THE CODE OF LIFE

Living things come in all shapes and sizes, from bacteria to people. But no matter its form, life is written in characters from a single genetic code — a chemical alphabet that animates the simplest to the greatest of works.

Deciphering the code is essential to improve living conditions and to cure diseases in people, plants and animals. The endeavor connects the beginning of life on Earth to the leading edges of biology, biotechnology and ethics.

Join us in the adventure.

A New Era of Understanding

For the first time in history, the blueprints that determine how we look, how we metabolize food or fight infections, at times even how we behave — are coming into focus.

Scientists have painstakingly cataloged approximately 25,000 genes that contain the hereditary information for the whole human race — otherwise known as the human genome.

What's more, the genomes of dozens of other important species, from mice to rice, have been sequenced, giving scientists vast lists of genes, but comparatively little knowledge of their functions.

UF Genetics Institute scientists will discover how these genes interact and express themselves, and use this knowledge to improve health and quality of life.
MISSION

The goal of the UF Genetics Institute is to harness the vast array of talent at the University of Florida to make exciting new discoveries, transfer technology to the marketplace and improve quality of life for all.

“Genetics is the most exciting area there is in all of the sciences – it represents the underpinning of all of biology.”

—Kenneth Berns, director of the UF Genetics Institute

Leadership (left)

Kenneth Berns, M.D., Ph.D., director of the UF Genetics Institute, has influenced major developments in experimental gene therapy for more than two decades.

A trailblazer for safe and potentially effective gene therapy for a variety of devastating human diseases, Dr. Berns is internationally recognized for his work with the adeno-associated virus, or AAV, as a vector for gene transfer.

A leading adviser to scientific academies related to genetics and microbiology, including the National Academy of Sciences and its Institute of Medicine and the National Institutes of Health, Dr. Berns holds both a medical degree and a doctorate in biology from The Johns Hopkins University.

He has focused the UF Genetics Institute on increasing current strengths in gene therapy and plant genetics, while building excellence in other key areas — bioinformatics, epigenetics, polygenic diseases, population genetics and comparative genomics.
enetics Institute scientists on a typical day are likely to be searching for solutions to perplexing human health woes, analyzing ways to increase the yield of important crops, or probing the structure of a plant that existed when dinosaurs walked the Earth. Their research landscape stretches across all of biology, which therefore requires the UF Genetics Institute to transcend traditional academic boundaries. Researchers are based in the College of Medicine and throughout the Health Science Center, the Institute of Food and Agricultural Sciences, the College of Liberal Arts and Sciences, the College of Engineering and beyond, ranging even to the College of Law.

In addition to the need to cure diseases and improve living conditions, the potential for commercial development of genetics and genomics research is great. Sales of DNA-based products and technologies in the biotechnology industry are projected to exceed $45 billion. Our research and development will help position Florida within the heart of this growth.

Molecular Anthropology (left)

Connie Mulligan, Ph.D., an associate professor of anthropology and associate director of the UF Genetics Institute, analyzes genetic variation to reconstruct the evolutionary history of humans and human pathogens. Her lab investigates the migration of modern humans out of Africa, colonization of the New World, genetics of alcohol dependence and ancient DNA.

Medicine and Genes

Julie Johnson, Pharm.D., director of the UF Center for Pharmacogenomics, is leading an $11.1 million study on blood pressure response for the national Pharmacogenetics Research Network initiative, a nationwide collaboration of scientists supported by the National Institutes of Health to study how an individual’s genes affect response to medications. Researchers at medical centers across the nation are working with UF to find ways to enhance treatment by tailoring drug prescriptions to people's unique genetic make-ups.
Clinical trials are in progress for gene therapies to treat cystic fibrosis and alpha-1 antitrypsin disorder — grave diseases that affect the lungs and other vital organs. Meanwhile, remarkable progress in treating genetic causes of blindness has been made in animals. In fact, scientists from the UF Genetics Institute were the first to give sight to Briard dogs that were born blind, opening the door to expected clinical trials for people with a similar rare, inherited eye disorder. Among our accomplishments:

- Discovery of one of the most promising gene therapy vectors and the first clinical gene therapy trial using this vector in patients.
- Cystic fibrosis clinical trial
- Alpha-1 antitrypsin disorder clinical trial
- Developing gene therapy for conditions such as inherited forms of blindness, heart disease and emphysema.
- Identifying underlying genetic markers for diseases such as diabetes, Alzheimer’s disease and Parkinson’s disease.
AGRICULTURAL ADVANCES

The Institute of Food and Agricultural Sciences has made great strides in the application of genetics in the field of agriculture. Current projects:

• Deciphering the genetic maps of corn, wheat, rice and other important plant species.

• Inventing gene transfer methods to enhance the nutritional value and shelf life of food products.

• Protecting the environment with genetically engineered plants and microbes.

• Employing genetic engineering to manufacture new protein-based medicines for human diseases.

• Increasing the hardiness of important timber species.

• Genetic solutions to agricultural nuisances, including two high profile ones in Florida — mosquitoes and the citrus canker.

A New Light (left)

Light quality, quantity and duration inform plants about their surroundings. Research in the lab of Kevin Folta, Ph.D., an assistant professor of plant molecular and cellular biology and horticultural sciences, attempts to elucidate the molecular and biochemical signaling networks that link light to plant growth and development.

Timber Traits

John Davis (left), Ph.D, Gary Peter, Ph.D., and Matias Kirst, Ph.D., are among the University of Florida Genetics Institute scientists working on a research project to identify genes that regulate wood properties and disease-resistance traits in loblolly pine. Kirst is an assistant professor and Davis and Peter are associate professors in UF’s School of Forest Resources and Conservation. The research, funded by a $6 million National Science Foundation grant, will benefit the $200 billion forest industry in 13 southern states where loblolly pine is the most-planted species for commercial timber. The work requires extensive expertise in population genetics and bioinformatics — two of the main areas pegged for development in the UF Genetics Institute’s strategic plan.
FLOWERING SCIENCE

Flowering plants account for nearly all grain and vegetable crops, making them by far the most nutritionally and economically important plants. By melding botany, paleontology, genomics and bioinformatics, UF researchers are investigating the genetic architecture of the flower, tracing it back to its origins more than 130 million years ago.

The journey is answering questions about the extraordinarily rapid diversification of flowers, a fundamental puzzle in plant biology that famed naturalist Charles Darwin called the “abominable mystery.”

Along the way, scientists hope to learn more about plant-based cures for diseases and ways to improve crops.
MECHANISMS OF CHANGE

The unfolding development of an organism is a mysterious process. Consider the metamorphosis of a caterpillar to a butterfly. Both have identical DNA in their cells, yet they are immeasurably different in form and function. The change is in how the genes are organized and regulated.

Epigenetics, rather than focusing on the sequence of molecules that make up genes, looks instead at changes on DNA, such as the addition or removal of little molecular bundles that turn genes on or off. These bundles can influence genes by chance, or because of diet, environment or experiences. Learning to control them may solve problems of several forms of cancer and, perhaps, mental illness and other diseases.

Epigenetics
The mechanisms of change are at the heart of the emerging field of epigenetics, according to biochemistry and molecular biology professor Thomas Yang, Ph.D., director of the Center for Mammalian Genetics at the UF College of Medicine. Scientists are finding that nutrients, toxins, behaviors and environmental influences can turn genes on or off without altering the genetic code in any way.
MINING DATA

Current genetics technology generates large amounts of data, which require the sophisticated classification and analysis techniques of biological information science, as well as people who understand the applications.

Since the Human Genome Project was completed in 2003, the challenge facing scientists is to organize and catalog this vast amount of information into a usable form. Exploring and interpreting animal, plant and microbial genomes with computer technology is of major importance in the post-sequencing era.

Already a core of bioinformatics faculty members exists in the statistics and computer science departments of the College of Liberal Arts and Sciences. Additional faculty members with strong interests in bioinformatics are in the colleges of Engineering and Pharmacy, IFAS and the departments of molecular genetics and microbiology, anthropology and zoology.
An exciting, new doctoral program is being launched at the University of Florida through the Genetics Institute. Students will have the opportunity to complete a core curriculum that emphasizes the fundamental concepts of genetics and the use of bioinformatics. Scientists will be able to do their thesis research projects with any of the Genetics Institute members.

In addition to increasing the amount of graduate students at UF, the doctoral program will aid in recruitment of high quality faculty, enabling them to help develop the program in its formative stages.
University of Florida Genetics Institute researchers make important discoveries in their laboratories and work diligently to translate their findings into help for patients and solutions for agricultural and environmental problems.

Exciting times are ahead. Doctors will be able to more accurately detect disease and tailor drugs and other medical treatments to fit a patient’s personal genetic makeup.

Farmers will grow more food in ways that are more environmentally friendly.

Drug developers will trace the evolutionary relationships of plants to find new treatments for cancer and other diseases.

The state-of-the-art UF Genetics and Cancer Research Building paves the way for this important research by fostering interdisciplinary teams and providing core laboratories.

How You Can Help
Private philanthropy accelerates medical and scientific advancements.
Gifts and pledges for the UF Genetics Institute strengthen our research programs and educational activities. They may be designated for endowments that support key researchers, clinicians, graduate students and medical school residents, or for equipment and facilities support. Many endowment gifts are eligible for State of Florida matching gift support, ranging from 50 percent to 100 percent of the gift. Endowment gifts are also eligible for naming opportunities.

To learn more, contact the Office of Development and Alumni Affairs at (352) 273-5855. Or email Jancy Houck, associate vice president of health science center development, at jhouck@ufl.edu.

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