S
ince their first public appearance, three cloned mules Utah State University animal scientist Ken White and colleagues Dirk Vanderwall and Gordon Woods from the University of Idaho produced in 2003 have garnered a lot of attention. The cloned cattle White’s research group have produced at USU enjoy less celebrity, though they are still something of a curiosity. But once visitors are face to face with the clones, their most frequent comments seem to be, “They just look like mules,” or, “They just look like cows.”

“Exactly,” White responds. “That’s what they are.”

Perhaps we’ve all seen too many movies and read to much science fiction. In real life cloned animals are not evil robots, don’t look like carbon copies of one another, and they don’t behave like the cell donor or any genetically identical siblings. Some visitors seem almost disappointed that the animals don’t have extra eyes or mutant limbs, and a bit surprised that they aren’t sickly, weak or wheezing.

Just as they do in all living things, the genes that built the cloned mules and cattle are simply doing their jobs—the genetic material just went through a few extra and carefully orchestrated steps along the way. One looming goal for scientists now, and probably for decades to come, is figuring out which genes do what, how they do it, and how we can use that knowledge.

It’s a quest that makes many people, governments and even some scientists very uncomfortable.

Many plants clone themselves as a matter of course, and many bacteria and other simple organisms have cloned themselves for cons. A much younger process involves harvesting cells from an adult animal and creating genetic copies (somatic cell nuclear transfer). It graduated from the realms of science fiction to science fact with the birth of Dolly the sheep just 10 years ago. Questions about cloning’s practical and ethical implications were discussed well before Dolly was conceived, but the debate has clearly accelerated. The controversy shows no signs of slowing as scientists become more successful at cloning and the answers are never simple.

Put “cloning ethics” into an Internet search engine and be ready for a virtual avalanche of information to show up—more than 6 million choices on Google alone. When does life begin and what constitutes life? When does life begin if there is technically no conception? The debate is further complicated because, for most people, cloning is just another ingredient in the medically/scientifically/ethically/politically confusing mix of all things related to genes and reproduction, including stem cell research and therapeutic cloning.

National Science Foundation surveys over the years have found public opinion fluctuates on some matters related to cloning and stem cell research, but the vast majority of Americans are absolutely against human cloning. Most find the idea of cloning humans as a commercial enterprise equally disturbing. But when you get to questions about stem cell research and therapeutic cloning aimed at discovering treatments for diabetes, Parkinson’s disease and other major medical problems, opinions are far more divided.

Just as there are no easy answers to these questions, there is no going back now. The cloning train has left the station and regularly picks up speed. The questions we have to ask and thoughtfully answer are, “Where do we want it to go?” and “What is the best way to get there?”

Stan L. Albrecht, President, Utah State University

H. Paul Rasmussen, Director, Utah Agricultural Experiment Station

Noelle E. Cockett, Vice President for Extension and Agriculture

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COPY CATTLE
Making exact genetic copies of outstanding animals is no longer just a dream. But do clones grow up to be just like their "parents"?

BACTERIA: THE BACKBONE OF FERMENTATION
Have you eaten your bacteria today? Scientists take a good look at the bacteria that give cheese, milk and yogurt their flavors.

GREEN GENES
Why are some plants thirstier than others? The answer may lie in their genes.

TEACHING CHILDREN TO FIGHT BAC!
Virtual food handling with Jerry Germinowski, Perry Cite and friends leaves a lasting impression on young cooks.


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Copy Cattle
Relative to many scientific advances, somatic cell nuclear transfer—a technique for cloning—has made the journey from "Can it be done?" to "What can we do with it?" very rapidly. Since Dolly the sheep was born in 1996, several other animals have been cloned including cows, goats, pigs, mules, cats and horses.

Several cows and bulls currently at Utah State University and at Idaho-based Simplot Land and Livestock are the results of recent cloning research and are well on their way to helping scientists understand more about what’s possible for cloned livestock. The animals are the cloned offspring of parents with outstanding milk producing abilities and beef carcass traits. The work may also help answer (and will at the very least stir up) very basic questions about the impacts of nature vs. nurture on how animals develop.

UAES animal scientists Ken White and Tom Bunch and members of their research team were all part of the first successful
effort to clone a member of the equine species—three identical mules born in 2003 and produced in cooperation with University of Idaho scientists Dirk Vanderwall and Gordon Woods.

"The mules are healthy and doing well," White says. "It was exciting to be part of that work, to be the first to produce equine clones. But we will gain much more information from the cattle work and that is very exciting to us and to people in the cattle industry."

Simplot is very involved in supporting the research, caring for the beef cattle, gathering data and keeping careful records of the animals’ development. But the things the team learns will be publicly available.

"The company is an important partner in this work," White says. "But the things we learn will not be proprietary. Scott (Simplot) just really wants to have an impact on the industry and help take this science to the next level."

In addition to exploring how cloning might be applied to producing superior beef and dairy cattle, White and his team of fellow professors, graduate and undergraduate students research assistants and technicians are also trying to solve some of the problems that prevent cloned calves from successfully developing and being carried to term. On average the team has about a 20 percent success rate of producing cloned embryos that are ready to implant in surrogate mothers. Six years ago their success rate was just 3 percent.

"Newer techniques we’ve learned and developed are putting us closer to a 20-30 percent success rate," White says. "But this is still an inefficient technology. We are learning a lot about differences in oocytes and cell lines. Now we know why so many of the pregnancies fail. It has everything to do with the development of the placenta and now we’re looking for ways to compensate for those problems."

To date, the group has produced about 40 beef calves. Not all of them survived, but mortality rates are not greater than you would expect in any population of calves. Some have unusually large navels because umbilical cords have grown larger trying to compensate for a lack of nutrients. The team is focusing on some specific placenta problems and altering conditions in the environment they create for the oocyte, or egg, when the desired genetic material is inserted and fused.

In the case of the beef cattle,
the team wants to determine whether outstanding carcass traits and efficient growth rates can be passed along to cloned offspring. Cells were harvested from several animals, including one steer that graded prime and weighed 1,200 pounds, compared with others who received the same feed and weighed 900 pounds. Differences among the cloned calves started to show early on, White says. At about two months of age, the clone of the especially large animal weighed 310 pounds and was a standout among calves from other cell lines that were born within four days of each other because they weighed an average of 185 pounds. At six months he looked as large as some of the yearlings.

"The really interesting thing will be to see what happens when these animals with high growth rates and some control bulls are bred with similar types of females," White says. "What traits will be inherited and what impact could that have on an overall population of animals?"

UAES researcher and Extension beef specialist Dale Zobell is working with White's team because while understanding the science is important, the goal is to consistently produce superior animals. If it turns out that rapid growth rates and top grade carcass composition are inherited by the cloned cattle and by their offspring who are conventionally bred it could give producers some big advantages.

"With an adult cell donor you are working with a known entity," Zobell says. "From a commercial point of view, if these traits are passed along and you produce calves that routinely gain weight faster and grade choice or prime, it will be huge. If you could go to a buyer and tell them you know every calf will
grade choice or prime it would be a big incentive for them to increase their bid on the calves."

Zobell says those higher grades of meat can increase profitability between 10 and 25 percent. Additional profits could also be realized by breeding cattle that are genetically predisposed to rapid growth because they require fewer days on feed to reach the same size as others in the herd.

Another bit of genetic research teamed with the right animal management and food handling could be another potential economic boost.

"We know there are genetic factors in tenderness and that there is a tenderness gene," Zobell says. "If we can breed that in and guarantee that the meat from the calves you are raising is going to be tender it would be huge. I can’t even guess how much that would be worth."

Product consistency is also a factor producers must consider because consumers want to be able to count on what they buy. That doesn’t mean that consistency comes easily, Zobell says, and especially not in beef. He points out that just one breed of chicken is raised for meat, but there are about 25 “main” breeds of cattle and many variations within breeds. That’s a lot of genetic information to sort through and understand.

“A commercial producer is not going to go out and get someone to create a herd of clones," Zobell says. “The idea is to get animals that can be used for breeding who will pass along their genes. That’s where we can have the biggest impact, breeding bulls with the traits we want with cows we’ve already got. We know our cows well. We know their blood lines and maternal characteristics.”

In related work, the research team has cloned calves from cells taken from dairy cows that were outstanding milk producers. Now the researchers must wait until it’s time for the cows to deliver their first calves and begin their first lactation cycles to see
whether they will take after their cell donor "mothers" or not. Researchers at several universities have studied the composition of milk from cloned cows and found it to be indistinguishable from milk produced by other cows.

While cloning extraordinary animals is an appealing prospect, learning to do it is not a simple task and certainly not a quick one.

"These aren't mice," White quips. "We want to study the genetics and fetal development of clones, but we've moved the work out of the lab and into the field because we have no interest in rodents. We want to be able to use the science in livestock because economic margins are critical to producers. That means working on larger time scales because we can't produce multiple generations of cows in a matter of a few months. Exciting as this is, we've learned to be patient."

— Lynnette Harris

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Most of us don't think of bacteria or the process of fermentation when we slice cheddar cheese or eat strawberry yogurt. In fact, it probably never crosses our minds. But for researchers Bart Weimer and Jeff Broadbent, it is seldom, if ever, not on their minds. For the past dozen years, Weimer and Broadbent have been studying the lactic acid bacteria responsible for fermentation in foods.

Weimer, director of the Center for Integrated Biosystems at Utah State University along with David Mills of the University of California-Davis, established the Lactic Acid Bacteria Genome Consortium (LABGC). The consortium is a collaboration of researchers hand picked by Weimer and Mills, from seven land grant universities around the country and includes Broadbent, a Utah State professor in the Department of Nutrition and Food Sciences.

The consortium's interest lies in eleven lactic acid bacteria and their roles in the fermentation processes used to produce foods such as cheese, yogurt, pickles and wine. Among the goals of the consortium are pinpointing the role of bacteria in food-fermentation and understanding the complex pathways involved in the fermentation process, as well as studying the relationships each has to related pathogens or disease-causing bacteria, which may lead to advances in food preservation and safety.

In order to understand the specific roles of these bacteria, one must understand fermentation—a process that is not as simple...
as it may first seem. Making cheese, for example, involves timing and precision. The process begins with whole milk. Heat and acid or bacterial enzymes, depending on the type of cheese being produced, are then added which causes the milk to coagulate. Starter culture bacteria is added to acidify and ferment milk sugars, which results in lactic acid production and a drop in pH. This acidic environment is maintained for specific amounts of time after which the curd is separated from the whey. Salt is added to the curd, and the cheese is the packed away at low temperatures and left to age. During the aging process, bacteria break down the milk proteins, fat and carbohydrates which, along with added enzymes, result in different textures and flavors depending on the enzymes added. After the cheese has aged for the desired amount of time, fermentation is complete, the bacteria having done their jobs at the many stages of the process.

Food scientists are interested in understanding how bacteria can survive during fermentation and why pathogenic bacteria don’t surface once heat, acid or enzymes are added. After working in the food production industry, Weimer became more interested in the science behind the process of food fermentation, especially in understanding what enables some bacteria to survive and why others don’t, and investigating the functions of specific genes in lactic acid bacteria.

In order to begin to understand the complexities of food-fermenting bacteria the genomes for each bacterium had to be sequenced. The consortium teamed up with the U.S. Department of Energy’s Joint Genome Institute (JGI), renowned for its work on the Human Genome Project, to obtain genome sequences for nine important food-fermenting bacteria. With the completion of
the genome sequencing, researchers were then able to employ gene array technology, a powerful new tool to analyze the expression of hundreds or thousands of bacterial genes simultaneously under different environmental conditions. A gene array consists of a checkerboard pattern of probes corresponding to different genes printed on a glass microscope slide. This allows researchers to "look up" the desired gene under different test conditions. Weimer likened the arrays to a phone book. Just as the phone book allows people to look up any phone number, with the advent of gene arrays, researchers are now able to look up the level of expression of any gene and begin to understand how the bacteria regulate genes under different environmental conditions. They can record the gene expression of the bacteria as they react to different environments such as heat, acid and salt. They can also inactivate or "knock out" certain genes related to protein metabolism and see how that alters the bacterium's survival or growth in certain environments. Each bacterial species has a different genetic composition and has to be tested individually.

Between the seven universities, each scientist has taken a bacterium and is studying it extensively. Weimer and Broadbent both study bacteria associated with cheese production. Weimer works on *Lactococcus lactis* and *Brevibacterium linens*, which are found in the starter cultures of cheese. Broadbent also works on *Lactobacillus casei* found in the non-starter make up of cheese. Both are excited about the rapid rate of progress and the numerous possibilities brought about by new technologies that allow them to do gene sequencing. With $20 billion worth of cheese...
shipped in the United States annually, it is easy to understand why the consortium and industry are excited at how fast this information is being processed and made available. Broadbent remembers in the very recent past when research went at a much slower pace.

“A grant would be written, and it would take a year and a half to choose a gene,” he said. "Now scientists can start with the gene in hand.”

Research has been pushed in a way that was not possible before. In fact, scientists at Utah State are already taking advantage of this information. Professors in the Nutrition and Food Sciences Department are successfully making an aged cheddar cheese with intense flavor, in 4-6 months by adding the Lb. Helveticus strain sequenced by LABGC scientists. Broadbent encourages anyone interested in the research or just interested in good cheese, to “pick up a sample the next time they visit our dairy and see if they agree it is some of the best cheddar ever made at USU.”

Scientists and cheese lovers at Utah State are not the only ones who will benefit from this research. Scientists all over the world are building on the work done by the LABGC and JGI. Broadbent stated it best when he said, "the engine that drives scientific advancement is best fueled by open dialog and information exchange."

— Audra Aston

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Just as the phone book allows people to look up any phone number, with the advent of gene arrays, researchers are now able to look up the level of expression of any gene and begin to understand how the bacteria regulate genes under different environmental conditions.
Seeing an expanse of lawn or a field of alfalfa prompts most people to think of little beyond mowing and feed for cattle. But many plant scientists see the same landscape wonder why some plants are less thirsty than others and how some plants tolerate salt or low temperatures while others wither and die.

Utah Agricultural Experiment Station researchers believe the answers lie in the genes. Although identifying the right genes is a challenge, it’s one they are taking on, identifying those that are the keys to specific traits in various species and using the information to give plants a boost up the survival-of-the-fittest ladder.

Alfalfa is Utah’s largest cash crop and boasts one of the highest nutritional values among common hay crops. Utah-grown alfalfa feeds the state’s robust dairy and meat industries, and is also a principal fuel for California’s dairy industry and is exported around the world.

Early in 2004, UAES researcher Yajun Wu assembled a team to identify drought tolerance genes in alfalfa. Funded by a seed grant from the university’s Center for Integrated Biosystems and a Community/University Research Initiative (CURI), Wu’s team is using both genomics and proteomics to unlock the genetic and functional secrets of alfalfa cells. Genomics means studying an organism’s entire set of genes, including instructions for making all of its proteins. Proteomics focuses on those proteins, how they interact to build an organism and their role in how that organism functions.

“We’re looking for differences in gene expression,” Wu said. “Once we identify genes with specific traits, such as drought tolerance, we can use this information to develop hardier plants.”

Wu calls it “an interesting phenomenon” that alfalfa grown in Utah has good yields and is of consistently high quality, but consecutive years of drought take their toll. Persistent drought conditions serve to deepen growers’ concerns about the impact of water shortages on crop production costs and yields. And even years with normal precipitation, Utah’s growing population and economic development will place increased pressure on finite water supplies.
“More drought-resistant alfalfa means less need for irrigation and more consistent yield,” Wu said.

The implications of Wu’s studies extend far beyond Utah’s borders. Drought and other environmental stresses, such as soil salinity and cold, are major inhibitors of food production worldwide, he said, and account for more crop failures than do pathogens and other causes.

Using a process called global gene expression profiling, Wu and colleagues are using a microarray system to sort through thousands of genes simultaneously. The researchers monitor how genes react to drought.

“Certain genes appear to ‘switch on’ in response to dehydration, allowing for the production of proteins that cause cell walls to expand,” said Wu.

Of course, identifying the drought-tolerance genes is just the beginning. “We put the genes back into plants and over-express them,” he said. “We still have to show that these genes are critical to drought resistance.”

Ultimately, Wu hopes to decipher a portion of the complex maze of genetic activity in which thousands of genes are switched on and off in response to a variety of environmental assaults. Such responses regulate cell wall development, which is key to understanding how plants survive.

“We’re still learning about the function of each gene,” he said. “As we examine when, where and how each gene is expressed, we gain a better understanding of the plant as a whole.”

Wu’s colleague and UAES researcher Paul Johnson is studying the genetic maze of a different plant, but has the same primary environmental concern—lack of water.

Johnson evaluates so-called alternative grasses for landscaping, such as Buffalo grass, and better-known standard turf grasses, such as Kentucky bluegrass, to determine optimal mixtures for water conservation and adaptability to temperature extremes. A growing awareness of the need to conserve water often conflicts with our traditional landscaping aesthetic that values expanses of green, well-watered, weed-free grass and increases the interest in research like Johnson’s.

Paul Johnson
"Across the country, more than 50 million acres of land are covered with turf," Johnson said. "That's an area the size of Nebraska and the largest component of that acreage is not golf courses or parks, it's backyards."

In the United States, turf grass seed production is second only to corn seed production, he explained, and unlike many other ground covers, grass doesn't just look nice and hold the soil in place.

"What other plant can you play on, sit on, trample and let your pet relieve themselves on?" Johnson asked. "We ask a lot from grass and still expect it to look good. Grass is very inviting and sociological studies indicate that grassy landscapes are the most calming and soothing for humans."

But many of the estimated 50 million-plus lawn owners in the United States are anything but calm about the appearance of their lawns. They edge, mow, water, fertilize and battle weeds until the grass on the other side of their fence couldn't possibly be greener. Still, expecting a lush expanse of green carpet so common in states east of the Mississippi in the parched and increasingly populous West is a very tall order, especially when the most commonly grown varieties of turfgrass require 1-2 inches of water each week. In evaluating different turf varieties, Johnson cites various trade-offs related to their characteristics and says that beyond adjusting sprinklers, landscapers and lawn owners will likely need to adjust their expectations.

"There's no perfect grass for every situation in Utah," he said. "Buffalo grass, for example, tolerates heat well but goes dormant and brown earlier than traditional varieties. Will homeowners tolerate a brown lawn for a few months of the year?"

Johnson doubts that prairie grasses can replace standard varieties in high traffic areas such as athletic fields and golf courses that require quick recovery, but new hybrids on the horizon may soon provide acceptable alternatives to traditionally used grasses.

"We're developing mixtures that match warm season grasses with cool season grasses to offer attractive, less demanding, more prudent options for residential, commercial and public landscapes," Johnson said.

He added designs that combine turf with other features—mulch, trees, gravel paths and rocks, for example—further lessen demand for water in the landscape while retaining turfgrass in areas where it makes sense.

"For color, texture and standing up to foot traffic it's hard to beat bluegrass, but it's not the only thing out there," Johnson said. "So for the spaces where the kids play, where you picnic in your yard or play croquet, plant some bluegrass. But in other places plant something more interesting that requires less water. We just need to plan to use turf areas intelligently."

— Mary-Ann Muffoletto & Lynnette Harris

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Brian Gowen is a research assistant professor in the Department of Animal, Dairy and Veterinary Sciences (ADVS). Prior to coming to Utah State, Gowen was a postdoctoral scientist at the National Institutes of Health's Laboratory of Human Bacterial Pathogenesis in Hamilton, Montana. He earned a bachelor's degree in microbiology at Colorado State University and his doctoral degree in biomedical science at the University of South Carolina School of Medicine. Gowen is currently investigating the role of Toll-like receptors in host defense against viral infection and the use of immune response modifying drugs as antiviral therapies.

Heidi Kratsch is assistant professor in the Department of Plants, Soils and Biometeorology and USU Extension horticulture specialist. She earned a bachelor's degree in agriculture and masters degree in biology, at the University of Wisconsin, and completed her Ph.D. in horticultural plant physiology at Iowa State University. Kratsch is associated with USU's Center for Water-Efficient Landscaping which promotes water conservation and quality through research in landscape irrigation and sustainability. Among her research interests are germination and root zone activity of native and drought tolerant landscape plants.

Susan Mannon is an assistant professor in the Department of Sociology, Social Work and Anthropology. Her research and teaching interests include gender, race and ethnicity, ethnographic methods, and labor market inequality. She was Fulbright scholar, conducting ethnographic field work in Costa Rica for her dissertation titled, "Our Daily Bread: Constructing Households, Constructing Labor Markets." Her UAES research contributes to an ongoing project examining family and work issues and focuses on Utah's growing Latino community. She earned a bachelor's degree in anthropology at the University of Michigan and her master's and doctoral degrees from the University of Wisconsin–Madison.
David Peak is professor and assistant head of Utah State's Department of Physics. While not new to the university, Peak is new to the ranks of UAES researchers and collaborates with biologist Keith Mott investigating networks of leaf stomata as they open and close to regulate plant respiration. The team studies how these dynamic networks may be an example of computation in a multicellular but non-neuronal biological system. Peak earned a bachelor's degree at the State University of New York–New Paltz and a doctoral degree at SUNY–Albany. His research and teaching interests include detecting and controlling chaos, self-organizing dynamics of subsurface water flow, and he is an avid supporter of undergraduate research.

Lee Rickords is associate professor and molecular geneticist in the Department of Animal, Dairy and Veterinary Sciences. He teaches graduate courses in medical genetics, embryology, molecular and cellular biology. Rickords' research interests include nuclear reprogramming of stem cells and adult somatic cells, gene regulation in early embryonic cells, gene screening and gene targeting. He earned bachelor's and masters degrees in animal science at Brigham Young University and his doctorate in reproductive physiology and genetic engineering at Louisiana State University. Prior to joining the faculty at Utah State, Rickords was a member of the graduate faculty at Oklahoma State University and director of molecular pre-implantation genetics at Children's Medical Center in Tulsa, Oklahoma, where he studied gene regulation and worked on diagnosis, analysis and gene sequencing related to genetic diseases and early developmental anomalies.

Quinton Winger's research focuses on understanding molecular and genetic regulation of embryo development. His work includes studying factors that regulate implantation in the uterus, placenta development, and how stem cells differentiate to become a wide range of cells in mammals. Winger earned a bachelor's degree in genetics and a master's degree in physiology from the University of Western Ontario, and a doctoral degree from Texas A&M University. He is an assistant professor in ADVS.

Heidi Wengreen was the subject of an undergraduate researcher profile in Utah Science six year ago and now joins the faculty as a research assistant professor in the Department of Nutrition and Food Sciences. Building on her experiences as a student researcher, Wengreen continues her investigations of nutritional epidemiology. In 2000, she said she loved being able to analyze data gathered from large populations—and loved it enough to make a career of it. "It's like putting together a puzzle," she said then, "And the things we learn can help so many people." Her research interests include ways in which nutrition affects incidence of hip fracture and memory loss in aging populations.
Sheep Genome Sequencing

Noelle Cockett, a Utah Agricultural Experiment Station researcher and vice president for Extension and agriculture is the principal investigator on the four-nation International Sheep Genome Sequencing Consortium that has begun work toward mapping the genome of sheep with the goal of improving meat and fiber production as well as animal health. Funded in part with a $1 million National Research Initiative Grant from the U.S. Department of Agriculture to Utah State University, the project involves researchers from Australia, New Zealand, Great Britain, and the United States.

"This collaborative project will provide additional resources for advancing genomics research in sheep," said Cockett. "It will allow us to develop overlapping pieces of DNA."

The results of international efforts to sequence the cattle genome are proving useful to the sheep research team. Having sequences of the cattle genome already available allows comparisons with the sheep genome and helps in positioning genes on the sheep genome map.

"Mapping the sheep genome will lead to advances in food and fiber production and identification of important traits in animal health and disease resistance," said Joseph Jen, USDA under-secretary of research, education and economics. "International collaborations like these are vital for promoting worldwide use and understanding of important scientific information.

In addition to Utah State, project participants include the USDA's Agricultural Research Service, Scotland's Roslin Institute, the United Kingdom's Biotechnology and Biological Sciences Research Council, Genesis Faraday in Great Britain, New Zealand's AgResearch and three Australian groups—Commonwealth Scientific and Industrial Research Organization, Livestock Australia and Australian Wool Innovation."
A Growing Legacy: Agriculture for the 21st Century

There was a time when barns and sheds were prevalent on Utah State University’s main campus and cattle were sheltered and fed in places where classrooms, laboratories and libraries now stand. Over the years, campus expansion and the changing needs of agricultural education and research moved many agricultural facilities and activities to more suitable locations.

Now, prompted by expansion of the university’s Innovation Campus and its growing role in state and local economic development, USU’s College of Agriculture, Utah Agricultural Experiment Station and USU Extension have an opportunity to create facilities to serve agriculture in the 21st century. Plans are underway to develop a new complex of classrooms, offices, computing labs, indoor and outdoor laboratories, and animal handling facilities on land just south of Logan on land associated with the university’s existing South Farm and Caine Dairy Teaching and Research Center.

“Constructing a new agricultural complex will allow even greater integration of our teaching, research and extension activities,” says Noelle Cockett, vice president for Extension and agriculture. “We have an opportunity to assess which activities will be best served there or on the main campus. It is really an opportunity to improve the ways we serve people in agriculture and develop future leaders.”

Research and teaching facilities currently on land north of the main campus—including animal stalls and barns, equipment sheds, laboratories, researchers’ offices, a feed mill and an equestrian arena—are not suitable for moving, but will be replaced at the new complex.

“Consolidating facilities will allow us to easily transfer new knowledge from the lab to adjacent animal facilities and research plots, and increase the involvement of our students,” says Paul Rasmussen, UAES director and associate dean of the college. “Faculty and students will have greater flexibility to work in classrooms, labs and in the field because the new agricultural complex will integrate all those activities.”

In addition to the new complex, the agricultural science building on campus will be replaced in the next few years. The E.G. Peterson Agricultural Science Building was constructed in 1953 and has not had a major renovation since. The building is high on the state’s list to be replaced due to safety concerns. As activities in the building have changed over the years, air handling systems have become inadequate for mixing laboratory, office, and classroom functions.

In addition, desktop computers, copy machines, printers and
high tech laboratory equipment were not the norm in 1953 and the building's electrical system has become severely overburdened in the ensuing years.

"The new building will be situated on the campus main quad," Cockett says. "It's a very appropriate spot since this is the state's land grant university and the only state school offering a comprehensive agriculture curriculum. We will have space to bring our agricultural economics faculty into the new building rather than having them in the business building, and new classrooms with multi-media teaching tools will be a welcomed by our professors and many others because the classrooms will be used for many courses offered by departments outside our college."

The university received funding from the Utah Legislature to move forward with the estimated $10 million project. Salt Lake City-based Robert Jacoby Architects and Associates have been selected to develop plans for the new complex.

"We are fortunate that legislators understand the importance of supporting agriculture in the state by helping us replace some important facilities," Rasmussen said. "Change is always challenging, but we see this as an exciting opportunity to create a complex that enhances our efforts in research, teaching and Extension."

Efforts are also underway to secure funding for a new agriculture building on the university's main campus. Learn more about the new facilities at www.agx.usu.edu.
Utah Botanical Center Earns Honor

In recognition of its efforts to inspire Utahns to work toward a more sustainable future by incorporating resource-conserving tactics in homes and landscapes, the Utah Botanical Center was among the projects honored at Envision Utah’s Governor’s Quality Growth Awards. The Utah Botanical Center (UBC), located in Kaysville, is a project of Utah State University, the Utah Agricultural Experiment Station and Utah State Extension.

Governor Jon Huntsman Jr., commended the selected projects for working now to improve Utah’s future. “These are great examples of projects that add to our quality of life, our economic vitality, our sustainability,” Huntsman said. “They represent a very futuristic look at the issues of growth, and I think that’s something to be applauded.”

Eleven projects from across the state were honored this year. The UBC’ mission is to raise people’s awareness that preserving natural resources enriches quality of life for all generations and that there are beautiful ways to live and landscape that are well suited to desert climates. Although a substantial portion of the UBC is still in the planning and development phase, the re-engineered ponds and surrounding plants and wildlife have been visited by thousands of school children on field trips tied to the state’s core science curriculum. The Utah House, which demonstrates sustainable construction and conservation of water, gas and electricity, has also attracted thousands of visitors and is the site of a variety of workshops and courses.

The UBC is also the site of ongoing research in many aspects of resource conservation, including propagation of native plants and demonstrating methods of grouping plants with similar water requirements in the landscape to help reduce water use.

“It is important to recognize that continued and accelerating growth in the state is going to have a huge impact on all of our lives,” said Dave Anderson, UBC associate director. “We live in the second-driest state in the nation and reducing water use in homes and landscapes is critical. It’s not about cutting back because of drought years, it’s about making choices that are more appropriate for where we live.”

The UBC has published a list of the flowers, trees and shrubs in the Utah House landscape, categorized by their level of water use. The guide also notes which plants are native to Utah, and which are especially attractive to butterflies and hummingbirds. For more information, including a printable version of the UBC’s Water-Wise Landscaping brochure, look online at www.utahbotanicalcenter.org.
**Roundup Ready Alfalfa**

Alfalfa is the nation’s third most important crop in economic value, and the highest valued perennial forage. More than 22 million acres are grown in the United States. More than 99% of alfalfa grown in the U.S. is for forage use.

Alfalfa is considered the premier forage crop for dairy cattle. The high forage quality requirements of dairy cattle result in a greater need for pure stands of alfalfa for that market. Weed control of annual and perennial weeds in alfalfa, has always been challenging to growers.

Weed control in seedling alfalfa during crop establishment and weed control in established stands are the key challenges for growers. If protected from initial weed competition, a vigorous alfalfa stand competes well with weeds that may invade the stand later. After establishment, alfalfa stands naturally thin over the years, thus allowing for additional weeds. Weeds reduce alfalfa yield, but more importantly, weeds reduce the forage quality of alfalfa.

**Roundup Ready Alfalfa**

Regulatory review was completed for Roundup Ready® alfalfa on June 27, 2005 for use on farms in the United States. Roundup Ready alfalfa is in the queue for regulatory approval in key import markets. Monsanto and Forage Genetics International will commercialize the limited quantity of Roundup Ready alfalfa seed by broadly licensing to seed companies across the country. To verify use of seed and forage only within the United States, dealers and the alfalfa growers who purchase Roundup Ready alfalfa seed will sign an agreement with Monsanto and Forage Genetics that the seed and the forage from their Roundup Ready alfalfa crop will be used on farms in the U.S. only. The current requirement to use Roundup Ready alfalfa products on US farms will be lifted when necessary import approvals are in place, anticipated by the end of this year.

“Although seed is very limited for this year’s fall planting, we wanted to ensure that hay and forage producers in the key alfalfa markets had a chance to experience Roundup Ready alfalfa as soon as possible,” says Mark McCaslin, President of Forage Genetics, International, a division of Land O’ Lakes. “Seed will be available to retailers in time for those producers interested in fall planting to buy some Roundup Ready alfalfa.” For details on the availability of Roundup Ready alfalfa seed, alfalfa growers should contact their local seed dealer.

“Roundup Ready alfalfa will benefit growers interested in producing high quality alfalfa. Field trials over the last five years have reflected higher yields and higher quality, especially showing benefits in the first year,” says Dr. Jennifer Ralston, Monsanto Technology Manager for Roundup Ready alfalfa. “The Roundup Ready alfalfa system also provides an easy means of managing weeds for alfalfa producers. The wide application window and the unsurpassed crop safety with Roundup Original MAX and Roundup Weather MAX sprayed over the top of Roundup Ready alfalfa allow the producer to have more flexibility than with conventional alfalfa.” Roundup agricultural herbicide use is an environmentally sound method of weed control with a 30-year history of safe use.

It has been six years since Monsanto and Forage Genetics conducted the first field tests with Roundup Ready alfalfa. “We are grateful for the excellent work of the university agronomists and weed scientists who have helped Monsanto and Forage Genetics to develop the product concept of Roundup Ready alfalfa. They have completed numerous scientific studies over the last several years and have given us excellent guidance on the agronomic recommendations for controlling weeds in alfalfa fields. Also, the University of California Seed Biotech Center published an excellent guide last year that outlined what alfalfa producers should expect from Roundup Ready alfalfa, especially in California.”

While pricing has not yet been announced, top alfalfa growers from across the country have indicated through market research that a system like Roundup Ready alfalfa would be expected to net $30–$80 per acre in the establishment year alone with the increased yield, quality, and simplicity of the system compared to conventional alfalfa production.

Ralph Whitesides: (435) 797-8252 ralpw@ext.usu.edu
Rasmussen Receives Award

The Renewable Natural Resources Foundation (RNRF) selected Philip Rasmussen to receive its annual Sustained Achievement Award, recognizing his long-term contributions and commitment to protection and conservation of natural resources.

Rasmussen is a professor of soil science and UAES researcher, and also wears several administrative hats serving as a UAES assistant director, assistant director of Utah State University Cooperative Extension, NASA geospatial extension specialist, and director of the USDA's Western Regional Sustainable Agriculture Research and Education (SARE) Program. But he is better known to countless farmers and land managers as, “No-till Phil,” a reflection of his years of dedication to conserving natural resources while emphasizing agricultural productivity.

Rasmussen spent the early part of his career establishing no-till research plots across the

Grain and Grass Releases

Unless otherwise noted, seed of these new varieties is available from the Utah Crop Improvement Association, Department of Plants, Soils and Biometeorology, Utah State University Logan, UT 84322-4820 (435) 797-2082

Blue Powder Indian Ricegrass

Nurseries, landscapers, homeowners and landowners will be primary users of Blue Powder Indian ricegrass. The plant has glaucous foliage—meaning it has a somewhat powdery, bluish-grey coating. It’s prominent stature and especially its high rate of germinability make it a good candidate for nursery production and landscape use. Indian ricegrass is the state grass of Utah and Nevada. Blue Powder came up as a volunteer in a seed-increase plot at the Utah Agricultural Experiment Station’s Greenville Research Farm and was noticeable because the plot produced both glaucous and non-glaucous plants. Seed harvested from those glaucous plants was bulked to form Blue Powder. It is noteworthy that seed harvested in 2002 had a 42.8% germination rate when it was planted following two weeks of chilling because many wildland seeds are difficult or impossible to germinate for nursery production.

Bozoisky II Russian Wildrye

Intended as a winter forage and a revegetation grass for arid and semiarid rangelands in the Intermountain region and Northern Great Plains, Bozoisky II has a much broader genetic base than other Russian wildrye cultivars and has been extensively evaluated on rangeland sites. The new cultivar was taller than two other commonly grown wildryes. Relatively slow seedling growth and development are the most serious limitations of Russian wildrye. Bozoisky II established significantly better and had a higher yield than did Tetra can and Tetra-I. In the Northern Great Plains and Intermountain region, Bozoisky II is adapted to sagebrush, mountain brush and pinyon-juniper on arid to semiarid rangelands.

Aquila barley

This new six-rowed spring feed barley developed in the Utah State University Small Grains Breeding program has an early heading date and a test weight equal or superior to that of other widely grown cultivars. Aquila traces its ancestry to crossbreeding that began in 1992. Aquila is recommended for growing under irrigation in the Intermountain region. Small grains geneticist and UAES researcher Dominique Roche named Aquila after the genus of several species of eagles, including the golden eagle (Aquila chrysaetos L.), which are found in mountainous regions, steppes and high deserts of most of North America.

After years of breeding selection and increasing the amount of seed, Aquila was subjected to Western Regional Irrigated Spring Barley Nursery tests for three years and grown for four consecutive years on 15 sites throughout Utah. The results of those tests show Aquila’s yield was not statistically different from that of widely grown Steptoe or Baroness barley, but its test weight was significantly higher than that of Steptoe and similar to that of Baroness. On average, lodging—the tendency of plants to lean severely or lie flat on the ground—can be
Intermountain West and encouraging the use of innovative and sustainable technologies. Devoting his career to a blend of research and extension work has made him an administrator with a "one-foot-in-the-field" approach to issues that confront people in agriculture.

His penchant for technology led him to work with personal computers when they were just beginning to be widely used in agriculture and natural resource management. He became the nation's first NASA-sponsored geospatial Extension specialist in 1999, pioneering the use of satellite data for precision agriculture and resource management.

The RNRF is a nonprofit consortium of scientific, professional and educational organizations whose primary purpose is to advance science and public education in managing and conserving renewable natural resources.

a problem in small grains, but Aquila's stiff straw resists lodging. In field trials only 9% of Aquila plants lodged as compared with 34% of Baronesse and 36% of Steptoe. Its average protein content is similar to that of the other two varieties. Preliminary tests show Aquila is susceptible to barley stripe rust, but resistant to barley loose smut and covered smut.

Goldeneye Barley

Goldeneye is another recently released six-rowed spring feed barley. It has high yield potential, very low propensity for lodging and a relatively high test weight. Goldeneye is named after two species of ducks that are common winter residents of Utah. The first generation of the new variety was grown in a greenhouse during the winter of 1990-91. Goldeneye is recommended for growing under irrigation in the Intermountain region of the United States. It has been tested for seven consecutive years in several locations in Utah and has yield similar to Steptoe and Millenium barleys and higher than that of Baronesse. Goldeneye is also resistant to barley loose smut and covered smut.

**TBTE001 & TBTE002 Wheatgrass Genetic Stock**

UAES and the USDA-Agricultural Research Service Forage and Range Research Laboratory joined to release wheatgrass TBTE001 and TBTE002 genetic stocks intended for inheritance and linkage studies. The waxiness of glaucous leaves plays a role in photosynthesis and resistance or tolerance to biotic/abiotic stress. The new stocks are intended for scientists studying leaf glaucousness, working toward isolating the gene that controls the trait, or studying inheritance patterns. Seeds of TBTE001 and TBTE002 are available (10 seeds per request) from Richard R.-C. Wang, USDA-ARS-FRRL, Utah State University, Logan, UT 84322-6300.

Dominique Roche: (435) 797-7214 DRoche@mendel.usu.edu
USDA Forage and Range Research Lab: (435) 797-3066 Web: http://wheat.usu.edu

Small grains breeder Dominique Roche inspects his research plots.
Aspen are valuable forest trees, but are rapidly being lost to grazing animals. Aspen reproduce only by sending up suckers from a root network, suckers which are a favorite food of livestock, deer and elk. Fencing to exclude animals is prohibitively expensive. Research done over the past several years on Utah’s Cedar Mountain has tracked migration and eating patterns of elk and deer at various times of the year and their interactions with livestock. We are identifying critical and less-critical periods of aspen development that can be used to schedule grazing and still allow trees to grow. We are also studying whether nutritional supplements can dissuade animals from eating aspen suckers, protecting ecosystems and providing immense cost savings over fencing. Aspen have an important place in Utah’s forests and provide habitat for many animals and birds.
An estimated 76 million people in the United States suffer from foodborne illnesses every year, and most of them get the bad "bugs" from food improperly handled at home. Eighty-eight percent of children regularly prepare food for themselves and others and USU researchers teamed up with LetterPress Software—a company based at USU’s Innovation Campus—to create a child-friendly tool that teaches them how to handle food safely. "Children Fight Bac!" is a series of interactive computer activities that were tested in 6th and 7th grade Technology, Life and Careers classes. Students enjoyed using the animated programs, increased their average hand washing time in class, and scored well on tests about food safety—including tests administered months after they had completed the modules. Utah family and consumer science teachers learned about the program at a statewide conference and the USDA distributed a brochure nationwide promoting the program. "Children Fight Bac!" won the 2005 Distinguished Achievement Award for Educational Software in the Children’s Science Programs category and was recently nominated for Best Educational Software and Most Innovative Software awards by the Association of Educational Publishers.

Development of Lactose-Surfactants and Polymers to Improve Water Utilization and to Reduce Soil Runoff in Agricultural & Municipal Set
Development of New Approaches to Rangeland Monitoring and the Assessment of Condition and Trend
Development of Whole-Genome Radiation Hybrid Map for Sheep
Diet, Cognitive Function, and Risk of Alzheimer’s Disease Among Participants of the Cache County Study on Memory, Health and Aging

Using layers of satellite images, USU researchers developed a model to give us a look at what the Wasatch Front might look like in the year 2030 based on population and settlement pattern projections. They created a series of alternative scenarios that predict patterns of development. The research is being used by stakeholders in efforts to make wise growth and land use planning decisions that consider impacts on open space, watersheds and prime agricultural land.
BEHAVE—which stands for Behavioral Education for Human, Animal, Vegetation and Ecosystem Management—inspires people to master and apply behavioral principles to better balance ecological, economic and social aspects of land and animal management. Researchers have discovered patterns of learning and behavior that can be used to protect overused and fragile ecosystems and improve economic outcomes. In addition to ongoing research, consortium members have produced 26 fact sheets, a 62-page booklet, a training video and DVD, conducted numerous seminars and short courses, trained a network of 110 facilitators to provide ongoing training for producers and agency staff tasked with managing millions of acres of public land in Utah and throughout the intermountain region.

Direct and Correlated Responses of Insects Adapting to New Crop Hosts
Diversity of Bacterial Endosymbionts in Homopteran Insects (Hemiptera: Sternorrhyncha)
Drought Management Project, Utah
Drought Management, Utah
Dynamics of Rhizosphere Chemistry: Influence on Sustainable Agriculture

Emerging Opportunities and Threats in Utah Agricultural Markets
Enhancing the Competitiveness of U.S. Red Meats
Environmental/Management Factors Affecting Use of Low-Quality Forages by Beef Cattle
Ethylene Synthesis and Sensitivity in Crop Plants
Evaluation of Surface Water, Radiation, and Energy Balances, and Possibility of Harvesting Solar and Wind Energies in Different Ecosystems
Evaluation, Development, and Management of Native and Adapted Grass Species for Turfgrass Applications in the Intermountain West
Examination of Spatial Scale Effects in Land Atmosphere Interactions

Factors Involved in Plant Stress Protection by Root Colonizing Pseudomonads

Determining the Cause of Pesticide Misapplication by Private, Commercial and Noncommercial Applicators of Utah

Research aimed at understanding why pesticides are often applied inappropriately lead USU scientists to develop education programs that are saving Utahns hundreds of dollars and reducing the amount of pesticides that are misapplied. More than 90% of participants reported that changes they made based on our research and reduced pesticide application costs by at least 10% and more than 25% of participants reported saving more than $200 annually over the past four years.
Progressive declines in brain function, known as dementia, threaten the independence of elderly people around the world. Alzheimer’s Disease, the most common form of dementia, currently affects more than 4 million Americans and the National Institute on Aging estimates that the cost of caring for them exceeds $100 billion annually. USU researchers embarked on the ambitious Cache County Study on Memory and Aging in 1995, tracking more than 5,000 Cache County senior citizens’ physical, mental and emotional health. Many facets of the study are now benefitting people, including recent findings that those who eat the most fruits and vegetables are less likely to develop dementia than those who eat the least. Reports are also forthcoming on effects of vitamins and other supplements, exercise, relationships and other factors that effect health and wellness as people age.
Evaluation, Development, and Management of Native and Adapted Grass Species for Turfgrass Applications in the Intermountain West

Utah, like much of the Intermountain West, is increasingly urban and turfgrass is the largest component of most urban landscapes. We are working to develop grasses and mixtures of grasses that can remain green and offer a safe surface for recreation while saving up to 50% of the water currently needed for turfgrass areas. For a 5,000 sq. ft. lawn this equates to a savings of approximately 25,000 gallons per year. For the traditionally used turfgrass species, management that is better tailored to growing conditions here will reduces the amount of pesticides applied as well as provide a 10-15% water savings.

Testing
Nutrient Cycling in Great Basin Ecosystems: Feedbacks Between Plants and Soils
Nutrient Dynamics in Forests and Woodlands
Nutrient Management and Water Quality
Nutrient Management and Water Quality
Nutrition and Management of Feedlot Cattle to Optimize Performance, Carcass Value and Environmental Compatibility (from NCT192)
Nutritional Characteristics of Forage Kochia (Kochia pro-strata) as a Forage Plant for the Utah Livestock Industry

Hydrochemical Models as Tools for Managing Crops and Soils Under Deficit Irrigation with Poor Quality Waters

A model capable to predict interactions between plants and their environment has been a sought after tool for managing sustainable agriculture and for environmental preservation. But those interactions are extremely complex and a model to predict them must account for variations among plant species, soil type, water quality and quantity, climate and management practices. USU researchers have developed such a model, the first of its kind, that successfully predicted water use and crop yield saline conditions in soils that impact plant growth. The models they developed are being applied to problems such as disposal of wastewater from electrical power plants through irrigation. Using wastewater in this way is less costly than using evaporation ponds or deep injection systems and saves Utah Power & Light customers about $48 million annually.
**Improvement of Winter Wheat Through Breeding**

It's not easy staying ahead of threats to Utah's grains industry. In the past 10 years, newly introduced insects such as cereal leaf beetle and Russian wheat aphid have attacked Utah crops. In addition, a new race of winter wheat disease, dwarf bunt, was discovered in the past five years. USU grain breeders continue to work on developing new cultivars that can stand up to pest and disease threats and produce high yields. It is a process that requires years of selecting and crossing superior parents, evaluating the resulting plants, harvesting and producing more seed. But resistance to insects and diseases is not the only consideration. Each grain variety possesses specific qualities that are important to mills, bakeries and other end-users. Utah is home to the nation's ninth largest milling industry and keeping our mills supplied with grain from local growers boosts the state's agricultural and economic stability, especially in rural communities.

**Pasture and Forage Research, Utah**

- Pasture and Forage Research, Utah Project at Utah State University
- Plant Genetic Resource Conservation and Utilization
- Population Change in Rural Communities
- Population Dynamics, Social Change and Outcomes: Spatial, Temporal, and Life Cycle Variations
- Position Utah Botanical Center to Promote Transition to Water-Efficient Landscaping Throughout the Intermountain Region
- Processes of Surface Hydrology in the Semi-Arid West
- Production and Use of Intermountain West Native Plants for Low Water Landscapes
- Production of Foundation Seed Stocks
- Production, Transition Handling, and Reestablishment of Perennial Nursery Stock
- Properties of Novel Cell Signaling Proteins
- Protein structure sensors through molecular imprinting: Applications towards prion detection and correction
- Public Lands and Rural Economics
- Puccinia thlaspeos as a Biocontrol Agent for Dyer's Wood

**Q**

Quantitative Soil Survey and Interpretation

**R**

- Rangeland Ecological Research and Assessment
- Rangeland Resource Economics and Policy
- Reducing the Adverse Impacts of Naturally-Occurring Food-Borne Toxins
- Regulation of Calcium and Phosphate Transport Across Intestine
- Regulation of Intestinal Phosphate Absorption
- Research Advances in Agricultural Statistics
- Research Planning Using the Current Research Information System (CRIS)
- Revegetation and Stabilization of Deteriorated and Altered Lands
- Role of K+ Channels in Nutrient Detection Mechanisms in Pre- and Post-Ingestive Chemosensory Cells
- Rootstock and Interstem Effects on Pome-and Stone-

**Inhibition of Lipid Oxidation by Milk Mineral in Cooked Meat**

USU food scientists identified a new antioxidant that is derived from whey and could be an economic boost to dairy farmers, food processors and retailers. Milk mineral is effective in slowing the rate at which fats in meat oxidize, become darker and cause off flavors. Milk mineral received USDA approval for use in turkey sausages and is being sought for other ground beef and pork products. Researchers have determined optimum amounts of milk mineral that help preserve meats and estimate potential sales in Utah of $45,000 and $2.25 million nationwide. In addition to extracting value from what would otherwise be a dairy byproduct, producers would save money usually spent on whey disposal.
Improving management and use of irrigated pastures can potentially reduce feed costs by $12.5 million annually for Utah’s dairy farmers and reduce cattle feed costs by $21 to $30 million. Plant breeding research continues to identify grasses and legumes that are drought tolerant, heavy forage producers and provide high nutrition levels. A new research facility has been established which allows us to more effectively integrate studies of the complex relationships between plants, soils, irrigation and animals and share new findings with dairy and cattle producers statewide.

Fruit Trees
Rural Communities and Public Lands in the West: Impacts and Alternatives
Rural Communities, Rural Labor Markets and Public Policy
Rural Sociology (Administrative Project)

Science and Engineering for a Biobased Industry and Economy
Selection and Production of Nitrogen-Fixing Native and Non-Native Plants for Sustainable Intermountain West Landscapes
Silviculture of Intermountain Subalpine Forests
Small Fruit and Viticulture Research

Social and Biological Aspects of Community Forests
Social Change and Well-Being in Amenity-Growth Rural Communities: The Role of Seasonal and Episodic Residents
Social Equity and Ecosystem Management: Integrating Social Science in Resource Planning, Policy, and Decision making
Software Development for Landscape-Level Cost-Effectiveness Analysis of Invasive Plant Management
Soil-Mediated Controls on Weed Establishment and Growth in the Field
State-Federal Income Taxes: Stability and Effect on Economic Growth and Farm Saving
Strong Marriages in the Native American Culture
Structural Changes in Livestock-Based Agriculture in the West: Implications for Rural Well-Being
Sustainable Cropping Systems Utilizing Low-Cost Precision Agriculture and Remote Sensing Techniques
Systems to Improve End-Use Quality of Wheat

The Ecology and Management of Disturbance in Intermountain Subalpine Spruce-Fir Forests
The Management Style and Competence of Dairy Farmers as an Indicator of Profitability and Productivity
The National Atmospheric Deposition Program (NADP)
The Role of AP-2 Transcription Factors in Bovine Reproduction
The Role of Phosphoinositide Signaling in Bovine Reproduction
The Utah State University Multicultural Scholars Program
Toxic Effects of Minerals, Plants, and Interactions of Plants with Minerals in Livestock
Turfgrass Management in the Intermountain West: Conservation of Water and Nutrients

Use of Biotechnology and Fermentation Technology in Food Processing
Using Cattle as Vegetation Manipulation Agents in Sagebrush Communities
Using Genomics to Address Health and Disease Resistance in Livestock
USU Analytical Laboratories
Utah Botanical Center - Spring and fall 2006 field trips were completely booked.

Utah Climate and Weather Database
Utah Consumer Bankruptcies: Why Do We Lead the Nation?
Utah Health, Nutrition and Lifestyle Survey of Adults 50 Years of Age and Older
Utah State Botanical Garden Service Project
Utah State University Insect Collection and its Maintenance

Testing the Olfactory Concealment Theory
The newest Utah orchard use rootstock/cultivar combinations that can reach full size and production within 3-5 years of planting. Production in these high-density orchards can be 200% higher than with conventional fruit production, but not all varieties are well suited to Utah growing conditions. Researchers are testing apple, tart cherry and peach rootstocks. These fruits represent those grown on an estimated 6,100 commercial acres in Utah, which have an estimated product value of about $16 million annually. Trials of 18 apple varieties were conducted in orchards around the state and researchers identified five with the greatest potential to benefit Utah growers. Information on yields has been shared with growers annually at the Utah Horticulture Association conference and through several publications. A comprehensive survey will be conducted this year to assess grower’s practices. If these newly tested varieties result in a modest 10% yield increase, the state’s fruit industry will see an estimated increase of $1.6 million annually.

Social and Biological Aspects of Community Forests

Trees are important in urban and rural landscapes, and most people value the trees in their communities. Researchers found that people believe pruning trees is alright when the goal is healthier trees. But those same people can become disgruntled and angry when trees are pruned for utility line clearance. Power outages cost the nation’s economy $119 billion annually and trees cause a large percentage of those outages. USU researchers have improved pruning methods that consider esthetics and not just cutting around the power lines and developed materials to educate people and increase acceptance of tree pruning.
While the Utah Botanical Center continues to develop, the research and educational activities there are moving forward and providing benefits to people well beyond Davis County. Research on how to propagate plants that are native to Utah, or well-adapted to our high desert climate, is helping nurseries adopt new techniques that will make these drought-tolerant landscape plants more readily available. Demonstrating beautiful and waterwise landscapes provides people with plans adaptable to their home landscapes, an important step in conserving Utah’s limited water resources. The Utah House has hosted more than 10,000 visitors, and more than 3,500 school children annually visit the Center on field trips focused on wise resource use and ecology of the site’s ponds and wetlands, all based on the state’s core science curriculum.

Supported by a statewide network of weather stations and using more than 100 years of archival data, the Utah Climate and Weather Database collects and coordinates climate data for the state that is vital to people and businesses statewide. Information they manage and products they create provide data that allow engineers to determine snow loads on structures, farmers to better manage their crops and water resources, and policy makers to develop energy codes and regulations suited to Utah’s varied climate regions.
Distribution of Appropriated Funds:

Federal Appropriations: $1,949,709 6.4%
Hatch: $985,805 3.2%
McIntire-Stennis: $226,841 0.7%
Hatch RRF: $707,264 2.3%
Animal Health and Disease, Section 1433: $29,799 0.2%

State Appropriations: $12,221,800 39.7%

Total Appropriations: $14,171,509 46.1%

Grants, Federal, State, and Private: $16,588,350 53.9%

Personnel:

Faculty: 60.9
Staff: 158.4
TEACHING CHILDREN TO

Fight BAC!

Illustrations Courtesy of Letterpress Software
An estimated 76 million people suffer from foodborne illnesses in the United States each year according to the Center for Disease Control and Prevention. Janet Anderson, associate professor of dietetics at Utah State University, is working to reduce that number and has created an award-winning way to teach children about safe food handling.

Anderson developed a program called Children Fight BAC!, which teaches valuable food handling skills using humor and interactive computer activities. The project is supported by the Utah Agriculture Experiment Station.

The goal is to teach 5th–8th grade students why they need to handle food safely and how to do it. The project is comprised of 12 interactive lessons that teach students how to clean, separate, cook and chill foods. The modules allow students to virtually participate in 27 activities such as placing food
in the correct place in a refrigerator, and learning the temperatures needed to thoroughly cook various foods. Animated microorganism characters lead students along presenting instructions, information, and a little humor—and it works.

The program, designed and developed by LetterPress Software, Inc. in the Utah State University Innovation Campus, received an international EDDIE award, at the Ninth Annual Education Software Review Awards for excellence in software educational programs. It was also awarded the 2005 Distinguished Achievement Award for Children's Science Software by the Association of Educational Publishers.

In Anderson's previous research, she found that although foodborne illnesses make news when several people become ill after eating tainted restaurant food, people make a lot of food handling mistakes at home. Symptoms of foodborne illnesses vary widely from mild to severe stomach discomfort and other upsets in the gastrointestinal tract. Annually in the United States 325,000 people are hospitalized and 5,000 die due to ingesting foodborne toxins. People with compromised immune systems, young children and the elderly are especially susceptible.

Instead of focusing on adults, Children Fight BAC! focuses on middle school-aged children who are learning how to cook and are preparing more food at home. The hope is to teach them healthy food handling habits before they develop bad ones. Anderson also found that there was a lack of educational materials concerning food safety for this age group.

The program was evaluated at Mount Logan Middle School in Logan, Utah, and involved 130 6th grade students in technology, life, and career classes. Before using the Children Fight BAC! modules, students were observed preparing a meal of a sandwich and

**Animated microorganism characters lead students along presenting instructions, information, and a little humor—and it works.**
"Not only were they highly engaged in the program, they learned from it."

a fruit smoothie. On average, students washed their hands before handling food for barely 15 seconds, and some only when a teacher prompted them. The Food and Drug Administration recommends washing for at least 20 seconds with soap, agitation and running water. The students also took a pretest about basic food safety knowledge, and the average test score was just 59 percent.

After completing Children Fight BAC! activities, students were given a post-test, and the average score was 90 percent. They were again observed preparing a meal and this time washed their hands for an average of 26 seconds. One month later another food safety test was administered to assess how much the students retained and the average score was 83 percent.

“We are thrilled with the program because the students loved the animated cartoon program and all of the interactive games,” Anderson said. “Not only were they highly engaged in the program, they learned from it.”

Children FightBAC! is a cooperative effort involving USU, the Safe Food Institute, LetterPress Software, and the Partnership for Food Safety Education. Anderson is working with the USDA to determine the best way to get the program into the hands of teachers. A look at the program is available online at www.childrenfightbac.org.

— Lindsay Nelson

Contact Info:

Janet Anderson: Janet.Anderson@usu.edu

LetterPress Software: www.lpsoftware.com
Aaron Davis says although many classes have taught him about what research is, now he’s learning about how research is done—and the difference between hearing and doing has changed his career path. Aaron was an international studies major and joined Professor Ken White’s laboratory in August 2004 after hearing the professor give a public lecture about embryo transfer research. Aaron approached Dr. White following the lecture and asked about the possibility of studying some aspect of embryo cloning. Since joining the nuclear transfer team, Aaron made a change to animal science and is headed for graduate work in reproductive biology, continuing his work in White’s lab. His research focuses on trying to understand and improve the health of placentas that support the development of cloned embryos. A major limitation of the successful development of cloned embryos is that the placenta is often compromised. Aaron’s task has been to create a line of stem cells that develop into placental tissue. The goal is that those cells could be injected into a nuclear transfer embryo and that they would supplement the cells that develop into the placenta. If the team is successful, this innovative procedure will lead to more competent placenta development and more cloned embryos resulting in live births. Results of his undergraduate research paved the way for his graduate program and could have far-reaching effects in our understanding of reproductive biology.

— Lindsay Nelson & Lynnette Harris

"His research focuses on trying to understand and improve the health of placentas that support the development of cloned embryos."
search: Science on the web

Find Utah Science and other information about the people and projects of the Utah Agricultural Experiment Station online at www.agx.usu.edu

Visit these Web sites for more information related to topics in this issue of Utah Science.

Cattle Cloning
http://biosystems.usu.edu/cloning

More about cloning at USU.

Lactic Acid Bacteria in Cheese
This Department of Energy website offers information regarding the microbial genome program, including which microbes are of interest and why they are important, and provides links to publications and microbial genome databases.
http://microbialgenome.org/organisms.shtml

More information about USU researchers’ work with microbes at the university’s Center for Integrated Biosystems.
http://www.biosystems.usu.edu/research/focus_areas/detail/index.php?id_topic=1

Children Fight Bac
www.childrenfightbac.org

Try out online demonstrations of a few of the Children FightBac! activities and lessons at the LetterPress Software website. Will you make all the right moves as you put food into the virtual refrigerator?
http://www.lpsoftware.com/online.html

Small grains
Learn more about USU’s wheat and barley breeding programs, yield trials and variety releases at the Small Grains Research website.
http://wheat.usu.edu/

The Utah Crop Improvement Association website is the place to find information about certified field production, seed availability and a certified seed directory.
http://www.utahcrop.org/

The UAES offers these recommendations as a service to readers, but is not responsible for the content of sites it does not produce.