Loma Linda University Health has gained global prominence by asking questions that were daring, difficult and ahead of their time: Could we save a newborn’s life with a transplanted heart? Could protons destroy cancer without damaging surrounding tissue? Could we remove the prostate without opening the abdomen? Is there a way to keep dental patients conscious yet comfortable during procedures?

We did not shrink from these questions. We knew how desperately patients and families needed answers. So we opened new avenues of exploration and led the way to the first successful infant heart transplantation, to the first hospital-based proton treatment center, to the transurethral prostatectomy technique (TURP) now used universally, to a sedation method that transformed every branch of dentistry, and to numerous other advances that have helped shape modern medicine.

The quest reflected in our motto, “to make man whole,” forms the core of who we are and the foundation of all we’ve accomplished. Each of our revolutionary advances in medical education, practice and research is a valued part of our heritage and a vital contribution to our world.

Yet there is more for us to discover and more for us to achieve.
Basic Science and Translational Research

At Loma Linda University Health, basic science research is an area of strength and a major avenue of interdisciplinary discovery by which we contribute to medical science’s body of knowledge.

Translational research goes further, concerning itself not only with the exploration of a theory but with its ultimate practical application. This too is an area of strength for us.

As a smaller academic medical center, we can nimbly move through the translational phases from concept to clinic right here, testing our theories in our labs and conducting clinical trials in our hospitals and outpatient facilities.

Collaboration is another key to our success; we work together across disciplines to ask creative questions and find innovative solutions.

A Leader in Clinical Trials

We heavily invest in clinical trials, which are central to the process of turning a novel theory into a proven treatment modality. We have more than 180 clinical trials in process at any given time and consistently rank among the nation’s top 10 for enrolling the largest numbers of children in cancer clinical trials.

We are now conducting a phase-three clinical trial to open breast cancer treatment to the many benefits of proton therapy. This is the largest, most mature study of its kind available anywhere, following 100 patients and monitoring them an average of five years after treatment.

Even though proton therapy is a relatively new cancer treatment for early-stage breast cancer, it has already shown remarkable promise as a non-invasive, low-risk option over conventional therapy. The extreme precision of proton treatment more effectively targets cancerous cells without damaging surrounding breast tissue and reduces radiation treatment time from seven to two weeks.

Results show an excellent in-breast recurrence-free survival rate of 97%, with minimal side effects to the breast, lungs and heart. Patients and physicians assessed cosmetic results — both immediately and after five years — as good to excellent in 90% of cases.

The Department of Pharmaceutical Sciences engages in translational research focused on treating diseases by developing new drugs and new uses for existing drugs. William Hughes, PhD, dean of the School of Pharmacy, is pictured with resident pharmacist Bishoy Tannious, Pharm D.
Innovative Questions. Impactful Answers.

As together we imagine a healthier, whole tomorrow, we are building on our research successes and asking new questions — including some we will introduce in the pages that follow.

The complex answers to these crucial questions have the powerful potential to restore wholeness — preventing and treating injury and disease and extending healthy longevity.
INVESTIGATOR

Gary E. Fraser, MBChB, PhD, Principal Investigator
Professor of Medicine and of Epidemiology

1974 - 1988
Subjects: 34,192 California Adventists ages 25+

Key Findings

Vegetarians had a lower risk of obesity, hypertension, diabetes and death from all causes.

Eating small quantities of nuts on most days reduces the risk of coronary heart disease.

On average, Seventh-day Adventist men live 7.3 years longer, and Adventist women live 4.4 years longer than other Californians.

Men with high consumption of tomatoes had a 40% lower risk of prostate cancer.

2002 - present
Subjects: 96,000 U.S. and Canadian Adventists ages 30+

Funded by the National Institutes of Health, this is one of the largest, most comprehensive studies of diet and cancer. It aims to determine which dietary approaches increase or decrease the risk of developing cancer of the colon, rectum, breast or prostate.

Participants completed detailed questionnaires on diet, physical activity, social and behavioral health, and socioeconomic status and provided whole-blood samples. Each of the 96,000 questionnaires included 2,000 data fields, generating 192 million data points.

Roughly 7,000 of these participants had also contributed to the Adventist Health Study - 1, allowing researchers to track data over four decades.

“Data show a progressive weight increase from a total vegetarian diet toward a non-vegetarian diet. For example, 55-year-old male and female vegans weigh about 30 pounds less than non-vegetarians of similar height.

Cholesterol levels, diabetes, high blood pressure, and the metabolic syndrome all had the same trend: the closer to being a vegetarian, the lower the risk in these areas for all participants.

As the Adventist Health Study - 2 continues, we will ask further questions: Which foods help prevent other cancers, diabetes, heart disease, Alzheimer’s disease and arthritis? Which is more important: avoiding meat or eating more vegetables? Does faith contribute to health?

“Our studies have shown that lifestyle can add years to a person’s life and change the risk of suffering from many chronic diseases and cancers. Our research is helping us better understand crucial new information about what foods enhance quality of life and how factors such as faith contribute to health.”

— Dr. Gary Fraser (left, with Michael Orlich, MD), faculty member and research pioneer in the world’s longest study on healthy longevity

Question:

What impact do lifestyle choices have on health and longevity?
Question:

What if we could identify the “fingerprints” of health at the molecular level?

INVESTIGATORS

Penelope Duerksen-Hughes, PhD, Principal Investigator
Associate Dean for Basic Science and Translational Research
Chair of Basic Sciences and Professor of Biochemistry

Gary Fraser, MBChB, PhD, Professor of Medicine and of Epidemiology

Charles Wang, MD, PhD, MPH, Professor of Microbiology, Director of the Center for Genomics

Christopher Wilson, PhD, Associate Professor of Physiology

An ambitious new cross-disciplinary research project will attempt to do something completely unprecedented in the history of medicine: to define what health looks like at the molecular level.

Genomic research has shown us what can go wrong at this level and how genetic signals trigger illness and disease. But what does wellness look like at the molecular level — what are its “fingerprints”? And what triggers health?

Two factors unique to Loma Linda University Health make this groundbreaking research possible. Foremost is our mission of treating the whole person rather than just a disease or condition. This long-term emphasis on wholeness integrates all of our teaching, research and care and encourages questions, like the one posed by this new research, that could reshape our understanding of health at its most fundamental level.

Further, this new research builds on the vast data gathered through the Adventist Health Studies on the lifestyle factors proven to contribute significantly to health and longevity.

An ambitious new cross-disciplinary research project will attempt to do something completely unprecedented in the history of medicine: to define what health looks like at the molecular level.

Interestingly, although these studies have defined and connected the inputs that tie specific diet and lifestyle behaviors to outcomes, such as age at death or cancer incidence, very little is yet known about what links them at the molecular level.

For example, our data show that eating walnuts improves heart health. But, at the molecular level, how does this cause-and-effect relationship manifest itself? This question opens up an entirely new perspective and presents us with a timely, high-impact opportunity for discovery.

By identifying the distinctive molecular fingerprints associated with health and longevity and determining how they connect to lifestyle choices and demographic data, we will vastly broaden medical science’s understanding of how genetic switches trigger wellness or disease.
Our scientists will ask several questions, such as:

- What is the influence of exercise, socioeconomic status, diet and/or social network at the molecular level? Do such factors trigger health or disease or affect the rate of aging?
- To what extent are life events, such as developing diabetes, depression or heart disease, reflected at the molecular level?
- Do the molecular fingerprints of healthy elderly differ from those of the general population? If so, are there ways to change those fingerprints and improve one’s prospects for staying healthy longer?

We expect this pioneering research to yield deep insights for determining the best interventions — whether lifestyle changes or treatment — to help individuals and communities achieve lifelong health. Exciting preliminary data from the team is already supporting this promise. For example, we know that one’s DNA methylation pattern — which influences the genes that are turned on and off — changes with time, so that this pattern can be used to estimate one’s biological age.

Initial data from this project indicate that dietary pattern influences methylation pattern, such that vegans and individuals who eat fish but no other meat have a biological age perhaps five years younger than that of their non-vegetarian counterparts.

We anticipate that these findings will enable physicians to design a personalized program for each patient to attain optimal health. After obtaining a blood or saliva sample, physicians would analyze the DNA, RNA and other biomolecules to assess a patient’s current health status, and may be able to predict — with a high degree of accuracy — what illnesses or medical conditions the patient is likely to develop. They would then prescribe lifestyle changes that could literally turn off the genes whose activation would otherwise lead to disease.

Can you imagine the far-reaching implications of the potential to activate the genes that trigger health? Parents could address their health issues through positive lifestyle changes and thus pass on genetic patterns that would “predispose” their children to wholeness and longevity.

Ellsworth E. Wareham, MD, who turned 100 in October 2014, bears the molecular “fingerprints” of health. He embodies the Adventist Health Study findings on lifestyle choices that have helped him stay active and healthy beyond the century mark.

More than 30 years ago, Wareham — a Loma Linda University alumnus, faculty member and cardiac surgeon — observed that the coronary arteries of the meat eaters he operated on were far more clogged than those of his vegetarian and vegan patients. He decided to go vegan, being careful to include lots of fruits, whole grains, vegetables and nuts in his diet.

Throughout his high-profile career, Wareham traveled the world as a founding member of the Loma Linda University Overseas Heart Surgery Team, training countless medical professionals and ultimately saving the lives of thousands of patients in 17 countries. In 2009, he finally retired at the age of 95, but has scarcely been idle since. He drives his own car and mows his own lawn. He and his wife, Barbara, maintain an active social life in their church and community.

Further recognition of Wareham’s remarkable life came when Dan Buettner and a team of National Geographic researchers identified five regions of the world where people live noticeably healthier and longer lives. People in Loma Linda and the other Blue Zones®, as these health hotspots are called, reach the age of 100 at rates 10 times greater than anywhere else. (Loma Linda is the only Blue Zone® in the United States.) Mr. Buettner devoted several pages in his book, “Blue Zones: Lessons for Living Longer From the People Who’ve Lived the Longest,” to telling Wareham’s story and sharing his ideas on health and longevity.

Loma Linda University Health’s research to identify the molecular markers of health and gain a deeper understanding of the link between lifestyle and longevity will help more people remain healthy and active well into their later years.
One of the most provocative recent findings in medical research is that stressors experienced before birth can alter the pattern of gene expression for a person's entire life.

Our Center for Perinatal Biology has examined several aspects of specific in utero stressors — hypoxia, excess calories and too much or too little protein — and found that they can induce epigenetic changes at the earliest stages of embryonic development, predisposing an individual to chronic conditions such as hypertension, coronary artery disease, type 2 diabetes and other serious diseases in adolescence and adulthood.

Our researchers further observed that several genes that regulate blood pressure underwent pronounced changes as a consequence of a low-protein diet during pregnancy.

Question:
Could we map the connection between prenatal stressors and adult-onset disease?

A Novel Hypothesis
With the connection between prenatal stressors and chronic conditions later in life well established, we are pursuing studies to understand how this cause-and-effect relationship works at the embryonic/developmental level.

We propose to test a novel question: Do in utero stressors alter the DNA methylome and microRNA expression in embryonic and non-embryonic stem cells? Without altering the sequence of DNA nucleotides in genes, DNA methylation affects the extent to which a given gene will be expressed, and thus the resultant messenger RNA and protein that will be produced. MicroRNAs can also up- or down-regulate gene expression. We believe this alteration may lead to significant insights into how early life events, especially in the cells that influence organ formation, may mark or contribute to increased susceptibility to health problems in later life. Our research will compare gene expression profiles induced by too much or too little protein.

This exploration underscores the vital need to create maps of the DNA methylome and the changes resulting from these prenatal stressors to clarify the unknown mechanisms responsible. This mapping process will provide a basis for understanding how the origins of adult health and disease develop. With this information, we may uncover early life indicators of increased risk factors for later disease and may develop more effective interventions for vulnerable individuals and populations.

For example, the diseases our researchers observed from prenatal stress correlate well with epidemiologic data from several human experiments and in populations from both underdeveloped and developed countries. These diseases are also prevalent in immigrants to the United States and in certain ethnic groups who may have experienced various stressors during previous generations. Thus, this basic research has clinical significance that is worldwide.

To our knowledge, no other group is conducting similar studies with global quality-of-life implications. Loma Linda University Health is pioneering the exploration of the molecular mechanisms of prenatal stressors and the biology of development from embryo to fetus to newborn to adult.
The Center for Perinatal Biology: A Model of Research Excellence

Dr. Lawrence D. Longo, Loma Linda University Health’s eminent basic science researcher, had a straightforward strategy for founding our Center for Perinatal Biology: “Attract the brightest investigators, give them a place to be as productive as possible, and stay out of their way!”

Dr. Longo’s approach proved effective as he worked to establish the Center as an intellectual incubator — a supportive setting in which to develop not only ideas but also the investigators and collaborative relationships necessary to explore those ideas.

Without exception, the Center’s faculty are national and international leaders in fetal and neonatal physiology and/or biochemistry who devote 90% or more of their time to research and training. Their outstanding work attracts highly competitive funding, including more than 40 years of steady support from the National Institutes of Health.

Over the past four decades, the Center’s reputation has grown and its influence has extended, with Dr. Longo himself overseeing the professional development of more than 200 post-doctoral fellows, as well as numerous visiting scientists and scholars from the U.S., Europe, Asia and South America. Many of them have moved on to populate some of the finest academic departments in the U.S. and around the world.

Thanks to Dr. Longo’s visionary leadership and tireless efforts, the Center now stands as a world-renowned research hub — and an impressive exemplar of what is possible on our campus.

Loma Linda University Health is pioneering the exploration of the molecular mechanisms of prenatal stressors and the biology of development from embryo to fetus to newborn to adult.
The prevalence, death rate and health care burden of atrial fibrillation — irregular heartbeat — are on the rise worldwide.

Treatment is moving from a strategy of suppression with drugs, which have had serious side effects and limited success, to one of potential cure with ablation — destroying cardiac tissue to block the electrical signal that triggers the irregular beat.

But catheter ablation is complex and carries significant risks. Many patients might benefit from treatment that uses proton beams instead of a catheter to target the tissue in a non-invasive manner.

As Loma Linda University Health pioneered hospital-based proton therapy 25 years ago, we now propose to expand that frontier, bringing proton treatment to cardiac medicine for the first time.

We will explore the use of protons to treat atrial fibrillation, potentially offering patients a safer, more effective treatment option — without the side effects of drugs or the risks of invasive procedures.

This method could be conducted on an outpatient basis and cut treatment time from at least eight hours to as little as one, eliminating the need for a hospital stay and reducing the burden of this condition on the health care system.

The technological advances this project requires us to develop will facilitate research in other areas where muscle movement, insufficient beam precision or other factors now preclude proton treatment. Our research will thus expand the application of this innovative, non-invasive treatment method even further, widening the circle of patients for whom protons offer new options and new hope.

INVESTIGATORS

Jerry Slater, MD, Principal Investigator
Professor and Chair of Radiation Medicine

Ramdas Pai, MD, Principal Investigator
Professor of Medicine

Sudha Pai, MD, Associate Professor of Medicine

David Bush, MD, Professor of Radiation Medicine
and of Basic Sciences

Marcelo Vazquez, MD, PhD, Associate Professor
of Radiation Medicine

Andrew Wroe, PhD, Associate Professor of
Radiation Medicine

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and of Basic Sciences

Marcelo Vazquez, MD, PhD, Associate Professor
of Radiation Medicine

Andrew Wroe, PhD, Associate Professor of
Radiation Medicine

Might protons offer safer, faster treatment of irregular heartbeat?
Imagine what more we could do with proton therapy

The safety, precision and limited side effects of proton therapy ideally suit it for treating many cancerous and noncancerous conditions in adult and pediatric patients. Researchers at Loma Linda University Health have successfully used it to treat more than 200 sites, including the prostate, breast, liver, brain, spinal cord, eye, chest and abdomen.

Arteriovenous Malformations (AVMs) Treatment

AVM is an abnormal connection between the arteries and veins in the brain that usually forms before birth. It can cause brain bleeds, seizures, pain, personality changes, and impair movement, cognition, vision and speech.

Given the complexity of this condition and the fact that many patients are children or young adults, proton therapy offers a unique advantage over high-risk surgery. The proton beam treats large, small and irregular AVMs while protecting the rest of the brain.

This procedure is termed “radiosurgery” as we are using the proton radiation to perform surgery and close off these blood vessels. We’ve already treated more than 200 patients, with excellent outcomes, and look forward to replicating these results, restoring more young people to wholeness.

Pain Management Research

As a result of battlefield injuries, many U.S. combat personnel experience continuous and severe pain. This pain is often debilitating and remains even after physical injuries heal. We are studying the use of proton therapy and advanced imaging techniques to precisely identify and target the nerve that is firing the pain signal. By irradiating this nerve with protons, we may be able to turn down the pain “volume,” without impacting sensory or motor function. We expect to find that this alternative to invasive surgery provides significant pain control and markedly improves quality of life.

A Translational Research Exemplar

Our Department of Radiation Medicine has an impressive track record for moving research from concept to clinic. It began 25 years ago with Dr. James Slater’s visionary decision to bring technology from various accelerator and physics laboratories into a hospital setting, allowing him to more quickly develop, test and deliver this promising new cancer treatment.

A collaborative team of physicians, physicists, nurses, computer scientists, engineers and biologists continues this translational tradition, improving and expanding proton therapy for patients around the globe. This approach has led to many significant advances, including:

- Creating our radiosurgery program — one of the best in the world
- Allowing patients to be treated faster, safer, more effectively, with fewer side effects and fewer hospital visits
- Improving patient immobilization and positioning and enhancing the treatment nozzle, all of which yield more precise and efficient beam targeting.

Dr. Andrew Wroe, Medical Physicist, Department of Radiation Medicine
Cell-based therapeutics represents a new revolution in biomedicine, letting researchers program cells to send and receive certain biological signals, travel to precise locations, adapt to changing circumstances and perform complex tasks.

At Loma Linda University Health, researchers like David Baylink, MD, have successfully programmed cells to accomplish some astonishing things. Their work has the potential to directly and dramatically impact patients’ healing and quality of life.

**Building Bone in Osteoporosis Patients**

Osteoporosis is one of the most prevalent and costly aging-related diseases, affecting 200 million patients worldwide.

In healthy cortical bone (hard shaft bone such as that found in the shin), the bone wall is thick and strong. With osteoporosis, the wall becomes thin and porous as bone is lost. Healthy trabecular bone (the spongy bone in joints, for example) has a lacy pattern inside. But with osteoporosis, the intricate connections that form this pattern disappear, leaving the bones so brittle that just bending or coughing can cause a fracture.

Dr. Baylink and his team collected stem cells and engineered them to seek out the sites where bone had been lost, secrete a regenerative protein and thereby replace the lost bone.

The cells behaved as scripted, but with stunning precision. They didn’t just build up the bone material, making cortical bone thicker and less porous; they also rebuilt the intricate connections of the lacy pattern in the trabeculae, restoring the bone’s structure and strength.

**Stimulating Bone Regeneration After Fracture**

After a fracture, the body heals itself, replacing clotted blood at the injury site with cartilage and then converting the cartilage to hard bone. This process takes six to eight weeks in young and healthy patients — longer in others. But Dr. Baylink and his team found a surprising shortcut.

By injecting a therapeutic gene into the fracture site, they could skip the cartilage phase of the healing process entirely, going directly from fracture to bone regeneration and accelerating the healing process by 33%.

“Currently there is no available therapy for fracture repair,” says Dr. Baylink. “This is a step, but there are bigger steps.” Next he wants to address such questions as: Could we amplify our results by injecting a special subset of regenerative stem cells, engineered to express the therapeutic gene, directly into the fracture site to complement the action of the proven gene therapy? Could we make fractured bones heal even faster — perhaps twice as fast as they do naturally?

Dr. Baylink’s work in bone regeneration and repair is supported by grants from the National Institutes of Health and the Department of Defense and by gifts from grateful patients.

**INVESTIGATOR**

David J. Baylink, MD, Principal Investigator
Distinguished Professor of Medicine

**Question:**

Could we use cell therapies to rebuild bone and cure gastrointestinal diseases?
“I wanted answers,” says Dr. David Baylink, summing up the passion that has fueled his brilliant research career of more than 50 years. His work has indeed yielded answers—along with multiple patents and more than 500 scholarly papers in such areas as molecular genetics, tissue regeneration, and gene therapy—and made him one of the world’s leading authorities on osteoporosis. “The goal is to cure people, and we’re making progress. This is marvelous.”

Curing Inflammatory Bowel Disease

Inflammatory bowel disease (IBD) is miserable, incurable, sometimes fatal and increasingly common, especially in formerly low-risk areas such as Asia and southern Europe.

Treatment with large doses of the active metabolite of vitamin D3 taken by mouth reduces the inflammation but floods the blood with dangerously high levels of calcium (“hypercalcemia”).

To solve this problem, Dr. Baylink and his team engineered cells that would travel to the inflamed tissue in the bowel and make the needed active metabolite on site. Because the active metabolite was targeted directly to the bowel rather than being taken by mouth and flowing throughout the body, the team found they could increase the dose several fold — an amount sufficient to stop the inflammation but without inducing hypercalcemia.

The researchers also took steps to protect the patient from infection — a common and serious complication of IBD. They programmed the cells to produce cathelicidin (which kills invasive bacterial) and to replenish the “glue” that prevents bacteria found in the bowel from getting into other parts of the body.

In laboratory studies using a single injection of the engineered cells, researchers saw an 80% improvement of symptoms and in regeneration of gut tissue in just six days.

Dr. Baylink and his team were granted a patent for their cure protocol and are eager to explore the next big questions in this area of study: What might the fundamental aspects of this therapy mean for Alzheimer’s, diabetes, multiple sclerosis, rheumatoid arthritis and other diseases? And how quickly can we translate our current technology to addressing these other inflammatory diseases?

Dr. Baylink’s research showed that a single injection of engineered cells improved inflammatory bowel disease symptoms by 80% in just six days.
Millions of people worldwide suffer from hemorrhagic strokes and traumatic brain injuries that cause long-term disabilities and often death. As Dr. Zhang and his team explore the causes of these events, they hope to discover lifesaving new treatments and prevention strategies.

Beyond damage to brain cells, these events affect supporting tissues and cells in nearby blood vessels. Impact or pressure from bleeding causes mechanical injury, while blood components released by injured vessels and a chain of inflammatory reactions cause chemical changes. The destructive cycle escalates as vessels distended from a loss of muscle cell contraction allow blood to leak between cells and between the brain and membrane.

Dr. Zhang and his team propose that because these events share similar characteristics, a common intervention may be possible.

Preliminary lab testing suggests that osteopontin — a human protein delivered by nasal spray to treat other conditions — aids in wound healing, prevents cell death, reduces swelling and improves neurological function in stroke patients. This is its first use for brain hemorrhage treatment.

The National Institutes of Health (NIH) recently awarded a $6 million program project grant to Dr. Zhang and his team to establish a Center for Brain Hemorrhage Research. This is a large, highly competitive, prestigious grant to support a group of scientists at a respected university studying a single theme and the second for Loma Linda University Health. The first was awarded to Lawrence Longo, MD, to start the Center for Perinatal Biology. Dr. Zhang is conducting additional research funded by grants from the NIH, Department of Defense, American Heart Association and other foundations.

“By emphasizing research that has the potential to be translated to clinical management, we are pushing stroke research forward,” says Dr. John Zhang, pictured with his colleague and wife, Jiping Tang, PhD, associate professor of physiology and pharmacology.
Can we accommodate the “brain chemistry” of a food-addicted obese individual to help sustain long-term weight loss?

Current methods to bring overweight individuals into health by admonishing them to eat less and exercise more remain largely ineffective.

A study by Dr. Warren Peters explores the possibility of pharmaceutically adjusting the neuro-biology of obese patients so they can more successfully follow an individually tailored lifestyle plan that addresses the psychological, dietary, sociological and physical activity aspects of obesity.

Could a substance derived from shellfish protect the brains of Alzheimer’s patients?

In some patients with Alzheimer’s disease, the brain’s inability to remove a starch-like protein called “amyloid” causes the walls of tiny blood vessels to become inflamed and weakened, leading to microbleeds. Dr. Wolff Kirsch is developing a nanoparticle therapy that uses chitosan — a substance derived from shellfish — to deliver a gene that targets amyloid, protecting against inflammation and possibly stopping or even preventing microbleeds that appear to be part of Alzheimer’s pathology.
We have long recognized that dentistry is central to whole-person care. It is now widely understood that what happens in the mouth both affects and reflects what is happening elsewhere in the body. For example, the mouth is directly connected to the bloodstream and digestive system, making the mouth a key entry point for disease and making symptoms in the mouth a key tip-off to the presence of disease.

Our Center for Dental Research is a leader in interdisciplinary studies focused on understanding oral health in the context of overall health. Their research in this area explores such topics as:

- The relationship between type 2 diabetes and the breath odor and gum disease associated with it
- The effects of periodontitis — a unique, long-term infection — on general health, with preliminary findings suggesting a correlation between this inflammatory condition and problems of the central nervous system
- The extent to which poor dental aesthetics such as misaligned or discolored teeth compromise patients’ social skills and confidence

Whether focusing solely on oral health or looking at the mouth in terms of the whole person, our researchers continually introduce innovations in clinical education and transformational research, contributing significantly to the rapid pace of advances in dentistry.

Could we correct chemotherapy resistance in the most deadly form of childhood cancer?

Dr. Kimberly Payne joined Loma Linda University Health with a passion for building a research program that leverages basic science discoveries for improved health. She developed a network of collaborators from within the organization and across the country to focus on creating and using disease models to identify therapies for aggressive forms of B-cell acute lymphoblastic leukemia, the most common type of cancer in children.

The reason one form of this leukemia is so deadly (with a survival rate of only 30%) is that it produces a protein that is activated in the patient’s body and makes cancer cells resist chemotherapy.

The current method of identifying therapies for this leukemia does not activate this protein, making it difficult to identify which therapies will help patients. Dr. Payne’s team has developed a unique model that lets them grow leukemia cells with the molecules that activate the problem protein in an environment that mimics the patient’s body.

The team is testing treatments that could target the problem protein and kill chemo-resistant cancer cells. This approach has the potential to completely change this type of cancer from one that now kills most patients to one that is completely curable.

Dr. Payne’s work is funded by the National Institutes of Health, Hyundai Motor of America’s Scholar of Hope Award and other sources.

What happens when dentistry is about more than the mouth?

We have long recognized that dentistry is central to whole-person care. It is now widely understood that what happens in the mouth both affects and reflects what is happening elsewhere in the body.

For example, the mouth is directly connected to the bloodstream and digestive system, making the mouth a key entry point for disease and making symptoms in the mouth a key tip-off to the presence of disease.

Our Center for Dental Research is a leader in interdisciplinary studies focused on understanding oral health in the context of overall health. Their research in this area explores such topics as:

- The relationship between type 2 diabetes and the breath odor and gum disease associated with it
Launching New Journeys of Discovery

Our quest for research breakthroughs is at the heart of our commitment to making the world healthier and more whole. Accordingly, we have made research a major funding priority in Vision 2020 — the largest philanthropic initiative in our history.

Looking back on the successes that set us on a global stage, and looking ahead to the research questions we will answer and the lives our work will restore in the coming years, we are inspired to take bold action, greatly expanding and enhancing our already robust research enterprise.
A Strategy for Transformation

We began this transformational endeavor by gathering stakeholders from throughout our organization to assess our current program and devise a strategy for preparing Loma Linda University Health to even more effectively respond to a rapidly evolving research landscape.

This task force delved into every aspect of our interdisciplinary basic science and translational research program, with their work culminating in a nearly 100-page document that outlines a plan for maximizing our program’s potential.

Two monumental initiatives will address many of the document’s recommendations.

We will substantially enlarge our research endowment to fuel our pursuit of the next big answers in medical research and will build a new research center to serve as a global nucleus for collaborative inquiry and innovation.

Funding Future Exploration

Federal and corporate funding has been a steady source of support for our research ventures, but these dollars are not keeping pace with the opportunities to make even more significant discoveries. It’s time for us to reach beyond the inherent limits of sponsored research.

Substantially enlarging our research endowment will free us to:

- Explore innovative and even daring theories others haven’t thought of or aren’t willing to take on
- Pursue important studies even though they may not yield lucrative patents
- Provide seed money to bring promising projects through the early stages of development, establishing their eligibility for outside funding
- Invest in a new generation of rising investigators whose greatest achievements lie ahead
Creating a New Home for Research

Our faculty, students and staff function as a cohesive family working in a rare setting where eight schools provide training in all areas of the health professions — all on the same campus as our flagship hospitals.

The relatively small size of our organization and our campus has helped generate many discoveries by faculty and students from across disciplines. But there is a critical need for a central facility to support the unprecedented research opportunities ahead, a setting that would foster collaborative inquiry and innovation at greater levels than ever before.

We will build the Center for Health Discovery, dedicated to research and located at the heart of our main campus. In this fertile environment, investigators will gather to solve some of medicine’s most puzzling challenges.

Under the same roof, we will establish the Wholeness Institute. Our work there will build on our traditional core theme of healthful living and on our ongoing commitment to finding and sharing knowledge that will increase longevity and improve quality of life.

Encouraging Collaboration
Creating solutions to complex problems requires teams of specialists from diverse backgrounds working across administrative, geographic and disciplinary boundaries.

Building a research center that facilitates a team science model will allow our researchers to synchronize their expertise in undertaking truly interdisciplinary, translational science.

The design of the new building will feature carefully considered architecture with spaces that naturally encourage interaction, subtly unleashing the synergy of interdisciplinary dialog and greater interaction between faculty and students and among colleagues.

Thanks to our partnerships with a large network of hospitals around the world, our collaborative efforts extend far beyond our campus. The new building will serve to centralize these efforts and project our research capabilities to all parts of the globe, promoting international collaborative research to solve the most critical health issues facing humankind.

Enhancing Translational Research
Effective clinical trials capability is the cornerstone of a fully translational research center. The new Center for Health Discovery will include dedicated space for clinical trials. This will boost our translational research by letting us enlarge the scope of trials, conduct early-stage trials (which our current facilities cannot always accommodate) and conduct a broader spectrum of trials, in areas such as clinical practice, medical devices and behavioral health.

Improving Competitiveness
Creating such a center will also improve our eligibility for research dollars. Many funders, including the National Institutes of Health, base grant awards on the amount of square footage dedicated to research and on the ability to attract top scientists, who seek higher-caliber research space.

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<th>Future Research Endowment</th>
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<td>Building Construction</td>
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<tr>
<td>Furnishings and Lab Equipment</td>
<td>$10 million</td>
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<td>Total:</td>
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Along with high-performance, state-of-the-art research laboratories, the Center for Health Discovery will house centrally managed core facilities vital to enhancing quality, encouraging collaboration and enabling growth.

These include:

- **Genomics Lab:** This space will house instrumentation for DNA extraction, high throughput screening, genotyping, and gene expression and methylation studies, equipping us to make major contributions in this increasingly consequential field of research.

- **Bio-specimen Repository:** The availability of well-annotated bio-specimens is a critical link between basic science and translational research, giving investigators ready access to these essential specimens.

- **Data Management:** Adopting a centralized system for collecting and managing institutional knowledge and data will help us meaningfully track our performance, make agile course corrections based on advanced analytics, and leverage our program’s unique capabilities with potential funders and other external partners.

We will equip the new Center for Health Discovery with creative and clinical space to foster collaborative research and reflect the centrality of whole-person care.

Preliminary plans call for the Center for Health Discovery to include the components indicated below, with space-use organized to support the Center’s four programmatic themes: research, education, wholeness and collaboration.

Since our founding, we have focused on whole-person care, infusing it in our teaching, research and clinical practice. Historically, this unique approach has distinguished us in many ways, including inspiring us to explore wellness matters — such as a possible link between vegetarianism and health — long before modern medicine opened to such considerations.

We have invested significant effort and resources in wellness research and typically have over 100 studies in nutrition, exercise, obesity and related areas underway at any given time. Such work — including more than 50 years of our groundbreaking Adventist Health Study series — has helped solidify our position as a global leader in disease prevention and health promotion.

Given our stature as a leader in wholeness — and in view of the world’s growing interest in preventing disease and improving health — it is time to increase our wholeness research and more broadly disseminate our findings.

Toward that end, we are creating a Wholeness Institute to be housed in the new Center for Health Discovery. There we will pursue breakthroughs in wellness research, translate those findings to clinical applications, and share them by multiple means, from community education to academic publications.

The Institute will become a destination for visitors from across our community and around the world to come and learn — meeting with our experts, studying in our resource library, attending symposia or retreats, and accessing wellness services. It will also be a catalyst for knowledge, equipping our physicians, students and global network of partners and alumni to take what we know — and what we will learn — about health and wholeness to every part of the world.
Inaugurating a New Era in Research

The opening of the Center for Health Discovery will be a seminal point in the transformation of research at Loma Linda University Health. But strategic change will continue long after opening day. As well as being a vehicle for advanced research studies, we envision the new facility serving as a catalyst for continual reassessment and refinement of our research program.

The Center will be a place where new teams come together in creative and clinical spaces to imagine methodologies and invent technologies, where those innovations are tested and adapted before moving to broader implementation and wider dissemination, where the world awaits the answers that will “make man whole.”
Visionary Partners Accomplishing the Extraordinary
A Historic Opportunity for the Future of Health and Wholeness

Loma Linda University Health has thrived for over 100 years as a leader in comprehensive prevention and wellness, helping change the practice of medicine through a spirit of collaboration and inquiry. Recently, Loma Linda University Health unveiled a bold $1.2 billion strategy to significantly expand our focus to improve the quality and longevity of lives at a greater intensity than ever before. We are seeking new partners in this vision to once again push the frontiers of medicine and whole health.

Vision 2020 is the philanthropic portion of this comprehensive strategy and the catalyst for us to build on our core strengths of cutting-edge research, medical education leadership and world-class clinical care. From Vision 2020, which will seek $360 million in philanthropic support, we will build a new adult hospital and greatly expand our Children’s Hospital. These new facilities will enhance our educational capabilities and expand our capacity to serve as our region’s only Level 1 Trauma Center.

Research and education are at the heart of Vision 2020. We will implement innovative education and research plans that will foster greater collaboration and bolster new discoveries and strategies for our vision of a healthier, more whole world. Together with visionary philanthropic investors, Loma Linda University Health will develop the optimal environment in which to explore the next big questions in medical research. The research Loma Linda University Health is conducting and the questions we are now forming have laid the groundwork for this bold vision.

We invite you to join us in this quest for new discoveries. Your generous support, which can be a beneficial combination of current and planned gifts, will help expand research opportunities and provide state-of-the-art facilities where the answers to puzzling medical questions will be found.

The Center for Health Discovery, situated in a prominent location at the heart of the Loma Linda University campus, will be a most visible sign of our commitment to providing hope through discovery. We are honored to offer naming opportunities associated with the Center for Health Discovery, recognizing the generosity of our philanthropic partners.

Thank you for considering this invitation. Your investment will set the foundation for a new era of care and discovery that will improve the quality of life for generations worldwide.