

# LINUS PAULING INSTITUTE

OREGON STATE UNIVERSITY  
RESEARCH NEWSLETTER

SPRING 2023

A RETURN TO LINUS PAULING DAY CELEBRATIONS IN CORVALLIS LOOK INSIDE ►

## LADY OF THE FLIES

### An Interview with Dr. Alysia Vrailas-Mortimer

We are pleased to introduce Dr. Alysia Vrailas-Mortimer, the newest principal investigator at the Institute. An associate professor in Oregon State University's Department of Biochemistry and Biophysics, Dr. Vrailas-Mortimer received her Ph.D. in Genetics and Molecular Biology from Emory University. Before coming to OSU, she was an assistant professor at the University of Denver and an associate professor at Illinois State University.

Dr. Vrailas-Mortimer utilizes the fruit fly model in her research, and with it comes a wide range of genetic tools at her disposal. For nearly two decades, she has used these flies to elucidate cellular responses to stress.

We sat down with Dr. Vrailas-Mortimer to discuss her work using fruit flies as a model for human disease, what can be accomplished with them, and how her research connects with that of other investigators at the Institute to advance optimal health.

### Why should we study fruit flies?

That's a great question. We work with the common fruit fly: *Drosophila melanogaster*. Researchers have been studying this species for more than a century. Work in this model has helped us to better understand the role of genetics in human disease.

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Oregon State University  
Linus Pauling Institute

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**Emily Ho, PhD**  
Endowed Chair and Director,  
Linus Pauling Institute

## FROM THE DIRECTOR

The year has only just begun, but 2023 is off to a great start.

First, the Linus Pauling Institute welcomed two new faculty members: Dr. Alysia Vrillas-Mortimer and Dr. Nathan Mortimer joined us after accepting positions in the Department of Biochemistry and Biophysics at Oregon State University.

Dr. Vrillas-Mortimer is our newest principal investigator at the Institute, and Dr. Mortimer is now an affiliate faculty member. Both of their labs use fruit flies as an experimental model, and their research expands the capabilities of the Institute in unique ways (see cover article).

We held our annual Linus Pauling Day event featuring a webinar and open house (see pages 6 and 7). It was great seeing everyone face-to-face again, and we hope to host more in-person activities soon.

Chris Petersen from the Oregon State University Libraries has edited a new book based on his popular Pauling

Blog. Called *Visions of Linus Pauling*, it is the subject of our most recent webinar (see page 7).

The annual day of giving at the University – known as Dam Proud Day – is on April 26. On that day we will be seeking support for a new initiative to support students at the Institute (see page 3).

And, in case you are interested, registration is now open for our biennial 'Diet and Optimum Health' conference. This year's theme is *Precision Health: How to Live Better, Longer* (see back cover). The next issue of this newsletter will include summaries of some of the conference presentations.

This is only the start of our plans for 2023 – more will be coming. We are making some important changes to the publication schedule of this newsletter, and we will soon be expanding our communication formats (see page 5). Our goal is to bring you more ways to connect with the Institute.

Hope to hear from you soon!

## Emily Ho Named OSU Distinguished Professor

Oregon State University has named Drs. Emily Ho and Yanyun Zhao as its 2023 University Distinguished Professor recipients, the highest academic honor the university bestows upon faculty. Dr. Ho is the director of the Linus Pauling Institute and a professor in OSU's College of Public Health and Human Sciences, and Dr. Zhao is a professor of food science in the College of Agricultural Sciences.

Both Ho and Zhao will deliver lectures about their research on May 24 at the Memorial Union on the OSU Corvallis campus. The lectures will also be livestreamed.

Dr. Ho's presentation, entitled *From B to Z: Food & Nutrients to Help You Live Better Longer*, will focus on her work with broccoli and zinc. Dr. Zhao's presentation, *A Challenging Yet Rewarding Journey in Search of Sustainable Food Packaging Solutions*, will focus on the impact of food packaging waste on the ecosystem and the quest to develop sustainable solutions.

Additional details can be found at [lpi.pub/Distinguished2023](https://lpi.pub/Distinguished2023)



Emily Ho, PhD



Yanyun Zhao



# DAM PROUD DAY 2023

**Dam Proud Day is the annual day of giving at Oregon State University. For 24 hours, starting at midnight on April 26, the Linus Pauling Institute requests your help.**

On April 26, gifts to the Institute will benefit our research programs, the Micronutrient Information Center, and a new initiative called the Hagen-Butler Student Legacy Fund.

Honoring one of our most venerable principal investigators, Dr. Tory Hagen and his longtime laboratory manager Judy Butler, the Student Legacy Fund will provide additional support for graduate students – from laboratory supplies to travel funds – to advance their scientific careers.

Dam Proud Day is an especially important day to give because Oregon State University and generous benefactors of the Institute have challenged us to garner extra gifts on April 26. If we can meet their fundraising goals, we will receive additional funding for our programs.

Here are just some of the challenge gifts we can earn on April 26:

**Director's Challenge:** When 10 gifts are received, \$1,000 will be awarded to the Micronutrient Information Center.

**Director's Circle Challenge:** When 50 gifts are received, \$10,000 will be awarded to the Research Innovation Fund.

**The 20k Challenge:** When 75 gifts are received, \$20,000 will be awarded to the Hagen-Butler Student Legacy Fund.

**Hagen-Butler Legacy Challenge:** When 100 gifts are received, an additional \$20,000 will be awarded to the Hagen-Butler Student Legacy Fund.

More can be found on the Dam Proud Day website – and it is your support that will allow us to reach these goals. 🌟

**For more about the activities of Dam Proud Day see:**  
[lpi.pub/DamProud](https://lpi.pub/DamProud)

**Even if you are not able to support us online on April 26, any gift made to the website, call-in gift, or check noted for **Dam Proud Day** will help us achieve our goals!**



**Support our annual day of giving!**

**All gifts received on **April 26th** will help make Dam Proud Day a success!**

**Participate in our  
24 hour challenge  
on April 26th!**



**Oregon State University  
Linus Pauling Institute**

**For more information see: [lpi.pub/DamProud](https://lpi.pub/DamProud)**



**Alysia Vrailas-Mortimer, PhD**  
Principal Investigator,  
Linus Pauling Institute

Dr. Vrailas-Mortimer recently received funding from OSU's College of Science Disease Mechanism and Prevention Fund for a project titled ***Why is a fly a good model to study my grandmother's tremors?***

**For more about the activities of the Vrailas-Mortimer lab, see: [lpi.pub/VMLab](http://lpi.pub/VMLab)**

While it might sound odd, we know that flies are quite similar to humans – at least at the cellular level. About 70% of all genes involved in human disease have counterpart genes in fruit flies. For example, we have developed flies with Parkinson's disease and Alzheimer's disease through genetic manipulation.

Through these disease models, we can study how a disease progresses at a molecular level. They also allow us to evaluate the efficacy of potential disease therapies.

My lab is particularly interested in Charcot-Marie-Tooth disease or CMT. This disease is characterized by defects in motor and sensory neurons. A person who has CMT often faces problems with movement and muscle wasting.

Since we are able to reproduce CMT in fruit flies, it allows us to look at the affected cells and tissues, study how the disease progresses, and explore the efficacy of gene therapy. Many of these approaches are impossible to conduct with patients.

### **What other advantages do fruit flies offer?**

Another advantage of using *Drosophila* is that they do not live very long. They grow from an embryo to an adult in about 10 days, and they only live for about two months.

Because of this, we can set up experiments to ask if a drug, a dietary compound, or a specific eating pattern can increase or decrease their lifespan. This gives us evidence that specific changes cause the flies to live longer or shorter lives – studies we simply cannot accomplish in humans.

This also means that we can reproduce the effects of old age in a very short period of time – much shorter than most other model organisms. Mice and rats, for instance, live for two years or more. And, in these animals, some disease symptoms may not appear for several months.

Additionally, we can raise flies quickly and easily. They do not require extensive care or special animal facilities like rodents and other mammals. We have now established a fly lab in the Linus Pauling Science Center where we can breed and raise flies for our experiments.

We can easily raise large numbers of flies to conduct expansive screening experiments in experimental drug or nutrition studies. Using large numbers of animals is advantageous when trying to determine a therapeutic dose range, as well as defining ineffective or potentially toxic doses.

### **How are flies used for nutrition research?**

Fruit flies can be given dietary supplements, just like other animals or humans. One interesting story from our lab involved the testing of supplements made from fruits that we purchased from a local health food store.

Marketed as an antioxidant blend, this supplement contained resveratrol, several anthocyanins, and a few vitamins. We tested it in flies carrying a mutation that resulted in accelerated aging. When these flies were fed supplements that contained Açai berry, they improved. The Açai supplements appeared to delay some signs of aging and helped restore lost motor functions.

We also found that some of the other supplements tested protected against the effects of paraquat, an herbicide commonly used in agricultural settings. Environmental exposure to this chemical has been linked to oxidative stress and Parkinson's disease in humans.

In flies, the oxidative stress from paraquat causes Parkinson's disease and disruptions in circadian rhythms. We found that feeding flies supplements containing Açai berries partially protected them from the effects of paraquat exposure.

In some preliminary experiments we fed flies vitamin E, but we encountered some problems. Vitamin E is fat-soluble, and fruit flies do not eat a lot of fat – unfortunately, you cannot just feed them oil.

Now that we are at the Institute, Dr. Maret Traber is helping us find better ways to feed vitamin E to our flies. Together, Dr. Traber and I are hoping to explore the role of vitamin E in our disease models.



## Can you talk about your research on minerals in flies?

We are interested in a neurodegenerative disease called Menkes disease, which is caused by mutations in a gene called *ATP7A* that encodes a copper transport protein. People with this disease do not transport copper into cells correctly, so they show symptoms of copper deficiency in the brain.

It might seem logical to just give patients more copper, but this approach can cause problems. To find out why, we reproduced the approach in flies. We found that the extra copper accumulated outside of neurons – not inside the cell where we want it to be – and that resulted in more oxidative stress and damage.

Thanks to work with our collaborators at Emory University, we identified some parallels between Menkes disease and Parkinson's disease. We now are wondering if some genes related to copper transport or handling could be important in the development of Parkinson's disease.

My lab also recently published a paper on manganese toxicity. Excessive manganese exposure – through environmental or occupational exposures – can cause neurodegeneration. We found that high levels of manganese in cells activate stress responses in mitochondria that do not turn off properly.

Stress responses are usually turned on to protect the cell. But when we stopped this stress response from activating, cells became much more resistant to high amounts of manganese.

We are also currently exploring if this phenomenon has any connections with the development of Parkinson's disease.

## Where do you see your work going at the Institute?

I'm really interested in a process called protein homeostasis, particularly how proteins are destroyed and removed when they have outlived their usefulness. We know that this process declines as we age, causing widespread dysfunction.

A number of diseases of aging, such as Alzheimer's disease, Parkinson's disease, and several muscular dystrophies, can be characterized by clumps of protein called aggregates that affect neurons and muscles. We are studying a protein called p38, which controls both protein aggregation and oxidative stress resistance.

For example, when we force flies to produce more p38, protein aggregation decreases, and lifespan is extended. How does p38 do this? Are there any treatments that can also increase p38 activity? Finding ways to either increase the activity or production of p38 could potentially help combat certain age-related diseases.

One of the reasons I am very excited to be part of the Institute is that I can tap into the expertise in natural products held by Dr. Fred Stevens and Dr. Richard van Breemen. Dr. Tory Hagen has some very exciting compounds that target the mitochondria, and it makes me wonder if they can also influence p38 activity. 🍷

## Coming Changes to the Newsletter

### What is changing?

Moving forward, the *Linus Pauling Institute Research Newsletter* will return to two issues annually, arriving in the spring and fall of each year. Instead of a newsletter in the summer and winter, we will send out a summary of our recently published digital materials.

### Why?

Our online offerings, such as our webinar series, special online videos, and additions to the Micronutrient Information Center, have greatly expanded in the past few years. A digital format allows us to provide timely announcements and perspectives on the latest nutrition research occurring at the Institute and around the world.

We recognize that many of you prefer to receive print communications from us, rather than online digital content. Thus, biannual summaries of our digital offerings can be provided.

### What do you need to do?

If you are subscribed to the email list for the Institute, there is nothing you need to do today. Just keep reading our emails for the newsletter and other updates from the Institute.

If you are not currently subscribed to our emails, we suggest you sign up today at [lpi.pub/signup](http://lpi.pub/signup).





**Anita Carr, PhD**  
Director,  
Nutrition in Medicine Group,  
University of Otago, Christchurch

The recording for  
this webinar is now  
available online at  
[lpi.pub/VitaminC2023](https://lpi.pub/VitaminC2023)

## VITAMIN C FOR IMMUNE HEALTH

On February 28, Dr. Anita Carr presented our Linus Pauling Day webinar: *Optimizing Immune Health: How Much Vitamin C Do You Need?* She reviewed the roles of vitamin C in the immune system, what we know about vitamin C requirements, and situations when taking extra vitamin C is warranted. Some key take-home messages from Dr. Carr are summarized below.

### Many people do not get enough vitamin C.

The goal is to maximize the amount of vitamin C in your bloodstream by consuming a variety of fruits and vegetables or taking a dietary supplement each day. Many scientists who work with vitamin C advise getting a minimum of 200 mg of vitamin C from foods and/or supplements every day to reduce the risk of cardiovascular disease and type 2 diabetes. At the moment, however, many people fall short of this modest goal: one-third of all US adults have daily vitamin C intakes lower than what can be found in a single orange (60 mg).

### The amount of vitamin C you need depends on multiple factors.

In her presentation, Dr. Carr reviewed the data from the National Health and Nutrition Examination Survey (called NHANES), a measure of the dietary intake, health, and nutritional status of adults and children in the United States. She and her colleagues found that people who are male, smokers, overweight, or have type 2 diabetes tend to have less vitamin C in their bloodstream. This suggests that people who fall into these categories should consider taking more vitamin C than what is typically recommended. This is why the Linus Pauling Institute recommends that all adults get at least 400 mg of vitamin C each day.

### You may need more vitamin C if you get sick.

There is some evidence to suggest that our bodies can absorb more vitamin C during an illness. As Dr. Carr explained, vitamin C is relatively safe for most people and taking larger amounts of vitamin C when you have a cold or an infection does not seem to have many negative consequences. There is some suggestion in the scientific literature that short-term daily doses of 1,000-2,000 mg of vitamin C can reduce the duration of the common cold, especially in children.

### There is no difference between vitamin C from food versus a tablet.

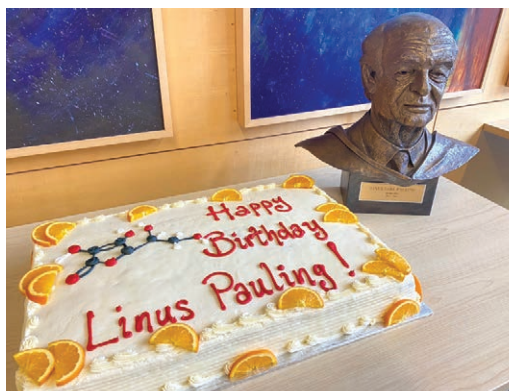
Ascorbic acid (vitamin C) acts the same way in the body regardless of the source. Tightly controlled studies by Dr. Carr and colleagues have shown that there are no advantages to consuming a kiwifruit versus a tablet, at least in terms of maintaining blood concentration of vitamin C. Fruits and vegetables rich in vitamin C contain a variety of other nutrients, phytochemicals, and fiber. These whole foods offer other nutritional advantages over supplements and should be the foundation of a healthy diet. 🍌

Additional information can be found in our guide *100 Questions about Vitamin C*. See [lpi.pub/VitC100Q](https://lpi.pub/VitC100Q)

# A LINUS PAULING DAY CELEBRATION

February 28, 2023, marked the 122<sup>nd</sup> anniversary of Dr. Linus Pauling's birth. Known as Linus Pauling Day in the state of Oregon, it serves as a day to celebrate Dr. Pauling's life and legacy. As is now tradition, we held a celebration in Dr. Pauling's honor, while taking the opportunity to showcase the work of the Institute that bears his name.

The event consisted of an afternoon of activities in the Linus Pauling Science Center on the Oregon State University Corvallis campus. This began with a public watch party for Dr. Anitra Carr's webinar



(see page 6). Dr. Carr was formerly a research associate at the Institute where she and Dr. Balz Frei wrote several key reviews that shaped international vitamin C recommendations.

Afterward, Stephen Lawson gave a tour of the building. Lawson, who worked at the Institute until 2016, is the former CEO of the Linus Pauling Institute of Science and Medicine when it was located in Palo Alto, California.

The event continued with an open house where the staff, faculty, and students of the Institute presented their research.

As the evening drew to a close, Dr. Emily Ho addressed the crowd that gathered and invited everyone to share in a special cake made in honor of Dr. Pauling's birthday.

In all, it was a wonderful return to in-person gatherings at the Institute that we hope to repeat for years to come. 🍷



**Stephen Lawson**  
Executive Officer, retired,  
Linus Pauling Institute

## VISIONS OF LINUS PAULING

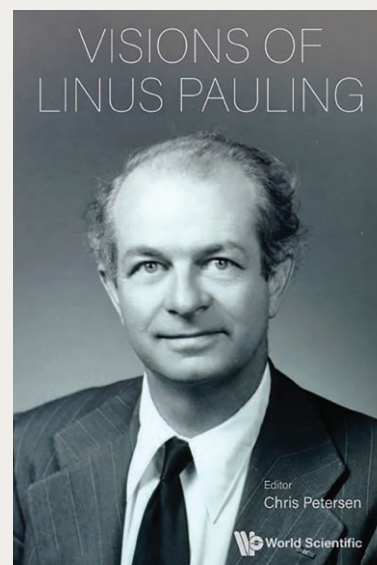
Established in 2008, the Pauling Blog has been a repository of information about the life of Dr. Linus Pauling. It is free to access, but this information has only been available online – until now.



Chris Petersen, the principal archivist within the Special Collections & Archives Research Center at the OSU Libraries, recently assembled a curated collection of the stories from the blog into a new book: *Visions of Linus Pauling*.

This book features different facets of Dr. Pauling's life, from his early career as a scientist until his death in 1994. Including tales never before published, the stories provide context to his remarkable achievements and insights into his family.

**To celebrate this achievement, we recently held a webinar with Chris about the book. The recording for this webinar, *Visions of Linus Pauling: Reflections on the Man and His Institute*, is now available online on YouTube at [Ipi.pub/VisionsWebinar](https://ipi.pub/VisionsWebinar)**





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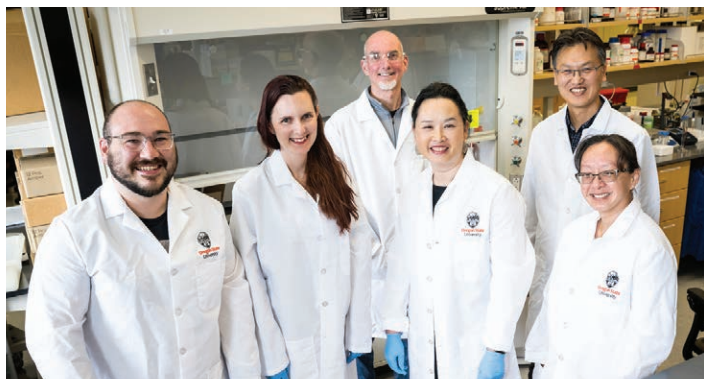
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**For Registration and  
Conference Information:**

**[lpi.pub/DOH2023](http://lpi.pub/DOH2023)**



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Photo: Ascorbic Acid Crystals by Henri Koskinen