# The Origins of the Berkeley Scientific Journal

## Caroline Kane, PhD

**Caroline Kane, PhD**, is Professor in Residence Emerita of Biochemistry, Biophysics and Structural Biology at UC Berkeley. Her research is centered on gene expression in eukaryotic cells, specifically the transcription elongation process. She has been the faculty advisor for BSJ since the journal was founded in 1996.

## Brent Mishler, PhD

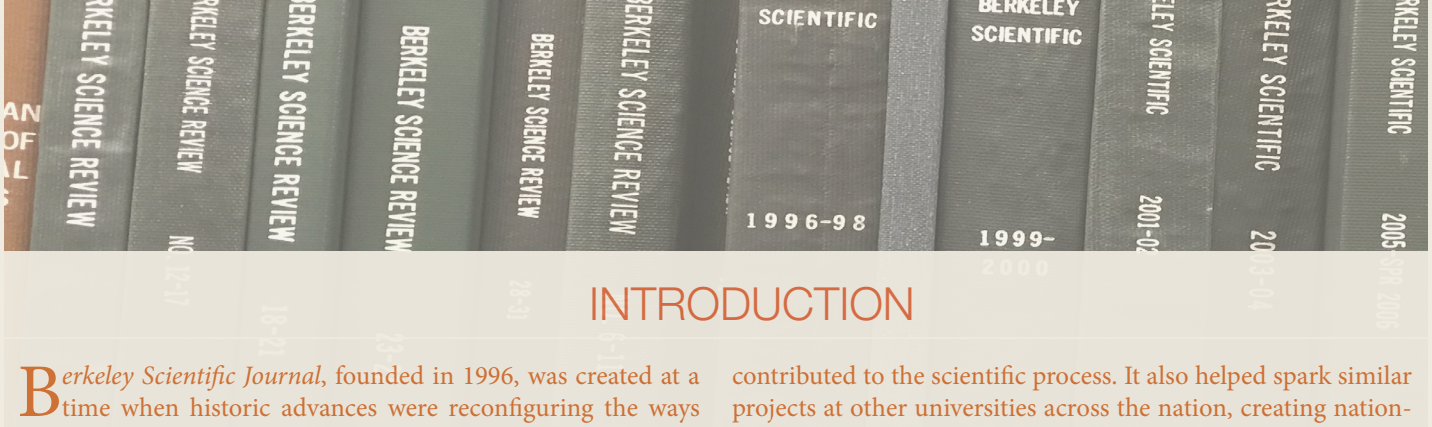
**Brent Mishler, PhD**, is the Director of the University and Jepson Herbaria at UC Berkeley and a professor in the Department of Integrative Biology. BSJ published co-authored research of Professor Mishler in Spring 1996 for our "Inaugural Issue."

## Robert Tjian, PhD

**Robert Tjian, PhD**, is professor of biochemistry and molecular biology at the University of California, Berkeley and was named an Howard Hughes Medical Institute investigator in 1987 and served as president of the institute from 2009 to 2016. In one of our earliest issues, BSJ published an interview with Dr. Tjian in 2000 for our "Special Report on Biotechnology."

## Michael Eisen, PhD

**Michael Eisen, PhD**, is a Professor of Genetics, Genomics, and Development in the Department of Molecular and Cell Biology at the University of California, Berkeley and a Howard Hughes Medical Institute Investigator. He is one of the co-founders of the Public Library of Science, an open access library of scientific literature, and also the current Editor-in-Chief of *eLife*, a peer-reviewed open access scientific journal for biomedical and life sciences.




# INTRODUCTION

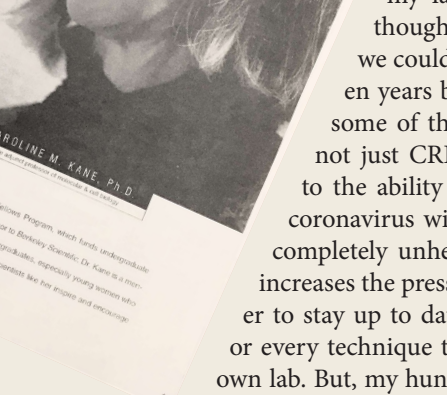
*Berkeley Scientific Journal*, founded in 1996, was created at a time when historic advances were reconfiguring the ways people spoke about, wrote about, and worked in science. It was a special moment for scientific research. The first mammal, Dolly the sheep, was successfully cloned in a laboratory. Later that year, Andrea Ghez and Reinhard Genzel first found evidence for a black hole residing in the center of our galaxy, a discovery that earned them the Nobel Prize in 2020 (along with Roger Penrose).

As one of the first science journals dedicated to undergraduate research in the nation, BSJ reflected and contributed to these reconfigurations. It helped undergraduate scholars formalize their engagements in science and scientific publication, making more visible the substantive roles through which students contributed to the scientific process. It also helped spark similar projects at other universities across the nation, creating nationwide venues where undergraduate participation in science was normalized and celebrated.

In this special piece, we commemorate the 25th anniversary of the *Berkeley Scientific Journal* by reflecting on the journal's progression since its early days, as well as the evolving fields of scientific journalism and publication. In conversations with Caroline Kane, who has served as the Journal's faculty advisor since its initiation in 1996, as well as other faculty members involved in early issues of the journal, we consider how the landscapes of scientific research, academic publication, and communication with the public have changed over the past quarter century.

## PROGRESS IN RESEARCH

**BSJ: How has the development of new research methods and techniques throughout the years changed the landscape of biological research?**




CK: It has sped up discovery, and that is not a surprise. Historically, this has always happened in science. When CRISPR was first introduced, I wished I still had my lab running because I immediately thought of half a dozen experiments that we could do so rapidly that would have taken years before because of the complexity of some of the cloning or knockouts. And, it is not just CRISPR. Fifteen years of research led to the ability to put together these vaccines for coronavirus within six to eight months. That was completely unheard of. In a way, this acceleration increases the pressure on scientists because it is harder to stay up to date on everything that is happening or every technique that you might want to use in your own lab. But, my hunch is that scientists have always felt that kind of pressure. I am really pleased that discoveries are happening even faster because it means that we are still inching closer and closer to the biological truth of the way things work, but these inches get covered faster.

**BSJ: How, if at all, have your research projects shifted over the years in response to recent developments?**

BM: For several years, I have been a faculty instructor for the course in Moorea, "Biology and Geomorphology of Tropical Islands" (ESPM C107 or IB 158LF), and it has been my privilege to oversee the progression of student projects over the years. The Moorea course (accessible online at moorea-ucb.org/) is an unusual course at Cal and began just before BSJ in 1991. For most of the students that take it, it is their first real experience with independent research. Most courses or projects we allot student research units to do not consist of independent work; students are carrying out something somebody tells them to do. In the Moorea course, students go from square one and learn how to pick a research topic and design a good set of actions to address it before following through all the way to publication. The Berkeley Scientific Journal has been valuable as one of the ultimate goals for some of our best students to aspire to in that they can not only produce a class paper, but they can publish it. We have had publications in other journals as well, but BSJ has been a very trustworthy goal for the students all along.

One idea that the students are really interested in now is the data science revolution. Several students are interested in modeling the ranges of both native and invasive species. My own research has changed a lot into big data approaches with large scale phylogenies, which use genomic data and then geographic data from museum databases. The questions are enduring, but

the methods that we are able to apply keep getting better. The new techniques that are coming out in data science, molecular biology, and computational biology are nice additions to a set of more traditional techniques that persist and ultimately are still needed for our field of ecology and evolution.

RT: I no longer do the old kinds of experiments that I did 30 to 40 years ago here. My research methods used to be to tear the cell apart, isolate the protein, and study it in isolation. Now, we produce whatever we want to study through genetic engineering. We would not be able to do this without Jennifer Doudna's discovery of CRISPR systems. For example, if we want a protein to carry a fluorescent tag, we use gene editing to put a fluorescent tag on the molecule so that we can study its movement. The fluorescent light is a way to spotlight the molecules we want to see in the middle of a billion other molecules running around in the cell.

BSJ: Professor Kane, our journal interviewed you in our fall 1997 issue for the article, "Women in Science: An Exploration of Barriers." What are your opinions on the progress of gender equality in STEM fields in 2021?

CK: I think there has been an enormous improvement, but there is also an enormous way to go. Gender equality in all sciences has improved dramatically since the late 90s. Currently UC Berkeley's Molecular and Cellular Biology department has almost 30% faculty as women in tenure track roles and positions. We are one of the most diverse departments in the United States regarding the proportion of women in faculty positions, but there is still a long way to go because certain groups, such as women of color as well as the LGBTQ+ community, remain underrepresented. With regards to the LGBTQ+ community, some of our own faculty who are part of this community were even intimidated from admitting that until 10 years ago; the shift towards greater acceptance is only very recent. Underrepresented groups still face microaggressions and offhand comments, but I am gratified that it is so much better now. I am still working on the issue of increasing diversity in the scientific community as well as including those who have disabilities, whether they are visible or invisible.

## OPEN ACCESS PUBLICATION

BSJ: What are your thoughts on the rise of open access publications? In your opinion, how, if at all, has this shift affected research in academia?

BM: I think it is great. I am speaking, though, as somebody who is in a moderately rich institution as compared to many around the world. Everything I have published for years is open access, and I think everything in science publication will ultimately end up moving toward open access. In my opinion, it is fair to expect that the more well-funded researchers and institutions can pay for publication. The one caveat I would have is that there should always be a way to publish, even if researchers cannot afford to do so. Some sort of grant or subvention or even forgiveness of fees should be a part of the system. It is pragmatic for your career to publish in open access publications. If something is buried in a print world that nobody can access electronically or if something is not freely accessible online, chances are that individuals will just ignore it. These days, it almost always has to be open access. I really believe in science for the people, and I believe the way to make this discourse democratic, open, and available to everyone is to make it open access. For example, in the Jepson Herbarium, where I am the Director, our biggest project is called the Jepson Manual. The manual used to be a book we sold, but now we give the information away for free on the website The Jepson eFlora. We have open access to our most central, important set of resources, which I believe we have to do. It is tempting to sell things, but it is better to raise your money in other ways through fundraising and grants.

ME: Previously, the issue with research was physical accessibility; it was neither easy nor free to send hard-copy journals to everybody on the planet. The internet allowed us to gain access to the information we wanted. So, on that note, the scientific community thought of creating a big database of every scientific paper such that we can easily search for information and connect what we read to experiments we are interested in doing. However, these papers were owned by publishers, and we had no right to download them, use them, or distribute them in any way. It seemed so obviously wrong. Research is a public good. It is mostly funded by public money, and it is performed by scientists who are working in the public's interest in order to do good for the world. As a scientist, I would want everybody who is interested in my work to be able to access the information. So, I, along with my advisor at the time, Pat Brown, and Harold Varmus, created the Public Library of Science (PLOS) to publish all open access journals. We wanted to fix this problem by creating a totally different model for science publishing, where the fundamental principle is that whatever you produce is freely available; there are no restrictions on who can access or use the material. Publishers did not want to do this because they make a lot of money from publications, and scientists still want to publish in the most prestigious journals for their career. The scientific community did not completely make the shift to open access for a long time, but it is finally now starting to happen. Of course, there is still a role for journals that organize information, but they should not have such exclusivity tied to them. Regarding the process of peer review, we should not only review works of science at the very beginning and only have them reviewed by one authority. However, there is the danger that if you rely on public commentary, random people can say whatever they want. Overall, the shift to open access requires a lot of care, thought, and oversight to make sure that these endeavors are not destroyed by the internet.

CK: I am a huge proponent of open access. Some open access journals even put the papers up after peer review but before formal publication to let others comment on the reviewers' comments, as well as comment on the paper itself, in case they have additional input. I retired in 2008, and if I did that in 2008, I would

not have been able to publish my research anywhere; that was considered full release of your data. However, now, most of the open access journals will still accept these papers. I think that it can only improve the quality of the paper and in some ways, make it more credible. Open access also helps to make non-scientists feel more included in the discourse of the scientific community as they can see for themselves what science really is, which is progress through disagreement, uncertainty, discussion, and changing hypotheses based on new data. Tax payers pay for the research, so they should be able to have access to publications, even the publications they may not understand.

RT: I would say there is a major revolution going on. Many of us here in Berkeley feel that when our work gets done, we want it to be publicly accessible as soon as possible. Open access matters most to underprivileged scientists in developing countries. Open access means we are trying to democratize science. One of the things that has really revolutionized publication, especially during COVID, is bioRxiv, which is basically a preprint server. After scientists do experiments and write a paper, they can send it to bioRxiv instead of major publishing journals. Your paper automatically becomes public. At this point, nobody has reviewed it yet, but you get a lot of comments and you can start adding experiments to make sure the results are interpreted properly. The next step would be sending it to journals where there would be very stringent review. In the meantime, you would still update the bioRxiv version. What I like about this process is that the open access version is in your control, not in the control of the journal. That is going to have massive implications for democratizing information. This type of publishing is really crucial during COVID because of the urgency of the topic, so a lot of papers were put into bioRxiv, including ours.

## SCIENCE JOURNALISM

**BSJ: With the rise of social media over the past few years, science journalism has declined as a means for providing information for the general public. What do you make of this trend?**

BM: It obviously goes without saying that the nature of scientific discourse has really gotten worse. You can see it right now with all the misinformation about COVID-19, and before that you could see it with climate change and evolution. I think that makes the role of real scientific publications evermore essential. When BSJ started, it was not as obvious why we had to have peer reviewed, real scientific papers, but now it is just essential. There have to be places where real scientific studies have undergone peer evaluations so we can get trustworthy information. My recommendation to people is to use social media for social things, like keeping up with your friends and family, but do not use it for anything important. For example, in the Moorea course papers we do not really want people to cite blogs and websites. We say, "Cite real scientific papers." You can have Joe's blog on science and Joe can say anything, but you should not believe it. You have to go look at the real literature. I think BSJ really has to keep going and has to keep that high standard.

ME: The internet has empowered people with the opportunity to communicate science to wide audiences. However, since traditional media has been disrupted by the internet, science journalism as a full-time profession is harder than it used to be. Something that has disintegrated is our ability to have an overall agreed-upon distribution of science information that governs the way we make decisions as a society. It has become easy for the public space to be occupied with either misleading science disinformation or sometimes just chaos, which undermines the whole endeavor. It is not that people have suddenly started to be more ill-informed or biased in their thinking, but rather that because of the internet and increased connectivity, we now are more aware of this issue. The viral character of science disinformation is really problematic. Additionally, some media outlets are out to find the most marketable bits of disinformation and spread them. During the COVID-19 pandemic, a few prominent scientists became the worst actors in this space by broadcasting inaccurate information. So, it is not always the scientific community against the world, but sometimes also the scientific community against itself when we are all figuring out what to do. But there are pluses and minuses here. It is a hard time to be in the business of trying to communicate science to the public because it is not entirely clear who you are talking to and what they expect out of you, but if you decide to become a science communicator, you have so many more options to do that than ever before on so many platforms.

CK: I think that sometimes people want to believe what fits their beliefs about the way the world works. Previously, when scientific journalism contradicted what people believed about how the world worked, as long as the journalism respected the people who were skeptical, these people likely accepted the new facts. However, now it is much harder for the non-scientific public to figure out which sources are credible. As you have seen with vaccinations for COVID-19, there is misinformation that has come, often from people's friends, on social media, which is spreading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An Ethnopharmacological Stu
and Antimicrobial Plants on

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**Department of Integrative Biology, College of Le

Key Words: Ethnopharmacology, A

ABSTRACT: This study presents the first phytochem
healers were consulted in selecting 12 plants of antica
corresponding to 26 different plant species from 18
brine shrimp cytotoxicity screen was employed o
extracts were screened by their activity against yea
found to be cytotoxic. Thirteen of 14 possible antim

INTRODUCTION

stereotypes that are just not true. This is one of the reasons why religious leaders, community figures, and people you personally might know have been recruited to spread accurate information. People are more likely to believe information from individuals they trust over "trusted" sources. This makes it more difficult for scientific journalists to try and change anybody's mind. However, that does not mean that scientific journalists should change what they are doing. In fact, more than before, it means they need to still write articles in language that non-scientists can understand and still write articles that use data, use logic, and rational and critical thinking. It is unacceptable for them to insult readers who disagree.

**BSJ: Do you have any advice for us as undergraduate science journalists attempting to publish accessible and accurate information for our community?**

ME: In the movie "Almost Famous," there was a piece of advice to "be honest and unmerciful," and I think that this is one of the things we need to do more of in science journalism. There is often too much of an effort to smooth over the rough edges of science, sanitize the way science is presented, remove ambiguity, and pretend as a writer that you understand everything, but you never really do, right? Even when I am reading about things I know like the back of my hand, I am still always learning something because I am never completely, fully aware of all the nuances of things I write about. We have shaped the idea that the job of a science communicator or journalist is to take something really complicated and smooth its edges for the public so they can consume it in bite-sized, easily digestible chunks, as if we were explaining something to a toddler or someone incapable of understanding it. We do a disservice to the public in thinking that what we need to do is to turn science into a bunch of bullet points that can be easily captured. It makes people think that they are being sold something as opposed to being given insight into something. And I think that is a mistake. I think the public is much more sophisticated in their thinking than people give them credit for. Most people behave like scientists in some way or another. They make empirical observations about the universe and try to figure out how it affects them. As science communicators, rather than thinking of yourself as someone who is just going to compartmentalize and simplify information, think of yourself as an agent of the public, doing what they do not have time for and do not have the relevant expertise to do. We go in and wade into a complicated subject and spend time to learn not just the details, but also the context of it. Then, we come back and distill the information for the public in a way that captures what matters, communicating it to them without destroying the nuances.


Berkeley Scientific

dy of Possible Anti-Cancer
Mo'orea, French Polynesia.

r*, Brent Mishler**
and Science, University of California, Berkeley
tters and Science, University of California, Berkeley

ntimicrobial, Anticancer, French Polynesia

ical screening of Tahitian medicinal plants. Traditional Tahitian
ncer and 14 plants of antimicrobial use. A total of 27 crude extracts
amilies were investigated. Anticancer compounds are cytotoxic, i
possible anticancer plant extracts. Possible antimicrobial plant
st and *E. coli* cultures. Nine of 15 possible anticancer extracts wer
icrobial extracts were found to inhibit microbial growth.

MATERIALS AND METHODS

*Plant Material:* All plant material was collected by the auth
after referring to a traditional Tahitian medicine recipe book
(Grepin, 1980), a paper on traditional aspects of Tahitian medicin
(Gaertner, 1994), and interviewing Leontine Naore and M. Leua
two local healers.
Most plants were found in littoral, rain forest, and riparian hab
plants were found in cultivation. Only the reputed
plant were collected for testing (Hellwig
deposited at the University
P. Gomp Biological

*Preparation of Extracts:* The mi
weighed, ground and extracted with
0.1g/ml concentration of plant extract (Vlietinck, 1995). The mi
erated plant suspension was stored at 4°C. Filter paper disks
mm in diameter) were impregnated with ethanol extract and dried
antimicrobial screen (Dimayuga, 1991).

**BSJ: In your opinion, what has been the most significant impact of BSJ on the Cal scientific community?**

CK: I think there are two most significant impacts. One is providing a legitimate, reviewed location for undergraduates to put their science without having to wait for it to be included in one of the larger papers from their research laboratories, where you may or may not have the first authorship. BSJ has provided a venue for undergraduates to publish peer-reviewed science, so when faculty see an issue of BSJ, they know that other faculty and senior scientists have taken a look at the work to ensure the papers are up to a professional standard.

The second aspect is that BSJ humanizes scientists and those of us who are in the scientific community. Other than being professionals or scientists in academia or industry for years, we are also sports fans, music fans, and all of these other things. What BSJ has done is humanize scientists for the undergraduates on the Berkeley campus and even for many of our staff members. BSJ has softened the image of scientists while not losing its scientific nor journalistic rigor.

## REFERENCES


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