (*Civil Engineering*), N. Ercal (*Chemistry*), M.W. Fitch (*Civil Engineering*), D. Forciniti (*Chemical Engineering*), Frank (*Biological Sciences*), N.L. Gale (*Biological Sciences*), A.W. Hatheway (*GE and Pet. Eng.*), P.M. Lutz (*Biological Sciences*), D.B. Manley (*Chemical Eng.*), C. Merrow (*Chemistry*), B.R. Patterson

(*Biological Sciences*), K.D. Peaslee (*Metallurgical Engineering*), C.W. Ramsay (*Metallurgical Engineering*), M.E. Schlesinger (*Metallurgical Engineering*), J.L. Schmitt (*Physics*), P.K. Terkonda (*Civil Engineering*), J.L. Watson (*Metallurgical Engineering*), K.J. Westenberg (*Biological Sciences*).

The Center for Environmental Science and Technology (CEST) is an expression of commitment by the university to be a positive force in helping society deal with environmental problems and concerns. Its mission is to involve students in the resolution of real-world environmental problems by enlisting them in research programs at UMR. To this end CEST fosters academic (students and faculty), industrial, and government laboratory participation in interdisciplinary environmental research. This multi-faceted program brings to bear new and existing technologies to the solution of environmental problems.

CEST may, therefore, be considered a catalyst for environmental research and teaching. It brings together under a common umbrella more than 25 faculty as senior investigators, research investigators, and adjunct investigators. Represented are more than a dozen engineering, physical science, life science, mining, and metallurgical disciplines. CEST also brings together a wide array of extraordinary laboratories and institute. These have an impressive array of capabilities and unique expertise in cloud and aerosol sciences, materials research and recycling, environmental trace analysis, materials characterization, toxicology, coatings technology, environmental monitoring, and many other areas.

Center for Pyrometallurgy

Fulton Hall

David G.C. Robertson (*Director*); K.D. Peaslee; and M.E. Schlesinger.

The center was established in 1982.

Research is conducted in the areas of smelting, refining, roasting, oxidation, plasma processing, materials processing, computer modeling, and information systems. In all cases, emphasis is on basic understanding and application of fundamental principles to long-range research questions and innovation in the field of pyrometallurgy.

Cloud and Aerosol Sciences

Laboratory

Norwood Hall

G. Wilemski (*Phys., Director*); R. W. Alexander (*Phys.*); K.J. Alofs (*M&AE and EM*); G.L. Bertrand (*Chem.*); J.C. Carstens (*Emeritus Prof. Phys.*); D. E. Hagen (*Phys.*); B.N. Hale (*Phys.*); S. Kapila (*Chem.*); J. Podzimek (*Emeritus Prof. M&AE and EM*); J.L. Schmitt (*Phys.*); D.R. White (*B.E.*); P.D. Whitefield (*Chem.*).

Global environmental concerns have propelled the atmospheric sciences to international prominence. Well known issues such as the ozone hole, acid rain, and global warming attest to the urgency of atmospherically related problems now facing society.

CASL is administered by the Physics Department and is also a part of CEST (Center for Environmental Science and Technology). It is a multidisciplinary effort drawing on the solid base of engineering and sciences provided by UMR. Students from various academic departments perform their thesis research within the laboratory in partial fulfillment of the M.S. or Ph.D. degree requirements of their "home" department.

The program is directed toward a fundamental understanding of the role of aerosols, including clouds and fogs, in our atmospheric environment. Current studies focus on basic nucleation processes of water and ice, cluster structure both in the gaseous phase and on substrates, homogenous binary nucleation, neutron scattering measurements on nanodroplet aerosols, particle formation in supersonic expansions, the heterogeneous chemistry and chemical composition of air borne aerosols and their impact on the atmosphere, the physics and chemistry of cloud forming aerosols in the atmosphere, and the environmental impact of combustion aerosols in the troposphere and stratosphere.

The Laboratory houses a variety of instrumentation, much of it unique. Prominent are a pair of cooled-wall (expansion type) cloud simulation chambers capable of accurately reproducing thermodynamic conditions in atmospheric clouds, a finely tuned expansion chamber used to study nucleation phenomena, instrumentation designed to directly determine the chemical composition of particles on which droplets form, and an extensive facility for both the on-ground and in-flight collection and analysis of combustion (e.g. jet exhaust) aerosols.

In addition to acquiring a knowledge of cloud, aerosol, and atmospheric science, the laboratory imparts to students a familiarity with a wide variety of data acquisition, signal conditioning, and system engineering problems.

Continuing Education

Mechanical Engineering Annex

Continuing Education is the campus-based unit which administers and coordinates short courses, conferences, seminars, and workshops, for UMR students and other audiences; local, national and international.

Working with the departments of all three schools/colleges, they provide the expertise to make available non-credit programs and off-campus credit programs.

In addition to UMR's continuing education, programs, independent study courses are offered, representing all four campuses of the University of Missouri.

For further information contact Continuing Education at (573) 341-4132.

Design Engineering Center: An Overview

Mechanical Engineering Annex

Kenneth M. Ragsdell (*Director*)

The Design Engineering Center is a unique industry/ government/university research partnership. The purpose of the Center is twofold: to provide a quality education to properly prepared and motivated students

(both graduate and undergraduate) and practicing engineers, and to address the current and future American industrial need for effective design and manufacturing methodology in support of efficient product development. The Center is located within the Mechanical Engineering Annex at the University of Missouri-Rolla. The current organization consists of a Director, a number of graduate and undergraduate students, and participating faculty. Current areas of research include Total Quality Management, concurrent Engineering, Taguchi Methods, the Design Process, Design Optimization, and the creation and distribution of a design optimization software environment. The Center reaches out to small business in the region in cooperation with two Small Business Development Centers; one a full service activity and the other focuses on technical information.

The DEC software User's Group exists to distribute and support the software that is developed as a result of Center research. We currently distribute the packages, OPT3, BIAS, OPTLIB, MELIB, OPT2, TRUOPT, TOPT, and CHOPS by grant agreement to members of the Software User's Group. Currently four membership grades are available; Subscribing, Associate, Regular, and University Membership. For more information contact:

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Electronic Materials Applied Research Center (EMARC)

303 Starumanis Hall

Harlan U. Anderson (*Director*)

Electronic Materials Applied Research Center (EMARC), a state/industry/university sponsored research program at UMR, is in its third year of developing new electronic materials technologies for the economic growth of industries in Missouri and throughout the nation. EMARC was formed through the support of the State of Missouri and the University of Missouri-Rolla due to an awareness of emerging technologies in piezoelectric sensors, actuators and emitters; fuel cells and oxygen permeable membranes; and thin film structures and devices.

The unifying theme for EMARC activities is the development of new ceramic and polymer materials and associated processing technologies for demanding applications where improved performance, yield, and reliability are desired. These activities build on the Center's core capabilities in molecular-level design and synthesis of materials, materials process, solid state materials analysis, and applications testing. EMARC also seeks to identify new areas where its R&D capabilities can be applied to industrial needs.

The Center is continually looking for ways to develop commercial applications from electronic materials and welcomes any inquiries you may have. Please contact Dr. Harlan U. Anderson, the Center's director, at

(573) 341 or by e-mail at: emarc@umr.edu for additional information.

Engineering Research Laboratory

Engineering Research Lab

Lokesh Dharani (*Director*)

The Engineering Research Laboratory (ERL) is an incubation environment for new and/or developing, interdisciplinary engineering research projects. The laboratory has housed such projects as laser manufacturing, virtual prototyping, the Environmental Research Center, a construction materials testing laboratory, laser manufacturing laboratory, the Center for Infrastructure Engineering Studies, and the Intelligent Systems Center (ISC). The ERL offers space for projects too large for existing space in one engineering department and non-restrictive organization within which to develop a new research ventures. The ERL help engineering departments in proposal development, graduate student recruitment, contract with granting agencies, administration of the School of Engineering graduate studies program, and organization of interdisciplinary research initiatives. It also houses the Minority Engineering Program.

Environmental Research Center Engineering Research Lab 206 Butler-Carlton Hall/113

C.D. Adams (*Director*), P.K. TerKonda (Associate Director), M.W. Fitch (Investigator), J.G. Burken (Investigator), and K.D. Hargis (Secretary)

The Environmental Research Center (ERC) was established in 1965. Its mission is to provide environmental engineering expertise to entities within the state of Missouri through performing environmental research and services addressing Missouri's environmental issues. A second mission of the ERC is to provide undergraduate and graduate students with outstanding educational opportunities in environmental engineering research in order that they may provide Missouri's industries, corporations, academia, and government with premier technological and scientific leadership.

The mission of the center involves both engineering and science. Investigators within the center maintain close liaison with appropriate local, state, and federal agencies; with industry and environmental consultants in Missouri and elsewhere; and with citizens of Missouri. Additionally, a wide variety of cooperative research and instructional relationships exist between the Environmental Research Center and other centers, departments and programs at UMR and peer institutions.

Current research interests of the Environmental Research Center are: development of integrated chemical/physical/biological processes for industrial, hazardous, and drinking water treatment; development of improved *in situ* and *ex situ* bioremediation technologies for contaminated soils and groundwater; phytoremediation technology; biofilm reactors; ozonation and advanced oxidation technologies; development of control measures for heavy metals and associated toxicity;

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and examination of indoor and outdoor air pollution control systems.

The Environmental Research Center maintains state-of-the-art instrumentation including; a variety of gas chromatographs; a total organic carbon analyzer; and atomic absorption spectrophotometer; an ion chromatograph; advanced oxidation and biochemical instrumentation; air quality instrumentation; respirometers; research microscopes; UV, visible IR, and fluorescence spectrophotometers; as well as many other instruments.

Experimental Computation Laboratory

Computer Science (rm 337)

Bruce McMillin (*Director*)

The Experimental Computation Laboratory (ECL) is an organization dedicated to research in advanced methods of distributed and parallel computation. The current focus is on the use of rigorous mathematics through formal methods to create fault-tolerant and secure real-time distributed computing systems. Additional work is done in computational sciences. Interdisciplinary research is the cornerstone for the success of the ECL.

Graduate and undergraduate students and faculty are supported by several grants from Air Force Office of Scientific Research and the National Science Foundation which utilize the ECL.

Experimental Mine Bridge School Road

J.C. Tien (*faculty member responsible*)

The Experimental Mine, situated on Bridge School Road 1 1/2 miles from the main campus, consists of 25 acres of surface and underground facilities which provide excellent opportunities for mineral engineering research. The surface land includes several dolomite quarries. The underground workings consist of four shafts and 1,500 feet of single-level drifts.

A variety of mine-related equipment is available for student use. This includes air compressors, rock drills, mucking machine, slusher and motor, diamond core drill, blasting seismography, extensometers, and surveying instruments. A complete ventilating fan system is connected to the underground area, appropriately installed for experimental data collection.

Recent faculty and students research has been conducted in the areas of rock blasting, mine ventilation and atmospheric control, rock mechanics, and pipeline transportation. The quality of facilities is indicated by the frequency of requests for government and industrial use of the premises. Student projects, however, retain priority on this equipment and the working areas.

Graduate Center for Materials Research

Straumanis Hall

Senior Investigators: H.U. Anderson (*Cer. Engr.*); R. Brow, (*Cer. Engr.*); F.D. Blum (*Chem.*); D.E. Day (*Cer. Engr.*); L.R. Dharani (*M&AE & EM*); W. Huebner (*Cer.*

Engr.); W.J. James (*Chem.*); T.J. O'Keefe (*Met.*); J.O. Stoffer (*Director and Chem.*); and J.A. Switzer (*Chem.*).

Research Investigators: A. Belarbi (*Civil Engr.*); R.F. Brown (*Bio. Sci.*); D.R. Carrol (*Basic Engr.*) H.L. Collier (*Chem.*); W.G. Fahrenholtz (*Cer. Engr.*); Bahador Ghahramani (*Engr. Mgt.*); J.M. Gregg (*Geol. & Geophys.*); E.B. Hale (*Phys.*); D.E. Hoiness (*Chem.*); Scott Kirby (*Chem.*); A. Kumar (*Nuc. Engr.*); N. Leventis (*Chem.*); D. Mattox (*Cer. Engr.*); G. Merrill (*Chem.*); R.E. Moore (*Cer. Engr.*); N.C. Morosoff (*Chem. Engr.*); J.W. Newkirk (*Met.*); M.J. O'Keefe (*Met.*); P.d. Ownby (*Cer. Engr.*); O.A. Pringle, (*Phys.*); M.N. Rahaman, (*Cer. Engr.*); C.W. Ramsay (*Met.*); D.G.C. Robertson (*Met.*); Samit Roy (*M&AE and EM*); M.E. Schlesinger (*Met.*); T. Schuman (*Chem.*); D. VanAken (*Met.*); M.R. Van De Mark (*Chem.*); and G.D. Waddill (*Phys.*).

The Graduate Center for Materials Research was established for the purpose of multidisciplinary research on materials and to provide improved centralized laboratories and specialized equipment for faculty and students involved in materials research. The Center provides graduate students in many academic departments (e.g. ceramic, chemical, civil, and metallurgical engineering, mechanical and aerospace engineering and engineering mechanics, chemistry, life sciences, and physics) with advanced training in materials engineering and science.

The research conducted in the Center ranges from fundamental science to applied engineering and includes the development, evaluation, application, and understanding of ceramics, metals, polymers, and composites.

Major accomplishments from the Center include: glass microspheres for treatment of liver cancer, transparent composites for windows/armor, electrodeposition of shape memory alloys, glassphalt road paving, ceramic materials (perovskites) for fuel cells, electrodeposited superlattices, electrodeposited epitaxial films, quantum-confined materials such as tunnel diodes, nanolithography, asbestos-free brake lining, new permanent magnet materials, dielectric and piezoelectric properties of normal and relaxor ferroelectric, high frequency phased linear arrays for medical ultrasound, and improved building envelope systems to withstand natural disasters. In 1985, the past achievements and continuing importance of the UMR materials engineering and science program were acknowledged when this program was declared one of only eight areas designated for eminence in the University of Missouri-System.

The Center is located in Straumanis Hall, a four-story building with 30,000 square feet of laboratory and office space. The Center contains all the modern equipment needed for research on materials development, characterization and evaluation, and for measuring common mechanical, thermal, electrical, and optical properties. It contains specialized and adaptable experimental facilities for:

- ceramic superlattice electrodeposition
- electrochemical characterization for deposition and corrosion
- electronic materials
- ferroelectric ceramics

- glass melting (up to 1650°C), fiber drawing, flame spheroidization and property measurements
 - nanomaterials
 - plasma deposition of materials
 - biomaterials
 - composites
 - structural characterization by x-ray diffraction, electron microscopy (including field-emission SEM), scanning tunneling microscopy and atomic force microscopy
- The Center has an active interest in industrial research and economic development which is suitable for graduate student education and which falls within the technical expertise of the staff.

High Pressure Waterjet Laboratory

Rock Mechanics Facility

David A. Summers (*Director*), Marian Mazurkiewicz, and Grzegorz Galecki.

The High Pressure Waterjet Laboratory has been established as a separate group within the Rock Mechanics and Explosives Research Center (RMERC).

For over two decades UMR has built an international reputation in the area of high-pressure waterjet cutting and cleaning. During that time the technology has moved out of the laboratory and into industry with a broad band of applications. In the past, through contracts that have been awarded, faculty researchers in the RMERC have pursued many of these applications. The establishment of the waterjet laboratory as a separate substructure provides a focus for research activities in the waterjet field and recognizes UMR's leadership in waterjet research.

Fields to be encompassed within the laboratory include the areas of high-pressure jet cutting; high-pressure jet cleaning; high-speed fluid cavitation; the mechanisms of surface erosion; two-phase fluid flow, including the addition of particulates to the jet stream; the mechanisms of fluid jet generation; and the surface physics of fluid impact. Applications include mining, civil engineering, industrial and military uses.

Institute of Applied Mathematics

Rolla Building

Leon M. Hall (*Director*).

The Institute of Applied Mathematics brings together faculty and students from the Department of Mathematics and Statistics and other science and engineering departments to study applications of mathematics to a variety of scientific and technological problems. It provides educational opportunities and serves as a resource for the state in support of high-technology industrial development.

Research is conducted on both the graduate and undergraduate level. UMR's computer facilities provide support for research and give the campus state-of-the-art capabilities for doing experimental work in mathematics.

Institute for Applied Chemistry And Nuclear Magnetic Resonance

Schrenk Hall

Frank D. Blum, *Director*

The Institute of Applied Chemistry and Nuclear Magnetic Resonance was established by the Chemistry Department in 1990. It was the outgrowth of the Institute for Surfactant Systems which was established in 1983. At that time, Dr. Frank D. Blum was named Director of the Institute.

The purpose of this Institute is to provide a research group that can focus on problems relating to applied chemistry. In addition, most of the funding supports the operation of the Nuclear Magnetic Resonance (NMR) Laboratory, supervised by Dr. Frank Blum. The NMR instrumentation is multi-disciplinary and is used by many researchers on campus.

Members of the Institute include: Dr. F. Blum; Dr. R. G. Brow, Dr. H. Collier, Dr. L. Dharani, Dr. Dr. E. Hoinness, Dr. H. Jo, Dr. S. Kirkby, Dr. N. Leventis, Dr. N. Morosoff, Dr. P. Neogi, Dr. G. Patterson, Dr. T. Schuman, Dr. O.C. Sitton, Dr. L. Sotiriou-Leventis, Dr. J.O. Stoffer, Dr. J. Switzer, Dr. M. Van De Mark, Dr. R. M Ybarra.

The Institute promotes the study of chemical solutions to practical problems in the areas of polymer coatings solvents, surfactants, thin films, and environmental science. The Institute consists of faculty members involved in research. It has a good balance of science and engineering. The specific interest is the behavior of polymers and biopolymers, coatings, composites and conducting materials, as well as the discovery of new types of materials from chemical synthesis and novel techniques such as plasma treatment. The transport of molecules in colloidal and polymer systems is being studied by several researchers. The structure and dynamics of surfactant based systems, including micelles, microemulsions, liquid crystals and colloidal dispersions, are being studied as well. The development of chemical processing methods and the production of nano-scale and ceramic materials are also of interest.

Institute for Chemical and Metallurgical Processing

Straumanis Hall

T.J. O'Keefe (*Director*)

The institute was established in 1974 to enhance interaction among researchers in several disciplines whose research interests are concentrated on extractive metallurgy and chemical processing. Particular emphasis is placed on the metals produced in the region. Studies are active in minerals processing, hydrometallurgy, electrometallurgy, and pyrometallurgy, many arising from current industrial problems of process efficiency, and pollution control or both.

The institute staff has close ties with major metal producers in both the U.S. and abroad who support a variety of research projects of industrial interest.

Institute of River Studies Environmental Hydraulics and Hydrology

Butler-Carlton Civil Engineering Hall

C.D. Morris (*Director*)

Water and water-resources problems are often comprehensive in nature and their complexity is such that their resolution requires cooperative effort from individuals from a wide variety of academic backgrounds. The purpose of this institute is to encourage and to foster interdisciplinary team research directed toward resolution of the water and water-resources problems of Missouri and the nation.

The focus of institute activity is on the nation's natural waterways. In particular, the institute has a long record of research into problems related to major rivers in the midwest. The institute helps bring academics together with agencies, companies and industries to initiate research. The institute assists in assembling potential research collaborators and in preparation of proposals.

Institute of Thin Film Processing Science

Straumanis Hall

Nicholas C. Morosoff (*Director*)

The Institute of Thin Film Processing Science provides advanced graduate education in thin film processing and creates a nucleus of scientific talent for innovative research in this area of science. It is part of the Graduate Center for Materials Research.

The institute provides an identifiable focus for currently existing research on thin films at UMR. It serves as a focal point where experts of many fields in industry, government, and the academic world can meet to exchange ideas and discuss problems. The institute also sponsors seminars, symposia, and colloquia on a regular basis.

This film processing is a high technology area of major interest to the semiconductor and microelectronics industry and has a wide range of applications. Thin films are used to insulate and protect the surfaces of intricate electronic devices. They also provide increased adhesion in composite materials, improve the corrosion resistance of surfaces and form a part of composite biomaterials.

In addition, these films are used as membranes in separation processes, such as separating one gas from another. These applications include the recovery of carbon dioxide (which is used in tertiary oil production) and separating carbon monoxide from hydrogen.

Intelligent Systems Center

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Internet Home Page: <http://www.isc.umn.edu>

Vittal S. Rao (*Director*)

Senior Research Investigators: A. Belarbi, F.Y. Cheng, M. Crow, M. Leu, and F. Liou.

Research Investigators: L. Acar, V. Allada, S. Balakrishnan, V. Birman, K. Chandrashekhara, G. Chen, J. Choi, B. Chowdhury, J. Drewniak, F. Ercal, Y. Fu, S. Kapila, R. Kellogg, S. Keyvan, K. Drishnamurthy, B. McMillin, T. Meinert, A. Miller, R. Mishra, A. Okafor, K. Peaslee, S. Pekarek, H. Pottinger, C. Saygin, D. Sourlas, K. Stanek, R. Stanley, R. Stone, S. Subramanya, A. Tikku, and H.L. Tsai.

Description of Center and Research Focus Areas:

The Intelligent Systems Center (ISC) is one of two research programs on UMR campus designated as eminent programs. The ISC mission is to provide an interdisciplinary research environment in which faculty from various departments can cooperate and conduct research on sponsored projects involving real physical systems with special emphasis on an intelligent (smart) systems approach. ISC has integrated its primary research mission with UMR's commitment to develop internationally recognized graduate research programs focused on key technologies.

The approaches for accomplishing ISC's objectives consist of (i) developing interdisciplinary research programs to match the emphasis areas of sponsoring agencies with the expertise of UMR faculty, (ii) conducting basic scientific research (iii) obtaining long-term federal research grants and industrial contracts, and (iv) developing multidisciplinary research facilities.

ISC considers the education of graduate students as one of its major activities and provides graduate research assistantships through the Center's investigators. The students supported by research grants choose their thesis topics to be closely related to the grant. The interdisciplinary nature of research provides an excellent opportunity for the students to interact with students from other disciplines. The students also gain valuable experience in working as a team and acquire communication and project organization skills. The interaction between graduate students and program managers from industries and federal agencies is very helpful in the application of their research to real-world problems.

Multidisciplinary research teams consisting of faculty members and graduate students from the departments of basic engineering, chemical engineering, chemistry, civil engineering, computer science, electrical and computer engineering, engineering management, mechanical and aerospace engineering and engineering mechanics, metallurgical engineering, nuclear engineering, and psychology have been established to conduct research in emerging technologies. The ISC has also developed state-of-the-art laboratories to conduct research on smart structures, neural networks, agile manufacturing and automatic inspection, and structural health monitoring. The Center provides advanced computing facilities (hardware and software) to its research investigators and graduate students working on research project. Active research is in progress in the following interdisciplinary research areas:

- Smart Structural Systems
- Rapid Prototyping and Virtual Manufacturing
- Intelligent Control and Monitoring of Energy Systems
- Information Technologies
- Nanotechnologies/MEMS

- Counter Terrorism
- Structural Health Monitoring of Infrastructural Systems/Aging Aircraft

Intensive English Program (IEP)

The Intensive English Program (IEP) at the University of Missouri-Rolla provides intensive instruction in the English Language for international students whose proficiency in the language is insufficient for admission into course work at the University.

The IEP offers 20 hours of non-credit course work per week in all aspects of language learning – pronunciation, reading comprehension, vocabulary development, grammar, writing, listening comprehension, speaking interaction, and note-taking. The program provides instruction at four proficiency levels: Beginning English, General English, Introduction to Academic English, and English for Academic Purposes.

All international students who have not satisfied the University's language-proficiency requirements are required to complete IEP's assessment testing which is comprised of four tests:

- Michigan Test of English Language Proficiency (MTELP) (*A standardized test that evaluates abilities in grammar, reading comprehension, and vocabulary*)
- Test of Writing Proficiency (TWP) (*A locally developed test that uses nationally developed guidelines to evaluate abilities to write clear, well organized English*)
- Oral Proficiency Evaluation (ORE) (*A locally developed test that uses nationally developed guidelines to evaluate abilities to speak English*)
- Test of Listening Proficiency (TLP) (*A locally developed test that evaluates abilities to understand spoken English, especially in a classroom setting*)

Students who perform well on all tests may be approved immediately for academic course work at the University. Other students are enrolled in IEP course work and then complete the series of tests again at the end of the semester. Recommendations for promotion into a higher level of the IEP or for advancement into university course work are made by the IEP's academic coordinator based on student testing and faculty input.

Students who enroll in the IEP must complete that program to the satisfaction of its director and academic coordinator (i.e. satisfy all graduation requirements) before being allowed to enroll full time in university course work. A student may enroll in a reduced university load (in conjunction with IEP course work) with the approval of both his/her academic department and the director of the IEP.

Ordinarily, the IEP is open only to students who intend to pursue study at UMR and who have been conditionally admitted to the University. If space exists, international students already admitted to UMR and already taking course work may enroll in IEP courses to improve their English. In addition, international persons

with no academic affiliation with the University may be considered for admittance.

For more information on the IEP, contact the Office of International Affairs (IA), 103 Norwood Hall, University of Missouri-Rolla, Rolla, MO 65409-0160 Phone: 573-341-4208 Fax: 573-341-6333.

International Affairs 108 Norwood Hall

Jeanie Hofer Smallwood (*Director of International Affairs*)

The Office of International Affairs (IA) coordinates international activities, administers all matters involving immigration for international students and scholars, and provides advisement services to the University's international population.

The International Affairs Office is responsible for the recruitment of international students and serves as a direct contact with U.S. government agencies, embassies, consulates, and the private sector concerning international activities. International Affairs serves as the campus home for international student exchange programs and the majority of study abroad programs (see section on Study Abroad Programs on page 8 of this catalog). In addition, the International Affairs Office assists faculty wishing to travel or work overseas, and offers educational programs, both domestically and abroad.

International Affairs coordinates and administers UMR's Applied Language Institute which houses the Intensive English Program. The Office of International Affairs serves as the office responsible for the organization of international protocol activities and tracks the status of linkage agreements.

Laboratory for Atomic, Molecular and Optical Research Physics

Don Madison (*Director*)

The Laboratory for Atomic, Molecular and Optical Research is composed of UMR faculty members performing research in atomic molecular and optical physics. This scientific area is concerned with the structure of atoms and molecules and their interaction with each other, with electromagnetic fields, and with surfaces.

The laboratory provides an environment which enhances this research activity, and which fosters cooperation and collaboration. The laboratory also provides a structure for formal cooperative programs, group funding, and other collective scientific activities.

Basic studies in the atomic, molecular and optical sciences have made major contributions to many of the new technologies that exist today. Laboratory faculty and staff members continue to contribute to the development of advanced concepts in such wide ranging areas as femtosecond laser physics, atomic interaction dynamics for electron, positron, and ion impact, and atomic processes important in controlled nuclear fusion.

Office of University Outreach and Extension

John W. Sheffield (*Director*)

The Office of University Outreach and Extension (formerly the Center for Technology Transfer and Economic Development) was established to extend the research-based knowledge and problem-solving resources of the university to meet the needs of the state, nation and the international community. Centers administered by the Office of University Outreach and Extension include the Rolla Regional Office of Mid-America Manufacturing Technology Center (MAMTC), the Industrial Assessment Center (IAC), the Small Business Research and Information Center (SBRIC), Cooperative Extension and Economic Development activities.

The MAMTC office is one of an elite group of Manufacturing Extension Partnership centers with funding from the National Institute of Standards and Technology (NIST) and the Missouri Department of Economic Development. MAMTC's primary purpose is to make manufacturers more productive and competitive. Through one-on-one consultation, training, workshops, industry networks, technology searches and other resources, MAMTC can help companies improve quality, reduce costs, and increase productivity. The IAC is funded by the U.S. Department of Energy, Office of Industrial Technologies, Energy Efficiency and Renewable Energy program. The IAC helps small- and medium-sized manufacturing plants find ways to prevent or control waste and made their processes more productive and energy-efficient. The IAC conducts free assessments for qualified manufacturing plants. The U.S. Small Business Administration provides funding for the Missouri Small Business Development Centers to provide an effective assistance program that helps business create jobs and boost the economy.

The broad array of professional expertise and experience is used by all of these centers. In addition to faculty and professional staff, these centers involve UMR graduate and undergraduate students. These centers also provide students with an in-depth training experience in the real world.

Rock Mechanics and Explosives Research Center

Rock mechanics Facility

Senior Research Investigators: Marian Mazurkiewicz; Samit Roy; David A. Summers (*Director*); and Paul N. Worsey.

The Rock Mechanics and Explosives Research Center, organized in 1964, brings together leading investigators from different disciplines to research static and dynamic rock mechanics and explosives technology. The High-Pressure Waterjet Laboratory of the center has developed a world-renowned team of waterjet technology specialists.

Areas of current research capability are: mine design, strata control, rock stress measurement, centrifugal testing-simulation of stress in complex geological structures, properties of rock under confining pressures,

similitude studies, rock mechanics and applied geology, dynamic rock mechanics, dynamic strain measurement, high-pressure waterjet rock cutting, constitutive properties of rocks, high-pressure waterjet long-wall mining of coal, deep mine problems, ultrasonic wave measurements in rock, dynamic creep in rock, crating with explosives, fracture propagation in rock, explosives and blasting, rock penetration and disintegration for rapid excavation, coal mine roof stability, concrete cutting and scarifying with water, and waterjet cleaning.

A substantial contract is currently held with the U.S. Navy for studies related to the demilitarization of military high explosives and rocket propellants; assessment of washout parameters using high pressure water jets and analysis and treatment of the waste stream produced. Reformulation of the washed out material into commercially useable explosives is also being undertaken.

Interdisciplinary scholars and researchers bring differing and unique views to problem solution in fields which benefit the area, state, nation, and ultimately the world.

Small Business Research and Information Center (formerly Technology Search Center)

Fred Goss (*Director*)

The Small Business Research and Information Center (SBRIC) is part of the Missouri Small Business Development Center (MO SBDC) system. MO SBDC is a partnership between the U.S. Small Business Administration and the University to provide management and technical assistance and training to Missouri's small businesses. The special services provided by SBRIC include research into technological solutions using online databases and affiliations with national and regional technology transfer centers and federal laboratories; referrals to technical experts from the UMR campus and elsewhere; access to and analysis of market, corporate and other sorts of information needed by Missouri's small businesses; the preparation of special research reports of use to small businesses in industries significant to the state; and the electronic publication of Missouri TechNet News via the World Wide Web.

Transportation Institute Butler-Carlton Civil Engineering Hall

Gary S. Spring (*Director*)

The Transportation Institute is made up of faculty and students from various disciplines who share mutual interests in traffic and transportation engineering. The major objective of the institute is to encourage research and educational activities relating to the safe and efficient transport of materials, products and passengers. All modes of transportation are of interest to the institute including highways, rail-roads, water-ways, airways, pipe-lines, and conveyors as well as terminals and other unique or evolving modes. Studies have ranged from optimization of traffic control at intersections to energy consumption by school busing and procedures to identify, analyze, and correct high-accident locations on highways.

UMR Engineering Education Center

Telecommunity Center Building University of Missouri-St. Louis Campus

Victor Birman (*Director*)

The UMR Engineering Education Center, located on the UM-St. Louis campus, offers UMR courses and degrees to working engineers and scientists in the St. Louis area. The courses, offered in the evenings, are graduate credit courses, applicable to master of science or Ph.D. degrees. Ph.D. degrees, however, require a period of residence on the UMR campus, (see pages 13 and 14), and an approved dissertation project site. Most of the courses can also be taken by non-degree candidates for personal enhancement.

The MS may be earned in aerospace, civil, computer, electrical, environmental, manufacturing and mechanical engineering, as well as engineering management, and engineering mechanics. Offerings may be expanded if warranted by interests and requirements of area students.

Requirement for the MS degree at the UMR Engineering Education Center are identical to those on the Rolla campus. Courses are taught by UMR faculty members, and by UMR-approved industrial research engineers and scientist.

In addition to degree programs, the center provides research, service and continuing education through conferences, workshops, seminars and short courses.

The center was established in 1964, as a part of the continuing education programs at UMR. Over 2,500 engineers obtained M.S. degrees at the center. Further information can be obtained from the director, at 8001 Natural Bridge Road, St. Louis, MO 63121, phone 314-516-5431, or from the Dean of Engineering at UMR.

Video Communications Center Library

Ross Haselhorst (*Manager*)

The Video Communications center offers to the campus and community a variety of video production and television broadcast capabilities. Services include professional-quality video taping and editing for educational and business applications. The resulting master tape may be mass duplicated or broadcast to satellite from the VCC. In addition, live satellite programming can be originated in the VCC's studios, or programming may be received from satellite and taped, watched in the VCC, or transmitted to other auditoriums on campus. The VCC can also participate in live two-way video/audio teleconferences with the other MU campuses. Additional services include film or slide-to-tape transfers, computer images-to-tape transfers and videotape duplication.

Almost from its beginning the VCC has, through the cooperation of academic departments on campus, produced credit courses for the National Technological University. NTU works in cooperation with 45 colleges and universities to broadcast graduate-level course

work to approximately 400 business and government facilities throughout North America. Besides semester-length credit courses, the VCC and UMR instructors with expertise in areas of special interest to industry are continuing to produce one and two day short courses for the NTU network.

The Video Communications Center is the UMR campus termination of UMRV, the University of Missouri Video Network. This network links the four campuses of the UM system with capability of full two-way teleconferencing among two, three or all four campuses. In addition, connections can be made to other universities and businesses having compatible teleconferencing equipment. This system is being used to carry between campuses credit courses in physics, engineering management, nursing and education, to name a few. Administrative and staff personnel conduct meetings on the network, thereby saving time and travel. Special teleconferences on topics such as trade with Japan and rural health care and carried over UMRV for the benefit of education and input from local enterprises.

The Moeller Writing Studio/Writing Across the Curriculum Program

113 Campus Support Facility

Linda Bergmann (*Director*)

The Dr. Beverley Bowen Moeller Writing Studio is located in 113 Campus Support Facility. Professors and Graduate Teaching Assistants in any course may refer undergraduate students to the Studio for help with writing in any field of study. The **Moeller Writing Studio** is staffed with Writing Assistants, undergraduate peer tutors who help students with general writing skills and with discipline-specific writing, such as proposals, technical memos, and laboratory reports. They see students both by appointment and on a drop-in basis. The Writing Assistants also maintain a collection of handbooks and other writing resources in both print and electronic media for students to consult. Open tutoring hours are posted early in the semester, and students can make tutoring appointments by phone or e-mail for a wide range of times. Writing Assistants are available to students without charge.

The **Center for Writing Technologies** is located in 114 Campus Support Facility, connecting with the **Moeller Writing Studio**. This is a Computer Learning Center linked to the campus network and specially equipped with writing, editing, and desktop publishing software, and with printers, a scanner, and a Smart board. It is used for classes and workshops, and is available for general student use during Writing Studio office and tutoring hours, when not being used for classes.

Templates for producing graduate theses in accordance with University of Missouri-Rolla thesis and dissertation criteria are available on the **Writing Across the Curriculum** web pages at:

<http://www.umar.edu/~wac/templates.html>

The primary purpose of the **Moeller Writing Studio** and the **Center for Writing Technologies** is to

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support **Writing Across the Curriculum**, UMR's program to improve undergraduate students' writing abilities. In addition to required and elective writing courses in the English Department, all departments at UMR are developing writing emphasized courses to give students experience writing in their academic and professional fields. Although the **Moeller Writing Studio** focuses on undergraduate writing, graduate students are welcome to use the Center, to consult with tutors and to attend the various workshops the program offers. The Writing Center houses a seminar series on topics suggested by students and faculty, and is looking for additional ways to involve graduate students. Graduate students who have ideas for the program should contact the director. For more information about **Writing Across the Curriculum** services and facilities, contact the Director of Writing Across the Curriculum, 223 Humanities/Social Sciences Building, University of Missouri – Rolla, Rolla MO 65409; call (573) 341 4436; or e-mail: wac@umr.edu.