At 80 the marks of decay are all too visible. ... Perhaps, with luck, I will make it, more or less intact, for another few years and be granted the liberty to continue to love and work, the two most important things, Freud insisted, in life.”


Jean Louise Calment, the French woman who lived to be 122 and had the longest confirmed human lifespan on record, believed in moderation. Chocolate, olive oil and laughter were part of her daily routine. Although few people will achieve Calment’s status as a supercentenarian, a commonsense approach to healthy aging will help them successfully move through their golden years.

The stakes are high as boomers retire and put greater demands on the health-care system. In 2017, the U.S. population will hit a tipping point. For the first time, people age 65 and older will outnumber those under 18, according to the National Institute on Aging. This shift is known as “The Silver Tsunami.”

Carolyn Aldwin has committed her career to the study of aging for more than 40 years. Uncertainties arise as we age, from health to living arrangements and even sex, but a growing body of research will help people negotiate the challenges as they grow older.

“I believe in ‘optimal aging’,” says Aldwin, the Jo Anne Leonard Endowed Director of the Center for Healthy Aging Research at Oregon State University. “People are going to get sick. But how do they make the most of their lives? What are people doing to promote the well-being of themselves, their families and their communities as they age?”

OSU researchers are pursuing these questions, and many more, as they examine the range of aging-related issues. From physical and cognitive functions to social dynamics and even technology, they are tackling topics that will touch everyone, either through their own life journey or as they assist elderly parents and family members.

By 2025, Oregon is projected to have the nation’s fourth highest proportion of older adults. Oregon State’s leadership in healthy aging couldn’t be more timely.
Imagine finishing up a meal at a favorite restaurant. You’ve had nagging concerns about your 85-year-old mother who lives at Oatfield Estates in Milwaukie, so you pull out your smart phone and access the facility’s “family portal.” By logging onto this site, you can see where Mom went that day, how quickly staff answered calls for help and read notes from caregivers. How was her appetite? Did she take her medications? How was she feeling?

Not long ago, this concept seemed visionary at best. Not so today. Technology is increasingly used to address issues and solve problems associated with aging. Researchers call it “gerontechnology.” Their goal is to enhance the quality of life for older adults in their own homes or in residential facilities.

“How do you help people remain in their homes and live independently as long as possible?” asks Ron Metoyer, director of the gerontechnology research core in the Center for Healthy Aging Research at Oregon State University. “That’s our focus.” Their studies are leading to reductions in the cost of aging care and helping scientists learn how our behavior changes as we age.

Sensors for Seniors

In Patrick Chiang’s lab, technology for aging takes the form of wearable electronic sensors. Typically about the size of a quarter, these miniature sensors can be worn on a lapel or even applied on the skin like a bandage, says Chiang, an associate professor of electrical engineering.

In a project funded by the National Science Foundation, Chiang partnered with researchers from the Oregon Health & Science University to design a sensor that monitors the indoor movements and location of elderly patients in their homes. Study participants wore a device around their neck or on their chest. With “ultrawideband indoor navigation,” the sensors enabled researchers to study aspects of the seniors’ behavior such as how fast they walk. The speed of a subject’s gait directly correlates to cognitive function and independence level.

Sensors are also under development for use in today’s “smart homes,” adds Metoyer, an associate professor of computer science. For example, sensors can track how much people are eating, how they’re sleeping and, if placed where medications are stored, whether or not pills are taken regularly.
Sensors at apartment doorways represented an early form of gerontechnology. Today, Elite Care has advanced to using online family portals in all of its communities. Although Lundberg and Reed are no longer involved in the company’s daily operations, they are working on a smart-phone app that will help adult children monitor aging parents’ activities while their parents are still living at home. For example, through the use of motion-sensing technology, the app will alert adult children via cellphone if their father didn’t get out of bed by a specified time.

This level of surveillance isn’t for everyone. It may feel too much like “Big Brother.” However, it can also bring peace of mind. “Our vision is to build a cocoon for the elder person,” Reed says. “This software would allow family members to be involved in the care of their parents while allowing parents to live independently in their own homes longer through the latest and greatest sensor technology.”

How data from sensors are communicated to seniors has spawned another area of gerontechnology research. Through data visualization, Metoyer aims to ensure that information can be displayed in ways that are meaningful and useful for seniors.

“How do you empower them to learn about themselves and use the data to draw a simple conclusion about their health?” Metoyer says. “Do you use a simple bar chart or do you need something that shows the time component as well? The point is that you want to match the complexity of the chart to the complexity of the task that they’re trying to accomplish — whether it’s trying to lose weight or stay in touch with their children.”

Aging may be a universal experience, but culture and ethnicity affect how aging relatives fit into the family picture. Latino families, says Carolyn Mendez-Luck, tend to care for their elderly family members at home and delay institutionalization, relative to other racial and cultural groups.

The assistant professor in the College of Public Health and Human Sciences at Oregon State University looks at family caregiving of Latino elders and at age-related health disparities among older Latinos.

“Elders traditionally are afforded an esteemed status in the family,” she says. “When combined with strong cultural values around the family, elders are often seen as deserving recipients of care.”

All in the Family

Such concerns inspired Shannon Mejía, a graduate student who studied with Karen Hooker, co-director of OSU’s School of Social and Behavioral Health Sciences, and with Metoyer. Now a post-doctoral research fellow at the University of Michigan, Mejía received her master’s and Ph.D. degrees from Oregon State in Human Development and Family Studies with a minor in aging sciences. She is focusing on older adults in her research and says she was motivated by her parents, Lydia Lundberg and Bill Reed, the founders of Elite Care and Oatfield Estates in the Portland area.

The average age of people in Elite Care facilities is 85, says Lundberg. More than 80 percent have a dementia diagnosis and are losing cognitive function. With this in mind, the company has been using an integrated sensor/software information system in its communities since it opened in 2000.

“When people move into a community, they worry about losing their power,” Lundberg adds. “You want people to be able to move about as freely as possible, but you also need to know where they are. It’s good to know if a person is leaving their apartment.”

Long-Term Care

Latino families extend caregiving for elders

BY THERESA HOGUE
As the rate of technology innovation speeds up, the landscape is quickly changing for sensors and apps for aging. Chiang is now creating even smaller sensors that would reduce cost, size and power needs — essentially a disposable sensor — that could deliver data more rapidly, harvest energy from the environment and leverage medical services.

“We’re working on figuring out big-data applications, trying to glean important information from continuous but noisy data,” he says. “Potential markets include insurance companies and consumers. Insurance companies could use this information to reduce the cost of clinical drug trials, while consumers can help monitor how their aging parents or even their adolescent children are doing.”

of care and are a focus of much attention in the family.

“In my research, I have found that caregivers describe the home as a place of warmth and love that cannot be replicated in a formal institution. Many of the caregivers I interviewed viewed nursing homes as places of last resort and wouldn’t send their family members there because it would be like abandoning them.”

Compared to other cultural groups, Latino families are no more likely to care for their elders, but Latinos are more likely to be high intensity caregivers (in terms of the range and scope of responsibilities) compared to non-Latino whites.

A relatively high rate of chronic illnesses among Latinos may help to explain such practices. For example, Latino adults are diagnosed with chronic conditions such as diabetes at younger ages compared to non-Latino white adults.

“Thus because Latino elders are sicker from having more chronic conditions and severity of those conditions, they require more help,” she adds.

Latino families are often described as extending far beyond the nuclear family to include aunts, uncles and family friends. However, Mendez-Luck’s research indicates when it comes to caregiving, one family member often assumes much of the responsibility.
“As you age, your balance recovery reflexes may get out of practice ... older adults can be trained to reawaken those reflexes.”

“Community Quilt” Software
With the first wave of computer programmers hitting retirement age, seniors are playing a key role in another digital endeavor: open-source software. Carlos Jensen is examining the value of older adults’ contributions to what he calls the “community quilt” model of programming.

In this global, collaborative software environment, anyone can adapt the technology to his or her needs. Programmers alter code and share their developments with the community. With support from Google and other companies, Oregon State has long maintained an open-source software lab for students who have contributed to products such as the Firefox web browser and the Linux operating system.

Jensen’s research shows that older adults bring a perspective to the development of open source that is very different from that of younger programmers, particularly with health-care tracking applications. “We learned that the kinds of applications they (seniors) need were not available in the app store,” says Jensen, an associate professor of computer science. “They have a different set of concerns and a different understanding than the 20-something programmers who develop these applications.”

For example, through his research, Jensen learned that there were no apps available to help seniors prevent falls. “They wanted an app to remind them to do their falling exercises every day,” he adds.

Heading Off Falls
If you doubt that falling is a constant worry among older adults, consider this: Each year, one-third of adults 65 and older falls, according to the

Uncharted Territory
Health care adapting to longer lives

BY THERESA HOGUE

As adults live longer, the challenge of maintaining health through their senior years increases. Differences among individuals become more pronounced and older people may not respond to treatments as they would have when they were younger.

The field of geriatric health care is moving forward rapidly, says Michelle Odden, an epidemiologist at Oregon State University. For both providers and patients, the challenge is keeping up with the complexity and uniqueness of individuals as human lifespan extends beyond its historical parameters.

“The honest truth is that there are a lot of unknowns about how to promote health in very old age, but it is an exciting time,” says Odden, an assistant professor in the College of Public Health and Human Sciences.

“The main messages for my research are: You shouldn’t treat an 80-year-old like you would treat a 50-year-old, and perhaps more challenging, you shouldn’t treat 80-year-old Sophie like you would treat 80-year-old Mary. One size does not fit all when it comes to prevention in old age.”

Older adults have had a lifetime to accumulate health risks, whether from smoking, lack of exercise or other habits, she says. And as people near the end of life, personal preferences become more significant. For example, what is more important to the individual? Maintaining cognitive function? Increasing life span? Avoiding a heart attack?

“These preferences along with a better understanding of the unique physiologic changes that accompany the aging process are needed to guide treatment and prevention decision-making in old age,” Odden adds.

The key to attaining healthy golden years, Odden says, is pretty straightforward, but it starts much earlier than retirement. “As much as we would love a magic pill, the best medicine for longevity is maintenance of a healthy lifestyle.”
Mike Pavol has been addressing this problem for more than 15 years. He directs the Musculoskeletal research core in Oregon State’s Center for Healthy Aging Research and is an associate professor in the College of Public Health and Human Sciences.

Pavol uses technology to train people not to fall. Through studies with a pneumatic sliding platform and computerized visual prompts in OSU’s Biomechanics Lab, he has determined that people can learn to respond to a loss of balance by taking a step, thus preventing a fall. Training people to react and step more appropriately, he says, can help them to avoid a debilitating accident.

“The response to a loss of balance is a reflex,” Pavol says. “Over your lifetime, you learn how not to fall — really from the time you learn to walk. However, as you age, your balance recovery reflexes may get out of practice. What we’ve learned is that older adults can be trained to reawaken those reflexes.”

In the future, research by Pavol and Jensen could intersect. Pavol would like to make step-training for fall prevention more broadly accessible. “Our thought is that a step-training application could be made into a software product that people could potentially use independently in their homes,” Pavol adds.

Such technologies may be important now, but the need will only grow. The average lifespan is increasing. Over the next century, the number of centenarians is expected to increase tenfold, according to the National Institute on Aging. Oregon State researchers aim to help them remain healthy and independent for as long as possible.

Anastasia Athon is known professionally as Annie Athon Heck. She is the associate vice president in University Relations and Marketing at OSU.

The Public Is Welcome
Learn more about aging science and technology

The public can participate in research to advance the knowledge of aging. Join the Center for Healthy Aging Research at upcoming events or sign up for a research project through the Life Registry.

April 1, Aging Sciences in Oregon, Celebrating the 10th Anniversary of the Center for Healthy Aging Research. CH2M Hill Alumni Center, OSU. Contact Holly Lenz, 541-737-4993, or see health.oregonstate.edu/healthy-aging/10-year.

April 2-3, Annual OSU Gerontology Conference. Speakers will address physical therapy, caregiving and public policy. Contact Sunita Vasdev, 541-737-2261, or see osugero.org/.

Life Registry. Volunteers aged 50 and older can participate in research projects. For an application to join the registry, contact Holly Lenz, 541-737-4993, or see health.oregonstate.edu/healthy-aging/life-registry.
The Copper Connection
Experiments show potential for new ALS treatment
BY NICK HOUTMAN

If you’re unlucky enough to get Lou Gehrig’s disease (aka, amyotrophic lateral sclerosis or ALS), treatment options are few. One drug, Riluzole, has been shown to marginally increase survival. Other drugs can be used to manage ALS symptoms, but there is no cure.

For more than a decade, Joe Beckman has been studying the chemistry of the disease. In some ways, his research has run counter to the conventional wisdom, but recent results from his lab suggest that he’s on the right track. With colleagues in Australia and the United Kingdom, he has demonstrated a treatment that, for the first time, dramatically extends the survival of laboratory mice that have been engineered to develop ALS.

Untreated, these animals live no longer than about 130 days. “We’ve extended survival past 278 days for some of these mice. That’s longer than anyone has ever shown,” says Beckman, Distinguished Professor in the College of Science at Oregon State.

As ALS proceeds, motor neurons in the central nervous system die. The result is a gradual loss of muscle function and paralysis. Up to half of people with the disease die within three years. Globally, about 140,000 people are diagnosed with ALS annually. In the United States, about 30,000 people live with the disease at any one time, according to the ALS Association.

Scientists have traced one of the causes of ALS to a mutant form of an enzyme called superoxide dismutase, or SOD1. Healthy forms of the enzyme act as an antioxidant by removing so-called “free radicals.” However, when SOD1 goes awry, it partially unfolds, loses zinc and copper ions and becomes toxic. The metal-free form of the enzyme has been shown to kill nerve cells.

Beckman and his team worked with mice that have a SOD1 mutation as well as a gene that carries copper into the enzyme. By giving the mice CuATSM, a copper-containing compound, orally and through the skin, they delayed progression of the disease and extended survival.

That result was surprising because the treatment also increased concentrations of SOD1. Other researchers have concluded that more SOD1 accelerates the disease. However, CuATSM treatment also “greatly reduced” unfolded forms of the enzyme, says Beckman.

“We believe that with further improvements, and following necessary human clinical trials for safety and efficacy, this could provide a valuable new therapy for ALS and perhaps Parkinson’s disease,” adds Beckman, who holds the Burgess and Elizabeth Jamieson Chair in Healthspan Research in Oregon State’s Linus Pauling Institute.
Designing Mice for Human Healing

Tiny rodents save lives through genetic engineering

BY LEE SHERMAN

You can order them in yellow, two-tone (black-and-tan), “misty,” beige, “chinchilla” and lots of other colors and tints. They’re not handbags or home appliances, but like those other products they’re designed by humans and available for purchase on the Internet.

These multicolored commodities are research mice, and they can be credited for countless biomedical breakthroughs in cancer and other diseases. In the “benchtop-to-bedside” slog toward drug discovery, animal studies are the step between the petri dish and the human trial, says OSU’s attending veterinarian Dr. Helen Diggs.

“With mice, we’re able to look at cancer — the growth of tumors, the spread of malignancies — in a way we could never do in a human patient,” says Diggs, who oversees the health and wellbeing of OSU’s 400,000 research animals. “You can see how fast it grows, where it spreads and how it responds when you treat it with a drug you’ve developed.”

The varied hues in the rodents’ fur coats manifest outwardly the genetic makeup of their DNA — makeup that has been manipulated in the lab. Take the yellow mouse as a hypothetical example. Let’s say it’s missing a gene that protects against ovarian cancer. That missing gene was lost on purpose, “knocked out” of the animal’s DNA sequence by scientists at a federally regulated research animal facility. The beige mouse, on the other hand, might possess an extra gene that promotes prostate cancer — a gene that was intentionally inserted or “knocked in” to the mouse’s DNA.

In essence, Diggs explains, “You’re removing or adding pieces of material to the mouse’s genetic sequence in order to trigger or prevent an ailment.” These genetically engineered mice (GEMs for short) allow scientists to study cancer, obesity, HIV, Alzheimer’s and a host of other human diseases without risk to human patients. Because the mouse genome is similar to the human genome, treatments can be tested in mice and then translated to human afflictions. Only after a drug’s safety and efficacy have been amply demonstrated in mice will the U.S. Food and Drug Administration consider trials in human subjects.

The Jackson Laboratory in Maine, which Diggs calls the “granddaddy” of all breeding facilities, is a major source of “knockout” and “knock-in” mice for Oregon State University, where about 25 researchers are currently conducting biomedical research with mouse models. Among them are Siva Kolluri in the College of Agricultural Sciences, who is studying new compounds for treating breast cancer; Adam Alani in the College of Pharmacy, who studies novel drug formulations for ovarian cancer; and Oleh Taratula, also in the College of Pharmacy, who is investigating the use of near-infrared light in treating ovarian cancer and melanoma.

Next door to Diggs’ office, lab animal technicians carefully prepare sanitized, custom-made cages with sterile water, special diets and bedding that encourages nesting behaviors. The cages will house shipments of mice from specially ventilated shipping containers. After their flight across the continent, the mice are closely monitored by the technicians and given extra TLC.

Costing as much as $300 each, the GEM animals are VIPs in the world of research rodents. But the treatment they receive under Diggs’ vigilance is no more rigorous than what’s given to a plain-brown $25 lab mouse. When it comes to the stringent rules and regs that govern research animal care, she says, all creatures are created equal.
In the life of Bo Park, there’s a quirky connection between her early childhood in South Korea and her pharmacology research at Oregon State University: fish.

In the city of Incheon where she was born, her mom and dad sold hot bowls of fishcake soup from the food truck they owned and operated. As a pre-pharmacy student in Corvallis, Park studied fish collagen as a nutrient source for *Vibrio cholerae*, the bacterium that causes cholera. She collected her experimental collagen from the skins of two fresh trout she bought from the seafood case at WinCo.

There’s yet another fish connection in this story. When Park traveled to Boston last May to accept a prestigious award from the 43,000-member American Society for Microbiology (ASM), she and her OSU faculty mentor Aleksandra Sikora dined on calamari and black squid-ink pasta at a restaurant called the Daily Catch North End. The special dinner celebrated Park’s recognition as one of only 26 students nationwide awarded a 2014 ASM Undergraduate Research Capstone fellowship for a discovery she made during work on her University Honors College thesis. Scholarships from OSU’s Undergraduate Research, Innovation, Scholarship and Creativity program, as well as from the Howard Hughes Medical Institute and the Honors and Pharmacy colleges, helped support her research.

A big question under investigation in Professor Sikora’s lab is, What keeps cholera pathogens alive in rivers and streams where they can infect humans who drink the water or eat the fish? Park’s discovery that a protein called VChC, secreted by *V. cholerae*, degrades fish collagen opens up an important new avenue of investigation in the study of cholera, an often-deadly infectious disease that afflicts millions every year, mostly in developing countries of Africa, Asia and other regions hit by natural disasters, wars and climate disruption.

“*V. cholerae* lives in water,” explains Park, now in her first year as a graduate student in OSU’s College of Pharmacy. “This finding indicates that maybe it uses fish collagen as a food source. We already know it utilizes chitin” (the exoskeletons of insects and other organisms).

Sikora, a professor of microbiology in the College of Pharmacy, says the discovery is a potential breakthrough in cholera research. “*V. cholerae* is a common denizen of a range of aquatic ecosystems,” she says. “The persistence of the pathogen in natural habitats is a crucial factor in the epidemiology of cholera. As cholera remains one of the top global infectious disease threats, understanding the basic mechanisms of *V. cholerae* environmental survival is a prerequisite for the development of preventative measures.”

Park expresses her awe for her mentor’s prolific thinking. “I’ve told Aleksandra, ‘You have so many ideas pouring out of you all the time.'” Science shares the same creative spirit as art, says Park, who draws with oil pastels when she’s not in the lab or the classroom. “Just like artists, scientists look at what others have done, what techniques and tools they’ve used, and then figure out what they can bring that’s new,” she says. “Scientists, like artists, have to find meaning and purpose in their work — what does it mean to them?”

While presenting her research in Boston, Park was thrilled to briefly meet French scientist Alain Filloux, a pioneer in the field of microbial protein secretions. Now, as the third author on a paper published in 2014 by the journal *Infection and Immunity* and the first author on a paper in the *Journal of Bacteriology*, Park herself is building her own body of research literature.

“Bo is an excellent and thorough young researcher,” Sikora says. “She’s highly motivated and determined — two qualities that are particularly important in the lab because experiments often do not work. It’s challenging not to become frustrated.”
THE OREGON STATE UNIVERSITY ADVANTAGE

Connects business with faculty expertise, student talent and world-class facilities, and helps bring ideas to market and launch companies.

Business for Life

Accelerator provides a safe space for health-care startups

Got an idea for a new drug to treat antibiotic-resistant tuberculosis? Or maybe a diagnostic test for cancer? A new medical device to treat sepsis (blood poisoning)? How about a nutraceutical (product containing herb- or food-based nutrients) for a dietary supplement?

Researchers at Oregon State University are investigating these and other advancements in health care. But, before innovations can wind up in your medicine cabinet or in a doctor’s hands, they need to pass through a landscape that is foreign to most scientists: business and government regulation.

That’s where Mark Lieberman and John Turner, co-directors of the OSU Advantage Accelerator, serve as guides. They connect researchers and innovators with experts in business development and regulatory policy. Their six-month training programs at the Accelerator provide a road map from lab to marketplace.

For startups in the life sciences and health care, government oversight comes down to the U.S. Food and Drug Administration (FDA). “When it comes to new drugs, the FDA is concerned with three things: that it’s pure, that it’s safe and that the efficacy is appropriate,” says Lieberman. “Those are the big three for the FDA.”

To satisfy FDA criteria requires deep pockets and plenty of time. It can take, on average, $1 billion and 10 years or more to bring a new drug to market. New medical devices — whether a heart valve or a tongue depressor — usually take less time (three months to two years) to get regulatory approval.

It’s also critical to know the market. Researchers can zero in by surveying potential customers. “As a business person, how do I know what you want to buy if I haven’t spoken to you?” says Lieberman. “The market is always your guide. The market determines whether you’re successful or not.”

That knowledge, he adds, can be captured by developing what is known as a “minimally viable product,” a version that allows a team to collect valid data with the least effort.

The OSU Advantage Accelerator provides a convenient back porch where researchers can explore their innovations in a safe, supportive environment. “There is a progression about who you tell, but this is an open forum,” says Turner. “Inventors can get feedback, and as appropriate, we can bring in a broader base of people. Early-stage investors are very interested in coming here and looking under the hood.

“The pipeline from OSU is exciting,” he adds. “It’s a matter of recognizing the opportunities for capital investment and partnering with the right companies.”

Mark Lieberman

John Turner

To discover what the Oregon State University Advantage can do for your business, contact Brian Wall, Assistant Vice President for Research, Commercialization and Industry Partnering, 541-737-9058. oregonstate.edu/advantage
Public health affects every life and every day of every life. Public health adds years to our lives and quality of life to our years. Public health means transforming our current emphasis on sick care to a true public health system that delivers prevention as early as possible.

— Howard Koh, director of the Leading Change Studio at the Harvard T.H. Chan School of Public Health, 2015 Oregon State University commencement speaker