The Robert H. Lurie Comprehensive Cancer Center of Northwestern University has launched a new **Center for Population Epigenetics and Cancer**, which is a joint venture with the Department of Preventive Medicine at Northwestern University Feinberg School of Medicine.

The Center will unite Northwestern’s experts in the new and exciting field of epigenetics with:

- Cutting-edge laboratory technologies;
- In-depth biological and population data collected from people around the world; and
- Methodological advances in ‘big data’ analysis to develop new, precision medicine-style targets for cancer early detection, prevention, and treatment to benefit patients with cancer and their families worldwide.

Led by Lifang Hou, MD, PhD, the Lurie Cancer Center’s director of Global Health and a member of the National Cancer Institute’s Blue Ribbon Panel for former Vice President Biden’s Cancer Moonshot Initiative, the Center for Population Epigenetics and Cancer aims to expand Northwestern’s ability to study human diseases in numerous cancer populations. It is at the forefront of scientific efforts to develop new biological tools for detecting cancer, and to study the rapidly expanding field of epigenetics.

We all know that the code of our DNA is important for health and susceptibility to disease. But, what is increasingly clear is that how our DNA is modified and expressed is even more important than the original DNA code itself. The goal of the Center for Population Epigenetics and Cancer is to identify changes on a molecular level that could serve as ‘early warning’ signals for a disease in its earliest stages of development, or as a metric of an individual’s long-term behaviors and lifestyle that affect health status (good and bad). In time, Dr. Hou and her colleagues also hope to identify epigenetic targets that could be used to stop chronic diseases before they even develop. This is particularly true of cancers, where epigenetic dysregulation is considered a hallmark of the disease.

**Modulating the Genetic ‘Signal’**

Epigenetics is the study of ways in which the “packaging” of our genetic code (DNA) can be changed—changing the way our genes function without actually altering DNA itself. Scientists have already identified multiple ways in which this can occur by looking at the mechanisms that can interact with your environment and lifestyle, and with one another, to prevent or increase the risk of disease. One of cancer’s defining characteristics is widespread dysfunction in these epigenetic mechanisms. This dysfunction stands in stark contrast to the DNA in healthy cells. Thus, our researchers at the Center for Population Epigenetics and Cancer hope that epigenetics could someday be used as the basis for a blood test for cancer.

Epigenetics can also determine your biological age—measuring ‘wear and tear’ on your cells and your DNA. Our investigators are currently exploring what it means when this biological age (also known as epigenetic age) is out of sync with your chronological age. And, they are studying what this means for disease prediction and prevention.

In addition, unlike mutations also found in the DNA of cancer cells, epigenetic dysfunction can be reversed. Eventually, scientists will be able to learn how to manipulate these sorts of changes to produce numerous effects on the cellular and even molecular levels. This could have any number of applications in cancer research and treatment, up to and including ways in which physicians could block cancer cells from metastasizing through the body, and even induce them to self-destruct without causing damage to healthy tissue.

The Center for Population Epigenetics and Cancer is currently exploring a number of these biological markers and their trajectories in the years before a patient gets a cancer diagnosis. Our investigators also are examining the interplay between epigenetics and genetic markers related to age, and the ways in which these relationships change as you get older, in the hopes of developing a blood test for measuring biological age. This also could serve as another early detection marker of cancer.

“Through our new Center for Population Epigenetics and Cancer, we will scale up our efforts to the level demanded by both the sheer quantity of data represented by the ‘new frontier’ of epigenetics as well as the enormity of the task presented to cancer researchers in the Cancer Moonshot Initiative.”

Lifang Hou, MD, PhD, Director of the Center for Population Epigenetics and Cancer, Chief of Cancer Epidemiology and Prevention in the Department of Preventive Medicine, Lurie Cancer Center’s Director of Global Health, and member of the National Cancer Institute’s Blue Ribbon Panel for former Vice President Biden’s Cancer Moonshot
You Are What You Eat

In close collaboration with nutritional researchers at Northwestern, the Center for Population Epigenetics and Cancer also is actively expanding its efforts to look at the role that food and similar everyday lifestyle behaviors (such as physical activity) play in these epigenetic mechanisms. For years, doctors and their patients have struggled to understand the complex and, at times, contradictory nature of the published research linking nutrition to many kinds of diseases. These published recommendations can sometimes reverse themselves after decades of being the accepted, conventional wisdom.

Epigenetics offers us the opportunity to change that. By identifying the ways and specific parts of the DNA in which nutrition, exercise, and other everyday activities can alter the epigenetic expression of genes, scientists can begin to understand the precise molecular pathways underlying the links between lifestyle and disease development. This will allow for targeted lifestyle recommendations such as daily allowances designed specifically with your age, gender, race, and other characteristics in mind that will reduce the occurrence of disease. A better understanding of how these processes interact will also open the door to new drugs, based on the foods you eat and things you do every day, which can give physicians effective new options against cancer and other diseases.

Bringing Populations Together for Science

In order to study human disease, we need data from real human populations. The larger and more diverse these populations are, the better and more sophisticated analyses population scientists can perform. Furthermore, as new and better technologies for measuring epigenetic changes come to market, we will be able to collect more and more data at an increasingly cheaper cost. This is essential as population studies typically run on a budget.

Already, faculty members within the Center for Population Epigenetics and Cancer have developed a worldwide reputation as specialists in the unique challenges of studying epigenetics in large populations. We have entered into collaborations with research groups inside and outside of Northwestern to provide them with scientific support. Not only does this cement Northwestern’s reputation as a hub of epigenetic expertise and research, but it allows our research team to take advantage of ready-to-use biological samples from around the world. Our laboratory has human epigenetic data from over 20,000 individuals from backgrounds including Americans (both Caucasians and minorities), Europeans, Africans, Arabs, and Asians. This work also includes subpopulations that can teach us about specific aspects of epigenetic markers including their heritability (in Amish and neonatal populations) and their relationship to the environment (in veterans).

A fully-supported Center for Population Epigenetics and Cancer will greatly enhance the Lurie Cancer Center’s ability to conduct epigenetic studies and provide scientific support to cancer researchers and clinicians. Our aim is to scale-up our efforts to the level demanded by both the sheer quantity of data represented by the “new frontier” of epigenetics, as well as the enormity of the task presented to cancer researchers by the Cancer Moonshot Initiative. We hope to expand our current facilities to give us the flexibility to deploy innovative new technologies, such as 5-hydroxymethylation or 5hmc, single-cell technologies, and liquid biopsies. Ultimately, our goal is to leap to the forefront of this exciting new area of cancer research and lead the field of population epigenetics into the development of epigenetic markers as targets for cancer prevention.

“The new Center for Population Epigenetics and Cancer within the Lurie Cancer Center will have a big impact on our efforts to prevent cancer by detecting malignant diseases, identifying individuals susceptible to cancer, and ultimately developing strategies to effectively intervene early in the process.”

Leonidas Platanias, MD, PhD, Jesse, Sara, Andrew, Abigail, Benjamin, and Elizabeth Lurie Professor of Oncology and Director, Robert H. Lurie Comprehensive Cancer Center of Northwestern University
NORTHWESTERN MEDICINE

Northwestern Memorial HealthCare and Northwestern University Feinberg School of Medicine are seeking to impact the health of humankind through Northwestern Medicine. Our commitment to transform healthcare and to be among the nation's top academic medical centers will be accomplished through innovation and excellence. At the Lurie Cancer Center and medical school, we recognize that every positive contribution we have made to cancer care, research, and education has been made possible by generous donors who have entrusted us with their philanthropic support.

We invite loyal donors and interested friends to join Dr. Hou and her colleagues in advancing the Center for Population Epigenetics and Cancer. Your gifts of outright support and endowment will provide the resources we need to introduce breakthroughs that will improve the diagnosis and treatment of people living with cancer today and in the future.

About the Lurie Cancer Center

- The Robert H. Lurie Comprehensive Cancer Center of Northwestern University—one of 48 National Cancer Institute (NCI)-designated Comprehensive Cancer Centers in the nation—is committed to being a national leader in the battle to overcome cancer.
- The Lurie Cancer Center supports care for a broad range of cancer types through comprehensive research; distinguished and dedicated faculty and staff; a world-class teaching program; and ongoing advances in medical, surgical, radiation, and interventional oncology.
- We are a founding member of the National Comprehensive Cancer Network (NCCN): an alliance of 27 of the nation’s leading cancer centers dedicated to improving the quality, effectiveness, and efficiency of cancer care so that patients can live better lives.
- Northwestern’s Lurie Cancer Center is a founding member of the Big Ten Cancer Research Consortium, which collaborates on oncology clinical trials that leverage the scientific and clinical expertise of the Big Ten universities.
- The Lurie Cancer Center has established major research strengths in breast, genitourinary, gastrointestinal, aero-digestive, neurologic, and gynecologic cancers; hematologic malignancies, sarcoma, melanoma, cutaneous lymphoma, and pediatric oncology.
- Our research programs in hormone action/signal transduction, angiogenesis, gene regulation, biologic therapies, mathematical modeling, and nanotechnology are nationally and internationally recognized.
- The Lurie Cancer Center OncoSET (Sequence, Evaluate, Treat) Program, launched in 2015, combines genomic sequencing and molecular diagnostics to identify new, individually tailored treatments and clinical trials. We recently initiated the Lurie Cancer Center OncoSET Clinic with the leadership of Massimo Cristofanilli, MD, associate director for Precision Medicine and Translational Research. The OncoSET Molecular Tumor Board, a multidisciplinary group of physicians and scientists, reviews the results and recommends a personalized treatment plan.
- The Translational Bridge Program is one example of how the Lurie Cancer Center is fostering collaboration to heighten the impact of translational research by providing funds for Postdoctoral Fellows to conduct research in an area of fundamental importance to cancer biology, with future potential for translation into a diagnostic or therapeutic setting. Lurie Cancer Center Bridge Fellows carry out their projects in a basic science lab headed by a seasoned investigator, and partnered with a clinician with expertise in a particular cancer or clinical research field. The Bridge Fellow is mentored by both of these faculty members, serving as a bridge to exceptional translational research.
- Our outstanding basic, translational, and clinical research complements a full range of prevention, early detection, treatment, rehabilitation, and palliative care programs for all types of cancer.
- Our nationally recognized supportive oncology programs and survivorship specialty clinics include fertility preservation services for young adult cancer survivors.
- A five-year grant from the NCI is supporting the creation of the Chicago Cancer Health Equity Collaborative (ChicagoCHEC) and helping Northwestern, the University of Illinois at Chicago (UIC), and Northeastern Illinois University to work together with many of the city’s underserved communities to reduce cancer disparities and improve health.