Nutrition emerging as a "hard science" in human health

By Anne Glausser
Oregon State University

CORVALLIS – A much better understanding of the role of diet and supplements in maintaining optimum health well into old age has emerged over the past 20 years, according to one expert, and today is helping to address chronic diseases that kill most people in the developed world — heart disease, stroke, diabetes and cancer.

As he retires this month after leading the Linus Pauling Institute at Oregon State University since 1997, Balz Frei, director and distinguished professor of biochemistry and biophysics in the College of Science, has outlined some of the key advances of that period, and the steps still needed for nutrition researchers to work more closely and successfully with the medical community.

In the recent past, Frei said, nutritional research was rife with inconclusive studies that showed associations but no firm cause-effect relationships of disease prevention. Long-term trials with humans to study disease prevention are difficult and often cost prohibitive, and laboratory animal tests that showed effects — such as the effect of a certain food on cancer incidence — often lacked an explanation of "why."

In the past two decades, a period of extraordinary growth for the Linus Pauling Institute, researchers have worked to answer that question of "why" with considerable success.

"What I wanted to achieve with the institute was to put science behind nutrition," Frei said. "We're helping to lead the field of nutrition into more science and mechanism-based research that can have a real impact on promoting human health and preventing disease."

In this research, an underlying cause of aging and chronic disease has now emerged — chronic inflammation. Inflammation and its accompanying surge of "free radicals" are tied to several major killers, including cardiovascular disease and certain cancers. Scientists are honing in on the mechanisms of inflammation and the antioxidants that can prevent free radical damage.

> **"What I wanted to achieve with the institute was to put science behind nutrition."**
> **– Balz Frei**

Important discoveries have been made with vitamin E, in particular, in understanding why this nutrient is required by the body and the role it plays in protecting critical fats, especially during brain development and in the aging brain. Research on vitamin C showed that it helps arteries relax and lowers high blood pressure, a chief cause of stroke.

The institute has also helped change the worldview of vitamins and other nutrients. Instead of seeing them simply as a way to correct or prevent a deficiency condition like scurvy, they are increasingly recognized as a way to help prevent chronic disease, counter toxins and contribute to healthier aging.

One molecule in particular, lipoic acid, has shown promise in its ability to "bring cells back to a youthful state," Frei said. This compound triggers a reaction in cells that makes them more capable of fending off free radicals and other toxic insults that cause inflammation and disease.

Other findings of importance during Frei's tenure at the institute include:

• The discovery and mechanisms of action of several phytochemicals that may help prevent cancer, metabolic syndrome, and cardiovascular disease.

• Compounds of particular interest range from catechins in tea to quercetin in onions, sulforaphane in broccoli and xanthohumol in hops.

• Chlorophyll, a phytochemical that gives plants their green color, can bind to a toxic mold compound called aflatoxin that causes liver cancer, and render it inactive.

• Omega-3 fatty acids found in fish or fish oil have been shown to have important health effects, including their role in halting progression of fatty liver disease.

• The role of vitamin D in boosting the body's immune system is being viewed with significant future importance, with the advent of multi-drug resistant bacteria, including one recently confirmed strain that resists medicine's last-ditch antibiotic.

"Vitamin D plays a crucial role in many functions of the body, not just bone health, and it's now a public health challenge to raise the levels of it in the population worldwide, so that everyone has the best shot at fighting infections," Frei said. "LPI works beyond the ivory tower to help people make the right decisions regarding the use of diet and dietary supplements."

An important future goal, Frei said, would be a full outreach to the medical community.

"Communication between the nutrition science and medical communities is not happening at the scale it needs to right now," he said. "We need a bridge, and LPI, its Micronutrient Information Center and other public outreach services are well-suited to be that bridge. If we could bring about a change in how medical doctors are educated, I think that would be a major contribution to public health."

There's an urgency to change perceptions on diet and supplements among the medical community as well as the general public, Frei said, as rates of chronic, preventable diseases continue to increase.

> **"Communication between the nutrition science and medical communities is not happening at the scale it needs to right now."**
> **– Balz Frei**

"There's so much misleading information out there, so many false promises when it comes to dietary supplements," Frei said. "We're trying to counter these claims with evidence-based health information about vitamins, minerals, and phytochemicals. It has been, and to some extent continues to be an uphill battle for nutrition science to establish itself as a 'hard' science. But there's also a realization now of how critical the field is to human health."

During Frei's tenure as director, LPI has grown from one principal investigator to 12, focused on the study of healthy aging, cardiometabolic disease prevention, and cancer prevention and intervention.

More than 650 published research papers and review articles have been cited by peers over 26,000 times, and more than $55 million in funding came from the National Institutes of Health and other agencies.

The institute's endowment has quadrupled since its inception at OSU, and during the university's recent capital campaign LPI raised $48 million, $15 million of which went toward the construction of the Linus Pauling Science Center, a state-of-the-art research and education facility.