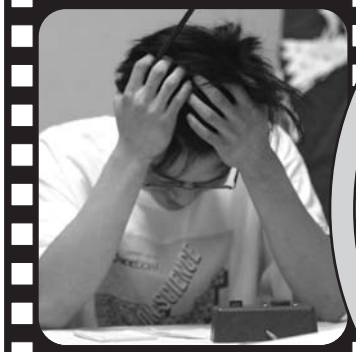


NATIONAL SCIENCE BOWL®

Saturday

Seminars

May 1, 2004

National Science Bowl®
Saturday Seminars

May 1, 2004
National 4-H Conference Center
Chevy Chase, MD

Seminars by Times and Locations

Room	Session I 9:00 - 10:15 a.m.
Aiton Auditorium	*Plenary Session: Hyperspace, Time Travel, The Theory of Everything, and Reading the Mind of God* *Dr. Michio Kaku* *Facilitator: Aaron Schuetz*
	Session II **10:30 - 11:45 a.m.**
Arkansas	*Every Bug Counts, or Does It?* *Dr. Deborah Newby* *Facilitator: Debra Halliday*
Idaho	*Superstring/M-Theory: The DNA of Existence?* *Dr. Sylvester James Gates, Jr.* *Facilitator: Michael McGinnis*
Illinois	*Science in the Kitchen and in the Candy Store* *Dr. Robert Wolke* *Facilitator: Linell Carter*
Kentucky	*Hydrogen & Fuel Cells Workshop for Teachers* *Ms. Kaye Kamp* *TEACHER WORKSHOP* *Facilitator: James Morgan*
Louisiana	*The Potential and Challenge of Parallel Computing* *Dr. Robert Wisniewski* *Facilitator: Bernadette Ward*
Missouri	*Enhancement Activities* *Facilitators: Jan Tyler, Dawn Manning, Vince Shielack, Dirk Shulund*
Montana	*Fairest Mysterious: True Art and Science* *Ms. Lisa Laughy* *Facilitator: Martha Hammond*
Ohio	*Mr. Magnet's Science* *Mr. Paul Thomas "Mr. Magnet"* *Facilitator: Bob Countryman*
Oklahoma	*The Mars Exploration Rovers* *Dr. John Callas and Ms. Jessica Collisson* *Facilitator: Ray Ng*
Washington	*How Viruses Cause Disease* *Dr. Anne Simon* *Facilitator: Bob Kuech*

Room	Session III 1:30-2:45 p.m.
Arkansas	*Every Bug Counts, or Does It?* *Dr. Deborah Newby* *Facilitator: Bernadette Ward*
Idaho	*Superstring/M-Theory: The DNA of Existence?* *Dr. Sylvester James Gates, Jr.* *Facilitator: Bob Kuech*
Illinois	*Science in the Kitchen - and in the Candy Store* *Dr. Robert Wolke* *Facilitator: Ebony Sails*
Louisiana	*The Evolution of Cluster Computing* *Mr. Douglas Fuller* *Facilitator: Ray Ng*
Missouri	*Enhancement Activities* *Facilitators: Jan Tyler, Dawn Manning, Vince Shielack, Dirk Shulund*
Montana	*Fairest Mysterious: True Art and Science* *Ms. Lisa Laughy* *Facilitator: Debra Halliday*
Ohio	*Mr. Magnet's Science* *Mr. Paul Thomas "Mr. Magnet"* *Facilitator: Linell Carter*
Oklahoma	*The Mars Exploration Rovers* *Dr. John Callas and Ms. Jessica Collisson* *Facilitator: Michael McGinnis*

Cover Illustrations from the National Science Bowl® Saturday Seminars, May 5, 2003.

Center of camera: A team participating in enhancement activities uses wind power to lift a weight to the table. Front bottom: Dr. Robert Roberts discusses the science of ice cream. Another team works to build the strongest bridge. Back middle: Mr. Robert Hogg demonstrates robot. Other photos: Teams participating in the model fuel cell car race competition and competing in the bowl.

Need to "Zoom into Science" for the Science Bowl?

Choose any of the seminars that interest you on the previous pages for each session. If they all look good and you want to see which would benefit you in the competition, they are grouped below by National Science Bowl® question subject area.

Want to expand your ***Astronomy***? Observe pages 5 and 14.

Need to enliven your ***Biology***? Look at pages 6 and 16.

Inhibited on your ***Chemistry***? Read pages 8 and 14.

Want to shake up your ***Earth Science***?
Cross-examine pages 13 and 14.

Have a ***Math*** problem? Add up the facts on pages 9, 12, and 17.

Need a lift on ***Physics***? Check out pages 5 and 14.

Question on ***General Science***? Go to all of them!

Good Luck!

Hyperspace, Time Travel, The Theory of Everything, and 'Reading the Mind of God'

Dr. Michio Kaku

Plenary Session
Aiton Auditorium
9:00 - 10:15

There has been a revolution sweeping physics in the last few years, as we complete Einstein's dream of a "theory of everything" which can unify all the forces of nature. His goal was to find an equation, probably no more than one inch long, that will allow us to "read the mind of God." Today, the leading (and only) candidate is the fabulous superstring theory, which is defined in 10-dimensional hyperspace. Once completed, it may answer some of our deepest questions, such as, "can time machines be built? What happened before the big bang?" If this theory is correct, then the "mind of God" is cosmic music resonating through 10-dimensional hyperspace.

Dr. Michio Kaku graduated summa cum laude from Harvard in 1968 as number one in his physics class. He has worked at the Berkeley Radiation Laboratory at the University of California and at Princeton University. Today, Dr. Michio Kaku holds the Henry Semat Professorship in Theoretical Physics at the City University of New York (CUNY), where he has taught for over 25 years. Dr. Kaku is an internationally recognized authority in theoretical physics and the environment. His most popular books include "Hyperspace: A Scientific Odyssey Through Parallel Universes," "Time Warps and the Tenth Dimension," and "Visions: How Science Will Revolutionize the 21st Century." Every week, Dr. Kaku hosts an hour-long radio program, "Explorations in Science," which covers topics in science, technology, war, and politics. His television appearances include the Larry King Show, Nightline, PBS's Nova and Innovation, 60 Minutes, Good Morning America and CNN News. He has been featured in PBS documentaries, TLC, Discovery Channel, BBC, TechTV, and the SciFi Channel. He has appeared on over 600 radio programs around the country and has been quoted in newspapers from coast to coast.

Every Bug Counts, or Does It? Microscopic versus Molecular Detection of Microorganisms

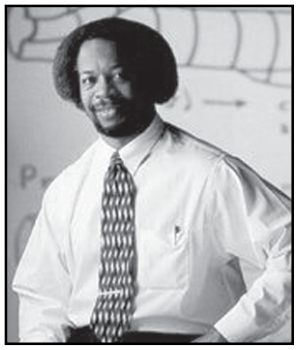
Dr. Deborah Newby

Arkansas
10:30 - 11:45
1:30 - 2:45

Since the 17th century, microbiologists have been counting bacteria. Microscopy remains an important tool for quantification of microbes, but great advances have been made enabling rapid quantification of specific populations using DNA technologies. One such advancement is the development of real-time PCR, sometimes referred to as quantitative PCR (qPCR). Real-time PCR provides a means of detecting and quantifying DNA targets by monitoring PCR product accumulation, measured by increased fluorescence during cycling. Advantages of real-time PCR over conventional PCR will be discussed. Seminar participants will have a chance to enumerate microbial populations using images of microorganisms as well as with output from a real-time PCR assay.

Dr. Deborah Newby is a staff scientist and discipline lead for molecular biology in the Biotechnology Department at the Idaho National Engineering and Environmental Laboratory. Her research foci include genetic exchange in the subsurface, molecular characterization of methanotrophic bacteria from the Snake River Plain Aquifer, nonaqueous biocatalysis for chemical production, and development of molecular detection approaches for microorganisms. She is co-PI for a research project entitled "Development and validation of Brucella DNA signatures" sponsored by the U.S. Dept. of Homeland Security's Office of Biodefense Programs. Dr. Newby received her B. S. in chemistry from Willamette University, Salem, OR (1994), and her Ph.D. in Environmental Microbiology from the University of Arizona, Tucson, AZ (2000). She is affiliate faculty at Idaho State University and adjunct research faculty at Montana State University. She is a member of the American Society for Microbiology and the American Biological Safety Association and serves on the INEEL Bioterrorism Emergency Response Team and the INEEL Institutional Biosafety Committee. She is author or co-author of nine journal articles and has written a book chapter of microbial transport in the subsurface.

Superstring/M-Theory: The DNA of Existence?



Dr. Sylvester James Gates, Jr.

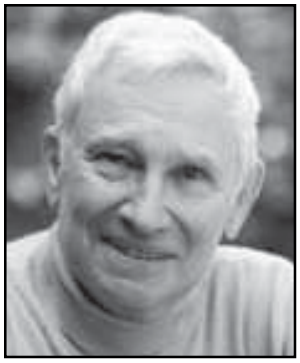
Idaho
10:30 - 11:45
1:30 - 2:45

The importance of DNA, the genetic code of life, is widely recognized. The information encoded in its strands provides a blueprint for all life. Since the 1970s, theoretical physicists have been studying the mathematics of the idea that the information for all of physical reality might be encoded in the structure of strands of superstrings, objects a billion, billion, billion times smaller than DNA. Einstein, calling them the "unified field theory," was the first to suggest that such possibilities might exist, but was unable during a thirty-year long quest to find logically-consistent mathematical support for this idea. This talk provides an accessible introduction for non-scientists to this frontier conversation about the deepest level of our universe and the basis of physical reality.

Jim Gates is well-known for his important work exploring the concept of string or superstring theory which may one day allow scientists to understand a unified theory of all forces. Dr. Gates earned B.S. degrees in mathematics and physics at the Massachusetts Institute of Technology. His Ph.D., also from MIT, was in elementary particle physics and quantum field theory. His thesis was the first at MIT devoted to supersymmetry. Following two years on the MIT faculty, he came to the University of Maryland in 1984. A 1991 to 1993 leave took him to Howard University, where he was a professor and chair of the physics department.

He has been president of the National Society of Black Physicists and is the recipient of many awards. Gates has advised the National Science Foundation, the U.S. Departments of Energy and Defense, the Educational Testing Service, and Time-Life Books. Last year he was the scientific commentator for a White House/ C-SPAN/BBC Internet broadcast with British physicist Stephen Hawking. He has been featured in two PBS series and is currently consulting on a PBS documentary.

Science in the Kitchen - and the Candy Store



Dr. Robert Wolke

Illinois
10:30 - 11:45
1:30 - 2:45

It's a cliché that "cooking is chemistry." But many more fascinating things happen in the kitchen besides the chemical changes in food caused by heat. Kitchen operations involve a complex combination of chemical, physical, and biological operations, most of which pass beneath the notice of both professional and home cooks.

Cooking begins in the supermarket, where hundreds of packaged foods with baffling ingredients on their labels compete for our dollars. What's in them? Back in the kitchen, we inject heat energy into those foods by boiling, frying, and roasting them. We may also remove and restore heat when freezing and thawing them. How is this heat energy transferred between the stove or freezer and the food? These and many other questions, including some from the audience, will be answered by "Professor Science" www.professorscience.com while demonstrating some of the principles involved.

Dr. Robert L. Wolke is a Professor Emeritus of chemistry at the University of Pittsburgh, an author, and a journalist. He earned his B.S. from the Polytechnic Institute of Brooklyn and a Ph.D. from Cornell University. He has written five books, including *"What Einstein Told His Cook: Kitchen Science Explained,"* "*What Einstein Didn't Know: Scientific Answers to Everyday Questions,"* and its sequel, *"What Einstein Told His Barber."* His syndicated column "Food 101" in the Washington Post has won several awards. He has contributed to magazines and encyclopedias, and is the consulting editor for Cook's Illustrated Magazine. He has been a researcher in nuclear chemistry at Cornell, University of Chicago, General Atomics, Oak Ridge National Laboratory and University of Pittsburgh. He is a member of Phi Beta Kappa, American Chemical Society, National Association of Science Writers, and the National Society of Newspaper Columnists.

The Potential and Challenge of Parallel Computing

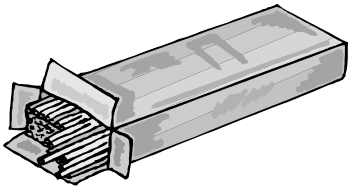
Dr. Robert Wisniewski

Louisiana
10:30 - 11:45

Many problems require a tremendous amount of computation power to solve. These problems range from predicting the weather, to simulating the interaction of complex molecules, to that new cool video game. A single processor, as is found in a standard personal computer or even powerful workstation, is often not sufficient. Parallel processing involves connecting together many processors - tens to hundreds or even more - and coordinating them to work together to solve a problem. In this talk I will describe the potential offered by parallel computing and present some of the difficulties encountered attempting to take advantage of its potential.

Dr. Robert William Wisniewski grew up in Lewiston, New York and attended Cornell University where he worked as a computer operator and later as a supervisor for Cornell Computer Services. He earned a Masters of Science in computer science at the University of Rochester, and earned his Ph.D. in 1996. He served as a research assistant to Professor Christopher M. Brown working on high-performance systems support for real-world applications and also worked closely with Professor Michael L. Scott and Leonidas Kontothanassis on multiprogrammed multiprocessor synchronization techniques. In 1994 and 1995, he received an ARPA fellowship in high performance computing. In 1997, he began work at IBM's T. J. Watson Research Center on the K42 scalable operating systems project (www.research.ibm.com/K42). The K42 project is a research effort aimed at designing from the ground up a scalable operating system targeted at small parallel machines expected to become ubiquitous, up to large-scale machines used in scientific computing. As part of this works he holds several patents in the field of computing. He has also made contributions to Linux, specifically contributing to LTT (the Linux Trace Toolkit). He is currently a research scientist and his research interests include scalable parallel systems, first-class system customization, and performance monitoring.

Enhancement Activities:
Pasta Ponticello Courso
The Wright Stuff



Missouri
10:30 - 11:45
1:30 - 2:45

The top three teams participating will receive prizes.

Pasta Ponticello Courso

Use your noodle to use these noodles to build a span that will span a space that will win first place!

Goal: Students will construct a simple structure capable of allowing the spaghetti to extend from a tabletop as far as possible.

Construction Rules:
1) You may use only the materials provided.
2) Structure may be attached to the desk or table.
3) Structure should allow the spaghetti to extend as far outward as possible from the edge of the tabletop.
4) Use of the floor, ceiling, or any other items not included in the kit is strictly prohibited.
5) Only the amount beyond the edge of the tabletop will be counted in the distance extended.

Competition Rules:
1) Bridge must be free-standing for one full minute in order to qualify.
2) The distance from the edge of the table to the non-supported end of the spaghetti will be measured.
3) The spaghetti structure reaching the greatest distance outward in a straight line from the tabletop will be the winner.

The Wright Stuff

It was just over a hundred years ago that the Wright Brothers left the ground. Now it is your chance! Your mission in this competition is to design, build, and fly a rubberband powered airplane. We provide you with a rubber band powered plane kit and other stuff. The only problem is that we've taken the wings out of the kit!

Goal: To design, build, and fly a rubberband propelled plane that will travel as far as possible without hitting the ground.

Construction Rules:
1) All teams will be provided a single kit with supplies and parts.
2) Only parts provided in the kit may be used to construct the airplane.
3) The rubber band (and a spare) will be provided to each team as part of their kit. Only one rubber band may be used on the plane at a time. No additional replacement bands will be provided if both of the originals are broken.
4) Each plane must be labeled with the team's name.
5) Teams are only allowed to compete with planes that they build themselves.

Competition Rules:
1) The competition will be held outdoors in an open area or in a long hallway.
2) Students can undergo trial runs as needed.
3) Students will not be provided with any replacement parts, though all teams will be given a total of 2 rubber bands in their kits.
4) Planes must self-launch from a specified tabletop surface. No throwing, slinging, springing or sproinging is allowed.
5) The plane's flight is ended when it first touches the ground.
6) The flight path will be the straight line between the beginning and the end of the course.
7) Total distance of the plane's flight will be measured from the starting point to the point along the flight path that is closest to the landing point of the plane.
8) Each plane will be allowed a total of two official flights. The farther of the two will be counted.
9) The winning team will be the team whose airplane flies the greatest distance.
10) In the event of a tie, the furthest teams may be asked to compete in a run-off flight with new rubber bands.

Fairest Mysterious: Standing at the Cradle of True Art and Science

Ms. Lisa Laughy

Montana

10:30 - 11:45

1:30 - 2:45

This title is from a quote by Einstein: “The fairest thing we can experience is the mysterious. It is the fundamental emotion which stands at the cradle of true art and science. He who knows it not and can no longer wonder, no longer feel amazement, is as good as dead, a snuffed-out candle.”

What I hope to convey in my presentation is the creative potential of mathematics, as a way to connect with the mysterious in the various fields of science. I will cover the use of mathematics as a source of inspiration in the creative arts, from the history of western art to contemporary times. Specifically I will discus the use of the Golden Ratio, and whether the appearance of this “Divine Proportion” in Egyptian and Greek art, as well as in the works of the Renaissance Masters, is present by design or by chance. For fun, there will be a simple hands-on project for the students to build an understanding of the use of the Golden Ratio in works of art. Then, as a group we will decide if this proportion does indeed represent the most aesthetically pleasing of ratios as many have claimed throughout history.

Lisa Laughy is a professional artist living in northern New Hampshire. She has been interested in the combination of mathematics and art since her high school geometry class, when she drew a tessellation design inspired by M. C. Escher. “I got an A in geometry once I figured out I could do math-related art projects as extra credit. Math got a lot more interesting for me then!” Since high school she has worked as an artist, developing a strong interest in Celtic artwork. The underlying mathematical structure of Celtic design has allowed her to further explore aspects of geometry in her artwork. She also incorporates the proportional relationship of the Golden Ratio in designing the layout of her intricately detailed paintings.

Mr. Magnet's Science
Mr. Paul Thomas

Ohio
10:30 - 11:45
1:30 - 2:45

Take a mesmerizing journey of discovery into the fascinating realm of magnetic phenomena. Paul Thomas, better known at MIT as Mr. Magnet, will uncover before your eyes the secret forces of ferromagnetism and magneto-electricity. What mysterious force field holds steady an aluminum fry pan suspended in space? A magnetic impulse launches Garfield into space and with sudden forceful energy bends metal into a useful shape. Light up the White House by generating electric energy with your muscle power. How many watts can you generate? If you dare, discharge one million volts of electric potential holding a lightning rod in your bare hands. The Mr. Magnet show is just for the fun of it.

Mr. Paul Thomas is currently a Plasma Science and Fusion Center Technical Supervisor at MIT. After graduating from technical school, Mr. Thomas joined High Voltage Engineering Corporation, where he worked under the guidance of Robert J. Van de Graaff to develop high voltage apparatus for research. He pursued a degree in electrical engineering at Northeastern University. Mr. Thomas joined the Massachusetts Institute of Technology in 1983, where as part of a team of scientists and engineers, he supervised the integration of computer controls on a large-scale fusion experiment. Nine years later, Mr. Thomas began his educational outreach by building a series of demonstrations and bringing them in a van into Boston area schools. In the nine years since the first school visit, Mr. Magnet has presented the program to nearly 300,000 students and teachers in the New England region. The show has also traveled to New Orleans, Atlanta, and Washington, D.C. for special events.

The Mars Exploration Rovers: The Corps of Discovery for Mars

Dr. John Callas
Ms. Jessica Collisson

Oklahoma
10:30 - 11:45
1:30 - 2:45

The planet Mars has been studied telescopically for centuries. In the last four decades Mars has been explored by a successive armada of fly-by, orbiting and landing spacecraft. Recent, highly-successful, orbiting missions have re-written the text books on the Red Planet, although revealing many more questions with each successive answer. It will only be with a surface reconnaissance that many of these new questions and many old mysteries can be answered. That surface reconnaissance has just begun. Two intrepid explorers, the Mars Exploration Rovers Spirit and Opportunity, have successfully landed at Gusev Crater and Meridiani Plenum, respectively, to begin the surface exploration of this great new territory. Dr. John Callas, Science Manager for the Mars Exploration Rover Project, will present the initial results of this grand undertaking just starting to unfold from the surface of Mars.

Dr. John L. Callas received his Bachelor's degree in engineering from Tufts University in 1981 and his Masters and Ph.D. in Physics from Brown University in 1983 and 1987, respectively. He then joined the Jet Propulsion Laboratory in Pasadena, California, to work on advanced spacecraft propulsion, which included such futuristic concepts as electric, nuclear and antimatter propulsion. Since 1989 he has worked on seven Mars missions. Dr. Callas is currently the Science Manager for the highly successful Mars Exploration Rover Project. In addition to his work on Mars Exploration, Dr. Callas is involved in the development of instrumentation for astrophysics and planetary science, and teaches mathematics at Pasadena City College as an adjunct faculty member. In his spare time, he mentors high school students interested in science and works with inner city elementary schools on science projects.

Jessica Collisson is currently supporting the Mars Exploration Rover Project as Flight Director for the Opportunity Rover. She joined the Jet Propulsion Laboratory as an Integration and Test Engineer for the Mars Exploration Rover project and assisted in the assembly and functionality testing of engineering models of the flight spacecraft. During that period, she served as the Lead Engineer for the Surface System Testbed; an area where using test rovers, pre-flight testing and surface operations support for the mission is performed. Before joining JPL she supported engine development testing at Boeing Rocketdyne for first-stage rocket propulsion systems. She received Bachelor of Science degrees in mechanical engineering and aeronautical engineering from the University of California, Davis in 1999.

How Viruses Cause Disease

Dr. Anne Simon

Washington
10:30 - 11:45

How animal and plant viruses cause disease is a subject of intense investigation throughout the world. Plant viruses cause billions of dollars in crop losses every year and contribute to widespread famine in many parts of the world. A major clue to the mystery of how very simple model plant viruses cause disease was found this year by studying a tiny RNA associated with a virus called Turnip crinkle virus (TCV). This RNA is known as a satellite (sat) RNA, a linear or circular RNA that requires a helper virus (like TCV) to supply proteins for its replication but is unrelated to the helper virus. TCV has a satellite (satC), that is able to change the symptoms of plants, despite being only 356 bases long. SatC causes TCV symptoms to be much more severe, which can lead to the death of the plant. However, when TCV contains a mutation that results in reduced production of its coat protein (the protein that forms the virus shell or capsid), satC is now able to completely eliminate the normal symptoms of TCV on plants. SatC accomplishes these symptom changes as an RNA – it does not encode any proteins! Clues to how satC functions and how the TCV coat protein is involved were uncovered by examining an exciting new field called RNA silencing.

Anne Simon received her B.A. in Biology from the University of California San Diego and her Ph.D. in Genetics from Indiana University. After 12 years as a faculty member at the University of Massachusetts Amherst, Dr. Simon moved to the Dept. of Cell Biology and Molecular Genetics at the University of Maryland College Park where her research is funded by the National Institutes of Health and NSF. Dr. Simon is also an editor of the journal "Virology" and Director of the Virology Program at the University of Maryland, which is affiliated with NIH. Dr. Simon was a science advisor for the hit television series, "The X-Files" and the X-Files movie "Fight the Future" and has written the book, "The Real Science Behind the X-Files: Microbes, Meteorites and Mutants" published by Simon & Schuster in 1999. She has given talks throughout the country on the science of the X-Files, was featured on "Good Morning America," the New York Times and "People Magazine" and was one of 50 scientists profiled for the New York Times Book "Scientists at Work."

The Evolution of Cluster Computing

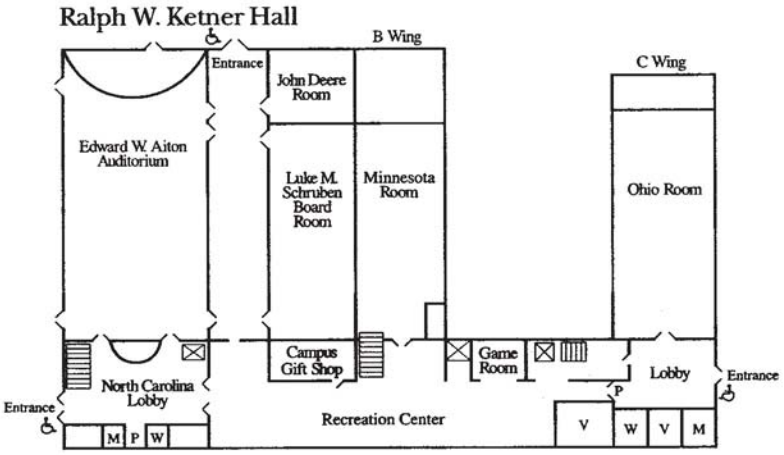
Mr. Douglas Fuller

Louisiana
1:30-2:45

High-performance computing has evolved explosively since the 1970s. This presentation will survey the history of high-performance computing, focusing on high-performance system architectures and design. It will also examine the influence of these architectures on today's top systems, algorithms, and future designs.

Douglas Fuller is a graduate student in computer science at Iowa State University, from which he received his B.S. in 2002. Douglas conducts research in high-performance computing at the Scalable Computing Laboratory, part of the US Department of Energy's Ames Laboratory. He attended Ankeny High School in Ankeny, Iowa from 1997-1999 and competed in the Science Bowl each year. Since competing at the National Science Bowl in 1999, Douglas has continually volunteered at the Ames Laboratory Regional Science Bowl and looks forward to his second opportunity to volunteer at the national competition.

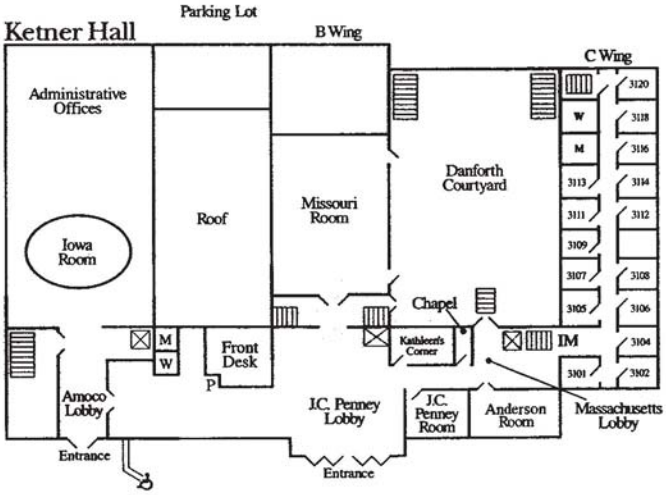
Interior Campus Map



Lower Level

J.C. PENNEY HALL

ROOMS 3101-3120



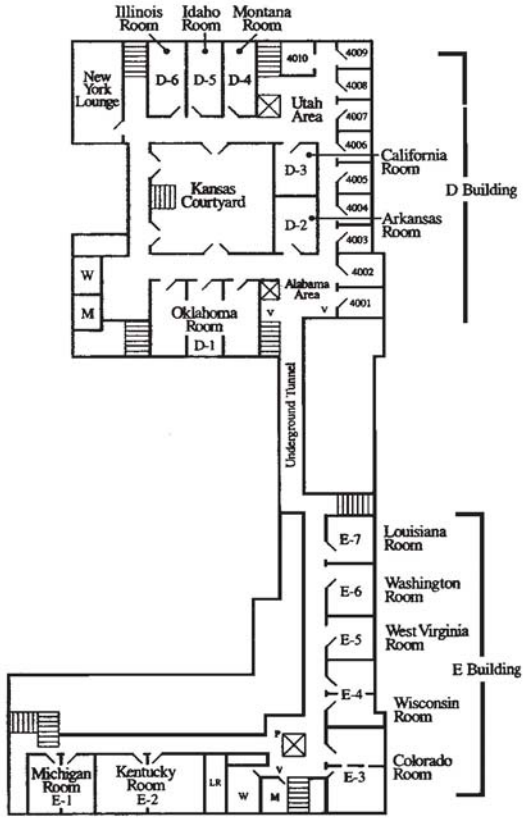
Ground Floor

ROOMS 4001-4010

FIRESTONE HALL

MCCORMICK HALL

W.K. KELLOGG HALL



Lower Level

KEY

- ELEVATORS
- STAIRS
- M / W — REST ROOMS
- LR — LAUNDRY ROOM
- IM — ICE MACHINES
- V — VENDING MACHINES
- P — PHONE
- ♿ — ACCESSIBLE ENTRANCE