backgrounds. And after spending the day in the lab, an expansive view of Frenchman’s Bay awaits the students at Highseas: from a balcony, a sitting room, or perhaps their own bedroom window. We know from decades of written testimony that this contemplative, focused setting motivates young people to consider a career in the sciences.

More than 2,000 students have participated in the program, and many of them look at their experience at the Laboratory as the turning point in their lives. Modifications to Highseas would allow us to adequately house the increased number of students that Jackson scientists are anxious to work with and give more students access to this unique opportunity.

The inspirational atmosphere at Highseas also holds great potential for all who partake in the array of educational programs at The Jackson Laboratory, as well as providing a great service to these participants.

Modifications to Highseas will address a critical need for the burgeoning Mastering Science program: living space for these teacher-interns during their semester-long residence at The Jackson Laboratory. The Bar Harbor region is a highly competitive and expensive housing market, with tourists, college students, seasonal workers, and Jackson Laboratory employees all competing for residential arrangements. Mastering Science participants encountered extreme difficulty when seeking temporary accommodations in this area; for example, one participant in the inaugural program had to commute frequently from Millinocket, Maine, to Bar Harbor—a four-hour round-trip. In order to put in the necessary hours at the Laboratory, another lived at his mentor’s house. The accommodation potential of Highseas would eliminate this obstacle.

Conclusion

With funding assistance from the George A. Ramlose Foundation, our educational programs will have the resources to grow while maintaining the quality of experience that will continue to guide fundamental experimentation and lead to landmark discoveries. “In high school it’s almost impossible to know what real science is about, because the excitement of science is in doing, not in books,” remarked Summer Student alumnus and Nobel laureate Dr. David Baltimore. “The discovery that research was something I could do was the most important moment of learning in my life. It really was not so much a matter of my ability to do it, as it was the discovery that questions whose answers were unknown could be grasped and dealt with by a high school student.”
Alice Doolittle Brooks Memorial Fund Endowment Report

The Alice Doolittle Brooks Foundation was created in the 1980s after longtime board member Henry Brooks' wife died from cancer. Several friends donated money to endow a memorial fund in her name at The Jackson Laboratory. This fund is one of the Laboratory's largest endowments and helps support young, under-funded investigators, especially those who are researching topics pertaining to cancer.

Because of my involvement in other grant writing projects, I was given the opportunity to write the entire 2004 endowment report. I was given brief research sketches from the Development Office; however, I interviewed Dr. Joel Graber and Dr. Tali Shalom-Barak for more information about their projects and for clarification.
The Alice Doolittle Brooks Memorial Fund

Endowed Fund Report

Established: February 3, 1986

Donations through 6/1/2004: $1,020,880 (88 gifts)

Market Value as of 9/30/2003: $4,795,806

Purpose: "To support unfunded investigators with preference given to young unfunded scientists associated with the investigation of cancer, and secondly other human health problems."
—Brooks Endowment Resolution, 1986

Use of Funds

During Fiscal Year 2003-2004, The Alice Doolittle Brooks Memorial Fund has provided support for three investigators at The Jackson Laboratory: Drs. Robert Burgess, Joel Graber and Tali Shalom-Barak. These investigators are studying Alzheimer's disease, post-transcriptional gene regulation and breast cancer.

Descriptions of these investigators' research projects follow.

July 2004
Robert Burgess, Ph.D., Associate Staff Scientist—Alzheimer's Disease

Robert Burgess arrived at The Jackson Laboratory in August of 2001 with the goal of studying the genetics of neurological development and degeneration.

The winner of numerous awards and fellowships, Dr. Burgess focuses his research on agrin, a protein involved in transmitting developmental signals from nerves to muscles. Dr. Burgess is currently developing a mouse model to determine agrin's function in the brain.

One aspect of Dr. Burgess' research focuses on the possible role of agrin in Alzheimer's disease. Agrin is associated with the amyloid plaques and tau tangles that are the principle hallmarks of the disease, and this association may play a causative role in the pathological progression of the disease. If agrin is involved in the formation of plaque and tangles, Dr. Burgess may have identified a potential molecular target for new drug treatments.

Dr. Burgess has 17 peer-reviewed papers based on his research and has three grants pending with the National Institutes of Health (NIH). He appreciates the vital start-up support provided by the Alice Doolittle Brooks Memorial Fund.

Joel Graber, Ph.D., Associate Staff Scientist—Post-Transcriptional Gene Regulation

Since November 2002, Dr. Graber has led a bioinformatics team that uses computational techniques to investigate post-transcriptional gene regulation and processing.

DNA, found in the nucleus of cells, contains thousands of genes that code for proteins. Proteins, however, are assembled in the cytoplasm in ribosomes. The DNA is too large to
escape through the pores of the nucleus, so a single gene from the long DNA strand is transcribed into mRNA. It is the mRNA that goes to the ribosome and is used as instructions to build a protein.

The first product of mRNA transcription, however, is much larger than the final protein because genes contain sections that have protein assembly instructions (exons) and sections that are nonsense (introns). The first production of transcription, then, is precursor mRNA. Pre-mRNA is modified so that all of the introns are cut out, and all of the exons are pasted together. Two untranslated regions (UTRs), however, are left at either end of the mRNA. The series of introns, the coding sequence, controls what protein is made; the UTRs control when and where that protein is made.

Characterization of the 3'UTR region is an ongoing process of statistical analysis and pattern identification, for which computational analysis is particularly well suited. Applying multiple computational and statistical techniques, Dr. Graber looks at systematic variation in 3'UTR sequences and determines whether or not the variation in these sequences is random, as mathematical models would predict, or non-random, governing the function of the protein.

In the short-term, Dr. Graber's research is helping to define the boundaries of genes. In the long-term, his research is helping others understand gene regulation, networks, interaction, and behavior. In fact, Dr. Graber collaborates with a number of researchers, one of which is Dr. Barbara Knowles from The Jackson Laboratory. Dr. Knowles' research focuses on early development of mice from oocyte maturation through fertilization and the early development of the embryo. All of these stages are controlled by gene regulation, in many cases 3'UTR-based regulatory elements.

Through collaboration with Dr. Graber and through his own findings, other researchers are beginning to understand these fundamental regulatory mechanisms. As researchers
begin to understand how normal gene regulation occurs, they can be also begin to understand how it can be disrupted, causing disease and developmental disorders.

Last year, Dr. Graber’s wife, Lindsay Shopland, received support for her research from the Alice Doolittle Brooks endowment. This winter, she won a position in the new Institute of Molecular Biophysics (IMB), established at The Jackson Laboratory on May 5. As IMB co-director Barbara B. Knowles, Ph.D. explains, “The IMB is an interdisciplinary leap into the future. It is the forum for the integration of newly developed instrumentation that will allow the application of optical physics and nanotechnology to genome structure. The ultimate goal is to understand precisely how genes control both normal development and human diseases and disorders.” Dr. Shopland is very excited about this new career venture, and we are grateful to the Brooks Endowment for providing support for her initial work at The Jackson Laboratory.

Tali Shalom-Barak, D.V.M., Research Scientist—Breast Cancer

IGF-I is a critical growth factor that regulates the growth of various tissues, including skeletal, muscle and adipose tissue. For nearly three years, Dr. Shalom-Barak has been studying how IGF-I’s effects vary between different stages of cartilage cell differentiation, as well as its effects on integrin receptor expression. Integrin receptors are found on the surface of cells and transmit chemical signals into the cell’s interior. This process regulates most cellular processes such as attachment, proliferation, differentiation, and survival.

During her research, Dr. Shalom-Barak discovered that during intense kinase activity by the IGF-I receptor there was striking effects in 293T human epithelial cells: cellular rounding and detaching accompanied by markedly reduced expression of integrins alpha 1 and alpha V. These results have multiple implications regarding IGF-I’s effects on cellular adhesion and the transmission of cancer cells throughout the body.

July 2004
More specifically, IGF-I levels affect the seriousness of breast cancer cases. Higher levels of IGF-I promote more aggressive cases of breast cancer to develop. The reasons for this are clear: IGF-I increases the migration of cancer cells, protects cells from apoptosis and increases cell proliferation. All of these factors contribute to an increase in the severity of the cancer.

Further investigation of Dr. Shalom-Barak’s findings is needed; however, knowing which proteins affect cancer severity provides hope for the development of new treatments to interfere with cancer progression. Because of the support of the Brooks Endowment, the identification of IGF-I signaling has on integrin receptor expression has lead to results that have allowed researchers to understand more about breast cancer.

Dr. Shalom-Barak is a non-clinical doctor of veterinary medicine who works as a research scientist in Dr. Wesley Beamer’s laboratory. Her husband, Dr. Yaacov Barak, is an associate staff scientist at the Laboratory.

Summary

The Alice Doolittle Brooks Memorial Fund at The Jackson Laboratory has provided continuous support for research since its inception in 1986. By funding primarily young investigators, with preference given to those studying cancer and related disorders, the Alice Doolittle Brooks Memorial Fund gives the next generation of genetic researchers a better chance for success in answering essential, fundamental questions in mammalian biology and genetics.
Cancer Research: Past and Present

For the 75th anniversary celebration of The Jackson Laboratory, the Office of Public Information in conjunction with The Bangor Daily News, published a supplement focused on The Jackson Laboratory. The supplement included content created by both partners.

For this supplement, I wrote a feature about Dr. Shaoguang Li's leukemia research. Because of the nature of the supplement, I connected his current research of CML and B-ALL to the cancer research tradition at the laboratory that extends back to Dr. C.C. Little, the laboratory's founder.

The supplement was published on Sept. 2, 2004, in major newspapers across the state of Maine, a combined readership of 840,000.
Cancer Research at The Jackson Laboratory: Today and Yesterday

By AMBER BAUER, Jackson Laboratory Summer Student

Memories draw Dr. Shaoguang Li’s thoughts away from his briefly lit office at The Jackson Laboratory in Bar Harbor. As he explains why he chose to become a cancer researcher, leaving behind his oncology practice, it is clear that he is thinking about the patients he left in China. For Dr. Li, cancer has many faces.

In a day and age when humans are expected to live longer than at any other time in history, cancer is astonishingly prevalent. For most people, cancer is not some abstract or theoretical concept; Cancer is a friend, a family member, a child... you. In fact, the American Cancer Society reports that there were nearly 1.5 million new cancer cases diagnosed last year in the United States alone.

Understanding, targeting, treating; those are the magic words for cancer researchers like Dr. Li at The Jackson Laboratory who have been using mice as the key to unlock the secrets of cancer for the past 75 years.

Finding a cure

Before Dr. Li decided to spend his career trying to understand the development of cancer, he was devoted to trying to treat it. Dr. Li spent six years as a physician in China before going back to school to earn two Ph.Ds so he could conduct cancer research.

“There were no curative therapies for some patients with certain types of cancer, and I felt I could not help them,” Dr. Li said. “I thought I could help develop curative therapies for cancer patients by doing research.”

After more than 10 years of leukemia research, Dr. Li has focused his attention on specific signaling pathways that cause normal cells to transform into cancer cells, specifically in mouse models of human Philadelphia chromosome-positive leukemias.

All leukemia patients have an excess of abnormal white blood cells. However, what distinguishes the dozen different leukemias from each other is the type of white blood cell affected and how fast the disease progresses.

Philadelphia chromosome-positive leukemias occur from a single mutation in a single gene. A piece of chromosome 22 in the blood-forming cells in the bone marrow breaks off and is incorporated into chromosome 9. The break occurs in the middle of a gene, BCR, and this little "gene-let" then fuses to another gene, ABL. The newly formed hybrid gene is called BCR/ABL.

Because BCR/ABL is a combination of two genes, it is no surprise that it produces a combination protein. This abnormal protein eventually stimulates uncontrolled production of blood cells, leading to leukemia.

Dr. Li and his team are studying two common types of Philadelphia chromosome-positive leukemias that have been induced in mice: chronic myeloid leukemia (CML) and B-cell acute lymphoblastic leukemia (B-ALL). CML usually appears in middle age, while B-ALL usually affects children.

Dr Li said that his research team wants to fully understand the pathways of oncogenes — mutated genes that contribute to normal cells transforming into cancer cells — because you have to know which pathway plays an important role in cancer development in order to find targets to block.

Blocking specific targets within signaling pathways was shown to be a viable leukemia treatment with the introduction of Gleevec. Gleevec is a drug produced by the Swiss-based pharmaceutical company Novartis that blocks an enzyme necessary to signal cancer cell formation. However, Dr. Li said that the long-term effects of the drug are still unknown, and it might not be a true cancer cure. A study published in 2001 (Continued on page 4.)

RESEARCH PROGRAMS

The Jackson Laboratory has a research staff of more than 350 people, with 36 Principal Investigators, leading research groups in six major areas:

- Cancer: breast, cervical, leukemia, brain, lymphoma, muscular dystrophy
- Neuroscience and Sensory Disorders: movement, vision, hearing, taste, smell, epilepsy, glaucoma, muscular degeneration
- Metabolism: diabetes, cardiovascular disease, obesity
- Immune System and Blood Disorders: AIDS, immune deficiency, immune system disorders, tissue transplant rejection
- Development and Aging: brain development, mouse genetics, ontogenesis
- Molecular Medicine: mouse genome informatics, comparative genomics
Summer Student Research Summaries

Each year The Jackson Laboratory publishes a scientific report that summarizes the research projects conducted that year. I was asked to write a similar report summarizing the research being conducted by the 34 summer students. Most of the information was collected by reading each student's proposal and by listening to Sponsor Night presentations.

The research summaries were collated into the following book targeted at a general, lay audience. The book was distributed to the audience at the Summer Student Symposium held on Aug. 16, 2004. The audience consisted of students, parents and laboratory staff. The research summaries also appear under each student's name on the 2004 Summer Student Web site (www.jax.org/education/ss04/index.html).
What I Did On My Summer Vacation

2004 Summer Student Research Summaries for the Non-Scientist

Amber Bauer
Public Information Summer Student
What I Did on My Summer Vacation

2004 Summer Student Research Summaries for the Non-Scientist

Amber Bauer
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Introduction

Why mice? What could studying this furry creature possibly tell researchers about human disease? As it turns out – a lot. Little has changed, genetically speaking, in the more than 75 million years of mammalian evolution. And with the completion of both the human and mouse genome sequencing projects, it is now estimated that humans and mice share 90 percent of their genes.

The fact that mice and humans are so genetically similar is of great importance to researchers. Understanding human biology, both in its normal and pathological states, requires a large amount of experimental data. However, there are these two things called morals and ethics that prevent researchers from studying human biological processes directly. Dr. Kenneth Paigen, former director of The Jackson Laboratory and Senior Staff Scientist, wrote in an article published in a 2003 edition of Genetics about the problems associated with using human subjects for genetic research: "Deliberately inducing pathology or toxicity is unacceptable; patients are understandably reluctant to provide serial tissue samples; a critical portion of human life, the embryonic/fetal period, is not very accessible; genetically defined lines cannot be created; the generation time is too long for extended genetic studies; and individuals exhibit a stubborn tendency to choose their own mating partners, frustrating geneticists."

Such problems associated with studying humans are overcome by using mouse models. Mice breed rapidly, can be inbred (which is not true of all mammals) to become genetically identical, have a short lifespan enabling lifespan studies and are small, and therefore inexpensive to maintain. Mouse research is also easily translated to humans because humans and mice are so genetically similar. When researchers find a gene that causes a disease in a mouse it will likely correlate to a gene that causes a similar disease in humans. The human gene will probably not be on the same chromosome, however, seeing as human and mouse genes were arranged into chromosomes differently over evolutionary time.

Because of all these traits, mice have been dubbed the ideal model for researching human diseases and disorders. From the discovery of the major histocompatibility complex, one of the fundamentals of basic immunology, to understanding the origins of cancer, mice have played a vital role in genetics and medical research for more than a century.
Pain Assessment of Analgesia in Mice

Pain assessment is a critical part of animal research because pain has so many effects on the animal and therefore research. Pain initiates a stress response in the animal that alters its metabolic and hormonal balance, often leading to catabolism, a destructive metabolic process. Pain also affects behavior, thereby affecting research results.

It is for these reasons, as well as to better the lives of laboratory mice, that Ebony is establishing a protocol for pain assessment on mice. To do this she tested pain responses to a chemical stimulus using three different analgesics at three different dosages. Ebony used a chemical stimulus because it best simulates the biphasic pain of surgery. Phasic pain occurs first is has a very short duration; tonic pain occurs later and lasts much longer.

By testing mice treated with a low, medium and high dosage of morphine, buprenorphine and carprofen against a control set of mice that have not been treated with an analgesic, Ebony is attempting to discover practical pain medications and effective dosages for use in clinical and medical settings.

It is often difficult to assess pain in mice because they inherently hide any outward signs of distress to protect themselves from predators. Therefore correlating assessment tests with analgesic effects will establish a basis from which lab mice can be more appropriately treated for the pain that results from research and surgical procedures.
Genetic Studies of Deafness Mutations

Hearing loss is the most common sensory disorder in the human population, occurring in one out of 1,000 live births. Fortunately, researchers are beginning to understand the development of these disorders and are gaining insight into the normal hearing process through the use of mouse models. New hearing-loss mutations are constantly being discovered because mice with hearing loss exhibit very recognizable characteristics: head tilt, head tossing, circling behavior and head bobbing. The effects of these mutations can easily be connected to human disorders because the human and mouse inner ear have many anatomical and functional similarities.

Hannah had two different research projects related to hearing loss this summer. One project stemmed from research conducted by a 2003 Summer Student. Last year a new hearing-loss mutation, jitterbug, was mapped and characterized. Hannah’s objective was to discover where the protein associated with this mutation is expressed in the mouse ear. Localizing this protein will help identify where and when the protein is expressed, as well as the pathways in which the protein is involved.

Hannah’s second project dealt with new mutations that lead to hearing loss in mice. Hannah’s objectives for this project were to find the chromosomal location of several mutations and discover which genes were mutated, as well as to determine the inner-ear pathology associated with these mutations. This investigation could lead to the identification of a novel gene involved in hearing loss.
Gene Expression Profiling of *Atp5a1* and *Spna2* in Mouse Inner Ears

Hearing loss is the most common sensory disorder in the human population, occurring in one out of 1,000 live births. Some hearing disorders also affect other parts of the body, including the heart, kidneys and eyes. Therefore, discovering and understanding the genetic effects of hearing loss has other important ramifications.

Julie’s research focused on two specific genes that are linked to hearing loss, *Atp5a1* and *Spna2*. *Atp5a1* is involved in energy production, while *Spna2* is involved in calcium ion binding. Julie’s objective was to determine the expression levels of these two genes by comparing mice with the trhl mutation, a mutation that affects the development of ear hair essential for hearing, and normal mice.

Identification of genes related to hearing loss is essential for researchers to uncover the factors necessary for normal auditory function. Analyzing mouse models can help researchers understand the mechanisms of auditory diseases that could lead to better diagnosis, prevention and treatment of human hearing disorders.
Genetic Mutations Linked to Mouse Ear Infections

Otitis media is an auditory disease that affects approximately 75 percent of children. Otitis media is caused by pathogens that enter the ear, colonize and then conquer the host's immune response. This leads to the accumulation of fluid in the middle ear. There are two types of this "middle ear infection," acute and chronic. Chronic otitis media can cause deafness, speech problems, meningitis and bacteremia.

People with otitis media share several characteristics: sibling history of frequent ear infections, Down’s syndrome, cleft palate and immune deficiency. Race may also have an influence; otitis media is much more common in American Indians and Australian aborigines than in other races. All of these shared characteristics point to genetic component to the disease.

Whitney’s research objectives were to study and fine map a new mutation, nm2343, on chromosome 10 that has been linked to Otitis media and ear infections in mice. The actual histology of the ear of these mutants will also be analyzed to better define a mouse model for human Otitis media.
Detection of Helicobacter in Laboratory Mice

Helicobacter is a type of bacteria that lives in the digestive tract of animals, including humans and mice. In infected humans, the bacteria can cause serious problems like ulcers and severe weight loss; however, infection in mice is not always associated with disease. If disease does appear in mice it can include chronic proliferative hepatitis, increase risk of liver tumors, inflammatory large bowel disease and gastritis.

Helicobacter is detected through fecal sampling; however, this is not a reliable method. Often only those mice that are suspected of infection are tested. Because not all mice or mouse strains show disease symptoms after infection, many infected animals are not singled-out for testing. Also, the testing method is unreliable. Often an infected animal will test negative for the bacteria when it actually is infected because of intermittent shedding. This is a major problem for researchers because the presence of helicobacter could influence research results.

Mihaela's project is to test four different strains of mice from four different mouse rooms at The Jackson Laboratory for helicobacter using fecal samples. Her objective is not only to discover whether these mice are infected with the bacteria but also to determine better methods of testing for the bacteria in the future.

Mihaela Senek

Sponsored by: Chief of Diagnostic Services James Fahey
Hometown: Tjsmarp, Sweden
School: College of the Atlantic
Year: Senior
Major: Human Ecology
Supported by: The Horace W. Goldsmith Foundation
Mapping Obesity Genes

Obesity is becoming an increasingly prevalent health problem in society. One reason it is gaining international attention is because it is linked to so many other health problems like heart disease, stroke, diabetes, gall bladder disease and osteoarthritis. Obesity has been found to have a large genetic component, which Alicia is investigating this summer.

There have been numerous studies investigating the genetic links to obesity in mice. One interesting finding in these studies was that the mouse strain AKR/J was always identified as obese whether it was set on a diet-induced obesity program or a non-diet-induced program. Therefore AKR/J mice are referred to as an “obesity prone” strain. Further studies on this strain revealed that the quantitative trait loci (QTL) for obesity were on Chromosomes 2 and 17.

Alicia is mapping the obesity loci in two lines of mice that were generated in an ENU-mutagenesis program. After the DNA of a group of B6 mice was mutagenized three obese animals were found: HLB51, HLB81, and HLB93. These three animals were bred to establish colonies. It was discovered that the mutation that made HLB81 obese was heritable; therefore its obesity was not caused by a genetic mutation. Thus, HLB81 was a straight B6 mouse, not a mutant. The HLB81 could be used as a background for the QTL that make the AKR strain fat.

Alicia’s project is to map the other two lines: HLB51 and HLB93. After the mapping is complete, she will compare her results to the established background map of HLB81 to see if there were any additional obesity loci present that were making HLB51 and HLB93 fat. This comparison would allow Alicia to confirm these new lines as new mutants.
Identifying and Mapping the Mutant Allele for Retinal Degeneration in nm3448

Retinal degeneration is characterized by the deterioration of photoreceptors in the retina that leads to a progressive loss of vision. This disorder has many forms that affect various parts of the retina and progress at different rates, leading to a wide-range of visual impairments. No form of retinal degeneration is treatable, however.

For any type of treatment to be developed, more knowledge of the mutation of the genes responsible for normal retinal development and formation is needed. So far 133 retinal degeneration genes have been identified, some with multiple mutations. Jiyang is attempting to locate nm3448, a new mutation linked to retinal degeneration, this summer.

nm3448 was found in a B6 strain at The Jackson Laboratory. Mice that have this mutation exhibit neurological problems as well as retinal degeneration. Jiyang is attempting to locate the gene this mutation occurs in and then is hoping to investigate its molecular nature. So far the mutation has been narrowed to Chromosome 18.

More advanced knowledge of the genetic causes of retinal degeneration would allow for early detection and prevention through gene therapy, as well as potential treatments. The techniques developed through experimentation also will be beneficial because they present a more efficient way to study genetic diseases and conditions. These techniques reach beyond ophthalmology into other areas of genetic research, such as type 1 diabetes and arteriosclerosis.

Jiyang Zhang

Sponsored by:
Research Scientist Bo Chang, M.D.
Hometown: Bayside, N.Y.
School: Massachusetts Institute of Technology
Year: Junior
Major: Biology
Supported by:
Clark Endowment, The Horace W. Goldsmith Foundation
Localization of Mitochondria during Oocyte Maturation and Early Development in the Mouse

Mitochondria are cellular organelles that are often referred to as "powerhouses" because they produce the energy used by the cell. In cells that require a lot of energy, such as sperm cells, mitochondria are very numerous. Previous studies have indicated that the movement of mitochondria is essential for egg maturation, fertilization and embryo development.

Jacquelyn's project had two main objectives. The first was to use time-lapse imaging to examine the movement of mitochondria during egg maturation and early embryo development in mice. Jacquelyn focused on development from the egg cell to the formation of eight-cell embryos. Jacquelyn's second objective was to create a timeline of the key events during these stages. Unlike previous studies, Jacquelyn strived to create a continuous timeline, more like a movie than snapshots at different stages of development like has been done previously.

Because mitochondria seem to be essential to normal embryo growth and development, Jacquelyn's study could have a tremendous effect on infertility studies and in-vitro fertilization methods. New in-vitro fertilization techniques are possible once the role of mitochondria is known. One day doctors may be able to transfer donor mitochondria to embryos, increasing the probability that the embryo will implant.
Mechanism for Tumor Induction by Retroviruses Lacking Oncogenes

The origins of spontaneous mammary gland tumors in mice were discovered at The Jackson Laboratory in the 1930s. The first breakthrough came in 1933 when the entire staff of the Laboratory published an article in Science that showed that mammary cancer was inherited through the mother. However, it was not until 1936 that mammary tumor development was connected to a mother's milk and later to a retrovirus, mouse mammary tumor virus (MMTV). Research on MMTV continues at Jackson today in Dr. Tatyana Golovkina's laboratory.

MMTV is a retrovirus, which means that its genome contains RNA instead of DNA. The virus is able to replicate itself using a protein called reverse transcriptase that creates double-stranded DNA from a single-stranded RNA template. The newly formed viral DNA is integrated into the host's DNA, allowing for replication of the viral genome. In many cases, the viral DNA that is inserted contains oncogenes, genes that lead to cancer; however, MMTV does not. Most scientists accept that MMTV causes tumors by inserting itself near protooncogenes in the host genome and stimulating their expression. Protooncogenes are genes that will become oncogenes (cancerous) if mutated or if their rate of expression is altered.

Silas' research hinges on the idea that mammary cell transformation from normal to cancerous involves a more complex interaction between the viral and cellular genomes. It is believed that specific viral proteins, like Gag, have to be produced along with activation of the oncogene in order for mammary tumors to occur frequently.

Silas is investigating whether the Gag protein collaborates with a specific protooncogene to promote the development of mammary tumors and fine mapping the gene responsible for susceptibility to Gag-independent mammary tumors. This research will provide insight into the prediction and treatment of cancer in humans.
Understanding B10.D2 Mice’s Resistance to Diabetogenic IS-CD8+ T Cells

Type 1 diabetes is an autoimmune disease, which means the body reacts against its own tissues as if they were foreign invaders, causing inflammation to isolate them and producing antibodies to destroy them. In this case insulin-specific (IS-CD8+) T cells destroy the insulin-producing b cells in the pancreas, which regulate blood glucose levels.

The non-obese diabetic (NOD) mouse strain develops diabetes spontaneously. In previous studies it was discovered that when the T cells isolated from the NOD mice were injected into other strains, the other strains became diabetic. This was not the case for the B10.D2 strain; they remained resistant. Further tests revealed that the NOD T cells remained in the mouse and were active, proving that the T cells had not been destroyed by the B10.D2’s immune system. It was hypothesized that something had to be preventing the T cells from homing in on the pancreatic islets and destroying the B cells.

Carol’s research is focused on this hypothesis. She is trying to understand the genes found in a specific region on Chromosome 17 that are responsible for this resistance. This region actually contains eight identifiable genes that are expressed in the pancreas. Carol has hypothesized that the resistance is due to polymorphisms within the coding regions of the DNA sequences between the different strains.

Carol’s research will increase what is known about type 1 diabetes, which will go to help the 1 in 7,000 children who are diagnosed with the disease every year. Because the mouse and human genomes are so similar, Carol’s findings can be applied to human resistance through genetic engineering or pharmaceutical intervention.
Bone Formation in B6.C3H-9 Congenic Strain With Male Specific Reduction in Skeletal Density

Bone is an important tissue that serves as a mineral reservoir, metabolic site, attachment point for muscles, as well as giving structural and protective support from compressive, tensile and other stresses. Bone structure is developed and maintained through a basic remodeling process controlled by two types of cells: osteoblasts and osteoclasts. Osteoblast cells control the formation of new bone, while osteoclast cells reabsorb bone.

Osteoporosis, a skeletal disorder characterized by reduced bone density and deterioration of bone tissue, is often said to occur when the bone resorption rate exceeds the formation rate. This net loss of bone increases a person's risk for fractures. Because nearly 70 percent of variation in bone density is due to genetic factors a genetic model is used to study the disorder. The other 30 percent or variation is due to environmental and gender factors.

B6.C3H-9, a congenic mouse subline, is the product of a cross between a mouse with a high bone mineral density (BMD), C3H, and a mouse with low BMD, B6. A congenic strain is a product of a B6 C3H cross backcrossed to B6 mice over 10 generations until all genes come from B6 except for the region of Chromosome 9 from C3H suspected to contribute to BMD. A congenic strain carrying a chromosome segment from another mouse strain, in this case C3H, can be used to discover which genetic components regulate the given phenotypic difference. When B6.C3H-9 are compared to B6 background mice, then in theory the only variation in their BMD should be caused by the region on Chromosome 9. When this comparison was made with both genders, the study showed that the bone density of congenic males decreased significantly, while the congenic females did not differ significantly from the B6 females.

Carolyn is investigating whether the significantly reduced bone mineral, volume and size parameters observed in the previous experiments were the result of lower osteoblast function and/or proliferation, hopefully leading to subsequent studies of the gene and its regulation.

Understanding the genetics behind bone density aid understanding osteoporosis. Carolyn's study specifically will add to researchers' understanding of how bone formation could be stimulated in an offensive attack against skeletal deterioration. Her study may also reveal how underlying gene function is responsible for bone density differences between males and females.
The Role of Heparan Sulfate Proteoglycan Agrin on B-Amyloid Plaque Formation on Neuritic Blood Vessels

Agrin is a protein involved in transmitting developmental signals from nerves to muscles. However, agrin has been identified as playing a role in Alzheimer's disease as well. Agrin is associated with the amyloid plaques and tau tangles that are the principle hallmarks of the disease. This association may play a causative role in the pathological progress of Alzheimer's disease. There are actually two types of agrin, based on preliminary results one type of agrin is suspected to enhance plaque formation, while the other is suspected to aid in clearing these plaques from the brain through the circulatory system.

Alzheimer's disease is the most common cause of senile dementia in older Americans. The disease is the result of a mutation that causes progressive damage to the regions of the brain that are responsible for cognition and memory. At the moment there is no accurate model for Alzheimer's disease because there are several pathways that lead to the degenerative conditions that characterize the disease.

If agrin is involved in the formation of plaque and tangles, agrin may be used as a potential molecular target for new drug treatments. If a molecule at the beginning of a disease-causing pathway can be disabled, then the entire pathway can be shut down and there will be no disease.
Positional Cloning of a Novel Neuromuscular Mutation

The Simon John Deviant is an autosomal recessive mutation, meaning that two copies of a mutated gene are necessary in order to have the trait. Affected mice are much smaller than unaffected mice and have ataxia, shake and have a muddled coat because they are unable to groom as a result of poor motor skills. Mutant mice, however, do not have a greatly shortened lifespan, which is in stark contrast to other neuromuscular mutants. Another striking difference is that sjd mice are often difficult to identify at a young age and have to be aged significantly in order to be positively identified.

The sjd mutation arose from a mutagenesis experiment focused on inducing mutations affecting male fertility. The mice with the new mutation were tested for fertility, and the fertile mice were given to Simon John to age for late-onset glaucoma. The neuromuscular problems were observed while the mice were aging in Simon John’s laboratory, and the new mutation was named after him.

Ashley is attempting to locate the sjd gene, which has been narrowed down to Chromosome 15. She is doing this by positional cloning, which involves maintaining a mapping cross and genotyping animals in search of recombinants within the gene interval. Once recombinants are identified, the known genes within that interval are sequenced for comparison with the published normal sequence. This process will allow Ashley to find the position of the gene that causes the mutation, find the amino acid sequence of the affected protein and surmise what the normal function of the affected protein may be.

Ashley’s research will increase understanding of human neuromuscular diseases. Through this understanding, it may be possible to develop drugs to mitigate and solve these problems.
Role of Steroidogenic Factor 1 (SF1) in Gonadal Sex Determination in Mice

During the early stages of development mammalian gonads have the potential to differentiate into either testes or ovaries. XY individuals usually develop into males with two testes, and XX individuals usually develop into females with two ovaries. There are cases, however, when the gonads develop as ovaries despite the presence of a Y chromosome or develop as testes despite the absence of a Y chromosome. This is known as complete sex reversal. Sex reversal in humans appears as frequently as one in 20,000 live births.

The primary gene involved in sex reversal, the sex-determining region of Chromosome Y (Sry), was first cloned in 1990. Sry was determined to be essential for normal testes development because without a functioning Sry gonads develop into ovaries regardless of whether the individual is XY or not.

Although Sry is the primary sex-determining gene, sex reversal can also occur with a seemingly normal copy. Therefore there must be other genes that contribute to sex determination. One of these genes is hypothesized to be steroidogenic factor 1 (SF1). SF1 was identified in 1992 and is involved in adrenal and gonadal development. SF1 is of interest to researchers because besides being present in the genital ridge (gonad precursor) during early development, SF1 also interacts with several other genes important in gonad differentiation. Jane's research focuses on uncovering the role of SF1 in gonad development and the pathways regulated by SF1 that lead to proper sexual differentiation.

Identifying and understanding the pathways of sexual differentiation may improve the way sex reversal cases are treated and allow for accurate identification of sex in ambiguous individuals.
The Normoblastosis Mutation in Mice: Investigation of Neurological Deficits in the nb/nb Cerebellum

Ankyrins are proteins that help attach other proteins to the plasma membrane of cells, helping create a cell's structure. These proteins are produced by three different genes: Ank1, Ank2 and Ank3. It has been observed that mutations in Ank1, like the normoblastosis (nb) mutation, lead to severe anemia because the red blood cells are very fragile. An ANK1 deficiency is actually one of the most prominent causes of inherited anemia in humans. Mice with the nb mutation also have neurological problems because there are significantly less cerebellar Purkinje cells (PKC) than in normal mice.

Purkinje cells are a special type of nerve cell that carries every piece of information out of the cerebellum. These cells have a great deal of control over the refinement of fine motor skills.

Jesse’s research focused on the decrease in cerebellar PKCs as a result of the nb mutation. His objectives were to investigate why the PKCs are dying and in what areas of the cerebellum the death is most pronounced. Jesse also investigated the number of ANK1 isoforms, proteins that have similar sequences of amino acids but not identical, that are expressed in brain PKCs. Jesse also tried to determine whether one part of the PKC dies before another.

Ankyrins are key proteins that are found in many forms throughout the body. This study will aid in future studies of Ank1 isoforms that may reside in other cells. Determining the effects of ANK1 isoforms in PKCs will clue researchers into what other isoforms are doing in other parts of both the mouse and human body.
The Role of Growth Hormone in Aging

Growth hormone is a protein that is needed for normal growth for many reasons: It increases mitosis and cell division, helps start protein synthesis by increasing membrane transport into cells and making RNA, and increases cellular uptake of organic nutrients, especially amino acids.

Growth hormone is also hypothesized to play a role in aging. Previous studies have linked lower levels of growth hormone to longevity. Bomopregha has focused her research on this connection. To do this she is looking at the process of cellular senescence. Cellular senescence is based on the idea that cells can only divide a finite number of times before they cannot divide any more. It has been hypothesized that shortened telomeres of chromosomes play a primary role in this process.

Bomopregha is using the histology of the kidney to determine if a growth-hormone deficiency slows the aging process. She is also designing and testing a system that regulates growth hormone. This research has the potential to help people live longer, healthier life.
Bioinformatics Search for Hematopoietic Stem Cell Regulatory Mechanisms

Stem cells are unspecialized cells that are generally defined by two major properties: They are capable of extended self-renewal through mitosis, and under certain conditions they differentiate into specialized cells that go on to form tissues and organs. Hematopoietic stem cells (HSCs) are stem cells found in bone marrow that differentiate to produce the entire system of blood cells. These are the most widely studied and understood of all the different type of stem cells.

Stem cell plasticity, their ability to differentiate into a variety of specialized cells, is what holds the greatest interest for researchers. Stem cell plasticity is a potentially invaluable tool in the treatment of human disease through regenerative therapies.

Another area of interest in stem cell research is the balance between proliferation and differentiation that is maintained by stem cells and the regulatory pathways that govern this state. For example, the mechanism that governs cell proliferation can provide clues about the causes of cancer and various types of birth defects.

Michael's research is focusing on understanding the regulatory factors that control stem cell function through bioinformatics, as well as comparing the various tools that are currently used for this type of analysis. To do this, Michael first is clustering genes from a stem cell database into a hierarchical tree according to the gene expression patterns. This tree will allow Michael to place 22 genes known to be over-expressed in the HSCs of mice into subgroups based on similar gene expression patterns in different stages of development. Michael will then look for motifs in nucleotide sequences in the promoter regions of genes within each of the subgroups using motif-searching methods. These motifs will then be used to find potential transcription factors for HSCs that can be tested for their biological activity.

Grouping HSC genes according to their expression pattern may lead to the discovery of genes that are governed by a single pathway, which may also lead to the discovery of the proteins that control gene expression in HSCs. These discoveries would go a long way toward understanding the central mechanisms that govern stem cell function, bringing researchers one step closer to being able to use stem cells to understand and treat diseases.
A Network Approach to Cancer Genetics: Visual Portrayal of Cancer Pathways with Genetic Database References

The Mouse Genome Informatics (MGI) Database contains all the information collected about the genetics of the mouse. It was created at The Jackson Laboratory and is available to the public online. The database is an important tool that is accessed by thousands of researchers worldwide every day; however, a major problem with the database approach is that databases do not provide an environment that visually expresses gene relationships and networks.

Providing an information source where the relationships are given in an interactive environment is crucial to understanding how specific molecular pathways work. Creating a direct representation of gene relationships provides a greater understanding of the underlying biological processes.

Rebecca’s project was to research specific pathways and take relevant genetic information found in the MGI database to put into a visual pathway context. This pathway context enabled her to overlay information on gene expression and other attributes of the pathway. The power of the flexibility of the pathways is the ability to express detailed and complex networks in a comprehensive representation. These visual pathways allow researchers to have an immediate and interactive environment for their research and for the application of genetic information.
Using Bioinformatics and PERL Programming to Catalyze and Simplify QTL Research for Specific Diseases

The Positional Candidate Analysis Display (PLAD) is a database of quantitative trait loci (QTL) available online that is used by researchers to identify disease-related genes. QTL are chromosome areas that contain genes involved in the expression of a trait, in this case various diseases. PLAD was created in 2003 by a Summer Student, and this year Ayodele will be modifying and enhancing the program.

Ayodele’s main objective for his project is to redesign PLAD to make it more user-friendly. These modifications include reorganizing the system, modifying the query options and using a color-coding scheme to present the data more clearly. Changes made to the query options will allow researchers to ask for only those genes that have specific characteristics or attributes. The color-coding will make it easier for researchers to differentiate between genetic sequences that are in coding areas of a gene (exons) and those in non-coding areas (introns).

Ayodele will also be updating the database by adding new disease QTL. Ayodele plans to focus on those QTL related to spinal orthopedic conditions like scoliosis and osteoporosis.

All of these modifications will decrease the time needed to narrow down thousands of genes to specific genes of interest that can be tested. Hopefully this will lead to more time for researchers to spend on actual gene investigations and, eventually, more discoveries.
Assessing Gene Ontology Annotation Consistency Between the Mouse and Rat Genomes

Bioinformatics is an emerging field of biological research that provides a way to catalog, manipulate and make predictions about large collections of data. One of the greatest bioinformatics achievements in the past decade has been the development of genomic databases. Genomic databases allow researchers to make genetic comparisons across species. However, different institutions defined and described gene products of different organisms, leading to differences in vocabulary. In order for genomic databases to be as useful as they are intended to be, a unified vocabulary must exist. For her project, Megan concentrated on identifying the discrepancies between the vocabulary used in the mouse and rat genomic databases.

Gene Ontology (GO) is a method of unifying the vocabulary pertaining to genes and gene products among organisms. The GO allows gene and gene products to be categorized so that their function and position in the cell can be easily accessed and compared to the genes and gene products of other organisms. These terms are grouped by three generalized categories: molecular function, biological process and cellular component.

Creating a unified and consistent vocabulary will give users of the databases a more common and globalized understanding. It will also provide commonality between different species, propagating an understanding of orthology and increasing correlations between organisms' genes and functions.
Identification of Homologous 3'-Untranslated Region Sequences and Characterization of Conserved Regulatory Elements

The “Central Dogma” of molecular biology is simple: Genetic information travels from DNA to RNA to proteins and essentially to bodily function. The processes behind this basic genetic principle are not quite so simple. DNA, found in the nucleus of cells, contains hundreds of genes that code for proteins. Proteins, however, are assembled in the cytoplasm in ribosomes. The DNA is too large to escape through the pores of the nucleus, so a single gene from the long DNA strand is transcribed into mRNA. It is the mRNA that goes to the ribosome and is used as instructions to build a protein in a process known as translation.

The first product of RNA transcription, however, is much larger than the protein because genes contain sections that have protein assembly instructions (exons) and sections that are nonsense (introns). The first production of transcription, then, is precursor mRNA. Pre-mRNA is modified so that all of the introns are cut out, and all of the exons are pasted together. Two non-coding sequences, however, are left at either end of the mRNA: a 5'UTR and a 3'UTR. The series of introns, the coding sequence, controls what protein is made; the UTRs (untranslated regions) control when and where that protein is made.

At each step in the central dogma there is a possibility for gene regulation. What Jill looked at was regulation after transcription, specifically regulation by the 3'UTR.

Jill’s project was to compare the sequence of bases found in the 3'UTR of mRNA from the same species and across species using the computer. Her goal was to identify patterns that remained constant, as well as the positions of those patterns. Because Jill focused specifically on regulation during the transition from oocyte to embryo, her research may eventually impact biomedical treatments concerning developmental biology.

Jill also is developing a computer program that will allow 3'UTRs to be identified and compared more quickly in the future. The program will allow a researcher to enter a gene name and receive a set of homologous 3'UTRs from the genomes of several different organisms.
Linkage Disequilibrium in the Mouse Genome

Linkage disequilibrium is the non-random distribution of alleles at two different locations on a chromosome. The inheritance of alleles, variations of genes, is random. Linkage disequilibrium (LD) describes a situation in which some combinations of alleles occur more frequently than chance would predict, making their inheritance non-random.

Inheriting alleles is considered random because of recombination. Recombination occurs when the same gene, one from the maternal chromosome and one from the paternal chromosome, are switched during gamete formation. The less distance between genes on a chromosome, the less likely they are to be separated by recombination. Genes that lie close together and are usually inherited together are said to be linked.

LD occurs in blocks of bases on a chromosome. In humans, these blocks are approximately 20-50 Mb in length; however, in mice these blocks are 3-6 Mb in length. Angela's project was to investigate the reasons for these large LD blocks within inbred mouse strains: Were they caused by suppressed recombination or by natural selection during the inbreeding process?

Angela hypothesized that if selection during the formation of inbred strains drove LD, then recombinant inbred lines would have recombination rates much less than that of F2 mice within high LD blocks. However, if suppressed recombination drove LD, then the recombination rates of these blocks in recombinant inbreds and the F2 would be similar.

The formation of LD blocks by natural selection could occur because random inheritance can produce disadvantageous combinations of alleles. Animals with the disadvantageous combinations will die, leaving the advantageous recombinants to reproduce among themselves. Over time, natural selection will favor those combinations of alleles that produce the most viable and fertile offspring. The unfavorable recombinants will be removed from the populations, reducing the recombination rate and the genetic distance between genes.

Understanding LD allows for understanding of chromosomal organization because it appears that chromosomes are organized to ensure genes that are functionally related are located close together, causing them to be inherited together.

This study also has significance because if regions of high LD can be identified, the associations between the genes within those blocks can be analyzed. This information could be used in future investigations into the genetic basis of many diseases.
Exploring Common Features of Gene Clusters and Desert Nuclear Organization and Their Links to Gene Expression

DNA encodes genes, which make up the genome of an organism. These genes are non-randomly arranged on chromosomes; some regions of the chromosomes are gene rich while others are gene poor. Previous studies have indicated that the separation of gene-rich areas (clusters) and gene-poor areas (deserts) affects the way that DNA folds into chromosomes on a smaller scale.

Long strings of DNA are compacted into chromosomes by a complex folding system. DNA is first wrapped around protein clusters called histones to form long strands of chromatin. Chromatin is then folded and condensed even more to create chromosomes in a process that is still not fully understood.

It has been suggested that chromosomes are not randomly positioned in the nucleus. The DNA from each chromosome forms a distinct territory that is separate from other chromosome territories. If chromosomes were randomly located they would be intertwined and spread out. These chromosome territories are non-randomly arranged in the nucleus with chromosomes that have fewer genes located to the periphery. There is also non-random organization within each chromosome territory. Chromosomal regions with high gene density have been shown to be arranged differently than those with low gene density.

Throughout the summer Laura examined different cluster-desert regions to determine if previously observed folding patterns were repeated in all gene cluster-desert regions and to see how the transcriptional state of the gene clusters affects their organization in the nucleus. Laura also investigated whether nuclear organization is dependent on the cell type and/or gene expression.

Because DNA is the starting point for protein production, understanding genes and how they are transcribed into mRNA is essential to understand how the body functions. Gene folding and chromosome structure are an important part of this. The study will also increase what is known about chromosome structure and how it is influenced by gene expression.
Testing Genes Underlying Both Experimental and In Silico High Density Lipoprotein Quantitative Trait Locus

High-density lipoproteins (HDLs) are often referred to as "good cholesterol." This is because high levels of HDL can significantly reduce a person's chance of developing atherosclerosis, the leading cause of death in industrialized nations. It is not definite how HDL decreases the risk of heart disease, but several methods are hypothesized: HDL stimulates reverse cholesterol transport and decreases cholesterol deposits in peripheral tissues like arteries, reduces the retention of lipoproteins, or inhibits chronic inflammation by decreasing the production of adhesion molecules and macrophage chemotactic proteins, among others.

Because nearly 70 percent of HDL-level variation is genetically determined and because high HDL levels confer such benefits, it has become increasingly important to locate the genes that regulate HDL concentrations. These genes might eventually act as new targets for atherosclerosis therapies.

Recent studies have concluded that variations in HDL concentration are associated with the apoA-I gene locus because mutations and deletions in this gene decrease the amount of protein product and also HDL levels.

This summer Allison is investigating the location of the gene responsible for HDL production in mice. Her first step was to compare QTL regions recognized by the computer database to those found experimentally. QTL regions are areas of chromosomes that consist of multiple minute DNA changes that, in this case, appear to affect HDL levels in different strains of mice. This comparison allowed her to focus only on those genes that were in QTL recognized by both methods. Then she was able to search for differences in protein sequences and mRNA expression, which reflect sequence differences, or mutations, in regulatory regions of DNA. Based on these differences, Allison will be able to identify which gene is associated with HDL production.
Glaucmatous Vision Loss: How and Why

Glaucoma is a group of eye diseases in which the output neurons of the retina self-destruct because of high pressure in the eye. When these neurons die there is no way for the eyes to communicate with the brain so the person goes blind. However, researchers have not found the definitive reason why these neurons become apoptotic (self-destruct). Joe’s project focuses on neuron apoptosis. Joe is investigating whether the molecule BIM, an important signaling pathway activator, is involved in causing neurons to self-destruct. BIM is already known to play an important role in another well-documented apoptotic pathway. Joe is also investigating the role of the Atria gene, which is involved in blood pressure regulation. By knocking out this gene in mice, Joe is testing whether or not blood pressure is an important factor in glaucoma neuron death.

If these genes are found to be important in glaucoma, then the specific molecules involved in the neuron death pathway can be targeted for treatment of glaucoma. Specifying the pathway will also lead to a greater understanding of the apoptosis pathway of neurons in glaucoma. If these genes are not found to be important, then the findings will weaken the argument behind the prominent theory explaining how elevated pressure triggers neuron self-destruction.
Screening for Possible Hematological Mutations

The Mouse Mutant Resource (MMR) at The Jackson Laboratory has approximately 270 established mutant stocks of mice with spontaneous genetic mutations. Sixty to seventy percent of these new mutations are at various stages of characterization. However, the general characterization process does not normally include hematological (blood) analysis, so new hematological mutations are often overlooked.

Gina is screening new mutants from the MMR for new hematological mutations by doing a complete blood profile. This research will provide a model to demonstrate the importance of hematological screening of mutant mice and may potentially identify characteristics not previously associated with known mutations. The project will also increase understanding of single-gene mutations.
Characterization of Cytokine Deficiency Induced Colitis Susceptibility Locus 1 (Cdcsl) Mediated NF-kB Responses in Antigen Presenting Cells (APC) from IL-10 Deficient Mice

Autoimmune responses occur when the body reacts against its own tissues as if they were foreign invaders: causing inflammation to isolate them and producing antibodies to destroy them. Nathan’s research focused on the effects of autoimmune responses in Inflammatory Bowel Disease and type 1 diabetes, looking specifically at T-cell activation and signaling proteins, like antigen presenting cells (APC), from IL-10 deficient mice.

APCs are part of the body's innate immunity, the first line of immune defense that is genetically determined. After coming into contact with invading cells, APCs place invader proteins on their surfaces. These proteins serve as an alarm activating other immune cells, like T cells, and sensitizing them to the form of the invader. When this signaling becomes dysfunctional, it is thought to cause the adaptive immune system to over-compensate, causing an immune response against normal tissues that is triggered by the approximately $10^{14}$ naturally occurring bacteria found mostly in the large intestine, and leading to colitis. Colitis is characterized by chronic inflammation of the digestive tract.

The cdcsl region on Chromosome 3 includes the gene that codes for NF-kB, a transcription factor used in the APC signaling pathway. Of the 10 genetic locations that have been correlated to colitis susceptibility, cdcsl has the strongest correlation and is the region of study.

In his IBD research Nathan is characterizing the nuclear translocation of NF-kB in immune bodies by stimulating them with different antigens and determining the effects that an interleukin-10 deficiency and cdcsl have on the activation of the expression factors for NF-kB.

Nathan also researched autoimmune responses in connection with type 1 diabetes using flow cytometry, T-cell labeling and splenocyte transfers.
Identifying Genetic Polymorphisms that Contribute to Kidney Disease

Kidney disease currently affects 10 percent of the American population, and the number is expected to rise in the coming years. Despite the disease’s prevalence, there have only been a few mutations found in humans that have been linked to kidney disease.

Previous studies have shown that the A/J and DBA2 mice commonly have high urinary albumin levels, a characteristic of kidney disease, while B6 strains have low levels of urinary albumin, which correlates to resistance to kidney disease. Since strains are bred to be genetically identical, crossing mice with different or opposite genetic traits can reveal the gene polymorphisms that code for either resistance or susceptibility to kidney disease. Caitlin used progeny from both an A/J x B6 cross and a DBA2 x B6 cross to locate the chromosome regions that contain genes that contribute to kidney disease.

Using a quantitative trait loci (QTL) analysis Caitlin will be able to link kidney disease to specific gene regions and then will be able to test candidate genes by comparing DNA coding sequences and expression levels in three strains of mice.

Understanding the genetics of kidney disease could ultimately lead to earlier detection and new treatments. These developments would decrease suffering, reduce the costs associated with treating end stage renal disease and hopefully reduce the instance of other conditions that are often coupled with kidney disease, such as cardiovascular disease.
The Genetic Analysis of Fatty Liver Disease

Non-alcoholic fatty liver disease (NAFLD), which affects 10-21 percent of Americans, occurs when fat comprises at least 10 percent of the liver. A NAFLD patient's liver looks like it has had alcohol-induced damage, but the person did not abuse alcohol. NAFLD most often occurs in people who are obese, diabetic and have elevated cholesterol and triglyceride levels.

The exact biological mechanisms of the NAFLD are not known, and there is a great deal of variation in the severity and outcome of NAFLD. This variation, however, cannot be explained in connection to a particular risk factor. Thus, it has been hypothesized that NAFLD has a genetic component, although studies have yet to identify a specific NAFLD gene.

The main objective of Abby's research is to determine if there is a strong genetic component regulating susceptibility to NAFLD and, if so, to map the gene's location. In order to complete this objective, Abby compared two strains of mice, one susceptible to NAFLD and one resistant to it and completed a QTL analysis.

Abby’s research hopefully will lead to a better understanding of the pathology of NAFLD and possibly determine new risk factors for the disease. The discovery of a NAFLD gene in mice might also lead to the discovery of a similar gene in humans. Thus, Abby’s research has the potential to spawn new therapies for the disease.
Role of Cyclin D1 in \textit{BCR-ABL} Signaling

Philadelphia chromosome-positive (Ph+) leukemias occur from a single mutation in a single gene. A piece of chromosome 22 in the blood-forming cells in the bone marrow breaks off and is switched with a piece of chromosome 9. The break occurs in the middle of a gene, BCR, and this little “gene-let” then fuses to another gene, ABL. The newly formed hybrid gene is called BCR-ABL.

Because BCR-ABL is a combination of two genes, it produces a combination protein. This abnormal protein eventually stimulates uncontrolled production of blood cells, leading to leukemia. The two common types of Philadelphia chromosome-positive leukemias that have been induced in mice in Dr. Shaoguang Li’s laboratory are chronic myeloid leukemia (CML) and B-cell acute lymphoblastic leukemia (B-ALL). CML usually appears in middle age, while B-ALL usually affects children.

Sarah’s research builds on the research Dr. Li’s laboratory conducted on the signaling pathways involved in Ph+ leukemias. The pathway that Dr. Li and his research team have focused their attention on involves a group of enzymes that help activate proteins. Their research has shown that these enzymes are important for the formation of cancer cells in B-ALL.

Sarah is focusing on the role of cyclins, which help control the cell cycle and may be involved in the BCR-ABL signaling pathway. The cell cycle is comprised of all of the steps involved in cell division. Cyclin D1 (CCND1) is required for a cell to progress from G1, in which the cells grows and prepares its chromosomes for replication, to S phase, in which DNA actually replicates.

Discovering how each protein in the BCR-ABL signaling pathway is involved in leukemia development will help in the creation of effective therapies that can be used to slow or cure Ph+ leukemias. If CCND1 is found to affect or regulate the formation of proteins later in the pathway, CCND1 might become a potential target for future therapies. Eliminating CCND1 in the BCR-ABL pathway may help slow the formation of cancer cells.
Gene Identification for the Spontaneous
Fitful Mutation

The fitful mutation is an autosomal dominant mutation that arose spontaneously from a C57BL/6J mouse colony at The Jackson Laboratory. Because it is dominant, a mouse only needs one copy of the mutated gene to be affected by the characteristic uncoordinated movements and seizures. These symptoms begin to appear at two weeks of age. If the mouse inherited two copies of the mutated gene, it will die at approximately three weeks of age. Because of the characteristics of affected mice, this mutation has been linked to epilepsy in humans.

The mutation has been narrowed down to a region on Chromosome 2 that contains 18 genes. Amanda’s project for the summer was to test two genes in this region to determine whether they were the ones containing the mutation. One of these genes produces a protein that is found in all inner ear hair cells. The second gene is a novel gene, meaning the function of it is not known. The protein it produces, however, has been found to be expressed in all tissues but primarily in the testis.

The majority of genes that have been identified in conjunction with epilepsy have dealt with mutations to ion channels. However, there are no apparent ion channel-related genes in the region where the mutation was isolated. That would make identification of the fitful gene a step toward understanding a different molecular cause of epilepsy.

Amanda’s experiment will either rule out these two candidate genes or will positively identify the mutation’s location. Identifying the gene causing the fitful mutation might identify a novel gene involved in epilepsy and ataxia. With knowledge of this gene more precise diagnoses may be possible. This knowledge could also lead to the development of more site-specific drugs and a better understanding of the molecular mechanisms that underlie these disorders.
Temporal and Spatial Expression of ALMS Protein in \textit{alms1} Gene Trap Mice

Alström syndrome is a rare disease, affecting 250 people worldwide, that is caused by inheriting two mutated genes (autosomal recessive). The syndrome is characterized by early childhood pigmentary retinal degeneration, which leads to blindness, as well as progressive hearing loss and obesity. The disease can also lead to type 2 diabetes, heart dysfunctions and kidney failure.

Alström syndrome is caused by a mutation in the \textit{ALMS1} gene, a gene that was only identified in 2001. The function of the protein produced by this gene is still unknown; however the protein is known to be expressed in all of the organs affected by the syndrome: testis, liver, kidneys, adipose tissue, eye, pancreas, kidney and brain.

Erika's research focused on discovering where ALMS protein localizes and is expressed in mouse models, as well as determining the timing of protein expression of ALMS protein in various mouse model tissues using embryos.

Even though only a handful of people are affected by Alström syndrome, many of the problems associated with the disease are common characteristics in the general population. Erika's research may lead to a better understand of the pathways that lead to obesity, diabetes, neurosensory defects and other common diseases.
An Investigation of Three Science-Writing Fields

Science writing at The Jackson Laboratory includes three major specializations: public information, science journalism and grant writing. Science writing serves as a bridge between the scientific community at the Laboratory and the general public. In public information, messages are disseminated to the public via the media. Amber used press releases focusing on the Summer Students to generate news stories about each student’s selection to the program and to generate awareness about the program and the Laboratory. So far, Amber has had five news releases picked up by students’ hometown newspapers. Amber also helped cultivate relationships with journalists during Press Week.

In science journalism, the reporter must take complex scientific concepts or theories and make them approachable for the average newspaper reader. Amber wrote one feature focusing on Dr. Shaoguang Li’s leukemia research and its connection to the cancer research tradition at The Jackson Laboratory.

In grant writing, the science writer must be able to break down complex scientific research into understandable terms, as well as communicate the reasons why the program or research is important. This is a more overtly persuasive type of writing. Throughout the summer, Amber had the opportunity to edit and write various concept papers and grant proposals to benefit educational programs at the Laboratory, as well as to write an endowment report summarizing three researchers’ current projects.

Amber also had the opportunity to learn about donor relations during her time at The Jackson Laboratory. She spoke at a luncheon for potential donors, as well as writing materials to send to donors that support the Summer Student Program.
Press Week

Press Week is an annual event that is sponsored by The Jackson Laboratory and Johns Hopkins University Medical Center. The event is held at The Jackson Laboratory during the second week of the annual Short Course in Medical and Mammalian Genetics. The short course is always held during the last full two weeks in July.

In 2004, 12 national science writers took part in the week’s activities, which included press briefings with researchers presenting at the short course as well as a carriage ride in Acadia National Park and a traditional Downeast Lobster Bake. These science writers worked for major news organizations such as Newsday, the Boston Globe and WGBH-NOVA, as well as for major research institutions such as The March of Dimes and The Howard Hughes Medical Institute.

Press Week was even more hectic because the BBC flew in to tape footage for a documentary of the history of mouse genetics. By taping during Press Week, the crew was able to interview researchers who had gathered for the short course and Scientific Symposium, as well as to get footage of the various strains of mice at the mutant mice clinic held on that Thursday for all short course and Press Week participants.

Photos of the various Press Week activities, press briefings at the Scientific Symposium and the BBC filming can be found on my digital portfolio in the Public Information section.
Sunday, July 25
5:00 p.m. - 7:00 p.m.
Bar Harbor Inn Welcome Reception and Briefing: Victor McKusick, M.D., Richard Woychik, Ph.D., David Valle, M.D., Patsy Nishina, Ph.D., Jürgen Naggert, Ph.D., Joyce Peterson, and Joann Rodgers, M.S.

Monday, July 26
8:30 a.m. - 9:30 a.m.
Gary Churchill, Ph.D., The Jackson Laboratory: "Developing Mouse Resources for Common and Complex Diseases"

9:45 a.m. - 10:45 a.m.
Nicholas Katsanis, Ph.D., Johns Hopkins University: "Clary Dysfunction in Human Pleiotropic Disease"

11:00 a.m. - 12:00 p.m.
Gonçalo Abecasis, Ph.D., University of Michigan: "Mathematics in Medicine: Unraveling the Genetic Basis of Common Disease"
Lunch

4:00 p.m.
Porcupine Room Open, Bar Harbor Inn

Tuesday, July 27
8:30 a.m. - 9:30 a.m.
Douglas Wallace, Ph.D., University of California, Irvine: "Mitochondrial Paradigm for Aging and Degenerative Disease: A New Perspective on Alzheimer's Disease"

9:45 a.m. - 10:45 a.m.
Joachim J. Harz, M.D., University of Texas Southwestern Medical Center: "Cholesterol Transporters—How They Shape Your Brain and Protect your Heart"
Group Photo

11:00 a.m. - 12:00 p.m.
John A. Phillips, M.D., Vanderbilt University: TBA
Lunch

4:00 p.m.
6:00 p.m. - 8:00 p.m.
Porcupine Room Open, Bar Harbor Inn
Lobster Bake, Calendar House Cottage (Fee $15 per adult; under 18 free)

Wednesday, July 28
8:30 a.m. - 9:30 a.m.
Peter Goodfellow, Ph.D., GlaxoSmithKline Pharmaceuticals Discovery Research: "The Genome and Drug Discovery"

9:45 a.m. - 10:45 a.m.
John Epplig, Ph.D., The Jackson Laboratory: "How Do You make a Good Egg?"

11:00 a.m. - 12:00 p.m.
Barbara Knowles, Ph.D., The Jackson Laboratory and Davor Solter, M.D., Ph.D., Max-Planck Institute of Immunobiology: "The Oocyte to Embryo Transition, Epigenetics at the Beginning of New Life"
Lunch

4:00 p.m.
6:15 p.m. - 8:15 p.m.
Porcupine Room Open, Bar Harbor Inn
Day Mountain Sunset Carriage Ride (Fee $15 per adult; under 18 free)

Thursday, July 29
8:30 a.m. - 9:30 a.m.
Edward Rubin, M.D., Ph.D., Lawrence Berkeley National Laboratory: "Comparative Genomics at the Extreme"

9:45 a.m. - 10:45 a.m.
Peter Agre, Ph.D., Johns Hopkins University: "Aquaporin Water Channels"

11:00 a.m. - 12:00 p.m.
Ethylin Wang Jabs, M.D., Johns Hopkins University: "Global Approaches to the Genetic Studies of Structural Birth Defects"

12:15 p.m.
Judith Hall, M.D., University of British Columbia: "Fetal Determinants of Adult Health and Twinning—Surprises and Insights into Mechanisms of Diseases"
Lunch

4:00 p.m.
Porcupine Room Open, Bar Harbor Inn
<table>
<thead>
<tr>
<th>Sunday, July 25</th>
<th>What</th>
<th>Who</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:30-5 p.m.</td>
<td>Set up for reception at Oceanfront Lodge, Bar Harbor Inn</td>
<td>Amber, Jade, Joyce</td>
<td>• Give-aways&lt;br&gt; • Name badges&lt;br&gt; • Name plates for head table&lt;br&gt; • Visitor cards&lt;br&gt; • Notebooks&lt;br&gt; • 10-15 copies of 2nd week Short Course schedule</td>
</tr>
<tr>
<td>5-8 p.m.</td>
<td>Briefing &amp; reception: Victor McKusick, M.D., Richard Woychik, Ph.D.,</td>
<td>Amber, Jade, Joyce</td>
<td>Ensure that everyone has dinner plans.</td>
</tr>
<tr>
<td></td>
<td>David Valle, M.D., Patsy Nishina, Ph.D., Jürgen Naggert, Ph.D.,</td>
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<tr>
<td></td>
<td>Joyce Peterson, and Joann Rodgers, M.S.</td>
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<tr>
<td>Monday, July 26</td>
<td>Pick up Morning Glory baked goods</td>
<td>Joyce</td>
<td></td>
</tr>
<tr>
<td>8:30-9:30 a.m.</td>
<td>Gary Churchill, Ph.D., The Jackson Laboratory: “Developing Mouse</td>
<td>Jade in PW sessions,</td>
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<tr>
<td></td>
<td>Resources for Common and Complex Diseases”</td>
<td>Amber/Joyce at table</td>
<td></td>
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<tr>
<td>9:45 - 10:45 a.m.</td>
<td>Nicholas Katsanis, Ph.D., Johns Hopkins University: “Ciliary</td>
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<td></td>
<td>Dysfunction in Human Pleiotropic Disease”</td>
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<tr>
<td>11:00 a.m. - 12:00 p.m.</td>
<td>Gonçalo Abecasis, Ph.D., University of Michigan: “Mathematics in Medicine: Unraveling the Genetic Basis of Common Disease”</td>
<td>Joyce (P/U papers)</td>
<td>Jade sells Lobster Bake/Carriage Ride tix</td>
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<tr>
<td>12:15 p.m.</td>
<td>Lunch</td>
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<tr>
<td>4:00-9:00 p.m.</td>
<td>Porcupine Room open</td>
<td>Joyce (P/U papers)</td>
<td>Jade off; Amber can come &amp; go as she likes</td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
<td>Speaker/Details</td>
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<tr>
<td>7:30 a.m.</td>
<td>Pick up Morning Glory baked goods</td>
<td>Joyce</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m.- 9:30 a.m.</td>
<td>Douglas Wallace, Ph.D., University of California, Irvine: “Mitochondrial Paradigm for Aging and Degenerative Disease: A New Perspective on Alzheimer’s Disease”</td>
<td>Jade in PW sessions, Amber/Joyce at table</td>
<td></td>
</tr>
<tr>
<td>9:45 a.m.- 10:45 a.m.</td>
<td>Joachim J. Herz, M.D., University of Texas Southwestern Medical Center: “Cholesterol Transporters—How They Shape Your Brain and Protect your Heart”</td>
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<tr>
<td>10:45-11:00 a.m.</td>
<td>Group photo</td>
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<tr>
<td>11:00 a.m.- 12:00 p.m.</td>
<td>John A. Phillips, M.D., Vanderbilt University: TBA</td>
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<tr>
<td>12:15</td>
<td>Lunch</td>
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<tr>
<td>4:00-5:30 p.m.</td>
<td>Porcupine Room open</td>
<td>Amber (P/U papers)</td>
<td></td>
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<tr>
<td>6:00-8:00 p.m.</td>
<td>Lobster Bake, Callendar House Cottage</td>
<td>Jade, Amber, Joyce</td>
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<tr>
<td>Time</td>
<td>What</td>
<td>Who</td>
<td>Notes</td>
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<tr>
<td>7:30 a.m.</td>
<td>Pick up Morning Glory baked goods</td>
<td>Joyce</td>
<td></td>
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<tr>
<td>8:30-9:30 a.m.</td>
<td>Peter Goodfellow, Ph.D., GlaxoSmithKline Pharmaceuticals Discovery Research: “The Genome and Drug Discovery”</td>
<td>Joyce/Asher take turns in PW sessions &amp; table</td>
<td></td>
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<tr>
<td>9:45-10:45 a.m.</td>
<td>John Eppig, Ph.D., The Jackson Laboratory: “How Do You Make a Good Egg?”</td>
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<tr>
<td>10:00-11:00 a.m.</td>
<td>BBC: Meet with Senior Staff Scientist David Harrison/see Harrison lab</td>
<td>Jade</td>
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<tr>
<td>11:00 a.m.-12:00 p.m.</td>
<td>Barbara Knowles, Ph.D., The Jackson Laboratory and Davor Solter, M.D., Ph.D., Max-Planck Institute of Immunobiology: “The Oocyte to Embryo Transition, Epigenetics at the Beginning of New Life”</td>
<td>Joyce/Asher take turns in PW sessions &amp; table</td>
<td></td>
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<tr>
<td>11:00 a.m.-12:00 p.m.</td>
<td>BBC: General lab tour</td>
<td>Jade</td>
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<tr>
<td>12:15 p.m.</td>
<td>Lunch</td>
<td>Jade</td>
<td>Joyce sells carriage ride tix</td>
</tr>
<tr>
<td>1:00-2:00 p.m.</td>
<td>BBC: Meet with Director of Research and Senior Staff Scientist Barbara Knowles</td>
<td>Jade (Joyce support)</td>
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<tr>
<td>2:00-4:00 p.m.</td>
<td>BBC: Meet with Nessa Reifsnnyder in Room 2730 to talk about stills/archive</td>
<td>Nessa</td>
<td>Nessa, please escort them out to lobby after meeting</td>
</tr>
<tr>
<td>4:00-5:30 p.m.</td>
<td>Porcupine Room open</td>
<td>Amber (P/U papers)</td>
<td></td>
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<tr>
<td>4:00 p.m.</td>
<td>Pick up food &amp; drinks for carriage ride</td>
<td>Joyce</td>
<td></td>
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<tr>
<td>5:30 p.m.</td>
<td>Oli’s Trolley picks up at Bar Harbor Inn</td>
<td>Amber, Jade, Joyce</td>
<td></td>
</tr>
<tr>
<td>6:15-8:15 p.m.</td>
<td>Day Mountain Sunset Carriage Ride</td>
<td>Amber, Jade, Joyce</td>
<td></td>
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<tr>
<td>8:15 p.m.</td>
<td>Oli’s Trolley returns to Bar Harbor Inn</td>
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<tr>
<td>Time</td>
<td>Event</td>
<td>Person(s)</td>
<td>Notes</td>
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<td>7:30 a.m.</td>
<td>Pick up Morning Glory baked goods</td>
<td>Joyce</td>
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<td>8:30-9:30 a.m.</td>
<td>Edward Rubin, M.D., Ph.D., Lawrence Berkeley National Laboratory: “Comparative Genomics at the Extreme”</td>
<td>Joyce/Amber take turns in PW sessions &amp; table</td>
<td></td>
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<tr>
<td>9:30 - 12:00</td>
<td>BBC: Film interview with David Harrison/footage of mice in Harrison lab</td>
<td>Jade (Nessa support)</td>
<td></td>
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<tr>
<td>9:45-10:45 a.m.</td>
<td>Peter Agre, Ph.D., Johns Hopkins University: “Aquaporin Water Channels”</td>
<td>Joyce/Amber take turns in PW sessions &amp; table</td>
<td></td>
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<td>11:00-12:00</td>
<td>Ethylin Wang Jabs, M.D., Johns Hopkins University: “Global Approaches to the Genetic Studies of Structural Birth Defects” Judith Hall, M.D., University of British Columbia: “Fetal Determinants of Adult Health and Twinning—Surprises and Insights into Mechanisms of Diseases”</td>
<td>Joyce/Amber take turns in PW sessions &amp; table</td>
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</tr>
<tr>
<td>12:15 p.m.</td>
<td>Lunch</td>
<td>Jade (Joyce support)</td>
<td></td>
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<tr>
<td>1:00 - 2:30</td>
<td>BBC: Film interview with Dr. Jeffrey Friedman outside (if possible)</td>
<td>Jade (Joyce support)</td>
<td></td>
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<tr>
<td>2:30 - 4:00</td>
<td>BBC: B-roll of Mouse Genetics Clinic with Senior Staff Scientist Muriel Davisson</td>
<td>Jade/Amber</td>
<td></td>
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<tr>
<td>4:00 - 6:00</td>
<td>BBC: Film footage of mice/interview with Muriel Davisson in Training Lab</td>
<td>Jade/Amber</td>
<td></td>
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<tr>
<td>4:00-9:00</td>
<td>Porcupine Room open</td>
<td>Joyce (P/U papers)</td>
<td>Amber can come &amp; go; Jade may bring BBC crew by</td>
</tr>
<tr>
<td>Friday, July 30</td>
<td>What</td>
<td>Who</td>
<td>Notes</td>
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<tr>
<td>6:15am</td>
<td>Symposium, Bar Harbor Club</td>
<td>Joyce, Amber</td>
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<tr>
<td>7:00-8:00am</td>
<td>Shuttle service for working staff</td>
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<td>7:00-8:00am</td>
<td>Shuttle service invited staff</td>
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<tr>
<td>7:00-8:00am</td>
<td>Registration</td>
<td></td>
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<tr>
<td>7:00-8:00am</td>
<td>Continental breakfast served</td>
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<tr>
<td>7:30am</td>
<td>Judy Alexander checks on arrival of speakers</td>
<td></td>
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<tr>
<td>7:50am</td>
<td>Guests take their seats</td>
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<tr>
<td>7:55am</td>
<td>Barbara Knowles Intro</td>
<td></td>
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<tr>
<td>8:00am</td>
<td>Rick Woychik: &quot;Welcome&quot;</td>
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<tr>
<td>8:10am</td>
<td>Victor McKusick: &quot;The Short Course&quot;</td>
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<tr>
<td>8:35am - 9:05am</td>
<td>Neal Copeland: &quot;Retroviral Insertional Mutagenesis Provides A Road map for Navigating and Annotating the Cancer Genome&quot;</td>
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<tr>
<td>9:00-10:00</td>
<td>BBC: Film interview with Skippy Lane in GRB 1025</td>
<td>Jade</td>
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<tr>
<td>9:10am - 9:40am</td>
<td>Harold Varmus - Title to come.</td>
<td></td>
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<tr>
<td>9:40am</td>
<td>Break (shuttle available)</td>
<td></td>
<td>Lobby/glass corridor Coffee, tea, fruit</td>
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<tr>
<td>9:40am</td>
<td>Press Briefing</td>
<td></td>
<td>Small conference room</td>
</tr>
<tr>
<td>10:00am - 10:30am</td>
<td>Peter Doherty &quot;T Cells, Viruses, and the Major Histocompatibility Complex&quot;</td>
<td></td>
<td>Ballroom – Podium</td>
</tr>
<tr>
<td>10:35am - 11:05am</td>
<td>Gail Martin &quot;The Road From Tertocarcinomas To Embryonic Stem Cells...and Beyond&quot;</td>
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<tr>
<td>10:00-11:00</td>
<td>BBC: Film interview with Moyha Lennon-Pierce in GRB 1025</td>
<td>Jade</td>
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<tr>
<td>11:00 - 12:30</td>
<td>BBC: Film instruments from 1947 fire in Video Conference Room</td>
<td>Jade</td>
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<td>Time</td>
<td>Event Description</td>
<td>Location</td>
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<tr>
<td>11:10am - 11:40am</td>
<td>Irv Weissman &quot;Differentiation and Self-Renewal of Hematopoietic Stem Cells&quot;</td>
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<tr>
<td>11:40am</td>
<td>Lunch</td>
<td>Ballroom/glass corridor, terrace</td>
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<tr>
<td>11:40am</td>
<td>Press Briefing</td>
<td>Small conference room</td>
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<tr>
<td>12:25pm</td>
<td>Lunch ends (shuttle available)</td>
<td>Susan Moxley to ring bell.</td>
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<tr>
<td>12:35pm</td>
<td>Guest take their seats</td>
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<tr>
<td>12:35pm - 1:05pm</td>
<td>Jeff Friedman &quot;Leptin and the Regulation of Body Weight&quot;</td>
<td>Ballroom – Podium</td>
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<tr>
<td>1:05pm - 1:40pm</td>
<td>Eddie Rubin &quot;Comparative Genomics at the Extremes&quot;</td>
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<tr>
<td>1:40pm - 2:00pm</td>
<td>Break (shuttle available)</td>
<td>Lobby/glass corridor; coffee, tea, cold drinks, fruit</td>
<td></td>
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<tr>
<td>1:40pm - 2:00pm</td>
<td>Press Briefing</td>
<td>Small conference room</td>
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<tr>
<td>2:00pm - 2:30pm</td>
<td>Peter Agre &quot;Aquaporin Water Channels: From Atomic Structure to Clinical Medicine&quot;</td>
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<tr>
<td>2:35pm - 3:05pm</td>
<td>Lee Hood &quot;Systems Biology Will Transform The Future&quot;</td>
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<tr>
<td>3:05pm - 3:15pm</td>
<td>David Valle Closing Remarks</td>
<td>Barbara Knowles Wrapup</td>
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<tr>
<td>3:00pm</td>
<td>Kid’s Program</td>
<td>Staffed by Jenn Bridgers</td>
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<tr>
<td>3:15pm</td>
<td>T.J.L tour guides in place</td>
<td>Staffed by Jill Kline</td>
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<tr>
<td>3:15pm - 3:45pm</td>
<td>Shuttle to Jackson Laboratory</td>
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<tr>
<td>3:15pm</td>
<td>Reset ballroom for donor dinner</td>
<td>Lisa John to check on room arrangements</td>
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<tr>
<td>3:15pm</td>
<td>Children’s Program</td>
<td>Program hosted by Jenn Bridgers</td>
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<tr>
<td>3:15pm</td>
<td>Hosts for speaker reception in place</td>
<td>Hosts?</td>
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<tr>
<td>3:30pm</td>
<td>Reception for symposium speakers</td>
<td>Amber, Jade</td>
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<tr>
<td>3:30pm</td>
<td>Training and Education Committee meeting</td>
<td>Staffed by Barbara Knowles, Barbara Tennent</td>
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<tr>
<td>3:30pm</td>
<td>Building Committee</td>
<td></td>
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<tr>
<td>4:15pm</td>
<td>Callendar/Highseas house tour guides in place</td>
<td>Harborside conference room; Cheryl Callinan to</td>
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<tr>
<td>Time</td>
<td>Event Description</td>
<td>Event Details</td>
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<tr>
<td>4:30pm</td>
<td>Shuttle van to Calendar house</td>
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<tr>
<td>5:00pm</td>
<td>Executive / SAC Meeting</td>
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<tr>
<td>5:00pm</td>
<td>&quot;Society for Discovery&quot; reception</td>
<td>Harborside conference room; Cheryl Callinan &amp; ? to host reception.</td>
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<tr>
<td>5:30pm</td>
<td>Registration</td>
<td>Lobby Entrance Registrars: Penny F., Rita H., Kate J., Jean R.</td>
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<tr>
<td>5:45pm</td>
<td>Shuttle service for invited staff</td>
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<tr>
<td>6:00pm</td>
<td>Donor Reception</td>
<td>Glass corridor, terrace Staffed by Lisa John</td>
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<tr>
<td>6:45pm</td>
<td>Presentation to Governor Baldacci</td>
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<tr>
<td>7:30pm</td>
<td>Donor dinner</td>
<td>Ballroom Staffed by Lisa John</td>
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<tr>
<td>8:00pm</td>
<td>Staff moves registration materials to TJL</td>
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<tr>
<td>8:15pm</td>
<td>Donor dinner program</td>
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<td>Keynote speaker: George Mitchell (confirmed)</td>
<td>Ballroom</td>
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<tr>
<td>9:15pm</td>
<td>Shuttle service for invited staff back to TJL</td>
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<tr>
<td>Saturday, July 31</td>
<td>What</td>
<td>Who</td>
<td>Notes</td>
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<tr>
<td>7:00am</td>
<td>Registration set up</td>
<td>Registrars: Nessa R., Cheryl C., Dawn F., Kate J.</td>
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<tr>
<td>7:30am</td>
<td>Shuttle service</td>
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<tr>
<td>7:40am</td>
<td>Registration</td>
<td>Registrars: Nessa R., Cheryl C., Dawn F., Kate J.</td>
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<tr>
<td>8:00am</td>
<td>BSO/BGT meeting</td>
<td>Staffed by Barbara Knowles, Barbara Tennent</td>
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<tr>
<td>9:00am</td>
<td>BGT/Corp. Meeting</td>
<td>Staffed by Janet Michaud and Jana Robinson</td>
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<tr>
<td>9:30am</td>
<td>Kid's Program</td>
<td>Staffed by Jenn Bridgers</td>
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<tr>
<td>10:00am</td>
<td>Scientific Colloquium</td>
<td>Staffed by Janet Michaud and Jana Robinson</td>
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<tr>
<td>10:30am</td>
<td>Tour of TJL</td>
<td>Staffed by Jill Kline</td>
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<tr>
<td>12:00pm</td>
<td>BGT/Corp. Luncheon</td>
<td>Staffed by Lisa Giulianelli, Janet Michaud, Jana Robinson</td>
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2004 Scientific Symposium

celebrating 75 years of discoveries

The Jackson Laboratory
and the visionary work of Leroy Stevens that would lay much of the foundation for modern embryonic stem cell research. Elisabeth Russell’s defining work on hematopoiesis and anemias, the research by Doug Coleman that eventually led to the discovery of leptin, and the blossoming field of complex trait genetics would help define The Jackson Laboratory as a world-class research institution. The growing array of genetically defined mice, the development of a repository for cryopreserved strains, and the Mouse Genome Informatics effort further identify the Laboratory as the world leader in mouse genetic resources.

Harold E. Varmus, M.D., received his M.D. in 1966 from Columbia University in New York and began his career as a surgeon in the U.S. Public Health Service. In 1968, he joined Ira Pastan’s laboratory at the National Institutes of Health as a Clinical Associate and in 1970, became a postdoctoral fellow in the laboratory of J. Michael Bishop at the University of California, San Francisco. Their partnership and subsequent research on oncogenes would lead them in 1989 to share the Nobel Prize in Physiology or Medicine for the “discovery of the cellular origin of retroviral oncogenes.” In 1993, Dr. Varmus, a member of the National Academy of Sciences, became the first Nobel Laureate to be appointed Director of the National Institutes of Health, a position that he filled until 1999 when he accepted his present position as President and Chief Executive Officer of the Memorial Sloan-Kettering Cancer Center. His research currently focuses on using biochemical, genetic, and molecular approaches to understand the normal and oncogenic properties of genes implicated in cancer.

Dr. Varmus has been a member of the Corporation of The Jackson Laboratory since 2001.

Gail Martin, Ph.D., is currently a Professor in the Department of Anatomy and Division of Genetics, and Director of the Program in Developmental Biology at the University of California, San Francisco. She received a Ph.D. in molecular biology from the University of California, Berkeley in 1971, and in 1973 joined the laboratory of Dr. Martin J. Evans in the Department of Anatomy and Embryology at University College London, England, as a postdoctoral fellow. After returning to the United States in 1975, Dr. Martin spent a year in the laboratory of Dr. Charles J. Epstein in the Department of Pediatrics at the University of California, San Francisco where she became an Assistant Professor in residence after joining the Department of Anatomy in 1976.

Dr. Martin was the first to isolate mouse embryonic stem (ES) cells from normal embryos and pioneered the study of the differentiation of embryonal carcinoma (EC) cells in culture. She has made significant contributions to the field of growth factor research, particularly with respect to the role of fibroblast growth factor (FGF) in organogenesis and limb development. Dr. Martin is a member of the Academy of Arts and Science and the National Academy of Sciences.

Dr. Martin has served as a member of the Board of Scientific Overseers at The Jackson Laboratory since 2001.

Peter C. Doherty, Ph.D., AC, FAA, FRS, earned a Master’s degree in Veterinary Medicine from the University of Queensland in 1966, and a Ph.D. in pathology from the University of Edinburgh in 1970. While conducting research from 1972-75 at the John Curtin School of Medical Research in Canberra, he began collaborating with Dr. Rolf Zinkernagel, studying the role of T lymphocytes in viral meningitis in mice. This work ultimately revolutionized the field of immunity by explaining the mechanism of T-cell recognition of self and “non-self” in cell-mediated immunity. In 1996, this work would lead Zinkernagel and Doherty to Stockholm to share a Nobel Prize in Physiology or Medicine “for their discoveries concerning the specificity of the cell mediated immune defense.”

Dr. Doherty was a member of the Walter Institute from 1975-1982, and then headed the Department of Pathology at the Curtin School in Canberra and returned to the U.S. to become chairman of the Department of Immunology at St. Jude Children’s Research Hospital in Memphis, in 1988. He is currently associated with the University of Melbourne in Australia.
Press Week Article

While waiting for the governor to arrive at the Mount Desert Biological Laboratory press conference, I was introduced to the owner of The Mount Desert Islander, a local weekly newspaper. While we were talking, he suggested that I write a short account of Press Week. Unfortunately, the article was never published.
Jackson Laboratory Hosts Distinguished Scientists and News Organizations
Amber Bauer, Jackson Laboratory Summer Student

Seventy-five years of genetics research drew scientists and journalists alike to the Bar Harbor Club the morning of Friday, July 30 for The Jackson Laboratory’s Scientific Symposium, “celebrating 75 years of discoveries...a vision for the future.”

The Symposium capped off the 45th Annual Short Course in Medical and Experimental Mammalian Genetics and the 40th Annual Press Week. At the Symposium, world-renowned scientists discussed major scientific breakthroughs of the recent past that in some way had their roots at The Jackson Laboratory. Among those who presented were Nobel Laureates Drs. Harold E. Varmus, Peter C. Doherty and Peter Agre.

Dr. Victor McKusick of Johns Hopkins University conceived of the Short Course while eating dinner at Testa’s restaurant in 1959. In the 45 years following that dinner, the course has become an educational hallmark in medical and experimental genetics, drawing more than 100 students each year. The roster of Short Course faculty is a virtual “who’s who” of modern biomedical research.

Press Week, which began in 1969, coincides with the second week of the Short Course. Press Week gives science writers from across the country the opportunity to be briefed on the newest developments in genetics research and make contacts with both researchers and colleagues.

"Some years we're lucky, and one of the prominent scientists who's here to lecture at the Short Course will have a major science story to announce during Press Week," said Joyce Peterson, Jackson Laboratory public information manager. "But mainly, reporters are here to get background on the stories they'll be covering all year, and incidentally they build valuable relationships with Jackson Laboratory researchers."

Over the years, science and medical reporters from virtually every major U.S. news organization have attended Press Week. The 2004 group included representatives from Newsday, the Boston Globe, the Journal of the American Medical Association, WGBH-NOVA and the Dallas Morning News.

This year’s 75th anniversary celebration and Press Week also attracted international media attention. Simultaneous to the Symposium a BBC television crew was wrapping up filming for a documentary about the history of the laboratory mouse. The crew interviewed both Jackson Laboratory researchers and Short Course speakers and is projected to air in England on a BBC station sometime in October.
Luncheon Presentation

I was asked by the Development Office to be the lunchtime speaker for a group of potential donors who flew up from Portland, Maine, to visit the laboratory. I spoke for about 10 minutes before lunch was served about my experiences as a summer student. I highlighted how I found out about the program, described my projects in the Office of Public Information and told a few stories about life at Highseas. Overall, I received a very good reaction and feedback to my presentation.
Agenda

Continental Breakfast

Welcome and Overview
Jim Osterholt, Vice President for External Relations
Dr. Rick Woychik, Director

The Jackson Laboratory and Its Role in Maine’s Economy
Li Erickson, Director of Development
Jill Goldswain, Director of Government Relations

Training and Education Programs at The Jackson Laboratory
Dr. Jon Geiger, Manager, Educational Programs
Joe Barker, Summer Student

Cancer Research
Dr. Shaoguang Li, Associate Staff Scientist

Lunch
Amber Bauer, Summer Student

Tour Cryopreservation
Dr. Carlisle Landel, Associate Research Scientist

Heart Disease Research
Dr. Gary Churchill, Senior Staff Scientist

Wrap up
Alan MacEwan, Corporation Member, The Jackson Laboratory
Janet Braga, Maine Region Officer
**Sponsor Night**

Every Tuesday and Thursday nights from the second week of my internship onward were "Sponsor Nights." What this meant was that the two or three students scheduled for that night would make a 10- to 15-minute presentation about their project. The student's sponsor and other lab members were invited to attend to help field questions and to stay for dinner, allowing the other students to interact with a large portion of the senior research staff.

Because I was an "early start" student, I was one of the first people to present at Sponsor Night. The following are the slides I used to describe science writing and the various projects I was just beginning.
Functional Analysis of Labular Development and Communication Using the Computer Mouse

aka Science Writing

Presented by Amber Bauer
Sponsored by Joyce Peterson

What is science writing?
- Public Information
- Science Journalism
- Grant Writing

Tools of the Trade
- News Releases
Tools of the Trade
- News Releases
- Fact Sheets
- Hard News Articles
- Features
- Grants
- Presentations

Press Week Activities
- Symposium
- BBC visit
- TONS OF FUN!!!
**Summer Student Scientific Symposium**

The final task as a summer student is to present your research results at the annual Summer Student Scientific Symposium. Laboratory researchers and staff, as well as friends and family members were invited to attend. Because I was the only student who was not working in the lab, I was slated to go last, approximately eight hours after the first presentation. As a result, I developed my presentation in a less formal manner. I knew most people would be tired of listening to presentations and would just want to go home for dinner. Thus, I combined information about science writing and my accomplishments with humor and a few inside jokes. The result was a more attentive audience who left the Symposium with smiles on their faces.
SUMMER STUDENT PROGRAM
RESEARCH SYMPOSIUM

August 16, 2004

The Jackson Laboratory
600 Main Street
Bar Harbor, ME 04609-1500

Please treat these talks as confidential as they may provide material for future publications.
AMBER BAUER

Mentor:
Joyce Peterson

Rendering the Genetic Lexicon into the Communal Vernacular (a.k.a. Translating Science into Plain English)

Science writing encompasses public information, science journalism and grant writing, bridging the gap between scientists and the public. In public information, news about the Laboratory is communicated to the public via the media. I wrote two separate news releases for each Summer Student, and generated six stories so far. I also cultivated relationships with national science writers during Press Week. In science journalism, the reporter must make complex scientific concepts approachable to the average person. I wrote one feature about Dr. Shaoguang Li’s leukemia research that will be published September 2. In grant writing, not only does science need to be translated, but the reasons the research is important must also be stressed — a more persuasive type of writing. I edited and wrote concept papers and grant proposals for educational programs at the Laboratory, as well as writing an endowment report summarizing three researchers’ current projects.

Supported by:
The Horace W. Goldsmith Foundation
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**Session 4**

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In my journalism classes we are always told that most people in the United States read at an eighth-grade level. That’s right, eighth grade. I don’t know about you, but I wasn’t reading about “functional genomics” or “post-transcriptional gene regulation” in the eighth grade. Thus, the average American citizen is not exactly prepared to read and understand the majority of the materials written by researchers at The Jackson Laboratory, which is really sad. As you’ve heard today, there is a lot of really exciting research going on here that has definite applications to disease treatments. It also creates quite a conundrum, seeing as the Laboratory is a non-profit organization. All of the research here is funded by the general public either directly, through private donations, or indirectly, through federal funding. So in order for there to be research, there must be an informed public. That’s where science writing comes in – science writers bridge this canyon between researchers and the public.

The science writer has one foot in the world of the scientist, where they speak one language: jargon, and one foot in the world of the general public, where they speak “just plain English.” In essence, the science writer is an interpreter between these groups, translating jargon into something understandable (and meaningful) to the public. There are actually three different types of science writers: grant writers, Public Information Officers and science journalists, each translating scientific material to a different degree and for a different purpose. I had the opportunity to explore all three during my summer internship, facing the triumphs and challenges associated with each.

There are numerous challenges faced by science writers. The first is that your words are chameleons, changing constantly over the course of the day to fit the audience you are faced with. Being able to make the change almost instantaneously from interviewing a scientist to writing so that even my mother can understand is essential.
Along those lines, because you are communicating research from the entire Laboratory, you have to know a little about everything. When I was writing the Research Summaries for the Non-Scientist, I went from obesity to diabetes to leukemia to deafness; from flow cytometry to QTL analysis to PERL scripts. This is not a job for someone who does not like to learn or who is afraid to ask questions. As Joanna Downer from Johns Hopkins Medicine said during Press Week: “I get to be a glorified grad student for the rest of my life.” And it’s true. I’ve learned more science in the past 11 weeks that most of my academic career combined. Although, I hope I never have to give myself another three-hour immunology crash course ever again! But it would have been difficult to write about Mouse Mammary Tumor Virus without it.

Despite the challenges there are also rewards. For me, the most rewarding experience was being able to participate in Press Week. In one week I met a Nobel Laureate, watched the BBC film a documentary, was introduced to the Governor of Maine and went to a party with Glenn Close. (Show photos).

I learned so much this summer. Not only about genetics but also about what it takes to be part of the Public Information Office at a major laboratory. Public Information is not just writing, although that’s the fun part. It’s also about maintaining open lines of communication and strong relationships with everyone at the Laboratory. It’s about juggling an insane amount information and various personalities to try to keep everyone happy: the scientists, the staff, your colleagues, the press, the public – all people with different interests and different ways at looking at information. I also learned that even the most mundane tasks, like taking photos for a Web site, can turn out to be adventures. And I learned more about Princeton than I ever needed, or wanted, to know.

Finally I learned a lot about this program. Throughout the summer I was able to watch the students because I really had a duel role: I was a science-writing intern, but also the “scribe” of the
Summer Student Program. Many of my projects were just to document the Summer Student experience. This ranged from writing news releases about each student to designing the 2004 Summer Student Web site. I was able to see how people interacted with each other and see how people’s interest was truly sparked by their project. I was able to see people come home after good or bad, long or short days at the lab. I was able to observe (but thankfully not experience) the defeat of a PCR gone awry – or not going at all for that matter. And by writing releases for each student at the beginning and end of the summer I was able to see how people did or didn’t change. Some people really have changed this summer – they will exit through the doors of Highseas tomorrow nine or 11 weeks after they first stepped through them as a different person: more mature, more sure of a career path, more hopeful for the future.

A few of us had life-changing experiences this summer. A few of us simply confirmed what we already knew about ourselves. But this program goes far beyond science and careers. It’s also about the people. I can honestly say that most of us have made friends that we still expect to receive Christmas cards from when we are 80.

After this summer there will always be something special about the sound of the ocean, the taste of a blueberry and the smell of mouse urine that will bring us back to The Jackson Laboratory.

And with that, I would like to thank Joyce Peterson for choosing me to be a part of this program. And to Jade Harmer for putting up with me for 11 weeks in a very small cave-like office and for answering all of my questions. David Brancaccio for challenging The Jackson Laboratory to create this internship. Also to the Office of External Relations for making me feel like I was part of the team, not merely a student passing through. And finally to The Horace W. Goldsmith Foundation because without it I would not have a paycheck.

So are there any questions?
Rendering the Genetic Lexicon into the Communal Vernacular

aka Translating Science into Plain English

Presented by: Amber Bauer  Sponsored by: Joyce Peterson

Methods

- Using mouse strain MAC/G4
- Generated news releases, feature stories, research summaries, grant concepts, endowment report, Web site, etc.

Why do we need science writers?

- Better public understanding.
- Public finances science.
- Serve as a bridge.

Challenges

- Words are chameleons.
- Have to know a little about everything.
  - Constantly learning.
Highlight: Press Week
• Every project is an adventure!

• The program is the people.

What I Learned:

• What it takes to be part of the
  Public Information Office at a major
  research laboratory.
  – Communication
  – Strong relationships
  – Juggling information and personalities
Acknowledgements

• Joyce Peterson and Jade Harmer
• David Brancaccio
• Everyone in the Office of External Relations
• The Horace W. Goldsmith Foundation
Introduction

My ultimate career goal, although generally stated is to become a science writer, is not to work as a journalist. I don’t want to be a science reporter for The New York Times or for Science. I want to be a science writer at a non-profit or government research laboratory such as the National Cancer Institute, The Scripps Research Institute or The Jackson Laboratory.

When I become a science writer, I want to contribute my time, energy and passion to help the world understand the important and exciting research that is being conducted in the field of genetics. Science is intimidating for many people and genetics even more so. The problem lies in the fact that many people fear what they do not understand, and most research is publicly funded. I want to help researchers get the funding they need to continue their research by educating the public. I also want to be able to say that I helped find the cure for cancer even if I never step foot in a lab and pick up a micropipette. I want to find the grant money for the researcher who does find the cure and then proclaim to the world that cancer has been vanquished while explaining how.

I know that achieving my ultimate career goals will take time. I have to break into and prove myself in the field first. I have learned during my time at Ball State that the best way to get ahead in any field is to make connections. Also, the best way to know if you are headed down the right path is to ask someone who has been there before. It is for both of these reasons that this section is so important. This section includes interviews that I conducted via e-mail with five science writers working in various industries, including television journalism, print journalism and public information offices.

I chose these five people for a number of reasons. The first was to renew connections that I made this summer. During my internship at The Jackson Laboratory I was able to meet and
network with 10 national science writers during the annual Press Week. I e-mailed my questions to all 10 of these science writers, and four responded: Joanna Downer, Tracy Hampton, Jim Keeley and Barbara Moran. The fifth science writer, Jason Bardi, works at The Scripps Research Institute, a non-profit research laboratory that I would love to have the opportunity to work at. Being able to interview him allowed me to establish a contact at one of the top five places where I would like to work.

The answers I received from these individuals have given me a lot of insight into what it takes to be a science writer. The stories about how each person became a science writer have shown me that there is no “right way” to get into the field. Some people started out as scientists; some started out as chefs-in-training. The important thing is not what you have your degree in but that you have a passion and an understanding for science and the ability to make complex subjects understandable. You also have to loved to learn because every day brings with it new discoveries and new difficulties.

These interviews have intensified my desire to go to graduate school and have shown me the importance of joining the National Association of Science Writers. Both of these endeavors will enable me to make more connections and learn more about the field. I am applying to the MIT science writing program for fall 2005 admission. Because my interests lie outside the heading of science journalism, I feel as though MIT’s program is the best choice for me. Also, many seasoned science writers have ties to MIT through the Knight Fellowship Program, giving me numerous networking opportunities. The only other programs that offered degrees matching my career goals were at the University of California-Santa Cruz and The Johns Hopkins University. UCSC’s program, however, was tailored toward educating experienced bench scientists and journalists. I did not have the credentials necessary to apply. The Johns Hopkins
program is much more closely linked to the humanities. Students had to show a command of a European language like French, Spanish or German in order to be admitted. And although I took French for five years, I knew that after three years of non-use I would not be able to show proficiency.

I am planning to join NASW during winter break. I hope that I will be able to attend the conference in Washington, D.C. this February. All of the science writers suggested that this conference would be an excellent opportunity to meet and talk to more science writers and would be an excellent opportunity to find a mentor in the field. Because all of the science writers I interviewed are NASW members, I hope that I would also be able to renew the contacts that I’ve established face-to-face.

Overall, these science writers were extremely generous to me, an aspiring science writer. Not only did they take the time to answer my questions and offer to answer any follow-ups, many of them also offered to help in any way they could so I could get my foot in the door. One of the science writers even offered to sponsor my application to NASW if I were to apply for regular membership rather than student membership. I hope to continue to cultivate these relationships because I welcome advice from people who have “made it” in the field of science writing. Perhaps these relationships will also help me in my own career, either aiding in my admission to MIT or in securing a science writing position once I graduate. Only time will tell.
**Jason Bardi**
Science writer
Scripps Research Institute

Q: *How did you get into the field of science writing?*

A: In my early life, I was a chef-in-training, and I didn't really know anything about science at all, but I became interested in science after many months of reading magazines like Scientific American, New Scientist and National Geographic. Back then I was most interested in astronomy and paleontology – two subjects that I, ironically, never really pursued.

To make a long story short, I enrolled in college at the age of 21 to pursue a degree in physics. During my first semester, I had some tremendous success in a basic composition course, winning an essay contest. So I became a double major in English and physics, went to graduate school and got advanced degrees in biophysics and science writing. The rest is history.

Q: *What professional organizations do you belong to?*

A: The National Association of Science Writers (NASW) is a very good organization, and I would encourage anyone interested in science writing to work on joining. I say "work on" because you have to actually apply for membership, including finding two sponsors who are already members and (I think) submitting writing samples. I believe you might be able to join as a student member without the clips, and it's cheaper too.

I would encourage you to join and to go to their annual meeting, which is in D.C. this year in February. There are terrific opportunities there to hook up with a mentor.

The NASW also has individual local chapters (D.C., New York, San Diego, etc.). Get involved in your local chapter if there is one.

There are a lot of resources on their web site for members and non-members. See www.nasw.org.

Q: *What is the most difficult part of your job?*

I am the only science writer at The Scripps Research Institute, which is one of the major private, non-profit basic biomedical research institutes in the world. As you can imagine, there are many papers coming out every week by scientists here. The most difficult thing is to decide which papers I should cover in our various publications and to juggle multiple projects that I'm working on simultaneously and that have cascading deadlines.

This juggling is a general difficulty facing almost all writers. I am no different.
Q: What is the most rewarding part of your job?

I like the range of subjects that I write about. In the last week, for instance, I have written stories about vaccines for cocaine addiction, a chromosomal aberration that leads to leukemia, antibodies that target metastatic breast cancer cells, a new technology for glycobiology and the structure of a cystic fibrosis protein.

This broad range keeps the job very interesting.

Then again, everything I write is directly related to research conducted here at Scripps Research. My subjects range over all of human health, but in the end almost everything I write could be summed up under the heading biology. If you look at newspaper reporters, you will find that they are even broader in terms of what they cover. A science reporter at a major market newspaper might write about everything from the origins of the universe to the origins of dating; from making cheese to making atomic bombs; and from dinosaur bones to new AIDS drugs.

Q: What advice do you have for an aspiring science writer?

Join NASW. Do an internship while you are in college or graduate school. Consider graduate school in science writing or journalism. These can be a great way to jump-start your career. Read a lot.

Q: What publications would you suggest I read?

Science and Nature both have excellent science coverage in their first few pages. These periodicals are expensive, though, so I would suggest reading them at the library. New Scientist is probably the broadest general interest science magazine. It can be good to read.

Tuesday's New York Times is perhaps the best newspaper to read, but don't miss out on AP and Reuters stories if you want to read about some breaking discoveries. The Washington Post and The Dallas Morning News also have good science coverage and weekly columns, and the Wall Street Journal has some of the best coverage of the pharmaceutical industry, medical ethics and other business-related health topics that you will find. Also, Sharon Begley has a weekly science column there that is excellent.

Scientific American is also very good magazine, and you will occasionally find excellent science articles in places like National Geographic (which has the best images you will find, bar none) and Wired.

There are a million other places to read about science. There are online magazines like Slate and Salon. There are online science sites like Genome Network News. And there are excellent pages to read to get basic information about science subjects on federal government-sponsored sites such as CDC, NIH, etc. For chemistry, I like to read Chemical&Engineering News.
Joanna B. Downer, Ph.D.
Assistant Director, science communication
Johns Hopkins School of Medicine Public Affairs

Q: How did you get into the field of science writing?

A: I was in graduate school for my Ph.D. in Chemistry, and my adviser asked me to decide what I wanted to do with my life, and he'd give me projects to get there. Unfortunately, there wasn't anything I was doing in the lab that I would want to do forever, and projects others were working on sounded interesting but didn't have enough pull, either. So I realized that the only thing I had enjoyed over the first two and a half years of grad school was writing textbook chapters and grant sections and editing my co-workers' papers and grants. Fortunately, my adviser already suspected this (He had the great foresight to assign me these writing and editing projects to test his hypothesis.), and when I went in to tell him that I wanted to do something with science and writing and editing, he said, "I think you'd like to be a science writer," before I could say anything at all. That sounded perfect, but I didn't really know what it was. At the time (January 1996), the American Association for the Advancement of Science had just done a big series of articles for their "Next Wave" Web site on science writing as an alternative career for scientists, and those stories were a revelation for me. Everything the people interviewed said reflected my thoughts perfectly. Everyone else's projects always seemed more interesting than their own. How could they focus on just one tiny area of science forever? How could they express their creativity and their interest in science?

So my adviser also offered my services to the public relations magazine for the department of radiology at Washington University in St. Louis (where I was in grad school) to write stories for the editor, and she was happy to have me. I wrote my first couple stories for her, and then used those as writing samples to apply for a AAAS Mass Media Science and Engineering Fellowship. I was given a fellowship spot in the summer of '97 at Time Magazine in Washington, D.C., which solidified my decision. I returned to St. Louis to finish my Ph.D. and used the AAAS experience to get paying freelance jobs through the National Association of Science Writers' jobs list. I started applying for permanent science writing jobs, mostly at universities and medical centers, in April of '98, even though I didn't expect to finish the Ph.D. until the fall. In August, I had three on-site interviews and two job offers. (The third job ended up disappearing because the person doing the hiring had her baby early and quit.) I chose to go to Duke University Medical Center in Durham, N.C., to be its first writer dedicated to covering basic science and clinical research news from its Cancer Center. (I started in November '98.) In June of 2001, I left Duke to come to Hopkins and be their first writer dedicated to covering the basic sciences, genetic medicine and cell engineering.

Q: What professional organizations do you belong to?

A: I belong to the National Association of Science Writers (http://www.nasw.org) and have at various points belonged to AAAS.
Q: What is the most difficult part of your job?

A: There are two answers to that question, since there are two parts to the job. On one hand, I'm a writer, and I write about scientific advances made by the researchers here. On the other, I'm a liaison between the institution, its faculty and reporters, both internal (for Hopkins publications) and external (the mass media). The most difficult part is usually taking a really complex, apparently esoteric scientific advance and making it understandable to a scientifically interested but general audience. The hardest one lately came out just yesterday. I had to find the right metaphor to make the reader understand what was happening. But I find an interesting catch-22 that I also find to be a difficult part of the job. If I do a good job and have good research to write about, reporters will call. But the more reporters who call, the less I can write.

Q: What is the most rewarding part of your job?

A: The aha! moment when either I figure out a great way to explain something, or the aha! moment when I'm talking to a reporter or working with them and they get it. I take a lot of pride in being knowledgeable about what my scientists are doing, and it feels good when reporters know that they are getting more than a glorified receptionist when they call Hopkins public affairs.

Q: What advice do you have for an aspiring science writer?

A: Probably the same advice as most people - read, read, read, and write, write, write. Read everything and anything - but not just to get information or for entertainment. Look at how the sentences are constructed as you're going. Do you come across a sentence or image you find particularly nice to read? Read it again, make a mental note, add the technique to your writers' toolbox. Do you find a sentence that's tough to get through or that's unexpected? How would you change it, what was the writer thinking, what effect would different changes have on the meaning, or on how it fits with the rest of the paragraph? Read great stuff - the National Geographic, Smithsonian, The New Yorker. Read regular stuff – Associated Press stories on cnn.com and in the newspapers. That is writing on the run – putting something together fast, making it as accurate as possible and then moving on. And write. Write poetry if it's in you. Play with words, Play with construction and imagery. Read scientific papers – part of being a fast science writer is knowing how to translate the science properly. How would you re-write the abstract in lay language, what do you need to keep, what do you need to get rid of in order to make it meaningful?

Q: What publications would you suggest an aspiring science writer read?

A: I'd suggest becoming a student member of NASW if you aren't already and subscribing to the NASW-talk listserv and just watching, or writing if you want to. It's a nice way to get a sense of issues in science writing and perspective. For example, recently someone wondered why the FDA would have kicked a knowledgeable scientist off a particular drug review panel. Now the
topic has morphed into evaluating research, evaluating government panels, the intricacies of conflicts of interest. If you can, I'd suggest attending the NASW conference, which is in D.C. this February, or the AAAS meeting afterwards. (NASW members can attend AAAS for free, there's a newsroom that's a bounty of experience and contacts and great opportunities to network and meet people.) NAS is midweek, but AAAS extends over the weekend, and the NASW party is Saturday night, which is another great meeting opportunity and a lot of fun. I'd also suggest signing up for the NASW-jobs listserv so you know about any new freelance or job posting. You can get a sense for what's out there, and start applying early if you see something interesting. As far as actual publications, anything you want. I personally really like the news sections of Science and Nature, which you should be able to get free online from a university computer or read in the flesh at the library.
**Tracy Hampton, Ph.D.**  
Medical news writer  
JAMA & Archives Journals

*Q: How did you get into the field of science writing?*

A: I was a postdoc and was tired of the lab, so I bought a book on alternative careers for scientists. Science writing was one option, so I looked into writing for the medical school's newspaper – the editor let me write some articles, and I loved it. I also did some writing for the public affairs office of the med school.

*Q: What professional organizations do you belong to?*

A: NASW

*Q: What is the most difficult part of your job?*

A: I don't really have a MOST difficult thing. Depending on the story I'm writing, it might be reaching an expert in the field, understanding all of the relevant details and background of a topic, or addressing my editors' follow-up questions.

*Q: What is the most rewarding part of your job?*

A: I love talking with other scientists about their work. It's also great to see my articles (and my name) in JAMA.

*Q: What advice do you have for an aspiring science writer?*

A: I feel that it's more important to know the science than to know journalism. If you want your sources to trust and respect you, you have to understand both the questions you're asking and the source's answers.

*Q: What publications would you suggest I read?*

A: JAMA, of course. Seriously, I would suggest The Scientist, any of the research highlights of the Nature Reviews, and any of the publications that medical universities and hospitals put out. (For example, "Paths of Progress" from Dana-Farber.) Also, books that have tips for science writers are helpful, but I find that they are basically filled with tips that are commonsense.
Q: Any additional comments?

A: If you want to be a science writer (assuming you understand science), the best way to see if it's a good career for you is to try it and learn from mistakes and successes. If you can, speak with folks at public affairs offices at medical schools and hospitals. They may be able to give you some assignments to get you started. Do assignments for free at first, and if you're good, they'll want to pay you to keep writing for them. I know that there are master's programs for science writing, but I didn't want to go back to school, so I just wrote during my free time.
Jim Keeley
Associate Director of Communications
Howard Hughes Medical Institute

Q: How did you get into the field of science writing?

A: This happened for me via a series of fortunate coincidences. As an undergraduate at
Vanderbilt University, I loved to take science classes and toyed with the idea of going to medical
school. But as I took more science and was exposed to the ideas behind molecular biology, for
example, I realized that what I loved most about the science was the ideas and not necessarily the
lab work. I would spend hours talking with classmates about the concepts we were learning in
the molecular biology classes – and actually spent a considerable amount of my own time
outside of class seeking out books about science, biology and theoretical physics, in particular.

My other great interest was writing, and I was a member of the Vanderbilt student newspaper,
although I did not write about science. In any event, I majored in English and took a steady diet
of science classes throughout my college career. When I emerged from college, I felt that I was
well read and certainly knew how to learn and teach myself new topics, but I was completely
unprepared to go into any particular field.

I took a few months to sort through my feelings. As fate and luck would have it, a friend told me
about a job in the public affairs office at Vanderbilt University Medical Center. I submitted a
resume, was interviewed, and got the job as an information officer, even though I did not have
much in the way of writing clips to support my application. They took a chance on me. That was
all I needed. Because I had a strong science background and abundant curiosity, I was given the
"basic science" beat, and covered all of the medical school's basic science departments for the
VUMC community newspaper. I was usually writing about three stories per week. This meant
digging up compelling story ideas, arranging interviews and writing and vetting the news stories.
So there was a tremendous amount of on-the-job training. But it was an exciting time.

Q: What professional organizations do you belong to?

A: The National Association of Science Writers, the D.C. Science Writers Association and the
American Association for the Advancement of Science

Q: What is the most difficult part of your job?

A: I would substitute the word "complex" for "difficult." As a science writer who is a public
information officer at the Howard Hughes Medical Institute, the most complex part of my job is
sorting through the many research publications authored by our researchers to find the ones that
are going to be the most interesting and have the best chance of "making news." In any given
month, I look over close to about 60 research articles. We write about 10 news stories a month,
so many of the research articles do not "make the cut" as a news story. But it may be that we can
use that article as the peg for a longer feature in our magazine, in which case I will pass that
information along to the magazine editor. But, as you know, the competition for getting in the news is very tough. Consider that most institutions of higher learning in the United States and abroad have public information offices. We're all trying to get our story in the paper or on TV. I'm fortunate enough to work at a place where science education is part of the mission. So, a primary goal of picking the stories that we write about is to purposely pick topics that will broaden the scientific knowledge of people who come to our web site or those who read our publications.

**Q:** What is the most rewarding part of your job?

**A:** Without question, the most rewarding part of my job is the really unique opportunity to interact on a daily basis, whether in person, on the phone or by e-mail, with some of the best scientists in the world. I love ideas, and I love explaining complex ideas. At HHMI, we employ about 300 of the top scientists who do research in areas like cell biology, genetics, immunology, neuroscience, structural biology, and computational biology. These scientists are based at more than 60 universities and medical schools around the country. They are truly inspiring people who are making a difference in the world. It's hard not to regard the privilege of interacting with them as the best part of my job. It reminds me of a recent speech that was delivered by Ben Patrusky, the executive director of the Council for the Advancement of Science Writing, who said that science writers have all been given a unique passport that permits them access to places off limits to most people — research laboratories where spectacular things are happening to improve health and the quality of life.

**Q:** What advice do you have for an aspiring science writer?

**A:** Be curious. Love to write and communicate. Always work on improving yourself — whether it's your writing; your understanding of science or a new field that's not familiar to you; and don't be afraid to take chances. Science writing is a field that has blossomed tremendously, even since I've been in it during the last 15 years. There are many avenues that you can take and still be a science writer, and they may not all be apparent to you when you graduate. Investigate your options. You may want to start out as a staff writer first. Or you may opt for a first job as a public information officer. But don't ever feel locked in. Use your job as a learning experience and network with others in your field. The opportunities are really endless.

**Q:** What publications would you suggest I read?

**A:** To some extent, this depends on your area, but I would read Science magazine, Nature, Discover, Scientific American, Time, Newsweek, JAMA, New England Journal of Medicine, Wired, The New York Times, listen to NPR — I could go on and on. Look at great science writing on Web sites, too — Salon.com comes to mind.
**Barbara Moran**
Senior researcher
WGBH-NOVA

*Q: How did you get into the field of science writing?*

A: My first journalism job, right out of college, was working for senior citizen's magazine as a feature writer. After a while, I started covering medical stories. I liked the challenge of medical writing, but quickly realized that I had no idea what I was talking about. So I went back to school and got an M.S. in science journalism, taking a lot of basic science classes along the way.

*Q: What professional organizations do you belong to?*

A: National Association of Science Writers, New England Science Writers

*Q: What is the most difficult part of your job?*

A: Getting scientists to speak English.

*Q: What is the most rewarding part of your job?*

A: Seeing my work on the air or in print and hoping that it may elevate the public debate on science.

*Q: What advice do you have for an aspiring science writer?*

A: Learn how to work in more than one media (i.e. TV and radio, or print and TV). Also, don't be an unquestioning science booster. I'm totally pro-science, but I also think that scientists should be able to answer questions about the societal implications of their work without being offended.

*Q: What publications would you suggest I read?*

A: "A Field Guide for Science Writers" might be interesting for you. It's published by the NASW.
Science Writing Internships

**American Physical Society**

*Web site:* http://focus.aps.org/

*Intern duties:* Interns will write for the Physical Review Focus web site, which describes physics research published in APS journals. Interns will also assist with the selection of worthy journal articles and with Web and e-mail list maintenance.

*Minimum qualifications:* Undergraduate physics coursework, bachelor’s degree in physics preferred.

*Salary:* $12/hr

*Dates of internship:* June or July through December

*Details about the publication or news office:* The Focus audience includes physicists, physics students and science writers. The stories mostly cover papers from Physical Review Letters, the world’s most prestigious physics journal.

**Argonne National Laboratory**

*Web site:* http://www.anl.gov/OPA/internship/

*Intern duties:* Participants will work at least ten 40-hour weeks on science news, feature stories and magazine articles for the Argonne News, Frontiers and logos, as well as related news releases and media contacts. This internship requires a strong background in journalism and an interest in science. The working environment is collegial, creative and collaborative. Argonne's Office of Public Affairs has six full-time professional journalist/writers who work with our interns.

*Minimum qualifications:* Participants must be full-time students at an accredited college or university and must have a strong interest in science-related journalism

*Salary:* $400/week

*Dates of internship:* Internships available quarterly

*Details about the publication or news office:* Argonne's Office of Public Affairs has six full-time professional journalists/writers who work with our interns. Argonne National Laboratory has more than 200 research programs in basic and applied science, including mathematics and computer science, biology, environmental research, materials science, physics, chemistry, energy research and advanced nuclear reactor technology. Argonne's Illinois site is located on a wooded, 1,500-acre campus near Chicago.

**Discover Magazine Internship**

*Web site:* http://www.discover.com/

*Intern duties:* Discover offers an approximately four-month, full-time, paid internship. We hire only one intern for each four-month period. Duties include researching and fact checking features and departments, tracking down story ideas for our news section and reporting and writing short news items for the magazine and the Web site.

*Minimum qualifications:* Candidates must be college graduates with a strong grounding in science. We particularly seek candidates who are enrolled in or who have completed an advanced degree science writing program.

*Salary:* $10/hr
**Fermi National Accelerator Laboratory**


*Intern duties:* Interns will write for the daily e-zine and monthly magazine. Interns also help with tasks in the Public Affairs Office.

*Salary:* $500 weekly or higher, depending on degree; appointments are 3 to 6 months

*Minimum qualifications:* bachelor's degree; proof of writing skills

*Dates of internship:* Internships are available during the fall, spring and summer semesters.

*Details about the publication or news office:* There are five staff members. Also, we frequently have national media coverage.

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**The Harvard Medical School Internship in Science Writing**

*Web site:* [http://focus.hms.harvard.edu/](http://focus.hms.harvard.edu/)

*Intern duties:* The program is writing intensive. The primary responsibilities of the intern include planning, researching and writing research briefs and features for Focus, the Medical School's faculty newsletter, which is sent to 16,000 faculty and staff at the school and its 18 affiliated institutions.

*Minimum qualifications:* A bachelor's degree, as well as an educational background in science and demonstrated writing skill. Good clips are important.

*Salary:* $10.00/hour

*Dates of internship:* There are three internships during the year: one in the fall, from September through December; in the winter/spring, from January through May; and in the summer, from June through August.

*Details about the Public Affairs Office:* Public Affairs is divided between publications and media relations. The publications side has a director/editor, production manager, editorial assistant and three science writers. The intern is an integral part of this editorial group.

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**The Jackson Laboratory**


*Brief description of intern duties:* The intern will have the opportunity to work with experienced writers in Scientific Program Development, the office responsible for a wide range of scientific writing and editing projects connected with The Jackson Laboratory's research, resources and education programs. The intern will also have the opportunity to focus on one or more research areas at The Jackson Laboratory, obtaining experience in explaining complex research projects to the general public. He or she will also interview and interact with peers in the Summer Student Program, with whom he or she will share residence and dining facilities. The intern will meet several world-class science journalists at the annual Press Week held at The Jackson Laboratory in conjunction with The Johns Hopkins University.

*Minimum qualifications:* At the time of participation in the program, a college student must be enrolled as a full-time undergraduate student, have at least one semester of undergraduate school remaining before graduation and be a U.S. citizen or permanent resident. Students majoring in either chemistry or biology and minoring in English are preferred.

*Salary:* $2,500 stipend plus room and board
Dates of internship: This is a nine- to eleven-week internship that begins in either late May or early June and ends in August.
Details about the publication or news office: The Scientific Programs Development staff includes two Ph.D. scientists with broad research experience and scientific writing expertise, a former science journalist and an information specialist. All of these professionals will help mentor the intern.

Journal of Young Investigators
Web site: http://www.jyi.org/
Intern duties: JYI science journalists actively participate in a writing-intensive immersion program designed to create effective science writing for the general public. Students in the program compose a diverse array of articles on topics from science policy to recent discoveries. To complement their writing experience, the undergraduates also edit news and feature articles written by other students in the program. Professional science writers from places such as The Howard Hughes Medical Institute, Lawrence Livermore National Laboratory and the Journal of the American Medical Association serve as mentors to these undergraduate science journalists by reviewing articles and providing detailed, constructive feedback. Under the guidance of their mentors, JYI undergraduate science writers are required to review articles written by other students. The combined experience of writing and reviewing non-technical science writing prepares students for careers in science writing and as future contributors to a scientifically literate public.
Minimum qualifications: Undergraduate college student with a strong interest in science journalism
Salary: None - valuable volunteer and learning opportunity
Dates of internship: Flexible
Details about the publication or news office: The Journal of Young Investigators, Inc. is an independent, not-for-profit, peer-reviewed, online science journal. JYI is managed entirely by and for undergraduate students from across the United States and abroad. Recognizing the importance of science communication among scientists and with the general public, JYI believes that training in effective communication should be integral to science education. As the first national, hands-on attempt to provide such training for undergraduates, JYI is dedicated to publishing only undergraduate research and science feature articles. JYI involves undergraduates in every step of the writing, editing and peer-review processes.

Popular Science
Web site: http://www.popsi.com/
Intern duties: Interns research, report and fact check. Interns get a lot of hands-on research and reporting experience, such as making phone calls to sources, attending press conferences and obtaining and evaluating products for review. Interns are an important part of the staff team and pitch in to assist editors and readers. You will not sit around waiting for something to do. Depending on their skills and enthusiasm, interns may have the opportunity to write items for the website, and the FYI, Headlines, What's New and How2.0 sections of the magazine. Interns' names are listed on the masthead.
Minimum qualifications: College degree, writing experience, and demonstrated interest in science and technology. Ideally the candidate has been published elsewhere (college publication, academic journal, etc.)
Salary: $100/week
Dates of internship: May/June through end of August. Exact dates are flexible.
Details about the publication or news office: Popular Science is the world's largest science and technology magazine with a circulation of approximately 1.5 million. The magazine is owned by Time4 Media, a subsidiary of Time Inc. (part of Time Warner). The office dress is neat but fairly casual. Suits are not needed, but ratty jeans or not permitted either in case you have to attend a press conference. Also, unless deadlines require otherwise, we will be working summer hours during the internship period: 8:45 a.m. to 5:30 p.m. Monday through Thursday and 9 a.m. to 1 p.m. on Fridays. With its small but tightly knit staff, Popular Science offers a fast-paced, hands-on experience. Interns have an opportunity to explore many topics and to become immersed in the daily intricacies of the editorial process. At the outset of the internship, the intern is introduced to the overall editorial system at Popular Science. After that, he or she is invited to jump in and proceed with various projects. Our interns have an opportunity to write for the magazine and almost always receive bylines.

Science Editor (the periodical of the Council of Science Editors)
Web site: http://www.nasw.org
Intern duties: The intern serves as staff writer for Science Editor, a bimonthly magazine/journal mainly for editors working in scholarly scientific publications. The intern also has the opportunity to take part in editorial tasks and to observe the workings of the publication
Minimum qualifications: Candidates must have excellent information gathering and writing skills. They also should have some science background and some understanding of the workings of scientific research and publication.
Salary: The salary for this 20-hour-per-week internship is $1050/month for master's degree students. For interns not at the master's level, the salary is adjusted accordingly.
Dates of internship: Internships normally are available for the fall, spring and summer semesters. Specific dates are flexible.
Details about the publication or news office: This internship is located at Texas A&M University. Because the internship normally is 20 hours per week, interns can concurrently pursue other activities, such as taking courses or working on a thesis. Sites employing recent Science Editor interns include the American Society for Microbiology, Chemical & Engineering News, the Journal of the National Cancer Institute and Texas A&M University Press.

Science Magazine
Web site: http://www.sciencemag.org/
Intern duties: Interns work as regular reporters on Science's news staff for 6 months. Their work is published by the daily news web page, ScienceNow and in the news section of the weekly magazine. Science is published weekly. ScienceNow is published five days a week.
Minimum qualifications: College graduate, writing experience
Dates of internship: January-June or July-December

Science News
Web site: http://www.sciencenews.org/
Intern duties: Interns work as full-time science writers at the weekly magazine.
Minimum qualifications: Bachelor's degree in science or journalism.
Salary: $1,800 per month
Dates of internship: 3-to-4 month period from May through August (spring and fall internships also available)

Details about the publication or news office: Science News is a weekly science magazine for a general readership. Science News is located in Washington, D.C.

Sources:
http://esys.ucsd.edu/kim/sciencewriting_internships.htm
http://www.jax.org/education
Graduate Programs in Science Writing

Boston University
Boston, Mass.
Program: Science journalism
Degree: Master's of Science in science journalism

Bowling Green State University
Bowling Green, Ohio
Program: Scientific and technical communication
Degrees: Master's of Arts in scientific and technical communication

Columbia University
Columbia, N.Y.
Program: Health, science and environment writing
Degree: Master's of Science in journalism

Cornell University
Ithaca, N.Y.
Program: Science communication
Degrees: Master's of Professional Studies in communication, Master's of Science in communication or doctorate in communication

Indiana University
Bloomington, Ind.
Program: Science writing
Degree: Master's of Arts in journalism

Iowa State University
Ames, Iowa
Program: Science communication
Degrees: Master's of Science in journalism and mass communication

The Johns Hopkins University
Baltimore, Md.
Program: Science writing
Degrees: Master’s of Arts in science writing

Massachusetts Institute of Technology
Cambridge, Mass.
Program: Science writing
Degree: Master’s of Science in science writing
New York University
New York, N.Y.
Program: Science and environmental reporting
Degree: Master's of Arts in journalism, plus certificate

Purdue University
West Lafayette, Ind.
Program: Science and culture
Degrees: Master's or doctorate in communication

University of California-Santa Cruz
Santa Cruz, Calif.
Program: Science communication
Degree: Certificate in science writing or natural science illustration

University of Tennessee-Knoxville
Knoxville, Tenn.
Program: Science communication
Degree: Master's of Science or doctorate in communication

University of Maryland
College Park, Md.
Program: Specialization in science communication
Degrees: Master's or doctorate in journalism

University of Minnesota-Twin Cities
St. Paul, Minn.
Programs: Scientific and technical communication (master's program); rhetoric and scientific and technical communication (Ph.D. program)
Degrees: Master's of Arts degree in scientific and technical communication or doctorate in rhetoric and scientific and technical communication

Sources:
http://www.nau.edu/~soc-p/ecrc/degprog.htm

For more information, consider using the Directory of Science Communications Courses and Programs in the United States compiled by Sharon Dunwoody, Elizabeth Crane and Bonnie Brown. To order, contact Sharon Dunwoody at the Center for Environmental Communication and Education Studies, School of Journalism and Mass Communication, University of Wisconsin-Madison, 821 University Ave., Madison, WI 53706. E-mail dunwoody@facstaff.wisc.edu.