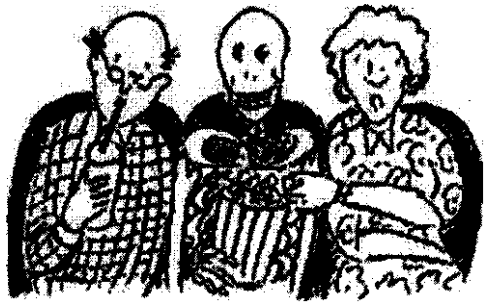
FEASIBILITY EVALUATION OF

SCIENCE IN THE CINEMA



FINAL REPORT

Prepared for the Office of Science Education, National Institutes of Health

by

Clare Von Secker, Ph.D.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Description of *Science in the Cinema.*

Science in the Cinema is a summer film festival for the general public held at the National Institutes of Health (NIH) in Bethesda, Maryland. The film series format is modeled after a similar program run by Dr. Danny Wedding at the Missouri Institute of Mental Health. The NIH Office of Science Education (OSE) initiated the series on the NIH campus in the summer of 1994 and has continued to sponsor the program annually. All films are shown with captions. Interpreters and real-time captioning are available for the post-film discussions.

One evening a week for six weeks each summer a film with a scientific theme is screened. *Science in the Cinema* evenings begin with brief remarks from OSE Director Dr. Bruce Fuchs, who introduces a guest speaker with expertise about the scientific or public health issue raised in the film. Following the screening of the film, the guest speaker provides additional background about the topic, identifies fictionalized elements of the film, and answers questions from the audience. For example, following showing of *Lorenzo's Oil* in 1994, guest speaker Dr. Hugo Moser of the Kennedy Krieger Institute in Baltimore, Lorenzo's physician, and Lorenzo's parents, Dr. and Mrs. Odone, answered questions about the ways they and Lorenzo were portrayed in the film and the scientific research connected with understanding and treatment of adrenoleukodystrophy, an incurable degenerative disease. That same year, Dr. Danny Wedding used the film *Benny and Joon* as a vehicle for increasing public understanding of clinical issues associated with diagnosis and treatment of schizophrenia and public awareness of how the media exploits some of the myths about mental illness.

Evaluation Purpose.

Since 1994, four goals of *Science in the Cinema* have been to (1) educate the public about scientific topics addressed in each film; (2) increase public awareness of Hollywood's tendency to add fictional elements to films, even those that are purportedly based on true stories; (3) correct common misconceptions that result from fictionalized portrayals in the media; and (4) promote the visibility of the missions of different institutes at the NIH. The primary purpose of this feasibility evaluation was to develop an outcome evaluation plan for measuring how well *Science in the Cinema* can expect to meet these program goals. Two key questions addressed in this evaluation were:

1. What is the best overall approach for evaluating *Science in the Cinema?*
2. What specific data collection strategies would be most appropriate for conducting an outcome evaluation?

Evaluation Design and Implementation.

Decisions about the optimal evaluation design for *Science in the Cinema* were informed by (1) a review of formative evaluations of *Science in the Cinema* from 1994 to 2000; (2) a purposive case study of transcripts of videotaped portions of *Science in the Cinema* sessions conducted in 1998; (3) a literature review of theoretical and empirical evidence surrounding the use of films to influence attitudes, correct misconceptions, and foster scientific literacy; and (4) an examination of evaluations of comparable programs.

Key Findings.

1. The average size of the audience for each film increased from about 225 to 900 participants between 1994 and 2000. There is every reason to believe that future audiences will number 1000 or more per evening. There is sufficient public

interest in and community support for Science in the Cinema to support a decision to continue to present this program annually.

2. Approximately 15% of the audience on any given evening completed and returned evaluation surveys. A modified version of a survey used in 2000 could provide information about why individuals attend Science in the Cinema, the demographic characteristics of the audience, participant reaction to the film and speaker, and whether individuals continue to discuss and learn about the topic after the session concludes (e.g., by discussing the evening with friends, viewing the movie again, reading materials provided by participating Institutes, or visiting Institute web sites on the Internet).
3. The NIH OSE has detailed documentation on implementation and evaluation of Science in the Cinema from 1994 to 2000 including copies of evaluations, audiotapes of sessions presented in the summers of 1998 and 1999, and logistical information that could be compiled into a handbook and used to facilitate dissemination of the program at other sites nationwide.
4. Science in the Cinema guest speakers educate the public about scientific topics addressed in each film. Speakers take advantage of audience engagement with the characters and plot to provide information about public health issues. The explicit educational emphasis varies from week to week depending on the theme of the film and the expertise of the speaker.
5. Science in the Cinema increases public awareness of Hollywood's tendency to add fictional elements to films, even those that are purportedly based on true stories. Guest speakers routinely differentiate factual from fictitious elements in

the films either by drawing audience attention to the accuracy of the scientific concepts presented in the film or by pointing out the invalidity of the underlying scientific premises.

6. There is no evidence that *Science in the Cinema* corrects common misconceptions about scientific research and public health issues that result from fictionalized portrayals in the media. The questions posed by the audience are more likely to be requests for new or more specific information than they are to be requests for clarification of misunderstandings. The extent to which the audience internalizes information to correct common misconceptions has not been, and probably cannot be, measured.
7. *Science in the Cinema* promotes the visibility of the missions of the NIH. Many of the guest speakers are Institute Directors or intramural scientists who describe their research goals and the numbers of persons who are likely to benefit directly or indirectly from their research. NIH publications are routinely distributed to the audience to further explain scientific or public health issues presented in the films.
8. Most health education programs, drug education programs, and programs aimed at increasing public understanding of science have never been evaluated and thus are not useful models to guide development of instruments for conducting an outcome evaluation of *Science in the Cinema.*
9. Of the few comparable program evaluations that are available, the most common information-gathering methods are surveys (e.g., self-reports, questionnaires), interviews, and document analysis. These methods could be useful and practical for evaluating *Science in the Cinema.*

10. In general, evaluations of comparable programs, if they exist at all, are of limited utility because of (1) selection bias (those who chose to participate and respond may not have been a representative sample); (2) evaluator bias (individuals who evaluated program effectiveness were often those responsible for running the program); and (3) practical considerations that limited data collection (e.g., insufficient funding, unrealistic goals).

Recommendations.

Modification of Program Goals. One of the original goals of *Science in the Cinema* was to correct common misconceptions about scientific research and public health issues that result from fictionalized portrayals in the media. However, exactly what these common misconceptions are or how participants' misconceptions influence or are influenced by their interpretation of events depicted in film is unknown. Further, consideration of alternative methods of creating conceptual change and understanding beyond the instructional strategies currently practiced during program implementation is unlikely. This goal should be modified.

Educational research suggests that science misconceptions tend to be pervasive and highly resistant to change or alteration, especially by traditional teaching methods (Engel-Clough & Wood-Robinson, 1985; Helm & Novak, 1983; Hopp,1985; Lawrenz, 1986; Osbome & Gilbert, 1980; Roth, 1985; Smith, 1983; Smith & Anderson, 1984a, 1984b). Future attempts to achieve this goal are impractical given the short duration of the intervention and the limited fiscal and administrative resources allocated for this program. What is feasible is for the NIH to identify a key concept or "take-home

message" for each film and to encourage each speaker to emphasize that message during introductory remarks and in post-viewing discussions.

There is ample evidence from feedback obtained from *Science in the Cinema* participants over the last seven years that this format increases public interest in and awareness of the scientific research and public health issues underlying fictionalized portrayals in films. Future evaluations could examine (1) how well *Science in the Cinema* increases public understanding of scientific research and the public health issues addressed in each film; (2) how well *Science in the Cinema* speakers and participants are able to distinguish factual from fictitious elements in the films; (3) the degree to which program outcomes are sensitive to participant demographic characteristics; (4) the relative effectiveness of different film genres; and (5) obstacles that prevent participation.

Optimal Evaluation Approach. Each evaluation method has advantages and drawbacks given the evaluation's purpose, design, implementation, findings, conclusions, and utilization. Evaluation approaches for programs such as *Science in the Cinema* are best informed by a mix of quantitative and qualitative techniques that balance the limitations of one paradigm with the strengths of another. Selection of a mixed methods approach is driven also by consideration of the extent to which the collected data will answer the evaluation questions, the practicality of the proposed timeline, the cost-effectiveness of the methods, and the likelihood of revealing significant, but unanticipated, program outcomes. A mixed method evaluation approach is optimal for measuring multiple program outcomes, minimizing threats to the internal and external validity of the evaluation findings, and providing information about *Science in the Cinema* that can be utilized meaningfully by a broad audience.

Optimal Data Collection Strategies. A mixed method approach that incorporates both quantitative and qualitative data collection strategies will provide the most complete evidence of attainment of three recommended goals of *Science in the Cinema,* namely to (1) educate the public about the scientific topics addressed in each film; (2) increase public awareness of Hollywood's tendency to add fictional elements to films, even those that are purportedly based on true stories; and (3) promote the visibility of the missions of different Institutes at the NIH. Six data collection techniques recommended for evaluating *Science in the Cinema* program outcomes are described below.

1. Survey techniques. Survey techniques have been used to evaluate *Science in the Cinema* since 1994. A modified version of an instrument that was used in 2000 could assist in evaluating how well sessions educate the public about scientific and health topics, increase individuals' sensitivity to the ways that "true stories" are presented in film, and increase public awareness of the missions of the NIH.

2. Document studies. Project records or documents available from the NIH OSE such as participant exit evaluations of each *Science in the Cinema* session, audiotapes, and longitudinal records of the logistical considerations involved in program presentation, can provide insights about program history, program implementation, the effectiveness with which the program promotes the visibility of the missions of the NIH, and whether the established program format is replicable and transportable.

3. Interviews with Key Informants. Selected OSE program staff can serve as key informants who provide "insider perspectives" about program implementation and success and "institutional memory" about the causes, rationale, and reasons for the decisions and approaches that guided evolution of the program. Because the number of

program staff who could serve as key informants is small, they can be interviewed individually. Advice and feedback from key informants will increase the credibility and utility of the outcome evaluation.

4. Structured Observations. Structured observations of *Science in the Cinema* can be planned and conducted using a carefully constructed protocol. During the pilot phase of the outcome evaluation, observations may be used to help develop focus group protocols. In the final outcome evaluation, observations can be used to evaluate the extent to which participants understand the key concepts, ask relevant questions, and are engaged in appropriate interactions.

S. Videotapes. Analysis of videotaped data would provide anecdotal evidence of how well various sessions educate the public about the scientific topics addressed in each film and increase public awareness of Hollywood's tendency to add fictional elements to films based on true stories. On-line versions of the video could increase the visibility of the NIH and provide a resource for teachers and the general public.

6. Focus Groups. Focus groups are useful to pretest topics or ideas that later will be used for quantitative data collection, to assist with interpretation of quantitative findings, to obtain participant perceptions of project outcomes and impacts, to identify problems in program implementation, to identify project strengths and weaknesses, to solicit recommendations, and to generate awareness of unanticipated program outcomes.

Optimal Evaluation Benchmarks. The feasibility evaluation provides advice about what outcomes of *Science in the Cinema* should be measured and how to measure them. With the exception of measuring conceptual change, the program goals proposed in 1994 are realistic and measurable. Review of formative evaluations conducted from 1994 to

2000 suggests that additional outcomes, notably those related to increasing the visibility of the NIH and disseminating the program nationwide, deserve attention as well. The following benchmarks will help OSE gather evaluation data that can be utilized by the NIH and others.

1. Pilot Survey Instrument. The 2001 version of Science in the Cinema should include a pilot evaluation of a survey instrument that incorporates (1) "checklist" items used in 2000 (i.e., "How did you hear about the program?" and "Why did you come to Science in the Cinema tonight?"); (2) items that ask the audience what they learned and how their awareness of Hollywood's tendency to add fictional elements to films was heightened; (3) requests for contact data and participation in focus groups; and (4) items that measure whether Science in the Cinema promotes the visibility of the missions of the NIH. The last group of items would ask participants how likely they are to (1) discuss the film with others (e.g., friends, family) after the session is over; (2) watch the film again (e.g., rent or buy a videotape or CD version of the film, watch a televised version of the film); (3) read the NIH publications that are distributed during the session; (4) visit an NIH web site; or (5) contact a related organization (e.g., National Alliance for Mental Health). The pilot survey instrument should be written by July 2001 and used in the summer of 2001. Data obtained from these surveys should be analyzed and summarized by December 2001.

2. Conduct Document Analysis. Document analysis of project records available from the NIH OSE can be used to develop the pilot survey and to design a handbook that records logistical considerations involved in program implementation. Audiotapes of sessions from 1999 and 2001 should be transcribed and analyzed to determine what film

selections, discussion strategies, and speaker-audience interactions most support program goals. Document analysis of evaluations for 2001 should be used to provide evidence of how well Science in the Cinema promotes the visibility of the missions of the NIH (e.g., identifying the N1II Institutes or Centers featured in different films; calculating the kind and number of NIH publications disseminated at each session) and to determine whether the established program format is replicable and transportable. Audiotaped versions of videotapes from 1999, which are available from OSE, should be transcribed by August 2001 and analyzed by March 2002. Document analysis should be completed by June 2002. If staffing permits, a Science in the Cinema Handbook should be compiled by September 2003.

3. Interview Key Informants. Key informants for this evaluation are the OSE staff responsible for presenting the program. These individuals are a tremendous resource for documenting everything from film selection to the logistics of program implementation. Interviews with this group will provide confirmatory evidence about how well Science in the Cinema promotes the visibility of the missions of the NIH and guidance for developing a handbook that would summarize considerations and actions required for a new staff to replicate or transport the program. Interviews with key informants should be completed by December 2001.

4. Conduct Structured Observations of Participants. Information obtained from structured observations of Science in the Cinema participants will be most useful if observers agree ahead of time on criteria and terms for describing events and behaviors. Structured observational data can be used to generate better understanding of (1) differences among participants who stay for the discussion sessions versus those who

leave when the movie has ended; (2) who asks questions; (3) interactions among participants; (4) what participants do with publications and other materials that are disseminated at each session (e.g., read them prior to viewing the film, take them home); and (5) other audience reactions to the speaker or the film, or both, that reflect audience engagement and learning. In addition to providing corroborating evidence about program success, the data can be used to help develop focus group protocols. The structured observation protocol should be completed by July 2001 and used to observe Science in the Cinema 2001 participants. Observational data should be analyzed and summarized by December 2001. A revised version of the instrument used for conducting structured observations should be prepared by June 2002.

5. Videotape Science in the Cinema in 2001. Videotapes of Science in the Cinema are useful for evaluating and disseminating the program. Videotapes provide evidence of how well various sessions meet program goals and can be used as a resource for others. On-line versions of the videotapes, like those available from previous summers, provide a resource for teachers and the general public nationwide. Videotapes from Science in the Cinema 2001 should be available on-line by October 2001. Analysis of the videotapes should be completed by August 2002.

6. Collect Focus Group Data. The survey used in 2001 is expected to include items that will ask participants whether they are willing to join a focus group and collect contact information from those volunteers. Several focus group sessions, each composed of Science in the Cinema 2001 participants with shared characteristics, can (1) illuminate interpretation of other quantitative and qualitative data and (2) illustrate how demographic characteristics, educational and occupational background, and prior

experiences influence program outcomes. A preliminary focus group protocol should be prepared by September 2001. Pilot focus group sessions should be conducted by November 2001. Results of feedback from focus groups and observational data can be used to inform development of a focus group protocol for use in evaluation of Science in the Cinema 2002.

Evaluation Utilization.

The findings of the proposed outcome evaluation can be used to (1) provide feedback about program effectiveness and value; (2) facilitate program replication and dissemination; and (3) develop reliable and valid instrumentation for measuring program effects. Evaluation findings will provide the NIH OSE with information about the effectiveness of and community support for Science in the Cinema and can be used to inform decisions about whether to continue to allocate financial and administrative support for the program on the NIH campus. Examination of internal documents and interviews with key informants will provide a formal record of the logistics underlying effective implementation of Science in the Cinema and the considerations essential to program management and success. This information will be useful for anyone interested in replicating the program. The instrumentation developed and piloted during a series of outcome evaluations will be tailored to measure specific program goals and will provide a consistent way to evaluate the effectiveness of Science in the Cinema regardless of when or by what organization it is presented. Inclusion of an evaluation component with a program aimed at promoting public understanding of science and public health will strengthen the contribution of Science in the Cinema as an educational resource and as a model for comparable program evaluations.

FEASIBILITY EVALUATION OF *SCIENCE IN THE CINEMA*

INTRODUCTION

Science Education at the National Institutes of Health.

We are a society of movie watchers. Films have long been used as instructional tools for helping audiences develop better understanding of and increased sensitivity to health problems. Pescosolido (1990) discussed how feature films could be used to influence sociological perspectives of health, illness, and healing. Perez (1988) described a literature-based program designed to inform junior and senior high school students about mental illness and to demonstrate the extent to which film versions represent inaccurate portrayals of reality. Dodson (1987) used a similar approach to help future nurses understand the human dimensions of illness and disability. The National Institutes of Health (NIH) uses film to enhance public understanding of science and to help individuals appreciate how fictionalized portrayals of scientific research and public health issues by the media influence their attitudes and beliefs.

Description of *Science in the Cinema.*

Science in the Cinema is a summer film festival for the general public held at the National Institutes of Health (NIH) in Bethesda, Maryland. The film series format is modeled after a similar program run by Dr. Danny Wedding at the Missouri Institute of Mental Health. The NIH Office of Science Education (OSE) initiated the series on the NIH campus in the summer of 1994 and has continued to sponsor the program annually. All films are shown with captions. Interpreters and real-time captioning are available for the post-film discussions.

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DATA ANALYSIS

Review of Formative Evaluation Data from 1994 to 2000.

The OSE has been collecting formative evaluation data of *Science in the Cinema* since 1994. Analysis of documents available from OSE staff suggests that, on average, approximately 15% of the questionnaires distributed to the audience were returned at the end of each session.

In 1994 evaluation questions were designed to generate demographic and educational profiles of the audience, to identify the most effective methods for advertising the series, and to gather feedback about audience reaction to the films, the speakers, and the setting. Feedback was used to improve the program so as to better meet the needs of the audience, particularly persons with disabilities.

From 1995 to 1999 formative evaluation data consisted mainly of informal feedback from individuals (e.g., comments ranging from rave reviews about the program to complaints about the technical quality of the video and audio portions of the film or about room temperature) and a short questionnaire consisting of open-ended items designed to gather data about who attended the program, (i.e., demographic and occupational profiles of attendees), how participants heard about the program and their reasons for coming, whether participants had attended *Science in the Cinema* before (i.e., previous summers or other sessions during that year), and individuals' reactions to the films and speakers. The audience also was invited to suggest film ideas for coming years.

In 2000 the questionnaire was streamlined and checklists replaced some open-ended items. For example, open-ended items such as "How did you hear about the program?" and "Why did you come to *Science in the Cinema* tonight?" were modified to include checklists of most typical responses. This questionnaire could provide more useful information if more explicit responses could be elicited from open-ended questions such as "Do you think [this movie] is a good choice for *Science in the Cinema?"* and "Do you think the scientific discussion led by [the speaker] after the film was beneficial?" Typical responses to these items are one-word answers (e.g., Yes! or Great!) that are not helpful for measuring how well program goals are met.

The size of the audience has increased steadily from 150 to 300 persons per night in 1994 to 650 to 1100 persons per night in 2000. As the popularity of the program exploded, OSE moved the sessions from the original auditorium (maximum capacity 500) to a larger auditorium with overflow rooms (capacity greater than 1100). Approximately half of the audience is likely to leave at the end of the film rather than stay for the

speaker's presentation. However, the remaining participants could provide a sufficient sample for conducting an outcome evaluation of *Science in the Cinema.*

***Science in the Cinema** 1998: A Purposive Case Study*.

The NIH presented the **fifth** *Science in the Cinema* film festival in 1998. Results of audience feedback from four previous summers had convinced the NIH that there was community support for this program. By then the size of the audience on the NIH campus each week often exceeded the capacity of the auditorium and some of the crowd of 1100 participants or more had to watch the film from overflow rooms. As word spread in the science education community about popularity of *Science in the Cinema* the program began to be replicated at other sites nationwide including at Harvard University and at Ohio State University. Science teachers also expressed interest in this particular program as a way of engaging and informing students.

OSE decided that one way to share the world-class experts with teachers and members of the public throughout the United States who might be interested in this program would be to videotape the introduction and the question-and-answer sessions of *Science in the Cinema.* Within weeks after each session, streaming video versions of the interactions between the guest speakers and their audiences were available on the OSE web site for students, science teachers, and the public.

Six films were screened in 1998: *Panic in the Streets, Drugstore Cowboy, Children of a Lesser God, As Good As It Gets, The Three Faces of Eve,* and *Gattaca.* As in previous years, this collection of films dramatized a range of scientific and public health problems, one of which had a historical as well as scientific focus.

The 1950 film *Panic in the Streets* portrays a public health service doctor's search for a killer who, in committing his crime, was exposed to a deadly virus and is at risk for becoming contagious and spreading an outbreak of the plague in New Orleans. This film was selected in part to commemorate the bicentennial anniversary of the Public Health Service. National Library of Medicine (NLM) Public Health Service Historian Dr. John Parascandola talked about the history of the film as well as about epidemiological issues surrounding transmission and treatment of the pneumonic form of *Yersinia pestis.*

Drugstore Cowboy follows the fate of a junkie, his wife, and another couple as they spiral ever deeper into a life of crime to finance their drug addictions. The film offers a realistic depiction of addicts' compulsive drug seeking and use in the face of negative consequences. The Director of the National Institute on Drug Abuse (NIDA), Dr. Alan Leshner, one of the world's foremost experts on drug addiction, noted that differences between voluntary behaviors associated with drug abuse and the state of compulsion associated with the brain disease drug addiction are "beautifully depicted in this not so beautiful movie."

Children of a Lesser God uses the fictional romance between a teacher at a school for the deaf and a deaf woman who works there to dramatize the real issues and challenges of two people trying to find a common ground for communication. Ironically, this was an evening that the sound portion of the film delayed viewing. The Director of the National Institute on Deafness and Other Communication Disorders (NIDCD), Dr. James Battey, discussed medical and social aspects of communication and noted that the film

"underscores the fact that there is no one size that fits all for communication among human beings and that in different families and that in different settings and different circumstances, different ways of promoting language skills and communications will work better."

As Good As It Gets is a story about a popular writer who suffers from obsessive-compulsive disorder (OCD) and how his interactions with a gay neighbor and a favorite waitress gradually help him realize the importance of people for one another. The Chief of the Child Psychiatry Branch at the National Institute of Mental Health (NIMH), Dr. Judith Rapoport, an expert on obsessive-compulsive disorder in adults and children, rated Jack Nicholson's performance an A' for showing some of the typical obsessions and compulsions that an otherwise rational and successful person may have and how positive relationships could provide an important source of behavior therapy.

The Three Faces of Eve portrayed the real-life story of the emergence of multiple personality disorder (MPD) in a young Georgia housewife and her psychotherapist's attempts to help her find her true identity. Psychiatrist-in-Chief at the Johns Hopkins Hospital and Director of the Department of Psychiatry and Behavioral Sciences at Johns Hopkins University, Dr. Paul McHugh, discussed whether MPD is a psychological response to life experiences and the possibility of repressed memories being the mechanism for MPD.

The science-fiction film *Gattaca* served as a vehicle for discussion of ethical and moral issues inherent in genetic engineering and the potential horrors of genetic technology. In *Gattaca,* society is divided into a genetically altered "superior" race, the

"valids," and "invalids" who are conceived the traditional way.

The Director of the National Human Genome Research Institute (NHGRI), world-renowned scientist Dr. Francis Collins, discussed his reaction to the film's premise of genetic determinism, the issue of whether DNA predicts enough about a person that this kind of a society could actually be possible, and some of the implications of genetic technology now and in the future.

An examination of the transcripts of audiotapes of the introduction and question and answer sessions from 1998 provided a snapshot of how well *Science in the Cinema* met four program goals, namely, to (1) educate the public about the scientific topics addressed in each film; (2) increase public awareness of Hollywood's tendency to add fictional elements to films, even those that are purportedly based on true stories; (3) correct common misconceptions about scientific research and public health issues that result from fictionalized portrayals in the media; and (4) promote the visibility of the missions of different Institutes at the NIH.

Goal 1: Educating the Public. All of the speakers took advantage of audience engagement with the characters and plots to provide information about public health issues. Each speaker's educational emphasis was slightly different, in large part because of the nature of the film and the expertise of the speaker. Scientists' remarks included drawing attention to small details of historical significance, focusing on one "take-home message," brief summaries of the biological basis of disease, some of the controversies surrounding disease diagnosis, etiology, and treatment, and the fine line between today's science fiction and tomorrow's science and technology.

NLM Public Health Historian Dr. John Parascandola drew attention to minor historical details of *Panic in the Streets* that might be overlooked by most viewers. He pointed out, "fm sure you all remember the scene at the end of the picture when Jack Palance is climbing the rope trying to reach the ship. Well that device on the rope that impeded his progress was a rat protector, or rat guard, which was designed to prevent rats from climbing up from the wharf onto the ship and a real motivation for developing these kinds of devices was a concern about the spread of plague by transporting rats which carried the disease."

In introducing the concept of drug addiction in *Drugstore Cowboy,* NIDA Director Dr. Alan Leshner focused audience attention on the difference between drug abuse and drug addiction. Before viewing *Drugstore Cowboy,* the audience saw a single slide that read, "What is addiction? It is compulsive drug seeking and use in the face of negative consequences." The audience was asked to think about those negative consequences as they watched the film. After the film, Dr. Leshner revisited the take-home message of the evening, saying, "Drug abuse is a voluntary behavior, but drug addiction is a disease. It's a disease of the brain that comes about because of what prolonged drug use does to the brain thereby resulting in that state of compulsion that's the essence of addiction." He used a slide of a functional MRI to illustrate how prolonged drug use actually changes the brain in fundamental ways that persist long after the individual stops using the drug.

NIDCD Director Dr. James Battey used the film *Children of a Lesser God* to increase public awareness of the prevalence of hearing disorders among people of all ages. He reported, "One out of every thousand infants born in this country and in fact

throughout the world [is] born unable to hear and about one child in 22 has a significant hearing problem. It's estimated that about 15 out of a thousand people under 18 in America have some type of hearing impairment and that 415 out of a thousand people over the age of 75 have significant hearing impairment, so it's a problem that affects both the young and the old." Dr. Batty explained the mechanics of hearing and identified the most common target for diseases and disorders that cause hearing impairment. He used a scanning electron micrograph of the hair-like structures (stereocilia) in the cochlea to emphasize the fragility of specialized middle and inner ear structures and to illustrate how easily they might be damaged.

NIMH psychiatrist and researcher Dr. Judith Rapoport took advantage of public engagement with the characters and story of As *Good* As It *Gets* to educate the audience about the biological basis of OCD. She explained that current scientific evidence points to associations of specific biological brain circuitry with typical OCD behaviors such as efforts to avoid contamination, repeating rituals, and magical numbers. She noted that scientists have speculated about why the brain would evolve such circuits and suggested that behaviors such as contamination avoiding may involve some sort of evolutionary adaptive circuitry.

The Three Faces of *Eve* discussant Dr. Paul McHugh used the film to educate the public about how film can influence individual behaviors and public perceptions of mental illness. He asserted that patients with MPD are not consciously fraudulent but rather sincerely believe that they have multiple personalities and act accordingly. Dr. McHugh contended that in reality MPD patients are troubled by a variety of other mental illnesses and "are responding to the socio-cultural prompts that specify both the forms

and the explanations for hysterical presentations." Dr. McHugh claimed that the prevalence of hysteria throughout history (from the Salem witch trials to the present) was directly correlated with cultural attitudes and belief systems. He noted that release of *The Three* Faces of*Eve* led to "a mini-epidemic of multiple personality generated by the patients' beliefs ... and physicians' interest in it."

NHGRI Director Dr. Francis Collins' educational approach was to ask the audience to consider their reactions to the provocative futuristic film Gattaca and imagine the implications of an ever-sophisticated understanding of the human genome. He queried, "Is that where we're headed? Can they really do that stuff? Can they do some of it now? Is this where we as a society are sort of irreversibly tracking ourselves based on all of the things we're learning about genes? After all, we're reading the newspaper practically every week about some new gene discovery. And where is this all leading anyway? We read about genes not only for diseases but genes for novelty seeking, or anxiety, or male homosexuality. All of those have been much in the news. Where is this all going to stop?" His questions were designed to lead the audience to one conclusion, namely, that "although it's never spoken in the movie, [there is] a little statement [in the credits] which says, `There is no gene for the human spirit.' That's the bottom line; that's the moral of this film, and don't you forget it!"

Goal 2: Increase Awareness of Factual versus Fictional Film Elements. Guest speakers routinely differentiate factual from fictional elements in the films. Most of the time speakers drew audience attention to the accuracy of the scientific concepts presented in the film. In 1998 four scientists found the films to be mostly realistic portrayals with

few liberties taken for artistic license and two generated spirited discussions about the validity of the scientific premises on which the stories were based.

In reviewing Panic in *the Streets,* Dr. Parascandola compared the measures taken to prevent an outbreak of disease in the movie with those that would have been realistic in 1950 when the film was made. He noted, "The discussion of the pneumonic plague ... is reasonably accurate. Giving [streptomycin] for treatment or perhaps even as a preventive measure for someone exposed to the disease would indeed be the treatment of choice... As for the plague vaccine in the film, however, which actually gets the majority of the attention, it's questionable as to how useful this would have been in the circumstances [because] the vaccine takes weeks to really take effect. So it probably would not have helped any to vaccinate those people who had already been exposed to the disease. One gets the [mistaken] impression ... that [if we] vaccinate these people ... they're fine."

In referring to a character from *Drugstore Cowboy,* Dr. Leshner commented, "I was very struck by the insightful comment that [main character] Bob made when he was talking about his experience that you can't talk an addict out of being an addict, or you can't talk an addict into just giving it up. And that's true. That also took us 20 years to discover scientifically. But the phenomenon is a state of compulsion and it's very difficult for people to conceptualize that."

In her opening comments about As Good As *It Gets* Dr. Judith Rapoport began, "Speaking as an expert on OCD...Jack Nicholson gave a very good example of some of the typical obsessions and compulsions that someone may have. First of all, and most strikingly, in many ways he's quite a rational, reasonable, and a normal person, and then he has these dramatic islands of irrationality, magical behaviors with these strange rituals,

repeating, counting, and most pervasively and strikingly, contamination ...Obsessive-compulsive patients, whether they've met anybody before with this or not, whether they are children or adults, do a lot of things very, very similarly ... The very juxtaposition of a very normal, charming, and increasingly attractive man, certainly a talented writer, a good piano player together with these very weird nonfunctional islands is almost a hallmark of the disorder."

Dr. Rapoport noted the gratuitous nastiness of the main character in the film was "a certain amount of artistic license" with what was otherwise an accurate portrayal of OCD. She noted, "Certainly, people with obsessive-compulsive disorder can be lonely, alienated, and depressed, but one thing that I think is not typical is the extraordinary degree of hatefulness." She also made more explicit details about five different effective medications for obsessive-compulsive disorder that are alluded to in the film, noting that "[The medication Jack Nicholson referred to] would have likely been one anti-depressant out of many anti-depressants ... with serotonin action that are main line first drug treatments for OCD."

Unlike other speakers in the series, psychiatrist Dr. Paul McHugh focused on fiction surrounding the disorder itself, not just its representation in the film. In summarizing *The Three Faces of Eve* Dr. McHugh warned the audience, "What I am going to say is quite counter to the concept really shown in this film, so beautifully, so persuasively, and so powerfully." He said, "You've seen a very nice example of a behavior that's beautifully depicted by our actress ...but the fact is that that film-which was so very persuasive ...[is a fiction] ...The film certainly showed you how interesting it would be to any doctor, let alone anyone else, to see such a performance ...but multiple

personalities are always artificial productions, the product of the medical attention that they arouse." He agreed that patients exhibiting MPD were mentally ill, but argued convincingly MPD was really a hysterical behavior that served socio-cultural purposes, not a result of psychological or somatic conditions or traumatic life experiences.

In separating the factual and fictitious elements of Gattaca, NHGRI Director Dr. Francis Collins explained first why genetic determinism was impossible, noting "Certainly, there are hereditary components to lots of human characteristics. We know that don't we, if we've ever met a pair of identical twins? But if you get to know a pair of identical twins who share all of their DNA you will quickly understand that they are not identical people at all."

Dr. Collins also addressed "a couple of silly things with this movie that are really wrong" such as getting a printout of a potential love interest's entire DNA sequence done and reported on five sheets of paper. He exclaimed, "Give me a break here. The genome is three billion base pairs. She would have had to walk out of there with a dump truck!" However, he noted that the public would face more subtle applications of genetic engineering and, ultimately, would have to decide how they felt about using genetic technology not just to prevent or cure disease but to produce offspring with specific genetic traits.

Dr. Collins conceded that some of the technological issues raised in Gattaca were far more than Hollywood hype. For example, early in the film an injured little boy was denied insurance coverage because of his "genetic endowments." Scenes throughout the film illustrated how genetic information could be used to foster employment discrimination. Dr. Collins reminded the audience that "It is possible now if you happen

to undergo a gene test that says you're at risk for some future illness, and such tests are beginning to appear, that in some circumstances, you may lose your health coverage or have your insurance premiums raised to the point where you can no longer afford them." And he added that already it is possible to obtain predictive genetic information in the workplace.

In another seemingly improbable scene from Gattaca, a couple create and sample a very large number of potential embryos by doing a DNA diagnostic test on the cell to predict the genetic endowment of each and select "the most compatible candidate." Dr. Collins reminded the audience that, while such a practice is not done now, it could be possible some day. He noted, "There are people working on this technique, a pre-implantation genetic diagnosis, and it has been applied in a small number of instances for couples who are at risk for Tay-Sach's disease or cystic fibrosis, for instance. But the notion of applying it to character traits seems as if one is crossing over a very significant line and many of us feel that line really shouldn't be crossed. But there will have to be a lot of debate about that. You can't draw a nice clean dividing line sometimes between diseases and traits."

Dr. Collins emphasized that Hollywood reflects what's going on around us and uses film to portray particular notions and perpetuate myths. He emphasized that far from what Gattaca would suggest, genetic determinism should be recognized as the fantasy that it is. He reminded the audience, "We are a lot more than our genes. We are also influenced ... by our environment, by our parents, by our peers, and by our own free will. Free will is not going to go away even after we get through the genetic revolution. I want to reassure you about that."

Goal 3: Correcting Misconceptions. One scientist explicitly stated a common misconception about disease in 1998. In his review of *Drugstore Cowboy* Dr. Leshner stressed, "What's important in addiction is not what most people think of, which is physical dependence ... but actually the compulsion to use drugs in the face of negative consequences." This format could be useful for making future audiences aware of some of the myths and stereotypes perpetuated by the media even if this awareness does not immediately correct common misconceptions.

The questions posed by the audience were more likely to be requests for new or more specific information than they were to be requests for clarification of misunderstandings. A member of the audience for *Children of a Lesser God* asked, "Could hearing loss be caused by pressurized cabins of aircraft for people who are traveling? I've heard a claim by one or two people who've thought they lost hearing shortly after flying." This may be a common misconception. NIDCD Director Dr. Battey reminded everyone that, "there is no systematic study that would support that contention."

Panic in the Streets generated questions about the epidemiology of a plague and reflected more a lack of conceptual knowledge than misconceptions. Typical questions were "After you are inoculated, how long does the vaccine last?" and "I'd like know if there is, like, a less chance of that happening now than there was in 1950?" and "If a morgue today were to come up with something like this, just whom would they call to decide if it were a problem, you know, if they just got a body that looked kinda weird, and then how would they act on that?"

Goal 4: Increased Visibility. Six films screened in 1998 drew attention to the general mission of the NIH as a public health organization, and to more specific missions of the National Institute on Drug Abuse (NIDA), the National Institute on Deafness and Other Communication Disorders (NIDCD), the National Institute of Mental Health (NIIAH), and the National Human Genome Research Institute (NHGRI). Examination of the videotape transcripts revealed that guest scientists Drs. Judith Rapoport and Paul McHugh each commented on how the films they reviewed increased awareness and acceptance of public health issues.

Science in the Cinema provides the general public with opportunities to learn more about the missions of individual Institutes at the NIH. Speakers, many of whom are Institute Directors, are able to discuss what the Institutes do and the numbers of persons who are likely to benefit directly or indirectly from medical research. For example, in his follow-up remarks to *Children of a Lesser God,* Dr. Battey spent a few minutes talking about the range of NIDCD-supported research endeavors including disorders of hearing, balance, smell, taste, voice, speech and language. He noted, "In our portfolio of grants and contracts, we have studies and research on exploring the basic processes of hearing as well as grants on the acquisition of language, both spoken and signed. We have grants to support knowledge of both oral auditory strategies for young, deaf children as well as studies to try to figure out how to optimally use American Sign Language. And our portfolio includes the development of new technologies and assistive devices, including improved TTY, which is a telecommunication device to help deaf individuals communicate, and computer-aided communication devices (hearing aids as well as cochlear implants) which are devices that bypass the inner mechanisms of the

ear ... stimulating the auditory nerve directly and facilitating communication and perception of sound by some deaf individuals."

Science in the Cinema: **A Literature Review.**

There is ample evidence that *Science in the Cinema* educates the public about scientific topics and increases public awareness of Hollywood's tendency to add fictional elements to films, even those that are purportedly based on true stories. There is only weak anecdotal evidence that *Science in the Cinema* increases public awareness of common misconceptions that result from fictionalized portrayals in the media and no evidence that misconceptions are corrected. A review of the literature investigated the theoretical and empirical evidence associated with the notion that *Science in the Cinema* reasonably can expect to be a vehicle for correcting misconceptions, influencing public perceptions, and changing attitudes.

Usine Film to Correct Misconceptions. Misconceptions are ideas or beliefs that are at variance with conceptions held by experts in the field. Misconceptions may arise from lack of basic content knowledge or may be the result of complex belief systems comprised of logically linked sets of ideas and assumptions that are used in systematic ways (Anderson & Smith, 1987; Barrass, 1984; Driver & Easley, 1978; Fisher, 1985, Osbome & Wittrock, 1983; Trowbridge & Mintzes, 1985). These misconceptions can prevent assimilation of new learning and interfere with acceptance of other, more scientifically grounded, explanations or theories (Watson & Konicek, 1990).

Educational research suggests that science misconceptions tend to be pervasive and highly resistant to change or alteration, especially by traditional teaching methods (Engel-Clough &Wood-Robinson, 1985; Helm & Novak, 1983; Hopp,1985; Lawrenz,

1986; Osborne, & Gilbert, 1980; Roth, 1985; Smith, 1983; Smith & Anderson, 1984a, 1984b). Efforts to correct common misconceptions about scientific research and public health issues would involve (1) identification of key concepts presented in each film; (2) consultation with experts to anticipate the range of misconceptions held by a diverse audience; (3) evaluation of participants' prior knowledge and understandings of scientific research and public health issues depicted in each film; and (4) integration of new information to generate deeper understanding and correct misconceptions (Carey, 1986; Duschl, 1990; Novak & Gowin, 1984; Posner, Strike, Hewson, & Gertzog, 1982). Given the challenges associated with teaching for conceptual change, any expectation that *Science in the Cinema,* particularly in its present form, is sufficient to correct common misconceptions about scientific research and public health is impractical.

Impact of Film on Conceptual Understanding and Attitudinal Change. Film has a pervasive effect on public perceptions and attitudes (Borchers, 1997; O'Donnell, 1983; Safran, 1998; Thomsen, 1993). Adolescents report that they learn about important issues by watching music videos on MTV (Christenson & Roberts, 1990). Thomsen (1993) proposed that negative public perception of teachers, education, and the nation's public schools was linked to themes and myths developed in American movies. Long (1996) argued that the growing anti-intellectualism in American Society is reinforced by negative portrayals of college faculty in popular films. Vaughan (1990) discussed how cultural caricatures of engineers popularized in fiction and films influence career choice.

Science and science fiction films have been used to explore and correct myths and misconceptions of students and the general public about a variety of topics including marine biology (Fortner, 1985), entomology (Weiss, 1989), and science and technology

(Murphy, 1996; Telotte, 1993). Evidence that films influence behavior is mixed. National attitudes about racial equality are traced to films (Aleiss, 1987). English (1972) found that the appeal of drug education films was due primarily to their emotional rather than their factual components. O'Donnell (1983) claimed that film violence, particularly that rationalized by sympathetic characters, increased aggressive behavior in viewers. But Stack (1990) found no statistical evidence of a link between films about teenage suicide and teenage suicide rate.

Allison (1966) looked at the effect of a film program and follow-up activities on attitudes of elementary school students toward science, scientists, and scientific careers. Pretest-posttest differences demonstrated the value of using experts to lead group discussions following the film. Distributing multiple choice focus questions to the audience prior to viewing the film also enhanced performance. Historically, studies support the belief that films can be effective mechanisms for creating attitudinal change (e.g., Merrill, 1957; Weisberger & Coles, 1971).

Review of Comparable Evaluations.

Determination of the best evaluation approach for *Science in the Cinema* was informed by examining evaluations of comparable programs, namely those that aimed to educate the public about health issues that affect them and those designed to increase public understanding of science. The comparison is a useful way to find sources of and solutions to common evaluation problems. Four elements of each group of evaluations were considered, namely, (1) the rationale for the program, (2) program goals, (3) how program effects were measured, and (4) the implications for designing future evaluations. Analysis of evaluation components of programs promoting public health education or

public understanding of science was expected to facilitate identification of ways in which program effects have been measured in the past and consideration of the implications for evaluating *Science in the Cinema.*

Comprehensive Health Education Programs. Comprehensive health education curricula present information about disease control, personal health, environmental and/or community health, family life and/or sex education, consumer health, nutrition, fitness, safety and first aid, mental health, and substance use. In addition, comprehensive school health education programs includes activities that enhance students' communication, decision-making, and responsible self-management skills. These school-based programs typically promote development of (1) health knowledge and health-related skills; (2) positive attitudes toward health and well being; and (3) adoption of healthier behaviors. In general, the review of these programs offers little guidance for developing instruments for conducting outcome evaluations of comparable program such as *Science in the Cinema* because the evaluations, if they exist, are methodologically weak and data collection methods are poorly described.

Tobacco, Alcohol, and Drug Education Programs. One of six national goals for American education (U.S. Department of Education, 1990) is that every school in America will be free of drugs and violence and will offer a disciplined environment conducive to learning. A longstanding approach to achieving **that goal has** been infusion of tobacco, alcohol, and other drug prevention programs within the school health education program. Most of these drug education programs have never been evaluated (Goodstadt, 1986). Of those for which evaluations are available, the most common information-gathering methods are surveys, interviews, and secondary sources of

information, such as school absenteeism and dropout rates, drug-related hospital admission data, and arrest rates for drug use and drug-related crimes. The evaluation approaches for these programs suggest that a mixed method evaluation that examines multiple outcomes (e.g., knowledge, attitudes, and behaviors) is appropriate.

Federal Drug Prevention Programs. With the passage of the Anti-Drug Abuse Act of 1986, the Federal government significantly expanded the delivery of drug prevention programs to school-aged youth. During the past 15 years, a number of strategies have been employed to change the attitudes and behaviors of children and adolescents regarding drug use. One criticism leveled against these efforts is that the programs do not contain a strong evaluative component (U.S. Dept. of Education, 1987; Bangert-Drowns, 1988). Study designs tend to rely on too few subjects and rarely include comparison groups. Assessments of program influence on attitudes and behavior traditionally rely on self-reports that easily can be biased by respondents' expectations about what evaluators want to hear. Conclusions about program effectiveness based on tests of statistical significance can be misleading because statistically significant findings are not necessarily practically significant. In general, weak evaluation methodology has hampered analysis of the effectiveness of many specific drug prevention strategies.

Media Fellowship Program. The Committee on the Public Understanding of Science (COPUS) is a joint venture of the Royal Society, the British Association for the Advancement of Science and the Royal Institution. Their purpose is to raise the profile and level of public understanding of science activities in the UK. One of these activities, the Media Fellowship Scheme, is designed to enable practicing scientists to develop greater awareness of the media. COPUS provides grants to cover salaries,

accommodations, and other costs of releasing scientists from their employers to work with newspapers, radio, television and press agencies and get "inside views" of how the media operates and the day-to-day lives of journalists.

When the collection of COPUS programs was evaluated in 1994, (Evaluation Associates Ltd., 1998a) the primary data collection tool was a questionnaire that contained a mix of open-ended and forced choice items. Likert-style questionnaire items gathered self-report information about how well activities improved participant appreciation, awareness and comprehension of science. A purposive sample of 10% of the respondents was selected for follow-up telephone interviews to gather background information, to explore in greater detail issues raised in the questionnaires, and to validate analysis and interpretation. Overall, 65% of the 903 participants surveyed returned questionnaires; a result that provides a benchmark that can guide expectations about response rates for future evaluations.

The evaluations, prepared by Evaluation Associates Ltd. for COPUS, is a valuable source of data on the effectiveness of events designed to improve public understanding of science. Two shortcomings that limited the utility of these program evaluation findings were (1) participants in the program were a self-selected group so those who chose to respond may not have been a representative sample; and (2) individuals who evaluated program effectiveness were often those responsible for running the program.

Drama Production. The British youth drama, *Cracked,* written and produced by the YMCA's theatre company with the help of funding by Wellcome Trust, toured schools and science festivals in the UK during 1997. The play explored mental illness through the eyes of a young runaway whose descent into suicidal depression was

triggered by the pressures of family and school. The goal of the evaluation was to identify the impact of *Cracked* on students' attitudes towards and understanding of mental illness (Evaluation Associates Ltd., 1998b). Data was collected from a matched sample 2035 students in 20 schools, 1081 before they saw the play, and 954 after. The pretest presented a scenario about a withdrawn and uncommunicative student named Chris and solicited students' opinions about his thoughts and the reasons for changes in Chris' behavior. Content analysis of open-ended responses to this pretest item revealed students' underlying attitudes about mental illness. The posttest included a scenario that measured students' attitudes toward mentally ill people living in the community and items that tested students' understanding and knowledge of mental illness. This design demonstrates a creative quantitative evaluation approach for measuring the impact of public understanding of science initiatives.

Interactive Exhibit. COPUS also sponsored the K-Zone, a set of seven interactive exhibits on health topics (e.g., cancer, heart disease). The aim of the K-Zone is to effectively communicate science facts that will support responsible decision-making. The exhibits are designed to engage the public and de-mystify science and health issues. The impact of the seven exhibits was measured at five contrasting locations in the UK (Evaluation Associates Ltd., 1998a). Pairs of evaluators observed and recorded interactions of 269 individuals with the exhibits and interviewed 41 people viewing exhibits. This design underscores the practical limitations inherent in evaluation of public understanding of science initiatives. Although evaluators could gather quantitative data on how people used and reacted to the exhibits, practical considerations precluded data collection about the impact of the K-Zone on peoples' knowledge and attitudes.

RECOMMENDATIONS

Modification of Program Goals.

One of the original goals of *Science in the Cinema* was to correct common misconceptions about scientific research and public health issues that result from fictionalized portrayals in the media. However, exactly what these common misconceptions are or how participants' misconceptions influence or are influenced by their interpretation of events depicted in film is unknown. Further, consideration of alternative methods of creating conceptual change and understanding beyond the instructional strategies currently employed for program implementation is unlikely. Attempts to achieve this goal are impractical given the short duration of the intervention and the limited fiscal and administrative resources allocated for this program. What is feasible is for the NIH to identify a key concept or "take-home message" for each film and to encourage each speaker to emphasize that message during introductory remarks and in post-viewing discussion sessions.

There is ample evidence from feedback obtained from *Science in the Cinema* participants over the last seven years that this format increases public interest in and awareness of the scientific research and public health issues underlying fictionalized portrayals in films. Future evaluations could examine (1) how well *Science in the Cinema* increases public awareness and understanding of scientific research and public health issues addressed in each film; (2) how well *Science in the Cinema* speakers and participants are able to distinguish factual from fictional elements in the films; (3) the degree to which program outcomes are sensitive to participant demographic

characteristics; (4) the relative effectiveness of different film genres; and (5) obstacles that prevent participation.

Optimal Evaluation Approaches.

Each evaluation method has advantages and drawbacks given the evaluation's purpose, design, implementation, findings, conclusions, and utilization. Evaluation approaches for programs such as Science in the Cinema are best informed by a mix of quantitative and qualitative techniques that balance the limitations of one paradigm with the strengths of another. Selection of a mixed methods approach is driven also by consideration of the extent to which the collected data will answer the evaluation questions, the practicality of the proposed timeline, the cost-effectiveness of the methods, and the likelihood of revealing significant, but unanticipated, program outcomes. A mixed method evaluation approach is optimal for measuring multiple program outcomes and minimizing threats to the internal and external validity of the evaluation findings. This evaluation approach will provide information about the implementation and impact of Science in the Cinema that can be utilized meaningfully by a broad audience both within and beyond the NIH.

Optimal Data Collection Strategies.

A mixed method approach that incorporates both quantitative and qualitative data collection strategies will provide the most complete evidence of attainment of three specific goals of Science in the Cinema, namely to (1) educate the public about the scientific topics addressed in each film; (2) increase public awareness of Hollywood's tendency to add fictional elements to films, even those that are purportedly based on true stories; and (3) promote the visibility of the missions of different institutes at the NIH.

Six data collection techniques are recommended for evaluating *Science in the Cinema* program outcomes. These include one quantitative technique, namely a short self-administered survey or questionnaire, and five qualitative techniques, namely, document studies, interviews with key informants, structured observations, videotapes, and focus groups. The combined input of contextual information obtained by qualitative data collection methods and the statistical data obtained from quantitative analysis will provide the most complete picture of the effectiveness of *Science in the Cinema* with different audiences.

1. Survey techniques. Survey techniques can address quantitatively some of the same questions as those investigated with qualitative data collection methods. Properly constructed surveys are simple to administer and can provide highly credible data in a cost-effective way. Further, a large number of responses are easily transformed for statistical analysis. However, surveys are limited in the extent to which they can tap into the contextual elements that explain why respondents answer as they do. Further, surveys do not allow for unexpected outcomes because individuals will only answer questions that evaluators ask. Complete reliance on self-reports (e.g., surveys or questionnaires) may not provide a complete picture of program effects.

Survey techniques have been used to evaluate *Science in the Cinema* since 1994. These instruments have enlightened formative evaluations by providing information about participant demographics and satisfaction with the program, identifying methods that are most successful for advertising the program, improving delivery of the program (e.g., technical improvements, climate control), and improving accommodations for persons with disabilities (e.g., handicap access; closed-captioned versions of film).

A review of responses to the evaluation question "Why did you come to *Science in the Cinema* tonight?" shows that, year after year, individuals with a wide range of backgrounds attend the program because they enjoy learning the science connected to the film. What is not known is whether some films are more influential than are others. Survey techniques could assist in evaluating how well these sessions educate the public about scientific and health topics, increase public awareness of Hollywood's tendency to misrepresent the reality of scientific research and public health issues in film versions of true stories, and increase public awareness of and support for the missions of the NIH.

2. Document studies. Documents studies involve analysis of a range of written or recorded materials that can include anything from public records such as newspaper archives, to internal records such as videotaped recordings of workshop presentations, to personal diaries or letters. Document studies are conducted for the purpose of gaining insights about a program that cannot be observed or noted in another way. In general, document studies are a practical, cost-effective, and unobtrusiveness method of determining the historical trends of sequences of a program within the context (e.g., setting, language) in which they occur when sources are readily available and accurate. Document studies are not advised if the information is incomplete, imprecise, questionable, lacks authenticity, or is difficult to access.

Project records or documents available from the NIH OSE can provide insights about program history, the logistics of program implementation, and participants' reactions to past programs. These records were not prepared for the purpose of the feasibility evaluation or at the request of the evaluator, but rather provide a historical record of the evolution of the program since 1994. The project records can be divided

into three major categories: (1) participant exit evaluations of each Science in the Cinema session; (2) audiotapes; and (3) records of the logistical considerations involved in program implementation.

Participant Evaluations. Since 1994 the NIH OSE has routinely collected exit surveys from participants. These evaluations are first-person accounts of Science in the Cinema experiences and snapshots of the audiences (e.g., age, gender, occupation). These internal records were formally evaluated by an external evaluator in 1994 and were informally evaluated by program staff from 1995 to 2000. These materials are useful for better understanding the project participants, for formative evaluation of the program, and for comparing outcomes of different summer sessions.

Audiotaped Sessions. Audiotapes of Science in the Cinema sessions from 1998 and 1999 are available from the NIH OSE. A transcript of speakers' introductory remarks and comments, questions posed by the audience, and speakers' responses to questions can be transcribed and the content can be analyzed to evaluate how well the interactions reflect attainment of program goals.

Internal Records. Internal records include mission statements, records of the films and guest speakers for each session, logistics, budgets, manuals, correspondence, and descriptions of program development and modification over time. These internal records reflect an institution's resources, values, processes, priorities, and concerns, and provide an unbiased record or history.

Accurate documents and raw data are readily available for Science in the Cinema. Information from these documents can be used to generate structured observation protocols and focus group questions, to document institutional policies and program

descriptions, to inform decisions about how to increase the visibility of the NIH, and to estimate future program costs. A document analysis of project records would assist analysis of various evaluation alternatives and development of measurable evaluation questions. Document analysis of future records can be used to provide evidence of how well the program promotes the visibility of the missions of individual NIH Institutes and Centers (e.g., calculating the kind and number of NIH publications disseminated at each session) and to determine whether the established program format is replicable and transportable.

3. Interviews with Key Informants. Key informants are persons or group of persons with unique skills, perspectives, or backgrounds relevant for informing the program evaluation. In general, use of key informants is warranted if they are knowledgeable about the subtleties of program implementation, the needs of program participants, or have expertise in areas of interest to the evaluator. Use of key informants is less advantageous if the time required to select and get commitment from them is substantial, there is a risk of bias, or informants may influence the type of data obtained.

OSE staff involved with *Science in the Cinema* can serve as key informants who provide "insider perspectives" about program implementation and success and "institutional memory" about the causes, rationale, and reasons for the decisions and approaches that guided evolution of the program. Because the number of OSE staff members who could serve as key informants is small, they can be interviewed individually. Advice and feedback from key informants will increase the credibility and utility of the outcome evaluation.

4. Structured Observations. Observational techniques are methods by which an individual or individuals gather firsthand data on programs, processes, or behaviors of participants. Observations inform the evaluation process by providing anecdotal or systematic evidence of a variety of behaviors and interactions. Observational techniques may require the services of highly trained, well-qualified observers, and may be expensive and time-consuming. Evaluation designs may limit observations if the procedures are too expensive or time consuming, if the observations are likely to affect the behavior of participants, if the observations are easily biased by investigator perceptions, or if the behaviors observed in a particular situation are atypical. Observational data provides evaluators with a more holistic perspective of program activities and effects than might be obtained by other methods.

Structured observations of *Science in the Cinema* can be planned and conducted using a carefully constructed protocol. Observers can be trained to look for attainment of a set of target concepts, to use preordained criteria and terms for describing events, and to use instruments to gather pertinent information. Instrumentation can be as general as a narrative description of events or as specific as a checklist or a rating scale of specific behaviors or activities that address evaluation questions of interest. Observations of participants of *Science in the Cinema* can be unobtrusive and systematic. During the pilot **phase of the** outcome evaluation, observations may be used to help develop focus group protocols. In the final outcome evaluation, observations can be used to evaluate the extent to which participants understand the key concepts, ask relevant questions, and are engaged in appropriate interactions.

5. Videotapes. Videotapes are a rich source of information about the contextual factors of a program. More information can be captured on videotape than can be recorded by live observers. Videotapes may be used to develop quantitative indicators to validate other evidence of program effectiveness. Multiple passes through the videotape can focus on finding evidence to support different goals and can provide more detailed descriptions of participant questions, reactions, and behaviors. Further, the long "shelf life" of video facilitates unanticipated post hoc analysis in a way that other data collection methods cannot. Analysis of videotaped data can be expensive, time-consuming, and labor intensive. The utility of videotaped data is highly dependent on quality of the recording equipment and the training of the videographer.

Following each *Science in the Cinema* featured film a guest scientist leads an informal discussion with the audience about relevant scientific or public health issues. A videotaped recording of this session would provide a specific narrative description of events and videotaped data could be coded using a rating scale for measuring specific questions, answers, and behaviors or used to help develop focus group protocols. Analysis of videotaped data would provide concrete examples and anecdotal evidence of how well various sessions educate the public about the scientific topics addressed in each film and increase public awareness of Hollywood's tendency to add fictional elements to films. In addition to their analytic value, videotapes can serve as vehicles for widespread dissemination of *Science in the Cinema* to a broad Internet audience.

6. Focus Groups. Focus groups combine elements of interviews, structured observations, and videotape data collection methodologies. Focus groups conducted by experts traditionally take place in a focus group facility that includes recording apparatus

(audio or audiovisual) and an attached room with a one-way mirror for observation. There is an official recorder who may or may not be in the room. Focus groups were used initially as marketing research tools for investigating the appeal of various products. In that context, focus group participants were paid for attendance and provided with refreshments. As users outside the marketing arena (e.g., educators) have adopted focus group techniques these features have became less common.

Focus group sessions are composed of 8-12 people with shared characteristics relevant to the evaluation. Focus groups are distinct from discussion groups, problem-solving sessions, or decision-making groups in that they capitalize on group dynamics. Focus group techniques make explicit use of the group interaction to generate data and insights that would be unlikely to emerge without the interaction found in a group and to allow firsthand insights into the respondents' behaviors, attitudes, language, and beliefs.

Focus groups are recommended over alternative methodologies (e.g., individual interviews) when the group interaction and dynamics are important for stimulating a richer response to better capture the range of differences among individuals. The focus group process is valuable for challenging the clarity of individual communication and thinking and illuminating conflicting opinions. Focus groups are also desirable from a logistic vantage in that staff resources (e.g., the availability of qualified focus group facilitators to control and manage groups) may support data collection from a large number of persons in a few groups when individual data collection with the same number of people would be impractical.

For Science in the Cinema, focus groups can be useful to pretest topics or ideas that later will be used for quantitative data collection, to assist with interpretation of

quantitative and qualitative findings, to obtain participant perceptions about topics raised in the films, to identify and define problems in program implementation; to identify program strengths and weaknesses, to solicit recommendations; and to generate awareness of unanticipated program outcomes.

Optimal Evaluation Benchmarks.

The feasibility evaluation provides advice about what Science in the Cinema outcomes should be measured and how to measure them. With the exception of measuring conceptual change, the program goals set forth in 1994 are realistic and measurable. Unanticipated outcomes from formative evaluations conducted from 1994 to 2000 suggest that additional goals, notably those related to increasing the visibility of the NIH and disseminating the program nationwide deserve attention as well. The following benchmarks will help OSE gather evaluation data that can be utilized by the NIH and others.

1. Pilot Survey The 2001 version of Science in the Cinema should include a pilot evaluation of a survey instrument that incorporates (1) "checklist" items used in 2000 (Le., "How did you hear about the program?" and "Why did you come to Science in the Cinema tonight?"); (2) items that ask the audience what they learned and how their awareness of Hollywood's tendency to add fictional elements to films was heightened; (3) requests for contact data and participation in focus groups; and (4) items that measure whether Science in the Cinema promotes the visibility of the missions of the NIH. The last group of items would ask participants how likely they are to (1) discuss the film with others (e.g., friends, family) after the session is over; (2) watch the film again (e.g., rent or buy a videotape or CD version of the film, watch a televised version of the film); (3)

read the NIH publications that are distributed during the session; (4) visit the NIH web site; or (5) contact a related organization (e.g., National Alliance for Mental Health). The pilot survey instrument should be written by July 2001 and used in the summer of 2001. Data obtained from these surveys should be analyzed and summarized by December 2001.

2. Conduct Document Analysis. Document analysis of project records available from the NIH OSE can be used to develop the pilot survey and to design a handbook that records logistical considerations involved in program implementation. Audiotapes of sessions from 1999 and 2001 should be transcribed and analyzed to determine what film selections, discussion strategies, and speaker-audience interactions most support program goals. Document analysis of evaluations for 2001 should be used to provide evidence of how well *Science in the Cinema* promotes the visibility of the missions of the NIH and to determine whether the established program format is replicable and transportable. Audiotaped versions of videotapes from 1999, which are available from OSE, should be transcribed by August 2001 and analyzed by March 2002. Document analysis should be completed by June 2002. If staffing permits, a *Science in the Cinema Handbook* should be compiled by September 2003.

3. Interview Key Informants. Key informants for this evaluation are the OSE staff responsible for presenting the program. These individuals are a tremendous resource for documenting everything from film selection to the logistics of program implementation. Interviews with this group will provide confirmatory evidence about how well *Science in the Cinema* promotes the visibility of the missions of the NIH and guidance for developing a handbook that would summarize considerations and actions required for a

new staff to replicate or transport the program. Interviews with key informants should be completed by December 2001.

4. Conduct Structured Observations of Participants. Information obtained from structured observations of *Science in the Cinema* participants will be most useful if observers agree ahead of time on criteria and terms for describing events and behaviors. Structured observational data can be used to generate better understanding of (1) differences among participants who stay for the discussion sessions versus those who leave when the movie has ended; (2) who asks questions; (3) interactions among participants; (4) what participants do with publications and other materials that are disseminated at each session (e.g., read them prior to viewing the film, take them home); and (5) other audience reactions to the speaker or the film, or both, that reflect audience engagement and learning. In addition to providing corroborating evidence about program success, the data can be used to help develop focus group protocols.

The structured observation protocol should be completed by July 2001 and used to observe *Science in the Cinema 2001* participants. Observational data should be analyzed and summarized by December 2001. A revised version of the instrument used for conducting structured observations should be prepared by June 2002.

5. Videotape *Science in the Cinema in 2001*. Videotapes of *Science in the Cinema* are useful for evaluating and disseminating the program. Videotapes provide evidence of how well various sessions meet program goals and can be used as a resource for others. On-line versions of the videotapes, like those available from previous summers, provide a resource for teachers and the general public nationwide. Videotapes from *Science in the*

Cinema 2001 should be available on-line by October 2001. Analysis of the videotapes should be completed by August 2002.

6. Collect Focus Group Data. The survey used in 2001 is expected to include items that will ask participants whether they are willing to join a focus group and collect contact information from those volunteers. Several focus group sessions, each composed of Science in the Cinema 2001 participants with shared characteristics, can (1) illuminate interpretation of other quantitative and qualitative data and (2) illustrate how demographic characteristics, educational and occupational background, and prior experiences influence program outcomes. A preliminary focus group protocol should be prepared by September 2001. Pilot focus group sessions should be conducted by November 2001. Results of feedback from focus groups and observational data can be used to inform development of a focus group protocol for use in evaluation of Science in the Cinema 2002.

EVALUATION UTILIZATION

The findings of the proposed outcome evaluation can be used to (1) provide feedback about program effectiveness and value; (2) facilitate program replication and dissemination; and (3) develop reliable and valid instrumentation for measuring program effects. Evaluation findings will provide the NIH OSE with information about the effectiveness of and community support for Science in the Cinema and can be used to inform decisions about whether to continue to allocate financial and administrative support for the program on the NIH campus. Examination of internal documents and interviews with key informants will provide a formal record of the logistics underlying

effective implementation of Science in the Cinema and the considerations essential to program management and success. This information will be useful for anyone interested in replicating the program. The instrumentation developed and piloted during a series of outcome evaluations will be tailored to measure specific program goals and will provide a consistent way to evaluate the effectiveness of Science in the Cinema regardless of when or by what organization it is presented. Inclusion of an evaluation component with a program aimed at promoting public understanding of science and public health will strengthen the contribution of Science in the Cinema as an educational resource and as a model for comparable program evaluations.

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