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How Hollywood Films Portray Illness

Robert A. Clark, M.D.

Part I: Oncology

Art imitates life, we are often told. Occasionally we also observe that life imitates art. Hollywood movies may fulfill the definition of *art* in both these adages. Movies evoke our fantasies, fears, loves, and hates and therefore reflect our lives. The art of film, however, diverges from real life because of the necessities of good storytelling: dramatization, plot lines, character development, and romanticism. Therefore, films are often imperfect reflections of our lives. As F. Scott Fitzgerald said, “There are no second acts in life.”

Movies have been blamed for creating disturbing or profane cultural images, leading to societal ills such as violence, sexual deviancy, and isolation. Whether art imitates life or the reverse, it may be instructive to study how movies depict medical themes, especially oncology, in order to understand how cancer and medicine are perceived in popular culture.

Medical themes have been popular in movies for as long as stories have been told on film. One author claims that Hollywood studios released more than one hundred films with medical or surgical themes in the 1930s and 1940s.¹ How films portray medical themes may tell us a great deal about how we perceive our medical care, and our mortality. In the end, movies are written, produced, and directed by people who often use their own experiences as creative inspiration. As those experiences change, so do films.

The purpose of this article is to review the American films of the twentieth century that have depicted themes related to cancer, to analyze the way patients, doctors, and oncology are portrayed, and to relate those portrayals to the realities of oncology and American medicine at the time of the films. If art imitates life, we would expect movies with cancer themes to reflect contemporaneous perceptions, oncology practice, and public policy. If, on the other hand, art does not imitate life, if the necessities of fiction and storytelling force film depictions to deviate from reality, we would expect films with cancer themes to be divorced from oncology practice and policy. If the truth is somewhere between the two extremes, the analysis will demonstrate mixed findings. From this analysis, we may better understand the perceptions surrounding cancer and its medical care.

I have been an avid moviegoer for almost fifty years and a physician involved in the care of cancer patients for more than twenty-five years. I have been fascinated

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for years with the way medical themes and technology have been presented in film. There is no question that this report is subjective and influenced by my own experiences.

However, in an attempt to make this study more objective, I used the Internet Movie Database (IMDb) to supplement my own movie experiences. The IMDb (<http://www.IMDb.com>) is a wonderful resource containing detailed information on more than 180,000 films, searchable by title, actor, director, theme, dialogue, quotes, and topics. I searched the IMDb for movies with medical and oncology themes using appropriate search terms — cancer, tumor, malignancy, hospital, illness, sickness, doctor, physician, medicine, medical. I also reviewed previously published literature about movies with medical themes, I found no prior reports about films with oncology themes.²

I limited my review to American feature films made for theatrical release. I excluded foreign films, those with psychological or psychiatric themes, documentaries, movies made for television, shorts, and pornography. I compiled a list of more than 150 movies with medical themes released between 1930 and 1999; only twenty of them had topics related to cancer (Table 1). I then viewed each of these films to see them in current context and related them to contemporaneous oncology policy and practice.

Table 1

Twenty Films with Cancer Themes Released
Between 1930 and 1999

	Year	Title	Cancer Theme
1	1939	<i>Dark Victory</i>	brain tumor
2	1948	<i>An Act of Murder</i>	brain tumor
3	1950	<i>Crisis</i>	brain tumor
4	1958	<i>Cat on a Hot Tin Roof</i>	terminal cancer
5	1970	<i>Love Story</i>	leukemia
6	1973	<i>Bang the Drum Slowly</i>	lymphoma
7	1979	<i>Promises in the Dark</i>	osteogenic sarcoma
8	1983	<i>Terms of Endearment</i>	lymphoma
9	1983	<i>Silkwood</i>	environmental leukemia
10	1985	<i>American Flyer</i>	leukemia
11	1991	<i>The Doctor</i>	laryngeal cancer
12	1991	<i>Dying Young</i>	leukemia
13	1992	<i>Medicine Man</i>	cancer research/lymphoma
14	1993	<i>My Life</i>	renal cancer
15	1996	<i>Phenomenon</i>	brain tumor
16	1997	<i>The Rainmaker</i>	leukemia
17	1997	<i>Critical Care</i>	breast cancer
18	1998	<i>One True Thing</i>	terminal cancer
19	1998	<i>A Civil Action</i>	environmental leukemia
20	1999	<i>Stepmom</i>	terminal cancer

Table 1 shows that the types of cancer portrayed in film do not represent the distribution of cancer types seen in real life. Leukemia and lymphoma account for nine of the twenty films, brain tumors for four, unspecified terminal cancer for three, and one case each of renal, laryngeal, bone, and breast cancers. Similarly, the age distribution of cancer victims in these films does not reflect reality. Over half the film cancer patients are under thirty years of age, and three-fourths are under forty. In order for films to continue to depict “clean” cancers, in young, attractive subjects, leukemia/lymphoma has become the modern movie’s cancer.

Although movies with medical themes have been common since the 1930s, films with oncology themes, rare until 1970, have become more prevalent in the 1990s. This trend may be explained by changes in demographics, in the film industry, in movie audiences, and in interest in medical topics.

From 1930 to 1955, movies were popular adult entertainment. The Great Depression and World War Two had reduced the American birthrate; the older demographics led creators of popular culture to target their product to adults rather than teens and children. Even farcical comedies with medical themes, such as *A Day at the Races* (1937) with the Marx Brothers and *Dizzy Doctors* (1937) with the Three Stooges, were adult fare, often shown in double features with more standard dramas. Prior to the mass dissemination of television, adults and families frequented neighborhood movie theaters for inexpensive entertainment. For example, the ticket price for *Gone With The Wind* (1939) was twenty-five cents. Therefore, prior to 1955, with a large adult audience, creators of Hollywood movies commonly presented adult themes, including medical topics.

Complaints about indecent motion pictures are not new. Many films made in the 1920s and early 1930s were considered too graphic, violent, or sexually suggestive. Medical situations offered filmmakers the opportunity to display exposed bodies, and exposed female bodies sold tickets.³ The Motion Picture Production Code (MPPC) was adopted in 1930 to set decency standards for film. This was a voluntary code, self-imposed by Hollywood moviemakers, to avoid governmental censorship legislation. The code limited severely the graphical presentation of medical themes and discussion of certain areas of anatomy, such as breasts. The code prescribed to filmmakers eleven “don’ts” and twenty-six “be carefals,” including prohibition of topics such as “sex hygiene and venereal diseases, scenes of actual childbirth — in fact or in silhouette, and children’s sex organs.”⁴ Surgical operations were explicitly identified as a “be careful” area in the code, and listed as a “repellent subject” along with hangings, cruelty to children, and sale of women.⁵

The most popular movies with medical themes before World War Two were historical or biographical — for example, *Arrowsmith* (1931), concerning conquering the plague; *The Story of Louis Pasteur* (1936), about the French microbiologist; *Yellow Jack* (1938), about curing yellow fever — or based on classical literary themes like *Camille* (1937) and *Wuthering Heights* (1939). Cancer, a dreaded word and a lethal disease during this time, was infrequently a movie subject. The common use of happy endings in films made before World War Two also limited the use of cancer as a film topic. Between 1930 and 1955, only three films depicted cancer themes, and all three concerned patients with brain tumors — *Dark Victory* (1939), *An Act of Murder* (1948), and *Crisis* (1950).

That all three movies portrayed brain tumors during this period was probably not accidental. Brain tumor represented a “safe” cancer topic, consistent with the MPPC.

It was a “clean” cancer since it did not involve sexual organs, messy gastrointestinal or genitourinary systems, surgical drains, or unattractive disfigurement by surgery, radiation, or disease. Its discussion did not require using medical or anatomical language considered controversial at the time. Instead, as was done in the first film about cancer, *Dark Victory* (for details, see Appendix), the brain could be safely discussed as the seat of knowledge, memory, and coordination of the rest of the body. Moreover, brain surgery itself is described in the film as “courageous” and “heroic.” A similar discussion of colon cancer surgery would have been unthinkable.

In *Dark Victory*, the post-operative heroine, played by Bette Davis, has only to wear a small cap, not unlike a Girl Scout’s cap, coordinated to her fashionable wardrobe, to cover her surgical wound. Post-operative thoracic or abdominal surgery would have been less attractive and acceptable cinematically.

After 1955, American demographics and movie audiences changed and so did Hollywood movie themes. The birthrate following World War Two soared, bringing “baby boom” youth to movie theaters by the late 1950s and 1960s. Moreover, with the availability of television, older adults began to stay home for entertainment rather than frequent movie theaters. Movie themes, including those with medical topics, were more youth oriented from 1955 to 1969. The proportion of films with medical themes decreased; films with cancer topics remained rare. Romantic comedies were in vogue — *Tammy and the Doctor* (1963) with Sandra Dee and George Hamilton — as were movies about romantic young doctors in training — *The Interns* (1962), *The New Interns* (1964). Romance between doctors and their patients has always been common fare for Hollywood films despite the ethical problems surrounding such relationships. For example, the heroine and the neurosurgeon in *Dark Victory* fall in love and marry after her surgery.

The evolution of American films changed dramatically in the late 1960s. Although films were targeted toward a younger audience, those movies did not do well at the box office. The audience that they tried to reach did not perceive the relevance of the youth-oriented films produced by Hollywood studios. Simultaneously, television provided a medium and experience for young creative writers, actors, and directors who could not obtain opportunities in Hollywood. Steven Spielberg, for example, began his career as a director in episodic television. Television dramas in the 1950s and 1960s portrayed themes and realism in dramas not often seen in movies of that period. The Hollywood studios, in financial trouble for the first time, were receptive to offering young directors creative freedom and control. These new filmmakers responded by making movies that broke cultural and cinematic molds.⁶ They discarded the standards of the MPPC, cared little for the newer Motion Picture Rating system (G, PG, R, X), and dared to portray topics and themes previously considered taboo.

Movies such as *Bonnie and Clyde* (1967), *Midnight Cowboy* (1969), and *Taxi Driver* (1976) portrayed violence, sex, and urban life as never before. *Midnight Cowboy* was a landmark film for several reasons. It was the first mainstream film willing to carry an X rating at its release; it was one of the first films to portray urban street life graphically. It was also the first, and still one of the only films, to portray the realism of illness for the poor and destitute.

Film patients are almost universally affluent, or at least quite able to afford medical care. Dustin Hoffman’s character, Ratso Rizzo, has tuberculosis but does not

have the money for medical care, food, or clean shelter. When his friend suggests that he get medical care at an indigent care facility, he movingly tells of the shame and lack of dignity he felt being treated there and his fear of becoming an experimental subject without control of his situation.

Films with medical themes were revolutionary in the 1970s. The black comedy *M*A*S*H* (1970) turned the traditional depiction of doctors and nurses upside-down. Doctors were portrayed as bawdy, sexual, antiauthoritarian, and against the film war in Korea in an era of real civil protests against an unpopular war in Viet Nam. Their reaction to the death and destruction of the Korean War was portrayed as a combination of alcohol consumption and comedy of the absurd. Another black comedy, *The Hospital* (1970) depicted a large urban teaching hospital as a place of danger, iatrogenic disease, confusion, and political strife. *Coma* (1978), which offered a woman medical student as a heroine, portrayed medical research and segments of the medical establishment as sinister.

New depictions of cancer themes were not necessarily included in this new wave of filmmaking. *Love Story* (1970), a highly traditional and successful Hollywood film, was one of the most popular romance films ever made (for details, see Appendix).

An attractive young couple, played by Ryan O'Neal and Ali McGraw, meet at Harvard, marry, and begin their life together despite differences in social and financial standing and against the wishes of his wealthy father. As reported in *Time* magazine in 1997, vice president of the United States, Al Gore, claimed that Erich Segal, the author of the novel and screenplay, used Mr. Gore and his wife, Tipper, as the models for the uptight preppie and his free-spirited girlfriend.⁷

Unfortunately, the young woman develops leukemia and dies, leaving the young husband with only his memories and love for his late wife. The film is notable for its scene in the doctor's office, where he tells the husband that his wife will soon die, but does not name a disease, nor does the husband ask for a diagnosis or other details. The doctor and the husband then decide to keep the information from the wife-patient for as long as possible to protect her from the bad news. She eventually becomes aware of her condition when she is referred to a hematologist for treatment. We can infer her diagnosis of leukemia from the on-screen discussions among film physicians, but it is never explicitly stated. She is treated briefly in the hospital and never discharged. Her death in the hospital is not portrayed on film; rather, we see her husband comfort her in bed prior to her death, and watch him exit the hospital room after her demise. Despite the religious and class differences driving the plot, his Boston Brahmin father, his WASP background, and her Italian-Catholic heritage, she is at last treated at the Klingenstein Pavilion of Mount Sinai Hospital in New York.

Similarly, *Bang the Drum Slowly* (1973) also presents leukemia as the film cancer of choice. A young catcher for a New York professional baseball team, played by Robert DeNiro, develops terminal leukemia prior to spring training and plays out the season. His best friend, played by Michael Moriarty, receives more information about the terminal nature of the disease than he does. His developing relationship with his friend, teammates, and family during his last summer is the basis for the film. His death is not depicted in the film; it ends with the end of the baseball season, his subsequent demise only implied.

In both *Bang the Drum Slowly* (see Appendix for details) and *Love Story*, leukemia is the terminal disease, the prognosis is initially withheld from the patient, and

death from cancer is not portrayed. Through 1973, no film had directly presented a death scene from cancer.

The real management of cancer, including the issues of diagnosis, prognosis, conventional and investigational therapies, outpatient care, patient confidentiality, and death, which we now consider routine, may not have been much different than its film depiction through 1970. The clinical research and public perceptions of cancer began to change with the National Cancer Act, signed by President Richard M. Nixon in December 1971.⁸ This legislation declared war on cancer and mandated resources, manpower, facilities, and development of a coordinated program that became the foundation for the national cancer program as we know it today. The National Cancer Act included provisions for increased budgets for oncology research, education, and physician training. It provided a special authority for the National Cancer Institute to transmit a budget directly to the president and Congress without modifications at other levels of the Executive Branch. This federal initiative, accompanied by popular press coverage, brought many issues related to cancer into the national consciousness and debate for the first time. Perhaps more important, it provided resources to improve our clinical management of cancer patients.

It may seem quaint or unrealistic that many Hollywood films do not use the word *cancer* nor explicitly state a diagnosis. This, however, probably reflects our own popular fears and uneasiness with these terms. As correlation, consider that as late as 1985, when President Reagan developed colon cancer, it was considered stunning and reported in the popular press as unusual that his physician, chief of the Surgical Branch of the NCI, Dr. Steven Rosenberg, began a press conference by simply stating "The president has cancer."

By the end of the 1970s, the film depiction of cancer had changed. *Promises in the Dark* (1979) is an interesting and innovative film for several reasons. First, it stars Marsha Mason as a physician. Women physicians had been portrayed in films of the 1930s — *Mary Stevens, M.D.* (1933), *Right To Romance* (1933), and *Woman Doctor* (1939), but had disappeared after World War Two. Finally, a woman surgical resident was portrayed in *Coma* and a woman physician in this film. Second, she searches a national database (available in real life from the National Cancer Act) to find experts and investigational therapies for her patient, a seventeen-year-old girl with osteogenic sarcoma. Third, the diagnosis, prognosis, and treatment options are clearly stated in the film and discussed with the patient and her parents, more closely resembling, for the first time in film, how we practice in our lives. And fourth, several issues related to death are more fully explored in this film than in previous releases.

Almost certainly, the differences in the depiction of film deaths between *Love Story* in 1970 and *Promises in the Dark* in 1979 (details in Appendix) are related to the publication of Elisabeth Kubler-Ross's *On Death and Dying* in 1969. Her groundbreaking work was accessible to both popular and medical audiences. By 1979, her work was so well known that the *Ladies Home Journal* honored her with a Woman of the Decade Award after naming her Woman of the Year in Science and Research in 1977.

In *Promises in the Dark*, the young girl's slowly deteriorating condition during the progression of her disease and her development of lung metastases are presented realistically, as are her outpatient treatment and home care during this time. The girl discusses her thoughts and wishes about her death with her doctor, but not with her

parents, saying that she doesn't want to be placed on life support near death. When she observes the girl having respiratory distress near death, a home health nurse calls an ambulance that takes the girl to a hospital emergency room. The patient, in a terminal coma, is subsequently intubated and placed on mechanical ventilation. The physician tries to convince the parents to discontinue life support, saying that the prognosis is terminal and that the girl did not want to be placed on mechanical ventilation. However, at the film end, when the parents decide not to terminate support, the physician herself stops support and permits death to occur. The quiet death under these circumstances is the first death related to cancer on film.

This was not necessarily the first time the subject of assisted death had been portrayed in film. In *An Act of Murder* (1948) a judge, the husband of a woman with a terminal brain tumor, considers killing her to ease her suffering. In *Crisis* (1950) a ruthless foreign political dictator with a terminal brain tumor asks a vacationing American neurosurgeon to end his life. The ethical crisis for the physician is whether to do the societal good deed of ridding the country of the tyrant or to follow the Hippocratic oath and refuse to assist death. Twenty-nine years later, in *Promises in the Dark*, the physician chooses to follow the wishes of her patient despite the directives and legal rights of the parents of the seventeen-year-old minor.

Three movies with cancer themes were released in the 1980s. The first, *Terms of Endearment* (1983) (details in Appendix), was very successful critically and financially. Shirley MacLaine plays a neurotic but loving mother who offers advice and comfort to her daughter, played by Debra Winger, through the daughter's troubled marriage to an unfaithful college professor. The daughter, mother of three young children, develops an enlarged axillary lymph node subsequently found to be a malignancy. We may only infer that it is lymphoma. The daughter, who was treated as an outpatient, then continued in the hospital. The film includes a realistic scene of a discussion between the daughter and her physician about the tumor's lack of response to chemotherapy and her worsening prognosis. Her condition deteriorates, and eventually she dies quietly, on screen, in the hospital. The mother and husband are in the room at the time of death, although the husband is asleep.

The film is notable for an emotional scene in which the mother first pleads, then angrily demands that nurses give her daughter pain medication that had been withheld according to a time schedule. I believe this to be the first time cancer pain management, including the reluctance to give narcotics as needed, was an issue portrayed on film. This film issue corresponds to our growing real-life awareness of the clinical challenge to relieve cancer pain adequately.⁹

Silkwood (1983) was based on the true story of Karen Silkwood, a corporate whistle-blower at the Kerr-McGee nuclear facility in Oklahoma, who alleged improper occupational handling of radioactive plutonium and disappeared en route to present evidence to federal investigators. An increased rate of cancers, especially leukemias, found among workers at the plant, led to suspicions about occupational exposures. A related film, *A Civil Action* (1998) (details in Appendix), was also based on a true story, that of an excess number of cancers, especially leukemias, that developed in Woburn, Massachusetts, because of industrial leakage of toxic wastes into the water supply. The film portrays the story of the lawyer, hired by eight families whose children died of leukemia, who discovers the true cause of the toxic exposure and recovers damages in court. Both these films use the true events of exposure-induced cancers as a vehicle to dramatize the subsequent heroics of the characters who uncover the corporate villains.

Environmental illness is a relatively recent phenomenon in film, probably beginning with *Silkwood*, although there are references to coal miners' pneumoconiosis in *The Citadel* (1938) and *Coal Miner's Daughter* (1980). Other recent examples are *With Honors* (1994), in which a character suffers and dies from pulmonary asbestosis, and *Safe* (1995), in which a woman develops a generalized hypersensitivity to multiple household exposures, products, solvents, and aerosols.

The concept of cancer as a result of pollution or toxic exposure is popular because it suggests effective treatments other than standard medical or surgical approaches. Cancer patients are attracted to alternative therapies that reflect emphasis on personal responsibility, nutrition, pollution, and purification; these issues have moral and religious overtones.¹⁰

At least fifty films with medical themes were released in the 1990s; of the twenty films with cancer themes in the last seventy years, ten reached theaters in this last decade. The marked increase in medical and cancer movies in the 1990s is probably caused by two related factors. First, the leading edge of the baby boom generation, which defined much of the audience for Hollywood films for the last four decades, began to age, reaching the age of forty-four in 1990. Films about adults with illnesses were now relevant to this generation. Second, and perhaps related to this demographic aging, health care costs became a significant economic and political issue in the late 1980s. Health care reform became a publicly debated issue and a legislative priority for newly elected President William Clinton in 1992. Probably in response to this growing awareness of health care issues, films with medical themes poured out of Hollywood from 1990 to 1995.

The Doctor (1991) (details in Appendix) is an outstanding movie that should be seen by every physician and medical student. This film is often overlooked by viewers, since in the same year at least two other medical movies, *Regarding Henry* and *Doc Hollywood*, were released and did better business at the box office.

William Hurt plays the title character, a superb and arrogant cardiac surgeon who develops laryngeal carcinoma. As a patient, he is forced to see hospitals, physicians, and oncology from a patient's perspective, at times a cold-blooded, bureaucratic, and frustrating image. The engrossing film is based on the true experiences of Ed Rosenbaum, M.D., who coauthored the screenplay.

The film is chock full of scenes we know all too well from real oncology life: (1) the clinical oscillation and fragmentation that multidisciplinary care can engender; (2) answering the same registration information at each clinical visit; (3) waiting long beyond scheduled appointment times to receive treatment or talk to a physician; (4) hearing the common fears and frustrations of patients as they sit in waiting rooms and compare stories. The scene of Dr. Rosenbaum's diagnosis is particularly believable. A technically competent, efficient woman otolaryngologist performs a video-assisted laryngoscopy and coldly informs the patient that he has cancer. As she continues her recitation of the facts, he recoils at the diagnosis and cannot assimilate her information. We infer that he is shocked and needs support, yet feels condescension from the otolaryngologist. Scenes with Elizabeth Perkins, who plays a fellow cancer patient who teaches him the ways of the medical system, are touching and real. In the end, his cancer is apparently cured, and he initiates an educational program for medical students to instill empathy and humanism, letting them experience directly the humiliations and frustrations of our modern medical complexes.

Movies with cancer themes are often romantic tear jerkers, and *Dying Young* (1991) is no exception (details in Appendix). Julia Roberts plays an aimless young

woman who takes a job as nurse/companion to a twenty-eight-year-old, rich art history graduate student with leukemia. They fall in love, but he decides to decline treatment and live out his remaining life with her in the idyllic setting of coastal northern California. The ending is romantically and medically unsatisfying: they separate, and his prognosis and outcome are undefined.

The film graphically portrays side effects of chemotherapy, which the patient calls poison (for example, hair loss, severe vomiting, appetite loss, lethargy) as his reason to stop treatment. Films released later in the decade — for instance, *One True Thing* (1998) and *Stepmom* (1998) portray chemotherapy more benignly.

People free of cancer perceive most chemotherapy-associated side effects as having greater impact on the quality of life than cancer patients do.¹¹ Moviemakers and movie viewers without direct experience may be influenced by such perceptions. Clinical advances in management of nausea and vomiting induced by chemotherapy have occurred in the past fifteen years. For example, one study showed that between 1983 and 1993, there was a reduction in the severity of symptoms patients experienced while receiving chemotherapy and a shift from patient concerns about physical to psychological issues.¹²

Dying Young portrays two other major oncology issues. First, as the nurse/companion, the young woman teaches herself about anticancer diets, nutrition, and herbs (from San Francisco's Chinatown) and prepares them for the young man. The real *American Cancer Society Cookbook* is featured prominently. Second, at the beginning of the film, both characters smoke cigarettes; after her self-education, she showily discards cartons of Camels.

Why don't movies depict the common cancers: lung, breast, prostate, and colon? As noted above, Hollywood moviemakers prefer young attractive victims and clean cancers. There is little cinematic attraction to the messiness of colons and prostates. Although mainstream films have a long love affair with naked breasts, breast cancer subverts nudity by presenting the organ as diseased. After all, is a breast with cancer sexy? I am aware of only one small scene in film alluding to breast cancer, despite this being a frequent topic for made-for-television movies. In *Critical Care* (1997), a movie that otherwise does not deal with cancer, a nurse in a critical care unit is trying to comfort a patient with end-stage renal disease and renal transplant rejection who does not want to return to dialysis. To show that she understands his fears and suffering, and that she too has faced the possibility of her own death, she removes her blouse and shows him her mastectomy site.

Finally, Hollywood is enamored of cigarettes, which limits its ability to portray smoking-related disease. Cigarettes are arguably the most important carcinogens in real life, but their role is rarely portrayed in film. Since film began, cigarettes and smoke have portrayed atmosphere and sexiness; smoking allows actor couples a quiet action device while delivering lines of dialogue. More recently, as the cost of financing feature films has risen markedly, corporate fees for product placement have supplemented film revenues. Cigarette companies, limited by law from television and certain other types of advertising, have paid to have their products featured prominently and appealingly in movies.

Cigarette smoking was the implied cause of laryngeal cancer depicted in *The Doctor*, and the young woman throws out cartons of cigarettes in *Dying Young*. This is the extent of Hollywood's depiction of smoking-related cancer.

Medical research has always been portrayed in Hollywood film as altruistic and slightly eccentric. The earliest medical theme movies were about researchers, and

Dark Victory was the first film that alluded to cancer research. In it, the neurosurgeon walks away from a lucrative society practice and sets up a microbial research lab in a Vermont farmhouse to search for a serum to cure gliomas. In *Medicine Man* (1992), a reclusive and eccentric scientist, played by Sean Connery, finds the cure for cancer in an open-air research lab in the Brazilian rain forest — this magic compound comes from insects in a rare flower found in only one area of the jungle (details in Appendix). Civilization is encroaching on that region of the rain forest, with clearing of trees for agriculture.

The film portrays the purity of an aboriginal culture, primitive medicines, and the rainforest, with its potential pharmacopoeia. The aboriginal *depsiva*, or medicine man, discloses the key to discovering the cancer cure. Corporate pharmaceutical companies are the villains here who would take this discovery and profit from it without necessarily helping human suffering. The scientist, who has a limited supply of the miracle compound, uses most of it trying to analyze its ingredients. He expends the last of it to cure a child with cancer; an abdominal mass disappears overnight after its administration. In an attempt to subvert the clearing of the forest, he accidentally ignites an explosion that destroys the forest, his lab, and his research notes, making this scientist the only movie character both to discover and to lose the cure for cancer.

Experimental cancer therapy, alternative cancer treatment, and home hospice care are themes first depicted in *My Life* (1993) (details in Appendix).

A young couple is expecting their first child, but the husband is suffering from renal carcinoma metastatic to the lungs. He receives experimental interleukin-2 therapy but his tumor does not respond. With no other treatment options, he is given a poor prognosis of only a few months to live. He cannot share his emotions with his wife, so he makes a video for his unborn child, expressing his feelings and expecting never to witness the birth. He seeks out an Asian healer, played by Haing S. Ngor, a real Cambodian physician who escaped the killing fields of his native country and became an actor in the United States. The healing he receives is certainly not mainstream but it helps him accept his disease and impending death. At the end, he develops brain metastases and receives home hospice care. He lives long enough to see his newborn child. His death scene is portrayed cinematically as a wild roller-coaster ride that allows him to overcome his fears as he leaves life.

The image of alternative or complementary cancer therapy has evolved significantly in the last ten years. As recently as 1991, a text published by the American Cancer Society detailed the spectrum of alternative therapy methods and decried their lack of scientific basis.¹³ That same year, investigators, in a study comparing patients with advanced cancer who were treated with either conventional or unorthodox therapies, reported no observed differences in outcomes between the two treatment groups.¹⁴ But public interest in and demand for alternative cancer treatments increased. In one recent report, 28 percent of women with newly diagnosed breast cancer sought alternative therapies; their quality of life measures and outcomes were worse than those of women who did not seek alternative therapies, indicating that use of alternative therapy may be a marker of clinical and psychological distress.¹⁵

My Life corresponds temporally to public debate and initiatives in public policy concerning alternative therapies. In 1990, lobbyists for unproved treatments persuaded Congress to mandate a study to evaluate a particular unproved method.¹⁶ In 1992 the Office of Alternative Medicine was created by U.S. Congressional man-

date. In 1998 it became the National Center for Complementary and Alternative Medicine within the National Institutes of Health, under the Omnibus Appropriations Bill.¹⁷ Its mission is to facilitate, support, and conduct research, training, and information dissemination in alternative treatments.

After the Clinton federal health care reform legislation failed in 1993, managed care by private health insurance companies thrived. Patients and physicians, however, expressed some dissatisfaction with restricted insurance plans that limited patient choice of physician or hospital or denied payment for complex or costly medical procedures. A medical insurance company became the villain in *The Rainmaker* (1997) by denying payment for a bone marrow transplant (BMT) procedure for a young man with leukemia (details in Appendix).

A young lawyer with few prospects, played by Matt Damon, files suit against the insurance company in this seemingly hopeless case that becomes a wrongful death action when the young leukemia victim dies. The lawyer eventually uncovers documentation that the insurance company knowingly denied payment for all such procedures despite its own conclusion that BMT was effective and medically indicated.

The economics of medicine have been portrayed infrequently in Hollywood films. Prior to World War Two, the fees for real medical care were paid in cash directly to a general practitioner. Fees were not standardized and practitioners often charged more to those able to afford higher fees, offsetting reduced fees for those unable to pay. Higher-cost complex care was less prevalent than it is today, but it was often unaffordable for many citizens. Health insurance was not widely available or purchased. Blue Shield insurance to pay physician fees and later Blue Cross insurance to cover hospitalization costs were community risk policies first created by physicians and hospitals to defray catastrophic costs. In *Dark Victory*, the patient is a rich society debutante who could afford a neurosurgeon specialist, as well as several consultants, to treat her brain tumor. *Interns Can't Take Money* (1937) depicted the standard of care that hospital trainees provided for those who could not afford private specialists. Movie plots, such as *Green Light* (1937) and *Dark Victory*, portrayed medical research as altruistic compared with private medical practice as mercenary.

After World War Two, health insurance became more widespread as a benefit of employment. The theme of medical economics disappeared from film until *Midnight Cowboy* (1967) as discussed above. In *Love Story*, the young man's conflict with his controlling father impels him to separate financially from his wealthy father. When his wife is diagnosed with leukemia, he cannot afford the cost of treatment and is forced to ask his father for \$5,000, leading to eventual reconciliation. In *Regarding Henry* (1991), a wealthy lawyer suffers paralysis from a gunshot wound to the head. He cannot continue to work, and his subsequent chronic care and rehabilitation depletes the family savings. His wife begins to work and they move to a smaller home to adjust financially; the changes are not severe; they are portrayed as improvements in their life. *The Rainmaker* then is one of the few films to depict a medical economic issue as a major movie theme.

Stepmom (1998) was directed by Chris Columbus, whose own mother died of cancer prior to the film's release (details in Appendix); he includes a dedication to her in the credits. In this film, a divorced mother, played by Susan Sarandon, develops cancer. Her ex-husband's new girlfriend takes care of her two children while she receives treatment. As her disease progresses and her prognosis worsens, it becomes apparent to the mother that the new girlfriend will become the children's stepmother

after she dies. The adjustment to and acceptance of her situation and their relationship is the basis of the film.

The description of the type of cancer in *Stepmom* is kept vague. There is allusion to a lump detected (breast cancer or lymphoma?) and initial treatment with surgery and radiation. When her cancer recurs, she begins chemotherapy.

Unlike *Dying Young*, chemotherapy in this film is depicted as tolerable and relatively convenient. The patient uses a portable infusion pump that can be worn on her belt to receive outpatient treatments. She controls her nausea by smoking prescription marijuana. Her death is not portrayed on film; the final scenes are her last Christmas with her family. This is a common device in Hollywood movies; terminal Christmas scenes are also used in *Dying Young* (1991) and *One True Thing* (1998).

Stepmom is notable because the oncologist is a black woman. Black physicians have rarely been portrayed in film. The earliest film including a black physician that I could find is *Lost Boundaries* (1949), in which a light-skinned African-American physician is forced to pass as white in order to practice his profession. In *Guess Who's Coming to Dinner* (1967), a young white woman brings her fiancé, a black physician played by Sidney Poitier, home to meet her parents, played by Spencer Tracy and Katharine Hepburn. Despite its benign and innocuous plot, the interracial romance was considered a radical theme at the time of its release. In *Article 99* (1992), Forest Whitaker portrays a black surgery resident in a Veterans Administration Hospital.

Cancer invades not only the life of its victims; the disease also affects families of cancer patients. *One True Thing* (1998), adapted from the Anna Quinlin novel, portrays this phenomenon better than most films (details in Appendix).

A suburban wife and mother develops cancer, type unknown. The husband and father, an emotionally detached college professor of English literature, withdraws and asks their daughter to care for her mother during her illness. The daughter, a staff writer for a New York magazine, resents leaving her life and career to care for her mother. The daughter's re-examination of her priorities, her adjustment to filling her mother's role, and her relationships with her parents are the core of the film.

One True Thing features a woman oncologist and a home care nurse. The mother-patient is more comfortable and open discussing her increasing medical difficulties — pain, limitations in self-bathing or grooming — with the nurse than with her daughter. The film realistically depicts the anger a cancer victim experiences as her usual daily activities become more restricted. It also shows the difficulties and stress that family members often experience yet are reluctant to acknowledge openly. The film ends with a brief allusion to assisted suicide. The mother begs her daughter and husband to help her die when she reaches an intolerable level of pain and disability. When the mother is found to have died from an overdose of narcotics, the daughter assumes the father assisted the suicide, and the father assumes the daughter did. In fact, the mother ended her own life with the overdose, sparing either of them the responsibility.

This analysis of twentieth century films with cancer themes has confirmed several points:

- Hollywood films rarely depict common cancers; instead uncommon “clean” cancers such as leukemia and brain tumors predominate.
- Medical themes in mainstream movies follow demographic taste trends.

- The 1970s marked significant changes in films with medical themes, owing to changes in the film industry and to public health policy changes in oncology.
- Important health policy issues related to economics, research, gender, and race are infrequently portrayed in films; however, public policy often gets translated to celluloid.
- Important clinical oncology issues, including treatment, symptom management, amelioration of side effects, and facilitation of the process of dying have been reflected in movies.
- In large measure, Hollywood films reflect contemporaneous oncology policy and practice; in large measure, art does imitate life.

Part II: Radiology and Medical Imaging

Radiology and popular cinema have much in common. Both are visual media that produce their output on film, both made dramatic entrances into the world on the same day over a century ago in Europe, and both disciplines are more innovative than ever before. On December 28, 1895, Wilhelm Conrad Roentgen reported his discovery of x-rays, made six weeks earlier, by publishing his report, “On a New Kind of Rays,” in the *Proceedings* of the Physico-Medical Society of Würzburg, Germany. The report included his famous image, obtained six days earlier, of his wife, Frau Bertha Roentgen: the bones of her left hand with her wedding ring encircling the proximal phalanx of her fourth finger. For his discovery, of course, he would receive the first Nobel Prize in Physics in 1901.

On that same day, December 28, 1895, about 500 miles away, Auguste and Louis Lumière presented the first motion pictures to an audience at the Grand Café on the Boulevard des Capucines in Paris. The Lumières and others, including Etienne-Jules Marey in France and Eadweard Muybridge and Thomas Edison in the United States, had for several years been developing various techniques to create moving photographic images. The Lumières alone, however, created a combination camera and projector that displayed a moving picture onto a screen before a hall of people.

While the common birth date may be coincidence, it is not surprising that both technologies immediately captured broad public interest and imagination, nor that radiation and medical imaging have been a staple of popular culture and motion pictures ever since. For example, two of the earliest commercial silent films were *The X-ray Fiend* (1897) and *The X-ray Mirror* (1899). On the other hand, films have been blamed for creating disturbing or profane cultural images, leading to societal ills such as violence, sexual deviancy, and isolation.

I review the American films that have depicted themes related to radiation and medical imaging, which analyzes the way patients, doctors, and radiology are portrayed and relates those portrayals to the realities of radiology and American medicine at the time of the films. As a radiologist for more than twenty-five years and a longtime moviegoer, I have been interested in the portrayal of medical imaging and radiation technology in films.

As in Part I, I turned to the Internet Movie Database for additional movie information about x-ray, radiation, radiology, radiologist, cancer, tumor, malignancy, trauma, hospital, illness, and so forth. I also reviewed previously published literature

about films with medical themes, finding no reports on movies including radiology or medical imaging episodes.¹ However, I have used material from the excellent cultural history of medical imaging in the twentieth century by Bettyann Holtzmann Kevles, *Naked to the Bone*.²

The 1930s and 1940s

For a large adult audience, Hollywood movies commonly presented adult fare, including medical subjects. In the early farces, medical x-ray imaging was treated as both infallible and benign. For example, in *A Day at the Races* (1937), Groucho Marx played Hugo Z. Hackenbush, a horse veterinarian who pretends to be a physician at a sanitarium near his racetrack in order to escape pursuing thugs. He woos and treats Mrs. Upjohn, a chronic hypochondriac played by the incomparable Margaret Dumont, to raise money for the elite but financially strapped sanitarium. When other physicians on the staff confront Hackenbush with the fact that Upjohn is not ill and needs no treatment, they use her radiographs as evidence. “The x-rays don’t lie,” they claim vehemently. In *Charley Chan in Egypt* (1935), radiography is used to uncover the contents of a mummy from a pharaoh’s tomb, predating the later real life investigation of mummies and fossils with computed tomography. In *Dizzy Doctors* (1937), as the Three Stooges run around a fluoroscopy room in a hospital, Curly pauses behind the fluoroscope that then displays his skeleton.

The benign and healthful nature of x-rays persisted through the 1940s despite early evidence of some hazards. The public perception of x-rays was associated with screening to detect tuberculosis, fluoroscopic aids to fitting shoes, and good health.³ However, as early as 1911, more than fifty cases of x-ray damage, including burns, mutilation, sterility, leukemia, and death were documented.⁴ A 1936 publication documented the suffering and deaths of practitioners, workers, and scientists from overexposure to radiation.⁵ Workers, mostly young women, who painted clock dials with radium died from their exposure. The clock manufacturers, however, were never found culpable as the victims were deemed to have an idiosyncratic susceptibility to radiation necrosis. Nevertheless, these radiation effects were considered occupational hazards that would not be portrayed in movies for another fifty years. Standards for radiation protection and acceptable dose limits were not promulgated until the mid-1930s.⁶ In *Meet Dr. Christian* (1939), Dr. Christian performs radiography on a young girl without any radiation protection for her or himself. From the resultant skull films (four frontal views and no lateral image), he diagnoses a cerebral hemorrhage requiring emergency surgery.

Perhaps the only movie that dealt with the hazards of radiation prior to 1950 was *The Invisible Ray* (1936). In this film, Boris Karloff plays Dr. Rukh, a visionary scientist who leads a group, including Dr. Benet, played by Bela Lugosi, to Africa to study an ancient meteorite. Rukh, exposed to the highly toxic radiation of the meteorite, was saved from death by radiation poisoning through an antidote devised by Benet. Subsequently, Rukh’s touch causes instant death to others — apparent transmitted radiation poisoning. Benet later finds that the meteorite’s controlled radiation restores eyesight to the blind. This, of course, is in contrast to reality; it was probably known then that radiation effects may cause cataracts and blindness. In the end, a side effect of the movie antidote drives Rukh into paranoid revenge against the members of his expedition, whom he accuses of stealing his discovery.

Radiographs of body parts could not be depicted, but allusion to x-ray imaging was attractive, since it carried the connotations of penetrating views through clothes and skin and visualization of sexual organs, the brain, the heart, and by extension, the mind and soul.

Kevles has argued convincingly that the earliest connotations of x-rays contained subliminal and overt eroticism.⁷ The invisible rays could unveil the hidden insides of a woman, and since men did much of the unveiling, x-ray imaging could be construed as a kind of visual deflowering. For example, nineteenth-century American physicians did not examine their female patients with a vaginal speculum because it was held to be immoral and improper to view the genitalia. At the turn of the century, the gaze was a more potent symbol of eroticism than the touch, and x-ray imaging was the ultimate gaze. Remember, the era of the discovery of x-rays was also the era of Sigmund Freud, and eroticism was both repressed and emergent in popular culture.

The argument for a connection between x-ray imaging and eroticism is also supported at that time by the common use of nudity in advertisements for radiography equipment. For example, a pamphlet advertising a radiography machine in 1896 came with red-tinted glasses and a sketch of a demurely dressed young woman on the cover. Looked at through the glasses, the viewer saw past her clothing, past her private parts, into her sexual skeleton. Another advertisement in 1899, from R. V. Wagner & Co. in Chicago for MICA Plate Static Machines, showed two naked women standing under text proclaiming the Naked Truth.⁸

This connotation of nudity through x-rays was exploited in *The Invisible Man* (1933), its sequel in 1940, and a parody, *Memoirs of an Invisible Man* (1992). In each, the title character is rendered invisible by exposure to a Hollywood version of radiation. The man's body is then portrayed as nothingness surrounded by bandages or clothes. To keep himself hidden, the hero remains naked and thus invisible. Ingested food becomes visible in him as it is eaten — not unlike ingested barium seen during fluoroscopy — and disappears as it is absorbed and becomes part of him. Gastrointestinal fluoroscopy with barium was well established by 1933. Walter Cannon published his classic descriptions of gastric and esophageal motility in 1898, and barium had replaced bismuth subnitrate as standard alimentary contrast material in 1910.⁹

In *Memoirs*, the audience sees different parts of the hero's body, as if looking at a scan with a radioactive tracer. When he smokes, the viewer sees his lungs fill and empty, as if the smoke were a contrast agent. At the end of the 1933 original, the protagonist lies dying in an empty plaster cast in a hospital bed. As he dies, his bones begin to show, as in a radiograph, followed by overlay of his muscles and skin. His cloak of invisibility disappears as his life ebbs away.

There has never been a movie biography about Roentgen. However, the life of another giant in the early investigation of radiation was depicted in *Madame Curie* (1943). Within days of reading Roentgen's publication in 1896, a Parisian physicist, Antoine-Henri Becquerel was inspired to try exposing uranium compounds, which were known to be phosphorescent, to sunlight. In a famous scientific "accident," while waiting for a sunny day, he placed the uranium rocks in a drawer with some photographic plates. Days later he discovered natural radioactivity when he observed the image of the rocks on the plates. Two other Paris physicists, Marie Curie and her husband, Pierre Curie, seeking a subject for Marie's doctoral thesis in 1896, were

inspired by Becquerel's discovery. The Curies isolated and determined the atomic weights of two new elements, polonium and radium, which emitted the quality she named radioactivity. For this work, the Curies shared the Nobel Prize in physics with Becquerel in 1903. Marie Curie would later be awarded the Nobel Prize in chemistry on her own in 1911. *Madame Curie*, starring Greer Garson and Walter Pidgeon and based on the biography by Marie Curie's daughter Eve, who gets a screenplay credit, is a faithful rendering of this tale and an excellent movie. Both Garson and Pidgeon received Academy Award nominations for their performances.

The 1950s

In *The Model and the Marriage Broker* (1951), a marriage broker arranges a relationship between a model and a radiological technologist. The portrayal of radiation in movies, however, did not follow these general medical film trends, because the public perception of the benignity of radiation changed in 1945 with the atomic bombing of Japan.¹⁰ X-ray imaging was now used to identify the dead blasted into slabs of concrete in the ruins of Hiroshima.¹¹ Radiation filled news headlines, but in the context of fallout from nuclear weapons. The Hollywood films of the 1950s depicted radiation as a vehicle for mutation, damage, and death.

Countless movies dealt with radiation effects in the 1950s, but several are classic science fiction films. *Them!* (1954), starring James Whitmore and James Arness, has an excellent cast and an intelligent script despite its plot about nuclear tests in the desert causing growth of giant mutant ants that take over the Los Angeles sewers. *The Day the World Ended* (1956), directed by the famous independent filmmaker Roger Corman, is an effective film with a good cast, depicting a group of survivors of nuclear war battling a mutant creature and coping with the end of civilization.

In another Corman film, *Teenage Caveman* (1958), Robert Vaughn stars as the young man searching for meaning in a world destroyed by nuclear explosion. Encountering a strange creature that kills with its touch, he learns that it's an old irradiated scientist in a radiation suit — another example of radiation poisoning transmitted by touch. In *Attack of the 50-foot Woman* (1958), a woman exposed to radiation during an alien encounter grows to an enormous height, permitting her to deal effectively with her philandering husband. Finally, *Godzilla* (1956) starred Raymond Burr and spawned at least ten sequels, including the high budget, theme-park version in 1998 starring Matthew Broderick. *Godzilla* is, of course, a giant, radiation-mutated lizard that chooses Manhattan as a nesting site, and causes havoc as scientists and the military attempt to destroy it.

This decade ended with a thoughtful but grim Cold War drama about Australians awaiting the inevitably lethal effects of nuclear fallout from atomic explosions that have already destroyed the rest of the world. In *On The Beach* (1959), Gregory Peck, Ava Gardner, Fred Astaire, and Anthony Perkins all give strong performances in an appropriately gritty black and white film that accurately presents the fears of those who were then alive.

The 1960s

In contrast to films about the harmful effects of radiation, 1960 movies revived the prurient nature of x-ray vision, a perennial favorite Hollywood theme. *Magic Spec-*

tacles (1961) and *Paradiso* (1961) both require special goggles that allow the viewer to see naked women, with little else in the plots. However, *X: The Man with the X-Ray Eyes* (1963) is a classic science fiction film starring Ray Milland and directed by Roger Corman. Milland plays a renowned scientist experimenting with human eyesight who develops a drug that enables the user to see through objects, walls, clothes, and the very fabric of reality. The theme of x-ray vision “seeing” truth through falsity is a recurring Hollywood metaphor throughout the twentieth century. The film scientist cannot live with the truth he sees. The implication is that the reality of x-ray vision is beyond human tolerance, meant only for the gods.

By this time, radiographic images of the interior of the body were so familiar that they became the setting for *Fantastic Voyage* (1966), a film based on the premise of a technology to shrink people and objects to microscopic size for about an hour. To save the life of a scientist with a blood clot, a submarine and its crew are shrunk and injected into his carotid artery. Using a drawing of the sick man’s arterial system as a map, the crew’s mission is to travel through his arteries into his brain where, with a miniaturized laser weapon, they will blast the clot out of existence. Certainly this film predated the more recent advances in interventional radiology, including use of both lasers and modern thrombolytic agents.¹² But, perhaps unknown to the film-makers, imaging of vascular thrombosis was already possible with angiography and radioisotope tracers, and interventional techniques were already being used for revascularization.

In 1953, Sven Seldinger described the technique that is the basis for modern percutaneous vascular access.¹³ By the time *Fantastic Voyage* was released, the technique for angioplasty and revascularization of peripheral arteries had been published,¹⁴ and further reports would describe arteriographic management and treatment of gastrointestinal bleeding¹⁵ and lysis of pulmonary clots.¹⁶

While perhaps the real arteriographic technology was too new for *Fantastic Voyage*, there is no excuse for *Inner Space* (1987), a parody/remake of *Fantastic Voyage*. Two decades later, in this film starring Dennis Quaid and Martin Short, there is still no reference to modern arteriographic, interventional, or cross-sectional imaging.

The 1970s and 1980s

The evolution of American films began to change dramatically in the late 1960s. Although Hollywood films were targeted toward a younger audience, those movies did not do well at the box office. Young viewers did not perceive the youth-oriented films produced by Hollywood studios as relevant. Simultaneously, television provided a medium and experience for young, creative writers, actors, and directors who could not find opportunities in Hollywood. Television dramas in the 1950s and 1960s portrayed themes and realism in dramas not often seen in movies of those years. The Hollywood studios, in financial trouble for the first time, were receptive to offering young directors creative freedom and control. These new filmmakers responded by making movies that broke cultural and cinematic molds.¹⁷

One of the hallmark films of this era was a horror thriller set in Washington, D.C. In *The Exorcist* (1973), a young girl, played by Linda Blair, becomes possessed by the devil. A Jesuit priest from Georgetown University recognizes the evil occupancy and arranges an exorcism by an elderly priest to save her life. Before the

priest makes the correct diagnosis, the girl's mother, played by Ellen Burstyn, takes her to Georgetown University Medical Center for a series of diagnostic tests. During an evaluation for a possible seizure disorder, the young girl undergoes carotid angiography, using direct carotid puncture and pneumoencephalography. The scenes are realistic and instructive, especially for young physicians who may not be familiar with the painful rigors of brain imaging prior to the availability of computed tomography (CT). Neurological imaging had rarely been depicted in movies prior to this film, despite brain tumor's being a common movie disease.¹⁸ The absence of brain imaging in movies probably parallels the real-life inability of plain radiography to image the brain. The emergence of brain imaging in films since 1973 parallels the growth of neuroradiology in true life.¹⁹

The 1973 release date of *The Exorcist* is significant, since across town at the real George Washington University Medical Center, one of the first CT scanners in the United States was already in operation.²⁰ Moreover, at Georgetown University itself, another CT technology was in development.

Godfrey Newbold Hounsfield had been working at Electrical and Musical Industries, Limited (EMI) in London for several years developing the CT scanner. In 1971, he and neurosurgeon James Ambrose obtained the first clinical CT image at Atkinson Morley's Hospital in Wimbledon from a forty-one-year-old woman with a frontal lobe brain tumor.²¹ For the development of this revolutionary imaging technology, Hounsfield would receive the 1979 Nobel Prize for physiology or medicine, along with Alan Cormack, who had first built an experimental scanner and devised mathematical algorithms for image reconstruction.²²

EMI, flush from its success in selling the musical recordings of the Beatles in the 1960s, built six prototype scanners.²³ Four units were placed in the United Kingdom and two were sold in the United States, one each to the Mayo Clinic and the Massachusetts General Hospital. David O. Davis, a neuroradiologist at George Washington University, had visited London in 1971 and seen the prototype scanner. The third clinical CT unit in the United States was placed at George Washington University in 1973, the time setting of *The Exorcist*. Moreover, at Georgetown University, Robert Ledley, a professor of biophysics and radiology, was developing the Automated Computerized Transaxial scanner, subsequently marketed in 1975 by Pfizer Corporation.²⁴

Dissemination of CT technology in Hollywood movies took longer than in clinical practice. The first film to depict CT was *Hannah and Her Sisters* (1986). Written and directed by Woody Allen — he also plays a hypochondriac television producer who believes he has a brain tumor because his doctor has discovered a mild unilateral hearing loss. To evaluate his hearing loss, he receives extensive audiometric and radiological testing and undergoes plain radiography, complex motion polytomography, which is inconclusive, and eventually CT. While waiting for the CT results, he imagines being told he has terminal cancer and has only months to live. When told the CT results are normal, he first experiences euphoria, then begins to re-evaluate his life and his mortality more seriously.

By 1986, CT was apparently familiar enough to audiences to be used for both dramatic and comedic effect. Yet by 1986, the diagnostic evaluation shown was anachronistic, since CT had by then replaced polytomography for evaluation of cerebello-pontine angle tumors, and would itself soon be replaced by magnetic resonance imaging (MRI). Ten years later, in *Phenomenon* (1996), a young man with

newly acquired mental skills is found to have a brain tumor. His diagnosis is also made with CT, not MRI. In *Regarding Henry* (1991), Harrison Ford is a lawyer who wanders into the robbery of a convenience store. He suffers a gunshot wound to the head and chest. His radiological evaluation seems clinically appropriate with plain skull radiographs and CT of the brain.

Another film to depict CT made a few errors. In *From Beyond* (1986), the CT scanner produces three-dimensional images of the brain, but it also generates radioactivity that triggers growth in the pineal gland and releases demons that destroy everyone nearby.

The concept of radiation as a significant public health risk was first rendered in *The China Syndrome* (1979), starring Jane Fonda and Michael Douglas. This film is a gripping drama about the attempted corporate cover-up of an accident at a nuclear power plant in California. Had the accident not been contained quickly, as it was, it could have triggered a catastrophic nuclear melt-down with a feared explosion capable of coring through the earth to China. With true timing stranger than fiction, one week after the release of this film, a similar real accident occurred at the Three Mile Island nuclear power plant in Harrisburg, Pennsylvania.

Alleging improper occupational handling of radioactive plutonium, Karen Silkwood, a corporate whistle-blower at the Kerr-McGee nuclear facility in Oklahoma, disappeared en route to present evidence to federal investigators. Both *Silkwood* and *The China Syndrome* use the events of radiation risk at nuclear facilities to dramatize the subsequent heroics of the characters who uncover the corporate villains. An increased rate of cancers, especially leukemia, found among workers at the plant, led to suspicions about improper occupational exposures.

As in prior decades, the metaphor of x-rays to see through falsehood into truth was repeated. In *The Man Who Fell from Earth* (1976), David Bowie plays a humanoid alien who comes to earth in search of water for his dying planet. Radiography eventually exposes him by revealing he has no bones. Similarly, in *Altered States* (1980), William Hurt plays a scientist who volunteers for sensory deprivation experiments. He then experiences hallucinations and evolutionary regression to an apelike hominid. As he loses his ability to speak, radiography of his larynx reveals its altered structure and proves the truth about human evolution.

Of course, every film decade has its x-ray vision films. In *Superman* (1978), the hero has very selective x-ray vision. He can peer through walls and solid objects to see fully clothed villains. He sees women topless, but not bottomless, and never sees naked men. Once again, the issue of radiation exposure with x-ray vision is never considered.

Kevles documents an excellent example of art imitating life with the film *Rampage* (1988).²⁵ In this courtroom thriller, a killer has been convicted of six counts of premeditated murder. His victims include men, women, children, and after an escape from custody, a police officer and a priest. The killer undergoes MRI scanning, with three-dimensional image display, to document that he has normal brain anatomy. However, the defense lawyer uses the results of a positron emission tomography (PET) scan to convince the jury that his client had abnormal brain function and therefore was not in control of his actions. The jury sends the killer to a mental hospital instead of the gas chamber.

Portions of this movie were filmed at the PET laboratory at the University of California at Irvine, a lab that had made a specialty of forensic psychiatry. By 1993

most of Irvine's clinical referrals and PET revenues came from lawyers who sought testimony about the brains of convicted felons for the penalty phase of their trials.²⁶ The science of PET imaging to identify criminal behavior was then, and remains today, controversial. Moreover, when the film was released in 1988, the medical uses of PET remained investigational and had not been approved by the federal Food and Drug Administration. Yet at that time, PET had been deemed to be accurate to meet community standards for real-life use in California courts.

Marcia Angell, an editor for the *New England Journal of Medicine*, has written about the increasing use of scientific testimony that has not passed peer review and general scientific acceptance.²⁷ In 1923, in *Frye v. United States*, a federal trial court ruled that a lie detector test could not be admitted as evidence, on the grounds that there was not yet a scientific consensus about the validity of this new technique. In *Frye*, the court said that testimony must speak to the work of others, that is, it was admissible only if it incorporated principles and methods generally accepted by the relevant scientific community. This ruling, upheld by the Court of Appeals, became the general acceptance standard for expert scientific testimony.

In 1975, new Federal Rules of Evidence were signed into law by President Gerald Ford. The new rules contained criteria for scientific testimony that included validity but omitted the requirement for general acceptance in the scientific community. Whether the new rules superseded *Frye* or not was unclear. The courts had no guidance at that time and product liability suits increased as the standard for scientific evidence was lowered. The use of PET scans for forensic testimony in 1988, when depicted in *Rampage*, was certainly controversial and by no means universal. In 1993, the United States Supreme Court, in *Daubert v. Merrell Dow Pharmaceuticals*, decided that the new Federal Rules superseded *Frye*. However, it required federal judges to undertake a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the fact in issue. Thus, judges are now the gatekeepers who decide whether to admit expert testimony. This decision remains controversial.

Advanced imaging technology, especially PET, which may show functional findings not seen with CT or MRI, is often more easily accepted over opposing expert testimony in court, because an image is more powerful than words. Much like the fictional jury in the film, when the movie lawyers in *Rampage* use PET images to prove mental incompetence, the audience is willing to accept the forensic proof of the technology.

The 1990s and 2000

At least fifty films with medical themes were released in the 1990s. The marked increase in medical movies in the 1990s is probably owing to two related factors. First, the leading edge of the baby boom generation, which defined much of the audience for Hollywood films for the last four decades, began to age. Films about adults with illnesses were now relevant to this generation. Second, and perhaps related to this demographic aging, health care costs became a significant economic and political issue in the late 1980s. Health care reform became a publicly debated issue and a legislative priority for newly elected President William Clinton in 1992. Probably in response to the growing awareness of health care issues, films with medical themes poured out of Hollywood from 1990 to 1995.

The Doctor (1991) is an outstanding movie, described in Part I, that should be seen by every physician and medical student. William Hurt, who plays the title character, develops laryngeal carcinoma. As a patient, he is forced to see hospitals and physicians from a patient's perspective, at times a cold-blooded, bureaucratic, and frustrating image. In the end, his cancer is apparently cured and he initiates an educational program for medical students to instill empathy and humanism, letting them experience directly the humiliations and frustrations of our modern medical complexes. Many real medical schools provide such experiences for medical students.²⁸

This film is full of scenes we recognize from real clinical life. Radiology is used to depict a microcosm of patient frustrations. The protagonist becomes irate when he has to wait to see the consulting radiation oncologist. Later, he receives a barium enema meant for another patient. Other films have also used movie radiology departments to depict patients' long waits or even disappearances. In *House of God* (1984), to justify keeping patients in the hospital, radiology tests are ordered unnecessarily. In *Article 99* (1992), when hospital administrators try to discharge patients early to save money, the resident physicians hide patients by losing them in the radiology department.

In *The Doctor*, Hurt's character undergoes a staging MRI scan. He becomes progressively irritated and anxious as days go by without having being told the results. Finally, he bullies radiology department personnel to read him his own MRI report, which does not indicate spread of tumor to regional lymph nodes. However, after radiation therapy, a second MRI scan shows primary tumor growth, necessitating a partial laryngectomy. I believe this to be the first clinical use of MRI scans in movies; the usage in *Rampage* was for forensic use.

In development since at least the early 1970s, several MRI investigational clinical sites were operational by the 1980s. The FDA, however, deemed MRI experimental until 1985, when commercial sales were permitted.²⁹ By 1991, filmmakers and audiences were apparently familiar enough with the technology to recognize its dramatic use in *The Doctor*.

In the 1990s, sonography finally made it to the movies. In *Father of the Bride II* (1995) and *Nine Months* (1995), real-time fetal sonography is depicted in scenes that bond husbands and a father — and presumably the audience — to the film's unborn child. By the time of the release of these films, ultrasound had been used in fetal evaluation for several decades.³⁰ Therefore the filmmakers again felt that the technology was widely enough disseminated to connect immediately with movie audiences.

Recent movies have continued the tradition of using x-ray vision for titillation. In *Total Recall* (1990), the airport x-ray metal detector was transformed for human use. People boarding the subway in a futuristic society pass through a security station that resembles a giant fluoroscopy screen. The security guards watch a series of live skeletons march by on their way to the trains. The issue of radiation exposure is of course ignored. In *The Kid with the X-ray Eyes* (1999), a young boy and his father find a set of goggles lost by international spies on the beach. Of course, they use these to see naked women — but only topless, never bottomless. Finally, a remake of the 1963 classic film *X: The Man with the X-Ray Eyes* is in production for future release, with Tim Burton scheduled as the director. It appears that, much like the future of radiology, the future of x-ray vision in movies is secure.

Sidney Poitier plays Dr. Luther Brooks, the first black intern at County Hospital, in a remarkable film, *No Way Out* (1950). The image of a black doctor treating

white patients was so threatening that this film was banned in parts of the United States and in Poitier's native Bahamas, then still a colony of Britain. The movie is notable for the performance of Richard Widmark as a hate-filled racist patient in the hospital. The interplay between these two great actors made this film a classic in the portrayal of race tensions and presaged the 1954 Supreme Court decision on *Brown v. The Board of Education of Topeka*. After two decades of civil rights strife, however, a black man as a physician in a film became acceptable. The radiation oncologist in *The Doctor* is a black man, as is the surgery resident portrayed by Forest Whitaker in *Article 99* (1992).

Radiologists are seldom shown in movies, and I have never recognized a female radiologist on film. Women physicians had been portrayed in films of the 1930s — *Mary Stevens, M.D.* (1933), *Right to Romance* (1933), and *Woman Doctor* (1939) — but had disappeared after World War Two. Women physicians were depicted in *The Disorderly Orderly* (1964), *Promises in the Dark* (1979), *Article 99*, *Stepmom*, and *One True Thing* (1999); a woman surgical resident was portrayed in *Coma*.

This review has described movie portrayals of radiography, radiation therapy, fetal ultrasound, angiography, computed tomography, MRI, and PET scanning. But to my knowledge, Hollywood has not yet described breast imaging with mammography or sonography. In fact, there has been virtually no reference to breast cancer in movies.³¹ There are at least three possible explanations for this omission. First, prior to the second World War, mammography was not widely available and the Motion Picture Production Code severely limited the ability of filmmakers to show or even discuss breasts. However, by the time mammography became widely available in the 1970s and 1980s, such limitations had disappeared.³² Second, themes of breast cancer and mammography are so widely disseminated in popular magazines and television that Hollywood filmmakers may consider the topic stale. Third, although mainstream films have long included a love affair with naked breasts, breast cancer subverts nudity by presenting the organ as diseased. After all, is a breast with cancer sexy? In this case, breast nudity trumps the x-ray connotation of nudity.

In summary, Hollywood films often exploit themes of nudity and eroticism with x-rays, even though these themes have little to do with real radiology. The prurient use of x-ray vision in films is an overwhelming temptation to filmmakers that has been utilized throughout the twentieth century. Popular films render radiation as either good or evil. The good characteristics are technological advancement, infallibility, health-related benefits, and the ability to uncover truth from surrounding mendacity. The evil characteristics include dramatization of the risks of radiation, nuclear holocaust, and environmental disaster. Too many films about radiation are science fiction and too few are reality-based stories about clinical care. While some movies use true events for inspiration, and while some science fiction themes predate true science and technology, most Hollywood reproductions of medical imaging are anachronistic compared with contemporaneous practice. Film depiction of imaging modalities usually requires complete familiarity with that modality from the audience. Unfortunately, the accurate depiction of radiology or the role and diversity of radiologists is seldom seen in Hollywood movies.

Why Can't Hollywood Display the Films Correctly?

One final note. If we were to use the display of radiographs in movies as a gauge, we

would never believe any movie technology. Movies are rife with examples of radiographs displayed incorrectly on light boxes, usually only as medical background decoration. The effects for a radiologist in the theater audience are dismay and frustration. Given all the money spent on contemporary commercial films, hiring an expert to display radiographs correctly would be a trivial expense.

For example, chest radiographs are displayed backward in *House Calls* (1978), *Critical Condition* (1987), *Article 99* (1992), and *Boiler Room* (2000). A chest CT was done to evaluate the effects of a gunshot wound to the character played by Tommy Lee Jones in *U.S. Marshals* (1998). Unfortunately, the CT film display is inverted. *The Doctor*, one of the most accurate medical films ever made, is based on the true experiences of Ed Rosenbaum, M.D., who coauthored the screenplay. Yet in the movie a chest film is prominently displayed backward. In the film *Patch Adams* (1998), about the life of an unconventional doctor during medical school, the real-life title character is credited as a writer and technical adviser. Despite this professional expertise, an inverted chest radiograph is displayed prominently in one scene that was also used in promotional trailers and previews.

A simple explanation for these errors is that the property manager probably observes the L or R on the radiograph, indicating left or right. He then orients the image on the light box with the L or R on *his own* left or right side, not realizing that the standard for orientation is the image's left on the viewer's right.

However, I have another theory. The late Thomas Beneventano, an esteemed radiologist at Montefiore Medical Center in New York, was fond of comforting candidates for the American Board of Radiology oral examinations, who in their nervousness and anxiety would inadvertently place a radiograph on the light box incorrectly. "There are seven ways to put a film up wrong," he would say, "and only one way to do it right. So the odds were seven-to-one against you." (With a rectangular two-sided image, there are two vertical and two horizontal possible orientations per side, or eight total possible ways to display the image.) He was correct. Filmmakers have a seven-to-one chance of putting the films up incorrectly, and it shows when one sees movies with medical themes. With such odds against uninformed filmmakers, perhaps we should be happy that the radiographs are displayed correctly in movies as often as they are. ❧

Appendix Movie Credits

Dark Victory, 1939

Directed by Edmund Goulding; starring Bette Davis and George Brent. Academy Award nominations: Best Actress, Best Musical Score, Best Picture.

Love Story, 1970

Directed by Arthur Hiller; starring Ali McGraw and Ryan O'Neal. Academy Award for Best Original Musical Score; nominated for Best Actor, Best Actress, Best Supporting Actor, Best Picture, Best Director, Best Screenplay Adaptation.

Bang the Drum Slowly, 1973

Directed by John Hancock; starring Robert DeNiro and Michael Moriarty. Academy Award nomination: Best Supporting Actor.

Promises in the Dark, 1979

Directed by Jerome Hellman; starring Marsha Mason and Ned Beatty.

Terms of Endearment, 1983

Directed by James L. Brooks; starring Shirley MacLaine, Jack Nicholson, and Debra Winger. Academy Awards for Best Picture, Best Director, Best Supporting Actor, Best Actress, Best Screenplay Adaptation; nominated for Best Actress, Best Supporting Actor, Best Music, Best Sound, Best Film Editing, Best Art Direction.

A Civil Action, 1998

Directed by Steven Zaillian; starring John Travolta and Robert Duvall. Academy Award nominations: Best Supporting Actor, Best Cinematography.

The Doctor, 1991

Directed by Randa Haines; starring William Hurt, Christine Lahti, and Elizabeth Perkins.

Dying Young, 1991

Directed by Joel Schumacher; starring Julia Roberts and Campbell Scott.

Medicine Man, 1992

Directed by John McTiernan; starring Sean Connery and Lorraine Bracco.

My Life, 1993

Directed by Bruce Joel Rubin; starring Michael Keaton and Nicole Kidman.

The Rainmaker, 1997

Directed by Francis Ford Coppola; starring Matt Damon, Claire Danes, and Danny DeVito.

Stepmom, 1998

Directed by Chris Columbus; starring Julia Roberts, Susan Sarandon, and Ed Harris.

One True Thing, 1998

Directed by Carl Franklin; starring Meryl Streep, Renée Zellweger, and William Hurt.

Notes

Part I

1. S. E. Lederer, "Repellent Subjects: Hollywood Censorship and Surgical Images in the 1930s," *Literature and Medicine* 17 (1998): 91–113.
2. Ibid.; P. E. Dans, "The Temple of Healing: Reflections from a Physician at the Movies," *Literature and Medicine* 17 (1998): 114–125; T. H. Crawford, "Visual Knowledge in Medicine and Popular Film," *Literature and Medicine* 17 (1998): 24–44; J. M. Welsh, "Strong Medicine at the Movies: A Review," *Literature and Medicine* 12 (1993): 111–120; J. K. Crellin and A. F. Briones, "Movies in Medical Education," letter, *Academic Medicine* 70 (1995): 745; R. Crawshaw, "The Physician at the Movies," *Pharos* (Summer 1998): 43–46; J.A.C. Girone, "Medicine in the Movies," *Postgraduate Medicine* 77 (1985): 205–210; C. Myser and D. L. Clark, "'Fixing' Katie and Eilish: Medical Documentaries and the Subjection of Conjoined Twins," *Literature and Medicine* 17 (1998): 45–67.
3. Lederer, "Repellent Subjects."
4. Ibid.
5. Ibid.
6. P. Biskind, *Easy Riders, Raging Bulls: How the Sex-Drugs-and-Rock 'n' Roll Generation Saved Hollywood* (New York: Touchstone Books, 1998).
7. "Can Al Bare His Soul?" *Time* 150, no. 25 (December 15, 1997).
8. C. Mack, "Legislative Efforts to Fund Cancer Screening," in *Cancer Screening*, D. S.Reintgen and R. A. Clark, eds. (St. Louis: Mosby, 1996), 290–297.
9. M. McCaffery, "Pain Control: Barriers to the Use of Available Information," World Health Organization Expert Committee in Cancer Pain Relief and Active Supportive Care, *Cancer* 70 (1992):1438–1449.
10. B. R. Cassileth, E. J. Lusk, T. B. Strouse, and B. J. Bodenheimer, "Contemporary Unorthodox Treatments in Cancer Medicine," *Annals of Internal Medicine* 101 (1984):105–112.
11. C. Lindley, J. S. McCune, T. E. Thomason, D. Lauder, A. Sauls, S. Adkins, and W. T. Sawyer, "Perception of Chemotherapy Side Effects: Cancer versus Noncancer Patients," *Cancer Practice* 7 (1999): 59–65.
12. A. M. Griffin, P. N. Butow, A. S. Coates, A. M. Childs, P. M. Ellis, S. M. Dunn, and M. H. Tattersall, "On the Receiving End.V: Patient Perceptions of the Side Effects of Cancer Chemotherapy in 1993," *Annals of Oncology* 7 (1996): 189–195.
13. Barrett S. Cassileth, ed., *Dubious Cancer Treatment: A Report on "Alternative" Methods and the Practitioners and Patients Who Use Them* (American Cancer Society, Florida Division, Inc.1001 S. MacDill Ave., Tampa, Fl. 33629, 1991).
14. B. R. Cassileth, E. J. Lusk, D. Guerry, B. A. Blake, W. P. Walsh, L. Kascius, and D. J. Schultz, "Survival and Quality of Life among Patients Receiving Unproven as Compared with Conventional Cancer Therapy," *New England Journal of Medicine* 324 (1991): 1180–1185.
15. H. J. Burstein, S. Gelber, E. Guadagnoli, and J. C. Weeks, "Use of Alternative Medicine by Women with Early Stage Breast Cancer," *New England Journal of Medicine* 340 (1999): 1733–1739.
16. Cassileth et al., "Survival and Quality of Life among Patients Receiving Unproven as Compared with Conventional Cancer Therapy"; Office of Technology Assessment, "Unconventional Cancer Treatments" (Washington, D. C.: Government Printing Office, OTA Publication No. OTA-H-405, 1990).
17. Public Law 105-277, 11 Stat. 2861.

Part II

1. S. E. Lederer, "Repellent Subjects: Hollywood Censorship and Surgical Images in the1930s," *Literature and Medicine* 17 (1998): 91–113; P. E. Dans, "The Temple of Healing: Reflections from a Physician at the Movies," *Literature and Medicine*

- 17 (1998): 114–125; T. H. Crawford, "Visual Knowledge in Medicine and Popular Film," *Literature and Medicine* 17 (1998): 24–44; J. M. Welsh, "Strong Medicine at the Movies: A Review," *Literature and Medicine* 12 (1993): 111–120; J. K. Crellin and A. F. Briones, "Movies in Medical Education," letter, *Academic Medicine* 70 (1995): 745; R. Crawshaw, "The Physician at the Movies," *Pharos* (1998, Summer): 43–46; J.A.C. Girone, "Medicine in the Movies," *Postgraduate Medicine* 77 (1985): 205–210; C. Myser and D. L. Clark, "'Fixing' Katie and Eilish: Medical Documentaries and the Subjection of Conjoined Twins," *Literature and Medicine* 17 (1998): 45–67; R. A. Clark, "Reel Oncology: How Hollywood Films Portray Cancer," *Cancer Control* 6 (1999): 517–527; P. E. Dans, *Doctors in the Movies* (Bloomington, Ill.: Medi-Ed Press, 2000); J. C. Soares, *Hollywood Doctors* (Charlottesville, Va.: Thomasson-Grant, 1994).
2. B. H. Kevles, *Naked to the Bone* (Reading, Mass.: Helix Books, Addison-Wesley, 1997).
3. Ibid.
4. Ibid.
5. P. Brown, *American Martyrs to Science through the Roentgen Rays* (Springfield, Ill.: Charles C. Thomas, 1936)
6. Kevles, *Naked to the Bone*; D. P. Serwer, *The Rise of Radiation Protection: Science, Medicine, and Technology in Society, 1896–1935* (Princeton: Princeton University Press, 1977).
7. Kevles, *Naked to the Bone*.
8. Ibid.
9. A. Margulis and R. Eisenberg, "Gastrointestinal Radiology from the Time of Walter B. Cannon to the 21st Century," *Radiology* 178 (1991): 297–302.
10. Kevles, *Naked to the Bone*.
11. J. Hersey, *Hiroshima* (New York: Knopf, 1946).
12. R. I. White, "Interventional Radiology: Reflections and Expectations," the 1985 Eugene P. Pendergrass New Horizons lecture, *Radiology* 162 (1987): 593–600.
13. S. I. Seldinger, "Catheter Replacement of the Needle in Percutaneous Arteriography: A New Technique," *Acta Radiologica* 39, Stockholm (1953): 368–370.
14. C. T. Dotterer and M. P. Judkins, "Transluminal Treatment of Arteriosclerotic Obstruction: Description of a New Technique and a Preliminary Report of Its Application," *Circulation* 30 (1964): 654–670.
15. S. Baum, M. Nusbaum, and W. Blakemore, "Demonstration of Intra-abdominal Bleeding by Selective Arteriography," *JAMA* 191 (1965): 389–390; S. Baum, M. Nusbaum, H. R. Clearfield, K. Kuroda, and H. J. Tumen, "Angiography in the Diagnosis of Gastrointestinal Bleeding," *Archives of Internal Medicine* 119 (1967): 1:16–24.
16. Y. Sakakihara, D. N. Biery, R. D. Polishook, D. E. Wagner, S. Baum, and M. Nusbaum, "Selective Lysis of Pulmonary Clots," *Surgery, Gynecology, and Obstetrics* 130 (1970): 5:821–8.
17. P. Biskind, *Easy Riders, Raging Bulls: How the Sex-Drugs-and-Rock 'n' Roll Generation Saved Hollywood* (New York: Touchstone Books, 1998).
18. Clark, "Reel Oncology: How Hollywood Films Portray Cancer."
19. J. M. Taveras, Diamond Jubilee Lecture, "Neuroradiology: Past, Present, Future," *Radiology* 175 (1990): 593–602.
20. Kevles, *Naked to the Bone*.
21. G. N. Hounsfield, "Computed Medical Imaging," Nobel lecture, *JCAT* 4 (1980): 665–674.
22. Ibid., G. DiChiro and R. A. Brooks, "The 1979 Nobel Prize in Physiology or Medicine," *Science* 206 (1979): 1060–1062.
23. Kevles, *Naked to the Bone*.
24. Ibid.
25. Ibid.
26. Ibid.
27. M. Angell, *Science on Trial* (New York: Norton, 1997).

28. D. Franklin and K. Griffin, "Doctors as Patients: How Does It Feel?" *Health* 5 (1991): 14–18.
29. Kevles, *Naked to the Bone*.
30. G. Leopold, Radiological Society of North America, Diamond Jubilee Lecture, "Seeing with Sound," *Radiology* 175 (1990): 23–27.
31. Clark, "Reel Oncology: How Hollywood Films Portray Cancer."
32. R. H. Gold, L. W. Bassett, and B. E. Widoff, "Highlights from the History of Mammography," *Radiographics* 10 (1990): 1111–1131.

