

Science and Culture: Science on-screen and behind the scenes

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In 2009, a team of Hollywood producers from Marvel Studios approached The Science & Entertainment Exchange, a program of the National Academy of Sciences (NAS), for advice on using good science to make the movie *Thor*. The filmmakers, aware of Arthur C. Clarke's maxim that "any sufficiently advanced technology is indistinguishable from magic," wanted a strong science backbone for the magic they were planning for the big screen. (Natalie Portman's character, Jane Foster, even paraphrases the quotation on-screen.)

Among other details, the producer's wanted to explain how the hammer-wielding superhero travels so quickly between Earth and his home realm of Valhalla. The Exchange, based in Los Angeles, brought in theoretical physicist Sean M. Carroll from the California Institute of Technology in Pasadena, CA. Carroll suggested that Thor travel by wormhole. "But [the writers] thought wormholes were too 90s," says Rick Loverd, who directs the program. Carroll then suggested that Foster, the on-screen scientist, instead use the "Einstein-Rosen bridge," a lesser-known synonym for wormhole. That's what ended up in the film. The filmmakers also wanted Jane Foster, a nurse in the comics, to be a scientist. Carroll suggested

she become an experimental physicist; in the final version, Foster was an astrophysicist.

The successful collaboration didn't stop there, Loverd says. In 2013, on the release of the sequel to *Thor*, the filmmakers and the Exchange held a competition for high-school girls to produce videos of themselves interviewing female scientists. The creators of the 10 best videos were flown to Hollywood to meet movie stars and visit studios.

Thor is no outlier. Every year, the number of filmmakers—representing multiple genres—who consult with the Exchange grows, says Loverd. Since its launch in November 2008, the Exchange has connected researchers to more than 850 movies and television shows, including blockbuster films such as *Prometheus*, *The Avengers*, and *The Amazing Spider-Man*, medical dramas such as *House*, political dramas such as *The Good Wife*, and the comedy *The Big Bang Theory*. Filmmakers and producers want to know about everything from bullet ballistics (for *The Good Wife*) to the atmospheres of exoplanets (*Prometheus*) to plausible diagnoses of rare diseases (*House*).

In the last six years the "phone hasn't stopped ringing," Loverd says. Producers call looking for expert consultants and scientists call to volunteer their services. The Exchange acts like a matchmaker. The program doesn't

advertise or measure its success, Loverd says, but the number of consults has increased every year, reflecting a growing interest in science in Hollywood.

Filmmakers who work with scientists are not generally trying to educate the public. They're looking to "make a better, more dynamic, and more interesting project," says writer, producer, and director Jerry Zucker, well known for his work on dozens of movies, including *Ghost* and *Airplane!* Zucker says he first became passionate about science when his daughter Katie was diagnosed with type 1 diabetes in the late 1980s. He and producer Janet Zucker, his wife, worked on efforts to advocate for stem cell research.

A serendipitous encounter with NAS President Ralph J. Cicerone helped get the Exchange off the ground by virtue of a \$1.1 million NAS grant. Since then, the Exchange has received financial support from a variety of donors, including the Howard Hughes Medical Institute, Google, the Walt Disney Company, the Gordon and Betty Moore Foundation, and the Alfred P. Sloan Foundation.

Audiences are more savvy now than they were 10 years ago in terms of what they're willing to believe, says Loverd. "They feel like they live in the future," he says, "and it's in the interest of storytellers to always be forward-looking as they create their worlds." Scientists can give the writers ideas about technology that will be plausible in a few years, says Loverd. Scientists can also inspire the creative forces behind television and film: Zucker, who has used the Exchange multiple times, says that as a result of his collaborations he's working on a comedy that takes place at the Large Hadron Collider. "There's no way we could do that without talking to scientists," Zucker says.

However, Loverd notes that a scientific consultation doesn't mean that a story will be wholly accurate in its final form, and the Exchange tries to give researchers appropriate expectations. "Our philosophy has to be about inspiring better science and not being the accuracy police," he says. "That philosophy gives us the opportunity to have the kinds of wins [in getting science in movies] that we had in movies like *Thor*."



Scientists and filmmakers engage in a panel discussion about the 2010 movie *Tron: Legacy* at Disney's El Capitan Theater. Left to right: Sean M. Carroll (California Institute of Technology), John Dick (Jet Propulsion Laboratory, California Institute of Technology, retired), Joe Kosinski (Film Director), Sean Bailey (President of Walt Disney Studios). Image courtesy of Colin Crowley.