Bryan Fisher
Student Legislative Coalition, Director
University of Minnesota at Morris

To the Senate Higher Education Finance Division
Jan. 20, 2005

I want to thank the Committee for hearing my testimony, as well as, President Bruininks for presenting a budget that balances the inherent tension between students contributing to their own education and the State helping us out along the way. This budget in addition to striking that balance between the state and students allows the University to firstly maintain its present rank as a world class research institution on one hand, but more importantly, on the other allows the University and its students to continue to positively affect our communities.

At the University of Minnesota Morris our students are especially active in the schools and nursing homes in our area. From assisting with art projects, to memorizing multiplication tables in the elementary schools, students are contributing to our state's most enduring strength – its children. And at the same time, we are helping care for our state's eldest residents, and are working to assure that their mistakes are not repeated, but more so, that their wisdom is not lost to time. These projects involve literally hundreds of students at our campus, and are just a small part of the resources that the University of Minnesota Morris directs toward the community it serves.

But we can do more, and with your support we will! At the same time, you must realize that if your support in not as forthcoming as the President and the Regents have requested, the strength of the University will be undermined because of the staff cuts, the inability to retain top faculty, and the increased burden on student finances as loans become an even more dominate form of financial aid if we fail to earn your assistance. Both of these factors in the end hurt our state, its students and elderly, and future of all of us.

With your support the University of Minnesota will continue to be affordable for its students, and the state will continue to have a wealth of young professionals that have experience serving their community, that are ready to grow the economy, educate our children, and care for our grandparents upon their graduation .

Thank your once again.

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Frank B. Cerra, M.D.
Senior Vice President for Health Sciences
Professor of Surgery

Office of the Senior Vice President for Health Sciences
Academic Health Center
Mayo Mail Code 501
420 Delaware Street S.E.
Minneapolis, MN 55455

612-626-3700
Fax: 612-626-2111
E-mail: cerra001@tc.umn.edu

WITNESS SIGN IN

NAME Shaun Laden

AGENCY OR ORGANIZATION Student, U of M

ADDRESS 14895 Colorado Ave Rosemount MN 55068

PHONE NUMBER 612 871-6289

EMAIL ADDRESS lade0015@umn.edu

NAME Dan Miller

AGENCY OR ORGANIZATION SNDmt U of M

ADDRESS 300 Washington Ave Suite 234, Minneapolis MN 55455

PHONE NUMBER (612) 414-8789

EMAIL ADDRESS dmiller@hhh.umn.edu

NAME

AGENCY OR ORGANIZATION

ADDRESS

PHONE NUMBER

EMAIL ADDRESS

NAME

AGENCY OR ORGANIZATION

ADDRESS

PHONE NUMBER

EMAIL ADDRESS

PLEASE SIGN IN FOR OUR RECORDS

2006–2007 Biennial Budget Partnership Proposal

Presentation to the
Senate Higher Education Committee
January 20, 2005

UNIVERSITY OF MINNESOTA

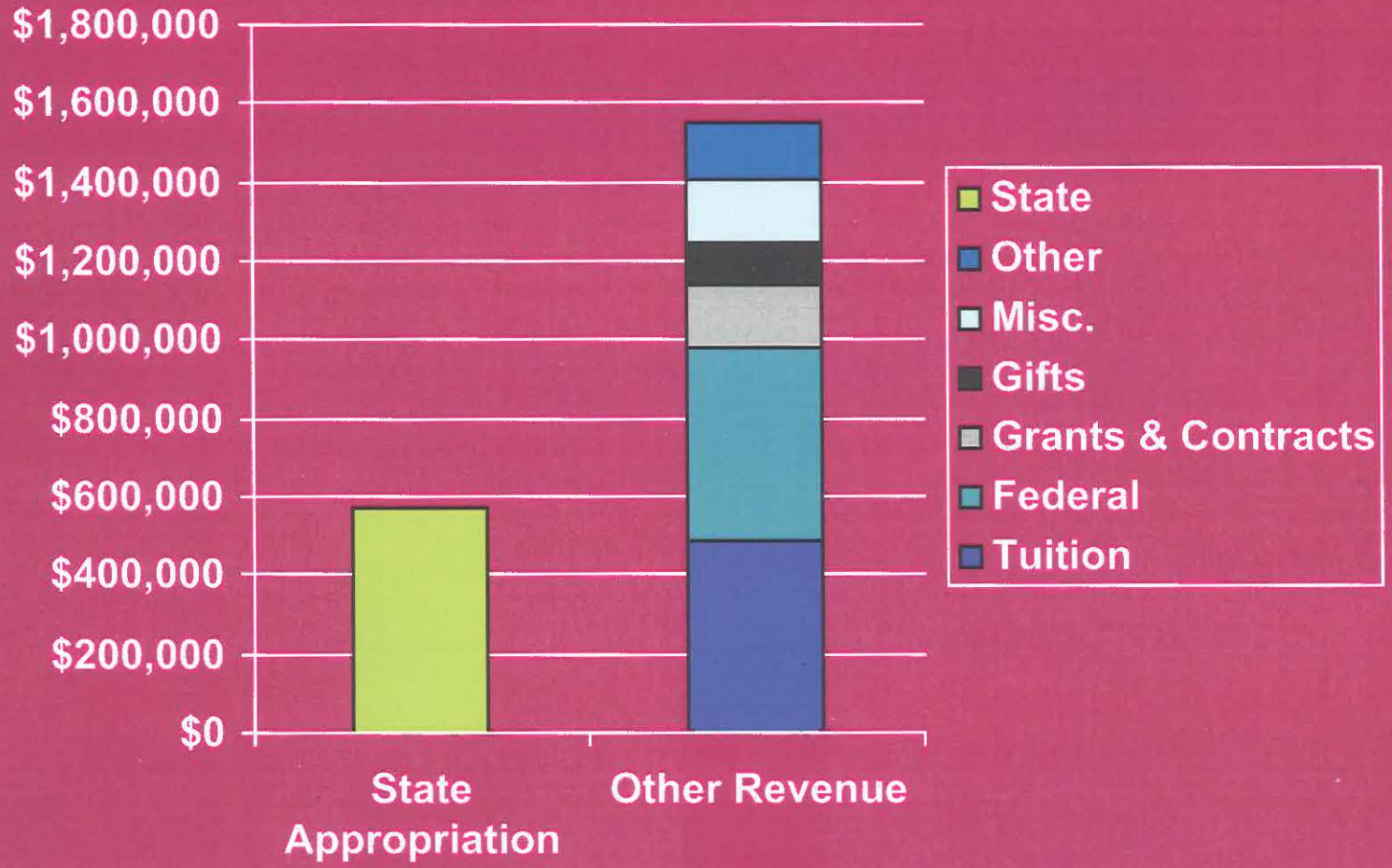
2006–2007 Biennial Budget Partnership Proposal

The Value of Investment in the University of Minnesota

- **Economic, cultural, and civic advantage**
- **Public goods**:
  - Quality **education** for next generation
  - **Talent magnet**
  - **Innovation** and **discovery**

Leveraging the State Appropriation

(FY2004, $ in 1,000s)



Partnership Proposal: Investments

State Investments

- Biosciences for a Healthy Society
- Attracting and Retaining Talent for Minnesota's Future
- Creating and Sustaining Essential Research and Technology Infrastructure

University Investments

- Faculty and Staff Compensation Increases
- Basic Operating Costs
- Other Academic Investments

2006–2007 Biennial Budget Partnership Proposal

	Increase over FY 2005	Increase over FY 2006
50% State Investment	**$42M**	**$42M**
University Investment		
reallocation	*$15M*	*$15M*
tuition	*$27M*	*$27M*
50% University Investment	**$42M**	**$42M**
Grand Total	**$84M**	**$84M**

UNIVERSITY OF MINNESOTA

2006–2007 Biennial Budget Partnership Proposal

State Investments

Biosciences for a Healthy Society

Healthy Foods, Healthy Lives

Translational Research in Human Health

New Products Through Biotechnology

Brain Function Across the Lifespan

UNIVERSITY OF MINNESOTA

2006–2007 Biennial Budget Partnership Proposal

State Investments

Attracting and Retaining Talent for Minnesota's Future

Preparing Students for the 21st-Century Economy

Competitive Compensation

UNIVERSITY OF MINNESOTA

2006–2007 Biennial Budget Partnership Proposal

State Investments

Creating and Sustaining Essential Research and Technology Infrastructure

Research Support

21st-Century Technology

2006–2007 Biennial Budget Partnership Proposal

- Maintain competitive position
- Improve quality and contributions
- Share responsibility

UNIVERSITY OF MINNESOTA

GROUNDBREAKING RESEARCH

UNPARALLELED OPPORTUNITIES

STATEWIDE ASSET

WHY INVEST IN THE UNIVERSITY OF MINNESOTA?

The University of Minnesota is one of the state's greatest assets and one of the best investments the state can make in its future. It is the public institution that can best position and prepare Minnesota for the future.

- University graduates–more than 12,000 in 2003-2004–build the state's well-educated workforce.
- Seventy percent of University graduates continue to live and work in Minnesota, contributing to their communities, the state's economy, and our quality of life.
- Significant growth is expected to occur in occupational areas requiring advanced degrees. The University is the institution that can best position and prepare Minnesota to meet this challenge.
- Ten percent of the University degrees awarded last year were in engineering.
- Nearly 40 percent of the degrees awarded on the Twin Cities campus were graduate and professional degrees.
- Two-thirds of the state's advanced health practitioners–doctors, dentists, pharmacists, advanced-practice nurses, and public health professionals–are trained at the University.
- The University is one of the nation's most productive graduate schools, ranking ninth in the number of Ph.D. graduates.
- More than 4,000 companies have been founded by Institute of Technology alumni–2,600 in Minnesota alone, with an estimated annual revenue of $45.9 billion and employing more than 175,000 Minnesotans.

The University of Minnesota is the state's only research university.

- The University receives more than 98 percent of all research dollars coming to higher education institutions in Minnesota. This investment is one the state cannot afford to lose.
- University research generates revenue for the state. For three years in a row, the University has brought in more than $500 million in sponsored research awards. And U.S. Department of Commerce statistics show that 39 jobs are created for every $1 million spent on university-based research.
- The University is a national leader in technology commercialization, a valuable activity for the state's economy. In the past five years, the University has received nearly 240 patents.
- The University has pioneered many groundbreaking techniques and procedures that benefit the health of the state and the nation. For example, the U's Center for Magnetic Resonance Research developed an imaging technique–the functional MRI–that shows the brain in action.
- University researchers were the first to find a link between eating oats and lowering cholesterol.
- University researchers work to improve the lives of people throughout the world; for example, 80 new crop varieties have been released, greatly increasing yields worldwide.
- University researchers invented one of the primary HIV/AIDS "cocktail" drugs, the first heart pacemaker, and the flight recorder.
- Investing in higher education is key to any region's economic vitality, and without sufficient, long-term investment, the University will lose opportunities to lead statewide growth and contribute to the quality of life that Minnesotans enjoy.

Future innovations, as well as the state's future professional workforce, depend upon investments made in higher education today.

- Without an increased commitment to higher education, Minnesota will lose its best and brightest students to other states.
- Without an increased commitment to higher education, the University will lose its ability to attract and retain talented faculty and staff, the backbone of every leading research university in the nation.
- Minnesota ranks 29th in the nation in tax support per $1,000 in personal income, behind Michigan, California, and others; Wisconsin ranks 18th.

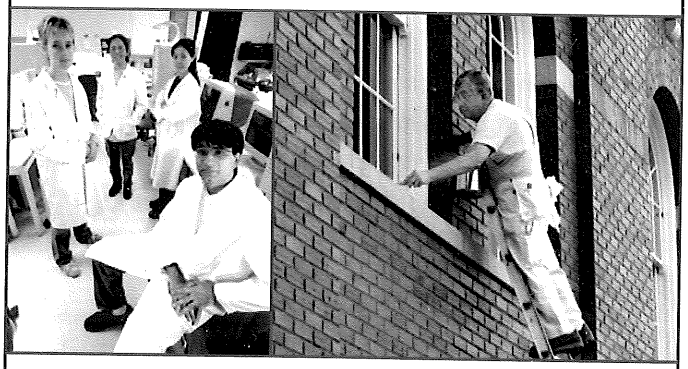
RECENT STATE INVESTMENT IN THE UNIVERSITY OF MINNESOTA

2003 Legislative Session

- University receives a ***$185 million cut***
- Represents a real cut to base funding
- University responds by freezing salaries, raising tuition, reducing workforce, and passing on increased health care costs to employees

2004 Legislative Session

- University presents a $188.7 million capital request to state
- Request focuses on "taking care of what we have"—renovation and renewal, not new construction
- Request is designed to meet the University's most critical capital needs
- Legislature ***fails to pass state bonding bill***



2005 Legislative Session

- University presents its 2006–2007 biennial budget request of $42 million in new state funding in each of the next two years
- University presents an updated (adjusted for inflation) 2004 capital request of $192.1 million to the state

THE REQUESTS

2006–2007 BIENNIAL BUDGET PARTNERSHIP PROPOSAL

1) Investment in academic initiatives in areas of existing University research strength and comparative advantage will help ***maintain the state's position as a world leader in the biosciences***.

   Biosciences for a Healthy Society

   - Healthy Foods, Healthy Lives
   - Translational Research in Human Health
   - New Products From Biotechnology
   - Brain Function Across the Lifespan

2) Investment in human capital will ensure that the ***best and brightest students*** stay in Minnesota and will help to ***attract and retain world-class faculty*** and staff, without whom the University cannot be a national leader in research and education.

   Attracting and Retaining Talent for Minnesota's Future

   - Preparing Students for 21st Century Economy
   - Competitive Compensation

3) Investment in infrastructure will ensure that faculty, staff, and students have the ***systems*** they need ***to support discovery and learning***.

   Creating and Sustaining Essential Research and Technology Infrastructure

   - Research Support
   - 21st Century Technology

For more detailed information about the biennial budget request, please visit www.umn.edu/govrel.

UPDATED 2004 CAPITAL REQUEST

1) The capital request supports the University's mission through ***investment in academic infrastructure***.

2) Quality facilities are essential to having one of the best research universities. The University cannot attract or retain world-class faculty without ***state-of-the-art research labs***. Minnesota's brightest high school students will not even consider the University without the best faculty and ***modern classrooms*** that meet today's pedagogical needs.

For more detailed information about the capital request, please visit www.umn.edu/govrel.

UNIVERSITY OF MINNESOTA

ABOUT THE U

Five Facts About the U

1 The University is governed by a 12-member Board of Regents, which is elected by the legislature.

2 The University is Minnesota's only research university, attracting 98 percent of all sponsored, academic research awards in Minnesota—more than $520 million in 2004.

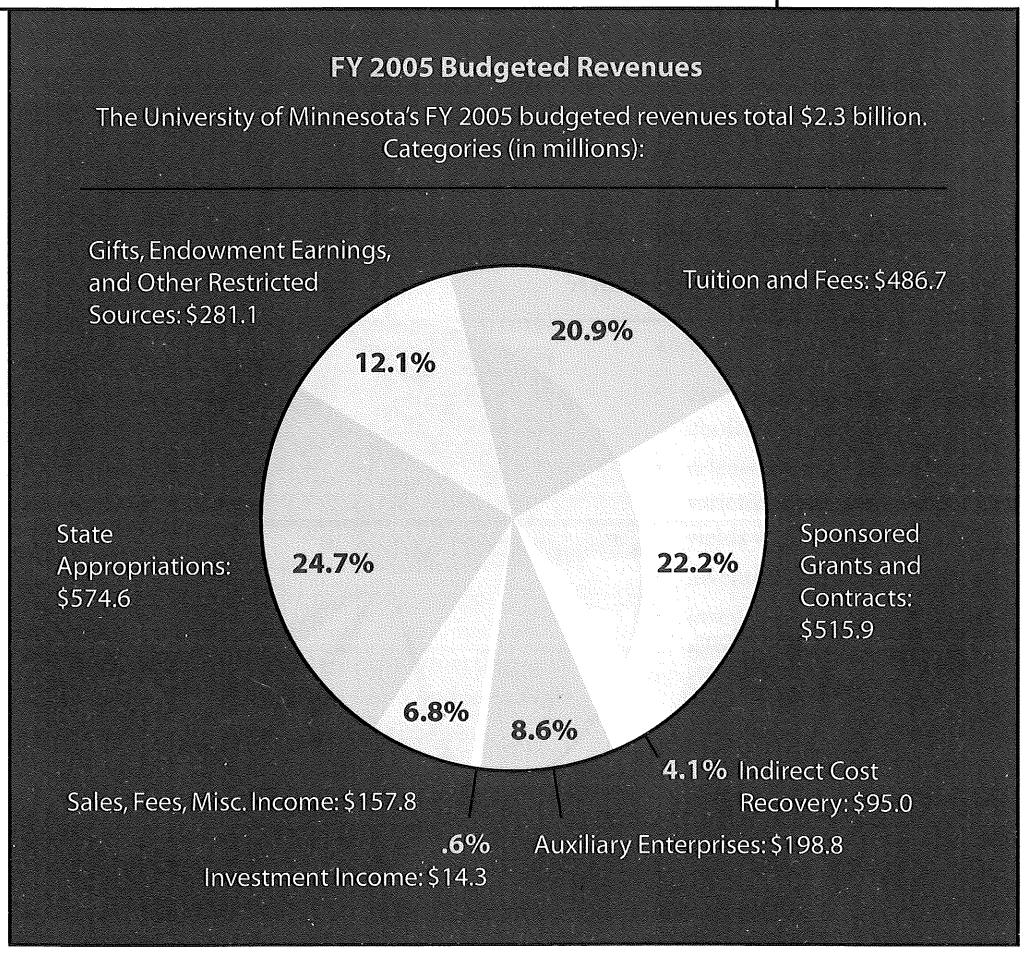
3 The Twin Cities campus is one of four campuses nationally that have both an agricultural college and an academic health center; these are the nation's largest and most complex campuses.

4 The University has four campuses, six research and outreach centers, one forestry station, a center in Rochester, and 18 regional extension offices.

5 A recent report from the University of Florida named the University of Minnesota, Twin Cities, as one of the nation's top public research universities.

FY 2005 Budgeted Revenues

The University of Minnesota's FY 2005 budgeted revenues total $2.3 billion.
Categories (in millions):



Enrollment Fall 2004

	Crookston	Morris	Duluth	Twin Cities	Total
Undergraduate	1,152	1,685	8,850	28,740	40,427
Graduate	0	0	661	13,841	14,502
Professional	0	0	212	2,832	3,044
Non-degree	936	154	643	5,541	7,274
Total	2,088	1,839	10,366	50,954	65,247

Degrees 2003–04

	Crookston	Morris	Duluth	Twin Cities	Total
Undergraduate	226	350	1,562	6,049	8,187
Master's	0	0	185	2,677	2,862
First Professional	0	0	0	715	715
Doctoral	0	0	0	592	592
Total	226	350	1,747	10,033	12,356

The University has received 239 patents in the past five years and helped establish more than 35 start-up companies, formed as a result of University research.

Endowments and Gift Support

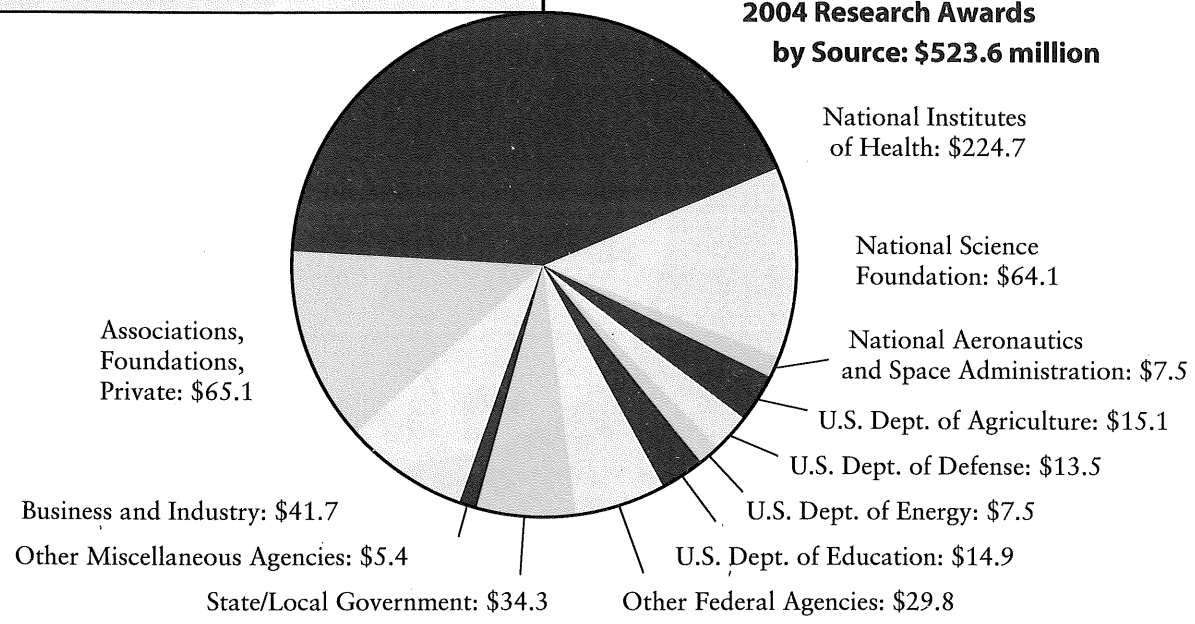
A record number of donors—81,979, including 42,379 alumni—made gifts and pledges totaling $145 million to the University of Minnesota during fiscal year 2004. The University is now raising funds for scholarships. The goal of the campaign is to increase by 50 percent the number of students who benefit from scholarships created through gifts to the University.

Did You Know...

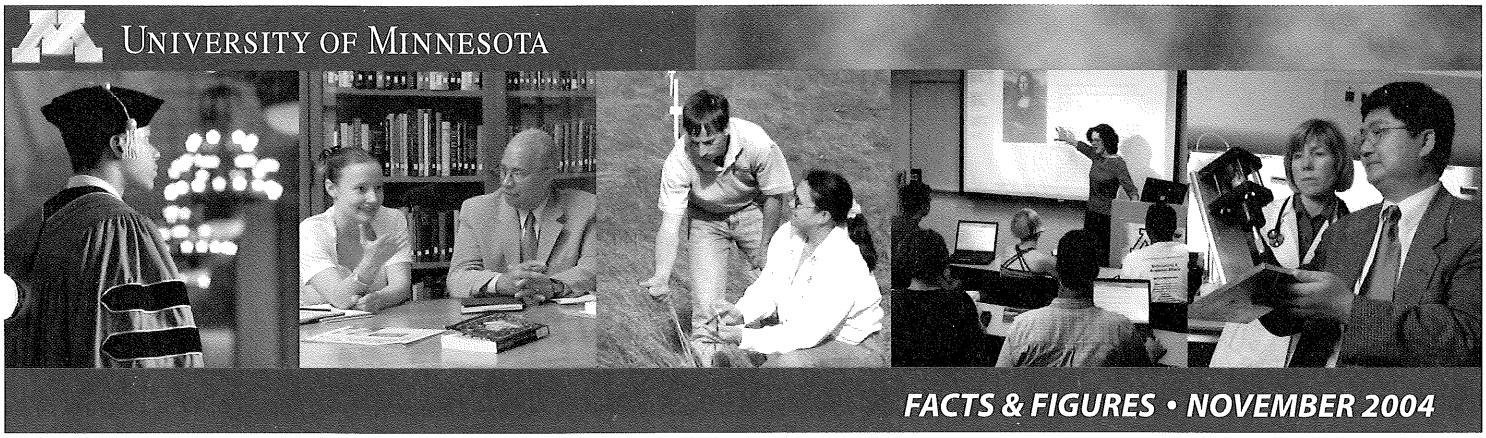
The University

- helps more than 1 million Minnesotans through public service programs such as extension service, clinics in medicine, dentistry, and veterinary medicine, and outreach to K-12 education
- is the state's fourth largest employer

2004 Research Awards by Source: $523.6 million



Published by the Office of Government and Community Relations. • This publication can be made available in alternative formats for people with disabilities. Please contact University Relations, 612-624-6868. • The University of Minnesota is an equal opportunity educator and employer. • Please recycle. • 11/04



OVERVIEW

The University of Minnesota is one of the state's greatest assets. It is one of the most comprehensive universities in the United States and ranks among the most prestigious. The University, with more than 370 fields of study, offers more choices and unique opportunities for its 60,000 students. It is both the state land-grant university and Minnesota's only research university, where new knowledge, new products, and new services improve the quality of life for all Minnesotans.

The University of Minnesota, Twin Cities (UMTC) is a classic Big Ten campus in the heart of the Minneapolis–St. Paul metropolitan area, just minutes from downtown. The largest of the four campuses, with its state-of-the-art facilities and stately historic buildings, it is set along the banks of the Mississippi River and in the rolling hills of St. Paul. With the most comprehensive academic programs of any institution in Minnesota, as well as the widest range of graduate and professional programs, the University offers unlimited academic and experiential opportunities for students and faculty alike.

The University of Minnesota, Duluth (UMD) consistently ranks among the top regional universities nationwide, attracting students looking for personalized learning on a medium-sized campus.

The University of Minnesota, Morris (UMM) has been named one of the top three public liberal arts colleges in the nation by *U.S. News & World Report* in its 2004 rankings of America's best colleges. Combining an honors education with an international perspective, UMM students are prepared for the challenges presented to them after graduation.

The University of Minnesota, Crookston (UMC) is recognized internationally for its academic quality. Its distinctively sharp focus on technology allows students–whatever their major–to develop the skills they need to succeed in the information age.

The University of Minnesota, Rochester (UMR), through a unique partnership with the Minnesota State Colleges and Universities, extends upper division undergraduate and postbaccalaureate degree programs to people in southeastern Minnesota.

Statewide Impact—The University also has six agricultural experiment stations, one forestry station, and regional extension service offices that serve all parts of the state. The University's public service programs (e.g., extension service; clinics in medicine, dentistry, and veterinary medicine; outreach to K–12 education) help more than 1 million people annually.

RANKINGS

The Twin Cities campus ranks among the top 25 public and private research university campuses in the following measures.

Measure	Rank
Total Research	10th
Federal Research	15th
Endowment	24th
Annual Private Giving	14th
National Academy Members	23rd
Ph.D. Degrees Awarded	9th
Postdoctoral Students	16th

2003, The Center, *University of Florida*

A STATEWIDE ASSET

Improving Lives—The work of faculty, staff, and students at the University has improved the lives of people throughout the world. Among numerous accomplishments and contributions are the following:

- discovery that eating oats reduces cholesterol
- release of more than 80 new crop varieties that have greatly increased yields worldwide
- invention of the first heart pacemaker
- invention of the flight recorder (black box) for aircraft and the retractable seat belt for cars
- development of hundreds of cold-hardy plant varieties, including fruits, vegetables, flowers, and shrubs
- development of the widely used personality test, the Minnesota Multiphasic Personality Inventory (MMPI)
- invention of one of the primary HIV/AIDS cocktail drugs

Degrees Awarded—University graduates become Minnesota's professionals. The University awarded 12,356 degrees in 2003–04. Ten percent of all degrees awarded were in engineering, and nearly 40 percent of the degrees awarded on the Twin Cities campus were graduate and first professional degrees.

A LEADER IN RESEARCH

Minnesota's Only Research University—Many states have at least two major research universities (Michigan and Michigan State; Iowa and Iowa State). The University is Minnesota's only research university.

New Research Facility—Today, the human genome has been deciphered, opening the door to extraordinary advances in medicine. At the Translational Research Facility, scheduled to open in summer 2005, basic science discoveries will be developed into therapies for the prevention and treatment of diseases such as hemophilia, cancer, Alzheimer's, AIDS, seizure disorders, and diabetes.

Patents—The University has received 239 patents in the past five years and helped establish more than 35 start-up companies, formed as a result of University research.

Sponsored Research—The University is one of the leading recipients of federal research awards. The University received more than $520 million in grant and contract awards from federal, state, and private sources in fiscal year 2004. The University conducts 98 percent of all sponsored academic research in Minnesota.

EDUCATIONAL CHOICES

More Choices—Through the Undergraduate Research Opportunities Program, students can participate in faculty research. Each year, nearly 450 students receive financial support to participate in this program.

University students can also enhance their education through more than 250 study, work, and internship programs in 60 countries worldwide.

Student Satisfaction—Students' satisfaction with their University experience is very high–94 percent rating it high or very high after their first year on campus. Overall satisfaction is at its highest levels for undergraduates and graduates since the University began measuring.

International Students—The University supports an international population of more than 4,500 people from over 130 countries. The University also has more than 250 exchange agreements with institutions around the world.

ENROLLMENT AND DEGREES

	UMC	UMD	UMM	UMTC	Total
Enrollment Fall 2004					
Undergraduate	1,152	8,850	1,685	28,740	40,427
Graduate	0	661	0	13,841	14,502
First Professional	0	212	0	2,832	3,044
Nondegree	936	643	154	5,541	7,274
Total	2,088	10,366	1,839	50,954	65,247
Degrees 2003–04					
Undergraduate	226	1,562	350	6,049	8,187
Master's	0	185	0	2,677	2,862
First Professional	0	0	0	715	715
Doctoral	0	0	0	592	592
Total	226	1,747	350	10,033	12,356

MOST RECENT RETENTION/GRADUATION RATES

	Class	UMC	UMD	UMM	UMTC
1st year retention	2002	68.2%	76.7%	79.6%	86.0%
2nd year retention	2001	50.2%	67.6%	70.0%	75.7%
4-year graduation rate	1999	19.7%	22.5%	40.2%	31.8%
5-year graduation rate	1998	33.9%	44.9%	53.4%	50.1%
6-year graduation rate	1997	39.6%	52.7%	59.9%	55.0%

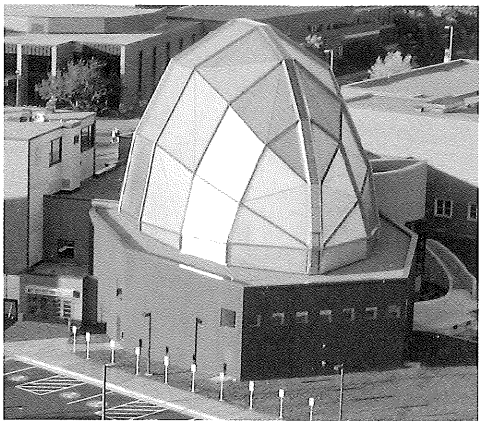
MINORITY AND INTERNATIONAL STUDENT ENROLLMENT

Fall 2004	UMC	UMD	UMM	UMTC	Total
African American	29	136	41	1,868	2,074
American Indian	23	120	143	330	616
Asian/Pacific Islander	26	264	57	3,891	4,238
Chicano/Latino	29	91	28	967	1,115
International	36	215	22	3,663	3,936

UMTC students on the Washington Avenue Bridge

TUITION AND REQUIRED FEES

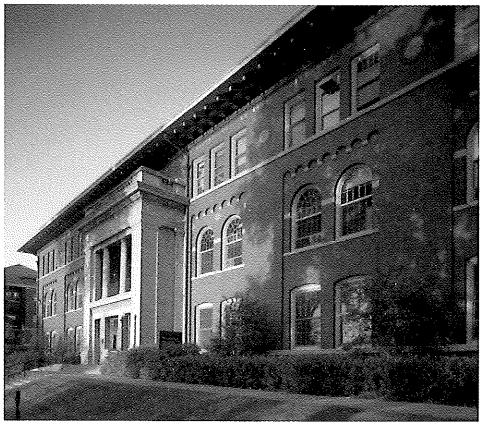
2004–05		UMC	UMD	UMM	UMTC
Undergraduate	Resident	$6,608	$7,936	$8,951	$8,029
Undergraduate	Non-res	$6,608	$19,044	$8,951	$19,659
Graduate	Resident	–	$9,398	–	$9,525
Graduate	Non-res	–	$16,498	–	$16,624
M.B.A.	Resident	–	–	–	$21,172
M.B.A.	Non-res	–	–	–	$29,552
Vet Medicine (DVM)	Resident	–	–	–	$17,142
Vet Medicine (DVM)	Non-res	–	–	–	$32,931
Law (JD)	Resident	–	–	–	$17,148
Law (JD)	Non-res	–	–	–	$27,242



Weber Music Hall at UMD

BIG 10 COMPARISON—RESIDENT TUITION AND REQUIRED FEES

2004–05	Undergraduate	10-Year Increase	Graduate	10-Year Increase
Penn State	$10,856	116%	$11,796	110%
Michigan	$8,722	59%	$13,585	62%
Minnesota	$8,029	126%	$9,525	127%
IL-Urbana	$7,944	112%	$8,310	97%
Ohio State	$7,542	144%	$8,250	84%
Michigan State	$7,352	59%	$8,108	55%
Indiana	$6,777	101%	$5,796	76%
Purdue	$6,092	111%	$6,092	111%
Wisconsin	$5,866	114%	$8,320	116%
Iowa	$5,396	120%	$6,182	114%



Biosystems and Agricultural Engineering building at UMTC in St. Paul

UNIVERSITY EMPLOYEES

Fiscal Year 2004	UMC	UMD	UMM	UMTC	Total
Civil Service/Bargaining Unit	90	689	182	8,161	9,122
Administrative	42	92	37	1,511	1,682
Faculty–Tenure, Tenure Track	47	300	110	2,364	2,821
Faculty–Other	7	131	14	510	662
Professional	50	94	36	2,189	2,369
Total	236	1,307	378	14,735	16,656

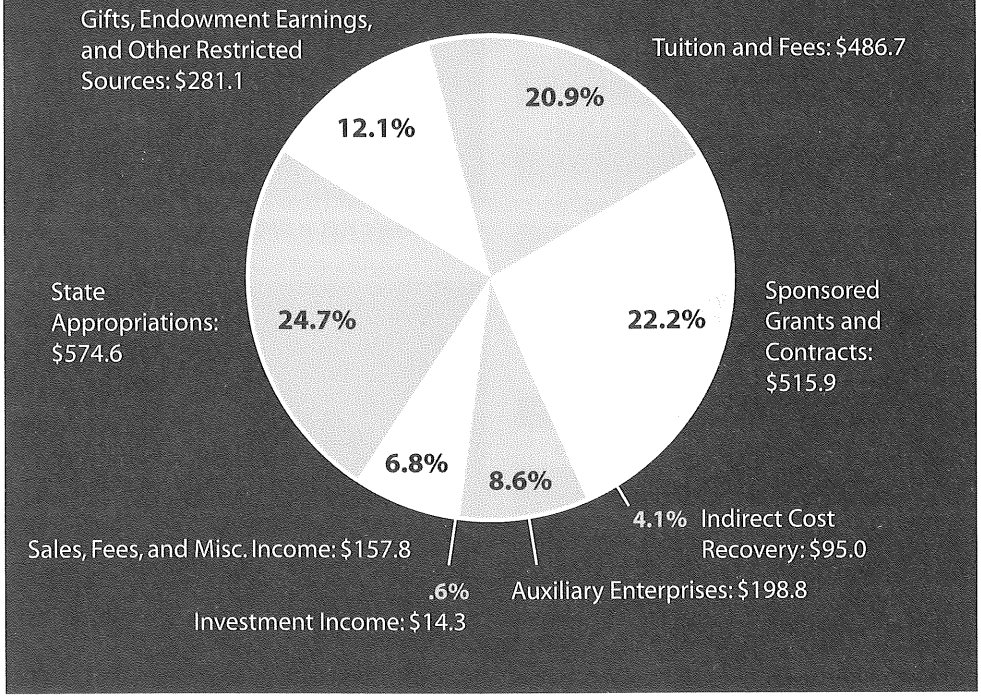
PHYSICAL ASSETS

	UMC	UMD	UMM	UMTC	Other Properties	Total
Surface Acres	1,588	308	1,288	1,154	–	4,338
Number of Buildings	32	54	28	253	444	811
Gross Square Feet	566,000	2,936,000	920,000	21,870,000	1,910,000	28,202,000

This publication can be made available in alternative formats for people with disabilities. Contact University Relations, 612-624-6868.
The University of Minnesota is an equal opportunity educator and employer. ⊛*Contains 10% pcw. 11/04—10,000*

FY 2005 Budgeted Revenues

The University of Minnesota's FY 2005 budgeted revenues total $2.3 billion. Categories (in millions):



Student Center at UMM

Researcher and students at UMD

SPONSORED FUNDING

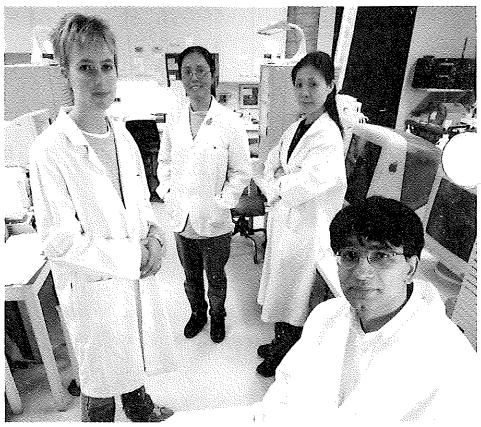
Fiscal Year 2004 Sponsored Awards	$523,641,208
Award Source	
National Institutes of Health	42.9%
National Science Foundation	12.3%
Other Federal Agencies	16.9%
Associations and Foundations	12.4%
Business and Industry	9.0%
State and Local Government (e.g., MnDOT)	6.5%

Atrium at UMC

ENDOWMENTS AND GIFT SUPPORT

A record number of donors–81,979, including 42,379 alumni–made gifts and pledges totaling $145 million to the University during fiscal year 2004. This is the largest number of individual donors in the University's history. Fiscal 2004 was the first full year of fund raising at the University since the close of Campaign Minnesota, a seven-year campaign that raised $1.66 billion.

The University is now focused on raising funds for scholarships, which make it possible for students to concentrate on their studies, take advantage of opportunities at the University, and graduate on time with less debt. The goal of the scholarship campaign is to increase by 50 percent the number of students who benefit from scholarships created through gifts to the University. Private gifts are also used to support research, facilities, and faculty. There are now 374 endowed faculty positions at the University.



Genomics researchers at UMTC

UNIVERSITY OF MINNESOTA
An Annual publication of the **Office of the Vice President for Research**

Research & Inventions 2004

THE U OF M WORKING FOR YOU

Research, teaching, AND OUTREACH THAT spans the state

Jan 20

UNIVERSITY OF MINNESOTA

Research & Inventions

THE U OF M WORKING FOR YOU

This publication showcases the broad range of significant research and technology transfer at the University of Minnesota. It is published by the University's Office of the Vice President for Research.

EDITOR:
Brian Lieb

ASSISTANT EDITOR:
Linda Raab

DESIGN & PRINTING:
Designed and printed by U of M Printing Services

CONTENTS

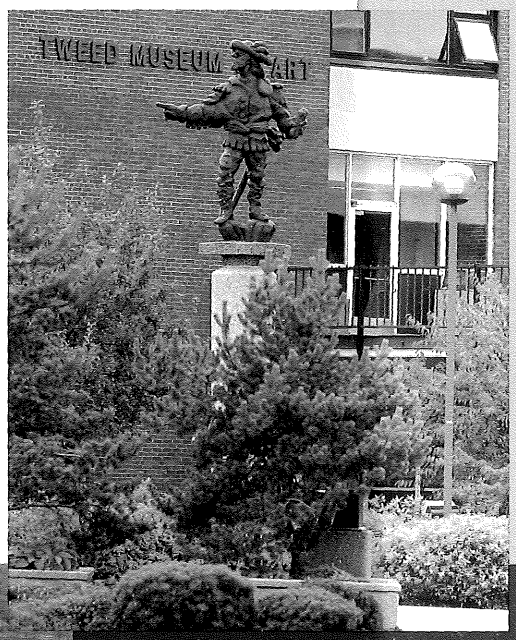


PHOTO BY BRETT GROEHLER

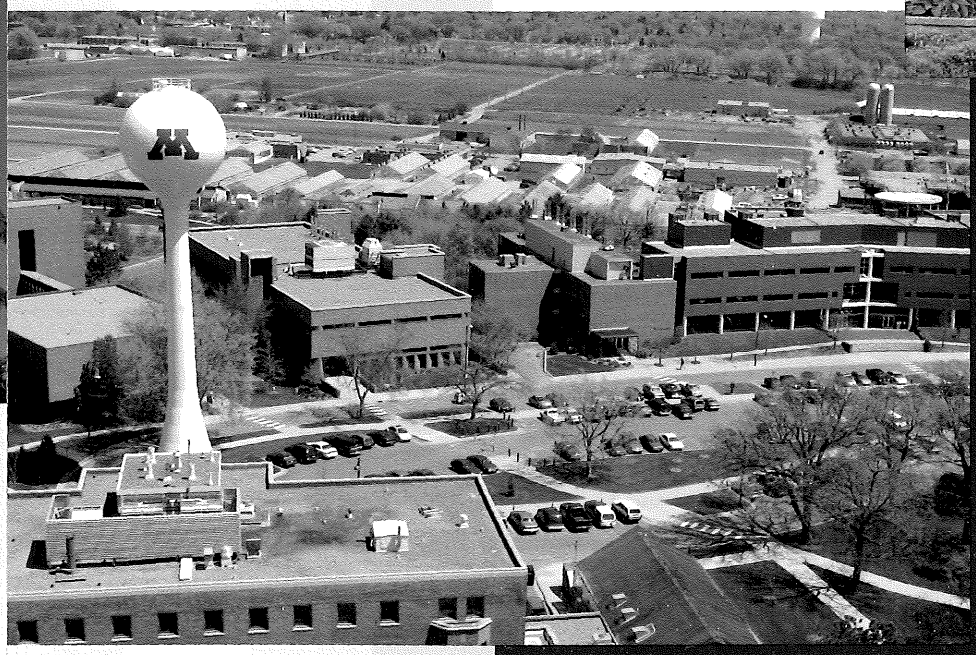


PHOTO BY TOM FOLEY

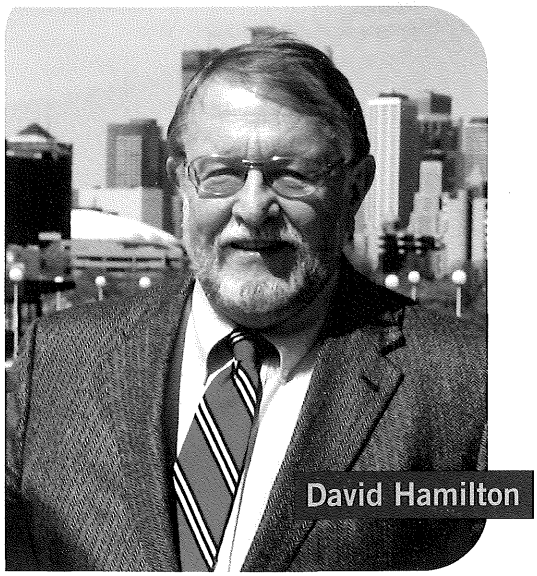
ON THE COVER
Class in session at the Cloquet Forestry Center.

COVER PHOTO BY DAVID HANSEN

BACK COVER PHOTOS: Flags: PHOTO BY BRETT GROEHLER, building: PHOTO BY MITCH KEZAR, water tower: PHOTO BY TOM FOLEY

Office of the Vice President for Research

From the Vice President



I'm delighted to give you an update of the University of Minnesota's research and technology transfer activities. This has been an exciting year for the University's research community, highlighted by the opening of the Office of Business Development (OBD). This office is designed to increase the number of successful start-up companies based on University of Minnesota research. OBD partners with researchers, students, entrepreneurs, and investors to achieve the long-term goal of enhancing Minnesota's economic vitality through successful University start-ups.

The University also furthered its research partnership with the Mayo Clinic by jointly awarding four research grants to University/Mayo collaborative teams. The major obstacle for continued development of the partnership is lack of state funding. Hopefully that will be rectified in the next legislative session.

Our faculty continue to garner considerable research funding, despite increased competition and tighter funding agency budgets. In fiscal year 2004, the University received $523.6 million in awards, the third consecutive year the University has broken the $500 million barrier. This high level of achievement is a tribute to the hard work of our faculty, staff, and students, as well as to the support of the citizens of Minnesota.

The University of Minnesota continues to protect University-developed technologies and to transfer them to the marketplace. Efforts by the University's Office of Patents and Technology Marketing have led to a record year for licenses and options (98) and a record $47.5 million in royalties.

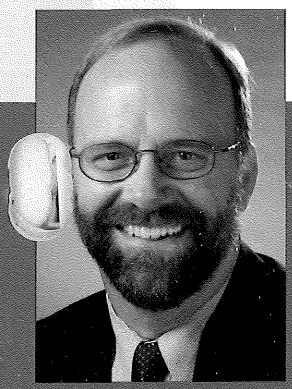
The examples of University research and technology transfer in this publication represent just a sampling of the tremendous work being done at the University of Minnesota. Our faculty create new knowledge through research that both enriches the lives of people and provides the foundations for the teaching and outreach functions of the University. This research is vitally important and has a positive impact on the people of this state. I'm pleased to share these stories.

I will be leaving my position as interim vice president for research at the end of January. I have greatly enjoyed my time in the position and know that the new vice president will carry on with vigor many of the programs I started.

Thank you for your interest and your support.

Sincerely,
David Hamilton
Interim Vice President for Research

O·V·P·R Office of the Vice President for Research
www.research.umn.edu



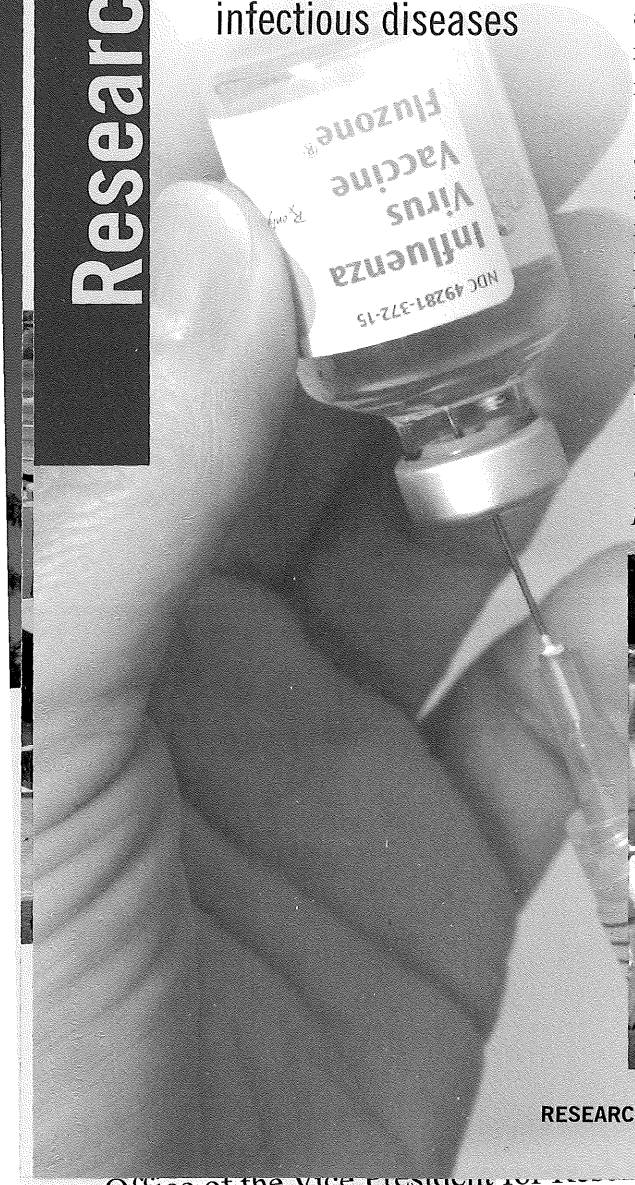
TIMOTHY MULCAHY, professor of pharmacology and associate dean for the biological sciences in the Graduate School at the University of Wisconsin-Madison, has been named the new vice president for research at the University of Minnesota. Mulcahy begins his new position on February 1, 2005.

Mulcahy has served as vice chancellor for research and associate vice chancellor for research policy at the University of Wisconsin-Madison, where he initiated improvements to the university's human subjects protections program, created a campus-wide research policy council, guided policy development involving conflicts of interest in clinical research, and provided oversight of all major federal research policy issues affecting the university.

David Hamilton, who has served as interim vice president for research for over 2½ years, will return to the University's Medical School as a professor of genetics, cell biology and development.

Diagnosing a Potential GLOBAL THREAT

The University's Veterinary Diagnostic Laboratory is at the forefront in the battle against emerging infectious diseases



In 1918, in the last year of World War I, soldiers on both sides of the battle suddenly faced a new threat—Spanish Flu. What started as an influenza outbreak in Kansas army barracks soon spread through U.S. military bases and then to the world along the trenches of the war and along trade routes. In Philadelphia alone, over 12,000 people died within a month of the outbreak reaching the city. Eventually, over one third of the U.S. population and one fifth of the world's population were infected by the virus, and 20 to 40 million lives were lost—more than 3 times the number that died in the war.

Subsequent influenza outbreaks in 1957 and 1968, while not as severe, still caused immense social disruption and economic loss. Despite much improved public health infrastructures, the 1957 Asian Flu claimed 70,000 lives in the U.S. alone and the 1968 Hong Kong outbreak claimed between 1 and 4 million lives worldwide.

Outbreaks of this magnitude are called *pandemics,* which occur when a new influenza virus appears against which the human population has no immunity, resulting in several, simultaneous epidemics worldwide. No one knows just when the next influenza pandemic will hit, but public health experts agree that another pandemic is a near-certainty. The World Health Organization (WHO) has even made elaborate pandemic preparations, setting-up a Global Influenza Surveillance Network of 112 National Influenza Centers to monitor for any unusual influenza viruses.

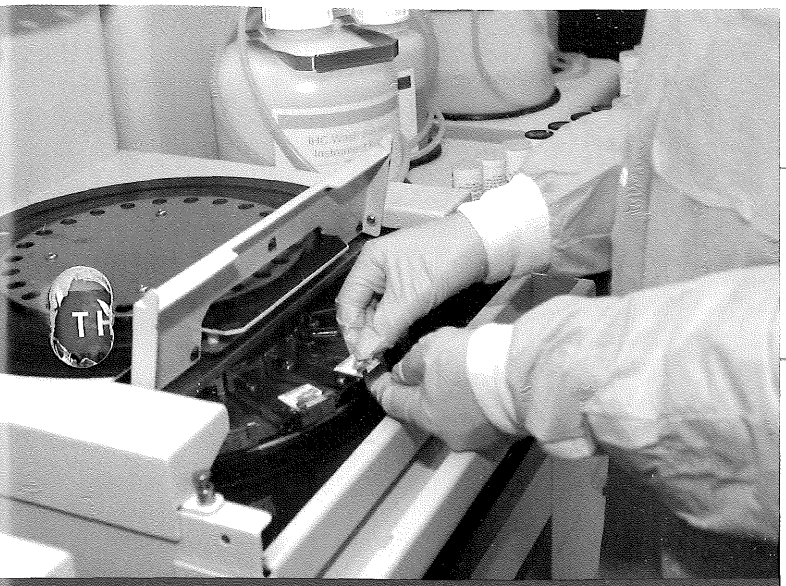
Such planning is imperative, as the Centers for Disease Control (CDC) and WHO estimate between 89,000 and 207,000 American deaths and up to 650,000 d in industrialized countries alone from next pandemic. The impact will be even greater in developing countries where healthcare resources are strained and the general population is weakened by poor health and nutrition.

If and when the next pandemic hits, an efficient global transportation system and increased urbanization will amplify the

PHOTO BY DAVID HANSEN,
U of M Agricultural Experiment Station

Office of the Vice President for

PHOTO BY MICHELLE RIEDEL, Veterinary Medicine



Testing for Chronic Wasting Disease.

spread of the disease in a way not seen in previous pandemics. Therefore, the ability to respond quickly to disease outbreak will be critical, especially considering that public health leaders have already identified a potential candidate for the next pandemic—avian influenza, currently simmering in Asia. According to Michael Osterholm (see accompanying articles, "Two U Centers" and "Agro-Security"), avian influenza "is the perfect storm. The only question now is: Will this set of circumstances be sufficient to push the microbial genetics over the edge and create a new strain of influenza virus that rivals past pandemic strains?"

Fighting zoonotic diseases

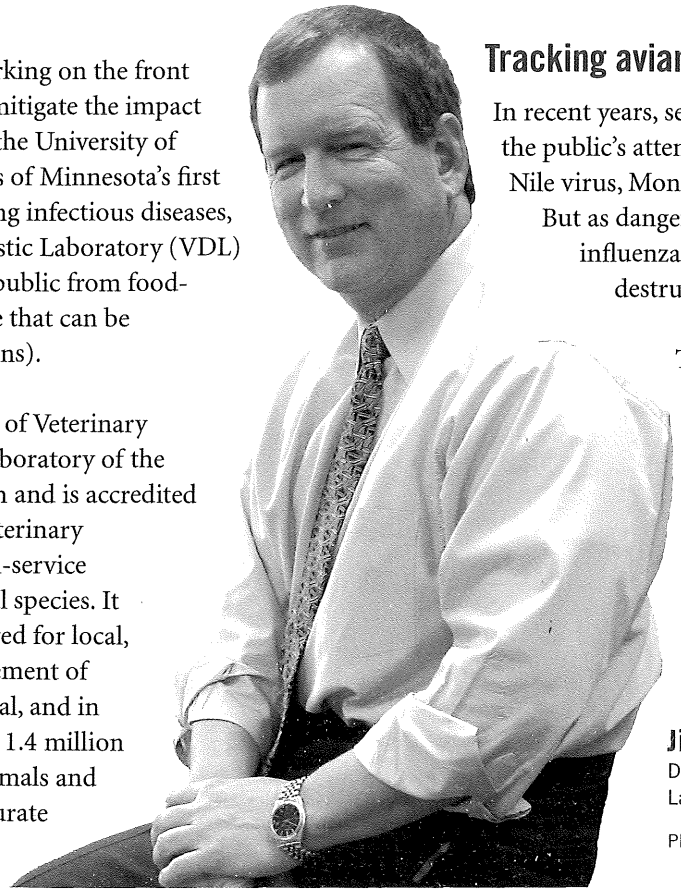
There is a web of Minnesotans working on the front lines of this battle to identify and mitigate the impact of a pandemic, including many at the University of Minnesota. As important members of Minnesota's first responder team in cases of emerging infectious diseases, the University's Veterinary Diagnostic Laboratory (VDL) plays a vital role in protecting the public from food-borne and zoonotic diseases (those that can be transmitted from animals to humans).

Located in the University's College of Veterinary Medicine, the VDL is the official laboratory of the Minnesota Board of Animal Health and is accredited by the American Association of Veterinary Laboratory Diagnosticians as a full-service diagnostic laboratory for all animal species. It provides laboratory analysis required for local, inter-state, and international movement of animals and animal genetic material, and in 2003 the lab performed more than 1.4 million diagnostic tests. "The health of animals and people depends on timely and accurate diagnostic testing and monitoring of animal diseases. Our lab gives us that ability," says Jim Collins, director of the laboratory. Part of the University of Minnesota since 1904, the laboratory's primary activity is to provide animal health support to livestock and poultry producers, practicing veterinarians, and other animal health consultants. To do this, the VDL works with a wide range of constituents, including the dairy, swine, and poultry industries; companion animal groups; the DNR; and both local zoos. The VDL also develops new and more effective diagnostic methods and trains veterinarians and graduate students.

> The importance of accurately monitoring animal health is immeasurable.
> **The University is key to that monitoring.**
> *Harry Hull, Minnesota state epidemiologist*

Integrated into all of this work, however, is the laboratory's role in identifying emerging diseases. It is this role that helps protect not only Minnesotans, but people all over the world. By collaborating with the Minnesota Board of Animal Health, the Minnesota Department of Agriculture, the Minnesota Department of Health, and within the University of Minnesota, the VDL holds a key position in the public health web.

According to state Epidemiologist Harry Hull, "this collaboration brings great strength to our ability to protect the people of Minnesota; strength not seen anyplace else in the country. The University's Veterinary Diagnostic Laboratory is a vital resource, not just for the state but also for the nation, in helping us deal with the potential threats of emerging infectious diseases."



Jim Collins,
Director of University Veterinary Diagnostic Laboratory (VDL).

PHOTO BY MICHELLE RIEDEL, Veterinary Medicine

Tracking avian influenza

In recent years, several zoonotic diseases have caught the public's attention—Mad Cow disease, SARS, West Nile virus, Monkeypox, and Chronic Wasting disease. But as dangerous as these diseases are, avian influenza holds the potential to be far more destructive.

There are three types of viruses associated with annual outbreaks and epidemics of influenza: A, B, and C. Of the three types, only influenza A viruses have the potential to cause a pandemic. Type A viruses can infect several animal species, including birds, pigs, horses, seals, and whales. However, birds are

INFLUENZA, continued

an especially important species because all known subtypes of influenza A viruses circulate among wild birds, which are considered the natural hosts for these viruses. The influenza viruses that infect birds are called *avian influenza* viruses.

Transmission electron micrograph of influenza A virus, early passage.
PHOTO FROM CDC ARCHIVES

Normally, avian influenza viruses do not directly infect or circulate among humans. However, each of the previous pandemics was caused by an avian influenza A virus that jumped the species barrier and attached to human cells. Sometimes avian influenza viruses jump directly from birds to humans, and sometimes they move from birds to other animal species, which act as mixing vessels, prior to jumping to humans.

In order for the virus to jump to humans, there must be a change in the virus's hemagglutinin (H) protein. Unfortunately, influenza A is particularly susceptible to such changes. Influenza A undergoes constant compositional changes as it replicates in animals and humans, creating numerous variants. In addition, influenza A viruses are capable of swapping genetic materials with other influenza A viruses and merging into new influenza subtypes; subtypes to which no population has immunity. The most recent strain of avian influenza to make the species jump, avian influenza H5N1, exploded this past year, killing over 30 people in Asia with a mortality rate of over 70 percent. H5N1 has mutated rapidly and has shown a propensity to acquire genes from viruses infecting other animal species, despite the forced cull of over 100 million chickens in Asia and vigorous containment efforts that included the slaughter of roughly 19 million chickens and turkeys in the Frasier Valley in southern British Columbia.

Part of the difficulty in containing the spread of the virus is that it is impossible to contain wild birds. They seem to have played a key role in the spread of the H5N1 virus, and their movement makes it a long-term threat. According to the WHO, "If more humans become infected over time, the likelihood also increases that humans, if concurrently infected with human and avian influenza strains, could serve as the mixing vessel for the emergence of a novel subtype with sufficient human genes to be easily transmitted from person to person. Such an event would mark the start of an influenza pandemic."

Minnesota, for its part, has a cooperative avian influenza control plan in place that includes education, monitoring, reporting, and response. "Early recognition of influenza in poultry flocks is of critical importance for rapid disease control," says Collins. "Through continued research and collaboration with world-renowned influenza experts, the Veterinary Diagnostic Laboratory continues to improve its ability to rapidly identify and characterize these potentially devastating infections."

In addition to poultry, the VDL monitors swine and other potential avian influenza carriers. Two of the three pandemics (1957 and 1968) spread to humans from pigs, and there is evidence that the 1918 pandemic also ultimately made the jump to humans from pigs. The VDL is a major contributor of swine influenza genetic sequence information to the Influenza Sequence Database, a national database for influenza researchers maintained at the Los Alamos National Laboratory.

According to Hull, "the vast majority of emerging infectious diseases are zoonotic, so the importance of accurately monitoring animal health is immeasurable. The University is key to th monitoring." Precautions such as those in place in Minnesota make it very unlikely that the current strain of avian influenza will enter the U.S., at least through birds. If, however, the virus shifts so that it can be transmitted from human to human, it will be virtually impossible to keep it from moving into this country's general population.

Tracking other zoonotic threats

In addition to their work with potential avian influenza threats, the Veterinary Diagnostic Laboratory plays an important role in monitoring other emerging infectious diseases. The lab was recently selected by the CDC as the national testing site to screen for the Monkeypox virus in animals. Monkeypox is a rare disease that occurs naturally in the tropical rainforest area of western and central Africa. If passed to humans, the disease behaves similarly to smallpox. The VDL is the first veterinary diagnostic lab to be selected as a full member of the CDC's Laboratory Response Network (LRN). This inclusion gives the University access to CDC protocols, immediate emerging disease information, an coordinated communications.

"We would not have received this designation without having the appropriate biosafety classification to contain viruses and prevent

PHOTO BY DAVID HANSEN, U of M Agricultural Experiment Station

contamination of other samples or laboratory areas," says Collins. "And because we have the same state-of-the-art molecular technology as the CDC labs, we are able to accommodate the high volume of testing samples. Membership in the CDC's LRN provides the University a great opportunity to rapidly diagnose and prevent diseases transmissible from animals to people."

The laboratory is also part of the state's Chronic Wasting Disease surveillance program and does important work on West Nile virus. And last fall the laboratory received U.S. Department of Agriculture approval to offer a new low-cost diagnostic test for Johne's disease, a bacterial infection causing intestinal inflammation in ruminants—cattle, sheep, and goats. The disease poses a significant threat to Minnesota's dairy and beef production industries, and controlling it is one of the state's top agricultural priorities. Developed by University scientists Kay Faaberg and Carrie Wees, the new DNA-based test is only available at the VDL. The test takes only 48 hours to complete, compared to 4 months for the standard test. This enables the lab to test hundreds of animals at a time.

Diagnostic tests such as these are an important part of the lab's work. The VDL offers 24/7 electronic results reporting of its diagnostic tests so that customers can securely access real-time results and download key data. "Material from throughout the country is fed to us because of our facilities and expertise," says Collins. "The work that is done here is not hypothetical; it is real. And there is payback in terms of food safety from healthier animal populations, infectious disease discoveries, diagnostic test development, and vaccines. And the laboratory even receives direct monetary payback from user fees for diagnostics tests, research grants and contracts, and from royalty income from discoveries made here."

Surveillance system

Diseases that jump from animals to humans are not new, but they continue to be a very real threat. These diseases have the potential to get into our food supply, can be transmitted efficiently by the modern transportation system, and can potentially be passed as easily as the common cold. That makes the response to disease outbreaks more important than ever. "Fortunately, Minnesota has an excellent surveillance system to combat infectious diseases," says Collins.

Rapid detection of outbreaks, isolation of possible pandemic viruses, and the quick development of diagnostic tools will be the front-line weapons in the next battle against pandemic influenza. And the University's Veterinary Diagnostic Laboratory will be in the trenches helping to protect us.

Written by Brian Lieb

TWO U CENTERS INVOLVED IN DISEASE PROTECTION

In addition to the Veterinary Diagnostic Laboratory, researchers from a variety of academic disciplines within the University are on the front lines of the battle to protect the public from disease. Important work is done in the School of Public Health, the Medical School, the Department of Microbiology, the College of Veterinary Medicine, the College of Pharmacy, the College of Agriculture, the School of Nursing, the Center for Bioethics, and the Law School. In addition, two centers within the Academic Health Center provide a focal point for the struggle against disease: the Center for Infectious Disease Research and Policy (CIDRAP), and the Center for Animal Health and Food Safety (CAHFS).

CIDRAP is at the forefront of addressing national issues related to public health preparedness, including agricultural and food biosecurity, food safety, and emerging infectious diseases. The center is led by Michael Osterholm, an internationally recognized expert in public health and a faculty member in the School of Public Health.

CIDRAP works to prevent illness and death from infectious diseases through epidemiologic research and the rapid translation of scientific information into real-world practical applications and solutions. Focusing on threats to public health that demand immediate attention, CIDRAP assembles research-based knowledge on the epidemiology, prevention, and control of disease agents and translates that knowledge into *best practices* and policy options.

Through its Web site, www.cidrap.umn.edu, CIDRAP serves as a highly credible information clearinghouse on selected infectious disease issues around the world and on relevant research, medical care, and policy implications. By bringing together the expertise of faculty from across the University and by disseminating information to physicians and the public, CIDRAP helps translate fear into appropriate action.

CAHFS works to strengthen Minnesota's ability to anticipate and respond to emerging issues and imminent threats from animal and foodborne diseases. The center focuses its work on the safety and security of the global food system and serves as a facilitator for stakeholders interested in animal health and food safety. The center communicates potential risks, enhances graduate and professional education, integrates animal and public health surveillance, performs basic and applied research, and facilitates quality assurance strategies in the food industry.

Like CIDRAP, CAHFS collaborates across the University and with government, industry, and other concerned organizations. Within the University, it is able to pull together talented faculty and researchers involved in human and veterinary medicine, public health, agriculture, nutrition, economics, engineering, and business. According to center director Will Hueston, "The center is not only interdisciplinary in terms of the U schools and colleges, we want to provide outreach to Minnesota and to the nation in the larger sense—everything from consumer groups to food manufacturers to producer groups—and establish a dialogue."

University

TO LEAD NATIONAL EFFORT

in Food Agro-Security

PHOTOS BY DAVID HANSEN, U of M Agricultural Experimen

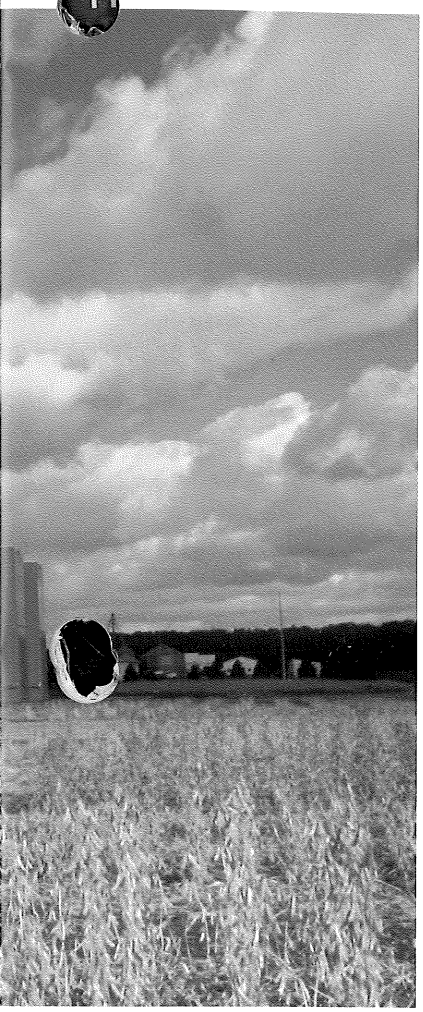
The University of Minnesota was recently named one of three Homeland Security Centers of Excellence and has received a three-year, $15 million grant from the U.S. Department of Homeland Security to help develop ways to protect the nation's food supply from deliberate contamination or terrorist attack.

The University's Center of Excellence, known as the University Center for Post-Harvest Food Protection and Defense (PHFPD), is a national consortium of academic, private sector, and government partners. The consortium comprises more than 90 investigators from the University of Minnesota, Michigan State University, North Dakota State University, and University of Wisconsin-Madison.

"The breadth and depth of food security knowledge we were able to pull together for this effort is unparalleled," said Frank Busta, professor of food science and nutrition and principal investigator on the grant.

"The University of Minnesota, with extraordinary strength and expertise in the health, animal, and food sciences, is uniquely positioned nationally to be a leader in the area of agro-security and f safety," said University President Robert Bruininks. "We're proud to lead this important effort and look forward to working with our partners in academia, public health, industry, and government to make our nation's food supply safer."

Historically, efforts to protect the food supply have focused primarily on preventing and reducing accidental contamination by naturally occurring agents. But the U.S. food system—moving from farms to processing, distribution, and retail food service—presents an array of vulnerable targets for terrorist attack. Intentional contamination of agricultural or food products with biological, chemical, or radiological agents could lead to devastating effects on human health and cause major economic losses to a critical sector of the economy.



"The need to protect against potential deliberate contamination now creates a demand for enhanced capabilities to anticipate, prevent, respond quickly to, and minimize the impact of such attacks," said Michael Osterholm, co-principal investigator and director of the University's Center for Infectious Disease Research and Policy. "This places great importance on federal, state, and local governments, and the private sector to coordinate and integrate their biosecurity activities."

Focus areas of research in the new center include improving the tracking of foodstuffs from farm to table; developing means to identify foreign organisms or chemicals in food; improving the process of tracking the distribution of contaminated food and warning potential victims; and finding the best ways to decontaminate food.

Prevention will also be a high priority. "We will make decisions about how to prevent an attack on the food system, for example, through high security in processing plants and transport or through employee screening," said Busta. "The goal is to make a system unavailable or unattractive to terrorists."

"This University of Minnesota team includes some of the brightest, most accomplished people in food production and health safety," said Minnesota Congressman Martin Sabo, the ranking Democrat on the House Homeland Security Appropriations Subcommittee, which allocates funding for and conducts oversight of the U.S. Department of Homeland Security. "The University's recognition as a Homeland Security Center of Excellence is well deserved. I know they will make fine contributions to the protection of our national food supply."

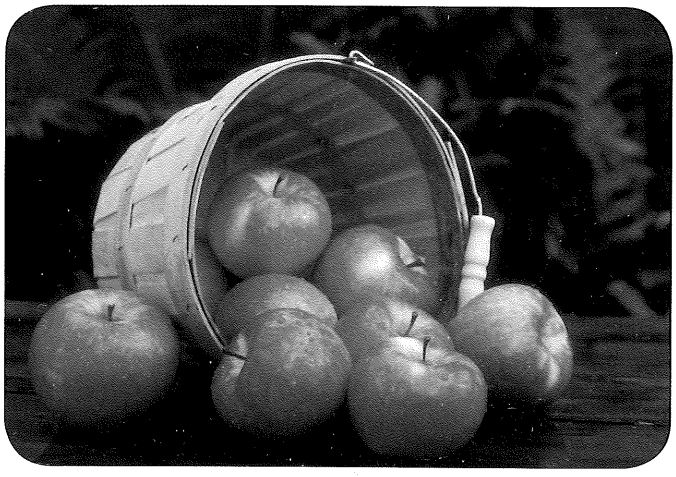


PHOTO BY DAVID HANSEN

Written by Amy Phenix and Molly Portz

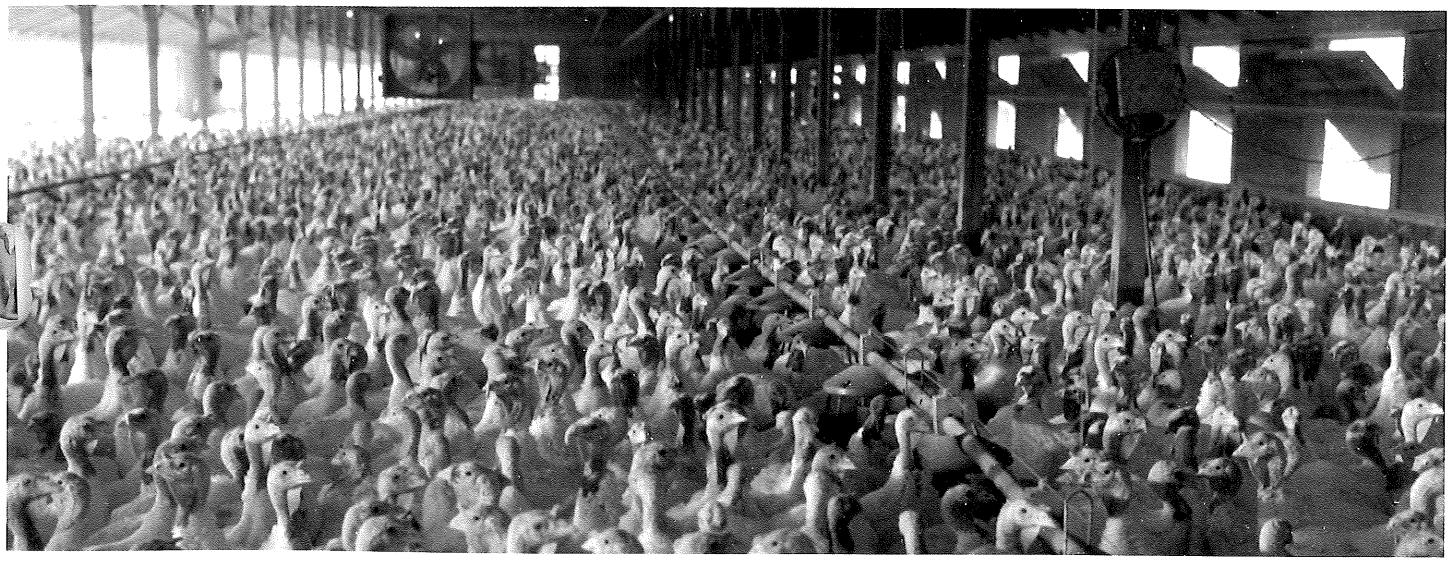


PHOTO BY DAVID HANSEN

Stewards OF THE FORESTS

The University's Cloquet Forestry Center helps manage a vital state resource

Philip Splett, from CNR's Department of Forest Resources, teaching a on plant identification and silvicu

PHOTOS BY DAVID HANSEN, U of M Agricultural Experiment Station

Minnesota has 17 million acres of forests, and it seems as if everyone wants a piece of them. The forest products industry produces annual revenue of roughly $7 billion, and there is a thriving demand for non-timber forest products like balsam boughs, birch bark, ginseng, and mushrooms. Minnesota forests also support multi-billion dollar recreation, tourism, hunting, and fishing industries. And while forest products and human activities are important to the state's economy, the forests also provide priceless wildlife habitat and ecological benefits.

Fortunately, the state has the University's Cloquet Forestry Center to provide research, outreach, and education that help citizens and communities balance the economic, social, and ecological demands placed on Minnesota's forests. Part of the College of Natural Resources (CNR), the center comprises 3,400 acres of forest in a variety of vegetation types, stand age classes, stand vigor conditions, and wildlife habitats. Some sections of the forest are intensively managed, some remain in a more natural condition, and others are reserved for teaching, research, or demonstration purposes. These features make it possible for center faculty and staff to do work that is unequaled in the region.

> We try to tie the research done here to the student experience.
>
> *Bob Stine, Cloquet Forestry Center director*

A long history of research

The center was established in 1909, primarily through the efforts of Professor Samuel Green, head of the University Forestry School; Fred Vibert, state senator and publisher of the Cloquet newspaper; and Rudolph and Frederick E. Weyerhaeuser, both of whom had interests in several Cloquet area sawmills, railroads, and logging operations. Because of the site's longevity, it has provided an ideal setting for long-term research. Management activities within the center's forest are determined at ten-year intervals, and many research projects span decades. "There is great value in the long-term studies at Cloquet," says Bob Stine, the center's coordinator. "Much of the research here has roots that go back many years. The emphasis of the research changes a bit, but the research goes on."

Professor Rocky Gutierrez continues research begun at the center over 40 years ago. "In wildlife research, Cloquet is synonymous with ruffed grouse research because of a 30+ year research project conducted by the late Gordy Gullion," says Gutierrez. Gullion's research received national and international acclaim, and his commitment to applied ecology led him to disseminate his research findings to a wide audience.

Gutierrez not only carries on the research of Gullion, he holds the Gordy Gullion Endowed Chair, a position create for a faculty member committed to applied ecology; specifically to wildlife management. Gutierrez and his students are looking at the role that forest structure and spatial arrangement of stands play in the occupancy of a particular stand by ruffed grouse. "Gullion's research provides baseline data from

which my student, Guthrie Zimmerman, will build models of habitat use, which will be tested using data he collects during his study," says Gutierrez.

Without the center, this research could not continue. "Cloquet is important for its stability as an institution and frequent forest management actions, which allow wildlife researchers to investigate both applied and theoretical questions about species such as the ruffed grouse," says Gutierrez. "It is among the very best areas to engage in applied research."

College of Natural Resources students doing field research.
PHOTO BY DAVID HANSEN

Included in the wide variety of forest-related research conducted at Cloquet are projects that have focused on tree genetic improvement programs, white pine disease, wood fiber quality improvements, timber harvesting activities which maximize efficiency while maintaining environmental quality, and the effects of different forest management practices on riparian (stream bank) areas, soils, and air quality.

Pat Huelman, coordinator of CNR's Cold Climate Housing Program in the Department of Bio-based Products, uses the center in his work with Louise Goldberg from the College of Architecture and Landscape Architecture. They oversee research in the center's Cloquet Residential Research Facility (CRRF). Funded by CertainTeed Corporation, the CRRF building has more than one thousand sensors to monitor temperature, humidity, airflow, pressures, and heat flux.

Data from the CRRF, says Huelman, show that we should think of a house—the building structure, mechanicals, and occupants—as interactive parts of a system. "By recognizing and respecting this system approach we can enhance the performance of our houses."

This type of approach to home building uses components such as air barriers; ground moisture/soil gas control; highly efficient windows; low-toxicity materials, finishes, and furnishings; and safe, efficient heating and cooling systems. With this approach, "residents will have a healthier and more durable house, and the energy savings will quickly cover any additional costs," says Huelman.

This research affects homeowners, the construction industry, and energy consumption in Minnesota, and it would be difficult to achieve without the CRRF and the Cloquet Forestry Center. "The facility is important because it provides continuous performance evaluation of various building materials and systems in a real, northern climate building," says Huelman.

More than research

In addition to research, the center has a strong outreach function. Programs at the center include the communication and demonstration of research results to natural resource managers and other resource professionals, and public programs which seek to increase knowledge and understanding of forest ecosystems and natural resource management. In addition, the center is one of the 18 regional extension centers in the state.

The center also provides CNR students invaluable field experience and the perfect setting to develop their research skills. "Students can learn so much more when we don't have to cut up the experience in the 50-minute block of a traditional classroom," says professor Kristen Nelson.

"What makes Cloquet unique," says Nelson, "is that it is an immersion experience, but with a level of efficiency that can't be replicated many places. Cloquet has varied forest types, landscape types, and experiment types, and they can be modified to fit what you need to teach or research. Students come here and can use what they have learned back in their classrooms in field problem solving."

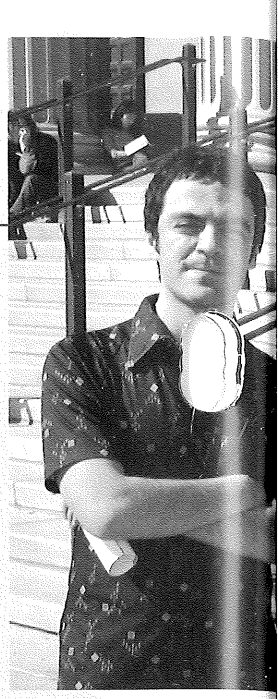
That student experience is by design. "We try to tie the research done here to the student experience," notes center coordinator Stine. Apparently, students appreciate it. "Every student I have talked with puts this experience at the top of their undergraduate experience," says Nelson.

It is the combination of excellence in research, outreach, and teaching that makes the Cloquet Forestry Center so important to Minnesota. With the center's help, the state's forests should be able to continue to provide the benefits that our people, wildlife, environment, and economy depend on.

Written by Brian Lieb

Measuring the growth of a spruce tree with a dial caliper.
PHOTO BY DAVID HANSEN

somali Web



The University is helping to create a
bilingual Web site *for* Minnesota's Somali community

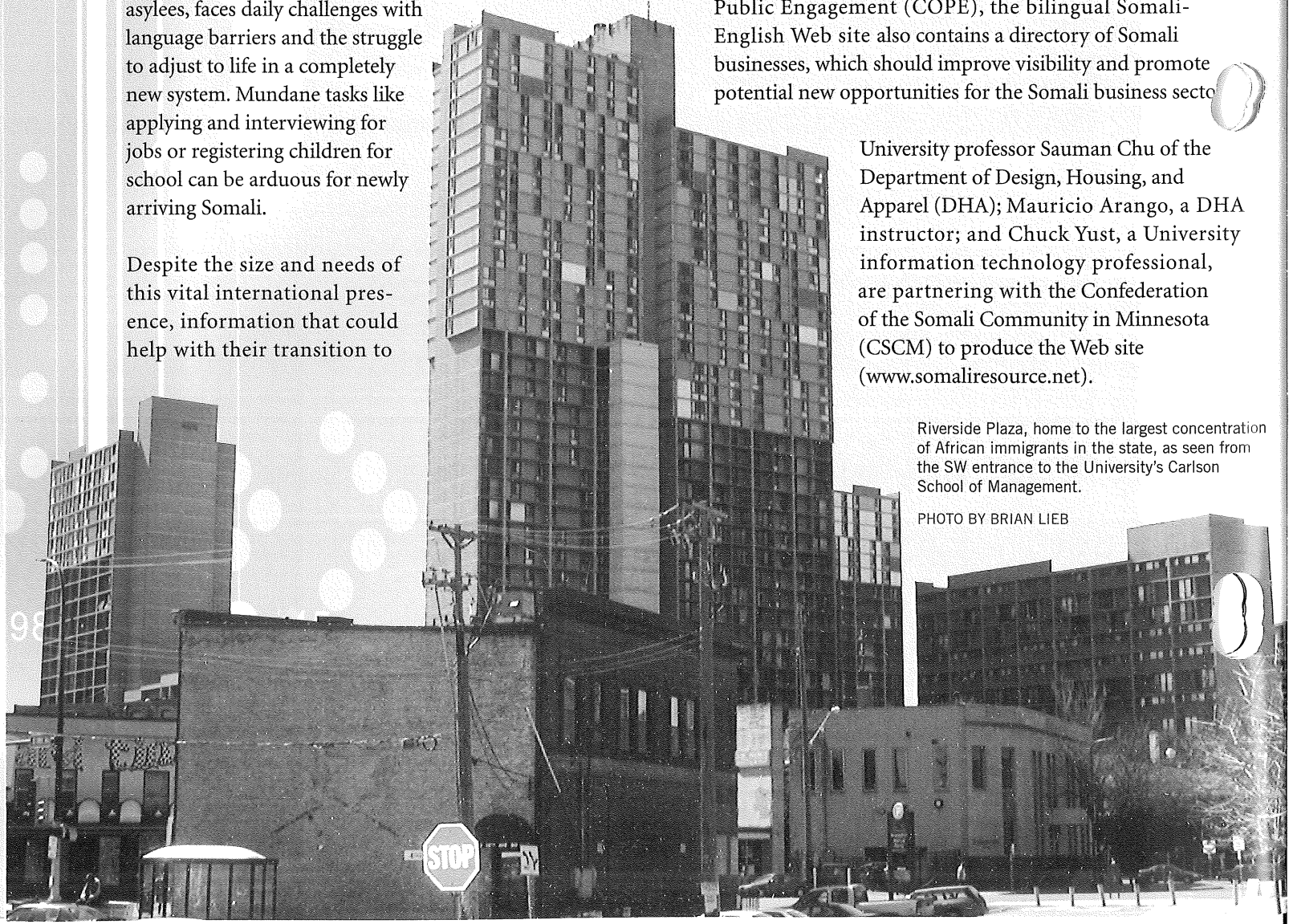
When civil war erupted in the northeast African nation of Somalia in 1991, the country's central government collapsed. Since then, nearly half of the country's population has been displaced and roughly 400,000 have died; and Somalia is still without a central government. Over one million people have fled the country, with thousands eventually arriving in the United States. After waves of secondary migration within the U.S., Minnesota is now home to the largest Somali community in the country, with a population estimated at 35,000.

That community, which includes immigrants, refugees, and asylees, faces daily challenges with language barriers and the struggle to adjust to life in a completely new system. Mundane tasks like applying and interviewing for jobs or registering children for school can be arduous for newly arriving Somali.

Despite the size and needs of this vital international presence, information that could help with their transition to life in Minnesota can be surprisingly difficult to access. A large inventory of employment, health services, housing, education, and transportation resources is available, but the information is scattered among different state agencies and non-governmental organizations.

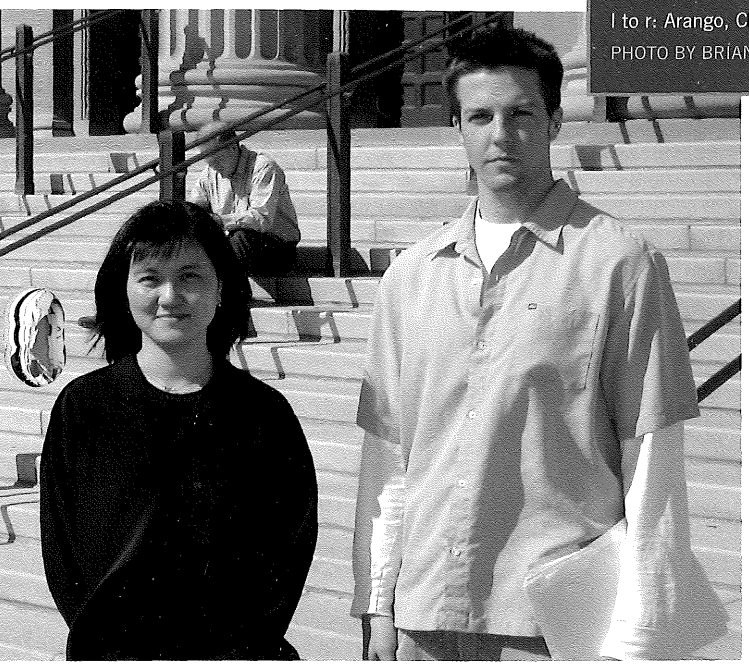
Recently, however, this information has been consolidated on a single Web site and translated into Somali. Funded by a grant from the University's Council on Public Engagement (COPE), the bilingual Somali-English Web site also contains a directory of Somali businesses, which should improve visibility and promote potential new opportunities for the Somali business secto

University professor Sauman Chu of the Department of Design, Housing, and Apparel (DHA); Mauricio Arango, a DHA instructor; and Chuck Yust, a University information technology professional, are partnering with the Confederation of the Somali Community in Minnesota (CSCM) to produce the Web site (www.somaliresource.net).



Riverside Plaza, home to the largest concentration of African immigrants in the state, as seen from the SW entrance to the University's Carlson School of Management.

PHOTO BY BRIAN LIEB



l to r: Arango, Chu, and Yust.
PHOTO BY BRIAN LIEB

According to Saeed Fahia, Executive Director of CSCM, "The site will have great value in the community. Many people don't know what resources are available to them, and it will empower people by gathering all of this vital information in one place."

Breaking the invisible barrier

The initial idea for this project began when Arango and Yust worked together in a University class. Both completed projects that focused on the neighborhood immediately adjacent to the west bank of the Minneapolis campus, home to the largest concentration of African immigrants in the state. Yust created a community guide with a map of African businesses and an overview of African immigrants, while Arango coauthored a piece exploring the invisible barrier between the African community and the University.

Chu's presence on the team stems from her expertise in multilingual communications. In a previous project with University of Minnesota professor Barbara Martinson, she studied the impact of cultural influences on graphic communications, focusing on Minnesota's Hmong and Somali communities. Among their findings were that translation accuracy is paramount, that colors can have different meanings in different cultures, and "that the majority of both groups preferred bilingual publications," says Chu. Those findings provided a foundation for the current venture.

The Web-site project began with an assessment of the major informational needs of Somali immigrants, and included a survey of the knowledge base already established by other social service and state organizations (e.g., Minnesota Council of Churches, Minnesota International Institute, Minnesota Refugee Center, and the League of Women Voters).

Focus groups have helped guide the site's design, and the project team is using bilingual postcards to advertise the site. Distributed among social service, business, and community organizations with a high density of Somali clients, the postcards also contain information on the location and availability of computers where people can access the site.

Fabric vender kiosk in a local Somali mall.
PHOTO BY CHUCK YUST

Improving computer literacy

One of the challenges for the project team will be to help the Somali community adapt to gathering information via the Internet. "This is a verbal culture, one that prefers face-to-face communication," says Chu. To help, the project team is holding workshops for Somali residents to give basic instruction in computer and Internet use and to demonstrate the new Web site's contents and navigation. In addition, the team hopes to distribute donated computer equipment to the community. "One of our goals is to improve computer literacy among Somali residents," says Yust. To help with that goal, visitors to the site can find information on how to donate computers.

Ultimately, the Web site is for all Minnesotans, not just for the Somali community. A section of the site provides a history of Somalia and an overview of the Somali presence in Minnesota. Ideally, the site will not only help newly arriving Somali in their transition to life as Minnesotans, it will help raise awareness about the vibrant cultural and economic life of Minnesota's Somali community.

Written by Brian Lieb

To visit the site, go to **www.somaliresource.net**

Many people don't know what resources are available to them, and the site will **empower people by gathering all of this vital information in one place.**

Saeed Fahia

MORE Recent Rese

A sampling of other noteworthy University of Minnesota research

PHOTOS BY DAVID HANSEN, U of M Agricultural Experiment Station

Helping Swine and Cattle

The University has received two grants totaling $8.8 million to develop strategies to eliminate porcine reproductive and respiratory syndrome (PRRS) in swine and Johne's disease in cattle, diseases that cause combined annual U.S. economic losses of nearly one billion dollars. The grants, from the U.S. Department of Agriculture, are the two largest National Research Institute grants ever awarded for animal disease research.

PRRS is a respiratory disease that results in severe reproductive failure in sows. It can also cause slow and stunted growth in young pigs. "PRRS is, by far, the most significant disease affecting swine," said Michael Murtaugh, professor of veterinary pathobiology and principal investigator on the PRRS research grant. "We are working with swine producers, veterinarians, and allied industries to maximize resources available to solve this problem and reach our ultimate goal—of eliminating PRRS regionally, if not nationally."

Johne's disease is a bacterial infection in cattle and other ruminants (e.g., sheep, goats, and deer) that causes severe, chronic gastrointestinal inflammation. The disease is difficult to detect, virtually impossible to treat, and can spread rapidly within a dairy herd. "This collaborative grant will allow faculty to maximize research dollars and make a lasting impact on animal health and protect the dairy economy," said Vivek Kapur, professor of microbiology and principal investigator on the grant. Kapur, co-director of the University's Biomedical Genomics Center, led the team that identified the genetic sequence of Johne's disease in 2002.

Fitting all Sizes

The College of Human Ecology (CHE) is developing a laboratory that will identify ways to improve the design, safety, and performance of clothing, sports gear, orthotic and prosthetic products, and even life-saving devices. The Human Dimensioning Laboratory includes a computerized body scanner that uses laser beams and camera lenses to take roughly 300,000 separate measurements of a person's body, all in just 20 seconds. The measurements are then uploaded to a three-dimensional computer model where the measurement data are linked with motion analysis technology.

The laboratory will help create better sizing and fitting of wearable products and allow mass customization of apparel—the ability to create customized versions of sizes to fit people with different proportions—at the same price as mass produced products.

The laboratory is run by CHE professors Karen LaBat, Elizabeth Bye, and Marilyn DeLong, with collaboration from the University's Human/Machine Design Laboratory (mechanical engineering) and the Human Factors Research Laboratory (kinesiology).

arch

Community Energy

The University of Minnesota, Crookston (UMC) has received a grant from the University's Council on Public Engagement to support an interdisciplinary study involving business, agriculture, and the humanities to identify success factors that make small communities and "community" (in the social sense) sustainable and successful in rural northwestern Minnesota. The project will also begin a narrative study of northwest Minnesota communities that continue to remain vital despite measured demographic change and decline. The project is being led by Sharon Neet, head of the Arts, Humanities, and Social Sciences Department; Susan Brorson, head of the Business Department; and Richard Nelson, director of UMC's Center for Agriculture and Natural Resources.

ntibiotic Resistance

Since penicillin first became a standard treatment for infection during World War II, antibiotics have been among the most commonly used classes of drugs in the world. Originally developed to kill bacteria attempting to commandeer human bodies, they have also found widespread application in veterinary medicine and as a growth-promoting feed additive, primarily in chickens and pigs.

Unfortunately, penicillin-resistant bacteria began cropping up within a few years of the drug's introduction. Almost as fast as we've developed new antibiotics, bacteria have developed new ways to survive them.

We are moving ever closer to a day when few, if any, antibiotics will be reliable weapons against our microbial foes. "It's not a question, just a matter of when," said Richard Isaacson, profes- r of veterinary pathobiology. Isaacson and colleague Randy nger are working to slow the spread of antibiotic resistance y studying the ecology of antibiotic resistance—how resistant genes and the bacteria harboring them move among humans, animals, and the environment. By understanding the dynamics of antibiotic resistance, the two hope to find ways to limit the spread of resistant bacteria.

Walkability in the Twin Cities

Researchers from the University of Minnesota's College of Architecture and Landscape Architecture (CALA) and the School of Public Health (SPH) are collaborating on a first-ever study of how the design of Twin Cities neighborhoods affects the level of exercise among residents.

The two-year study is funded by a grant from the Robert Wood Johnson Foundation. It will measure the association between environmental factors and the amount of walking done in residential neighborhoods.

"While social and economic characteristics are generally found to be more important predictors of whether people will walk than physical factors, the environment does make a difference," said Ann Forsyth, a principal investigator in the study and CALA professor. "This study will measure how much of a difference the environment makes and which factors are key."

"This collaboration between the fields of public health and architecture is important in light of the obesity epidemic and recent findings that there may be an association of living in suburbs and obesity," said Kathryn Schmitz, SPH professor, who is serving as an investigator on the project along with SPH professor Michael Oakes.

Coaxing Enzymes

Romas Kazlauskas, associate professor of biochemistry, molecular biology, and biophysics, advances the search for new drugs by inducing the evolution of new enzymes and new molecules with potential as medicines. His goal is more efficient and greener (less polluting) routes to the next generation of drugs.

"We're trying to evolve enzymes to synthesize new drugs, and we're also evolving small molecules and screening them for their potential as drug precursors," Kazlauskas said. In addition to advancing the search for new drugs, some of the new enzymes may find uses in industry as replacements for chemical processes that produce environmental pollutants.

RESEARCH, continued

Multicultural Concerns

Dana Britt Lundell

The Multicultural Concerns Committee in General College (GC) has helped put University faculty and staff at the forefront nationally in the field of developmental education—the study and practice of assisting students with academic preparedness and achievement in higher education. The Committee created a project called the Multicultural Awareness Project for Institutional Transformation (MAP IT) to help assess the climate and attitudes toward multiculturalism in institutions of higher education. The project has received national attention.

"It's very important for communities to have a way to examine themselves. It's important to find some kind of opening for discussion," said Dana Britt Lundell, director of GC's Center for Research on Developmental Education and Urban Literacy. "A college can say it has a mission of multicultural education, but how does it know it is fulfilling this mission? Every college needs to look at its climate and how it welcomes students. MAP IT is a starting point for assessments—it's one way to look at different angles of diversity issues."

Chasing the Wind

Katherine Klink, associate professor of geography, is trying to do the seemingly impossible—predict the wind. While mid- and upper-level winds are fairly predictable, surface-level wind is notoriously difficult to gauge. This has profound implications for the potential of wind power, as turbines must be placed where surface winds are strong and consistent.

Klink is studying the relationship between surface-level winds and mid-and upper-level winds. "There's a relationship between these mid-level winds and what's going on at the surface. But there hasn't been a lot of work done on what those relationships are," said Klink.

Ideally, this research will have implications beyond renewable energy. "Most weather and climate studies have focused on temperature and precipitation variability," Klink said. "I hope that research on wind will help climatologists develop a broader understanding of how weather and climate change over time, regardless of whether that change is due to natural variability, or to human activities, or both."

Bicycle Messengers and Economics

Stephen Burks, assistant professor of economics and management at the University of Minnesota, Morris, works in a new area—the overlap between experimental and behavioral economics. Experimental economics involves collecting data from controlled laboratory situations designed using economic theory. Behavioral economics analyzes human decision-making and judgments using a broad and realistic view of economic psychology. Combining the two can be difficult, but Burks has found ideal research subjects to study the way individual employee decisions affect individual and collective outcomes—bicycle messengers.

Many messengers have some choice about which customer calls they accept. An *economically rational* messenger will take dispatches that make the most money for the effort involved and avoid those that make less. This leaves less good work for other messengers and inefficiently matches messengers to jobs, lowering messenger-company revenue.

When individual behavior produces inefficient collective outcomes, it produces what economists call a *social dilemma.* While some people do behave *economically rationally* in this situation, research shows that many do not. Instead, they exhibit social preferences for cooperation, even when it affe individual revenue.

This research has been conducted in the U.S. and Switzerland, and the results are being analyzed to see if privately owned firms have different levels of individual cooperation compared to employee-owned firms. Performance data will be analyzed to see if cooperation in the experiment predicts cooperation on the job. "If successful, our look at the prediction of individual performance is likely to be the most compelling project finding for economists," said Burks.

PHOTO BY STEPHEN BURKS

Studying Entrepreneurs

Researchers in the Carlson School of Management (CSOM) are studying how entrepreneurial companies form and what accounts for their success or failure. To do this, CSOM professors Harry Sapienza, Dan Forbes, Mary Zellmer-Bruhn, and graduate student Patricia Borchert are studying entrepreneurship at its inception.

Working with eight other universities, the researchers are connecting with university-based inventors at the point when they disclose the creation of new products. Many of these inventions may never lead to a business, but the early connection with inventors helps the team understand the process of how entrepreneurial businesses originate, develop, and change over time.

The team will also conduct on-site, ongoing interviews with inventors, business advisors, and venture capitalists in an effort to determine what characteristics lead to successful entrepreneurial teams. By studying entrepreneurship as it forms, the researchers hope to be able to draw conclusions about what makes some new companies successful when so many others fail.

When Students Drop Out

According to the Children's Defense Fund (2002), one high school student drops out every nine seconds. "Dropout statistics are particularly alarming because jobs that pay living wages have virtually disappeared for youth without a high school diploma," said Sandra Christenson, professor of school psychology in the College of Education and Human Development. Christenson and colleagues have been studying school completion for more than 12 years, using a model they developed called *Check & Connect.*

Check & Connect is an intervention program aimed at marginalized students who have been identified as at-risk for dropping out or for school failure. These students include youth of all ages, with and without disabilities.

Check & Connect is designed to improve student engagement through relationship building, problem solving, and persistence. "Relationship building is the cornerstone," Christenson said. "We have to build trust with both the student and the parents for the program to work."

So far, the program has proven to be effective at helping students stay in school. In one study, 68 percent of the Check & Connect group were on pace to graduate within 5 years, versus only 29 percent of the control group.

Hydrogen Power

University of Minnesota engineers have invented the first reactor capable of producing hydrogen from a renewable fuel source—ethanol—efficiently enough to hold economic potential. When coupled with a hydrogen fuel cell, the unit, which is small enough to hold in your hand, could generate one kilowatt of power, almost enough to supply an average home. The researchers, Lanny Schmidt, Gregg Deluga, and James Salge, are all members of the Department of Chemical Engineering and Materials Science.

The invention is poised to remove the major stumbling block to the hydrogen economy. "The hydrogen economy means cars and electricity powered by hydrogen," said Schmidt. "But hydrogen is hard to come by. You can't pipe it long distances. There are a few hydrogen fueling stations, but they strip hydrogen from methane—natural gas—on site. It's expensive, and because it uses fossil fuels, it increases carbon dioxide emissions." The new reactor, in contrast, should not only reduce dependence on imported fuels, but actually reduce carbon dioxide emissions. It can also boost rural economies by increasing the demand for ethanol.

Sneaking Into the Brain

Pharmacy professor William Elmquist is working to get beyond the blood-brain barrier, the microscopic shield of proteins that protect the brain from invading toxins. While this barrier protects the brain, it also prevents delivery of potentially life-saving drugs. "We're working against the natural tendency of the brain to keep toxic chemicals out for its own protection. That's a difficult thing to do," said Elmquist.

Ironically, the barrier serves another purpose—viruses, like AIDS, use the brain as a sanctuary to hide from drug treatments. Elmquist's team is looking for ways to get drugs through the barrier to the central nervous system by preventing the protective proteins from performing their job. If successful, diseases won't be able to use the brain as a hiding place. "We want to eliminate that sanctuary," said Elmquist.

Fisheries Ecology

Thomas Hrabik of the University of Minnesota, Duluth's biology department is leading a team of researchers to identify habitat characteristics favored by spawning and juvenile lake trout over two shoals of the Apostle Islands in Lake Superior. Using remote sensing technology, the study will generate new information about how interactions among substrate size and stability, water movement, and sedimentation influence the reproductive success of lake trout. An understanding of water conditions coupled with high-resolution GIS information about habitat selection and use will help natural resource managers direct efforts to manage populations of these commercially important native fish.

Studying for Tests, Nintendo-STYLE

For professors who produced their theses on typewriters, the idea of studying by playing a computer game may seem strange. After all, even fairly young faculty were well into their teens when computers first appeared in high schools and when video games advanced from simple action games to problem-solving trials. But for today's college students, advanced technology and gaming have always been available. In fact, video games are so prevalent in contemporary youth culture that research shows a possible game-influenced change in hand coordination between the generations.

Dan Lim with student. PHOTO BY ANDREW SVEC

"The younger generation [25 and under] has taken to using thumbs in a completely different way," said Dr. Sadie Plant of Warwick University in England. A study produced by Warwick's Cybernetic Culture Research Unit showed that while the vast majority of adults use their index fingers to jab slowly at the keypads of their cell phones, youth instinctively, very quickly, and often without looking, use their thumbs. The likely cause: video games.

And students have learned more from video games than just how to exploit their thumbs. Modern games challenge players with sequences of progressively more difficult obstacles that must be overcome by solving problems. On average, players take between 20 and 50 hours to beat the games. This model of learning and persistence in problem-solving is normal for contemporary college students. In a sense, games have literally helped students learn how to learn.

Fortunately for both students and faculty, Dan Lim and his staff at the University of Minnesota, Crookston (UMC) have created a learning tool that can help students use their Nintendo-generation learning style to more effectively master course material. Lim, information technology management professor and director of UMC's Instructional Technology Center, has developed an academic game generator that retrieves questions from Web-driven databases for use in academic learning.

Developed in Macromedia Flash MX, the game generator interfaces with other learning applications and allows educators to upload learning content to create games for their own classes. Lim and his staff believe that the games could enhance learning at the college level and increase student success. "Students who use games to learn are kept on the material longer because they are engaged and they spend more time on the content," said Lim. And students engaged in learning are more apt to persist in their education and to graduate.

For students who have been gaming their entire lives, the problem-solving skills and persistence developed playing video games translate directly to academic games. To students, the format is normal; comfortable. "Academic gaming can make learning fun, increase time on task, and absorb students in learning content," said Lim. "Students play the games to win, and while they are playing, they are interacting with course content in a way that is compelling. Without even realizing it, they are learning."

> Academic gaming can mak**learning fun,** increase time on task, and absorb students in learning conten
>
> *Dan Lim*

Lim notes that disciplines that contain difficult content or numerous facts work particularly well with academic gaming because the learner is challenged by the game, is compelled to play longer in order to win, and therefore, is more apt to master the content.

Surveys of users of the learning games at UMC seem to verify this. Close to two thirds of students who used them indicated that the games made difficult content easier to learn. Overall, 73 percent said the games helped them self-learn course materials. According to one UMC student, "I played it [learning game] last night for about two hours, not to just study, but because it challenged me and I needed to beat it."

Currently, UMC has games in various academic subjects and in five game formats. One format, the *challenge game,* has 80 questions and 16 levels of difficulty. The game helps students gain confidence by starting them on relatively simple levels, then progresses through more difficult material, challenging students to sharpen their knowledge.

Using UMC's Flash Games Web site (flashgames.umn.edu), instructors at any institution can create accounts and upload questions to create challenge games that meet the needs of their particular classes. Already, instructors at 19 institutions from around the country are using UMC's academic games.

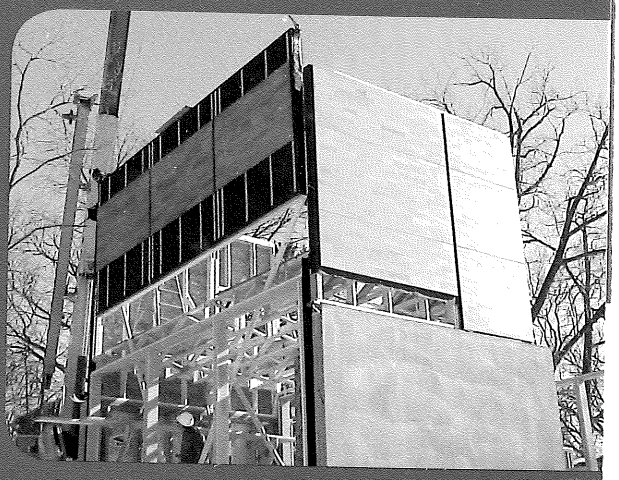
"Academic gaming is still a new area of research, but it could hold great promise for instructors and students," said Lim. Since instructors deal every day with a variety of students and learning styles, academic gaming can provide faculty with another tool for reaching students; one that students are comfortable with and will readily accept. And as the first university in the country to provide every full-time student and faculty member with a portable notebook computer (1993), UMC is the ideal place to develop and house the game generator.

Written by Brian Lieb

PHOTO BY JUNE KALLESTAD

New Technologies Put Pizzazz in Kit Homes

A section of an Aurora house being put in place.



Homebuilding is an old art form ripe for an infusion of new techniques. Leading the way in new innovations are wood products researchers at the Natural Resources Research Institute (NRRI) at the University of Minnesota, Duluth. They've brought together professionals who, using a team approach, are building more than houses—they're setting a foundation for economic development opportunities in the wood products industry in Northern Minnesota.

The new Aurora Building Systems pilot plant in Aurora, Minnesota, is based on a tried and true building technique—the kit house—updated with computer-driven technologies. Pre-cut, ready-to-build homes were a popular item in the Sears catalog from 1908 through the 1940s. Given today's high construction costs and need for affordable housing, their time has come again.

"Our goal is to build businesses that sell and produce ready-to-assemble house systems," explained NRRI wood products researcher Pat Donahue. "This way, pre-cut, wood-framed single and multi-family homes can be delivered to the job site and erected with a minimal level of skilled labor."

While there are many ways to build homes, the Aurora home concept is the only one of its kind. An exciting element of the package is the expertise of Minneapolis designer Charlie Lazor, who is charged with the task of making the homes beautiful, functional, and affordable.

"I care deeply about design and I believe it's as important as breathing fresh air," said Lazor. "Aurora's goal and my goal is to create a set of house products that are inspired, that make us say, 'wow'. There are many house products out there. My job is to differentiate the Aurora products from the rest of the field."

Building contractors are enthusiastic about the kit house concept because it saves time; which in turn, saves them and consumers, money. Computer design software determines exactly how much lumber and materials are needed. Everything necessary to build the home is delivered to the site, ready to be assembled, including panelized wall systems, windows, doors, and outside siding. And there's very little waste because all the lumber is cut to size right from the start.

The Aurora pilot plant will continue to develop new joinery techniques using different types of engineered wood to improve construction efficiency and quality. The Aurora business team plans to make good use of the pilot plant to use, as Donahue says, "Minnesota's wood industry to build Minnesota homes."

Aurora President Tink Birchem, also co-owner of Birchem Logging, knows how important it is to stay innovative in the wood industry. She and her business partner/husband Jerry were inspired to re-think their logging business after a trip to Finland where innovation in the wood industry is pushed forward. "We realized we needed to add value to our product," Birchem explained. "After meeting with Pat (Donahue) we saw how well this building concept would fit with our goal of diversifying what we do with wood."

The potential for growth of spin-off industries related to Aurora Building Systems on the Iron Range is a welcome addition to the economics of the area. Aurora built their first house in Minneapolis in December 2003 as a showcase for how innovation and design come together in this new adaptation of the old Sears kit home. Plans are also in place to build homes in Hibbing and in Tower-Soudan that will be sold through the Arrowhead Economic Opportunity Agency.

Written by June Kallestad

PRAIRIE POWER

Wind and Biofuels in West Central Minnesota

The staff at the University's West Central Research and Outreach Center (WCROC) in Morris embrace their surroundings—farm fields and ubiquitous breezes. The center, which responds to the diverse issues of Minnesota agriculture, focuses much of its work on animal husbandry, crop production, and horticulture. But efforts turned to renewable energy when WCROC staff sought ways to address the challenges agricultural producers and rural communities face with dwindling resources.

"As it developed, we came out with two broad goals," said WCROC director Greg Cuomo. "This was to be a model for other rural communities and communities looking at renewable energy for economic development, and it was to facilitate research on renewable energy as part of the larger University."

And their geographic location helped focus their vision. "We are trying to take the resources of West Central Minnesota—wind, crops for biomass and biofuels—and use them to our advantage," said Cuomo.

The Morris area will soon be home to hybrid wind turbines, a biomass heating and cooling facility, and the new University of Minnesota Renewable Energy Research and Demonstration Center; a community-scale center focusing on wind, biomass, biofuels, methane digestion, hydrogen generation, and the use of fuel cells.

The new center's two primary objectives will be to provide a model for rural communities and agricultural producers to integrate renewable energy systems into their economies, and to establish systems research that provides information to stimulate the renewable energy industry. Energy produced at the center will be integrated into production systems at WCROC, the University, and the surrounding community.

This new center is an important part of the University's Initiative for Renewable Energy and the Environment (IREE), which draws scientists from across the University to work collaboratively to produce information about renewable energy production and use. "Good things happen when you put people with different perspectives together," said Cuomo.

In 1993, the state legislature directed $20 million from the state and Xcel Energy to fund the IREE through 2008. About $3 million of the appropriation is going for the Renewable Energy Research and Demonstration Center.

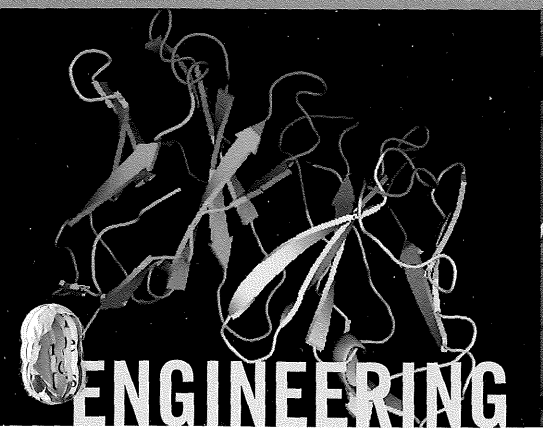
Researchers at WCROC and the new center will study dispatchable energy—using biofuels to create energy on demand—and wind to hydrogen energy production systems. University researchers will also study the use of biomass for heating and cooling systems. "The University is a good model to head the research, but we have lacked the ability to test biomass fuels for energy efficiency and emissions. This project will allow us to do that," said Cuomo.

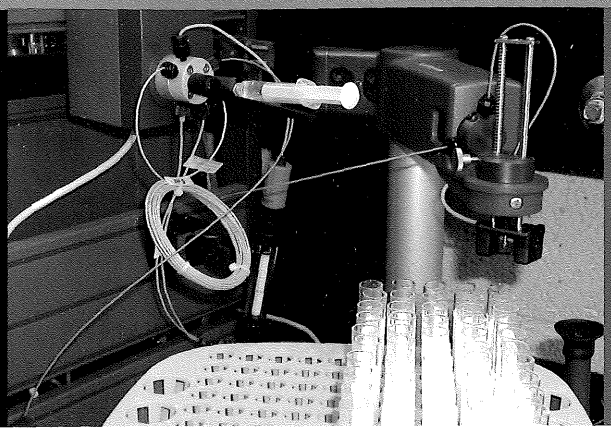
In addition, the city of Morris is investigating the possibility of using methane from surrounding farms as a source of energy. Together, the Univers and the community are helping make Morris a leader in developing energy systems that protect the environment and spur economic growth.

> Good things happen when you put people with different perspectives together.
>
> *Greg Cuomo*

"We are pleased to be a part of the IREE, and a part of this broad-based effort," said Cuomo. Since WCROC partners with a variety of constituencies (citizens, farmers, rural leaders, researchers from a variety of University departments, an faculty from other research and outrea centers), it is perfectly positioned to bring renewable energy research to the people of West Central Minnesota.

Written by Carol Stender (Agri News) and Brian Lieb





(L): Close-up structural view of the portion of an antibody that binds a foreign substance. The exposed loops (in red) directly interact with a particular foreign substance in a highly specific manner.

IMAGE PROVIDED BY JENNIFER MAYNARD

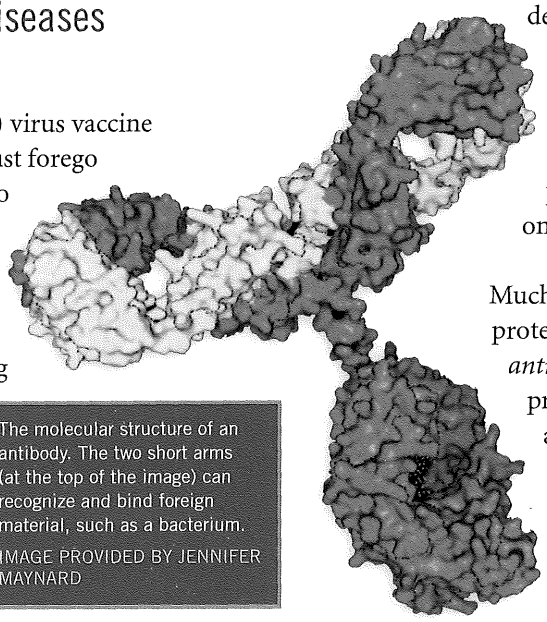
(R): FPLC apparatus used for purifying antibodies and other proteins.

PHOTO BY BRIAN LIEB

ENGINEERING *novel approaches to* Bacterial Infections

The field of protein engineering sheds light on the prevention and treatment of bacterial diseases

Because of an unexpected influenza (flu) virus vaccine shortage this year, many Americans must forego their annual flu shot. Media continue to report on availability of the remaining vaccine and how to prepare for the flu season. For the moment, illnesses caused by another type of infectious agent, bacterial pathogens, are receiving far less attention. However, infectious diseases caused by bacteria are a concern for public health officials and can pose significant risk to the public. For example, Wisconsin and, to a lesser extent North Dakota and Minnesota, have observed a recent spike in the number of cases of whooping cough, a highly contagious bacterial disease affecting the lungs and producing a severe, uncontrollable cough that can last for weeks. Whooping cough derives its name from a high-pitched whooping sound that can sometimes be heard, particularly in young children, when breathing in after a coughing episode.



The molecular structure of an antibody. The two short arms (at the top of the image) can recognize and bind foreign material, such as a bacterium.

IMAGE PROVIDED BY JENNIFER MAYNARD

In the University's Department of Chemical Engineering and Materials Science, newly arrived assistant professor Jennifer Maynard is using protein engineering to study the bacterium that causes whooping cough, *Bordetella pertussis*. A chemical engineer with a strong background in biology, Maynard uses recent advances in genetic engineering to design more sophisticated strategies to treat people with active disease and to discover better vaccine technologies to prevent disease.

Creating designer proteins as therapeutic agents

Over the past 15 years, scientists have learned how to artificially alter proteins or recombine portions of proteins to produce a desired effect, such as improved function, in a field known as *protein engineering*. Protein engineering relies on recombinant DNA techniques to make targeted changes at the DNA level that will produce a tailor-made protein possessing one or more favorable characteristics.

Much of Maynard's research focuses on using protein engineering to artificially construct *antibodies,* which are proteins naturally produced by the body's immune system as a defense against foreign invasion. Antibodies are highly specific and targeted in their action; each antibody can recognize and bind to only a single foreign substance. Protein engineering techniques allow scientists like Maynard to build specific antibodies that can bind to a particular bacterial target and to find those that can defend against bacterial infection. Administration of such engineered antibodies to a patient with a bacterial infection could represent a new therapy for the treatment of bacterial disease.

The field of protein engineering has already produced important medical therapies. While not all engineered protein therapeutics are antibodies (recombinant versions of insulin and human growth hormone are two examples of non-antibody engineered therapeutics), one successful antibody therapeutic that has been engineered is Genentech's Herceptin. Herceptin is an antibody targeted against the HER2 protein, which is over-expressed in approximately 25% of breast cancer patients. In its first year of availability, Herceptin reached $1 billion in sales. Proteins used as therapeutics are engineered for a variety of reasons, including

PROTEINS, continued

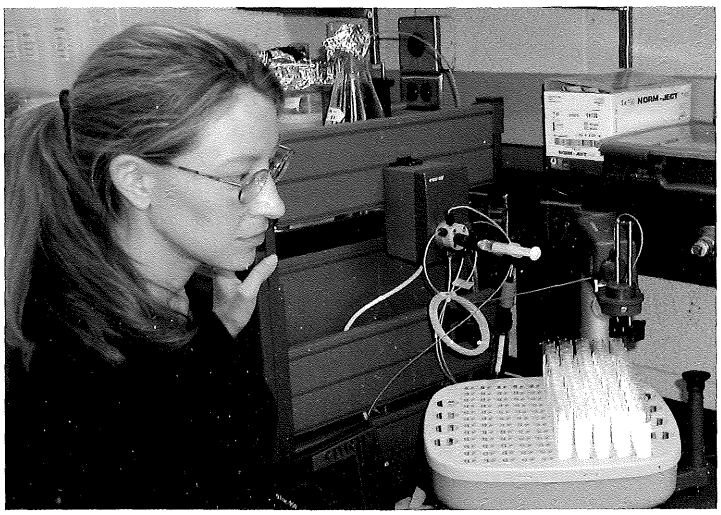
increased effectiveness (resulting in lower doses needing to be administered), more efficient expression (resulting in decreased production costs), and improved stability (resulting in a longer shelf life and/or half-life in the body) when compared to non-engineered forms of those proteins.

Engineering antibodies to treat bacterial disease

Using whooping cough as a disease model, Maynard is engineering antibodies that bind tightly to and neutralize the toxin secreted by Bordetella pertussis bacteria and may prove useful in treating that bacterial disease after its onset. As a preventive measure, vaccinations can provide future protection, or immunity, against a bacterial pathogen. While most American children are now routinely vaccinated against whooping cough, developing antibody therapies for it is important because the whooping cough vaccine is less than ideal. For that vaccine, "scientists still do not understand the basis of immunity, and protection from disease only lasts a few years," according to Maynard. In addition, existing therapies for active whooping cough are insufficient. Physicians frequently cannot use antibiotics to treat whooping cough, because diagnosis often occurs after the time when antibiotics would have been effective. Current treatment options for infants and toddlers, who are most severely affected by and run the greatest risk of complications from whooping cough, are limited to supportive care.

The field of protein engineering has already produced important medical therapies.

Beyond studying just the pertussis toxin, Maynard wants to globally study Bordetella pertussis bacterial immunity. She theorizes that an immune response only needs to be established against a subset of the bacterium's components to completely protect an individual. Maynard has coined the term *protective immunome* to describe the sum of all the parts of the bacterium against which protection must be established to prevent illness.



Jennifer Maynard using FPLC apparatus. PHOTO BY BRIAN LIEB

Developing and administering a set of antibodies that protect against these components of Bordetella pertussis could block all the ways these bacteria cause disease. To create such a therapeutic cocktail, Maynard and her team must first engineer thousands of antibodies in the laboratory. Once assembled, these antibodies can be screened to find a few viable therapeutic agents to include in the cocktail.

Treating an active bacterial disease by directly administering antibodies that can combat and eliminate bacterial components, rather than vaccinating an individual to establish future protection, is known as *passive immunization*. According to Maynard, passive immunization is attractive "when the disease presents a serious health hazard, but available vaccines or other treatments are inadequate: for example, if the vaccine itself can be risky [as with anthrax or Lyme disease], or if the disease occurs too infrequently to justify mass vaccination [as with anthrax and smallpox]."

For bacterial infections, treatment of active disease with antibiotics can stem the tide of bacterial growth but does nothing to address the action of toxins released by the growing bacteria. If left unchecked, the remaining toxin can cause serious illness or disease symptoms and even death, as in the case of the anthrax toxin. However, if an individual exposed to *Bacillus anthracis*, bacterium that causes anthrax, is treated with antibodies against the anthrax toxin (passive immunization) in conjunction with antibiotics, the antibodies can block the negative effects of the toxin, preventing such serious consequences.

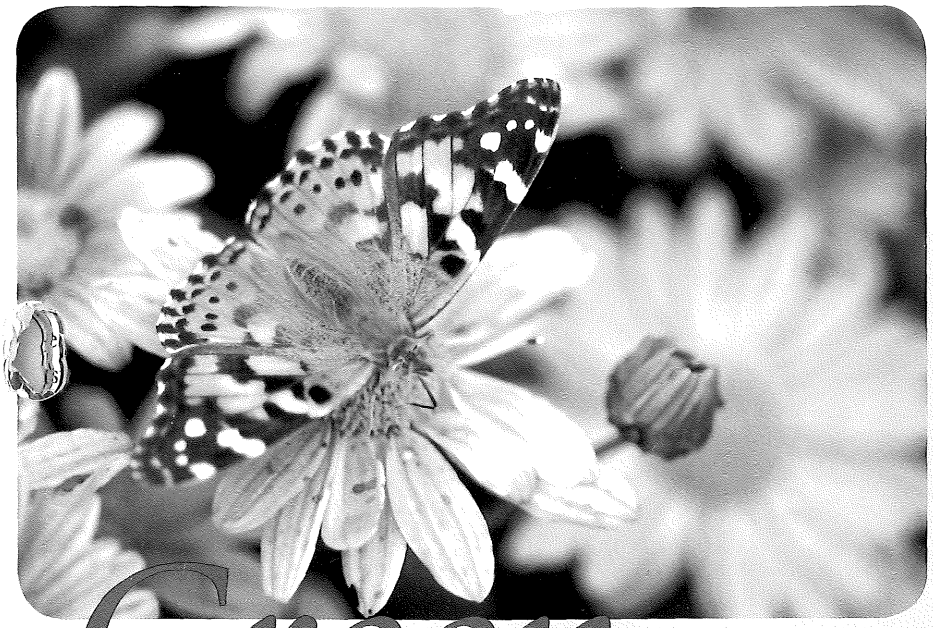
To systematically design the best antibody therapeutics, Maynard is developing a mathematical approach, known as a *pharmacokinetic model*, to elucidate the characteristics of antibody-bacteria interactions. By testing with this model, she can determine how much antibody is needed in a passive immunization scheme to prevent symptoms of disease, how high the affinity of an antibody for its bacterial target must be to be effective therapeutically, and other relevant parameters. With these data in hand, Maynard will go into the laboratory knowing what kind of antibody she wants to create to maximize its therapeutic value.

Using vaccine strategies to prevent disease

Despite advances in the field of antibody therapeutics and lingering issues over the safety of vaccinations, scientists remain dedicated to building better vaccines. Maynard's antibody engineering work will increase understanding about what mediates protection in bacterial disease, which in turn will help in the development of better vaccine strategies. One vaccine approach that Maynard is interested in is to use protein engineering to

PROTEINS, continued on page 23

PHOTOS BY DAVID HANSEN, U of M Agricultural Experiment Station



Green Lab

Research done at UMore Park protects our food, economy, and environment

Anyone who has recently driven south from St. Paul on Highway 52 to Farmington, Northfield, or Red Wing, has seen the changes that come with population growth. What was once miles of farmland is quickly becoming suburbanized, part of the ever-expanding waistline of the Twin Cities metro area.

But turn west onto Highway 46 in Rosemount and you can still find 7,500 acres of green space; some of it farmland, some of it forest, and some of it meticulously designed with flowers and decorative plants.

This green island, which seems so out of place in this developed corridor, is the University of Minnesota Outreach, Research and Education Park (UMore Park), currently home to the research programs of 37 University faculty members.

Faculty have used the site to develop extensive research programs in the biological control of insects, weeds, and pathogens affecting field and vegetable crops. UMore Park's large fields, extensive acreage, and diversity of staff, skills, and equipment allow research activities on crops grown throughout the region and the isolation of these plants for experimental purposes. "UMore Park is a critical resource for University of Minnesota researchers and serves faculty from Colleges of Agricultural, Food, and Environmental Sciences; Architecture and Landscape Architecture; Natural Resources; and Veterinary Medicine," says UMore Park Director Phil Larson.

The site is also important for its education and outreach functions. Over the years, the facility has been the open-air lab for many graduate students in various fields, helping to shape the careers of hundreds of scientists. The College of Veterinary Medicine uses the farm at UMore Park to help train veterinary students in its Goat Project, which produces antibodies for diagnostics and development. The farm "provides a hands-on learning experience for students working with the goats, sheep, llamas, donkeys, and chickens in the project," said University veterinarian Cindy Wolf.

As part of its outreach function, UMore Park partners with the University of Minnesota Extension Service. Their projects include the New Immigrant Farm Program, the Dakota County Master Gardeners, and a mixed-use recreation trail. The farm program works with 20 families involved with 1 to 3 acre vegetable production tracts with educational emphasis

GREEN LAB, continued

Master Gardeners site at UMore Park.
PHOTO BY DAVID HANSEN

UMore Park Prairie.
PHOTO BY DAVID HANSEN

on production technologies and marketing. The master gardeners have established a teaching, research, and demonstration garden on site. And a 10-½ mile recreational trail designed for hiking, horseback riding, and cross-country skiing provides a recreation resource for area residents and serves as a focal point for equine research and education.

But it's the research, made possible by its size and location, that garners most of the attention for UMore Park. Entomology professor Ted Radcliffe has used the site to study various insects for much of his 41 years at the University. "It is an attractive place to do research because it is accessible and it represents a typical agricultural environment with associations of natural enemies, diseases, and land buffers," said Radcliffe. Larson notes that UMore Park's "proximity to the Twin Cities campus and large land mass are major factors in supporting the research efforts of our faculty."

> It is a remarkable facility. Without it, many of us would not have been able to do this type of research. It is a great resource for the University, the people of Minnesota, and beyond.
>
> *Professor Ted Radcliffe*

Keeping carbon

Its unique location and land characteristics make UMore Park an ideal place to study the role of agricultural production on climate change. John Baker, USDA-ARS scientist and professor of soil, water, and climate uses the site's large fields to study carbon sequestration, a naturally occurring phenomenon that happens when carbon is breathed and retained in terrestrial ecosystems. Trees and plants, for example, absorb carbon dioxide then release the oxygen and store the carbon.

In a perfect world, equal amounts of carbon would return to ecosystems through photosynthesis and escape into the atmosphere through plant, animal, and microbial respiration. But human activities have thrown the carbon balance off, flooding the atmosphere with carbon dioxide and raising global temperatures.

The United States has thus far rejected the guidelines of the Kyoto Protocol for mandatory reductions in carbon emissions, instead proposing a voluntary approach under which major fuel consumers could either reduce their emissions or offset those emissions by paying others, such as farmers and foresters, to engage in practices that store carbon. The U.S. now has a carbon exchange in Chicago that administers the world's first multi-national and multi-sector marketplace for reducing and trading greenhouse gas emissions. But no one knows for sure how much carbon could be sequestered through such programs.

That is what Baker and others are trying to find out. They are looking at the effectiveness of various crop management practices—strip tillage, no till, use of cover crops, planting of Bt corn varieties—in retaining carbon in the soil when compared to traditional crop rotations and plowing schedules. Without the proximity of UMore Park and the size of the fields, Baker would be unable to do this research. "You must have large fields with natural borders to do this," notes Baker. "A campus research lab simply can't replicate that."

Sap suckers

In the summer of 2000 a new pest began to appear in soybean fields in Minnesota and other Midwest states: the soybean aphid. Pale yellow and less than 1/16 inch in length, soybean aphids pierce the soybean's plumbing system and suck the plant's sap, reducing crop yields by removing photosynthates (sap), reducing photosynthesis, and transmitting viral diseases. Not a key pest in their native Eastern Asia, the aphid has rapidly become a major threat to agriculture in Minnesota and much of the Midwest.

During the growing season, aphid population growth can be phenomenal—"like a pyramid scheme gone awry," according to entomology professor Ken Ostlie. Because the aphids are predominantly female, mature in less than one week, and reproduce asexually, their populations double every three to five days. In one recent field study, the aphid population exploded from 1 aphid per plant to 5,000 per plant in just 5 weeks. And since the aphids

essentially clone themselves, they are likely to adapt resistance to insecticides fairly quickly.

Ostlie and other researchers in a variety of University departments are trying to find ways to combat the aphids by looking at many variables, including the temperature preferences of the aphids; the reliability of natural control by predators, parasites, and fungal diseases; and soybean cultivars that are more resistant to the aphid.

Their research has staggering implications. In 2002, just two years after they were first discovered in local fields, soybean aphids cost the state of Minnesota $240 million in treatment costs and crop reduction. Currently, all 7.3 million acres of Minnesota's soybean production are considered at-risk.

But the impacts of aphid infestation extend beyond the soybean economy as farmers grapple with cascading effects on whole-farm finances, crop acreage decisions, soil fertility, erosion and soil sequestration, and the environmental impacts of insecticide use. Without a solution, farmers will shift to other crops, dramatically affecting the regional agricultural industry and global trade.

UMore Park's fields make this vital research possible. "Without the Rosemount site," notes Ostlie, "we couldn't really deal with this outbreak without researchers driving hours each day to an outstate site. That would cost significantly more and take more time, which we don't have right now."

Bang for the buck

Former UMore Park director David Walgenbach notes that the research at UMore Park has historically been done with relatively small budgets, especially when compared to the multi-million dollar grants that have become common in recent years. Despite those budgets, UMore Park research has had a profound impact on science and the economy—just ask Ted Radcliffe. In the 1970's he studied how to combat the alfalfa weevil. Spending roughly $2,000, his team introduced a wasp parasite that has essentially permanently controlled the pest in the state. "Within three years of release, the parasite moved on its own to every county in Minnesota with alfalfa," said Radcliffe. That $2,000 investment saved roughly $100 million in losses over the 10 years after release of the parasite.

Without UMore Park, the alfalfa weevil would have enjoyed a much longer heyday. "It is a remarkable facility," says Radcliffe. "Without it, many of us would not have been able to do this type of research. It is a great resource for the University, the people of Minnesota, and beyond."

Radcliffe now works on ways to use integrated pest management techniques to combat green peach aphids, a major threat to the potato industry. That research, like his research on the alfalfa weevil and the research of other UMore Park faculty and graduate students, makes the green island in Rosemount important to the research mission of the University, and ultimately, important to Minnesotans.

Written by Brian Lieb

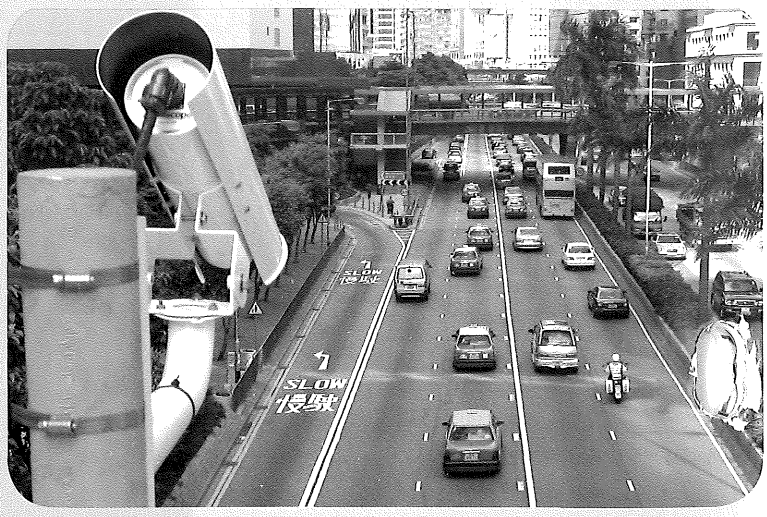
PROTEINS, continued from page 20

create vaccines for conferring immunity to more than one bacterial toxin with a single vaccine. For example, although structural similarities exist among one of the anthrax toxins, cholera toxin, and one of the dangerous *Escherichia coli* toxins, currently if an individual is immunized against one, he or she would not be protected against any of the others. According to Maynard, "we want to try to create a super-vaccine so that if you're immunized, you're protected against the whole family of toxins. We can use the conserved B- and T-cell epitopes [stretches of the toxin proteins that highly relate to each other and can elicit an immune response] and recombine them into a single molecule" to be used as a vaccine.

Vaccines continue to be a mainstay in the fight against bacterial disease, in part because of issues of access to care. "Antibody therapeutics will really only be practical for industrialized countries, and they'll always be a more expensive treatment. You want to find approaches to be of benefit to everybody," noted Maynard. Given recent advances in protein engineering and our understanding of the immune system, the discovery of such approaches to address bacterial diseases seems more possible now than ever before.

Written by Linda Raab

Coffman Memorial Union, Twin Cities campus.
PHOTO BY BRIAN LIEB



Autoscope

Computerized traffic management system EASES CONGESTION

Three stories above the intersection of Washington Avenue and Union Street on the University's east bank campus, a solitary white camera monitors the bustling traffic below.

The camera is part of a revolutionary traffic management system using a computer to process video images of roadways and intersections. The system, called Autoscope, detects cars, classifies them by vehicle type, and continuously measures speed, volume, occupancy, density, and queue lengths. It provides real-time information to traffic management engineers who can use this data to guide traffic more efficiently through intersections and congested highways, detect accidents or stalled vehicles, and improve emergency response times of local authorities.

Although the technology behind Autoscope is new, the road to its implementation winds back nearly 20 years. University professor Panos Michalopoulos first came up with this idea to control traffic almost three decades ago. In 1984, after seven years of research and development, his team unveiled a prototype of its new system. After the University's Office of Patents and Technology Marketing was unable to find partners willing to invest the $10 million needed to develop the prototype into a commercial product, Michalopoulos started Image Sensing Systems Inc. (ISS) to further develop and market the system.

In 1992, ISS sold its first Autoscope to the city of Troy, Michigan, which eventually installed units to control more than 300 intersections. Today more than 50 countries use an Autoscope system, which in turn support over 30,000 cameras in such major U.S. cities as Houston, Detroit, New York, and Minneapolis.

Based in St. Paul, ISS has offices around the world and is listed on NASDAQ.

Written by Jason Sanford and Bruce Erickson

Research 101

Research-related data and how University research gets funded

Research at the University of Minnesota is supported by both external and internal funding. External funding to the University comes from a variety of sources (see the accompanying statistics for information on who supports University of Minnesota research) and in a variety of forms. This article describes one type of research funding that faculty members apply for: grants.

Q: What is a grant?

A: A grant is a pledge of funds to the University earmarked for the support of a research project proposed by a faculty member.

Q: Are all applications for grant money funded?

A: No. Funding agencies receive many more project proposals than they can fund. New proposals must undergo a competitive review to determine which researchers will receive a grant. During review, proposals are examined for key elements such as the use of innovative approaches, the likelihood that the proposed project can be successfully completed, and how the results of the proposed project will extend knowledge in the field.

Q: How competitive is it to get a grant?

A: For federal sponsors, on average only 25-30% of proposals submitted nationwide for competitive review are successfully funded.

RESEARCH 101, *continued on next page*

Q: How do University of Minnesota faculty members fare when competing for grants?

A: Using the National Science Foundation (a major sponsor of University of Minnesota research; see the accompanying statistics) as an example, in the last two fiscal years the University has exceeded that sponsor's nationwide success rate for each of those years by 17% and 30%.

The largest sponsor of University of Minnesota research, the National Institutes of Health (a DHHS entity; see the accompanying statistics), determines the outcome of proposals being competitively reviewed differently than and publishes less complete success rate statistics than the National Science Foundation. However, University records indicate that our faculty consistently exceed the nationwide success rate for competitively reviewed proposals at the National Institutes of Health.

University of Minnesota
Office of the Vice President for Research
Financial Summary FY 2004

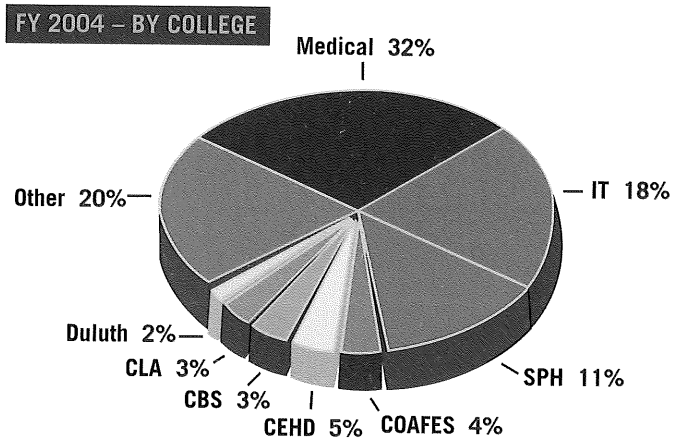
Dollar amounts represented in millions

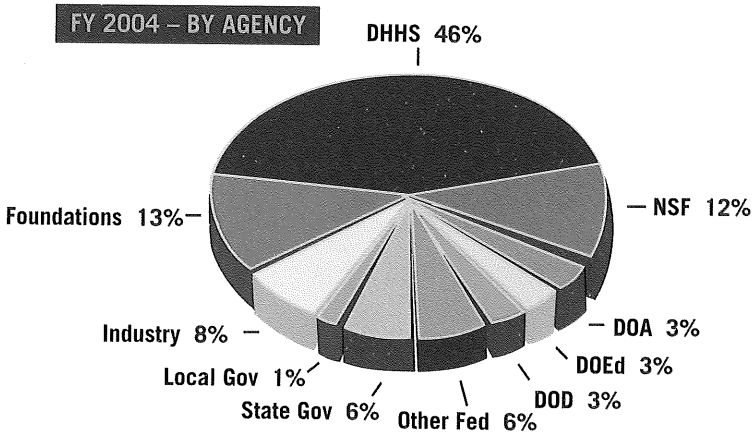
Grant and Contract Award Summary
FY 2004 – BY COLLEGE
By College or Campus

Medical School	$168.8
Institute of Technology (IT)	94.8
School of Public Health (SPH)	59.0
College of Education and Human Development (CEHD)	25.8
College of Ag., Food and Env. Sciences (COAFES)	22.9
College of Biological Sciences (CBS)	17.4
College of Liberal Arts (CLA)	17.3
University of Minnesota - Duluth	9.8
Other	107.9
Total	**$523.6**

Grant and Contract Award Summary
FY 2004 – BY AGENCY
Source of Funds

Federal	$377.2
Department of Health and Human Services (DHHS)	239.2
National Science Foundation (NSF)	64.1
Department of Agriculture (DOA)	15.1
Department of Education (DOEd)	14.9
Department of Defense (DOD)	13.5
Other Federal	30.2
State Government	29.5
Local Government	4.8
Business and Industry	41.7
Foundations and NGOs	70.5
Total	**$523.6**



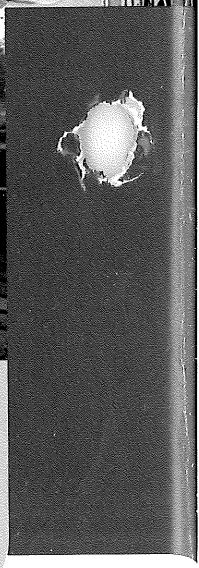


University of Minnesota Technology Transfer Data

	FY 00	FY 01	FY 02	FY 03	FY 04
Disclosures	218	231	233	218	217
New U.S. Patent Applications	78	83	94	72	75
U.S. Patents Issued	67	37	43	54	37
Licenses and Options					
New	93	85	72	58	98
Start-ups	11	10	6	4	3
Total Active Agreements	470	517	559	591	656
Gross Revenues	$23.1	$16.8	$26.5	$38.7	$47.5
Patent Cost Reimbursement	$1.3	$1.1	$1.1	$1.0	$1.1

Source: Office of Patents & Technology Marketing. Generated 8/01/04. Dollar amounts represented in millions.

University of Minnesota



University of Minnesota
450 McNamara Alumni Center
200 Oak Street SE
Minneapolis, MN 55455-2070

Nonprofit Org.
U.S. Postage
PAID
Mpls., MN
Permit No. 1

O·V·P·R

Office of the Vice President for Research