

## This is a Neuron on Nicotine

**LORI DAJOSE**  
Office of Strategic  
Communications

When a person takes a puff on a cigarette, nicotine floods into the brain, latching onto receptors on the surface of neurons and producing feelings of happiness. But nicotine does not simply stay on the surface of cells—the drug actually permeates into neural cells and alters them from the inside out. Now, a team of scientists has developed a protein sensor that glows in the presence of nicotine, allowing the researchers to observe nicotine's movements in cells and reveal more about the nature of nicotine addiction.

The work was led by Henry Lester, professor of biology at Caltech and previously a visiting scientist at the Janelia Research Campus of the Howard Hughes Medical Institute (HHMI). A paper describing the research appears online on February 4 in the *Journal of General Physiology*. Lester is also an affiliated faculty member of the Tianqiao and Chrissy Chen Institute for Neuroscience at Caltech.

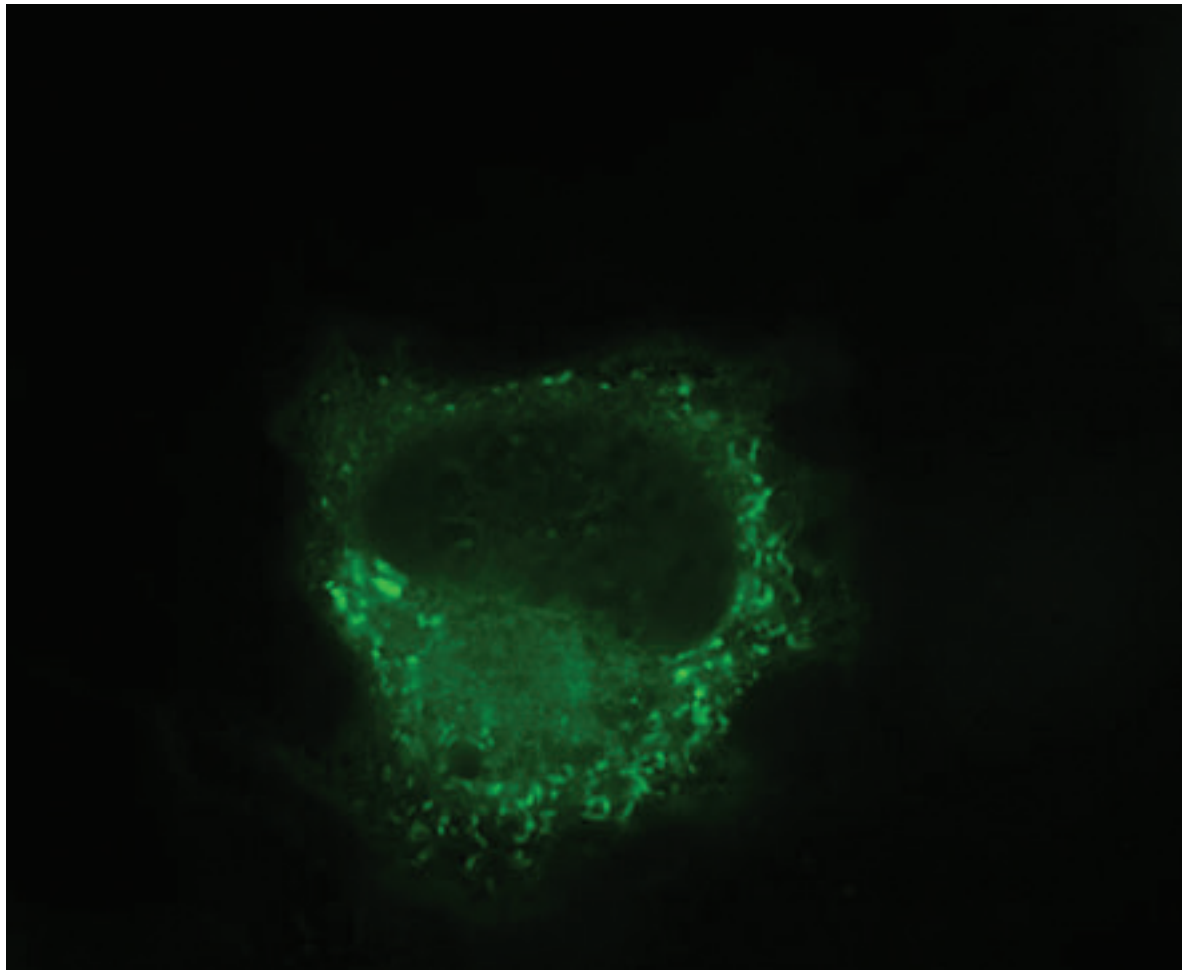
The endoplasmic reticulum is the equivalent of a cell's factory and warehouse—the place where proteins are synthesized and packaged in order to be shipped to various other locations both inside and outside of the cell. Nicotinic receptors (nAChRs) are among these proteins; after being manufactured in the endoplasmic reticulum, they then travel to the cell's surface. When nicotine molecules

enter the body, they travel through the bloodstream and reach brain cells, where they meet the nAChRs on the surface of these cells. This triggers the cells' processes of releasing chemicals of reward and happiness.

protein. The sensor is designed to close around nicotine, and this then activates the fluorescent protein to glow brightly, indicating where the nicotine molecules are located and how many are present.

to chaperone additional nAChRs on their journey to the cell surface. As a result, the neurons are more sensitive to the nicotine, which enhances the rewarding feelings after a puff on a tobacco cigarette or an e-cigarette.

The paper is titled, "Determining the Pharmacokinetics of Nicotinic Drugs in the Endoplasmic Reticulum Using Biosensors." Co-first authors are Amol Shivange, formerly a Caltech postdoctoral scholar and now at Novozymes in Bangalore; Philip Borden of Janelia; and Caltech graduate student Anand Muthusamy. In addition to Lester, other authors are Caltech postdoctoral scholars Aaron Nichols, Kallol Bera, Matthew Mulcahy, and Saidhbhe O'Riordan; Huan Bao and Edwin Chapman of the University of Wisconsin; Ishak Bishara, a former intern in the Lester lab; former Caltech undergraduate Janice Jeon (BS '18); Bruce Cohen, a senior scientist in the Lester lab; Charlene Kim, research technician assistant in the Lester lab; Dennis Dougherty, the George Grant Hoag Professor of Chemistry at Caltech and director of the Beckman Institute; Jonathan Marvin of Janelia; and Loren Looger of Janelia. Funding was provided by the National Institutes of Health, the California Tobacco-Related Disease Research Program, the California Institute for Regenerative Medicine, the Brain & Behavior Research Foundation, HHMI, the Della Martin Foundation, Louis and Janet Fletcher, and Caltech Summer Undergraduate Research Fellowship donors.



*In this image, a biosensor is targeted to a cell's endoplasmic reticulum and glows green in the presence of nicotine  
Credit: Lester Group*

What happens once nicotine has moved into the cells, however, has not been well understood. Lester and others previously found that some nAChRs remain in the "warehouse"—the endoplasmic reticulum—where they, too, can bind to nicotine. Hoping to gain insights into nicotine's effects within cells, Lester and his team developed a tool called a biosensor to visualize where the drug collects inside of cells. The biosensor is composed of a special protein that can open and close, like a Venus flytrap, and an inactivated fluorescent

Scientists can put the biosensors into particular parts of a cell—in this work, they placed them in the endoplasmic reticulum and on cells' surfaces—and watch them light up as nicotine floods in.

By making movies of cells containing biosensors in a lab dish, the team has discovered that nicotine enters into the endoplasmic reticulum within a few seconds of appearing outside a cell. Furthermore, the nicotine levels are more than enough to affect nAChRs during their assembly and

In other words, the more a person smokes, the more quickly and easily the smoker gets a nicotine buzz. This is part of nicotine addiction.

While the movies now focus on isolated neurons in the lab, the scientists want to determine whether nicotine's intracellular movements are similar in the neurons of live mice. Additionally, they are developing biosensors for other drugs, such as opioids and antidepressants, to observe how these compounds interact inside and outside of cells.

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# ARC Minutes

Meetings are every week in SAC 13

Present: Arushi Gupta, Tanvi Gupta, Michael Yao, Olivia Grabowsky, Margaret Lee, Sophie Howell, Shubh Agrawal, Alycia Lee

Submitted by: Arushi Gupta

## ARC Dean's meeting 2/21

- ARC Members will sit down with Dean's, registrar, someone from the provost's office. They'll ask us about how our projects and core is going.
- If you haven't told Beth an RSVP yet, make sure to do that soon.
- Freshman opinions are particularly helpful because of core

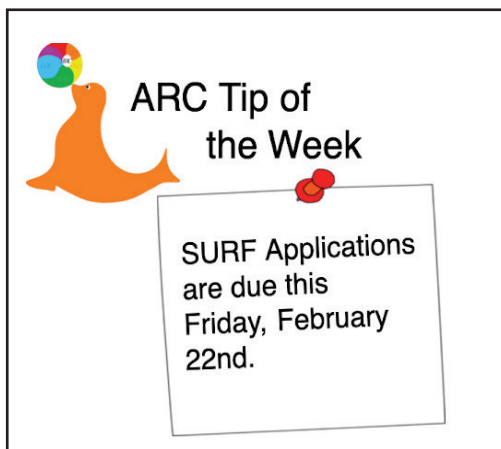
## Project updates: SFLs (Student-Faculty Lunches), Course Capture for third term, Research List/website

- Sophie will get started on sending out emails on that today, SFLs will be held on the 28th of February at lunch
- Registration is coming up soon and normally we send out the survey of which courses to survey and who is able to record usually around when registration begins
- Maggie expressed interest in beginning to take lead with Course Capture. Arushi will get her in touch with LC (previous rep) to get her set up in starting to get that ready.
- Daniel (not present) has been working with Tarini, Caleb, and others in getting the research list up and running. Will have additional updates (hopefully) at the next meeting.
- Daniel and Alycia are organizing a joint Lloyd-Ruddock peer advising session for third term registration right before registration opens. Would be good for other house reps to start coordinating this.

## SFC (Student-Faculty Conference) Updates

- Surveys are still open and on the ARC website. Freshman can also fill it out as well for some majors. Some discussion about potentially adding the surveys to the major, 'core' classes for some of the majors (i.e. CS2 or CS21 for CS majors), although not sure if there's enough time to do this. This would depend on what types of people (in regards to experience) each SFC committee is looking for to fill out the surveys.
- Honor code survey is coming out soon, and it's very important to get high response rate for this. There will also be prizes awarded through the Dean's office for filling out the survey.

**The ARC website at [arc.caltech.edu](http://arc.caltech.edu) has more information about what the ARC does if you are interested. We meet every Sunday at 2pm in SAC13 and our meetings are open to everyone! If you have any questions, please feel free to email [esalzman@caltech.edu](mailto:esalzman@caltech.edu).**



# ASCIT Minutes

Meetings are every week in SAC 13

## ASCIT Board of Directors Meeting

No ASCIT meeting this Sunday due to 3 day weekend.

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.

# Upcoming Events

## EDITORS-IN-CHIEF

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.

## SURF Proposal Follow Up Session

**B** Tuesday, February 19 | 12 PM | Center for Student Services 360 (Workshop Space) – Center for Student Services

Location: Hixon Writing Center Keep in mind you can also sign up to talk one-to-one with a writing specialist during our regular tutoring hours to discuss a SURF proposal at other times. While the large group meeting held on February 4th at noon will explain the basics of the SURF proposal and give you an opportunity to ask questions about it, it will not be a venue for reviewing your draft. Sharing your draft with others, including your mentor and co-mentor, is crucial to writing an excellent proposal. To help you out with getting feedback on your draft, the HWC will host two proposal workshops. These workshops will be led by a STEM Writing Specialist and will involve getting guided feedback from peers on the strengths and limits of your proposal. You must sign up to attend a workshop. Please consult these detailed instructions about how to make your reservation. There is a cap of 20 participants per workshop.

Contact Student Faculty Program Office [sfp@caltech.edu](mailto:sfp@caltech.edu) at 6263952885

## A Chronicle of Black Students at Caltech

Tuesday, February 19 | 12 PM | Center for Student Services, 2nd Floor, Common Area

Please join the Caltech Center for Diversity for a celebration of Black History Month by welcoming alum. Dr. Edray Goins for a presentation entitled, A Chronicle of Black Students at Caltech. Dr. Goins will talk about the history of Caltech's black students – including the first undergraduate and graduate students, and honor Lee F. Browne who tirelessly worked to increase diversity and promote the value of diversity at Caltech. Dr. Goins is a professor of mathematics at Pomona College. He earned his B.S. in mathematics and physics here at Caltech, and his Ph.D in Mathematics at Stanford University. A native of South Los Angeles, Dr. Goins spends his time engaging underrepresented students in mathematical research. He has taught mathematics and physics in the Freshman Summer Institute (FSI – currently FSRI) here at Caltech, and currently runs an NSF-funded Research Experience for Undergraduates (REU) titled "Pomona Research in Mathematics Experience (PRiME)." RSVPs recommended but not required - <http://diversity.caltech.edu/events/RSVP>

Contact Monique Thomas [mlthomas@caltech.edu](mailto:mlthomas@caltech.edu) at 626.395.8103

## Caltech Library Workshop: Overview of Library Resources

Wednesday, February 20 | 2 PM | Sherman Fairchild Library 328

This class will give a quick overview of Library services, collections, and databases. We'll talk about DocuServe, CODA, finding print and eJournals, our locations and Open Access. Whether you're new to campus or have been here for years this class will help you make use of all that the Library has to offer.

Register: <https://libcal.caltech.edu/event/4977421>

## The Linde Hall Inaugural Math Symposium

Friday, February 22, 2019 to Sunday, February 24, 2019 | 2 PM | Linde Hall 310 – Ronald and Maxine Linde Hall of Mathematics and Physics

Schedule/Speakers can be found at the event URL <http://pma.caltech.edu/linde-hall-inaugural-math-symposium>

Contact Mathematics Department [lindemathsymp@caltech.edu](mailto:lindemathsymp@caltech.edu) at 626-395-4335

For more information see <http://pma.caltech.edu/linde-hall-inaugural-math-symposium>

## Let's Talk

Friday, February 22 | 3 PM | Jorgensen 126 – Earle M. Jorgensen Laboratory

Let's Talk is a chance for students to have brief, informal, and confidential chats with Counseling Services staff. You can ask questions, troubleshoot concerns, find advocacy opportunities, and learn about campus resources. It's not a substitute for formal counseling and is not considered mental health treatment. Let's Talk staff can listen to your specific concerns, help you problem-solve, and connect to resources both on- and off-campus that could be helpful to you.

Fridays 3:00 PM - 4:30 PM from January 11th - March 15th, 126 Jorgensen.

## Theater Arts Caltech: Avenue Q

Sunday, February 24 | 2 PM | Ramo Auditorium – Donald E. Baxter, M.D., Hall of the Humanities and Social Sciences

Winner of the Tony® "Triple Crown" for Best Musical, Best Score and Best Book, Avenue Q is part flesh, part felt and packed with heart.

The laugh-out-loud musical tells the timeless story of a recent college grad named Princeton, who moves into a shabby New York apartment all the way out on Avenue Q. He soon discovers that, although the residents seem nice, it's clear that this is not your ordinary neighborhood. Together, Princeton and his new-found friends struggle to find jobs, dates and their ever-elusive purpose in life.

Filled with gut-busting humor and a delightfully catchy score, not to mention puppets, Avenue Q is a truly unique show that has become a favorite of audiences everywhere.

Performances are the last weekend in February and the first weekend in March.



## Seeking Successor for (Generation 2) Housetalia Comic

As most of you may know, four years ago, I started the Housetalia comic on social media/the internet. It starred eight walking Rotation violations and was primarily a funny House-based humor comic. It proved to be fairly popular over its run. Now that I have graduated, I can't continue; but the Houses belong at Caltech. *They don't belong with me.*

So... I'm considering passing on the Housetalia comic to an underclassman. I'd like someone who:

- Has at least one year left at Caltech
- Can draw competently
- Keep a consistent weekly update schedule during the school year
- Write all Houses/Residences fairly, and stay funny

If you are or know someone who is interested, contact me and I'll let them "apply". It'll probably consist of making a sample comic, and a short conversation learning about the series being inherited.

Contact Amulya Mohan at [amohan@alumni.caltech.edu](mailto:amohan@alumni.caltech.edu)

Housetalia comic archive at:  
<https://www.facebook.com/groups/housetalia/>  
<https://web.archive.org/web/20180901232026/http://housetalia.caltech.edu/comics/79.html> (Website recovered from Internet archive, about 1 term outdated)



## Emotional Well-being Series

2019

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GET MOVING WITH BEHAVIORAL ACTIVATION

FEBRUARY 13  
EMOTION REGULATION STRATEGIES

FEBRUARY 20  
GETTING UNSTUCK FROM EMOTIONAL RUTS

FEBRUARY 27  
HEALTHY SEXUAL RELATIONSHIPS

MARCH 6  
MINDFULNESS AND EMDR FOR SELF-CARE

MARCH 13TH  
MANAGING YOUR FAMILY'S EXPECTATIONS

LUNCH PROVIDED  
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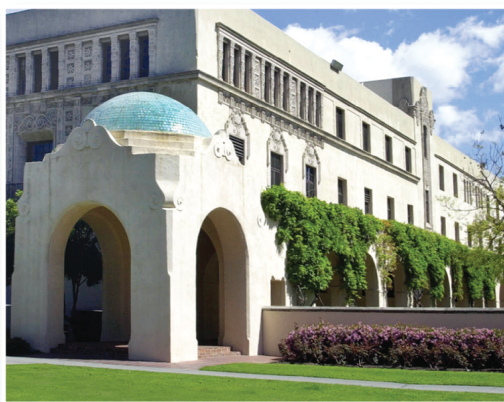
[WELLNESS.CALTECH.EDU](http://WELLNESS.CALTECH.EDU)



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## Seeking Ushers for CaltechLive!

Do you have a passion for the arts? Are you a people person? If so, come play an important role in the CaltechLive! 2019 season. You'll make new friends, support the arts and see performances for free!

Seeking energetic, articulate people to provide excellent customer service for Caltech Public Events. Serve as a goodwill ambassador; ensuring audiences have a safe and enjoyable experience while attending performances and programs in Beckman and Ramo auditorium. Ushers must be able to stand on their feet for long periods of time, assist patrons to their seats, read and comprehend printed tickets and communicate respectfully and clearly. Assist with concession or souvenir sales as needed. Must be able to lift up to 25lbs. Ushers are scheduled on an event basis, typical shifts include nights and weekends. Prior theater experience is a plus.

To apply contact: Ed Brown at [edbrown@caltech.edu](mailto:edbrown@caltech.edu)

## LET'S TALK

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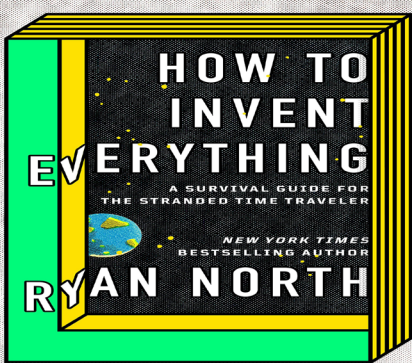
Fridays 3 - 4:30pm  
Jan 11 - Mar 15  
126 Jorgensen

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*Let's Talk is not a substitute for formal counseling  
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## Beavers Set Multiple Records, Sweep La Verne

**GOCALTECH.COM**

Actual Sports Content Editor

PASADENA (Feb. 13, 2019) – The Caltech men's basketball team hit a trio of milestones with Wednesday's 59-46 victory at the University of La Verne, completing the season sweep of the Leopards.

Wednesday's win gave the Beavers their 10th win of the season, the first time Caltech has hit double-digit wins under Head Coach Dr. Oliver Eslinger and the first time since the 1953-54 season. Caltech has only won more than 10 games on two occasions in the history of the men's basketball program. Additionally, the Beavers set the team record for single-game blocks with 10 and junior guard Alec Andrews (Folsom, Calif. / Folsom) secured the single-season assists record and now finds himself with 126 assists on the year after another six-assist game. Andrews is also the team's all-time career assist leader, meaning the junior has now secured the trifecta of single-game, single-season, and career assists records and will have his entire senior season to continue to build on the historic total.

Caltech's 10 blocks came from six different players, including its starting five, but sophomore forward Spencer Schneider (Houston, Texas / Clearbrook) led the way with three rejections. The sophomore also had his most prolific game of the season on the glass with 13 rebounds to go with 12 points in 34 minutes of action. The Beavers endured eight lead changes but began to take ownership of the game after the first five minutes en route to outscoring the Leopards by seven points in the first half. Schneider did most of his damage in the second half, but the first half belonged to sophomore guard Gokul Srinivasaragavan (San Ramon, Calif. / Dougherty Valley), who scored all but two of his team-high 16 points within the game's first 20 minutes. The sophomore made five shots in that span, including a pair of three-pointers to create the early momentum Caltech needed to come away with a hard-fought road victory of epic proportions.

"I am so happy for our players," Eslinger said. "To get double-digits on

the road in a conference setting, we knew it was going to be tough. It wasn't easy and we had to battle and shine. Our guys came together and played terrific defense and worked through each possession."

Inside defensive dominance notwithstanding, Caltech's greatest team achievement came in the turnover department. The Beavers turned the ball over just eight times to the Leopards' 20, which made for a multitude of opportunities for the visitors in transition. Caltech outscored La Verne, 7-0, on the fastbreak and 20-5 in points off turnovers and did all it could to stand its ground when the Leopards took possession. The effort level on defense resulted in the Beavers ceding their fewest amount of points in any win this season -- and in recent memory. In addition to Schneider and Srinivasaragavan's sound offensive games, sophomore guard Marcus Gee (Santa Monica, Calif. / Santa Monica) scored 14 points in 34 minutes as the visiting team's third player to reach double-figures. Once Caltech jumped ahead with five minutes to play in the first half thanks to one of Gee's two three-pointers, the Beavers went on to hold the lead for the rest of the game, avoiding the prospect of a late surge from the host Leopards.

Caltech has now beaten La Verne at least once in each of the previous five seasons, the team's longest streak of success against any SCIAC foe. While the Beavers can at best finish at 12 wins this season, two removed from the all-time program record, the camaraderie shown by this year's team combined with its blend of talent and youth could position the men's basketball program for even bigger things to come in near future.

"We are proud of how we executed to start the game," Eslinger said. "These guys will remember this forever; making history together on the same night as our women did."

Eslinger and the Beavers will look to build some late-season momentum when they host the University of Redlands on Saturday, Feb. 16 at 7:30 p.m.



Arm in arm in arm.

-gocaltech.com

## Women's Basketball Gets Record Fourth SCIAC Win



Onwards and upwards.

-gocaltech.com

**GOCALTECH.COM**

Actual Sports Content Editor

PASADENA (Feb. 13, 2019) – The Caltech women's basketball team endured a physical battle but came away with its fourth SCIAC victory of the season against visiting University of La Verne on Wednesday evening. The four conference wins have surpassed last year's total and 2018-19 will go down as the team's most successful season against conference competition.

The Beavers defeated the Leopards, 59-53, and led from start to finish despite some stiff opposition from the Leopards over the game's final half. A perfect shooting game from senior center Elizabeth Eiden (White Plains, N.Y. / Holy Child) helped get the home team over the top. Eiden picked up her 11th 20-point game of the season and did so utilizing her toughness inside in addition to her mid-range jumper from the elbow, one of the most significant new wrinkles the senior added to her arsenal over the last two years. Caltech's starting center also played an instrumental role down the stretch, knocking down all four of her free throws around the one-minute mark to keep her team at a three-possession distance. With La Verne trailing by five with 20 seconds to go, Eiden made a key block on the Leopards' leading scorer, then did so again just seconds later to return possession to her team, allowing sophomore Lauren Suezaki (San Ramon, Calif. / California) to hit a pair of free throws to put Caltech back up by seven points with 16 seconds to go in regulation.

"Coach had been emphasizing how much I needed to be in on the help side all night," Eiden said. "Their shooter had a pretty successful game, so I knew I had to get there to contest her shot."

Junior guard Grace Peng put forth another strong performance of her own, contributing to the Beavers' victory in a variety of ways. Peng scored 15 points, but also led

Caltech with eight rebounds and five assists while turning the ball over on just two occasions. Peng's role as a facilitator proved a boon for the Caltech offense, as three of her assists came on easy baskets for Eiden while the other two happened on successful three-point baskets for senior guard Nika Haleftiras (San Diego, Calif. / Our Lady of Peace), who finished the game with 10 points in all. Senior forward Madeline Schemel (Westport, Conn. / Staples), like Peng found multiple ways to contribute with six points, seven rebounds and four assists, including successful passes on the Beavers' first three baskets.

"Everyone has an important role on this team," Peng said. "When they do their jobs like tonight, it makes it easier for me to focus on doing what I do best and contributing whatever the team needs from me."

The Beavers are now 3-1 against the quick-paced Leopards under Head Coach Bridgette Reyes. While both teams had evenly matched games in terms of the turnover battle, Caltech made the most of its opportunities with 13 points off turnovers while outshooting La Verne at the free throw line by nearly 25-percent. The Beavers led by as many as 10 points late in the third quarter and started hot with a 19-12 first quarter that saw the home team begin the game with two quick baskets. Caltech has gotten more comfortable playing in all four quarters this year, and Wednesday's game marks the first time this season the Beavers have led from coast-to-coast in a SCIAC win.

"This win feels great for our team," Reyes said. "I think our squad has proved that they can compete in this league. They have continued to strive for more and give everything they have, for this school and for each other."

Reyes and the Beavers will prep for their final game of the season -- a Senior Day clash with the University of Redlands on Saturday, Feb. 16 at 5 p.m.



## Caltechlive!

### THE EARNEST C. WATSON LECTURE SERIES

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#### MY HALF-CENTURY ROMANCE WITH CALTECH AND WITH BLACK HOLES, WORMHOLES, TIME TRAVEL, AND GRAVITATIONAL WAVES



**Kip Thorne (BS '62)**, Richard P. Feynman Professor of Theoretical Physics, Emeritus, Caltech Division of Physics, Mathematics and Astronomy

The "warped side of the universe" - objects and phenomena made from warped space and time - was once mere speculation. In this talk, Caltech physicist Kip Thorne (BS '62), the Inaugural Robert F. Christy Lecturer, will describe how he and colleagues transformed a portion of that warped side (black holes and gravitational waves) into observed phenomena, and what they have learned about another portion (wormholes and time travel).

WED., FEB. 27, 2019 • 8 PM

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Wednesday, February 6  
12pm @ Avery Library  
Lunch is provided!

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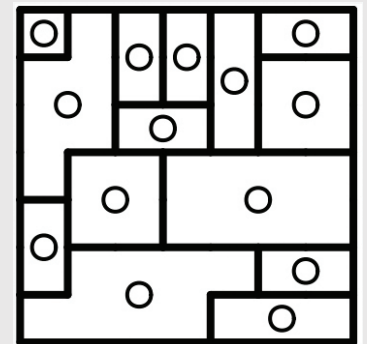
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## Galaxy

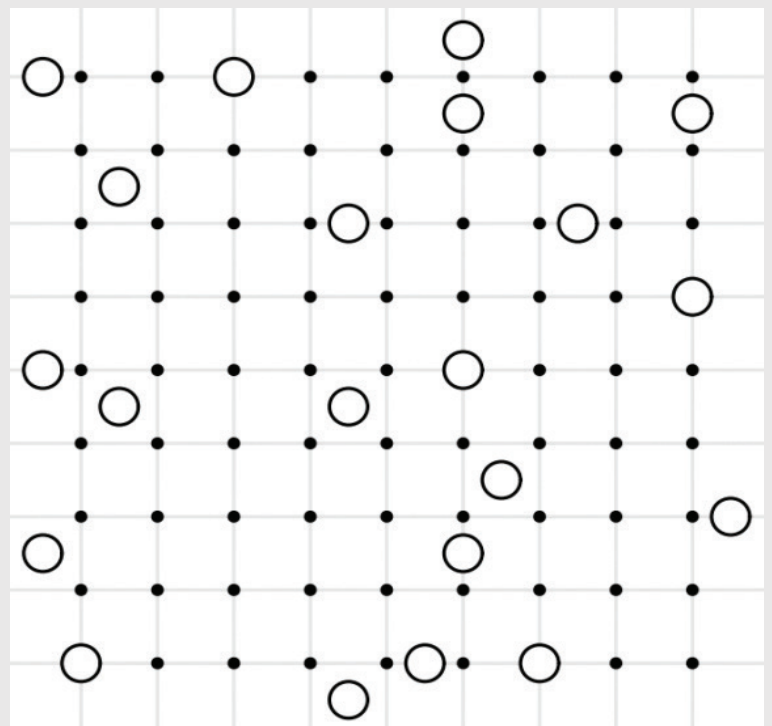
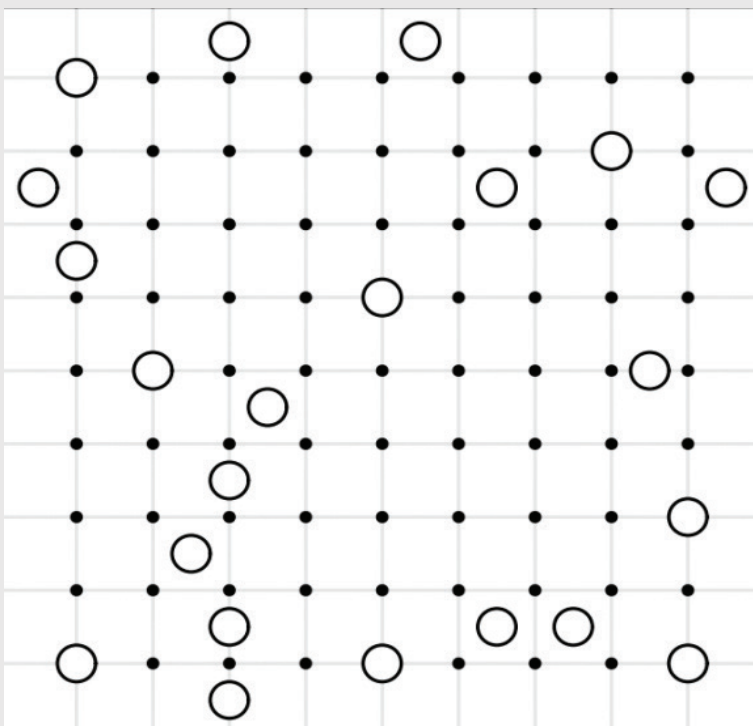
More Galaxy Puzzles!

### 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:



I came.





## Mathdoku (KenKen®)

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!

I saw!

90×	2	13+	1-		
				12+	
	5+		2+		30×
3+		21+		3+	
1-			10×		

11+		10+		16+	
	11+				
14+			360×		7+
	2-				
		36×	2-		20×
			2-		

## Diagramless Crossword

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.

I conquered my Chem 3x report.

Hint: 1 Across starts at Row 1, Column 2

### Across

1. Golfing pin
4. The night before
7. Small bird
8. Hoop
10. Male red deer
11. Fiend
12. Flexible twig
14. Possesses
17. Dialect
18. In this place
19. Irritate
20. Small wooded hollow
21. Short-tempered
26. Tinned
29. Scoundrel
33. Female horse
34. Large open vessel
36. Form of rummy
37. Desiccated
39. Border
40. Flightless bird
41. In the past
42. Gown
43. Stepped
44. Hen-peck
45. Crony
46. Portent
47. Type of emblem
49. Drab
51. Damage or loss
55. Method

58. Expert

59. Gemstone
63. Coconut meat
64. Hankering
65. Publication
67. Type of song
68. Adventure story
69. Military vehicle
70. Examine minutely
71. The sheltered side
72. Snakelike fish

### Down

1. Rubbish
2. Spooky
3. Go in
4. Wear away
5. Devotional watch
6. Join up
7. What person?
9. Jewel
13. One of a pair used to control a horse
14. Belonging to him
15. Part of a circle
16. Snow runner
17. Parts of the Roman calendar
22. Retaliation
23. Intransigent
24. Army unit
25. Emollient
26. Core group
27. Type of gas

28. Necessities

30. Rebound
31. Fragrance
32. Defamation
33. Encountered
35. Pull
36. Space
38. Lair
48. Notion
50. Halt
52. Beam
53. Frozen water
54. Males
55. Significance of a story or event
56. Speak up
57. Male duck
60. Out of fashion
61. Quickly
62. Established by law
63. Feline
66. Operated

crossword from <http://www.puzzlechoice.com>

