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14. ABSTRACT

During the last year the major activity of the "Communicating Science and Engineering" project involved the third workshop (Catalyst Workshop) planned through the American Film Institute with the participation of colleagues in the industry, and with assistance from media experts at the National Academy. This workshop had the goals of 1) providing scientists and engineers with an opportunity to learn about the film industry and to enhance their science-oriented script writing skills (in order to involve more scientists and engineers in the creative process), and 2) providing data and learning for the project about approaches to professional activities in this area of research (the unique nature of the project presents planning difficulties because of the lack of a knowledge base or established research community to draw from). The Catalyst Workshop was held in August. Studies of the educational aspects of the project, in terms of impact, are reported.

15. SUBJECT TERMS

education, science education, graduate education, science and engineering communication

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"A Study of Communicating Science and Engineering"

AFOSR Grant No. F49620-03-1-0306

M. Gundersen, P.I. mag@usc.edu

OBJECTIVES

The purpose of this project, "Communicating Science and Engineering," is to create a relationship with the entertainment industry that fosters improved communication of science through entertainment. Depictions of science and scientific activities influence children and the population at large and play a role in their attitudes and interests. Thus, these depictions are an important seed element in training and education in science, engineering, and preparation of the nation's defense. The project will work with the entertainment community to make available engaging elements of science for motion pictures and television, and will provide a basis for improved depictions of science and engineering. Entertainment professionals at senior levels, including the current president of the DGA, will play leading roles and will direct an array of supporting activities. The funding will make possible a broad effort with the goals of establishing offices for resources within the entertainment community that will interface directly with the scientific and engineering communities and with their professional organizations.

STATUS OF EFFORT

1. 3rd Annual Catalyst Workshop. August 14-18, 2006. Organized in conjunction with the American Film Institute (AFI), the program covers a period of five days and brings together scientists and some of the leading authorities in the field of screenwriting and filmmaking. Using an expanded curriculum, the program has allowed for increased opportunities for collaboration between program participants. See appendices for more information.
http://www.afi.com/education/catalyst/default.aspx

2. 1st Annual Film Camp for Girls. A week-long course to prepare young women who are completing their sophomore, junior or senior years of high school for the rigors of entering a full-time course of study in film production and/or history or theory. Film Camp for Girls is committed to addressing the under-representation of women in American film schools, as well as in the nation's media arts field as a whole. Ten participants are chosen to work with industry professionals and recent film and television production masters programs graduates, covering such topics as screenwriting, directing, producing, sound, grip/electric, editing and critical discussion. The program also focuses on science, math and technology in entertainment, using screenings of science-based film and television as a springboard for discussion.
http://www.filmcampforgirls.com

3. Studies of Educational Effectiveness. There are few research studies that focus on the influence of television and film on science and science careers. The research that does exist typically falls within four categories:

-Film and television studies
-Communication sciences
-Science education
-Perspectives on the popular (science & culture)

In last year's annual report, we included as an Appendix a small body of work that can be used as a foundation for conducting further inquiry.

4. Catalyst Website. Organized and renovated by Prof. Diandra Leslie-Pelecky of the Physics Department of the University of Nebraska, a website detailing the growing link between science and writing for entertainment can be found at:
http://physics.unl.edu/~diandra/catalyst/catalyst.php

ACCOMPLISHMENTS/NEW FINDINGS

Public Dissemination of Knowledge About the Value of Science
Articles Published About the AFI Catalyst Workshop

Bhattacharjee, Yudhijit. 2005. More Science, Less Fiction. *Los Angeles Times Calendar Live*, March 13.

Byrne, Jane. "Engineers Bring Science to Life Through the Movies." *Engineering Times,* July 2005.

Fischbach, Bob. 2005. Making Good Films a Science. *Omaha World-Herald*, October 23.

Gundersen, Martin A. "Star Power." *Worth*, March 2006, 36.

Gundersen, Martin A. and Diandra Leslie-Pelecky. "Scientists as Screenwriters." *The Writing Show*. Interview. mp3

Knight, Jonathan. "Hollywood or Bust." *Nature* 450 (2004): 720-22.

Successes of Catalyst Workshop Participants

Diandra Leslie-Pelecky (2004, 2005) has signed a contract to write a popular book on the science behind NASCAR, and is working with NASCARImages, the production company arm of NASCAR, to develop a television series on the science of NASCAR. (See Ms. Leslie-Pelecky's 2005 bio in Appendix E.)

Valerie Weiss (2004) has written, directed and produced two films. She is currently writing several scripts for film and television, including a feature film called "Losing Control." (See Ms. Weiss' bio in Appendix E.)

Sylvie Beaudin (2005) has written a comedy that has gained notice from two different producers in Montreal, as well as a pilot for a television drama series in the vein of "Grey's Anatomy" that focuses on the veterinarians and veterinary students in a vet school.

BUDGET
Grant has expired and all funds have been expensed.

PROBLEM AREAS
None

PERSONNEL SUPPORTED

Martin Gundersen	PI
Alexander Singer	Consultant
Kristan Venegas	Program Director

PUBLICATIONS

Dr. M. Gundersen, "Star Power," Worth, March 2006. pg. 36

INTERACTIONS/TRANSITIONS
A. Participation/Presentations at Meetings, Conferences, Seminars, Etc.
B. Consultative and Advisory Functions to Other Laboratories and Agencies
C. Transitions. Describe Cases Where Knowledge Resulting From Your Effort is Used, in a Technology Application

During the last year, meetings with the project leaders, primarily Dr. Gundersen and Mr. Singer, were initiated by several agencies and organizations. These included the Department of State, the Office of Science and Technology Policy, and Northrup Grumann. In each of these meetings, methodologies were discussed for development to use the means of the project to enhance awareness and interest in science and engineering. Dr. Gundersen has been asked to give an invited presentation to a meeting in Europe, Film in Science and Science in Film, Zurich, in Oct 2006.

NEW DISCOVERIES, INVENTIONS, OR PATENT DISCLOSURES
None

HONORS/AWARDS
None

APPENDIX A: AFI CATALYST WORKSHOP INFORMATION

One of the most important issues for our nation is the need to engage young people-and society in general-in the activity of science. And aspect of this is the role of entertainment. Professionals in technical areas often hear and express opinions about the quality of the portrayal of science in film. Such portrayals affect the perceptions of people and the interests of children. Film and television teach.

Sometimes we think of addressing this by somehow encouraging Hollywood to produce pictures with "better science." Of course, in order to accomplish the goal of producing scripts with better science stores, an increase in the number of science-literate writers is desirable.

Successful professionals in the scientific community often possess excellent writing skills. They frequently juggle projects-as writers do-often working on several disparate projects simultaneously. They manage time well, accomplishing complex, creative goals.

The purpose of the Catalyst Workshop, therefore, is to provide a means for scientists and engineers to become more knowledgeable about the initiation of motion picture projects. The Catalyst Workshop encourages those scientists and engineers interested in working in entertainment to learn how to write and submit scripts.

The Workshop focuses on the screenwriting craft and practice, and faculty for the Workshop consists of professionals working in film and television, allowing participants to see inside the world of screenwriting in order to improve their own ideas for film and television.

APPENDIX B: ARTICLES ABOUT THE AFI CATALYST WORKSHOP

Star Power

In an industry rife with canards, making movies should be rocket science.

By Martin Gundersen

Science

FROM DR. FRANKENSTEIN TO Rick Moranis in *Honey, I Shrunk the Kids*, the silver screen is full of scientists who are either madmen or nerds. Science was even removed from the hands of humans in *The Matrix* trilogy, in which our species battles evil computers. Appealing characters such as Jody Foster's terrific portrayal of a young astronomer in *Contact* are too infrequent.

These few exceptions can really stand out in a kid's mind. In my own childhood, my ambitions were fueled by the 1950s classics *Destination Moon*, which endeavored to add realism to its story, and *The Day the Earth Stood Still*, which featured a smart alien with no desire to eat humans.

Today, enrollment in U.S. graduate science and engineering programs is falling relative to other parts of the world. An article in the December 5 issue of *Design News* reported that China is graduating close to 1 million engineers a year, India 300,000 and the United States only about 75,000. In China, of course, the government plays an important role in determining national educational enrollment, and can influence career goals in ways that are not possible in the United States. Here we depend heavily on forms of persuasion that, in addition to immediate economic drivers, include public perceptions of quality of life and job satisfaction.

Efforts to recruit enough science majors to meet the growing demand are not helped by movies that suggest a disconnect—sometimes weighty, sometimes silly—between the enterprise of science and its relationship to society at large. It would certainly not hurt, and it might help, to show young Americans media images of scientists who are just like anyone else—which they are. Some scientists even nurture fantasies of making movies.

I have thoroughly enjoyed my own modest forays into Hollywood. I have been asked to consult on scientific details in several movies. Particularly rewarding was my experience consulting on laser physics for the 1985 film *Real Genius*, in which two brilliant college students develop a laser and then find out their evil professor plans to turn it over to the government for use as a weapon. I was fortunate to work with a director, Martha Coolidge, who insisted on verisimilitude.

Martin Gundersen is a professor of electrical engineering, physics and chemical engineering and materials sciences at the University of Southern California.

For many years, I have talked with Martha, along with Joe Petricca of the American Film Institute (AFI), director Alex Singer and Bob Barker of the Air Force, about the idea of getting more engineers and scientists involved in the creative process of making movies. We decided it was reasonable to think that some people in the sciences might have good script ideas, and just might be able to create scientific-minded characters the youth of America would want to emulate.

WORKING HYPOTHESIS

Finally we decided to do something about the idea, so we put together a screenwriting workshop for scientists at AFI that has run the past two summers. We received 57 applications for the first workshop and narrowed that down to 15 participants from diverse areas of science. Among them were an aerospace engineer, a molecular geneticist, a molecular biophysicist, a neuroscientist, a chemical engineer, a nano-scale physicist and an electrical engineer. (Those interested may watch for the next workshop announcement on the AFI website.)

Teachers included screenwriting instructor Syd Field. The students had opportunities to meet other screenwriters and agent Pat Quinn. They learned about the art of the pitch and were able to pitch stories to two producers.

It is too early to know if any of these pitches will see their way to the big screen, but one of the participants from the 2004 workshop, Valerie Weiss, an MIT-educated biophysicist, was asked to discuss story material with several companies. She also participated in another workshop that supports the development of women directors in film.

Most of the storylines are held in confidence because these ideas are potentially intellectual property that scriptwriters would like to sell. I will have to leave the judgment of the scripts that came out of the workshops to the real industry people, but I am very optimistic because of the caliber of the scientists who participated. They have remarkable abilities, talent and enthusiasm. I believe that their judgment, brains and scripts will contribute to effectively communicating science—and even to the quality of entertainment. ◘

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MOVIES

More science, less fiction

Leagues under the sea or lost in space, many films play fast and loose with the facts. An experiment underway hopes to prove accuracy is an asset.

By Yudhijit Bhattacharjee, Special to The Times

By day, Leo Cheng is a NASA engineer who helps coordinate experiments onboard an unmanned spacecraft orbiting Saturn.

By night, he's fine-tuning a screenplay about two brothers in a Chinese American family — one of whom grows up to become a physicist while the other becomes a theater actor. Their relationship is strained when they fall in love with the same woman, and the physicist strives to show the woman that he too has an artistic side. "I wanted to humanize scientists through the story," Cheng said.

ADVERTISEMENT

Cheng's writing effort is part of an experiment that Hollywood and the scientific community hope will lead to a more accurate portrayal of science in movies and on TV. Proponents aren't driven by the altruistic mission of increasing scientific literacy but by the belief that a realistic portrayal of science and scientists makes movies more compelling.

Launched by Martin Gundersen, a laser physicist at USC, with a grant from the Air Force Office of Scientific Research, the project's goal is admittedly an ambitious one. After all, the chasm between the worlds of science and movies is sometimes as wide as that between fact and fantasy. But both sides believe that getting scientists interested in writing screenplays could be a worthwhile step toward bridging those worlds.

"I know getting scientists to write screenplays sounds radical," said Gundersen, who began the experiment with a two-day screenwriting workshop for scientists at the American Film Institute last year and is planning another one this summer. "But the world of science is full of people with terrific skills and intelligence. There have got to be some out there with the necessary imagination and writing ability."

Easier said than done, as Cheng found out when he received comments

Keeping it real?

on the first 30 pages of his work from a screenplay reviewer in Hollywood. The science was solid, the reviewer wrote, but where was the story? The reviewer advised Cheng to delete several scenes in the script that served no purpose other than adding scientific realism and replace them with scenes that advanced the plot instead.

"He didn't hold anything back," Cheng recalled, still recovering from the thumbs-down nature of the critique. "But it was fair criticism."

It didn't come as a shock, either. As one of the 14 physicists, biologists and engineers who attended the AFI workshop, Cheng knew screenwriting wasn't going to be easy.

Surrounded by pictures of legends such as Audrey Hepburn and Alfred Hitchcock, he and the other participants sat in the institute's library as they took in lectures from Hollywood professionals on topics ranging from the structure of screenplays to the marketing of scripts. They also learned the grim statistics of the business: A tiny fraction of scripts submitted to Hollywood get optioned, and a fourth of those lucky few get made into a movie.

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The bar is slowly rising

The difficulty of dramatizing science is only one reason why good scientific content is rare in movies, according to AFI Vice Dean Joe Petricca, who supervised the workshop.

The culture of the filmmaking business — oft criticized as being more concerned about commercial success than artistic quality — is by and large unfriendly toward science, he said. "The typical attitude is, 'Why look for real science when we can make it up?' "

Even in cases where accurate science could be introduced without modifying the story line, there is resistance to do anything that goes against the supposed expectations of the audience. Chris Vogler, a former development executive at Fox 2000 and an instructor at the workshop, recounted the making of "Volcano," which shows Los Angeles on the verge of being destroyed.

"I kept pointing out that lava makes bell-like sounds, but the studio would have none of it," he said. "They wanted it to roar like a freight train. Volcanologists probably thought the movie was a comedy."

That said, several movies in recent years have raised the bar for scientific realism in filmmaking and are likewise raising Hollywood's awareness about the need for quality scientific content, said Alex Singer, a workshop instructor and a veteran director of more than 200 television shows, including episodes of "Star Trek: Voyager."

Take Robert Zemeckis' "Contact," acclaimed for its nuanced portrayal of an astronomer who discovers a civilization 26 light years away, and Ron Howard's "A Beautiful Mind," which won praise from the scientific community for its sophisticated presentation of mathematics. The pair have not only achieved artistic success but have done well commercially.

The phenomenal popularity of Disney-Pixar's "Finding Nemo," an animation film about a

clownfish journeying thousands of miles to find his lost son, can be attributed at least in part to its faithfulness to marine science and its realistic portrayal of the oceanic environment, Singer said. He also pointed to the successful use of science in lending depth to movies that don't involve a science-based plot: One example being the portrait of a surgeon in Peter Weir's "Master and Commander," who is shown pursuing his interests as a naturalist in addition to treating wounded shipmates on a 19th century British vessel.

"When the bar is raised, it's bound to have an impact," Singer said. "After 'Saving Private Ryan,' for example, you can no longer do a stupid movie about Omaha Beach."

Increasing media coverage of advances in science and technology is fueling a demand for compelling entertainment based on plausible science, said Frank Spotnitz, one of the writers of "The X-Files" and an instructor for the workshop session on TV writing.

"But creating that kind of entertainment is a challenging task," he said.

The participants at the AFI workshop, chosen from among 60 applicants from around the country, came prepared with ideas to meet that challenge. Some — like Cheng's — emphasized the human side of scientists. Others ranged from science thrillers to science fiction.

One of them — by GlaxoSmithKline bioinformatics researcher James Brown — was about an American epidemiologist who is studying throat cancer in a subpopulation of Afghanistan and traces its origin to a U.S. bioweapons program. Another, by Houston environmental engineer Carl Carlsson, explored the life of the first child born to a human colony on the moon.

"These are compelling stories because, ultimately, they are about people, not science," screenwriter George Walczak — an AFI graduate who recently wrote a screen adaptation of "An African in Greenland" — told the participants. "What you as scientist-screenwriters have to be able to do is preserve the drama without sacrificing the science."

That's the fundamental difficulty in writing good science-based screenplays, said Walczak, who called it the screenwriter's equivalent of an "engineering problem with multiple constraints."

For one, there's little time in a movie to bring the viewer up to speed on the relevant science. Then there's the problem of communicating abstract scientific concepts visually. And finally, even though everyday life in the lab is exciting for the passionate scientist, moments of scientific drama with universal appeal are few and far between.

As a solution, Walczak recommended following his "law of thermodramatics," which states that high stakes such as a life-or-death situation are necessary for a screenplay to be compelling.

Filmmaker Martha Coolidge, who used Gundersen's help to spruce up the science in "Real Genius," a 1985 comedy about college kids developing a high-powered laser, told the scientists that another obstacle they could expect to encounter was creating the shorthand for a given scientific development.

"If it took 10 years with 150 failures to invent the jet engine, how on Earth do I show that in five minutes in a movie?" said Coolidge, a past president of the Directors Guild of America.

Although many studios hire scientists as consultants on projects involving science, the results vary depending on how receptive the crew is to the scientist's suggestions.

Adam Summers, a marine biologist at UC Irvine who consulted on "Finding Nemo," was struck by Pixar's willingness to make expensive changes for the sake of good science. "When a kelp biologist told them that putting kelp on a coral reef would be a terrible thing to do, they pulled hundreds of thousands of dollars' worth of art with kelp on it," Summers said. "They said, 'Yes, it makes a great visual, but there's no real story reason to do it and it's scientifically bankrupt, so we can't do it.' "

Summers said he had a diametrically opposite experience on the next film he consulted for; the results were so embarrassing that he won't reveal the name. To swell the ranks of scientifically minded professionals in Hollywood, the Alfred P. Sloan Foundation has been awarding annual prizes for science-based screenwriting and production at six film schools around the country. Started in 1998, the program has seen a steady increase in the number of students applying for the awards and has generated a "bank of very impressive screenplays," according to program director Doron Weber.

None has been made into a commercial movie.

"We see our effort as an investment in the next generation of filmmakers," Weber said. "In the coming years, when these students get top jobs at studios, they'll bring to the table an awareness of science and technology themes that is currently lacking in the industry."

To raise scientific awareness among established screenwriters and directors, Gundersen also plans to organize workshops where scientists will do most of the talking and filmmakers will do the listening.

"It'll be a lot harder to pull that off than getting scientists to try a hand at screenwriting," he admitted. In the meantime, Gundersen is at work creating a more extensive screenwriting workshop for scientists this summer. At the very least, he hopes that Cheng and other workshop graduates will develop second careers as science consultants.

"And if even one of them manages to write a successful screenplay," Gundersen said, "it'll be a giant leap for science in popular culture."

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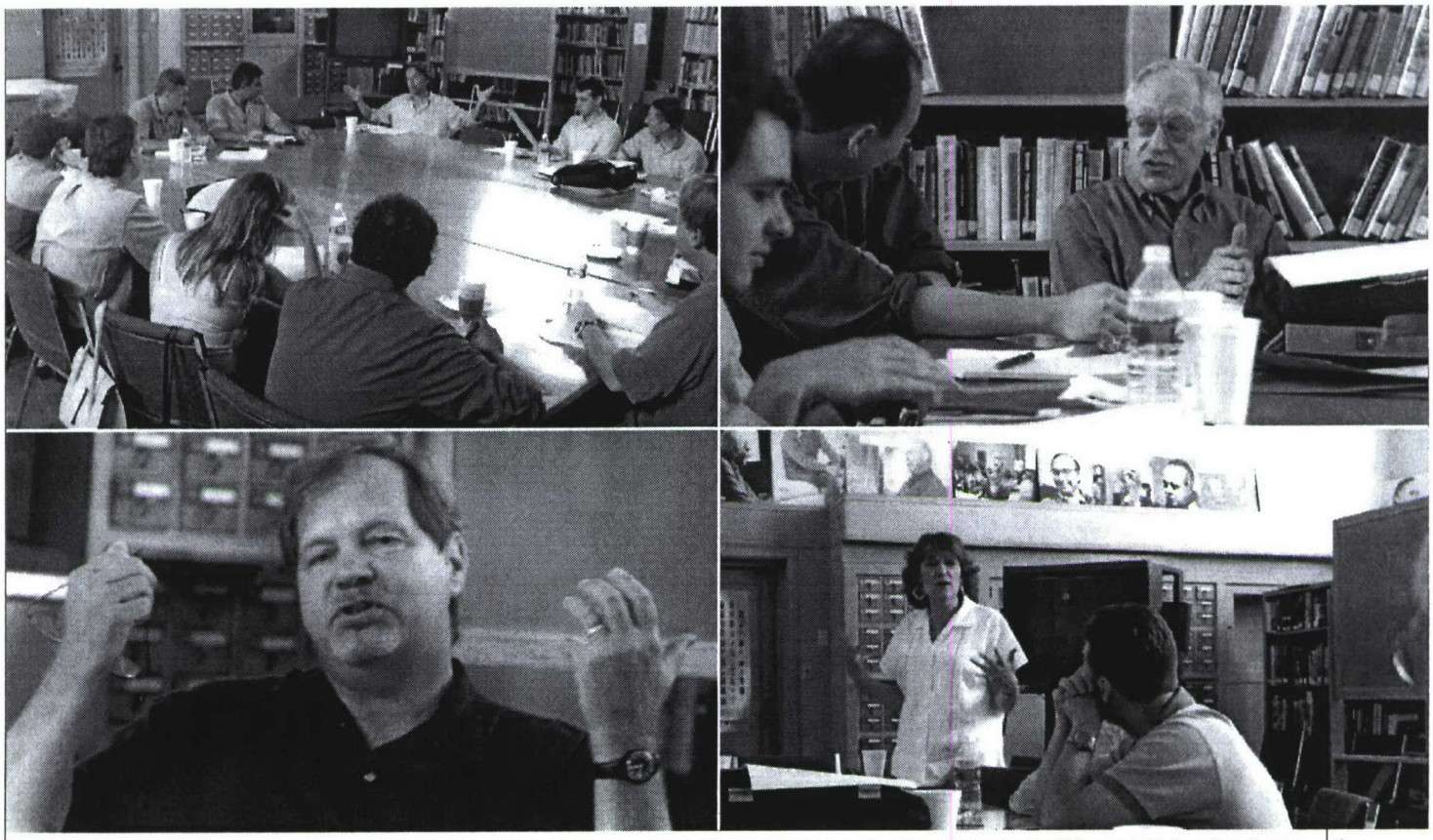

Fine words: aspiring writers are lectured by film luminaries (clockwise from top left) Frank Spotnitz, Alex Singer, Martha Coolidge and Christopher Vogler.

C. SCHWARTZ

Hollywood or bust

Last month, a handful of scientists who have toyed with the idea of writing for the movies were given a masterclass by Tinseltown's finest. Jonathan Knight joined them.

In the 1997 disaster movie *Volcano*, whole sections of Los Angeles are demolished by lava. For advice on the film, the production crew turned to Christopher Vogler, one of Hollywood's top story consultants. "Lava actually makes a tinkling sound like glass as it cools," Vogler says, "but they wanted it to roar like a freight train. Any volcanologist who saw the movie probably thought it was a comedy."

On a bright summer morning in mid-July, Vogler recounted this anecdote to a group of 15 scientists. They had come to Hollywood from all over the United States and from various scientific disciplines for a weekend workshop on screenwriting. Their goal was to learn how they could help improve the image of science and scientists in the movies. "You face an uphill battle with this stuff," Vogler continued. "But it's a good fight."

The scientists sat around a large conference table in the sunny library of the American Film Institute (AFI), a writing and directing school nestled on a hillside just minutes from the world's largest film studios. Shelves of scripts lined the walls and dozens of film stars — including Michael Caine, Sean Connery and Audrey Hepburn — gazed down from posters as Vogler and a cast of Hollywood luminaries gave their best advice on everything from writing a good script to getting a production company to read it. At times the challenges seemed demoralizing, and yet by the end of the workshop, the scientists were, if anything, inspired.

"It gave me the motivation to consider screenwriting as a serious hobby, if not a potential new career," commented Leo Cheng. Currently, Cheng works at the Jet Propulsion Laboratory (JPL) in nearby Pasadena as a science-planning engineer for Cassini, the spacecraft now orbiting Saturn. "I learned a great deal," he said.

"In film and television, scientists are often quirky, nerdy, obsessed, reclusive, self-important and not infrequently mad. These are not character traits that appeal to kids."

The portrayal of science and scientists in the mass media are two separate but related issues, both of which have long been a source of irritation for real-life researchers. We all know that scientific accuracy generally falls by the wayside when it might interfere with dramatic effect. How exciting is a silent explosion in outer space, after all? And if it took decades instead of days for global warming to flood New York, the current blockbuster *The Day After Tomorrow* might have made less of a splash. Still, this leaves many scientists worried that such movies serve only to misinform a public whose knowledge of science comes mainly from the big and small screens.

But it is the issue of how scientists themselves are portrayed that brought many of the participants to the workshop. Diandra Leslie-Pelecky, a materials scientist at the University of Nebraska in Lincoln, fears that media stereotypes are turning generations of children off any thought of a career in research. In

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CAPITAL PICTURES

Waiving the science: *The Day After Tomorrow* favours drama over accuracy for the flood of New York.

film and television, scientists are often quirky, nerdy, obsessed, reclusive, self-important and not infrequently mad. These are not character traits that appeal to kids, she says.

Leslie-Pelecky has had numerous conversations with children about their views on scientists. She is leading a project funded by the National Science Foundation that is investigating the impact of the media on children's attitudes. She has encountered many children who believe that the researchers who have visited their elementary schools aren't the real McCoy. "They might say the person was too 'normal' or too good-looking to be a scientist," Leslie-Pelecky told *Nature*. "The most heart-breaking thing is when they say, 'I didn't think he was real because he seemed to care about us'."

Much misunderstood

For others at the workshop, improving the public's perception of scientists was of personal importance. "Whenever I meet a non-scientist, I'm afraid they misunderstand what I am," says Michael Strong, a graduate student in biochemistry at the University of California, Los Angeles.

About five years ago, such concerns led William Wulf, president of the National Academy of Engineering, to call his friend Alex Singer, a television director. "He was worried about the decline in the number of young people entering the sciences, and he wondered whether the media could be having an effect," recalls Singer, whose credits include *Hill Street Blues*, *Star Trek: The Next Generation* and *MacGyver*.

The discussion rumbled along for some time until the idea for the workshop finally gelled. Martin Gundersen, a physicist at the University of Southern California in Los Angeles and an acquaintance of Singer's who has served as a science adviser on Hollywood films, helped to arrange funding from the Air Force Office of Scientific Research. The show was on.

Lights, camera, action

More than 50 scientists applied to participate when the workshop was announced in May. The 15 chosen had all demonstrated an interest in screenwriting, Gundersen says, and each came to the workshop armed with a script idea.

Carl Carlsson, an environmental engineer with a Houston power company, described his idea for a screenplay about a 14-year-old girl growing up on the Moon. James Brown, head of discovery bioinformatics at GlaxoSmithKline's facility in Upper Providence, Pennsylvania, brought along his bioterror-themed idea in which recent advances in gene therapy are twisted by terrorists to do more sinister things. And Ron Garret, who designs computer modules for martian rovers at JPL, came with a draft script called *The Cure*, in which a mysterious disease changes the lives of three molecular-biology graduate students.

"I was very intrigued by all of your ideas," said George Walczak, a screenwriter and graduate of the AFI. But as the scientists thrashed out their ideas with the instructors, many of them learned that they were missing key elements — without which their screenplays had little chance of success.

The formal structure of a film script is fairly standard. It runs to around 120 pages, roughly a minute per page, and is generally divided into three acts of about 30, 60 and 30 pages, respectively. The script details the action and dialogue but leaves most of the specifics of shooting, such as camera movement, up to the director.

The surprise for many of the scientists was the overwhelming importance every one of the workshop's instructors placed on character-based narratives. The message, in a nutshell, was that the main theme of a dramatic film cannot be Mars exploration or evolution or even a scary virus. Instead, it has to be a protagonist and his or her 'journey'. Any scientific content is incidental.

Hero worship

So, for example, the 1997 film *Contact*, based on a book by the late astronomer and science popularizer Carl Sagan, would not have worked had it just been about the search for extraterrestrial intelligence. It succeeded as a film because it was about an astronomer — played by Jodie Foster — who dreamed her whole life of reaching the stars and who battled numerous obstacles on her journey. This eventually took her to a distant corner of the Universe to meet alien beings.

A good script is essentially the classic hero's journey, key elements of which can be found in everything from Homer's *Odyssey* to aboriginal folk tales. The stages of this journey are outlined in a number of scriptwriters' guides, including Vogler's seminal book, *The Writer's Journey: Mythic Structure for Writers*, which has become a key reference for many Hollywood screenwriters.

By this test, many of the scientists' script ideas were not yet fully formed, and the instructors had a number of ideas for improving them. Taking Brown's bioterror idea, Vogler suggested allowing the central character, a cancer epidemiologist named Paul Edwards, to express a wish early in the film. It could be to win the Nobel prize or to overcome some character flaw, Vogler said. "When the protagonist makes a wish, the story immediately wakes up and pays attention," he explained. The audience then has a goal by which to mark the character's progress.

The challenge, then, is how to bring science into a script that is driven by the story of its protagonist. "I read things in *Science* and *Nature* every week that are absolutely fascinating," said Tom Katsouleas, a plasma physicist at the University of Southern California, citing a *Nature* News Feature

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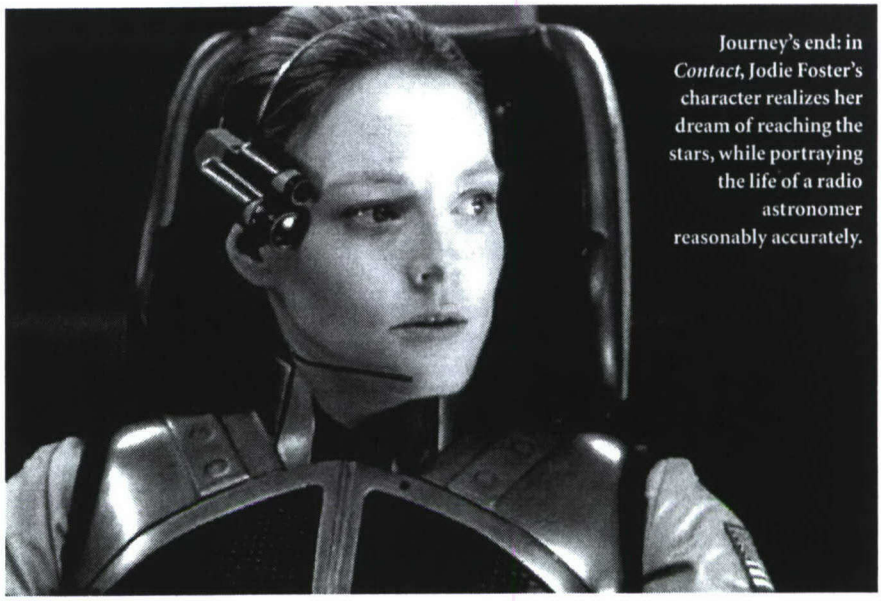
published in February about the last universal common ancestor, the theoretical first cell that gave rise to all cellular life on Earth (see *Nature* **427,** 674–676; 2004). He asked the instructors: "How do we put something like that into a script about character?"

Frank Spotnitz, who for four years was executive producer of the TV drama *The X-Files*, suggested that the protagonist might have to recreate this creature to save the planet. "If it were for *The X-Files*, I'd think about how it could start killing people," he added.

Life-or-death situations are essential. The stakes must be high in a screenplay, whether for film or TV. Walczak calls this the "law of thermodramatics". "If you aren't sure what the stakes are, find out what your main character cares most about in the world," he urged the scientists. "Those are your stakes."



Journey's end: in *Contact*, Jodie Foster's character realizes her dream of reaching the stars, while portraying the life of a radio astronomer reasonably accurately.

F. DUHMEL/WARNER BROS/SOUTHSIDE AMUSEMENT/KOBAL COLLECTION

Lab liabilities

The realities of screenwriting are sure to disappoint those scientists who wish the world at large could get a more realistic glimpse of what their daily lives are like. As with many other professions, the daily drudgery of research does not make for good movie action.

Spotnitz told the group he toyed with the idea of showing the details of an experiment on *The X-Files*. The crew filmed a half-hour segment of Agent Scully working in the laboratory, but killed it and rewrote the script after everyone agreed it was far too boring. Singer concurred: "Most scientific work is unfilmable."

On top of all this, the screenplay writer has to consider a factor that book writers are free to ignore: cost. For instance, making a character age 15 years over the course of the film might be important to the story, but the producer who reads it will immediately think of the hundreds of thousands of dollars it costs to artificially age the actors and shift the time period of the sets and costume. Similarly, writing "a freight train passed by" has enormous filming implications because of the time and expense required to back up a train for a second take. Producers care about cost, and writers ignore this at their peril.

> "There are a lot of people who make very good money writing very good scripts that never get made."
> — Alex Singer

Even after hearing this, the scientists in the workshop remained enthusiastic. "Show me the constraints and I can work within them," said Leslie-Pelecky. "That's what I do for a living."

But there was more to come. Writing a good script is only the first challenge. In particular, a producer then has to be convinced to buy it. The usual process involves finding somebody who knows somebody at a production company just to get the script in the door. Then it goes to 'readers', who are often young, aspiring screenwriters themselves. Their safest bet is to say 'no', rather than risk getting egg on their face for passing a lousy script on to a production executive. "They reject most of what comes in, and nine times out of ten the executive rejects what the reader passes," said Spotnitz.

Hollywood's dream factory can afford to be so picky because of the sheer number of scripts that come in every day. So far this year, 40,000 script ideas have been registered with the Writers Guild of America, according to Singer: "And this is a slow year."

Killer blows

Once a company has bought the option to make a movie, the producers are likely to want the writer to rewrite the script to their specifications. If they aren't pleased with the new version, they may kill it. If they are, they still need to find a director interested in making the film. If they don't, again the script dies.

There are so many ways for a script to die after it is optioned that many professional screenwriters don't have a single movie credit. But they keep at it. "There are a lot of people who make very good money writing very good scripts that never get made," Singer told the scientists.

Despite all this, there is hope for the future of science in film. For one thing, some directors are starting to care about scientific accuracy. Director Martha Coolidge, who made a presentation at the workshop on Sunday afternoon, hired Gundersen as a science adviser for her 1985 comedy *Real Genius*, about some brainy kids who develop a new high-powered laser. "The labs had a very real look, we even had a laser on the set," Gundersen said. "Comments from people in the field were uniformly positive about the accuracy of the science."

More recently, *Contact* gave a reasonably accurate portrayal of the work of radio astronomers. *Apollo 13*, the 1995 film about the ill-starred Moon mission, contained numerous accurate details about space travel. Such attention to detail raises the bar for other films, Singer claimed: "You can't make a stupid movie about the Moon any more." Even children's movies such as *Finding Nemo* have won plaudits for their attention to scientific detail (see *Nature* **427,** 672–673; 2004).

Workshop participant Valerie Weiss, who recently completed a PhD in biochemistry and has directed and produced two short films, is optimistic about the prospects of getting more and better science into the movies. Unlike most of the participants, Weiss has already turned all her attention to film. She founded a film programme while she was a graduate student at Harvard Medical School and moved to Hollywood in 2001 to pursue film-making full time. She now has a script idea for a movie about a scientist, but asked *Nature* not to reveal it in detail. "You can be scooped in film-making just like in science," she said.

Whether any of the ideas discussed at the workshop will end up on the big screen remains to be seen, but the next steps are in the works. Gundersen is thinking about holding a five-week workshop at the AFI next year, at the end of which each participant would have completed a script. Joe Petricca, vice-dean of the AFI Conservatory, has offered to organize screenwriting instructors or professional readers to provide feedback for any of the current participants who can submit the first 30 pages of a script by 1 October.

Brown, who is now fired up to work on his bioterror script, plans to take Petricca up on this offer. He feels better prepared knowing what challenges lie ahead. "It's daunting trying to get a paper into *Nature*, too. Yet people do it," he said after the workshop. "This is just the same." ■

Jonathan Knight writes for *Nature* from San Francisco.

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Print this article

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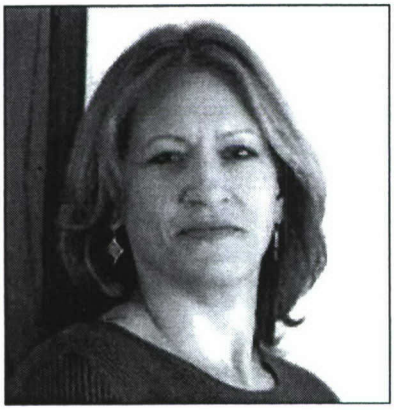
Making good films a science

BY BOB FISCHBACH
WORLD-HERALD STAFF WRITER

Evil or just plain crazy. Nerds and geeks.



Diandra Leslie-Pelecky

Personal: Grew up in Milwaukee; age 40

Family: Husband Bob Hilborn, a professor at Amherst College in Massachusetts

Work: Associate professor of physics at the University of Nebraska-Lincoln; director of Project Fulcrum, which seeks to improve science education in grades 3-8

On the big screen, few professions get a worse break than the scientist.

Make that mad scientist. From Jekyll and Hyde to James Bond, silent killers to Spider-Man, insane and evil researchers have made great movie villains.

When they're not depicted as power hungry or crazy, break out the bad hair, taped glasses and pocket protectors. Think of the computer-lab geek in "WarGames" or crew-cut Michael Douglas in "Falling Down."

Little wonder, then, that kids frequently conclude by middle school that being a scientist isn't cool. That's causing worries about the nation's future in an increasingly technological world.

Diandra Leslie-Pelecky, a professor of physics at the University of Nebraska-Lincoln, wants to do something about that. And the American Film Institute and the U.S. Air Force want to help her.

Leslie-Pelecky recently returned from her second screenwriting workshop at the AFI, where she and dozens of other scientists learned from the movie industry how to better tell a science-themed story on film and how to sell it to a studio. A small grant from the Air Force Office of Scientific Research is helping fund the workshops.

"Scientists haven't done a good job of communicating why what we do is both important and interesting," Leslie-Pelecky said recently from her UNL office. "That's reflected in the low number of people who want to go into science."

She's in a position to know. While her research at UNL concerns the use of magnetic nanoparticles in cancer treatment, her teaching focus is on developing physics courses for middle-school and elementary teachers.

Leslie-Pelecky runs Project Fulcrum, helping teachers and students in the schools. The project, with funds from the National Science Foundation, pairs scientists and teachers in seeking ways to improve science education.

In researching how kids get their ideas about scientists, she quickly learned movies and television are major influences.

And Hollywood has rarely hesitated to turn the laws of nature and research on their heads to make a film work - planting false notions in the minds of moviegoers.

"I can forgive inaccurate science in movies to a point," Leslie-Pelecky said. "But we're presented as the people who want to blow up the world, or as geeks. If you're a kid, you don't want to aspire to that."

All about the science

Good science
Here are films that depict fact-based scientific principles or nonstereotyped scientists:
"Proof." Gwyneth Paltrow and Jake Gyllenhaal stamp out the math-geek factor.
"Apollo 13." Great role models, and a story filled with science and problem solving.
"Finding Nemo." The reef and its aquatic life are firmly grounded in the real deal.
"Master and Commander." The shipboard doctor trains a budding young naturalist.
"Contact." Even when the story transcends known barriers, it doesn't violate natural law.

Bad science
These movies ignore the laws of nature or are populated by nerds and madmen:
"The Day After Tomorrow." In the film, global warming takes days, instead of decades, to do its worst.
"A Sound of Thunder." Changes caused by time travel hit a city in visible waves. As if.
"The Island." A cloning pioneer is evil to the core, and so are his research assistants.
"Spider-Man." The Green Goblin gives science a bad name, as does Doc Oc in the sequel.
"Volcano." Molten lava shouldn't roar like a freight train. It tinkles, like a

Martin Gundersen, a professor of electrical engineering and electrophysics at the University of Southern California, sees the result: less interest in science and engineering graduate degrees. chandelier.

"Most graduate programs in science and engineering have lots of highly qualified international students enrolled," he said, "but lesser numbers of native-born students. It's a really serious problem."

Gundersen was a consultant on the 1985 movie "Real Genius," about science prodigies. The filmmakers needed expert advice about lasers. He found a gulf between the worlds of film and science.

He developed a grant proposal that led to, among other things, the AFI screenwriting workshops, now headed toward their third year. Participants pay for their own travel, room and board.

For Leslie-Pelecky, the workshop met both personal and professional interests. Two days before the application deadline, she spied a small article about it in Science magazine.

Her impeccable credentials as a teaching and research scientist fit the Air Force goals of attracting kids to science careers. But she had always been a writer as well.

"I was one of those kids who was always making up stories," she recalled. "I had imaginary friends with entire histories."

When she was 13 or 14, she claimed an old typewriter her mom was going to throw out. In the summer, Diandra would sometimes write on it all day. As an undergrad she began with a major in radio and TV/film.

But, looking at the writer's life, she "decided I didn't want to spend my life begging for money and having others criticize my work. Of course, that is what I do now. But at the time, physics looked easier than writing."

Leslie-Pelecky learned plenty at AFI. Focus solely on the science, she said, and your movie won't get made. Movies need characters, drama and a story arc.

Participants learned about agents, the inner workings of studios and how story ideas get sold. They also learned the long odds of any script becoming a movie. The big moneymakers, she learned, are mostly derivative, or sequels, or based on a best-selling book.

In her second workshop, Leslie-Pelecky pitched an idea about a TV series set at a university to studio officials, who helped her reshape it.

Their blunt advice: Nobody knows you. Find a good writer with ties to the industry to develop your idea.

AFI is helping her make those ties and connect with other scientists who love to write. Workshop participants are also working toward connecting filmmakers with experts in various fields, so that future movies will not only be good stories but scientifically sound ones that don't demonize scientists.

Though at least one workshop participant has left research work for a movie job, Leslie-Pelecky sees challenges to leaving her university work behind.

"I can't drop everything I'm doing and go off to Hollywood yet," she said.

She puts her goal of drawing middle-school kids to science careers ahead of selling a script.

"I'm really concerned about this country maintaining its position as a world leader in science," she said. "Scientists are trying to make the world a better place. Communicating that is critical. And you reach far more people at the movies than you ever will in a classroom."

Contact the Omaha World-Herald **newsroom**

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Engineering Times
July 2005
Circulation: 57,578

Engineers Bring Science to Life Through the Movies

By Jane Byrne
Staff Writer

Americans go to the movies about 1.5 billion times each year, according to the Motion Picture Association. During the hours that they spend sitting in the darkness enthralled by the images on the big screen, moviegoers are a captive audience. Making a film is a sure way to get people's attention in the era of the low-attention span.

Some engineers and scientists are trying to take advantage of that momentary blip of absorption on the human radar screen by incorporating the professions that they love into movies. Michael Strong, a molecular biologist from Los Angeles, wants to get young people fascinated about science through outreach, particularly through films or television, which is why he took part in the American Film Institute's Catalyst Workshop for scientists and engineers.

The Aston Martin Vanquish was featured in the most recent Bond film, Die Another Day, *and featured built-in weapons.*

The weekend workshop, which was held for the first time last August, teaches 12-15 scientists about storytelling and screenwriting, and allows participants to have their work critiqued by filmmakers. AFI created the workshop to teach engineers and scientists about motion picture projects. The need for "better science" in Hollywood films is great, the institute notes. AFI is holding the workshop again for five days during the first week of August. The Air Force Office of Scientific Research supports the workshop to increase interest in science and engineering.

That is Strong's goal, as well. "I've found that one of the hardest things is to engage outside people in science-related activities because sometimes people are a little bit afraid of getting involved," he says. That's why he decided to take part in the workshop.

Strong enjoyed the experience because it taught him about what is involved in writing a screenplay and developing character-driven story lines. "A lot of the stories people were proposing were centered on a general idea," he says. But instructor Chris Vogler, author of *The Writer's Journey*, stressed that while the main idea is important, it is crucial to create a character that people can relate to in order to get the audience excited about the story.

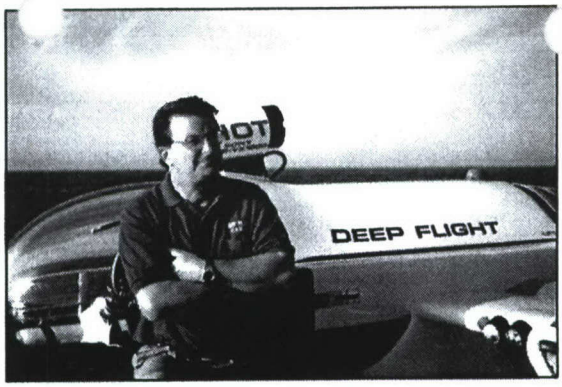
As a kid, Strong was inspired to get involved in science by a television show called *Mr. Wizard's World*. Now, he hopes to reach out to young people through his screenwriting. "I think any time there's science-related movies and television programs, as long as they're done well, that really inspires young people to go into these areas," he says.

Valerie Weiss, who also attended last year's Catalyst Workshop, has always had a love for science and the performing arts. As an undergraduate at Princeton University, she studied molecular biology and theater. At Harvard, she earned a Ph.D. in biophysics and founded a film program. Today, she is incorporating her talents through the work of the production company she founded, Ph.D. Productions.

Weiss's company is currently working on a full-length film called *Losing Control*, a comedy set in the world of Ivy League science. Weiss was developing the plot for *Losing Control* during the Catalyst Workshop, and was able to bounce ideas off of her professional peers. "It was really great to hear how they responded to it," she says. "It was fun to see their eyes light up about scientists being represented in such a truthful and entertaining way." The seminar gave her a helpful entrée into the world of filmmaking, she says.

"I think the only way we're going to encourage intelligent people to choose careers in science is to have it be something that people even know about, and the best way to do that is through movies and television," Weiss says. "There's no reason it shouldn't be a typical career option, but it's really something that most people don't have any familiarity with, and it would be nice to have science presented more casually."

One film legacy that is famous



Engineer Graham Hawkes, creator of Deep Flight submersibles, assisted in the filming of the 1981 Bond film, For Your Eyes Only, *and appears in a scene in which he attacks Agent 007 with a machine he designed.*

for presenting technology in a positive light is the James Bond genre, which began with Ian Fleming's novels in the 1950s and became a series of popular films, starting in 1962 with the hit *Dr. No*. The most recent Bond film, *Die Another Day*, was released in 2002 and grossed more than $47 million dollars.

In nearly every Bond film, the ingenious gadget man "Q" presents Agent 007 with fascinating devices for escape, life-saving gadgets, and futuristic weapons. One piece of equipment that's well-known for being part of the Bond films is the Aston Martin, a car that was used in five of the films.

What started as a clever bit of product placement by David Brown, who owned Aston Martin until 1972, soon became a convenient partnership between the Bond films and the maker of stylish vehicles. "It was a shrewd move on his part for sure," says mechanical engineer Ian Minards, who works for Aston Martin.

Minards was the chief program engineer for the company's "Vanquish" model, which was used in *Die Another Day*. He was part of the team of engineers that modified four cars for the filming of the movie, and saw some of the film's production.

"It was great to have the Aston Martin back in Bond, which is where it should be," he says.

One of the Vanquishes used in the film was equipped with weapons. The front grill opened, allowing four rocket launchers to emerge. The car also had two machine guns, one on either side. In addition, the vents in the hood opened to allow single action shotguns to pop out.

"Most of the weapons were controlled by compressed air," Minards says. In the trunk, a cylinder of compressed air similar to a scuba tank controlled the opening and closing of the front grill and the emergence of the rockets and guns. The whole system was controlled remotely with an attaché case. The shot guns were pushed out electrically, he explains.

Minards says helping to modify the car for *Die Another Day* and seeing some of the filming was a fun experience that he'll never forget. "We still have the car at Aston Martin," he says. Another model from the film is still in existence, but the other two were unusable after filming.

Another engineer who has used his creative and technical skills on a Bond film is Graham Hawkes, founder of Hawkes Ocean Technologies. The company designs and manufactures manned submersibles. Hawkes's goal is to build a sub that will travel to the Mariana Trench, the deepest point on the planet at 37,000 feet below the ocean's surface.

The 1981 film, *For Your Eyes Only*, features an underwater fight scene in which Bond is attacked while in a submarine. Hawkes designed the method of attack and portrayed a villain in the underwater scene.

"They asked how I would actually attack James Bond if he was in a submarine underwater," Hawkes says. He told the filmmakers that he would use a Mantis, a powerful submersible large enough for only one person that Hawkes designed. Hawkes's strategy—smash through the front of Bond's sub with one of the Mantis's arm-like drills.

The filmmakers asked Hawkes to do just that during filming, and he did. Before shooting the footage, Hawkes planned to hit the submarine at one-third thrust, but the filmmakers wanted more speed to get a better visual effect. Hawkes warned that at a higher speed, he wouldn't have much control because the machine would go right through the front of the sub. They told him to do it anyway. The drill did what he had predicted, which frightened the stunt man and surprised the filmmakers, Hawkes recalls.

Despite that incident, "It was a great deal of fun," he says. Today, he builds underwater aircraft with his submersible company. People regularly ask him when he will be in a Bond film again. But for now, he is content building his underwater vehicles.

Films that depict technology as being a progressive, exciting part of life, such as *The Matrix* and *Star Wars* trilogies, are continuing to be a favorite in popular culture. In fact *Star Wars III: Revenge of the Sith* holds the record for the top four-day gross in ticket sales, and *The Matrix Reloaded* previously held that record. If more engineers and scientists become involved in filmmaking, they could not only deliver realistic special effects to movie-going audiences, but could also spark an interest in these fields in many young minds.

APPENDIX C: AFI CATALYST WORKSHOP FACULTY 2006

CHRISTOPHER VOGLER
Christopher Vogler is the author of The Writer's Journey: Mythic Structure for Writers, and one of Hollywood's top story consultants. He has been a development executive for Fox 2000, a division of 20th Century Fox- where he worked on the development of the films COURAGE UNDER FIRE, ANNA AND THE KING, FIGHT CLUB and THE THIN RED LINE-and has been a consultant on many Disney productions. Vogler is now concentrating on writing and producing.

A 1971 graduate of the University of Missouri School of Journalism, Vogler served as an Air Force officer, producing briefing films and documentaries for the Pentagon and Congress on the military space program. He did graduate work at the University of Southern California School of Cinema-Television, where he won a Cine Golden Eagle for his student film MIND LIKE WATER. He began his film career as a story analyst for United Artists, later working for Orion Pictures, The Ladd Company, Paramount, MGM and Warner Bros. At the Disney Company, he worked closely with the Walt Disney Feature Animation division, consulting on THE LITTLE MERMAID, BEAUTY AND THE BEAST, ALADDIN, HERCULES and FANTASIA 2000, and he received a story credit for his contributions to THE LION KING. He continues to consult for Disney animation, Warner Bros. and other Hollywood clients.

Long interested in myths and their influence on modern storytelling, Vogler created a system for analyzing stories based on the work of the mythologist Joseph Campbell, while working at Disney. His influential memo on film story structure caught the attention of then-Disney production chief Jeffrey Katzenberg and was soon required reading for young development executives at major studios. That memo formed the outline for Vogler's book, The Writer's Journey, which has become a standard reference on structure for screenwriters and novelists.

As an expert on mythology and Hollywood's narrative patterns, Vogler has consulted on projects for IBM, Web site and game design companies, Fortune 500 companies, and major film and TV studios. He has conducted seminars on story structure and development for filmmakers all over the United States and worldwide.

Recently, Vogler wrote the screenplay and song lyrics for JESTER TILL, an animated film about the popular European folk character Till Eulenspiegel, produced by Munich Animation Studios. He is the executive producer of P.S. YOUR CAT IS DEAD, an adaptation of the Broadway play by James Kirkwood, directed by Steve Guttenberg; and is a story consultant on the upcoming Warner Bros. revival of the SUPERMAN movie series.

GEORGE WALCZAK
George Walczak is currently a faculty member at the AFI Conservatory and the lead writing instructor at AFI's Directing Workshop for Women. Holding an MFA in

Screenwriting from AFI, Walczak was a recipient of the Alfred P. Sloan Award. Now in his fifth year as an AFI adjunct faculty member, Walczak most recently wrote a screen adaptation of the French bestseller An African in Greenland. In 2001, he served as the Director of the Ojai Film Festival.

ALEX SINGER
Film Director
In his 40-year career, Alex Singer has directed over 280 television shows and five features. His credits include PROFILES IN COURAGE, THE FUGITIVE, THE BOLD ONES, POLICE STORY, LOU GRANT, CAGNEY AND LACY, HILL STREET BLUES, STAR TREK: THE NEXT GENERATION, DEEP SPACE NINE and VOYAGER.

Singer has received numerous awards, including an Emmy and a Humanitas Prize. He has lectured and taught film production and directing at a number of universities, including UCLA and USC, private institutions and the DGA. In the spring semester of 2001, Singer taught a 17-week course at USC's School of Electrical Engineering, titled "Enhancing Powers of Expression for Engineers: Effective Communication for Engineers at the Intersection of Technology, the Arts-and Multimedia".

Under contract to MCA/Universal Studios from 1990-91, Singer headed a task force assigned to integrate established motion picture technologies with computer-mediated forms of entertainment at their Orlando Florida theme park. He continued with MCA as principal consultant on the development of the entertainment applications of advanced forms of Virtual Reality technologies.

Singer is a longtime member of Global Business Network, a business think tank that develops scenario building strategic planning skills within organizations. At USC's Engineering School's Integrated Media Systems Center, he held the title of Senior Research Scholar and is now on their Science Advisory Board.

Singer is also on the Board of Advisors for the Institute for Creative Technologies, a joint U.S. Army and USC effort to explore and meld the creative resources of the cinema arts and communication technologies towards improving training and planning for the military.

JOE PETRICCA
Senior Vice Dean, AFI Conservatory
Holding an MFA in Screenwriting from AFI and a BFA in Film Production from the Tisch School of the Arts at NYU, Joe Petricca is responsible for oversight of administrative functions for all Education Programs, including the AFI Conservatory, National Workshops and special projects. He is Director of the AFI Directing Workshop for Women, the Catalyst Workshop and the Sloan Foundation funded programs. He has participated on panels and juries for such diverse projects as the Slamdance Film Festival, Kinotovar Festival in Sochi, Russia, and for the Academy of Television Arts and Sciences. As a screenwriter, he has had feature screenplays optioned and has written for

Robert Osborne on Turner Classic Movies. His screenplay, HUMAN RESPONSE, was the first recipient of the Program for Screenwriters Award (now known as the Fadiman Award). As an Art Director, his credits include numerous music videos (RUN DMC), commercials (LOTTO) and feature films (20 BUCKS). Currently, he also volunteer teaches screenwriting and filmmaking to at-risk teenagers.

CHRIS SCHWARTZ
Associate Manager
Conservatory Administration and Special Projects Chris Schwartz serves as AFI's Associate Manager of Conservatory Administration and Special Projects and has worked with AFI since 2000. He provides administrative support and coordinates specific projects for the office of the Senior Vice Dean in connection to the overall administration of the AFI Conservatory. He works closely with Joe Petricca on AFI's Directing Workshop for Women, the Catalyst Workshop and the Sloan Foundation funded programs. Before coming to AFI, Schwartz worked for producers Kathleen Kennedy and Frank Marshall for six years as an office manager and post-production coordinator. As a filmmaker, his short film, DINNER WITH KIP, won second place in Nintendo's Short Film contest and has aired multiple times on cable channels throughout the world.

APPENDIX D: 2005 AFI CATALYST WORKSHOP SCHEDULE

AFI
American Film Institute

Catalyst Workshop • 2005

August 1, 2005 Monday	August 2, 2005 Tuesday	August 3, 2005 Wednesday	August 4, 2005 Thursday	August 5, 2005 Friday
10am - 1pm MHCR **Format & Arc** **-Syd Field**	**10am - 1pm** MHCR **Outline** **-Mike Ellis &** **Karen Janszen**	**10am - 1pm** MHCR **Agents & Managers** **-Pat Quinn**	**10am - 1pm** MHCR **Story** **-Chris Vogler**	**10am - 1pm** MHCR **Pitch** **-Patty Meyer**
1 pm - 2 pm **Lunch Break**	**1 pm - 2 pm** **Lunch Break**	**1 pm - 2 pm** **Lunch Break**	**1 pm - 2 pm** **Lunch Break**	**1 pm - 2 pm** **Lunch Break**
2pm - 6pm MHCR **Format & Arc** **-Syd Field**	**2pm - 6pm** MHCR **Outline** **-Mike Ellis &** **Karen Janszen**	**2pm - 6pm** MHCR **Story** **-Gill Dennis**	**2pm - 6pm** MHCR **Story** **-Chris Vogler**	**2pm - 6pm** MHCR **Format & Arc** **-Syd Field**
	6pm - 7pm HBO Pavilion **Reception**		**6pm - 6:30pm** HBO Pavilion **Dinner**	
	7pm - 9pm MGSR **CSI screening/Q&A** **-Rich Catalani &** **Allen MacDonald**		**6:30pm - 10pm** MGSR **MINORITY REPORT** **screening/Q&A** **-John Underkoffler** **futurist/science advisor**	

MGSR-Mark Goodson Screening Room LIB- Library Building WB-Warner Building SDAC-Sony Digital Arts Center MHCR-Manor House Conference Room
FBSR-Frankovich-Barnes Screening Room HBO-HBO Pavillion SS-Soundstage TASR-Ted Ashley Screening Room

APPENDIX E: AFI CATALYST WORKSHOP PARTICIPANT BIOS

Catalyst Workshop 2004

James Brown
Presently, Dr. Jim Brown is the Manager of the Discovery and Analysis Bioinformatics Group (Genetics Research Division) at the Upper Providence, Pennsylvania, R & D site of the global pharmaceutical company, GlaxoSmithKline (GSK). He is responsible for coordinating bioinformatics analyses in support of multiple therapeutic areas including antibiotics, tropical diseases, musculoskeletal diseases and cancer. In his work, he has placed special emphasis on novel applications of evolutionary biology in drug discovery. Dr. Brown began his career at GSK by joining the former SmithKline Beecham in 1996 as a Senior Computational Biologist specializing in Anti-microbials.

Prior to joining GSK, Dr. Brown was a Medical Research Council of Canada post-doctoral fellow studying archaebacteria and the universal tree of life in the lab of Dr. W. Ford Doolittle at Dalhousie University, Halifax, Canada. His M.Sc. and PhD degrees, with thesis research on oyster aquaculture and sturgeon molecular population genetics, respectively, were granted from Simon Fraser University, Vancouver, Canada. He was granted a B.Sc. in Marine Biology from McGill University, Montreal, Canada. Dr. Brown is an author of over 50 peer-reviewed publications, including recent papers on testing bacteria-human horizontal gene transfers (Nature, 2001) reconstruction of the universal tree of life using large protein datasets (Nature Genetics, 2001) and ancient horizontal gene transfer (Nature Reviews Genetics, 2003). He also has a strong interest in fiction writing, which he hopes to develop in the AFI Catalyst Workshop.

Carl Carlsson
Carl Carlsson is a graduate of the Georgia Institute of Technology, where he majored in Civil Engineering. He has worked as an Environmental Engineer for 14 years, and is experienced in hazardous waste management and environmental permitting and compliance. However, he has never forgotten his dream of exploring space. As President of the Houston Mars Society, he advocates the exploration and settlement of worlds beyond Earth. He particularly enjoys speaking to children, and has served as a judge for the last three Mars Settlement Design Competition events at the Johnson Space Center. Carlsson lives in Houston, Texas, with his wife and two young daughters.

Leo Cheng
When Leo Cheng was seven years old, his ethnic Chinese parents moved his family to Guam. The warm tropical nights and clear dark skies supplied the ingredients for Cheng's dreams of space flight. By the time he graduated high school, he knew he wanted to study astronomy and engineering. Cheng attended college at Cal Poly Pomona and majored in Physics because it is the foundation of both astronomy and engineering. After graduating from Cal Poly, he spent two years as a research Physicist at Rensselaer Polytechnic Institute in Troy, New York. With a Masters degree in Physics, he returned to Los Angeles and found employment at NASA's Jet Propulsion Laboratory (JPL). He was able

to land a job with the Galileo Mission to Jupiter, designing the scientific experiments performed on board the spacecraft. After a five-year stint on Galileo, Cheng decided to expand his career into the world of commercial aerospace. He left JPL to work as a Mission Systems Engineer for Hughes Space and Communications, now called Boeing Satellite Systems. One of his toughest assignments was being the Mission Operations Lead for a satellite mobile phone system, where he was responsible for assembling the team of flight directors and engineers, training them to work in a real-time mission control environment. Three years ago, Cheng returned to JPL, not wanting to pass up an opportunity to explore another planet: Saturn.

Cheng is now the Science Planning Engineer, developing the scientific operational plans needed when the Cassini-Huygens spacecraft begins its four-year tour of Saturn, its rings, its icy moons and Titan, which is the large planet-like moon of Saturn. He hopes to bring to the Catalyst Workshop the same level of passion and diligence, which has helped him so far in life.

Donald Eberschloe
Colonel Donald R. Erbschloe is the Commander and Deputy Director of the Air Force Office of Scientific Research (AFOSR) in Arlington, Virginia. AFOSR is the manager for all basic research in the Air Force. The AFOSR is one of the 10 directorates that comprise the Air Force Research Laboratory (AFRL). The office has a staff of 200 people and an annual working budget of $400 million that supports more than 5,000 worldwide basic research projects critical to the defense of the United States. Colonel Erbschloe is also responsible for the technical planning, external AFOSR relations and personnel management for the AFOSR and its two foreign technology offices in London and Tokyo.

His career is balanced among three primary thrusts-operations, academia, and scientific and technical management. He is a command pilot with 3,900 flying hours in the C-141, TG-7A (motorized glider), and UV-18. During his tour in the 86th Military Airlift Squadron at Travis Air Force Base, CA, he was the Chief of the Operations Center during Operation Just Cause and the Chief Pilot during Desert Shield/Desert Storm. He has served three tours on the faculty at the Air Force Academy, as instructor through associate professor in the Department of Physics and as the Director of Faculty Research on the Dean of the Faculty staff. Following his first tour at the Academy, he was sent to the University of Oxford for his doctorate. Following his second tour at the Academy, he was selected as the Chief Scientist at the European Office of Aerospace Research and Development, a London-based detachment of the Air Force Office of Scientific Research. Following his third tour at the Academy, he was chosen as the Military Assistant to the Air Force Chief Scientist at the Pentagon. Colonel Erbschloe moved to AFOSR in November 2001 to head that organization's largest directorate and assumed command of AFOSR in January 2003.

Jennifer Galvin
Originally from Port Washington, NY, Jennifer Galvin's background in public health, marine science and her passion for travel has brought her to work with diverse

populations around the world. She has a BS in Aquatic Biology from Brown University, a MPH in Environmental Health Sciences from Yale University and is now pursuing her doctoral degree at the Harvard School of Public Health. Within the Water and Health: Epidemiology, Exposure and Risk Program, her work focuses on the interactions between ocean and human health. She is also a Trustee and on the Selection Committee of the Henry David Thoreau Scholarship Foundation. Through Galvin's work with the Center for Health and The Global Environment at Harvard Medical School, she had her first taste of screenwriting while serving as an advisor to the New England Aquarium's World of Water film, IN HOT WATER, about climate change and the oceans. Her Master's thesis became the founding paper for the Bermuda Biological Station for Research's Center for Ocean and Human Health, and she recently returned to Bermuda with the Atlantis Mobile Marine Laboratory, which studies remote islands and maritime communities. This fall, she will begin work on a documentary profiling Atlantis' work in the Arctic and serve as the film's scientific liaison for Laval University, Canada. Galvin's endeavors fuel her interest in making films that communicate how the health of the environment is critical to our health.

Ron Garret

Ron Garret is an aspiring screenwriter whose first full-length feature script, a mystery thriller called THE CURE, is currently being read by five Hollywood production companies. He is a hiker, a skier, a scuba diver, and a private pilot. For his day job, he is a principal scientist at the NASA Jet Propulsion Laboratory where, since 1988, he has taught robots how to avoid running into rocks. In 2000, he took a year off JPL to become the resident rocket scientist at Google. Garret has a wife, a dog, a cat, a mortgage and a PhD in Computer Science from Virginia Tech.

Dov Greenbaum

Dov Greenbaum recently received his PhD and M.Phil in Genetics from Yale University where he worked in Mark Gerstein's lab doing bioinformatics research. He received his Bachelor's degree in Biology and Economics from Yeshiva University (New York) in 1998. He has written a number of papers on the subjects of genomics and proteomics. In addition, he has published on the legal issues surrounding databases and copyright. Greenbaum is a big movie fan with a longstanding subscription to Netflix.

Tom Katsouleas

Thomas Katsouleas received his PhD in Physics from UCLA in 1984. He was an adjunct professor and research scientist at UCLA from 1984-1991, working on plasma-based accelerators and light sources. Since 1991, Dr. Katsouleas has been a professor in the electrical engineering department at USC. At USC, he was Associate Dean for Engineering Student Affairs from 1994-1999, and Associate Dean of Engineering Research from 2000-2001. Professor Katsouleas is a Fellow of the American Physical Society and the Institute of Electrical and Electronics Engineers (IEEE). He is Associate Editor of the IEEE Transactions on Plasma Science, the author of more than 130 journal articles and editor of four books. His current research is focused on advanced accelerator and beam physics research. He is a leading expert in advanced computational modeling of plasmas and accelerators. He leads a large multi-institutional effort (with Stanford and

UCLA) to demonstrate that a plasma can be used to miniaturize a particle accelerator from km to meter scales. This experiment uses the 3 km linear accelerator (linac) at the SLAC national laboratory to drive wakes and accelerate particles in meter-scale plasma placed at the end of the linac. This work has been recently featured in articles in Nature, Physics Today and several Physical Review Letters in the past year. Professor Katsouleas is also Chair-Elect of the USC Faculty Academic Senate.

Diandra Leslie-Pelecky
After receiving undergraduate degrees in Physics and Philosophy, Diandra Leslie-Pelecky earned a PhD from Michigan State University in 1991, for research on the crossover of spin-glass behavior from 3D to 2D in multi-layered nanoscale structures. Following postdoctoral work on the structural glass transition in orientationally disordered crystals and magnetic transitions in chemically synthesized magnetic nanoparticles, she became an Assistant Professor in the Department of Physics & Astronomy and the Center for Materials Research & Analysis at the University of Nebraska-Lincoln in 1996 and an Associate Professor in 2002.

Professor Leslie-Pelecky's research has been funded by the National Science Foundation, the Office of Naval Research, the Air Force Office of Scientific Research, the National Institutes of Health and the Nebraska Research Initiative. A more recent line of research is in collaboration with the University of Nebraska Medical Center and Los Alamos National Laboratory to develop biocompatible multifunctional magnetic nanofluids to be used for the detection and treatment of cancer.

In addition to research, Professor Leslie-Pelecky has a long-standing interest in scientific education in K-12 schools and for the general public. She currently co-directs Project Fulcrum, a National Science Foundation-funded program that teams graduate students in math, science and engineering with middle- and elementary-school teachers to enhance science and math education in the Lincoln Public Schools.

Dev Majumdar
Having spent his entire life in Palos Verdes, CA, Dev Majumdar decided to head east for college at the Massachusetts Institute of Technology. Four years and a degree later, he is more resolute than ever on coming back west, and will be spending the next six years at UCLA, getting a Biochemistry PhD. While at MIT, he studied a combination of literature and biology, and wrote regularly for the campus newspaper. The newspaper job got him to several press junkets and a few interviews with lesser-known celebrities. Majumdar also played a villain and helped direct an independent film with several friends. For the past year, he has focused more of his efforts into developing screenplays, and hopes to keep it a permanent fixture in his life as he goes through grad school.

Bogdan Marcu
A native of Romania, Bogdan graduated from the Polytechnic Institute of Bucharest obtaining an MS Degree in Aeronautical Engineering. While an engineering student and later as an engineering professional he has been a member and contributing writer for the Solaris Group, a Bucharest based science fiction film and literature club issuing a

monthly publication. Besides original work (short stories), contributions included translations of selected short stories from the English language fandom. The club enabled a valuable mélange of contributions mixing original work with translations from English (Asimov, P.K. Dick and many others), Russian (first Romanian translations of the Strugatsky Brothers' Roadside Picnic), French (Gerard Klein) and Japanese.

After seven years of aeronautical industry experience in Europe, Bogdan experienced the revolutionary changes of 1989 on the streets of Bucharest, and then left for studies in the US, getting a PhD degree in Aerospace Engineering from the University of Southern California in 1996. During his graduate studies and postdoctoral research with the USC he enjoyed exploring the world of computer simulations for various physics as well as doing aerodynamic car tests on the USC's wind tunnel and on dry bed of the El Mirage Lake in the Mojave desert, besides reading fiction literature and watching films as much as time has allowed.

Currently a Senior Engineering Scientist with the Rocketdyne Propulsion and Power Division of the Boeing Company, Bogdan is involved in the development of rocket propulsion for launching systems and space propulsion systems. Significant work includes prototype-certified redesigns for the Space Shuttle Main Engine subsystems, and Delta IV upper stage engine subsystems.

Matt Siegler

Matt Siegler was born and raised in the small town of Wayne, Illinois, where the Chicago suburbs meet the countryside. In high school, he was involved in acting and writing and had an interest in filmmaking and special effects. His parallel interest in science was egged on by documentaries and a summer class at nearby Fermi National Accelerator Lab. After a year at Ithaca College studying film, and a summer as an intern back at Fermilab, Siegler decided the scientist in him was taking over. He transferred across town to Cornell where he concentrated on Physics and Astronomy, while still completing a Film major in that school's small department. He worked in particle physics during the summers, and with the now famous Mars Rovers and student films during the school years. Science education became a very dominating factor in Siegler's life through weekly museum volunteer work, helping him forge a definite link between science and filmmaking-public science education through mass media.

A year since graduation, Siegler spent eight months in Switzerland working on a particle physics project, and currently is working on Mars science at Caltech. This fall, he will begin a Master's at the University of Chicago, likely to continue towards PhD studies in Planetary Astronomy with the hopes of strengthening him as a scientist and a science educator.

Edward Stites

Ed Stites is in his fifth year at the University of Virginia in their Medical Scientist Training Program (combined MD/PhD program). His research involves studying cell signaling networks with both mathematical and biological techniques. His wife is an elementary school reading specialist and they live in the foothills of the Blue Ridge

Mountains. He enjoys comedies and is an active member of the Charlottesville Area Organization of Screenwriters (CAOS).

Michael Strong
Michael Strong's scientific interests span the fields of chemistry, biology, genetics, biochemistry and computer science. He is currently finishing his PhD degree at the University of California, Los Angeles, where he has developed new methods for the analysis of sequenced genomes. While at UCLA, he has published a number of scientific papers on topics ranging from protein nanotechnology to bacterial pathogenesis. After earning his BS in Microbiology, with a concentration in Genetic Engineering, from the University of California, Santa Barbara, Strong pursued his interest in DNA Biochemistry at the California Institute of Technology. He has also conducted research, in the biotechnology sector, on the molecular detection of DNA.

In addition to his research interests, Strong has a sincere interest in making science more accessible to the general public. As part of this goal, he has participated in outreach programs that focus on teaching important scientific concepts to middle school and high school students. He has received numerous awards for his work, including the NIH National Research Service Award, the Paul Boyer Outstanding Teaching Award, the UCSB Outstanding Research Award and the UCLA Dissertation Year Research Award.

Valerie Weiss
Valerie Weiss is a writer/director living in Los Angeles. She recently completed her second film, I LOVE YOU, about a fashion photographer obsessed with his elusive muse. Weiss also co-wrote, directed and produced the feature film DANCE BY DESIGN, which has screened at film festivals in London, Providence, Boston, San Luis Obispo and Philadelphia, as well as at the Boston Museum of Fine Arts. Having majored in Molecular Biology and minored in Theater and Dance at Princeton University, Weiss went on to do her PhD at Harvard Medical School in Biological Chemistry and Molecular Pharmacology. For her thesis, she solved the X-ray crystal structure of a methyltransferase involved in nuclear transport. While at Harvard, Weiss founded and served as the Filmmaker-in-Residence of the Dudley Film Program. Weiss is currently writing several scripts for film and television, including a feature film called LOSING CONTROL.

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Sylvie Beaudin
Sylvie Beaudin grew up in a small, isolated town in Canada. At the age of 19, Beaudin chose to go to veterinary school. During college, she traveled around the planet to explore lifestyles outside of North America. After earning a DVM diploma, she worked for a year as a small animal veterinarian. She then took a job working in a diagnostic laboratory, which required pathology training that she didn't have, so Beaudin headed off to Oklahoma State University in 2000, where one of the pioneers of veterinary pathology was kind enough to take her under his wing, and make a decent pathologist out of her. Looking for a change of pace when she was done,

Beaudin went to live in Paris for three months. Lack of money—and reality—brought her back to the United States where she has been working for a veterinary diagnostic laboratory in Irvine, California, for the last year and a half.

Leo Cheng

When Leo Cheng was seven years old, his ethnic Chinese parents moved his family to Guam. The warm tropical nights and clear dark skies supplied the ingredients for Cheng's dreams of space flight. By the time he graduated high school, he knew he wanted to study astronomy and engineering. Cheng attended college at Cal Poly Pomona and majored in Physics because it is the foundation of both astronomy and engineering. After graduating from Cal Poly, he spent two years as a research Physicist at Rensselaer Polytechnic Institute in Troy, New York. With a Masters degree in Physics, he returned to Los Angeles and found employment at NASA's Jet Propulsion Laboratory (JPL). He was able to land a job with the Galileo Mission to Jupiter, designing the scientific experiments performed on board the spacecraft. After a five-year stint on Galileo, Cheng decided to expand his career into the world of commercial aerospace. He left JPL to work as a Mission Systems Engineer for Hughes Space and Communications, now called Boeing Satellite Systems. One of his toughest assignments was being the Mission Operations Lead for a satellite mobile phone system, where he was responsible for assembling the team of flight directors and engineers, training them to work in a real-time mission control environment. Three years ago, Cheng returned to JPL, not wanting to pass up an opportunity to explore another planet: Saturn.

Today, Cheng continues working for the Cassini-Huygens mission as the Science Planning Engineer. With his background in both science and engineering, Cheng's job involves planning and coordinating complex science experiments, balancing science objectives with the capabilities of the spacecraft. A participant in the 2004 Catalyst Program, Cheng is determined to bring humanistic stories about scientists and engineers to the big screen.

Paula Grisafi

Paula Grisafi is a molecular biologist studying yeast and plant genetics at Whitehead Institute for Biomedical Research at MIT. The eldest of seven children of Italian parents, Grisafi spent her formative years in Catholic girls schools. In spite of this, or because of it, she became interested in biology and chemistry in her early teens, an interest which has remained with her.

Grisafi has a Bachelor's degree in Biology with a Chemistry minor from Molloy College, and a Master's degree in Biology from Boston University. She has spent her working career doing research, first at Cornell Medical College in Manhattan, then at Cold Spring Harbor Laboratory on Long Island, then the Biology Department at MIT and now at Whitehead. Grisafi lives with her husband, also a scientist, and two dogs outside of Boston.

Amy Snyder Hale

Amy Snyder Hale is a graduate of the University of Richmond, where she majored in

Physics, and the University of Pittsburgh, where she studied Planetary Science. She has worked at the Jet Propulsion Laboratory studying Mars for the past five years, and is currently working on the Mars Reconnaissance Orbiter, which is slated to launch August 10. For fun, Hale enjoys scuba diving in California's coastal waters, and sailing on her cantankerous sailboat. She lives on Mount Wilson with three cats, her husband and one-year-old daughter.

G. Jeffrey Hoch
Jeff Hoch has professional backgrounds both as a writer and scientist specializing in environmental remediations. He began his professional career as a newspaper reporter, photographer and editor with newspapers in Pennsylvania for several years, then switched careers to be a hydrogeologist with environmental firms in Pennsylvania and Indiana. Although still active as a hydrogeologist, Hoch's career focus today is combining his two educational and professional backgrounds as a science/environment journalist with a variety of publications. He is currently working on a book about the effects of pesticides on farm workers in the United States.

John Hulteen
John Hulteen has a BS in Chemistry from the University of Puget Sound in Tacoma, Washington; both an MS and PhD in Physical/Analytical Chemistry from Northwestern University in Evanston, Illinois; and a postdoctoral fellowship from Colorado State University in Fort Collins, Colorado. He initially worked for Quantum-MKE as an electroplating engineer developing new read/write heads for hard disk drives. Currently, he is a research and development specialist at 3M developing low adhesion liners for pressure sensitive adhesives. His primary technical background includes creating and studying nanoscale structures and devices, analytical detection of ultra-trace compounds, and designing thin films with distinct chemical properties.

Diandra Leslie-Pelecky
After receiving undergraduate degrees in Physics and Philosophy, Diandra Leslie-Pelecky earned a PhD from Michigan State University in 1991, for research on the crossover of spin-glass behavior from 3D to 2D in multi-layered nanoscale structures. Following postdoctoral work on the structural glass transition in orientationally disordered crystals and magnetic transitions in chemically synthesized magnetic nanoparticles, she became an Assistant Professor in the Department of Physics & Astronomy and the Center for Materials Research & Analysis at the University of Nebraska, Lincoln, in 1996 and an Associate Professor in 2002.
Leslie-Pelecky's research has been funded by the National Science Foundation, the Office of Naval Research, the Air Force Office of Scientific Research, the National Institutes of Health and the Nebraska Research Initiative. A more recent line of research is in collaboration with the University of Nebraska Medical Center and Los Alamos National Laboratory to develop biocompatible multifunctional magnetic nanofluids to be used for the detection and treatment of cancer. Leslie-Pelecky was a participant in the 2004 Catalyst Workshop.

Update July 2006:
"Las week, I signed the final contract for a popular book on the science behind NASCAR. Believe it or not, if you want to see a real scientist, mathematician or engineer on television, NASCAR is one of the most likely places to do so. The book will be released by Dutton in February 2008 (in time for Daytona) and they have committed to a significant publicity effort."

"To top it all off, the producer who worked with my colleague Tim Gay on the Physics of Football is now working for NASCARImages, the production company arm of NASCAR. We pitched a show on NASCAR science to the Science Channel and they asked us to submit a treatment for a series instead of a one-off show. Although these things seem to take a really long time to work their way through to actually happening, Science Channel is interested and I would get to write for the show, possibly with an on-camera role. NASCAR has a goal of having a movie a year with a NASCAR theme, my producer at NASCARImages has prior experience producing a Hollywood movie and, yes, I have a story developed and I even figured out how to involve nanostructured materials as a legitimate plot point."

Ricki Lewis
Ricki Lewis is a science writer with a PhD in genetics from Indiana University, where she worked with flies that had legs growing out of their heads. She has published thousands of articles in a wide variety of magazines. She is currently a regular contributor to *The Scientist*, *Nature* and *Applied Neurology*. Lewis has been a genetic counselor since 1984 and has taught various biology courses at SUNY Albany, Empire State College and Miami University. She is author or co-author of five life science university-level textbooks published by McGraw-Hill Higher Education and an essay collection published by Blackwell. She is a hospice volunteer and a frequent public speaker. Lewis is married to a chemist and has three daughters and many cats.

Herbert Lin
Herbert Lin is senior scientist and senior staff officer at the Computer Science and Telecommunications Board, National Research Council of the National Academies, where he has been study director of major projects on public policy and information technology. These studies include a 1996 study on national cryptography policy (*Cryptography's Role in Securing the Information Society*), a 1991 study on the future of computer science (*Computing the Future*), a 1999 study of Defense Department systems for command, control, communications, computing and intelligence (*Realizing the Potential of C4I: Fundamental Challenges*), a 2000 study on workforce issues in high-technology (*Building a Workforce for the Information Economy*), and a 2002 study on protecting kids from Internet pornography and sexual exploitation (*Youth, Pornography, and the Internet*). Prior to his NRC service, he was a professional staff member and staff scientist for the House Armed Services Committee(1986-1990), where his portfolio included defense policy and arms control issues. He also has significant expertise in math and science education. He received his Doctorate in Physics from MIT. Avocationally, Lin is a longtime folk and swing

dancer and a poor magician.

Sam Mandegaran
Sam Mandegaran is a half Chinese and half Iranian who immigrated to the United States over 10 years ago. He did his undergraduate studies at Caltech in Electrical Engineering and Economics, even though he really wanted to be a Theoretical Physicist. He then went to Princeton for graduate school, but dropped out and returned to Caltech to pursue a PhD in Electrical Engineering. Recently, Mandegaran has been taking directing and filmmaking classes because he has become very frustrated with the image of science in our society, especially among teenagers, and has decided the only way to make a difference is through movies and TV.

Bogdan Marcu
A native of Romania, Bogdan Marcu graduated from the Polytechnic Institute of Bucharest obtaining an MS Degree in Aeronautical Engineering. While an engineering student, and later as an engineering professional, he has been a member and contributing writer for the Solaris Group, a Bucharest-based science fiction film and literature club issuing a monthly publication. Besides original work (short stories), contributions included translations of selected short stories from the English language fandom. The club enabled a valuable mélange of contributions mixing original work with translations from English (Asimov, P.K. Dick and many others), Russian (first Romanian translations of the Strugatsky Brothers' *Roadside Picnic*), French (Gerard Klein) and Japanese.

After seven years of aeronautical industry experience in Europe, Marcu experienced the revolutionary changes of 1989 on the streets of Bucharest, and then left for studies in the US, getting a PhD degree in Aerospace Engineering from the University of Southern California in 1996. During his graduate studies and postdoctoral research with USC, he enjoyed exploring the world of computer simulations for various physics, as well as doing aerodynamic car tests on the USC's wind tunnel and on a dry bed of the El Mirage Lake in the Mojave desert, besides reading fiction and watching films as much as time has allowed.

Currently a Senior Engineering Scientist with the Rocketdyne Propulsion and Power Division of the Boeing Company, Marcu is involved in the development of rocket propulsion for launching systems and space propulsion systems. Significant work includes prototype-certified redesigns for the Space Shuttle Main Engine subsystems and Delta IV upper stage engine subsystems. Marcu was a participant in the 2004 Catalyst Workshop.

Jeffrey Matsuura
Jeffrey Matsuura is a consultant who works with the creators of technology to develop commercial applications for their technology. Born in Cleveland, Ohio, and raised in the Washington, DC, metropolitan area, Matsuura earned degrees from Duke University, the University of Virginia and the Wharton School at the University of Pennsylvania. He is the author of three non-fiction books, and the co-author of

another, on topics associated with the business, public policy and legal aspects of technology. He is currently writing a book on nanotechnology policy, and coauthoring a book on the telecommunications industry. Matsuura has taught, as an adjunct and as a full-time instructor, at the community college, undergraduate, graduate and professional school levels, in the United States and abroad.

Louis Nguyen
Louis Nguyen has recently finished his graduate studies at UCLA where his research focused on understanding the mechanisms by which neurons use to form networks. It was also during this time living in Los Angeles that, as evidenced by his late fees at Cinefile (a video store), he was bitten by the film bug. Prior to graduate school, Louis was an undergraduate at Brown University and worked for several years as a research assistant at Stanford. Born and raised in Northern California, Nguyen does not show any contempt for Southern Californian culture and has never gone wine tasting. His favorite movies include GOODFELLAS, LE SAMOURAI and IN THE MOOD FOR LOVE.

Michael Seringhaus
Michael Seringhaus is a graduate student in the Department of Molecular Biophysics and Biochemistry at Yale University. He worked as a rotation student with Mike Snyder and Sidney Altman before joining Mark Gerstein's Bioinformatics Group. Before coming to Yale, Seringhaus graduated from the University of Toronto (Trinity College) and spent a year as the lead bioinformatics scientist at Affinium Pharmaceuticals (previously Integrative Proteomics, Inc.) in Toronto, where he spearheaded the company's computational biology initiative.
In spring 2003, Seringhaus was awarded an NSERC PGS-B fellowship by the Canadian government. He is a Graduate Affiliate of Trumbull College, and held a McDougal Fellowship for two years, working as the Writing Fellow at the Yale School of Graduate Studies. He is a member of the Graduate Student Assembly and represents the graduate students on the Executive Committee. He served on the editorial board of the *Yale Journal of Biology and Medicine*, and works as a staff writer for the Biological and Biomedical Sciences program magazine, *B*. He has also worked as a sailing instructor at the Yale Corinthian Yacht Club (YCYC), in addition to founding the Graduate Sailing Society (GraSS). He writes a regular column in the Yale Daily News and draws a comic strip for the Yale Herald .

Rebecca Sokol
Rebecca Sokol is a Tenured Professor of Medicine and Obstetrics and Gynecology at the Keck School of Medicine of the University of Southern California. She received her BA degree from Pitzer College of the Claremont Colleges and earned her MD and MPH (with an emphasis in Health Communication) from the Keck School of Medicine of the University of Southern California. Sokol is an internist/endocrinologist specializing in infertility. She conducts research in the areas of reproduction and toxicology. The NIH has funded Sokol's research for over 20 years, and she has published many research papers and chapters and received numerous awards for her research. Sokol is the Past President of the Pacific Coast

Reproductive Society and President-Elect of the Society of Male Reproduction/Urology, an affiliate of the American Society of Reproductive Medicine. She is a member of the Editorial Advisory Board of the premier infertility journal, *Fertility and Sterility*, and is a member of the National Association of Science Writers. Sokol is listed in the *Top Doctors in America* and *The Best Doctors in America*.

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Natalia Alexandrov

Natalia Alexandrov is a senior research scientist at the Systems Analysis and Concepts Directorate of the NASA Langley Research Center. Her general interests are in computational science and engineering, with emphasis in modeling, design, and optimization of large-scale complex systems. Her recent work is in multidisciplinary problem synthesis and optimization of supersonic aircraft, space exploration vehicles, and transportation networks. She is an associate editor of the AIAA Journal and Optimization and Engineering.

Douglas Ballinger

Lieutenant Colonel Douglas Ballinger currently serves as Professor of Aerospace Studies at the University of Minnesota (Twin Cities). During his 17 years of service, Douglas has performed a myriad of duties including personal protection of the President of the United States, defense planning with the Japan Defense Agency, and system security engineering of various weapons and reconnaissance platforms at the Aeronautical Systems Center, Wright-Patterson Air Force Base, Ohio. As a screenwriter, he has completed a screenwriting course in Salt Lake City and the "Writing for and Working with Hollywood: An Introduction for Scientists and Engineers" short course taught by author/screenwriter Syd Field and director Alex Singer . Additionally, Douglas has written a feature-length STAR TREK speculative script and has written for G. R. Claveria, an independent filmmaker in Los Angeles.

Alvin Chin

Alvin Chin graduated from Harvard College (A.B., *magna cum laude*, Biochemical Sciences, 1973) and Stanford University School of Medicine (M.D., 1977). After two residency years in general pediatrics, he did three fellowship years in pediatric cardiology at The Children's Hospital of Boston. After serving on the faculties of Harvard and UCLA, he joined the faculty of the University of Pennsylvania School of Medicine as assistant professor in 1984, later becoming associate professor and full professor. Until 1994, Alvin focused on developing ultrasound imaging techniques to non-invasively evaluate the various surgical reconstruction strategies used for congenital heart defects. During sabbatical leave in 1994, he pursued postdoctoral work in developmental biology and genetics with Mark Fishman at the Cardiovascular Research Center at Massachusetts General Hospital. Since returning to The Children's Hospital of Philadelphia, Alvin has turned his attention to identifying the underlying etiologies of congenital heart disease. Currently, he is studying the genetic regulation of embryonic heart development utilizing the zebrafish (Danio rerio)—an organism with rapidly developing, transparent embryo—as a model system.

Mark Greene
Mark Edward Greene is a National Research Council postdoctoral fellow at the National Institute of Standards and Technology in Gaithersburg, MD in the Optical Technology Division where he is studying the interactions between single biomolecules such as DNA and proteins. Mark earned Bachelor's degrees in Communications (Radio/TV/Film) and Materials Science and Engineering at Northwestern University in 1998 and 2000, respectively. He then immediately began work on a Ph.D. at Northwestern in Materials Science where he used atomic force microscopy and image analysis to study the elastic properties of DNA. After finishing his doctorate in 2005, he moved to Washington, DC for his current position. Mark's scientific interests include biophysics, nanotechnology, and various forms of advanced high-resolution microscopy. He enjoys the visual appeal and artistic nature of microscopy and has reckoned that the difference between shooting a film scene and imaging a molecule is simply a matter of scale and technology involved.

Suzanne Nguyen
Suzanne Nguyen is a writer trapped in the body of a molecular biologist writing up her Ph.D. thesis at MIT and the Whitehead Institute for Biomedical Research in Cambridge, MA. Her thesis describes a mutant mouse with neurological defects. Before coming to Cambridge, she graduated with a degree in biology from the California Institute of Technology in Pasadena, CA. Her first creative piece to be published outside of the blogosphere or the sphere of school underground publications will appear on Lablit.com, a site for literature on the culture of science.

Sidney Perkowitz
Sidney Perkowitz was born in Brooklyn, NY, and was educated at Polytechnic University, New York, and the University of Pennsylvania. As Charles Howard Candler Professor of Physics at Emory University, his research on the properties of matter has produced over 100 scientific papers and books. He has been funded by most major governmental agencies and
has served as a consultant to industry and to the US and foreign governments. He's a Fellow of the American Association for the Advancement of Science. In 1990, his interests turned to presenting science to non-scientists via books and articles, media, lectures, museum exhibits and stage works. His popular science books *Empire of Light, Universal Foam* and *Digital People* have been translated into six languages. He has written for The Sciences , Technology Review , the Los Angeles Times , Washington Post, *Encyclopedia Britannica*, and others. Media appearances and lectures include CNN, National Public Radio, the BBC and other European radio and TV, Smithsonian Institution, New York Museum of Natural History and the NASA Space Flight Center, among others. He is the author of the performance-dance piece *Albert and Isadora*, and the stage plays *Friedmann's Balloon* and *Glory Enough*. His newest book is *Hollywood Science*, to be published in 2007.

Perry Rose
Perry Rose graduated from CSU, Fullerton in 1990 with a B.S. in Physics. After briefly working with a professor in the laboratory analysis of the Diffuse Interstellar Bands, he

started working at JPL in a near-earth asteroid search project (PCAS, now reincarnated at NEAT). The team would spend one week each month using the 18" Schmidt at Palomar Observatory. Rose received numerous co-discovery credits for asteroids but no comets, and has one asteroid named for him—(9637) Perryrose. In 1991, he started working at Mt. Wilson Observatory at the 60-Foot Solar Tower telescope on a helioseismology project operated through USC. Nine years later, he went back to school and received an M.S. in physics in 2004 from USC. Rose continues to work on the helioseismology project as the project manager of the group. In his spare time, Rose volunteers as a telescope operator for the 16" and 60" telescopes at Mt. Wilson Observatory in educational outreach. He is an avid film fan, and dreams of building the ultimate home theatre system... after he becomes independently wealthy.

Ted Scambos
Dr. Ted Scambos is a glaciologist at the National Snow and Ice Data Center, at the University of Colorado in Boulder. Using satellite images and other data, he has tracked the effects of rapid climate change over several areas near the poles. He has visited Antarctica nine times. Earlier in his professional and academic life, he worked as an offshore geologist for the oil industry, and as a planetary scientist studying the moon and Mars. Gardening, writing and winemaking have been his hobbies, with varied success (ask for the white, and pass on the red). He and his wife and two sons live in Lafayette, CO.

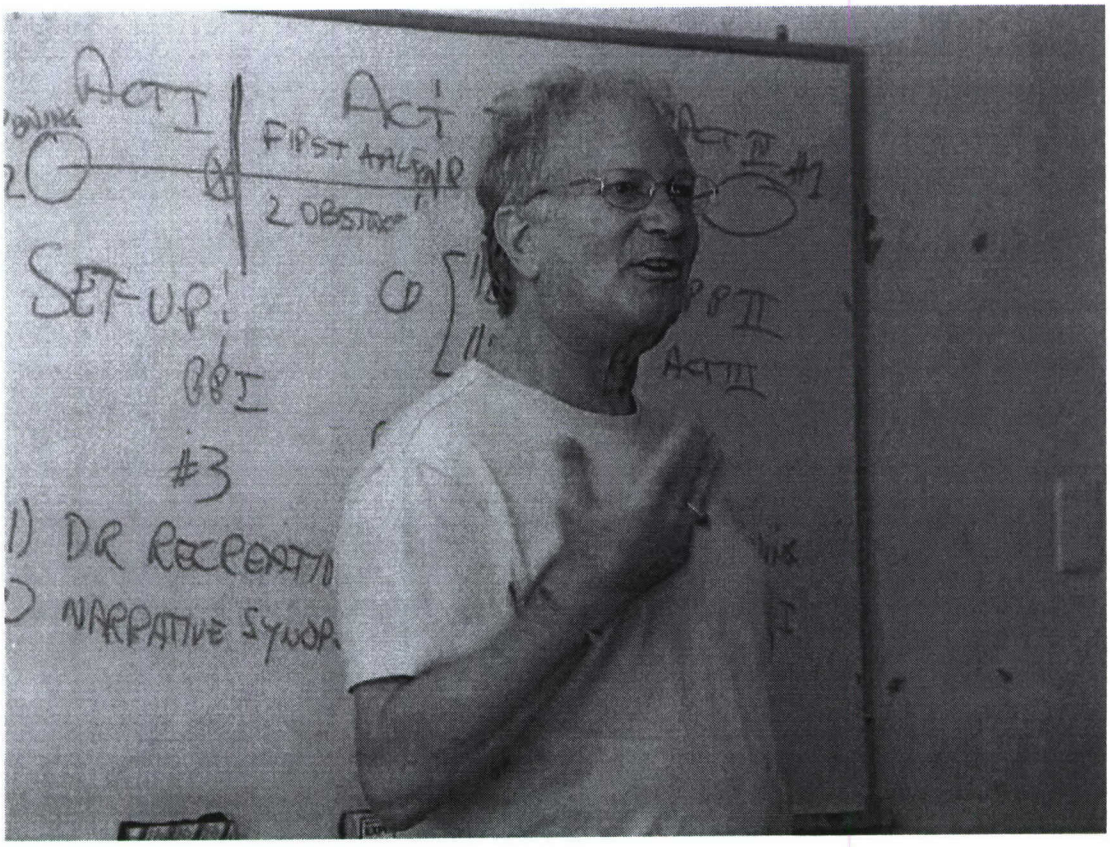
Jason Wiedenmann
Jason Wiedenmann currently works at a local college teaching general and organic chemistry. He is also finishing a second Master's degree in environmental engineering at USC. He has an undergraduate degree in chemistry from the University of Kansas where he went on a football scholarship and a Master's degree in atmospheric science from the University of Missouri. Additionally, Wiedenmann had one year of graduate study in atmospheric chemistry at UCLA. He has worked as a hazardous waste chemist as well as an environmental compliance officer. He began writing screenplays in 1998 and moved to Los Angeles to pursue that career. Recently, he has been writing more television specs and was accepted into Fox's writer's program last year.

Laura Wojcik
Dr. Laura Wojcik is a Senior Director with Packer Engineering in Ann Arbor, Michigan, where she is a consultant in the areas of biomechanics and mechanical engineering. Prior to joining Packer, Dr. Wojcik worked for Exponent, Inc. and for the Department of Engineering Science and Mechanics at Virginia Tech, where she performed research in musculoskeletal biomechanics and taught undergraduate and graduate courses in mechanical and biomedical engineering as an Assistant Professor. Before her faculty appointment, Dr. Wojcik was a Whitaker Fellow and a Postdoctoral Research Fellow at the University of Michigan. She earned her Ph.D. and M.S.E. in Mechanical Engineering from the University of Michigan and a B.S. in Mechanical Engineering from Michigan State University, where she was an Alumni Distinguished Scholar and a member of the Honors College. Dr. Wojcik is also a licensed Professional Engineer and has participated in professional workshops including the NAE's Frontiers of Engineering Symposium and

the Summer Institute on Aging Research sponsored by NIH and the Brookdale Foundation.

APPENDIX F: PHOTOGRAPHS FROM AFI CATALYST WORKSHOP 2005

Participants at the 2005 AFI Catalyst Workshop



Syd Field lectures at the 2005 AFI Catalyst Workshop

Pat Quinn and workshop participants at the 2005 AFI Catalyst Workshop