The Future of Imaging Cells: Q&A with Lu Wei

WHITNEY CLAVIN
Office of Strategic Communications

Caltech’s new assistant professor of chemistry Lu Wei is pushing the boundaries of imaging cells. She is developing new spectroscopy and microscopy techniques to track molecules in real time inside cells, and to visualize them in dozens of different colors. Though her primary focus is to create next-generation tools for biologists, Wei also plans to apply these tools to the complex environments of biological samples, such as brain tissues.

Wei grew up in the city of Wuhan in central China. She received her BS from Nanjing University in 2010 and her PhD from Columbia University in 2015. She came to Caltech as a visiting associate in 2017 and became an assistant professor in 2018.

We sat down with Wei to talk about her chemistry research and to learn more about one of her favorite Pasadena-area restaurants.

What kinds of microscopy techniques are you developing?

We make use of physical-chemistry principles to develop microscopy methods that enable us to visualize the dynamics inside cells. One method we are working on is vibrational spectroscopy, where we detect the vibrations of certain chemical bonds. For example, we have utilized a class of small chemical tags—such as those with certain types of carbon bonds, including carbon-carbon triple bonds—to detect small biomolecules of interest in live cells. Because these chemical bonds are not normally found in cells, and because they vibrate at a special frequency where none of the molecules in cells vibrate, they can be specifically tracked.

We can attach these tiny chemical tags to small biomolecules of interest such as neurotransmitters, nucleic acids, and amino acids, to visualize where these small molecules are in living cells.

How does this technique differ from others used for imaging cells?

A common method in bioimaging is fluorescence microscopy, which involves the protein called green fluorescent protein, or GFP, which was the subject of the 2008 Nobel Prize in Chemistry. GFP glows with a green color and is therefore used as a tag to visualize the insides of cells. However, GFP is a large molecule and is mostly suitable for tagging proteins. Using it as a tag for smaller biomolecules poses the risk of changing the properties of these functional molecules in cells. Our method better retains the properties of these small molecules.

What are some applications of this technique?

We can use our microscopy methods to visualize eight colors—corresponding to eight kinds of biomolecules participating in cellular activity at a time in a cell or tissue. These targets include proteins like alphatubulin, which makes up microtubules, major structural components of cells. We expect to be able to do even more colors in the near future. Our general goal is to push the frontiers of bioimaging. We want to be able to visualize something that we couldn’t see before.

How do you like Caltech so far?

I really like being at a small campus, where basically anywhere is within a 10-minute walk. It’s very convenient for talking to other people and setting up interdisciplinary collaborations. It’s a dream place to be for any scientist.

How do you like Pasadena?

It’s a really nice place, the climate is great, and I like the food. We just went to a nice place for dinner in Arcadia called Meizhou Dongpo with some faculty. Meizhou is a place in Sichuan Province in China and Dongpo was a very famous Chinese poet who also happened to be a good cook, so that’s why the restaurant is named after him. There is a lot of good Chinese food around here!
ANNOUNCEMENTS

Upcoming Events

The Upcoming Events column serves to inform students of upcoming events. The list is compiled by the Editors-in-Chief from information available around campus.

Thanksgiving Dinner 2018
Tuesday, November 20th | 5-8 PM | Chandler Cafe | Caltech Postdoc Association

The CPA Social committee in collaboration with the GSC welcomes Postdocs for Thanksgiving Dinner at Chandler Dining Services next Tuesday, Nov 20th from 5 - 8 pm. Share the gratitude with coworkers, friends, family and faculty!

The CPA will be sponsoring meals for 150 postdocs. Guests and family are permitted at a subsidized rate; however, spots are available first come first serve!

Please remember to bring your Caltech ID for verification on the day of the event.

There will also be a small box for donations to the Union Station Homeless Services in Pasadena in the spirit of giving thanks, so bring a canned good to donate if you feel so inclined.

Happy Thanksgiving!

Academic Drop Day
Wednesday, November 21st | 9 AM - 5 PM | Registrar, Center for Student Services

This is the last day for dropping courses, exercising your Registrar-given option to Pass/Fail classes, and changing sections to the nice TA.

Caltech Employee’s Federal Credit Union Closure
Thursday, November 22nd - Friday, November 23rd | CEFCU

All branches of Caltech Employees Federal Credit Union will be closed in observance of the Thanksgiving Holiday.

Registration for Winter Term (Glitch Day)
Monday, November 26th | 8 AM | REGHS

Set your alarm clocks early and connect your internet-connected device to Ethernet so that you can make sure that you get into those limited-enrollment classes you need to graduate!

Current juniors and seniors are invited to register beginning at 8 AM. Current freshmen and sophomores must wait till 8:30 AM to register for classes.

Mars InSight Landing: Viewing Party and Discussion
Monday, November 26th | 11 AM | Beckman Auditorium

Join Caltech and The Planetary Society as the newest visitor from Earth lands on the Red Planet. InSight is the first robotic explorer built to study the interior of Mars and take the planet’s vital signs, including its pulse and its temperature. Watch NASA’s live coverage of the landing, which will come from the InSight Team at the Caltech-managed Jet Propulsion Laboratory. Mat Kaplan of The Planetary Society’s Planetary Radio series will host a panel of experts who will provide additional commentary on the event on the Beckman Auditorium stage.

Please RSVP online at http://bit.ly/2TudWk4 for this FREE, public event. Light refreshments will be provided.

Doors open at 10:30 a.m. Touch down on Mars is expected around noon, with the first images expected soon thereafter.

Seating will be on a first come, first served basis. An RSVP does NOT guarantee entry. Once the venue is at capacity, we will not be allowed to admit additional people on the list. We recommend that you arrive to take your seat by 10:45 a.m.

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ASCIT Minutes

Meetings are every week in SAC 13

ASCIT Board of Directors Meeting
Minutes for 11/15/2018, Taken by Rachael Sun.

Officers Present: Sakthi Vetivel, Erika Salzman, Sarah Crucilla, Varun Shanker, Dana He, Alice Zhai, Rachael Sun

Guests: Alejandro Lopez

Call to Order: 12:10 PM

President’s Report (Sakthi):

• ASCIT movie night is happening tonight (11/16). Midnight donations happened this week – if anyone was dissatisfied with donation selection, please contact any one of the members of the ASCIT BOD.
• ASCIT had a meeting with Felicia yesterday (11/15) and discussed orange watch and having a fundraiser for victims of the recent fires at ASCIT movie night.

Officer’s Reports:

V.P. of Academic Affairs (Erika):

• SFC option chairs sent out to everyone. If anyone is interested on sitting on any committee contact the option chairs.
• Student-faculty luncheons are happening on 11/28 or 11/30, sign-ups will be sent out this coming Monday or Tuesday.
• Drop day Wednesday, course registration is on Monday 11/26.
• Donut course concerns is working now and the temporary form has been removed.

V.P. of Non-Academic Affairs (Sarah):

• Polyinterhouse is tomorrow night (11/17). Orange watch members have been selected and will be announced tonight.
• Working on creating a guide for rotation video and propaganda sheet registration. IHC is going to present it to Felicia soon.
• IHC has talked about Big I. The majority of people are okay with it happening, but no one wants to build for it.
• IHC had a meeting with Felicia last night. Talked about:
  • The fundraiser for the fire victims and decided to let ASCIT take this on, and potentially doing something for the shooting victims.
  • Orange Watch: will talk with involved administration about reforming Orange Watch and its curriculum after Polyinterhouse.
• Leadership convention ideas (training for people with leadership positions)
• Sarah is meeting with John Webster today to talk about vegetarian food.

Director of Operations (Varus):

• Reorganizing the storage closets is in progress.

Treasurer (Dana):

• Still waiting for RevComm to approve the interim treasurer appointment.
• People have turned in receipts for events and other expenses.

Social Director (Alice):

• ASCIT Movie Night is tonight. We will be having a fundraiser for fire victims at this event.
• Working on writing the MIF for ASCIT Formal.
• Regarding the November 30-December 1 weekend, will send out an interest survey about whether to do La Zoo Lights or ice skating.
• Talking to administration about doing a petting zoo on the December 8 weekend.

Secretary (Rachael):

• Nothing to report.

If anyone has any questions or concerns about a section of the minutes please email the appropriate officer. We are happy to answer any questions.

Meeting Adjourned: 12:50 PM

ARC Minutes

Meetings are every week in SAC 13

Present: Erika Salzman, Kanya Sreedhar, Arushi Gupta, Tunvi Gupta, Alphea Lee, Alice Jin, LC Chen, Albert Nazeri, Sophie Howell, Shubh Agrawal, Noah Yared, Alex Reeves

1. Retreat
   a. Not happening this weekend because of scheduling
   b. Maybe weekend of November 30th

2. Drop day (Nov 21) and registration (Nov 26)

3. Option advising being planned in houses

4. SFLs: professors being emailed, sign-ups will be emailed out to students on Monday or Tuesday

5. Course capture: will send out links for what courses to be recorded and people willing to record the lectures for next term soon; working on tracking down equipment

6. SFC will be held March 8

   a. Option committee chairs for SFCs have been selected; if you are interested in serving on the committee, contact the chair

7. Fires affecting members of the Caltech community

   a. ASCIT taking donations on venmo for people affected by fires
   b. Looking into extending application deadlines for high school applicants who were affected by the fires (talking to administration)
   c. If anyone has any other ideas, let us know

8. Discussion of bylaws

   a. Changed cap on at-large/frosh reps from 7 total to 4 each
   b. Clarified Faculty Board Committee appointments
   c. Amendments passed with a vote of 11-0

The ARC website at arc.caltech.edu has more information about what the ARC does if you are interested.

We meet every Sunday at open in SAC’s and our meetings are open to everyone! If you have any questions, please feel free to email salzman@caltech.edu.

This week’s recommended Tech usage after reading was brought to you by a dedicated reader. Photo courtesy of Reggie Gramovskiy.
CGPM Votes to Redefine Kilogram, Ampere, Kelvin and Mole

ALEJANDRO LÓPEZ
Contributing Writer

VERSAILLES, France — A single platinum-iridium cylinder sitting in a vault in a Paris suburb defines the kilogram; if its mass varies by a miniscule amount, the definition of a fundamental unit changes. In Ph 1b, Classical Mechanics and Electromagnetism, students are taught that the Ampere is defined as the current that, if passed in parallel through two infinitely long conductors, would produce an attractive force of 20 MN (and note that the definition of that newton also depends on the kilogram). The Kelvin is defined not much differently from how Andrew Celsius defined his temperature scale in the 1742, using the boiling and freezing points of pure water; the Kelvin is defined so that the triple point of water is 273.16 K. The mole is defined by the number of particles in 12 grams (again, 0.001 times the mass of that cylinder in France) of carbon-12. Over the centuries, unit definitions have transitioned from being defined by human constructions to being defined by the fundamental physical relationships of the universe. Still, these four, the kilogram units, had simply evaded a fundamental physical definition - until now. At the 26th meeting of the General Conference on Weights and Measures (Conférence générale des poids et mesures), which took place last week from the 13th to the 16th of November, in Versailles, Yvelines, Île-de-France, delegates from the member states of the International Bureau of Weights and Measures voted to redefine these units, effective on the April 20th, 2019: World Metrology Day. From that day forward these four units will each be defined using fundamental physical constants; the kilogram by Planck’s constant, the Ampere by the elementary electrical charge (the charge of a single electron), the Kelvin by the Boltzmann constant, and the mole by Avogadro’s constant. To accomplish these definitions required both very precise measurements of these constants and the technology to measure them and replicate them globally to ensure precise communication and reproducibility for scientific and commercial purposes. These four units join the other SI base units, the second, the meter, and the candela in being defined by fundamental physical measurements.

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EMAIL TECH@CALTECH.EDU WITH QUESTIONS.

AMAZON SKYMALL

Amazer Kids Light Gloves Children Finger Light Flashing LED Warm Gloves with Lights

$15.53 ★★★★★
Get in the holiday spirit with these LED gloves!
http://a.co/d/iclQFfX

Pink Queen Women’s Loose Oversize Turtleneck Wool Long Pullover Sweater Dress

$33.99 ★★★★★
Need to take that ugly sweater aesthetic to another level?
http://a.co/d/1LdnmR3

Candy Cane Spoons 1doz

$12.99 ★★★★☆
Born with a silver spoon in one’s mouth... or rather, a candy cane spoon.
http://a.co/d/4joKWxD

Enter this week’s raffle for your favorite Amazon SkyMall item here:
https://goo.gl/forms/5CQcFUOCMoVM4M852

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**Men's Basketball Tests Oxy in Annual 110 Rivalry**

The Tigers finished second in last year's annual 110 Rivalry game. While the Beavers pulled within nine by the final whistle, they were playing, so we had to get back to doing the things that made us successful down the stretch. It took us a while to get there but we know what we have to do have success against this team.

Sophomore diver Krystin Brown (Lake Forest, Calif. / Traubo Hill) also had a standout day on the boards, finishing second in the 1-meter competition and third and in the 3-meter competition with classmate Nerys Huffman (Broomfield, Colo. / Peak to Peak Charter School) coming in just 11 points behind on the latter board.

"I think maturity is going to make a difference for us," Reyes said. "This is a group that is going to give it all their time we step out onto the floor."

Caltech will be led by senior captains Elizabeth Eiden (White Plains, N.Y. / Holy Child) and Nika Hafelefiras (San Diego, Calif. / Our Lady of Peace). Both players have been positive factors for the Beavers in each of the last three seasons and will be counted on to provide their team meaningful minutes in the starting lineup. Eiden, who stands at 6-foot-3, is on pace to become the Beavers’ all-time leading shot blocker, while Hafelefiras took a big step forward last season with her perimeter shooting and played a major role in the team’s improved defensive metrics. The senior duo, both of whom made instant-impact contributions under Reyes’ coaching, accounts for half of the team’s senior class along with 6-foot-1 forward Madeline Schmel (Westport, Conn. / Staples) and Madelyn Stroder (Springfield, Mo. / Greenwood Laboratory), a positive presence off the bench.

"Our seniors know this is their last season to make an impact," Reyes said. "We’re starting to see them put the team on their shoulders and run with it. Nika and Liz’ dedication to this program, their teammates and willingness to sacrifice their own personal success to do whatever the team needs is something I appreciate as a coach. They are unselphless, great communicators and work well together because they have different skill sets. There is a real desire for them to succeed."

Junior guard Ramon, Calif. / California) brings a strong, skilled team and had a strong rookie season in spurs. The second-year player could provide the Beavers with a little bit of everything, including underclassmen leadership if she can stay on the court.

Claremont Men’s Basketball Tests Oxy in Annual 110 Rivalry

forgot to take the next step."
Let's Talk
...no appointment needed
Brief | Confidential | Supportive Conversations
FALL TERM 2018
10/3 - 12/14
Wednesdays
3PM - 4:30PM
243 Annenberg
(no session 11/21)
Fridays
3PM - 4:30PM
B114F N. Mudd
(no session 11/23)
Meet a Counseling Services clinician
Ask questions & troubleshoot concerns
Find advocacy opportunities
Learn about campus resources
Let's Talk is not a substitute for formal counseling.

Sponsored by Student Counseling Services
wellness.caltech.edu | 626-395-8331
(no session 11/23)(no session 11/21)

Every Tuesday, 12:00 - 12:50
9th Floor of Millikan Library in the study room
Secular, evidence-based meditation practices to improve your concentration, cope better with stress, and know yourself better.

Back to Galaxy Puzzles!

Directions
Connect the dots to make edges so that each circle is surrounded by a symmetrical galaxy shape, and the puzzle is completely filled with galaxies. The galaxy shapes must be rotationally (or 180°) symmetric, like the shapes shown here:

The California Institute of Technology’s best newspaper is the California Tech.
How to play Mathdoku (KenKen®):

1. Each box contains an integer from one to the number of boxes on a size. (4 for a 4x4 puzzle and 6 for a 6x6 puzzle)
2. Every row and column must contain exactly one of each integer.
3. The integers inside each cage (enclosed by bolded lines) must give the target number when combined with the operation shown.
4. Single box cages have no operation and just give the integer inside the cage.

Puzzles from Caleb Sander. Thanks!

We are also the only campus newspaper.

The diagramless crossword is similar to a standard US style crossword except in this puzzle there are five main differences:

1. You start with an empty 17x17 grid and are required to block out the unused cells yourself.
2. The clue numbers in the upper left corners are not filled in, so you have to figure out which cells are the correct ones and write in the clue numbers in small print.
3. The word lengths are not given, but all are at least three letters long.
4. The completed grid will form a pattern with rotational symmetry.
5. Every white cell forms part of an Across and a Down answer.

And that’s why we’re so good.

crossword from http://www.puzzlechoice.com
Sometimes I just sit and think about how rich I could get by drilling for oil on campus. I'm almost thirty percent sure that under the olive walk, there exists a huge reservoir of Texas Tea ready to be tapped. The existence of an oil field under campus makes perfect sense to me. From ChiA, I learned that like attracts like. Therefore, the oil from the olive trees on the olive walk should flow to where all the oil is. I don't see oil on the surface pavement, hence, the oil must be underground.

I've been keeping this to myself since frosh year to try to keep it from rival interests. I was worried that the administration must have come to the same conclusion when my smore year, they dug out the grass along the olive walk 2 or 3 times in a year. However, I was told that they just did that to put in more water pipes.

Now, I have decided to go public with my extremely reasonable hypothesis. Hopefully, within the next few weeks, I will get a major investment from an overseas firm to begin excavation. I'm pretty sure that Caltech would find an oil derrick in the middle of campus un-sightly, so I've decided to place all my equipment in the SAC.

If anyone would like to join me on this lucrative venture, just contact me via interdepartmental mail 160-86.

Answers to Puzzles and Crossword: http://bit.ly/2zegcGo

Sara Fish (b. 1999)
Missed Opportunity for a Loss Meme 2018
Ink on reverse of Ma 121 notes.

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