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Main Hall ^{to} Main St.

Vol. 3, No. 3

Special Edition

July 1997

Forging frontiers: UM faculty make marks in research

University of Montana faculty attracted a record \$26 million in research grants and contracts during the 1996-97 fiscal year for work ranging from migration into Montana to ecology of the state's rivers and lakes and from life on Mars to global warming.

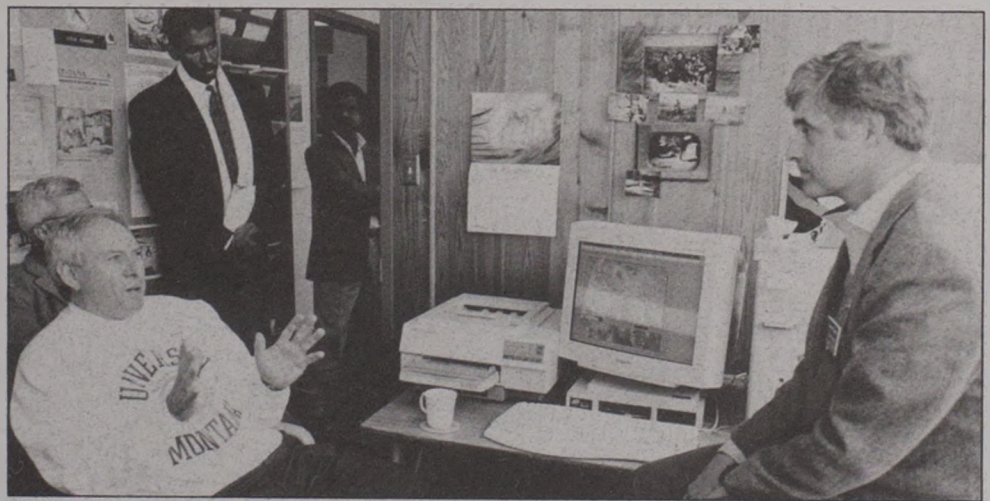
This is the seventh consecutive record-setting year for UM's external research funding. This year's total reflects a 10 percent increase over the 1995-96 total of \$23.5 million.

UM faculty use research funding to better educate students by involving them in the discovery process and employ them while they're in school; supply knowledge to elementary and high school teachers to take back to their classrooms; employ members of the community; and improve the quality of life and access to knowledge for all Montanans.

Research experience isn't restricted to graduate students; undergraduate students are at the heart of countless campus projects that somehow, someday will touch all Montanans.

Some research faculty employ high school teachers in their labs during summers and on weekends during the school year, while others invite high school students into their labs to get a head start in serious science.

This issue of Main Hall to Main Street examines only a sampling of the many ongoing projects in which students work side by side with faculty on cutting edge research of regional, national or international significance. In future issues, we'll examine other research of importance to Montanans.



NASA Chief Dan Goldin, left, and members of his staff chat with UM forestry Professor Steve Running, right, during a visit to campus in 1995.

Life on Mars

UM's Nancy Hinman has been monitoring NASA's Mars Pathfinder mission with a bit more excitement than most Montanans. Hinman, geology assistant professor, has been awarded NASA grants to study the prospect of life on Mars, and will soon begin analyzing the data collected by the mission's high-tech probe.

Hinman testified before the U.S. Senate Subcommittee on Science, Space and Technology last fall to urge continued research of the possibility of life on Mars, including more study on earth to better understand the fossilization process. A geochemist, she has studied fossilized micro-organisms in Yellowstone National Park, Australia, Iceland and Scotland.

"The sheer breadth of inquiries fielded

by the geology department in our small Montana city leaves no doubt that the findings have touched the imagination of our country," Hinman told the subcommittee. She added that fossil samples from Mars may be a better indicator of the geological history of the early planets because they haven't been "recycled" by plate tectonics.

Evidence of global warming

Is the Earth getting greener? Yes, and Ramakrishna Nemani, an associate research professor in the UM forestry school, has the data to prove it.

Nemani took the world by storm last spring when he co-authored a paper announcing the results of an intense study of satellite images and the discovery that not only is Earth getting

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Students, community benefit from research

by Richard Bridges
Associate Professor

Research: to question, to explore, to learn first-hand, to record one's observations, to discover. This pursuit of knowledge, its significance, and the rewards it brings Montanans should come as no surprise, for it is very much a part of our history.

To capture the impact of research and its potential, we need look no further than what might be considered Montana's first "grant". The proposal, for a grand sum of about \$2,500, was submitted to President Thomas Jefferson about 90 years prior to the founding of The University of Montana. The recipients of this grant were, of course, Meriwether Lewis and William Clark.

From canoes to computers

While the settings of research in Montana have changed from horseback and canoe to the scientific laboratories, field stations, computer terminals, libraries and conference rooms of our present universities, its importance endures. As discussed by President George Dennison, it is a mission that includes research which distinguishes a true university from other teaching institutions. This commitment rests on the belief that university faculty should not only convey information, but actively participate in the acquisition of new knowledge.

The understanding, use and support of research is, however, much more than an academic issue or exercise, for its impact reaches far beyond laboratory or conference room walls. In short, research at The University of Montana presents a "win-win" opportunity for our faculty and students, the state of Montana and our nation.

Rewarding research

One of the most tangible benefits of research is the economic support it brings to the University and surrounding communities. This past year, UM attracted approximately \$26 million in research contracts and grants. To put this in perspective with the University's overall budget, this amount is quite comparable to the support provided to UM by the state of Montana. Importantly, these awards do more than just aid the research efforts of the individual

professors who receive them. Portions of grants provide funding for graduate and undergraduate students, state-of-the-art equipment and library materials, as well as seed money for other faculty to develop new projects. This research support also creates well-paying jobs within the University community. This is especially advantageous for our many students who must work to pay for their education, because they can earn wages while gaining valuable experience in their fields of study.

It is also noteworthy that most of this funding originates from federal sources outside of our state. Because these dollars are "new" to our economy, they have a greater impact when they are infused and circulate throughout our community and state.

While the economic rewards of active research programs garner considerable attention, we cannot ignore the other obvious benefit: that is, the results from these inquiries. Whether investigating a virus or an entire mountain ecosystem,



Bridges observes student Danielle Dauenhauer in the lab

UM research projects yield needed answers to questions and issues confronting all aspects of our society. To not accept that responsibility would belittle the commitment, drive and talent of our faculty and students. We should be particularly excited about those projects in which Montana itself becomes the "laboratory."

Studies that focus on everything from our natural resources to our native peoples and our economy are invaluable in understanding and protecting all that we treasure about our state. These projects represent areas in which UM research not only contributes, but takes the lead at national and international levels. As the research efforts on this campus continue to grow, we envision UM becoming an increasingly valuable

resource to assist Montana's move into the next century.

The value of discovery

Of all the benefits that accompany research, none is greater than its impact on education. In fact, it is hard to imagine one without the other. If our common goal is to best prepare our undergraduate and graduate students for the unknown scientific, economic and social challenges of the future, who better to instruct than those carrying out research on the cutting edge of their disciplines? We all should see the value in engaging students with facts, ideas and concepts that are so current they have yet to reach textbooks. Beyond the lecture hall, these faculty allow our students to not merely hear about the process of research, but to actually participate. All across campus students are given the chance to work and contribute to ongoing research projects. While the practical lessons and insight gained from such experiences build upon lecture or laboratory classes, they can rarely be learned in these traditional settings.

The working relationships that develop between students and faculty, particularly at the graduate level, are very much akin to apprenticeships. Students learn first-hand the methods, challenges and frustrations of genuine research, as well as the excitement of discovery. We must encourage and increase these opportunities if we expect our students to develop the knowledge and skills that we will all depend upon in Montana's future.

As you read through this edition of Main Hall to Main Street we think you will be surprised at the quantity and quality of research that is being conducted on our campus. Although the articles only touch on a few people and projects, we hope they help you understand why we believe research is such an integral part of The University of Montana. We invite you to learn more about what we are learning.

Richard Bridges is an associate professor of pharmacology and toxicology in the School of Pharmacy and Allied Health Sciences. His research investigates the ways in which brain cells are damaged in neurological diseases and injuries.

Research, teaching go hand in hand

by President George Dennison

While all colleges and universities share the commitment to scholarship, not all of them have an identical mission in graduate education and research.

Combining the conduct of basic and applied research with the preparation of the next generation of scholars in a form of apprenticeship stands as perhaps the most distinctive characteristic and unique contribution of the American research university. Blending the service orientation of late 19th century American state universities and land-grant colleges with the research focus of the German universities of that era, the resultant American research university has developed a record of accomplishment unequalled in the history of higher education.

In the new model, the American research university appropriated the rationale and has relied upon it to articulate the relationship between graduate education and research.

As this statement of faith became a living legacy and a standard to guide conduct, the research university emerged as a basic engine of social progress and economic development. Innumerable examples come to mind demonstrating the contributions of university-based research to the resolution of societal problems, the improvement of human living conditions and the development of our economy. I do not mean to suggest that university-based research has not also generated new and different problems and challenges, frequently as unintended consequences, but rather to argue that the benefits overwhelmingly outweigh the detriments.

Help from outside

In the modern world of shrinking resources and increasing demands, research universities have found it necessary to rely upon external funding sources to sustain their graduate education and research programs. No university today can maintain its graduate programs without external

support, and no university can fulfill its mission to society unless it succeeds in this endeavor. With some exceptions — notably graduate training program grants — this support takes the form of grants and contracts to finance research projects that involve graduate students, in fact depend upon graduate student participation, for the conduct of the research. In this way, the research university extends the frontiers of knowledge while simultaneously preparing the next generation of scholars.

This unique blending of functions also benefits the state that assists the research university. In the simplest terms, consider the impact within the state's economy of an enterprise that attracts some \$26 million to the community, as The University of Montana does in the city and county of Missoula. Montana State University-Bozeman attracts another \$38 million to the state. Most of these funds go to pay for salaries, services and goods essential to the conduct of the research, with a majority of the expenditures made in the local economy. Moreover, these expended dollars have a multiplier effect of between 3 and 5 as they circulate within the economy. I find it difficult to identify a loser in this scenario.

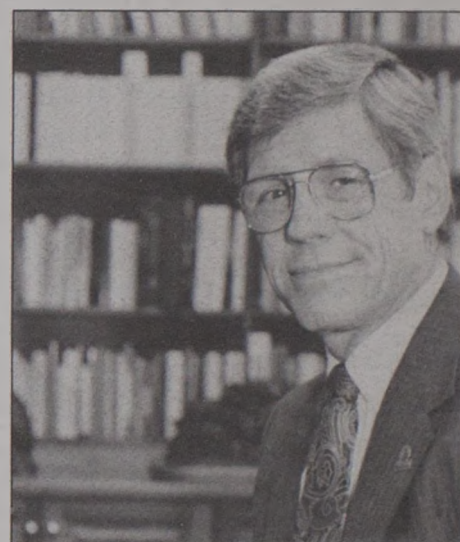
"Research is to teaching as sin is to confession. Unless you participate in the former, you have nothing much to say in the latter."

—John Slaughter
President
Occidental College

No loser here

The funded or sponsored research program of the research university provides incidental benefits to the entire campus even as it benefits directly those faculty members and graduate students involved in the funded projects. By spreading the overhead costs — administration, space maintenance, utilities and library acquisitions — of the institution over a larger base, funded research reduces the cost to the instructional and auxiliary programs. Moreover,

because of the synergism between research and instruction, even the undergraduate instructional programs benefit from the presence on campus of additional faculty members and specialized facilities the institution could not afford without the external support. By providing funds that the institution can allocate to finance the acquisition of equipment and renovation of facilities needed to enable new faculty members



President George Dennison

to initiate their research programs, funded research relieves the appropriated budget of these additional expenditures. And, finally but not exhaustively, most research universities set aside a portion of the indirect cost recoveries generated through funded research to provide small grants to faculty members in disciplines for which external support remains very scarce. Once again, a loser in this scenario remains difficult to identify.

Nonetheless, especially in recent years, many critics have discerned a conflict between research and instruction. No doubt the abuses that have occurred on some campuses have spawned this critical response. In Montana, we drifted close to the extreme of insisting that all of our colleges and universities conform to the same standard, typically that of the community college or the undergraduate college that emphasizes instruction and leaves little room for research. At The University of Montana, we cannot afford to accept such a standard. In order to sustain and fulfill the mission of the University, we must find an appropriate accommodation between research and instruction that penalizes neither while recognizing their interdependency. John Slaughter — president of Occidental College, former president of the University of Maryland and former director of the National Science Foundation — once quipped: "Research is to teaching as sin is to confession. Unless you participate in the former, you have nothing much to say in the latter." We will do well to attend his prudent counsel.

Opening doors, minds:

Research provides education, jobs for UM students

by Becky Shay
University Communications

Research. For some, the word may conjure up images of mad scientists stooping over microscopes, their hair matted and white lab coats hanging off their drooping shoulders. The reality is research extends beyond the lab and includes a wider range of people than full-fledged scientists. At UM, students play an active role in discovering

Graduate students in the sciences must complete a research project. Undergraduate students find work in their fields of study and get to earn some money without leaving campus.

All students involved in research have the opportunity to use state-of-the-art equipment and hands-on techniques that otherwise might merely be words on the pages of text books. All projects are done under the supervision of a faculty member, ensuring the quality of the project.

Seeing the big picture

Danielle Dauenhauer has been working in the UM lab of Associate Professor Rich Bridges since fall 1994, studying how different drugs work on nerve cells in the brain. She studies glutamate, a brain chemical tied to Alzheimer's disease and other brain traumas, including strokes. Dauenhauer points out her work won't bring a cure for Alzheimer's, but will help form an understanding of the chemical and its effects.

"Each little piece of information contributes to the big picture," Dauenhauer says. "That's important to me: seeing the big picture. A lot of times in classwork we don't see the big picture. We see little bits and pieces."

Dauenhauer has applied to graduate school. She also is considering the possibilities — and she's only just begun to look at all the doors open to her — for continuing in pharmacological research.

"It's a wonderful, wonderful education and job opportunity for me," she says. "It's a good supplement to my classwork."

Dauenhauer has co-authored two publications for trade journals and also made a presentation at the Montana Academy of Sciences in April 1996.

"There's so much more to learn," she says. "It gives me the drive to keep going and keep learning."

Inquiry improves instruction

For Stephanie Nadasi, who plans to one day teach science at the high school level, being involved in research is crucial in developing the skills she deems necessary for her career. She believes you can't teach the process of scientific inquiry without going through the process yourself.

"I feel very fortunate to have opportunities to develop skills that will enhance my growth as a future biologist," says Nadasi, who is working toward a degree in biology with an emphasis in environmental biology and biological education.

For the past two summers, Nadasi has worked with Assistant Professor Carol Brewer on plant eco-physiology research projects.

"Undergraduate research opportunities are essential for students to develop the skills needed to work and contribute as professional scientists..."

—Stephanie Nadasi

"All of my research experiences have taught me about the process of scientific inquiry and that the process of learning and discovery is just as important as the outcome," Nadasi says.

"Undergraduate research opportunities are essential for students to develop the skills needed to work and contribute as professional scientists. Acquiring content knowledge through conventional coursework is only one aspect of professional growth for future scientists."

State-of-the-art education

Darren Calhoun, a graduate student in clinical psychology, won't spend his professional life in a white lab coat. He says he applied to the UM program "knowing full well teaching is my ultimate goal." Before entering UM, Calhoun taught in the public education system and at a junior college in Wyoming.

Calhoun studies the prevalence of diabetes within the Native American population. An enrolled member of the Northern Arapaho tribe, Calhoun will survey members from his home on the Wind River Reservation in Wyoming.

"I'm going to be able to do research to truly help people in their lives," he says. "The project has opened my eyes to the point where I think I'll always be focused on something to do with chronic health with Native Americans."

Calhoun points out that faculty are required to do research so they can offer state-of-the-art education.

"That's what the world of academia should be about," he says.

Redirecting youths at risk

The combination of practical skills and a sound education is driving the research efforts of second-year graduate student Brenda Roche. She earned her undergraduate degree in psychology at UM in 1995.

Roche's project not only meets her graduate research requirement, but provides jobs for other UM students and helps youths across Montana along the way. She studies ways to offset the likelihood that people who are raised in foster care will end up in prison, on public assistance or among the homeless.

Roche started working with the Montana Department of Public Health and Human Services in October 1993 with a goal of assessing foster care



Nadasi in the field

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Student researchers

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youths' knowledge of life skills and developing training for mentors to work with the youth. Now her research includes evaluating the program and a long-term study that follows youths after they leave foster care.

Her project runs on about \$100,000 a year. It has a research component that helps 12 undergraduate students fulfill course requirements while assessing foster childrens' knowledge and life skills and providing technical support to mentors across Montana. These students also complete data entry and statistical analysis. Several of the students also volunteer as mentors, which gives them one-on-one experience with children in the foster care system.

Roche and eight other graduate students also work in a service component that trains mentors to work with youth. Students working in this facet of the project earn a stipend.

Working with communities

In 29 months of research, Roche and her team have recruited more than 350 mentors in communities across Montana to work with children in foster care. The students have trained 180 mentors and are evaluating the effectiveness of the training and providing technical support to those volunteers. The students have also assessed 870 youths in foster care. The youths are assessed every six months and the preliminary statistics are beginning to form, Roche says.

"It's a great deal for the state. It's great for the youth in care and it's great for the University," she says.

Additionally, in December 1996 Montana Youth for Change grew out of the project. The pilot group is made up of youths in foster care in Missoula and teaches leadership and self-advocacy.

More recently four undergraduate students started a pilot life skills group in Missoula. Two students lead the group, helping the youths work together to learn life skills that range from hunting for an apartment to creating a monthly budget. Young adults recently out of foster care also work with the youths to share their experiences outside the system.

Changing Directions is another group spawned by Roche's project. Using curricula developed at the Pacific Institute in Seattle, 16 foster care providers from Billings, Great Falls, Helena, Missoula, Kalispell and Libby are learning to help youths in care reframe the way they think about their lives and life experiences to help them make their own positive life choices.

Victor teacher spends summer with bees

Victor High School teacher Nathan Beckwith believes that learning is best achieved through hands on involvement rather than from a lecture or textbook.

This summer he is taking his own advice by helping bumblebee researcher Penny Kukuk in her UM lab. With a \$14,000 Partners in Science grant from the M.J. Murdock Charitable Trust and Research Corp., Beckwith is monitoring the development of bumblebees.

"I wanted to become more effective in teaching science, to be more hands on and on the cutting edge of research," Beckwith said. "I want to bring some of it back to the classroom and my students."

When Beckwith heard about the Partners in Science program at a conference last fall, he came knocking on doors at UM's Health Sciences Building in search of a mentor. He connected with Kukuk, a research associate professor in the Division of Biological Sciences. Kukuk studies how gases affect the behavior of bumblebees.

Beckwith's role in the research project is to develop about 35 bumblebee colonies and monitor how different levels of carbon dioxide affect their development. He feeds the queen bumblebees in his keep a daily diet of honey and pollen.



UM enters front line battle in HIV research

Vaccines are the most potent tool in the public health arsenal. Nearly all infectious diseases that have been controlled, polio and mumps for example, have been controlled by vaccination. The story will undoubtedly be the same for HIV, the virus that causes AIDS.

That makes UM's efforts to understand the virus and develop a vaccine all the more important, says Jack Nunberg, director of the biotechnology center and the HIV virology lab at UM.

A vaccine against the AIDS virus probably won't come out of UM's HIV virology lab, but the campus lab will contribute to the national/international team effort from which a vaccine will be developed.

HIV/AIDS research is "too big and too complicated for one person to do," Nunberg says, so cooperation on a national and international scale is a must.

The analogy of blind people and an elephant can be made: Each person feeling a different portion of the elephant will describe the elephant in a different way--one may call it long and slinky by feeling the trunk, another would describe it as large and flat by feeling an ear. Only by combining all the descriptions do you get a complete picture of the elephant.

"We don't work in a vacuum," Nunberg explains.

UM's HIV lab is funded by the National Institutes of Health. Both in his work in industry and now in his academic endeavors, Nunberg is a

participant in the NIH's National Cooperative Vaccine Development Groups. The group meets annually to coordinate resources and information about research.

"Things happen too quickly to rely on published work," Nunberg says.

While cooperation is necessary in HIV/AIDS research, it is also a boon for UM. Having a breadth of research means having a variety of techniques and instrumentation and a storehouse of knowledge spread across campus.

"It all builds," Nunberg says. "What one (project) gets is used by everyone and supports everyone else."

One of the best aspects of research efforts in higher education is the opportunity it provides for students. Ongoing research on campus is giving students the chance to do research in the fields they are studying in the classroom.

"Students are cheated if we just teach them current knowledge," Nunberg says. "We should be providing students the training to create new knowledge."

Another high point is the doors that are opened through research. For example, some students have the chance to attend national meetings and conferences to present papers and meet with leaders in their fields. That not only translates into excellent learning experiences but quite possibly job opportunities.

"Research is an opportunity for students to get the best training they can," Nunberg said. "More doors open to them by doing research."

—Becky Shay

Research

Continued from page 1

greener, it's getting warmer.

The report announced that spring is coming earlier than it did in the 1980s — especially in the northern latitudes — because of earlier snowmelt and higher temperature, which are almost certainly the result of a human-caused increase in carbon dioxide in the air.

Nemani worked with researchers from NASA, Boston University and Scripps Institutions of Oceanography.

The researchers found vast areas of vigorous forest growth apparent in Alaska, western Canada and central Siberia near Lake Baikal. For years, indirect evidence has indicated that people are changing the world's basic biological rhythms.

Meanwhile, Nemani's colleague, Professor Steve Running has maintained a 10-year research relationship with NASA. Running is creating computer software for the federal agency's Earth Observing System that will be launched in 1998.

At a cost of more than \$20 billion, the project is the largest ever attempted by NASA. Running's software will analyze data beamed back to Earth from EOS satellites.

Bee alert

Biological sciences Professor Jerry Bromenshenk and Associate Professor Garon Smith cause quite a buzz in the world of science these days. Their use of honey bees to sound the alarm on environmental hazards has won them a prestigious contract from the U.S. Army.

The buzzing insects pick up pollutants as they fly through the air. When the worker bees return to their "condos," Bromenshenk and Smith are there to study what was picked up during flight. "We've found out that because bees have fuzzy bodies, little branched hairs and electrostatic charges, they're really actually little electrostatic flying dust mops," Bromenshenk said. Monitoring bees, he noted, is one of the most efficient ways to sample the environment for pollutants.

Montanans on the move

It may seem that out-of-state residents are flocking to Montana at a rate that may finally take Montana to the million mark in population in no time flat. But geography Assistant Professor

Christiane Von Reichert found that isn't the case. Montanans are leaving at about the same rate.

Von Reichert has analyzed the Internal Revenue Service's state-to-state data and the Current Population Survey conducted by the U.S. Bureau of the Census to get the facts about migrants in Montana and compare the facts with Montanans' perception that outsiders are flooding into the state. She found that although Montana has gained roughly 50,000 people since 1990, during 1985-1990 Montana had a net loss of about 50,000 people who migrated to other states.

The net gain is roughly zero, but she said the rapid reversal of migration trends has Montanans concerned about

Montana and across the nation, increasingly shifting the burden of assistance from the government to non-profit organizations and the private sector, said Miller, president of the Montana Hunger Coalition.

Miller has several research projects that aim to anticipate welfare reform's impact on Montana and the private resources that will be needed to help absorb that impact. He works with the Montana Food Banks Network and the Montana Association of Churches to help prepare them for an increasing demand for food and other assistance.

Federal cuts in food stamp programs and elimination of federal "safety-net programs" for low-income families with children could have a devastating affect on many Montanans, said Miller, who has researched hunger in Montana since 1988.

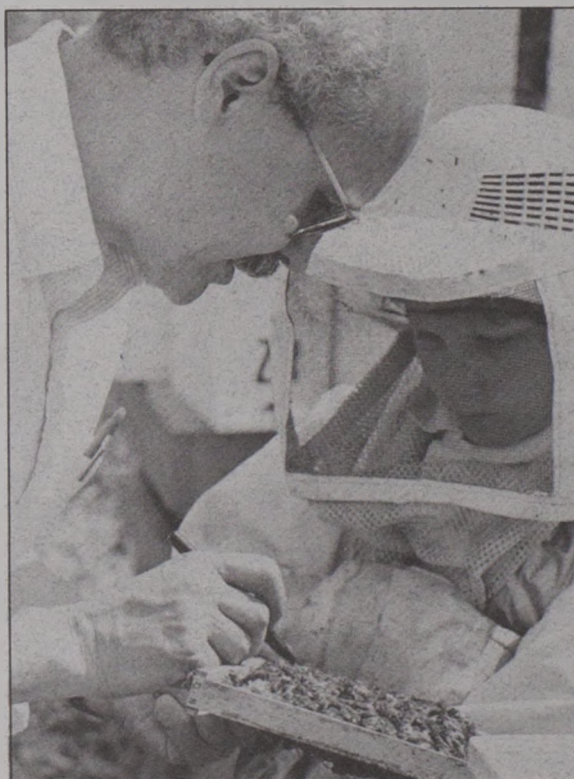
Even those who have never been on welfare may be deeply affected by the changes, he said. By moving mothers and others off welfare and into the work force, welfare reform will increase the pool of available low-wage workers, which will result in even lower wages, he said. In Montana, the predicted drop in wages for the lowest-paid workers is estimated at 10.2 percent, he said, a cut that is likely to force more Montanans, particularly families with children, into poverty.

Drug with dual purposes

Research pharmaceutical sciences Associate Professor Craig Johnston's work seems like a contradiction in terms: a drug that can both promote and inhibit fertility. His laboratory is trying to develop a nonsteroidal fertility agent that would not produce the severe side effects that accompany steroidal fertility agents now available.

His preliminary data using rodents show that analogues of the peptide oxytocin can stimulate a female's secretion of luteinizing hormone when given at certain times of the menstrual cycle, resulting in ovulation and increased fertility. On the other hand, when analogues of oxytocin are given before this critical time, they may prevent ovulation, resulting in contraception.

University Communications writers Terry Brenner, Rita Munzenrider, Kris Rodine and Becky Shay contributed to this article. Photos were taken by UM's Todd Goodrich.



Bromenshenk and his bees

migrants crowding residents out of the labor and housing market. Migrants are, on average, younger and better educated than residents, she found.

Helping the hungry

UM sociology Professor Paul Miller is working to prepare Montana assistance organizations for an expected rise in the number of hungry families who need their help.

Welfare reform legislation signed by President Clinton last summer will likely result in a marked rise in hunger in



The University of
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Mam Hall to Main Street is published monthly by University Communications at The University of Montana-Missoula. Send questions, comments or suggestions to Rita Munzenrider, editor, 317 Brantly Hall, Missoula, 59812, or call 243-4824. Photographer is Todd Goodrich.