



Update

The Caltech 6: America's First and Only All-Female Class of ChEs

The lives of six women reflect how far we have come,
and how much further we have to go.

On an unseasonably warm late-October day in Pittsburgh, PA, Rosemarie Wesson took the stage at AIChE's 2018 Annual Meeting. Under the muted glow of a dozen spotlights, she told the story of six women who entered the California Institute of Technology (Caltech) in 2001. Four years later, they would become the first and only all-female chemical engineering class to graduate from any American coed college.

The crowd, sparse but steadfast, listened intently as Wesson spoke about discovering the Caltech 6 and watched as she grew increasingly animated, as fervor crept into her voice. Thirty years ago, Wesson was among the first African-American women to receive a PhD in chemical engineering, and over the years, she has remained a fierce advocate of pioneering women in science. This story is special to Wesson, and she makes a compelling case for its universal importance.

In 2005, the Caltech 6 were only briefly acknowledged by the media: In a short piece by the campus newspaper and in an article for the *Los Angeles Times*. By most accounts, even according to the six women themselves, the existence of the Caltech 6 is nothing extraordinary.

But it is. According to the latest statistics, women make up only 13% of the engineering workforce. The percentage of females in engineering and computer science occupations has essentially stagnated since the early 2000s, and women across the engineering spectrum earn less than men. For every 100 engineering undergraduates, there are on average only 20 female students.

Engineering is a male-dominated field — in classes, in companies, and throughout the industry. In this world of men, there has only ever been one entirely female class of chemical engineers at a coed school,

and the Caltech 6 is it.

There is exceptional diversity among the six paths that converged at Caltech in 2001, and this single intersection and its aftermath are indicative of a larger condition. The Caltech 6 are reflective of the state of women in engineering as a whole — they represent all that we've already achieved, and what still needs to be accomplished. Above all, they are an inspiration for a group of people with few role models.

Before Caltech

Towering pines frame the limits of Placerville, an old gold rush town outside of Sacramento, CA. On its main street, the rounded stump of a tree that hanged three thieves in 1849 sits in the cellar of an old tavern. It's a town monument; the locals call Placerville "Old Hangtown" in honor of the once-intact tree. Amidst this tinny tourism, Haluna Gunterman grew up with 25



▲ The Caltech 6 — (left to right) Michelle Giron, Maryam Ali, Karen Sum Ping, Haluna Gunterman, Vicki Dydek, and Shannon Lewis, shown here in 2005 — are the first all-female chemical engineering class to graduate from a coed American university. Image courtesy of California Institute of Technology Archives.

chickens, her father, sister, and mother. Gunterman was born in Japan, like her mother. Her parents had met while her dad was teaching English there. None of them had ever heard of Caltech.

On the other end of California, in Los Angeles, Michelle Giron spent her childhood just outside the orbit of Caltech. She lived with her sister, her father, and her mother, a fierce and strong caretaker. Michelle's mother was a Vietnam War refugee. She had come to LA, where she met her husband and began a new life in the Golden State.

Shannon Lewis and Vicki Dydek both grew up in northern Virginia, in counties well-known for their prestigious schools. Lewis was the daughter of two tech-savvy entrepreneurs. Dydek was a preacher's daughter; hers was a loving home, but not one focused on science.

Over 7,000 miles across the Atlantic and a long way into the desert, Maryam Ali was raised in Pakistan by her father, an engineer, and her mother, a high school teacher.

Even further from the shores of California, Karen Sum Ping was raised on the beaches of Mauritius, a small island off the coast of Africa. Ping spent her youth in the tropical heat, chattering in Creole with her cousins, surrounded by loving friends and family. Crossing from one end of the island to the other took just one hour, so her parents knew pretty much everyone in town. Even in a close community, it was sometimes lonely. At times, she felt like her home existed entirely disconnected from the rest of the world.

In their formative years, the Caltech 6 had something very important in common: Support and encouragement. Gunterman's mother enrolled her in Japanese school in addition to California public school. On weekends, she gave up countless hours driving her daughter to math and science courses

taught entirely in Japanese. Ping's parents also pushed her to do well in school, to leave their island for greener pastures, despite how much they would miss her.

As a teenager, Giron watched her mother go back to finish the degree she had left behind when she got married. When Giron drove by Caltech at her mother's side, her mom told her that only the smartest people went to school there.

Ali's parents ingrained science into her thinking and her approach to the world. Her mom and dad were both scholars. To them, nothing was more important than education.

Dydek attended a prestigious science magnet school, where she thrived and grew to love chemistry. Lewis received encouragement from both her parents and her peers at the all-girls high school she attended.

In fact, Lewis (as well as Giron and Ping) received a female-only education long before Caltech. "Being at an all-girls school for sure built up my self-confidence, academically speaking," Lewis says. "I was interested in science, and everyone thought it was neat. The teachers opened up so many opportunities for me — being smart wasn't nerdy, it was rewarded."

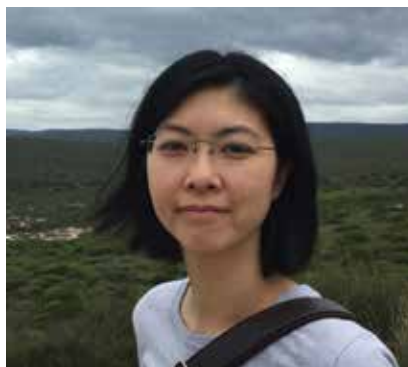
But that wasn't the case for everyone. Dydek's parents never opposed her love of math and science, but she

recognized very early their lack of enthusiasm when it came to her education. At family gatherings, Dydek's aunts and uncles asked her male cousins often about their future careers. Dydek always waited patiently to be asked about her dream job. Maybe she just wanted to yell: *A scientist! I want to be a scientist!* But her turn never came; nobody seemed to care what she wanted to be when she grew up.

Luckily, Dydek had plenty of confidence on her own. As she grew older, she clashed from time to time with her parents. They loved her very much, but her mother didn't like the way she dressed — her father was deeply religious and, at times, controlling. Above the television in her living room hung a sign that read: *Would Jesus watch this with you? "It was like Footloose, but without the dancing,"* Dydek says.

They disagreed frequently about Dydek's behaviors and actions, but she could never really stick to the rules. She was pushy and undoubtedly loud, and her dad would always tell her — girls shouldn't behave that way.

On the outskirts of Islamabad, Ali built sandcastles in the desert. She spent her youth devouring book after book, surrounded by interesting people. In many ways, her childhood was idyllic. Her parents were respected scholars living in a community of academics. They pursued Ali's education



▲ After graduation, Ping (left) pursued a law degree and then moved to Australia, where she currently works for a law university. Ali (right) works for a technology transfer company in California.

Update

Change is rarely loud or immediate. It is often gradual, established not just by female CEOs or Nobel laureates, but by the average female scientist. In this case, by a group of women, working quietly together in a classroom.

voraciously, and had high expectations for their daughter — when Ali failed a chemistry test, they confined her to her room for everything but meals. She could come out when she learned her stoichiometry, they said.

Like Dydek, Ali had other expectations thrust upon her, as well. Although Ali attended a coed school, she lived in one of the most conservative regions of Pakistan. Segregation of girls and boys was accepted, as were unspoken perceptions of how they should interact.

Ali recalls a girl who dropped her notebook at school, and how her classmates hooted when a boy picked it up for her. She wasn't allowed to wear anything cut above the ankle, and was expected to be appropriately soft-spoken and respectful.

She watched her mother cook and clean while her father sat in the living room, and grew up around women who stayed in their roles despite being far more intelligent or qualified than the men they were married to. These moments lit a spark deep inside Ali.

When Ali was accepted into Caltech, she knew it was her parents' encouragement and her innate curiosity that had made her successful. But there was something else, too.

"I always thought, as soon as I have the chance, I'm going to escape this dynamic and never enter it again," she says. "It might be why I pushed so hard in education. If education is power, and if it could earn me my independence, then for sure I was going to throw myself into this and be in charge of my own destiny — even if that just means getting to live in my own apartment. When I think about it, it doesn't seem so much like bravery as it does a matter of survival. I knew

if I fell into the same patterns of marriage and children, and always being told that my husband's stuff comes first, I knew if I accepted that lifestyle, I would slowly go mad."

Ali was not the only individualist. By the time Dydek turned 18, she wanted independence from her parents and California was sufficiently far away. Caltech was Dydek's rebellion, and she went in with ferocious ambition.

"I was never really afraid of failure," she says. "Who was I going to disappoint? When I entered college, I wanted to be the CEO of ExxonMobil. I wanted to be a badass. I wanted to get shit done, I wanted to make money and be in charge."

This fierce confidence blazes in all six women.

When Lewis entered Caltech, she was the smartest person she knew — she could do anything, learn anything, and succeed in any subject. Even as a high school student, she had wanted to be a chemical engineer.

Gunterman and Giron described a drive to surpass their peers that came from deep within. Each woman genuinely wanted to succeed, to have an illustrious career, win awards, and be recognized for her accomplishments.

"I was always motivated by pushing myself to my limits, taking on the biggest challenge that I could," Giron says. "I always wanted to be better. I always wanted to be the best."

In their teenage years, the Caltech 6 had few role models — the majority were guided toward chemical engineering by an early love of chemistry rather than any one scientist.

"It would have helped me a lot as a kid, to hear about women's achievements," says Ping. "I didn't really have

any role models. There was no one to show me what I could be."

Nevertheless, at 18, these six women had been admitted to Caltech, one of the most prestigious institutions of science and engineering in the world. In September 2001, just weeks after the 9/11 attacks, the Caltech 6 arrived in California ready to take on the challenge.

At Caltech

In 1891, Caltech was founded as a champion of science and engineering education. It wasn't until 1970 that the institution first admitted female undergraduates, after tremendous pressure from the university's president at the time, Harold Brown. Four women — Stephanie Charles, Deborah Chung, Sharon Long, and Flora Wu — would transfer to Caltech and become the first to earn bachelor's degrees in 1973.

At the time of his decision, Brown told the campus newspaper that admitting women to Caltech would "improve the esthetic climate and should stimulate intellectual diversity without diluting the strength of Caltech's attention to science and technology." Male students had long been in support of integration, and they rejoiced at the prospect of a thriving dating scene.

At other schools, the coed debate had sparked a different reaction. In 1952, following Georgia Institute of Technology's decision to admit women, one member of the university's board declared: "Here is where women get their noses under the tent ... we'll have home economics and dress-making at Tech yet."

In 1955, Pennsylvania State University's president, Eric Walker, published an editorial titled "Women Are Not for Engineering" in a departmental magazine.

By the time the Caltech 6 got to college, it was easy to believe that these opinions had faded with



time. They had not. At least, not completely.

Months before their graduation, Harvard Univ. President Lawrence Summers gave a prolonged speech on why women were poor at science, citing potential genetic differences in ability and interest. He later defended the statement as a way to provoke conversation on an important issue.

One year after the Caltech 6's graduation, a published study asserted that men were smarter than women because of larger brain size. Ten years later, Nobel Laureate Tim Hunt told an audience of science journalists in South Korea that he was in favor of single-sex labs. His trouble with girls centered on three complaints: "You fall in love with them, they fall in love with you, and when you criticize them, they cry."

Only a few months ago, in October 2018, Italian physicist Alessandro Strumia said that "physics was invented and built by men; it's not by invitation." In his presentation at a gender workshop in Geneva, he claimed that women were being hired over more-qualified men, and that the field of physics had become discriminatory against male scientists.

The dichotomy of male and female within the sciences is complex. But the fact is that for a dozen or more highly contested reasons, women still comprise the minority in the world of science, technology, engineering, and math (STEM).

And yet, when the Caltech 6 freshmen entered a classroom of solely women, they were unfazed. There was one male student at first, but he switched tracks during their second semester, a fact that greatly amused them. To this day, all six women emphasize how little they thought about the gender of their classmates. Their all-female class was just another class.

By graduation, however, people were starting to take notice of the Caltech 6. In the *LA Times* article, Dydek's distaste for the attention is captured well in the photographs. Her face, fixed somewhere between a smirk and a grimace, says it all.

"The fact that I was a woman, or that we were an all-female class, didn't even occur to me, or to my classmates," she says. "I never once thought it was a big deal, and I remember being a little insulted when everyone made it a big deal. Doesn't equality mean that it's not a big deal?"

Many of the Caltech 6 have grown to appreciate the singularity of their class, but the sentiment lingers: "Why the commotion? We just showed up."

The women fluctuate between reluctant pride and bewilderment over their class' distinction. For them, it is difficult to decide between pushing for recognition or for normalization. In the long run, which will help women? The answer is manifold.

"What I want as a female scientist

is to be respected for my work, not for my gender," Lewis says. "No one wants to feel like they only got where they are because people felt sorry for them, or that they would have gotten further if people weren't jerks. But we're at a point where celebrating an all-female class is good, not necessarily for chemical engineers already in college, but maybe for seventh-grade girls to look at and say, yeah, I could do that. That women are graduating in larger numbers is important to hear."

Although the Caltech 6 were an all-female class, they were no girl gang — they were just classmates, working together to survive four years and get through a notoriously difficult curriculum. The Caltech 6 are a great illustration of the expression "women helping women," but according to them, not in the way you would assume.

"When you say all-girls class, the first thought that comes to mind is girls painting their nails, doing homework, and swapping clothes," Ali says. "It wasn't a girls club — everyone was just trying to get stuff done."

In Gunterman's words, it was no sisterhood of engineers. "It was all about collaborating, surviving, going to office hours together," she says. "It was a group of eyes-on-the-prize people. There was no male or female. At 3 am, when the homework set isn't done, there is no gender."

For the Caltech 6, their class was



▲ From left to right: Lewis received her PhD in electrical engineering in Dec. 2018. Giron is a technical editor, Gunterman is a marketing manager for a software company, and Dydek is currently a researcher at MIT's Lincoln Laboratory in Massachusetts.

Update

**“We won’t tolerate the kind of foolishness that plagued these young women in the past. We just won’t tolerate it.”
— Frances Arnold**

just an ordinary collaboration, but it doesn’t have to be more than that to matter. At times, it is easy to assume that change will come only with extraordinary achievements, or with extraordinary women — women that “prove” females can be scientists. But change is rarely loud or immediate. It is often gradual, established not just by female CEOs or Nobel-prize-winning researchers, but by the average female scientist. In this case, by a group of women, working quietly together in a classroom.

Most of the six recall Caltech as a wholly academic setting, where gender never really came up.

They were mostly supported, challenged by their peers, and encouraged by their professors — particularly by Richard Flagan, a chemical and environmental engineer, as well as Frances Arnold, a chemical engineer who received the Nobel Prize in Chemistry in 2018.

A Caltech education absolutely benefitted the six women, but what was the impact of an all-female class? Some questioned whether their single-gender experience influenced them individually in a way that a mixed-gender class might not have.

It is difficult to quantify. For instance, Ali was initially relieved to find her class was not male-dominated — she was not used to communicating with men, and worried that she would have a hard time reaching out for homework help. Ultimately, she concluded that it made no difference, and even grew to occasionally prefer working with men.

The all-female class did not leave a

unique impression on Giron; it did not really impact Ping, who nevertheless attributes some of her confidence and discipline to Caltech. Lewis recalls a feeling of female solidarity with her classmates, but has no definite answer about its impact on her.

But Dydek believes she received a better education because of her all-female class. She saw friends contend with male classmates who wouldn’t pair up with them or work with them in groups. When she asked male engineers in her class about particularly difficult problem sets, they would tell her it was easy, or ask her if she had read the book.

“They were so confident from the very start,” Dydek says. “If it were me, and someone asked for help on a problem set I thought was easy, I would reconsider my answer. They never did, because they assumed they were right. The girls had more humility — I worked with five girls for four years, and I was never once made to feel stupid. I never felt like I couldn’t ask a question. I didn’t even realize how great that was.”

In college, Gunterman did not see any difference in gender, and she did not believe the things people said about mistreatment based on gender. “I used to think that people just need to be quiet and do their own thing, because there was no problem in the first place,” she says. “I was told I couldn’t do things because I was short, but never because I was a woman. My experience as an undergrad was unblemished — that introduction of doubt never came in.”

Like many of the Caltech 6, Gunterman didn’t discover the prejudice she had missed until she entered the workplace.

After Caltech

For Dydek, her rude awakening came at one of her first jobs. She was sexually harassed in a cleanroom at her work, under fluorescent white

lights, while wearing the equivalent of a space suit. It happened just once, but it wouldn’t be the last time she felt uncomfortable around male lab members.

At one of her first jobs out of graduate school, Giron felt distinctly uneasy, but she couldn’t quite put her finger on why. For her, it was the subtle things. Male engineers were expected to be great, she says, but she couldn’t determine if people necessarily expected the same of the female engineers.

The owner of Giron’s company purchased subscriptions to *The Economist* for all the men — and it was glaringly obvious that he did not deem it necessary to do the same for the women in her workplace. It was a stark contrast to the fierce encouragement she had gotten from her mother, her high school teachers, and her college professors. “A lot of the times we tell women they can achieve whatever they want,” she says. “But then we get here, and realize that we actually can’t.”

Dydek agrees that the front of sexism in science and engineering has changed. “It’s no longer large, noticeable actions,” Dydek says. “It’s no longer ‘you can’t do this.’ It’s the small things — not ‘you can’t do this,’ just ‘no, that’s stupid.’”

When Gunterman decided to get married, her superiors asked about her future at her company. They were worried her priorities might change, and reminded her she was up for a management position. Irritated, she recalls asking a recently engaged male coworker if he had gotten the same speech. He had not. This year, Gunterman and her husband are expecting a little engineer. At five months pregnant, she is still hiding the fact from her company.

“If people were questioning what my priorities would be just for getting married, I can only imagine what they would say if they found out I’m a



parent,” she says. “Every person would say they’re not being intentionally dismissive, but it’s the little chinks in your armor. I won’t take that judgment. I work until 10:30 almost every night. If I slow down, I’ll be average.”

Gunterman got that management position, but she still notices blatant injustice from time to time. She remembers sitting between a male and a female coworker at a meeting — the woman proposed an idea that the man immediately shot down. He asked her: Why would you say that? Twenty minutes later, he repeated the same idea, and was rewarded for it. Gunterman was shocked.

As Gunterman puts it, it’s kind of like playing a video game on a harder setting — it doesn’t mean you can’t win, it’s just harder. But everyone has their battles, she says. Lewis, Ping, and Ali have not had to fight this particular battle. For them, work discrimination hasn’t been an issue.

For the inequality that many women do face, style may have something to do with it, according to Ali and Gunterman.

They suggested that women are sometimes socialized to be quieter, less assertive, maybe even more docile, making them easier to overrule in a professional setting. Whatever the reason, it has become clear that while gender discrimination is still a problem, some men and even some women continue to belittle the issue.

“STEM is a very competitive world, and if the men feel at a disadvantage as a result of attention paid to women, they’re going to feel resentful,” says Arnold. “Anyone would. That’s how women felt a long time ago, and some still do today. But it’s important for women to stand up for what is right. That’s why the #MeToo movement has been kind of refreshing to me. Women, young women, are willing to go public with the truth, and that will change the way people

behave. We won’t tolerate the kind of foolishness that plagued these young women in the past. We just won’t tolerate it.”

The Caltech 6 have let nothing stand in the way of their success. Today, they are scientists, mothers, writers, professors, world travelers, and businesswomen. They are modern women in STEM.

Gunterman went on to earn a PhD in chemical engineering from the Univ. of California, Berkeley. Today, she works for a software company in California as a product marketing manager and an inspiring, eloquent leader of a diverse team.

Although most would no longer call her a scientist, Gunterman says that the scientific method and troubleshooting are alive and well in her career.

Giron graduated with a Master’s in chemical engineering from Cornell Univ. and continued to push her limits. She has worked in research and in industry, was briefly a writer, and even taught chemistry at her local community college.

Giron is fearless — as she moves through life, it is obvious that there is nothing she is afraid to try. She currently works as a technical editor, and is on her way to choosing her next adventure.

Dydek received her PhD in chemical engineering from Massachusetts Institute of Technology (MIT) and did her postdoc at Harvard Univ. She is not the CEO of ExxonMobil, but she does work at the MIT Lincoln Laboratory in space systems analysis.

She is witty and bright, and describes herself as an intellectual hedonist who enjoys solving puzzle after puzzle as an engineer.

After attending Caltech, Ali obtained her Master’s in chemical engineering from Auburn Univ. and her PhD in biomedical engineering from the Univ. of Texas at Austin.

She works in technology transfer at

a research institute in California. She still loves science just as much as she did when she was a child, and her success is centered around the dedication and passion she devotes to everything she pursues.

Lewis originally entered a PhD program at UT-Austin, but because of the health-related needs of her now-four-year-old son, she left graduate school.

She returned in 2016, and after successfully defending her thesis this past September, she received a PhD in electrical engineering. Science and engineering have helped frame her worldview — she sees human progress as the result of hard work and experimentation, and is wise beyond her years.

Ping went on to George Washington Univ. and earned a law degree. Ever the world traveler, today she works for a law school in Australia, where she and her husband, a fellow Caltech alumnus, reside. She is cautious but ferocious in her ambition — it is apparent that she is capable of anything she sets her mind to.

For some of the Caltech 6, studying in an all-female class has greatly impacted their post-graduation lives. For others, it is an event of the distant past — but for us, and for women everywhere, this story potentially represents the future.

“We need to encourage women to enter STEM,” Arnold says. “Societal concerns are less than they were 20 years ago, but they’re still there. It has become more about how women view themselves and whether they want to compete. STEM is a competitive place, and women have to be willing to join that fray and choose to compete or change that environment. Everyone benefits from support, but in the end it’s your own resilience, your own strength, that allows you to succeed. No one can prop you up — you have to do it yourself.”

— Nidhi Sharma