

# CAREERS

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Scenes from the US television comedy *The Big Bang Theory* benefit from the guidance of physicist David Saltzberg.

MEDIA CONSULTING

## Entertaining science

*Scientific advisers for films and television help to bring credibility to the screen — and take some tangible and intangible benefits back to the lab.*

BY PAUL SMAGLIK

Here's the pitch: swap running experiments with advising on screenplays. Mingle with stars instead of managing postdocs. Become independently wealthy instead of scrabbling for grants. Here's the reality: that could happen only in the movies.

Acting as a science adviser for film and television rarely turns into a full-time career. Most who become science advisers seldom, if ever, rub shoulders with celebrities. And they rarely get paid (see 'All that glitters is not gold').

"I get an e-mail every month from researchers who want to break into this business, thinking it will offer an alternative career, saying, 'How do I get into this? I want to quit the lab,'" says David Kirby, a senior lecturer

in science-communication studies at the University of Manchester, UK, and an expert on the intersection between Hollywood and science. "I kind of feel bad telling them they probably can't make a living doing this."

But many who advise as a 'side job' find these opportunities an entertaining adjunct to their research careers. Physicist David Saltzberg consults regularly on *The Big Bang Theory*, the popular US sitcom featuring physicists, but he would not trade that experience for his day job at the University of California, Los Angeles — even if it were to pay more. "I have 30 years invested in physics," he says.

So what is the benefit for scientists who go to Hollywood if it is not about big money or getting their name in lights? They are myriad, says Kirby. Outreach is one: a scientist's

involvement in a TV show or film can help to educate people about research in the way that the *Star Trek* film drew on images from NASA's Cassini mission to Saturn, or how *Contagion* illustrates the functions of the US Centers for Disease Control and Prevention. Involvement can also help those shows to portray scientists as real people and role models rather than as negative or laughable stereotypes.

And some scientists do get paid — in one manner or another. They are often granted film or TV credits, as well as rewards hidden within a film or show — their very own formula scribbled on a whiteboard or a textbook, perhaps, with their name on it, up there on the screen. And in addition to communicating science to the general public, science advisers can take on stimulating challenges such ►

► as drafting the rules of physics for a planet with a different gravity from Earth's or simulating the destruction of a space station.

They also get to have fun.

A step into the world of Hollywood became a case of fan fulfilment fantasy for James Kakalios, science adviser on *The Amazing Spider-Man*. In 2001, he was a newly minted professor teaching physics to first-year undergraduates at the University of Minnesota in Minneapolis — and he wanted to use more 'fun' examples than the textbook staples of a brick sliding on a surface or a ball falling from a tower. So he created a course he called "Everything I Needed to Know About Physics I Learned From Reading Comic Books".

Kakalios used some examples from the Spider-Man comics, such as how the superhero's adhesion to a wall would work using van der Waals forces (weak electrodynamic forces that act over small distances) or how much force a falling body wrapped in a spiderweb would exert. When the film *Spider-Man* was released in 2002, he and the university wrote a press release describing his class. The release attracted media attention, so he turned his class into a book, which garnered more attention — and, eventually, he was invited to be a science adviser for *The Amazing Spider-Man*.

He also advised on the film adaption of *Watchmen*, and subsequently produced a video explaining how one character's powers could be explained by quantum physics. The video has been viewed more than 1.8 million times.

Donna Nelson saw the same possibilities as Kakalios after reading an article in which *Breaking Bad* creator Vince Gilligan said that he wanted more formal science advice for his crime-drama TV series. Nelson, a chemist at the University of Oklahoma in Norman, thought that she could use the series "to build a bridge between science and entertainment" and expose more viewers to realistic portrayals of science. Not long after contacting Gilligan,

she met with him and the show's writers.

Of course, given the show's subject matter — a mild-mannered high-school chemistry teacher who starts making crystal methamphetamine, an illegal street drug, to fund his cancer treatment — she knew she had to tread carefully. She wanted to portray chemistry but did not want to glorify its misuse. Indeed, the



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David Saltzberg

US Drug Enforcement Agency advised the show to skip certain aspects of the production process.

One of her first inputs was in an episode in which protagonist Walter White taught his students about alkenes. White's classroom featured Nelson's blackboard notes and diagrams, which attracted interest from students around the world, many of whom started science blogs that were based on ideas presented in the show. "They would call me and interview me and then argue on blogs about what was correct or wrong. Or they would argue online and then contact me for a comment," she says. "These kids were becoming science groupies."

Scientist advisers on TV shows and films featuring scientists — such as *The Big Bang Theory*, *Breaking Bad* and *Gravity* — can help to create more nuanced versions of researchers than the usual evil nemesis or nerd character, such as a stereotypical James Bond villain or the eponymous lead character in *The Nutty Professor*.

A science adviser tends to interact mostly with a show's writers, and their first meeting is often a crash course for the writers in learning the everyday realities of science.

Nelson helped the writers to shape the Walter White character: the way he interacted with his former student, Jesse, for example, and how he portrayed his respect for accuracy and logic in science. She recalls that the writers peppered her with questions, such as: "What are scientists like?" and "Is this how they would talk to each other?" They asked what would drive someone like White to get a PhD, how such a person could end up as a high-school teacher, and what could influence a graduate student to give up a promising career in science.

Seemingly innocuous questions can have profound effects. The *Big Bang* writers asked Saltzberg what one physicist character would do to win back a love interest. Saltzberg vaguely suggested "something to do with holograms". The writers and producers conjured a scene of the character projecting images of Earth and the Milky Way for his girlfriend — in front of a live studio audience, who gasped collectively, Saltzberg says.

Working with Hollywood writers and producers has helped Saltzberg to develop in ways he had not anticipated. He had to broaden his knowledge beyond his speciality, for one thing. "As physicists, we are often digging narrowly into our own fields," he says.

And he thinks that his consulting work has improved his interpersonal skills through the need to interact with a set of writers and producers. Before *The Big Bang Theory*, he was involved in high-energy physics experiments with hundreds of participants, so being a team player was nothing new. But, he says, "something must have happened, because collaboration has become easier and easier".

Working with professional storytellers has also improved his public speaking. "When you

SARAH TANTILLO

## MEAGRE MONEY

### *All that glitters is not gold*

"Credit optional. Remuneration especially optional," says Malcolm MacIver, who provides science advice to film and television productions when he can fit it into his day job as a bioengineer at Northwestern University in Evanston, Illinois. So how are most Hollywood science advisers paid? "Bragging rights," says MacIver, who often works for free, including on his first Hollywood film, *Tron Legacy*, and his most recent work, for *Terminator: Genesis*.

Like other Hollywood science advisers, he says that he is ambivalent about the inconsistent compensation that scientists receive from the entertainment industry. On the one hand, he and others subscribe to the mission of organizations such as the

US National Academy of Sciences' Science and Entertainment Exchange, which aims for more and better portrayals of science and scientists. On the other hand, not being paid devalues the expertise the scientist brings to the project.

Even screen credit is inconsistent. In *Lab Coats in Hollywood*, science writer David Kirby relates that caterers must be listed in the credits that scroll at the end of a film, but science advisers do not get mandatory listing.

Kirby, a lecturer in science-communication studies at the University of Manchester, UK, points out that other consultants, such as animal trainers, tend to be paid at a much higher rate than Hollywood advisers.

Movie budgets include 'over-the-line' expenses that must be paid — stars' fees, catering, car service — and 'below-the-line' expenses for perks or services that are helpful but not essential, says Kirby. Science advisers' fees fall into the second category, even though their input can alter a plot point or character development.

Many scientists are prepared to work without pay because they feel that what they do is a public service — and fun. "I don't think that will change until the appropriate institutions provide pressure," says MacIver. Until then, he says, science advisers must make do with working for cachet, rather than for cash. **P.S.**



## BREAKING INTO TINSELTOWN

### How to make it big in the movies

Planetary scientist Kevin Grazier needed a connection and a lucky break to become the adviser for *Battlestar Galactica* in 2004. Since then, the scientific community has established more formal ties to the entertainment industry, and the Science and Entertainment Exchange (SEE) in Los Angeles, California, is foremost among them. Part of the US National Academy of Sciences, the exchange is working to inject more science into films and television by linking up researchers and film-makers.

"Anyone can play now," says Grazier, who spent 15 years as a research scientist at NASA's Jet Propulsion Laboratory in Pasadena on the Cassini mission. Indeed, the SEE has provided more than 800 matches since its 2008 launch, says programme director Rick Loverd. Scientists' involvement can range from a quick conversation with a writer or director to consulting from inception to end.

The SEE has built up a database of more than 1,500 scientists, and can also draw on the 6,000-plus members

of the academy, Loverd says. Joining that database requires a call or e-mail to the SEE, followed by a chat between the exchange and the scientist to ascertain interests and expertise. When someone from the entertainment industry needs input, they contact the SEE, which then identifies the best expert and arranges an introduction. "We make it very easy for both sides to get involved," says Loverd.

Here are a few ways scientists can get exposure to Hollywood:

- The SEE, [go.nature.com/pcxgsm](http://go.nature.com/pcxgsm)
- The UK Wellcome Trust and British Film Institute Screenwriting Fellowship, [go.nature.com/ybzy68](http://go.nature.com/ybzy68)
- The German Mathematics, Computer Science, Natural Science and Technology and Equal Opportunities in the Fiction Format, [go.nature.com/qfiava](http://go.nature.com/qfiava)
- The US Imagine Science Films, [go.nature.com/ubta9d](http://go.nature.com/ubta9d)
- The US Alfred P. Sloan Foundation's film-schools programme, [go.nature.com/i34efv](http://go.nature.com/i34efv) **P.S.**

are giving a talk or a lecture, you are putting on a show, like it or not," he says. "I've probably picked up a few things." (That would not include skills enough to write for the show. He suggested some jokes once: the writers politely advised him to stick to the science.)

California planetary scientist Kevin Grazier, who has advised on several projects, including the 2004 reboot of the TV show *Battlestar Galactica* and the film *Gravity*, says that his role requires soft skills and a thick skin (see 'How to make it big in the movies'). Both develop over time on the job, says the lecturer at Santa Monica College in California. Success requires building relationships: especially in TV where writers and producers can work together for years.

Writers generally respect scientists as long as they are not obstructionists who insist that a plot point cannot be pursued because of an obscure principle that most viewers would neither know nor care about. Grazier says that he has the most success when his suggestions open up story possibilities, not when they slam the door on ones the writers had developed. "You don't want to go in and say 'You can't do this, this or this,'" he says. "If your alternative leads to a better storyline, fine."

Theoretical physicist Sean Carroll, who advised on *Tron: Legacy*, adds that science advisers need to remember that they are not a principal investigator on the film set: that would be the director, showrunner

or producer. "Part of what makes you a successful science adviser is humility," he says.

Carroll, from the California Institute of Technology in Pasadena, says that his personal satisfaction comes not just from creating a more realistic scientific universe in films, but also from subtly introducing people to science. He points to his work on the movie *Thor* as an example. "It was a movie version of a comic-book version of a Norse god: not something you would associate with accurate physics." But he made a few subtle but profound suggestions and added accurate language about worm holes and travel through space and time.

The film-makers also wanted the Natalie Portman character — a nurse in the comic book — to have a more lofty profession, so he suggested that she be an experimental physicist and helped to shape her character. He wanted girls to see the film and realize that a science career could be possible, and desirable, for them.

Kakalios hopes that positively framed scientist characters — shaped with the help of science advisers — could even help to bolster funding for science down the road. Sometimes funders need to see the possible in a fictional context before they can make it real, he observes. "It could," he says, "be a case of superheroes saving science." ■

**Paul Smaglik** is assistant editor of *Nature Careers*.

## GENDER

### Perception differences

Female leaders underrate how their bosses and colleagues perceive their performance, find US researchers (R. E. Sturm *et al.* *J. Org. Behav.* **35**, 657–677; 2014). In a two-part report examining responses from 270 women across sectors including health services and banking, the authors find that lack of self-confidence, perception of gender roles and a lack of direct feedback from superiors contributed to women's self-underrating. Female managers also rate their own performances lower than do male leaders, the team found. Women in leadership positions must become aware of any negative self-biases, says co-author Leanne Atwater, a management researcher at the University of Houston in Texas. "If you're unsure of your boss's feelings about your work, get feedback and don't make assumptions," she says.

## FUNDING

### Irish entrepreneurs

The Irish Research Council in Dublin has launched an industrial PhD and master's programme that will place 70 postgraduate- and graduate-level researchers with businesses and non-profit organizations. Some 60–70 employers are joining the Employment Based Postgraduate Programme to help student researchers to develop innovation and entrepreneurial skills that should prepare them for entering the non-academic research workforce. The council contributes €24,000 (US\$32,700) for each student, who receives a salary from the employer. Council director Eucharía Meehan says that the programme provides junior researchers with career options.

## UNIVERSITIES

### China's rankings rising

China's higher-education star is rising, while Japan's is waning, according to the *Times Higher Education's* Asia University Rankings 2014. Japan dropped two institutions from the top 100, whereas mainland China added four. But Japan still leads the Asian nations with 20 top-100 universities; China is second with 18, and South Korea third with 14. Thomson Reuters, which collates the data, bases the rankings on 13 indicators, including research and technology transfer. China has advanced mostly as a result of increasing its research expenditure, says a Thomas Reuters spokesperson, whereas Japan's research budget has remained flat.