Dramatic changes are happening in higher education. Instead of simply memorizing copious pages of lecture notes, today’s undergraduates are challenged to become active contributors to developing new knowledge. Murray State University (MSU) is working to become Kentucky’s institution of choice for students who want to perform significant research and do real scholarly or creative work as undergraduates.

While student research, scholarship and creative activity are blossoming around campus, MSU’s new biomedical science program is particularly exciting. With the help of a generous grant from the Howard Hughes Medical Institute, MSU is building the foundation for an interdisciplinary program involving biology and chemistry faculty and students in an integrated research and teaching program. This interdisciplinary community of faculty and student scholars, striving to advance the frontiers of knowledge, is an essential element of a robust academic program.

Today, many of our incoming biology majors plan to pursue health-related careers. Our students’ attraction to medicine is easily explained by the exploding interest in biomedical research on the national level and the number of nationally renowned medical research institutions in our region, such as St. Jude Children’s Research Hospital in Memphis, Humana Hospital in Louisville, and the medical centers of Washington University, Vanderbilt University, University of Illinois and University of Louisville. Recognizing the

Under the leadership of John Mateja, Ph.D., Murray State University received its Howard Hughes Medical Institute award in August, 2000.

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Murray State University’s biomedical science faculty team includes:

Dr. David Canning (Developmental Biology)
Dr. J. Ricky Cox (Biochemistry)
Dr. Terry Derting (Physiology)
Dr. Leon Duobinis-Gray (Parasitology)
Dr. Tim Johnston (Molecular Biology/Microbiology)
Dr. Jin Liu (Bioorganic Chemistry)

Dr. Mark Masthay (Physical Chemistry/Biophysics)
Dr. James Stuart (Medical Microbiology)
Dr. Robert Volp (Toxicology, Biochemistry)
Dr. Sterling Wright (Neurophysiology)
Dr. Edmund Zimmerer (Genetics/Molecular Genetics)

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need to develop research opportunities for students in this area, approximately five years ago the College of Science, Engineering and Technology began to develop a research-rich interdisciplinary program in biomedical sciences.

Murray State students now have the opportunity to participate in an array of biomedically related research. Today our undergraduates are actively engaged in studies of extracellular matrix effects on gene expression, site-directed mutagenesis of ion channels, spectroscopy and photochemistry of photosynthetic and visual systems, mechanisms of gene expression, gene sequencing of antibiotic resistance, mapping of proviral sequences, metabolism of toxicants, protozoan structure studies, recognition of aminoglycoside antibiotics by enzymes, and reproductive endocrinology.

In 2001, MSU's Department of Biological Sciences introduced a new research-centered biomedical sciences degree. This program incorporates 15 credit hours of research into a student's four-year experience. This academic-year exposure, combined with multiple summer internships, gives biomedical science students hundreds of hours working side-by-side with faculty in research laboratories. By the time MSU biomedical science undergraduates receive their Bachelor of Science degrees, they will have more hands-on laboratory experience than many first, and even some second, year graduate students.

In addition to excellent on-campus research opportunities, MSU's Howard Hughes award has enabled us to team with outstanding research centers and universities to provide our undergraduates with off-campus research opportunities. Off-campus sites include St. Jude Children’s Research Hospital, The California Institute of Technology, Oak Ridge National Laboratory, Vanderbilt University and Johns Hopkins University.

While the cornerstone of the Howard Hughes award is our new Biomedical Science degree program and our Howard Hughes Undergraduate Research Scholars, the program is truly much more. With MSU and Howard Hughes support, the new Undergraduate Research and Scholarly Activity (URSA) Office has been created to encourage undergraduate research, scholarly and creative activity across the campus and to promote undergraduate scholarship on all six of Kentucky’s regional university campuses. To this end, the URSA office coordinated the first multi-campus event, Posters-at-the-Capitol, held in Frankfort, Kentucky in January 2002. Posters-at-the-Capitol, which was attended by Governor Paul Patton and members of Kentucky’s House and Senate, showcased undergraduate research and scholarship and helped Kentucky legislators better understand the importance of undergraduate scholarship to our students’ educations. Our ultimate goal is to establish state-supported internships for undergraduates from across the Commonwealth.
Adam Farley has been fascinated by science for as long as he can remember. He still vividly recalls his first chemistry set and some of those very early experiments.

Now, thanks to the generosity of the Howard Hughes Medical Institute, Farley’s “chemistry set” is much more sophisticated. Today, he uses modern biochemistry techniques and high-tech computers to combat antibiotic resistance.

“If we are successful,” Farley said, “the results of our experiments could open the door for the reuse of antibiotics that are now considered to be ineffective.”

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MOVING ON TO ADVANCED CHEMISTRY SETS

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There’s Nothing Like Working in a Lab

When Brian Greenwell was asked why he spends so much time working on his research project, he exclaimed, “I just enjoy working in the lab.”

“In high school, the best class I had was my advanced placement biology class because we spent a lot of time doing experiments. I just learn more when I’m in the lab,” explained Greenwell.

The biology major from Owensboro, Kentucky, did not lose any time finding his way into a laboratory when he arrived at Murray State. By the middle of his first semester he was volunteering in the research laboratory of Dr. James Stuart, a medical microbiologist. By the beginning of the second semester, he was also helping Dr. William Spencer, an aquatic botanist, in an introductory botany, teaching laboratory. He was in his third semester at Murray State when he learned of the Howard Hughes program.

“I had been helping others in the lab but I saw the Hughes program as a way in which I could develop my own research project,” Greenwell said. “You can bet I wasn’t going to pass up that opportunity,” he said.

When the Howard Hughes applications were reviewed, there was no question about whom Stuart wanted in his laboratory - Brian Greenwell.

Dr. Stuart became Greenwell’s mentor and the two began to study and assay bacteriophages, viruses normally found in sewage, of Enterococcus faecalis, a bacterium that infects humans.

“If we can find a phage that infects an antibiotic resistant strain of Enterococcus faecalis, that phage might also have the potential to transfer that resistance to a formally nonresistant strain of Enterococcus faecalis, making it resistant to the antibiotic. This process is called transduction,” Greenwell said.

While Stuart outlined the project goals and the basic procedure, it was up to Greenwell to perfect the procedures and move the project forward.

“He really let me work it out for myself,” Greenwell said. “He allowed me to perfect my procedure. We had daily meetings to discuss my progress and any problems I was having.”

“My first goal was to isolate 10 bacteriophages from human sewage using enrichment and plating techniques,” Greenwell said. The phages were then cross-streaked against 14 different capsular strains of Enterococcus faecalis, with Greenwell recording the sensitivity levels of each strain. The DNA of each phage was isolated and cut with four restriction enzymes to prove its uniqueness on the molecular level. Greenwell compared the banding patterns and established the uniqueness of each phage. Work on the transduction assays is about to begin.

Greenwell said the research is important because Enterococcus faecalis is a growing nosocomial, or hospital
"These antibiotics, called aminoglycosides, can fight bacterial infections like endocarditis, which can destroy heart valves. Aminoglycosides are also used to treat urinary tract, intra-abdominal, wound and pelvic infections," Farley went on to say. "Adam works incredibly hard and contributes new ideas to our research," said Ricky Cox, Adam’s research mentor and a faculty member in the Department of Chemistry at Murray State. "It is hard to believe that Adam is just starting his junior year."

Farley remarked, "The learning process is nonstop on my HHMI project. It is so different from the classroom. In the classroom you just see and hear the words. As you make measurements in the laboratory, the words take on a physical meaning."

Farley had nothing but praise for his faculty mentor, Dr. Cox. "While he is always willing to help, he also provides me with plenty of room to work independently," Farley said.

While only in his junior year, Farley is an experienced veteran at presenting his research findings. He has presented talks or posters at meetings of the American Chemical Society, Sigma Xi, the National Conference on Undergraduate Research, and the Kentucky Academy of Science.

Farley also presented his HHMI project findings at Posters-at-the-Capitol, a new event in Kentucky supported by Murray State’s Howard Hughes grant to help state legislators understand the educational importance of undergraduate research. Dr. Cox and Adam are also in the process of writing up their research findings for publication.

Like many students from the western Kentucky region, Farley is a first generation college student. Coming out of high school, he had little understanding of what a career in science entailed. "That’s all changed now because of my research experience," Farley said. "I now have a pretty good idea what a career in science would be like. I also now realize that I want and need to go to graduate school."

Albert Einstein once said, "The whole of science is nothing more than a refinement of everyday thinking." Adam Farley is refining those thoughts that began many years ago with that first chemistry set.

acquired, disease that can lead to urinary tract infections, septicemia and endocarditis. Understanding the transmission of antibiotic resistance among Enterococcus faecalis is an essential step in dealing with this problem.

"Brian is one of the hardest working students I know," Stuart said. "His strong suit is his willingness to pitch in and just get the job done," Stuart continued. "I can always count on him to do what he says he is going to do."

Greenwell said he thinks his work on the Howard Hughes project will give him an edge over others in his field of molecular biology when he looks for a graduate school. "I feel that experience is everything. I have learned an enormous amount from this project."

When asked about where he wanted to go to graduate school, Greenwell said, "I really haven’t decided yet. After all, I’ve just finished my sophomore year."
Helping Others

Ann Harper’s life has always involved helping others. Growing up in Russellville, Kentucky, Harper cared for her grandmother, who suffered from Alzheimer’s disease. She soon found herself doing volunteer work at a local nursing home. Today, Ann is an emergency medical technician and a rescue diver. It came as no surprise to Harper’s family when she said she wanted to go to Murray State University to pursue a career in medicine.

At Murray State, Harper, then a sophomore majoring in biology and minoring in chemistry, met Dr. David Canning, a developmental biologist involved in stem cell research. An interesting application of Canning’s work, and one that immediately attracted Harper, was the potential impact of this research on Alzheimer’s patients.

Harper’s Howard Hughes experiment, "An Investigation of the Expression of Specific Genes Unique to β-Induced Reactive Astrocytes," uses the brain cells of rats to identify genes unique to reactive astrocytes. Astrocytes are star-shaped brain cells that support the work of neurons by regulating their environment. Identification of genes unique to reactive astrocytes will provide powerful tools to further explore the creation of neuron growth inhibiting environments in brain trauma and Alzheimer’s disease.

“Harper’s HHMI project is being funded by the National Institutes of Health,” Canning explained. “Murray State’s primary role in this NIH project is to investigate cellular mechanisms responsible for creating scars at lesion sites in the central nervous system that inhibit the regeneration of neurons,” Canning said.

Harper’s response was more personal. “In the past I helped treat symptoms of advanced cases,” Harper said. “I have directly seen how Alzheimer’s affects families, so helping to find a way to eliminate the disease would be such a personal and overwhelming achievement,” Harper went on to say. While her work in the labora-
tory and her classes consume much of her time, Harper indicated that her life at Murray State is not all work. Harper is the Vice President of Gamma Beta Phi, a national honor and service organization, and President of the Outback club, a campus outdoor and wildlife society.

While graduation is more than a year and a half away, Harper is looking to the future. Harper plans to attend the University of North Carolina at Charlotte, enter a graduate program in Molecular Cell Developmental Biology, and continue research. Being involved in the HHMI program showed her that becoming involved in research is another great way to help people.

"I have directly seen how Alzheimer's affects families, so helping to find a way to eliminate the disease would be such a personal and overwhelming achievement."

"It's Molecular Biology, Not Rocket Science"

Victoria Petrie's life had been defined by learning what she did not want to do -- until the HHMI program helped her find something she really does want to do - become a genetic counselor and researcher to help those with genetically related illnesses.

"I grew up in Muhlenberg County, Kentucky, in the Lake Malone area," Petrie said. "My mother was a teacher at my school and I think everyone expected me to be a teacher too, but I knew that wasn't what I wanted to do." Petrie also took ballet classes as a child, but she said she knew she did not want to be a ballerina either. "I didn't think I had the grace and stamina for that," Petrie said.

Petrie does have grace and stamina in the laboratory, however, and she exhibits those qualities daily in her work on gene therapy at St. Jude Children's Research Hospital in Memphis, Tennessee. Petrie is a member of a research team using globin gene therapy to find a way to facilitate healthy hemoglobin growth in children with sickle cell anemia. This genetic blood disorder can lead to frequent and severe infections, damage to major organs, and episodes of acute intense pain.

"People associate St. Jude with cancer only," Petrie said, "but the mission of St. Jude is to 'Cure catastrophic illnesses in children using research and treatment.' That vision was one of the reasons Petrie became involved with the HHMI program.

"I really didn't know what I wanted to do with my undergraduate degree in biology," Petrie admitted. Petrie's Howard Hughes experience changed all that. "I have always wanted to make a difference in peoples' lives," Petrie said. "My work at St. Jude showed me how I could do that."

Two weeks after her official notification of acceptance into the program, Petrie met her mentor, Dr. Derek Persons, Associate Member of Experimental Hematology at St. Jude.

Petrie said Persons has been instrumental in her success at St. Jude. "He is so good at going back and reviewing what we had done," she said. "He really wanted to make certain I understood everything I did." In her meetings with him, Petrie said Persons would ask her why she had done something a certain way. "Occasionally I would try to get away with saying 'because they told me to.'" "Dr. Persons never accepted that answer," Petrie said with a smile.

Persons said that Vicky worked diligently during her summer at St. Jude mastering molecular cloning—an important part of gamma globin gene therapy. "Vicky has helped in our progress toward our ultimate goal of helping patients," Persons said.

One of Petrie's favorite sayings actually came from another physician on their research team, Dr. Abbot. Petrie said in teaching her to keep it simple, Abbot told her, "It's molecular biology, not rocket science."

Petrie said the HHMI project gave her a definite career path. "I know that I want to be involved in genetic counseling—in the research end of it," Petrie said. Genetic counselors help people understand the consequences of being carriers of certain genes and the specific illnesses that result.

Murray State's Howard Hughes award opened doors for Petrie that she said she could not have opened on her own. "How would I have gotten my foot in the door?" Petrie asked. "Only real scientists work at St. Jude."

Petrie is one of those real scientists now and wants to stay a part of the vision of St. Jude hospital. That vision is summed up in a statement by Danny Thomas, the founder of St. Jude -- "No child should die in the dawn of life."

It may not be rocket science to some people, but finding a cure to a devastating childhood disease could lead to a Nobel Prize. Petrie thinks that winning one of those might be nice too.
Murray State University and the Howard Hughes Medical Institute are developing tomorrow’s leaders in the biomedical sciences while changing the face of science education.
We invite you to meet our Howard Hughes Medical Institute undergraduate research mentors.
Laws of Medicine, Laws of Murphy

Adam Lowry, of Centralia, Illinois, is fast becoming a well-educated man. Now in his first year at The Emory School of Medicine in Atlanta, Lowry recently graduated with a biology degree from Murray State University.

Lowry’s last days at Murray State were among his most rewarding. During that time, he had the opportunity to spend an entire summer studying genetic mutations on the molecular level as an Undergraduate Research Scholar in the Howard Hughes Medical Institute program.

“I learned a great deal about the field of medical genetics and the skills necessary to contribute to that field,” Lowry said. “I also learned a lot about Murphy’s Laws,” he went on to say. “I could definitely have lived without that.”

Lowry’s HHMI project, “Gene Mutations Responsible for Metabolic VLCAD Deficiency,” studied the enzyme Very-Long Chain Acyl CoA Dehydrogenase, or VLCAD. VLCAD is a metabolic enzyme that helps break down fats for energy production during periods of fasting, such as sleep or between meals. A VLCAD deficiency may lead to dangerously low blood sugar levels, which are a result of the body’s inability to use efficiently the fat it has stored. VLCAD deficiency is especially dangerous for infants and newborns.

Medical science currently has no standard test for VLCAD deficiency. Lowry’s research, headed by his mentor, Dr. John A. Phillips, Director of the Division of Medical Pediatric Genetics at Vanderbilt University Medical Center, sought to determine the exact mutations in the VLCAD gene, laying the groundwork for an applicable, inexpensive test.

The summer began well for Lowry, as he and other members of the research team performed various tests on DNA samples from known VLCAD-deficient patients for comparison to normal DNA.

Problems arose after a few weeks when tests started to show results everyone knew to be incorrect. The last few weeks of Lowry’s research were spent trying to discover the culprit that was causing the problem. At Emory, he received word from the Vanderbilt team that the culprit was a deteriorating product ordered from an outside lab.

Lowry believes the problem occurred as a result of a new technique being used on his project. But, according to Lowry, he learned that solving such challenges are simply a part of what research scientists do on a daily basis.

Lowry appreciated Phillips’ guidance. When not with his patients, Phillips was always available to answer questions. At weekly meetings, the research team would discuss project goals and progress. After objectives were set, it was up to Lowry and the rest of the team to implement them.

Lowry discovered much about medical research—including
offspring conceived and increased sizes of reproductive and digestive organs in the offspring.

Webb remarked that his hands-on experience was better than work in a classroom because it allowed him to study science directly. The research project “made me more self-reliant.”

Webb said his mentor, Dr. Terry Derting, a physiological ecologist at Murray State University, furthered the independent aspect of the project. Derting encouraged him to decipher his data for himself.

“Lee is hardworking, has a good sense of humor, and is willing to help out in any way that he can,” said Derting as she leaned back in her chair. “Lee’s research is only the third scientific study that I know of to demonstrate that the genetic quality of potential male mates can be communicated through odor cues,” she added. “Recent research has demonstrated that even the human brain responds to a pheromone or odor cue,” she added. Thus, Lee’s research is an important step toward understanding the potential consequences of preferences for certain odors.

Webb found his experience fun and challenging, and HHMI “made it all possible,” he said. The research experience gave him a whole new experience with biology. He is hoping that his expertise will reach a new level, because he has the chance to do more research through the HHMI program in the upcoming summers.

After Webb completes his undergraduate studies he plans to further his education by studying Physical Therapy in professional school. “I would like to do physical therapy research,” he said.

In the meantime, Webb has presented his research to the Biology Freshman Orientation class at Murray State University, the Kentucky/Tennessee Academy of Science meeting and at Posters-at-the-Capitol, a poster session at Kentucky’s state capitol intended to help those who fund higher education understand the importance of research to undergraduate education.

Webb’s HHMI experience will never be forgotten because it gave him more insight into science and research. “I did not know what it was like. Now, I have a real respect for the people who do it.”
As a high school student in Owensboro, Kentucky, Adrian Yeiser began to develop an interest in medicine. Three years of college, four medical internships, and a Howard Hughes project later, Yeiser is now certain that he wants a career in the medical field.

Today, he will even tell you that he is seriously considering a career in medical research after becoming a doctor, a career path that was not in the picture before his Howard Hughes project.

In an animal physiology class, Yeiser met Dr. Sterling Wright, a neurophysiologist at Murray State, and liked how Wright approached teaching the course. When the Howard Hughes internships were announced and Yeiser saw an opening in Wright’s lab, he applied for the position. From the start, Yeiser’s drive and interest in medicine, as evidenced by his four medical internships, was clear.

The projects in Wright’s laboratory involve studying the pharmacology and biophysics of voltage-gated sodium channels cloned from muscle tissue. Sodium channels are responsible for the electrical activity in muscle cells that precedes muscular contraction. Yeiser’s HHMI project, entitled “Using Aminoglycoside Antibiotics to Explore the Pore Forming Region of Voltage-Gated Sodium Channels,” is an investigation that focuses on understanding the block of sodium channel currents by a common class of antibiotic drugs.

Yeiser has examined sodium channel sensitivity to a wide range of the aminoglycoside antibiotics to determine how drug size and net charge affect block of the channels. His research could ultimately provide clues about the architecture of the pore-forming region of the channel.

Yeiser presented his findings at the joint meeting of the Kentucky and Tennessee Academies of Science conference. He believes his HHMI research project gave him the opportunity to discover much about basic research—and about himself.

“Bright lights, big city.” This is how Aaron Compton of Somerset, Kentucky, summarized his first impression of Baltimore. Compton, who had just completed his junior year at Murray State University, was on his way to study at one of the most prestigious university hospitals in the nation, Johns Hopkins University.

While many areas in the field of medicine interest Compton, orthopaedic surgery has always been one of the highest on his list. “When I first began looking into Murray State’s new Howard Hughes program, I never expected to find an opportunity in orthopaedic surgery, let alone at a place like Johns Hopkins,” Compton said. “How many undergraduates can say they have studied and worked at a world-class facility like Johns Hopkins?”

Compton spent the summer working with Dr. Edward McFarland, an alumnus of Murray State University and Director of Sports Medicine and Shoulder Surgery at Johns Hopkins University. “For someone with an interest in orthopaedics, my project couldn’t have been more inter-

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Yeiser’s attention to detail and patience impressed Wright. “These are relatively tedious and difficult experiments to perform,” Wright said. “Adrian did not give up and worked until he mastered the required techniques,” Wright went on to say.

In his Hughes application, Yeiser stated, “I assure you, you will not find a more dedicated and hard-working applicant.” Having worked with Yeiser for almost a year now, Wright readily agrees.

The educational experience Yeiser received as a research student greatly supplemented the course work in his degree program. “You learn more in a research lab than you learn in an ordinary classroom,” he said. “The HHMI project allowed me to stay at Murray State over the summer, get to know my mentor, learn important lab techniques, and gain a perspective on the medical field I never really had,” Yeiser said.

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He spoke of how McFarland guided him through his summer experience. His mentor assigned Compton material to read weekly. This helped Compton understand what was going on in the clinic and operating room each day. McFarland “challenged me to stay on my toes,” said Compton. “McFarland also allowed me to attend numerous journal club and grand round sessions with other physicians,” said Compton.

In addition, his summer at Johns Hopkins gave Compton the opportunity to interact with medical students. Compton said that the medical students were very happy to answer his questions and even offered tips on interviewing and applying to medical schools.

Compton’s mentor also helped him get acquainted with the big city. Upon his arrival Compton said he was a little uneasy about living in a large city, but after his experience he definitely feels more comfortable.

His experience in Baltimore was a challenge, but Compton likes a challenge—that’s why he chose to study science. “After spending a summer at Johns Hopkins, I look forward to facing the challenges and satisfaction in modern medicine,” said Compton. “My experience at Hopkins more than reassured me that I want to pursue a career in medicine,” Compton said.
Stephen Compton, a Murray State University sophomore from Murray, Kentucky, cannot recall a time when he was not interested in science. He is fascinated with science because it "explains why things are the way they are."

Compton met Dr. Terry Derting, an ecophysiologist on the biology faculty at MSU, at a meeting with graduates from his alma mater, Murray High School. He soon accepted her invitation to help with on-going research in her laboratory. Before long, he was learning to obtain blood samples through heart puncture and isolating DNA for PCR analyses.

When the opportunity to participate in further research through the HHMI research program arose, Compton jumped at the opportunity.

His research, “Determining the Immune System’s Role in a Mammalian Energy Budget,” involved using house mice to determine how much energy it takes to maintain the immune system and to mount an immune response.

Whether the immune system is a costly component of an animal’s energy budget is a controversial question. Compton wondered about questions like “If a person has a virus, does the immune system take away energy normally used by other systems of the body?”
If Compton’s research showed that maintaining immunocompetence is a high-priority process, then equations traditionally used to describe energy budgets of animals can be modified to include the cost of immunocompetence.

To address his questions, Compton determined the energy cost of maintaining immunocompetence by comparing control mice with mice whose immune system had been suppressed. In a second experiment, he injected mice with sheep red blood cells and phytohemagglutinin to stimulate immune responses, then measured the energetic consequences of those responses.

Derting provided the idea for Compton’s experiment, but Compton developed his own methods for testing his hypotheses. He learned how to perform a variety of techniques and measurements, including using an open-system respirometer, collecting blood samples, conducting white blood cell counts, giving various types of injections, and performing dissections.

Derting remarked that “Stephen recognizes that all activities can be valuable learning experiences, whether in his direct area of interest or not. He enjoys research in the laboratory as well as helping with long hours of field work—even when up to his knees in mud!”

Compton enjoyed working with Derting and appreciated the confidence she showed in him. He gained self-esteem during the project by learning that he was capable of a lot more than he had thought. “Stephen’s awareness of himself and his abilities has grown tremendously as a result of his research activities,” Derting said.

Compton believes that being involved in research has put him in a better position than students who have relied solely on classroom instruction. “Using the summer for research will benefit me as I attempt to get into the medical field,” Compton said.

Compton has presented his research at the Kentucky/Tennessee Academy of Science meeting, and is already working on writing an article for submission to a professional scientific journal.

Compton is particularly excited about the upcoming summer. His second assignment with the Howard Hughes program will be at Johns Hopkins University. “Who could have imagined that someone from Murray, Kentucky, would be spending a summer at one of the world’s most highly regarded medical research universities,” Compton said.

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A WHOLE NEW WORLD

“It was a whole new world,” explained Thalya Burden as she spoke of her summer experience at St. Jude Children’s Hospital.

The summer after her junior year, Burden, an applied math major and Regents Scholar from Paducah, Kentucky, worked on the kind of research project few undergraduates ever see.

Under the guidance of Dr. Waleed Gaber, a nuclear physicist and primary research investigator in the Department of Radiation Oncology at St. Jude, she investigated the side effects of radiation therapy on lab rats. After a glass plate was surgically implanted in the cranium of rats, Burden directly observed leukocyte activity and permeability of the blood brain barrier. Gaber and Burden particularly focused on the effect of radiation therapy on white blood cells in the brain.

This was not Burden’s first research experience. Through her sophomore and junior years, Burden worked with Dr. Renee Fister, a Murray State University mathematics professor, on an optimal control problem applied to immunotherapy.

“While I certainly enjoyed the MSU project,” Burden explained, “it was a very different kind of problem.” The St. Jude project required that Burden integrate computers and advanced technology.

At St. Jude, Burden was introduced to state-of-the-art medical imaging technology. This experience gave Burden the opportunity to see research applied to a real life situation. “If we can determine what causes the side effects of radiation, then we can find ways to prevent those effects,” Burden said.

Burden especially appreciated working with her mentor. “Dr. Gaber treated me like a colleague, not like a student. We spent many hours a week discussing the problems we encountered during our research,” said Burden. She explained that Gaber listened to her ideas and gave her the freedom and encouragement to pursue them.

“At St. Jude, we were not always in the lab,” Burden explained; “We also attended three to four seminars every week on a variety of medical topics.” In several instances, Burden found the seminars directly applicable to her own research project.

Prior to her St. Jude experience, Burden had considered a future only in mathematics. Today, Burden is seriously considering pursuing a doctorate in biomedical engineering, a career choice she had not considered before her HHMI appointment.

Benjamin Franklin once said, “Knowledge is of two kinds: we know a subject ourselves, or we know where we can find information upon it.” Thalya Burden sought out new information and discovered a whole new world.