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Genetic research at UMC

Kimber grapples with problems of developing improved wheat

By Jyoti Dutta
University Information Services

Some people say scientists have a flair for the dramatic. How else could one describe their actions when considering their accomplishments since the dawn of scientific discoveries?

Gordon Kimber, UMC professor of agronomy, does not see it quite that way. Yet, only recently, he figuratively shook the international scientific community with his refutation of a long-standing theory about wheat evolution.

In essence, Kimber has challenged wheat's parentage.

To begin with, all wheats—whether they are used for making bread, pastry, macaroni or spaghetti—have a certain commonality. Geneticists like Kimber call this a "genome." In human beings, the genome is the basis of the general similarity among men. Genes account for individual differences. There are three genomes in bread wheats. Scientists call them A, B and D.

Until Kimber made his findings, geneticists thought that the B genome came from *Triticum speltoides*, often called "goat grass," a species related to wheat. Kimber's research shows that *Triticum speltoides* is not the real donor of B genome, and at present no one knows the real donor.

"What we have here is a major change in our appreciation of the evolutionary pathway of the wheat," Kimber says. "This may cause scientists to reconsider how they introduce desirable characteristics from related species. It changes our whole concept of how wheat originated."

Besides being "scientifically pleasing," Kimber says, the discovery could have some long-range benefits to wheat producers—if the real B genome donor can be found.

"The basic rule of genetics is that you can't breed unless you have variability," he says. "If you can add anything in the way of variability, it could improve the breed. Such could be the case if we find the missing link."

Kimber is on the track of that missing link, although he concedes it could be quite a while before it might be found.

In the meantime, he and his associates in the laboratory are engaged in various other research projects. They have already produced a very unusual hybrid, a cross between a barley and a wheat. They have treated the hybrid chemically to make it fertile, and if they succeed in doing so, this could open the door to putting barley characteristics into wheat varieties—a factor which eventually could mean improved wheats.

Research by UMC geneticist Gordon Kimber is causing scientists to alter some of their most basic ideas about the evolution of wheat.

Dramatic discoveries in the wheat research laboratory at UMC are not uncommon. The laboratory's fame started with the works of Dr. Ernest R. Sears, who joined the University in 1936 on an USDA appointment. He received worldwide recognition for his wheat rust research, which has helped to save millions of bushels of wheat annually.

Kimber came to Sears's lab about 10 years ago from Cambridge, England. Research in his laboratory is concentrated on wheat and its relatives, on studying their cytogenetics, evolution and relationship with wild species.

What is done in his lab is essentially basic research with clear practical application in mind. "I consider the establishment of the basic cytogenetic framework our most important goal," he says.

One of the main concerns of Kimber's laboratory is transfer of genes from wild species to the cultivated form. In some of the species related to wheat there are many desirable features, ranging from disease resistance to short straw and even such characters as cross-pollination mechanisms. The introduction of such characters into the wheats of commerce would make available a range of variation normally outside the scope of conventional plant breeding, Kimber says.

"Variations in cultivated wheat are limited," he says. "Any way you can transfer desirable features is welcome."

Dr. Moshe Feldman, Kimber's co-researcher in the lab, has been doing that. Feldman is a visiting professor from Israel. He has brought from that nation a wild variety of wheat with high protein content. He is now trying to transfer this feature into the wheat of commerce.

"You can easily guess what success in this research will mean to the developing countries," Kimber says.

Successful work in the wheat research laboratory is a joint effort, a collaboration of many people, even people from outside the national boundaries, Kimber notes. In addition to Dr. Feldman, a visiting professor from West Germany, Dr. Friedrich Zeller, is working with Kimber on the relationships of wheat and rye and rye cytogenetics. There was a researcher from India in the UMC lab who successfully developed a new staining technique to identify individual chromosomes. Other workers and visitors have come from Denmark and Australia.

"Our program is quite well known among the wheat researchers," Kimber says. "There may not be more than 10 or 12 groups in the world working in this area.

"We must well understand the relationship between the wild and the cultivated species of wheat. Only through this understanding can we bring in the many desirable characteristics from the wild ones to the cultivated ones. We badly need new genetic materials.

"And only wild species have them."

Board actions at a glance

Meeting May 20 in Columbia, the Board of Curators

- Increased the supplemental fee for UMKC dental students $330 per semester, effective next fall, bringing the annual fee to $1,870 for resident students.
- Discussed a self-insurance plan for medical professional liability insurance (malpractice insurance).
- Approved a plan to separate UMSL's fine arts department into a department of music and a department of art and to change the department of sociology and anthropology to the department of sociology, anthropology and social work.
- Changed the name of UMR's Materials Research Center Building to Martin Straumanis Hall in honor of the late Martin Straumanis, UMR metallurgy research professor from 1948 until his death in 1973.
- Approved a UMC proposal to sublease a building at 312 S. Ninth St. to serve as a branch library and to reduce storage problems in the general library.
- Awarded a construction contract for $129,941 to Prost Builders, Inc., of Jefferson City and Columbia for renovation of athletic dressing rooms at UMC's Memorial Stadium.
- Retained Kansas City architects Horner and Blessing to design an outdoor recreational facility at UMKC on land north of Volker Boulevard. The facility is to include four playing fields, six tennis courts, eight handball courts and dressing rooms.
- Awarded a contract for $156,400 to Prost Builders, Inc., to renovate restrooms in UMC's Stafford and Graham dormitories.
- Retained Detroit architect Cornelius L. T. Gabler to design a 2,000-square-foot storage addition to the Research Reactor Facility in Columbia.
- Awarded a contract to Lerch, Bates and Associates of Littleton, Colo., to prepare specifications for bringing 97 elevators on the four campuses into compliance with safety regulations. The modifications, expected to cost $263,580, will cause elevators to return to their main landings when smoke or fire is detected or a fire alarm is sounded.

Sidelines

New Letters

The spring issue of *New Letters*, UMKC's literary quarterly, has been published. Included in this issue are articles on poetry as therapy, by Heather Wilde, and covert censorship, by H. Bruce Franklin, fiction by James Schevill and poetry by Melvin B. Tolson, Rolf Dieter Brinkmann, Edwin Honig, David Kherdian, Carl Rakosi and Larry Rubin.

Copies, at $2.50 each, may be obtained by writing to *New Letters*, UMKC, 5346 Charlotte, Kansas City, Mo. 64110.

Degree for Unklesbay

A. G. Unklesbay, UM's vice president for administration, received an honorary doctor of science degree last month from Marietta College, where he earned his bachelor's degree in 1938.

Dr. Unklesbay joined the UMC faculty in 1947 as an instructor in geology. He was department head in 1966 when he was appointed executive assistant to John C. Weaver, who was then president of the University.

Zick appointment

Don Zick, central administration manager of employe training and development, has been appointed head of the College and University Personnel Association's Council on Training and Staff Development and has been named to serve on the group's Professional Development Advisory Committee as well.

Nobel laureate lectures

Biologist contemns restrictions on freedom of scientific inquiry

UM's fourth Thomas Jefferson Distinguished Visiting Professor was David Baltimore, 1975 Nobel laureate in physiology and medicine. A professor of biology at the Massachusetts Institute of Technology, Dr. Baltimore serves also as American Cancer Society professor of microbiology and consulting scientist in medicine at Boston's Children's Hospital Medical Center, and as consulting scientist in pediatric oncology at Children's Cancer Research Foundation in Boston. He holds degrees from Swarthmore, MIT and Rockefeller University. He has been on the MIT faculty continuously since 1968, having interrupted an earlier one-year appointment as post-doctoral fellow to accept a similar fellowship at Albert Einstein College for a year and to spend three years as research associate at the Salk Institute for Biological Studies.

Following is a transcript of his lecture, which was delivered last month at the annual Jefferson Club dinner at the Ramada Inn in Columbia:

At the end of a recent Woody Allen movie he tells an old joke that provides a convenient place to start tonight's discussion. A man in psychoanalysis one day says to his analyst, "My troubles are minor compared to those of my brother: he thinks he's a chicken." The doctor responds by asking why the man hasn't had his brother committed for treatment if he is so sick. The man answers, "I would, but I need the eggs."

This joke neatly sums up the traditional relation of science and society: society tolerates science because the products of science have been seen as beneficial.

That joke reminded me of a presumably apocryphal story I heard many years ago told about IBM. A man is shown through the main IBM facility and sees room after room carefully partitioned into small offices with neat desks, gray flannel suits and an air of calm efficiency. Then his guide accidentally opens a door through which the guest sees a room of chaos: bearded men in jeans, feet up on cluttered desks and a general aura of disrespectability and disorder. The guest turns to his guide and inquires about what's going on in there and why does IBM put up with it. The guide, with some embarassment, says, "Those are our basic scientists. We would love to get rid of them because they clearly don't fit in, but we can't because without them we wouldn't have a business."

The relationship where science is tolerated for its assumed beneficial results is now under strong attack on many fronts. Among the areas being questioned most strongly is that of contemporary research in biology. This evening I would like to tell you a bit about what modern biology has accomplished recently, why its utility is being questioned and therefore its very existence is being threatened and what the unthinking restraint of biology implies for the future of intellectual endeavor in our country.

Over the last 40 years a new science was born and brought to the highest level of accomplishment: it is called "molecular biology," and it differs from classical biology by being quantitative, analytical and chemical in its foundations while classical biology was more descriptive and phenomenological. Molecular biology has revealed to us the nature of one of the most fundamental and mysterious of all substances, the gene. Like all mysteries, there was a very simple underlying reality to the transmission of characteristics from parents to children: a code based on four letters holds the information and its physical storehouse is a virtually endless polymer called DNA. Knowing where genes were to be found, Watson and Crick in 1953 showed how DNA is organized and how it assures that information is transferred with almost perfect reliability from parent cells to progeny cells. Following their monumental achievement, many scientists contributed to learning how to make DNA, how to read DNA, how to rejoin DNA and, in general, how to manipulate genes at will.

What good has all of this new knowledge brought to the average person. The benefits of biology can be expected to come in the form of medical advances, or increases in food production, or in other changes in living processes which are positive contributions to civilization. But molecular biology, for all of its power as a basic science, has not been easily translated into practical advances. This is a situation which could change very soon. New discoveries are rapidly bringing molecular biology closer to an ability to affect the lives of the general public.

Of all the advances that have occurred, the most important is probably the development of a process called recombinant DNA research. This is a methodology whereby different pieces of DNA can be sewn together using enzymes and then the chimeric DNA can be inserted into a bacterium where it will multiply indefinitely. Because this methodology allows genes from any species in the world to be put into a common bacterium, there is the theoretical possibility of hazard in this research. The potential for hazard led a number of scientists, including me, to issue a call in 1974 for restraint in the application of these new methods. We were addressing a limited problem: could there be a recognizable hazard in the performance of certain experiments. That limited question opened a flood gate; other questions came pouring out and are still coming. They have led to a front-cover story in *Time* magazine, to an almost certainty of federal legislation this spring or summer, to a serious demoralization of some of the community of basic research biologists, and, most significantly, to a deep questioning of whether further advances in biology are likely to be beneficial to our society or harmful.

Most of the discussion you may have heard about recombinant DNA research has probably centered on whether the work is likely to create hazardous organisms. The mayor of Cambridge, Mass., raised the specter of Frankenstein monsters crawling out of the MIT and Harvard laboratories. The Andromeda Strain has been much in the headlines of stories about recombinant DNA. I am satisfied that most of such talk is simply science fiction and that the research can be made as safe as any other research. The people who make the arguments most strongly that recombinant DNA research is not going to create monsters are those who understand infectious diseases best and the ones who are hardest to convince are those with least experience in that area. But rather than defend my judgment that the safety issue has been blown up out of all proportion, I want to consider some of the more general issues that have been raised by the controversy.

If safety were the most important consideration behind the debate about recombinant DNA then we might expect the debate to focus on the hazards of the doing of recombinant DNA experiments. Instead, many of the discussions that start considering such questions soon turn to consideration of genetic engineering.

Let me digress a moment to explain the phrase "genetic engineering." Not everybody's genes are perfectly designed for the job of being a functioning human being. Many people have blood disorders, mental problems and a host of other disabilities that are traceable to a malfunctioning gene. It would be a triumph of medicine if the effects of such genes could be countered, and two of the approaches that have been considered are both called "genetic engineering." One approach involves altering some cells of the body so that they can carry out the needed function. A patient could, for instance, be treated in this way for a blood disease caused by an abnormal protein made by a mutant gene. A normal gene would be inserted into the precursors of his or her blood cells so that the normal protein would be made in place of or along with the aberrant protein. The genetically altered blood precursor could then cure the patient's disease, but the malfunctioning gene would still be transmitted to the patient's offspring. This form of genetic engineering would not change the gene pool of the species, and thus presents minimal moral problems. It is likely to be the first type of genetic engineering tried on human beings and could be tried within the next five years.

The second type of genetic engineering presents more of a moral dilemma because it could change the human gene pool. This would involve replacement of genes in those cells which transmit their genes to our offspring. Such cells are called "germ cells." Replacement of germ-cell genes would be very difficult and is, I suspect, at least 20 years off, but it presents no theoretical problems—only formidable logistic problems.

Both forms of genetic engineering, but especially the engineering of germ cells, present a very deep and perplexing problem: who is to decide, and how shall they decide, what genes are malfunctional? Fear that dictators will decide, and that their criteria will be the maintenance of their own power, has made the phrase "genetic engineering" symbolic of the moral problems that can be created by modern biology.

It should be clear from this description that genetic engineering of human beings is not the same as recombinant DNA research. But the two are rightly linked because recombinant DNA work is bringing closer the day when genetic engineering is a feasible process for use on certain human diseases. But recombinant DNA work will bring closer many possible new medical treatments, and is likely to bring other new capabilities; why then so much focus on genetic engineering? I think the preoccupation with genetic engineering results from its being a symbol of technology gone wild. Many people feel that if the possibility of curing a genetic defect by gene therapy should ever become a reality, the inevitable result would be people made to order. And that would truly spell the end to humanity as we now know it. It is the slippery slope argument: once you take a step over the edge you inevitably go downhill, and recombinant DNA research is seen as the first step inexorably leading to a world of manufactured human beings. It is argued that unless we block recombinant DNA research now we will never have another chance to control our fate.

To see the form of this argument most clearly and to highlight its danger to intellectual freedom and creativity, we should realize that similar arguments have been put forward in other areas. One of the most respected critics of recombinant DNA research, Dr. Robert Sinsheimer, has, for instance, made comparable analyses of two other research topics: aging research and attempts to contact extraterrestrial beings. He argues that if aging research is successful, then people will begin to live to much older ages and the changed age structure of the population along with the increased steady-state population will bring serious stresses to society. His fear about searching for extraterrestrial beings is that we could be successful. He considers that the discovery of civilizations much more advanced than ours would have effects like those the Europeans had on native Americans after the discovery of the New World. In the case of recombinant DNA research as well as the other topics, Dr. Sinsheimer says we should avoid studying these areas of science. Rather, he believes, we should put our resources to investigating areas of proven need such as fertility control.

All of these examples, and I could choose many others, especially outside of biology, have the same general form: people believe that there are areas of research that should be taboo because their outcome might be, or in some scenarios will be, detrimental to the stable relationships that characterize contemporary society. I have heard the argument in a different and more pernicious form from members of a Boston-area group called Science for the People. They argue that some research in genetics should not go on because its findings might be detrimental to the relationships they believe *should* characterize a just society.

Now we see what's going on: it is Lysenko again. For those of you who may have forgotten about Lysenko, let me refresh your memory. He was a Russian biologist, who was only recently repudiated, who believed that acquired

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characteristics could be inherited. Simply put, he believed you could produce a race of tail-less dogs by cutting off the tails of dogs over numerous generations. Lysenkoism was the official genetics of the Soviet Union for many years, and during that time, no other genetics was allowed. Only now is the Soviet Union recovering from the imposition of this orthodoxy on science. Why did Lysenkoism flourish? Because the political leaders believed that any other assumption about genetic processes was counter to Marxist-Leninist thought. To use the phrase I used before, they considered any other genetics dangerous to the relationships they believed *should* characterize Soviet society.

As I see it, we are faced with the question: "Should there be limits placed on scientific research that are based on the danger that knowledge can present to the established or desired order of society?" Having thus posed the question, I believe that there are two simple and almost universally applicable answers. First, the criteria determining what areas to restrain are inevitably political criteria and therefore will reflect a dominant ideology that is so likely to change in the near future that it does not provide a trustworthy guide for restraint. Second, attempts to restrain directions of scientific inquiry are more likely to be generally disruptive of science than to provide the desired specific restraint. So I am making two arguments: one is that science should not be the servant of ideology, because ideology assumes answers but science asks questions; the other is that attempts to make science serve ideology will be generally disruptive of science without assuring that only desired questions are investigated. Put simply, I'm saying that we *shouldn't* control science and anyway *we can't*.

Before trying to put some flesh on the bones of these arguments I must make a crucial distinction. I am talking here about basic scientific research, not about the technological applications of science. As we go from the fundamental to the applied, my arguments fall away. There is every reason why technology should and must serve specific needs. Conversely, there are many technological possibilities that should be restrained. There is no reason for us to be servants of our technology; we must rather be its master. But we must in the end be the servants of truth, and the discovery of truth is the role of basic research.

To return to basic research, let me first consider the danger of restricting investigation because its outcome could be disruptive to society. There are two dangers here: one is the fallacy that you can predict what society will be like even in the near future. To say, for instance, that it would be bad for Americans to live longer assumes that the birth rate will stay near where it is; but what happens if it falls even lower in the United States and also stabilizes elsewhere in the world. We might welcome a readjustment of the life span. Another argument for increasing the life span in America is that our complicated society is in need of increasing wisdom to maintain its balance and humanity. Maybe longer productive lives would bring a correspondingly deeper perspective on the interrelations of the elements of society. Maybe, in fact, aging research will bring society the perspective it sorely needs.

In a general form, we could call this argument the error of futurism. The futurist believes that the present holds enough readable clues about the future to provide a good basis for prediction. I doubt this assumption: to think that the data of today can be analyzed well enough to predict the future with any accuracy seems nonsensical to me.

The second danger in restricting areas of scientific investigation is more crucial: although we often worry most about keeping society stable, in fact societies need upheaval and renewal to stay vital. The new ideas and insights of science, much as we may fight against them, provide an important part of the renewal process that makes life vital and exiciting. I would define freedom by the range of opportunities available to an individual—the more he has to choose from, the freer his choice. Science creates freedom by ever widening our range of understanding and therefore the possibilities from which we can choose.

The other argument I mentioned in opposing imposition of orthodoxy on science is the practical impossibility of stopping selected areas of research. Take aging as a prime example: it is one of the mystery areas of modern biology. The questions are clear. Why do we get older? Why do organ systems slowly fail? Why does one species of animal live three years and another lives for 100 years? These seemingly straightforward questions are today unapproachably difficult for modern biology to handle. Not only can't we understand events that occur over years, we even have difficulty with questions about events that require minutes. In fact, molecular biologists are really only experts in the millisecond range of time. There are a few hints about where answers to the aging puzzle might be found but they are only the vaguest suggestions. In such an area of science, history tells us that successes are likely to come from unpredictable directions. A scientist working on vitamins or viruses or even plants is as likely to find a clue to the aging problem as a scientist working on the problem directly. In fact, someone outside the field is much more likely to make a revolutionary discovery than someone inside the field.

Let me take another example to show the generality of my contention. What if we were living at the turn of the century and wanted to help medical diagnosis by devising a method of seeing into the insides of people. We would probably decide to fund medical people to learn how to use bright lights, little knowing that the revolution would come not from a medical research scientist but from a physicist who would discover a new form of radiation, X-rays.

Major breakthroughs cannot be programed. They come from people and areas of research that are not predictable. So if you wanted to cut off an area of fundamental research, how would you be able to devise the controls. I contend that it would be impossible. You could close the National Institute of Aging Research and I doubt if any major advance would be prevented.

Although they would fail to produce their desired result, attempts to control the directions of basic research would hardly be benign. Disruption and demoralization would be the effects of trying to determine when a scientist was doing approved work and when he was violating regulations. Creative people would shun whole areas of science if they knew that in those areas their creativity would be channeled, judged and limited. The net effect of constraining biologists to approved lines of investigation would be to degrade the effectiveness of the whole science of biology.

Put this way, the penalty from trying to control lines of investigation seems to me greater than the benefit. I conclude that you can either choose to have more science or less science, but choosing which science you will have is not a feasible alternative.

I must qualify this broad generalization in one fundamental way: the less basic the research area in which controls are imposed, the less general disruption will be caused by the controls. You could prevent development of a specific pesticide or sweetener with little generalized effect.

With all of my arguments for the need for freedom of scientific research I would not want you to think me so naive that I believe science is not directed. All sorts of crucial decisions are made about general directions of science, usually by the control of available resources. Again, the formula I used before is applicable: the less basic the area of research, the easier it is to target. One of the great fallacies of the War on Cancer was the assumption that the problems to be solved were sufficiently well-defined to allow a targeted, applied approach to the disease. Some problems could be defined and those were appropriate targets for a war, but the deeper mysteries of cancer are so close to the frontiers of biology that targets are hard to discern.

I have painted a picture of inexorable, uncontrollable development of basic scientific knowledge and the response of many people to such a vision might well be to yell, "Help—if we can't put any controls on research maybe we shouldn't have any research." I would actually agree with that conclusion because it is certainly true that the rate of accretion of knowledge could be so fast that a brake might be appropriate. Of course there is a way to produce a slowdown: by controlling the overall availability of resources. A non-selective brake on science would decrease productivity without the disruptive and dangerous effects of trying to halt one area and advance another.

In fact, such a brake was applied in the late 1960s and today we have much less basic research, measured in constant dollars, than we had then. The danger seen by many is not that we have too much basic research but rather that we are living on our intellectual capital and that an infusion of funds into basic areas of research is needed.

I may seem to have strayed from my topic of recombinant DNA research, but I think not. There is today a draft bill in the U.S. Senate to set up a National Commission on Recombinant DNA Research. The charge to this commission discusses mainly questions of safety, but at the end of the bill questions of ethics and morality enter. The bill is a clear invitation to begin the process of deciding what research shall be allowed and what research prevented. The battle to stop the creation of this commission is being waged by scientists, university presidents and other concerned individuals across the country. But the legislation is moving through Congress so rapidly that the fight will be over long before most people know that it started. The new biology has become the new politics in a very concrete manner: biologists are spending their time in the halls of Congress trying to prevent the establishment of the first commission to be appointed to control basic research. I believe that our success or failure will determine whether America continues to have a tradition of free inquiry into matters of science or falls under the fist of orthodoxy.

I should like to finish this talk with a quote from the philosopher of contemporary biology, Dr. Lewis Thomas, the president of the Memorial Sloan-Kettering Cancer Center in New York. Dr. Thomas wrote recently in the *New England Journal of Medicine* about the recombinant DNA issue and ended with this analysis of the role of scientific research in the life of the mind: "Is there something fundamentally unnatural, or intrinsically wrong, or hazardous for the species, in the ambition that drives us all to reach a comprehensive understanding of nature, including ourselves? I cannot believe it. It would seem to me a more unnatural thing, and more of an offense against nature, for us to come on the same scene endowed as we are with curiosity, filled to overbrimming as we are with questions, and naturally talented as we are for the asking of clear questions, and then for us to do nothing about, or worse, to try to suppress the questions. This is the greater danger for our species, to try to pretend that we are another kind of animal, that we do not need to satisfy our curiosity, exploration and experimentation, and that the human mind can rise above its ignorance by simply asserting that there are things it has no need to know."

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Editor Harold V. Cordry
400 Lewis Hall, Columbia
Ph. 882-4591

Curators to meet

Pending legislative approval of the state appropriations to the University, the Board of Curators scheduled a special meeting at 3:30 p.m. today (June 10) to consider the 1977-78 budget, which goes into effect July 1.

The curators will meet not in the Memorial Union, where they usually meet when in Columbia, but in the recently opened Alumni Center on Stadium Boulevard.

The new budget was the only matter to be discussed at the meeting. The board's regular meeting will be in Columbia on June 23 and 24.

Scholarship fund

A scholarship fund in the name of the late H. Ralph Franklin, who was UM's director of grants and contracts, has been established to help provide for the university education of his son, Clifford, who will be a senior in high school next fall.

Contributions should be sent to "H. Ralph Franklin Memorial Fund," in care of Ms. Goldie Bolli, new accounts department, First Bank of Commerce, 8th and Cherry, Columbia, Mo. 65201.

Award to McKay

Barbara McKay, UMKC associate director of scholarships and financial aid, became the first woman in Missouri to be honored by the Missouri Association of Student Financial Aid Personnel when she received the group's Missouri Award, which was presented to her in recognition of her 22 years of service to the students of UMKC and the University of Kansas City.

Baber to UMKC

Buford Baber has assumed the position of director of scholarships and student financial aid at UMKC, after having served as associate director at UMC since 1971.

The former director at UMKC, Mike Novak, returned to his alma mater, Kansas State, to become director of its student aid programs.

Director named

Richard E. Boettcher, UMC professor of social work, has been appointed director of UMC's School of Social Work. He succeeds Roland G. Meinert, who resigned in order to return to teaching and research.

Here and There

Spectrum's calendar carries announcements which are judged to be of possible interest to persons throughout the University system. Anyone wishing to place an announcement in *Spectrum* should write to Calendar, 424 Lewis Hall, Columbia. The next issue of *Spectrum* is scheduled to appear July 8, and the calendar deadline is 1 p.m. on the preceding Friday.

St. Louis County Pops—8 p.m., June 10; Queeny Park, St. Louis. (Program: "More of the Big Dance Bands.")

"Sacred Circles: Two Thousand Years of North American Indian Art": exhibition—through June 19; Nelson Gallery, Kansas City.

St. Louis County Pops—8 p.m., June 11; Queeny Park, St. Louis. (Program: "Fun With Music.")

Charles Mingus Quintet—7 p.m., June 12; Swope Park Mall, Kansas City.

Duke Ellington Orchestra—7 p.m., June 12; Ramada Inn South, I-55 at Lindbergh, St. Louis.

"Song from the Earth: American Indian Art": lecture—7:30 p.m., June 14; Nelson Gallery, Kansas City.

St. Louis Symphony—8 p.m., June 14; Veterans' Memorial Park, St. Louis. (Program: Handel/Harty, Kabalevsky, Beethoven, Bartok, Joplin.)

St. Louis Symphony—8 p.m., June 15; Veterans' Memorial Park, St. Louis. (Program: Schubert, Bruch, Bizet, Tchaikovsky.)

St. Louis Symphony—8 p.m., June 16; Veterans' Memorial Park, St. Louis. (Program: Rossini, Borodin, Haydn, Berlioz, Mussorgsky, Strauss.)

Harriette Ann Gray Dance Company—8 p.m., June 17; Jesse Aud., UMC.

Little Symphony (Wash. Univ.)—8:45 p.m., June 17; Wash. Univ. Quadrangle, St. Louis. (Program: " 'London' Symphony No. 104 in D Major," Haydn; "Simple Symphony for Strings," Britten; "Classical Symphony, Op. 25," Prokofieff.)

Anatol—8 p.m., June 17-19, 24-26; Edison Theatre, Wash. Univ., St. Louis.

St. Louis Symphony—8 p.m., June 18; Arch, St. Louis. (Program: Dvorak, Liszt, Rachmaninoff, Mussorgsky.)

"The London Music Hall"—June 20-25; American Theatre, 9th & St. Charles, St. Louis.

The Merry Widow—8:30 p.m., June 20-26; Starlight Theatre, Kansas City.

St. Louis Symphony—noon, June 22; St. Louis County Government Plaza, St. Louis. (Program: Adam, Mussorgsky, Anderson, Herbert, Strauss, Ives/Schuman, Sousa.)

St. Louis Symphony—8 p.m., June 22; Multi-Purpose Bldg., UMSL. (Program: Mozart, Piston, Bernstein.)

St. Louis Symphony—8 p.m., June 23; Laumeier Park, St. Louis. (Program: Haydn, Anderson, Herbert, Strauss, Ives/Schuman, Sousa.)

Little Symphony (Wash. Univ.)—8:45 p.m., June 24; Wash. Univ. Quadrangle, St. Louis; Ingrid Jacoby, piano soloist. (Program: "Overture to 'The Marriage of Figaro,' " Mozart; "Concerto Grosso in D Minor," Vivaldi; "Siegfried Idyll," Wagner; "Piano Concerto No. 2 in F Minor," Chopin.)

St. Louis Symphony—8 p.m., June 25; Arch, St. Louis. (Program: Beethoven.)

Meet Me in St. Louis—June 27-July 3; Municipal Opera, Forest Park, St. Louis.

St. Louis Symphony—8 p.m., June 28; South County Park, St. Louis.

St. Louis Symphony—8 p.m., June 29; South County Park, St. Louis. (Program: Britten, Grieg, Bartok, Beethoven, Vaughan-Williams, Joplin.)

St. Louis Symphony—8 p.m., June 30; South County Park, St. Louis. (Program: Rossini, Borodin, Vieuxtemps, Berlioz, Ravel, Waldteufel, Tchaikovsky.)

Little Symphony (Wash. Univ.)—8:45 p.m., July 1; Wash. Univ. Quadrangle, St. Louis; Nathaniel Rosen, cello soloist. (Program: "Suite from the Water Music," Handel; "Nocturne and Scherzo from 'A Midsummer Night's Dream,' " Mendelssohn; "Divertimento for Violin-cello and Orchestra," Saint-Saens.)

St. Louis Symphony—8:30 p.m., July 2; Mississippi River Festival, St. Louis.

St. Louis Symphony—8 p.m., July 4; fireworks at 9; Arch, St. Louis. (Program: Korngold, Barber, Copland, Bock, Bernstein, Sousa.)

Hello, Dolly!—July 4-10; Municipal Opera, Forest Park, St. Louis.

Finian's Rainbow—8:30 p.m., July 4-10; Starlight Theatre, Kansas City.

The Misanthrope—8 p.m., July 6-7, 9-10, 26, 30, Aug. 29, Sept. 1, 10, 28; 2 p.m., July 9-10, 30, Sept. 10, 25; Missouri Repertory Theatre; Danciger Aud., Jewish Community Center, 8201 Holmes, Kansas City.

St. Louis Symphony—8 p.m., July 7; Bellefontaine County Park, St. Louis. (Program: Berlioz, Mussorgsky, Gliere, Vaughan-Williams, Bock, Bernstein, Sousa.)

Little Symphony (Wash. Univ.)—8:45 p.m., July 8; Wash. Univ. Quadrangle, St. Louis; Catherine Kautsky, piano soloist. (Program: "Symphony in D Major," Vorizek; "Piano Concerto in C Major, No. 467," Mozart; "Suite for Small Orchestra," Stravinsky; "The Unanswered Question," Ives.)

Vacancies

The following administrative, professional and academic vacancies were listed with Spectrum as of June 1:

UMC: Acquisition specialist; chemist; coordinator of forms control and procedures; coordinator, student financial aids; computer project manager; senior fiscal analyst (2); senior methods and procedure analyst; senior systems programer/analyst; systems analyst (4); systems programer/analyst.

UMC Med Center: Assistant director, nursing services (2); head nurse (4); health care evaluation analyst; nuclear medical technologist; registered medical technologist; senior nuclear medical technologist; senior systems analyst; staff development coordinator; staff nurse (41); director, social service department; caseworker-instructor, social service department.

UMKC: None.

UMR: Assistant superintendent of physical plant; part-time teaching position, psychology section, department of social sciences.

UMSL: Admissions adviser; chief engineer, KWMU; information specialist III: pre-school supervisor.

Persons interested in an administrative vacancy should inquire through the personnel office on the campus where the vacancy exists. Those interested in an academic vacancy should inquire through the department or school listing the opening.

Department heads wishing to place announcements of academic vacancies in *Spectrum* should write to *Spectrum*, 424 Lewis Hall, Columbia.

Legislation relating to UM

BILLS	STATUS IN HOUSE	STATUS IN SENATE
SB47—Prevents UM land sales of 500 acres or more without General Assembly approval.	Passed, but amended to 2,500 acres and requiring bids on timber, mineral or other natural resources of $1500 value.	Passed.
SB50—Sets legal definition of death.	Killed.	Passed.
SB101—Extends lobby rules to state administrative agencies.	Committee hearing held. No report.	Passed.
Senate Substitute for SB152—Requires course in education of exceptional child in order to get life teaching certificate.	Passed by both houses and sent to governor with emergency clause.	
SB389—Establishes a "Missouri Forest Research Council" headquartered at UM.	Committee hearing held. Reported "do pass."	Preliminary approval given.
HB293—Declares multiflora rose a noxious weed.	Passed.	Committee hearing held. No report.
House Committee Substitute for HB144 and HB339—Collective bargaining bill for public employes.	Killed.	
HB384—Allows unlimited leave for state employes called to duty by National Guard.	Passed by both houses and sent to governor.	
House Committee Substitute for HB428 and HB602—Creates "Federal Grant Program Fund" in state treasury.	Passed.	Committee hearing held. Reported "do pass."

The table reflects the status of various bills as of June 3. Additional information may be obtained from Mrs. Marilyn Selovich, 309 University Hall, Columbia (65201); ph. 314/882-4355.