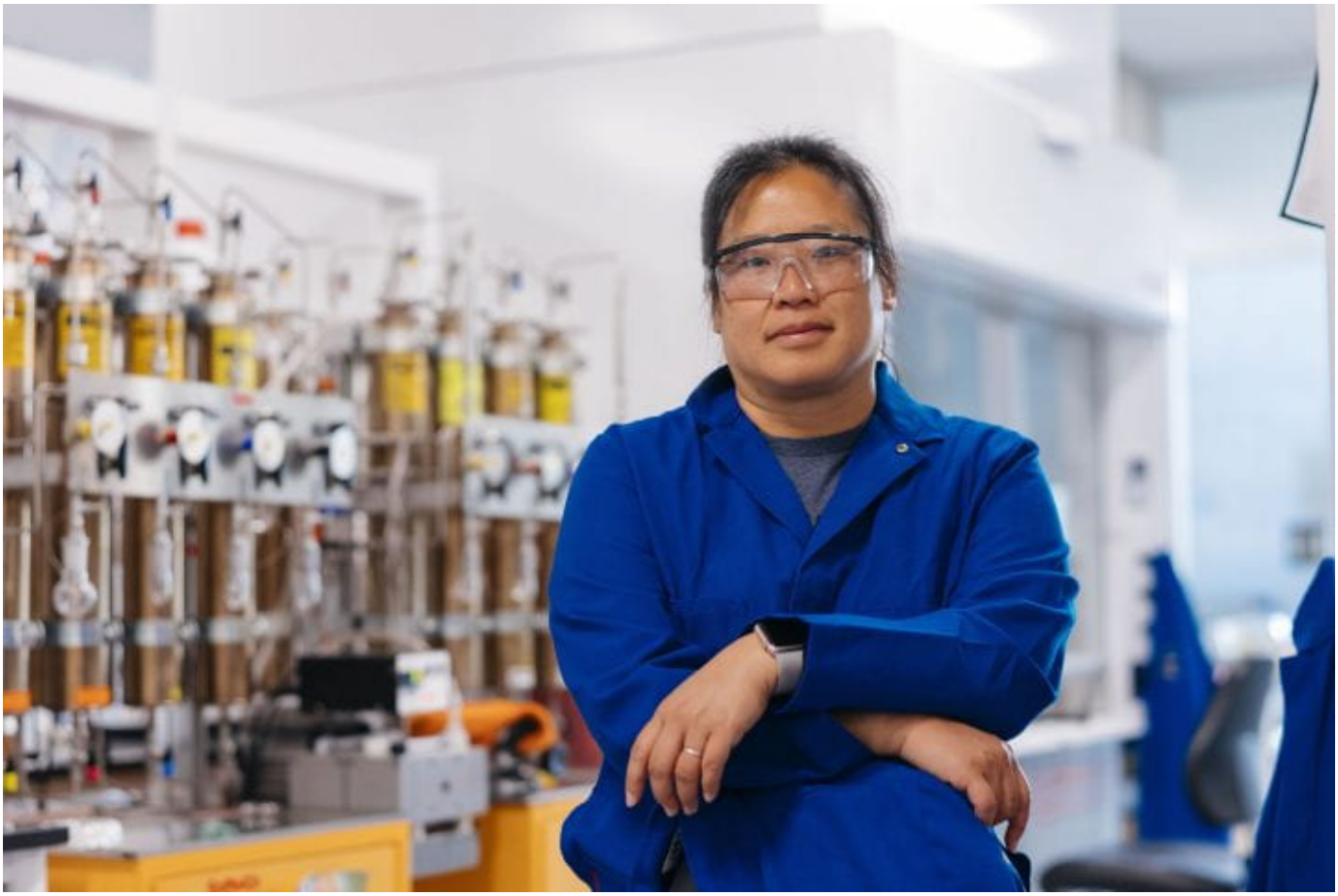
Curbing climate change

Jenny Yang and her lab team are refining revolutionary carbon capture technology.
Monday, April 21, 2025
Nicholas Schou
UC Irvine News



“The technology we’re creating is crucial for mitigating climate change,” says Jenny Yang, UC Irvine professor of chemistry. “By capturing and recycling CO2, we can contribute to a more sustainable future and help industries achieve net-zero emissions.”

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UC Irvine

One of the most important scientific research projects at UC Irvine is happening in the laboratory of chemistry professor Jenny Yang. There, she and her student

assistants are steadily refining a revolutionary approach to combating climate change through carbon capture technology. Yang's groundbreaking research focuses on removing carbon dioxide from the atmosphere and integrating these methods with existing heating, ventilation and air conditioning systems.

Her lab is currently developing a prototype that captures CO2 from indoor air, leveraging the energy already expended by commercial HVAC systems.

"Because CO2 in the air is fairly dilute, it takes a lot of energy to move enough air to capture significant amounts of CO2," Yang explained. "However, commercial HVAC systems are regularly moving large quantities of air, especially in high-occupancy places. Occupied spaces also have higher concentrations of CO2 – our exhalations are about 4 percent CO2. To keep CO2 at safe levels, a significant amount of building energy is spent on climate control for fresh air intake – only to cycle it out again. Coupling our CO2 capture with HVAC systems allows capture of CO2 from air that is moving anyway, and scrubbing out the CO2 would reduce the amount of fresh air that needs to be heated, cooled or dehumidified. It's a win-win for energy-efficient CO2 capture and reducing building energy costs."

As she and her team work toward a functional prototype, Yang is also in discussions about transitioning her technology into the HVAC industry.

From 2020 to 2023, she led a $1.5 million initiative funded by the Alfred P. Sloan Foundation aimed at developing new molecular compounds for electrochemical CO2 capture. Collaborating with researchers from UCLA and the Massachusetts Institute of Technology, Yang's lab group created new methods for capturing CO2 from flue gases emitted by fossil fuel plants as well as directly from the atmosphere.

"We were funded to pursue electrochemical CO2 capture and concentration," Yang says. "Current methods using aqueous solutions are energy-inefficient and require heat sources. By utilizing electricity, we can achieve much more efficient and cost-effective results."

Recent breakthroughs in her research include the discovery of a chemical system using tetrachloroquinone that exhibits stability in the presence of oxygen – an important factor for practical applications. "We've already demonstrated our system's competitiveness in terms of energy efficiency and stability compared to existing methods," Yang says. "Our goal is to reduce the energy costs even further."

In addition to her academic work, she has embraced entrepreneurship by co-founding AirLyte Technologies with chemistry graduate student Andrew Cypcar. It's a company focused on scaling her patented carbon capture solutions. "We're currently looking for funding to refine our chemical solutions and identify the best-use cases for our technology," Yang says.

Her commitment to innovation has not gone unnoticed. Recently, she won the Beall Innovation Award in the Physical Sciences for her significant contributions to the field, an accolade that includes a $65,000 cash prize to support the commercialization of her technology.

That seems a small price tag for such a promising discovery – one that has the potential to solve one of the most pressing challenges of our time. "The technology we're creating is crucial for mitigating climate change," Yang says. "By capturing and recycling CO2, we can contribute to a more sustainable future and help industries achieve net-zero emissions."

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