

Infectious Diseases in Cinema: Virus Hunters and Killer Microbes

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The world of infectious diseases has been rarely presented in the cinema with accuracy. Apart from random biographies of scientists and retellings of stories about great epidemics from the past, most films focus on the dangers presented by outbreaks of unknown agents that originate from acts of bioterrorism, from laboratory accidents, or even from space. We review these films and underline the possible effect that they have on the public's perception of infection—a perception that, when misguided, could prove to be problematic in times of epidemics.

Although the science of medicine—and infectious diseases and clinical microbiology, in particular—has evolved roughly in parallel with the art of cinema, the relationship between art and science remains inconsistent. This is particularly important in our time, because, as was proven in part during the recent anthrax outbreak, the public's perceptions—and, accordingly, their reactions—are significantly influenced by their view on scientific truth as presented by the media.

Cinema is an art of the 20th century, and there has been much progress in infectious diseases and microbiology in the 20th century. The discovery and widespread use of antibiotics coincided with the appearance and spread of the "talking pictures"; the incidence of and problems associated with antibiotic resistance increased in parallel with the threat to

cinema presented by television; the HIV epidemic coincided with the "VCR epidemic" in the early 1980s; and the beginning of the 21st century saw a bright future lying ahead both for science, in the form of molecular genetics, and for art, in the form of the digital revolution.

Medicine has been always overlooked by cinema. Admittedly, scientific study is a repetitive and, therefore, "boring" procedure, the specific nomenclature used in science can easily alienate nonspecialists, and surgical procedures may be unsuitable for viewing by sensitive audiences. Thus, cinema did not appear to have an affinity for medicine, until at least the past decade. Mainly because of the success of the television show *E. R.*, which has managed, by means of frantic editing, to simulate the atmosphere of any emergency department worldwide, the public and the film industry have focused more on medicine. Of all medical specialties, infectious diseases seems to be the only specialty that can offer cinema the required suspense. Memories of great epidemics and continuously available information on new epidemics and dangerous viruses have embedded in the public a sense of awe about

infection, a prerequisite for cinematic success. In this article, we review the history of films related to infectious diseases and discuss the various trends that have been present. One should never forget that some of these trends have subsequently been adopted by the public as facts, and, therefore, they act as determinants of public reactions to possible future infectious outbreaks and, perhaps, government policies.

HISTORICAL REFERENCES

The early days of cinema were characterized by admiration for infectious diseases pioneers and by awe for the devastating outcome of epidemics. *The Story of Louis Pasteur* (1935; director, William Dieterle) was an artistically and commercially successful retelling of Pasteur's efforts toward pasteurization and toward vaccination of sheep against anthrax. The film focused on the reactions caused by Pasteur's then-revolutionary ideas and was part of a series of saintly biographies that subsequently included *Dr. Ehrlich's Magic Bullet* (1940; director, William Dieterle), which focused on Ehrlich's attempts to fight both syphilis

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and the establishment. In the same vein, a biography called *Robert Koch* (1939; director, Hans Steinhoff) was produced by Nazi Germany, and, despite the presence of the authoritative figure of Emil Jannings in the title role, it managed to serve as Nazi propaganda. The hard-to-obtain *Docteur Laennec* (1949; director, Maurice Cloche) focuses on the fight against tuberculosis and the evolution of modern auscultation techniques.

The great influenza epidemic of 1918 and memoirs about the plague epidemics from medieval times have often been presented on film. *Influenza 1918* (1998) is a Public Broadcasting Service (PBS)-produced documentary focusing on the month-by-month spread of the great influenza epidemic of 1918. It is of adequate scientific and cinematic interest, is respectful of scientific information, and contains important educational and historical material. The influenza epidemic serves as an important determinant of the heroes' fate in a number of other films, most notably *1918* (1985; director, Ken Harrison), which focuses on the effect that the epidemic had on several Texan families. *Gypsy Fury* (1949; director, Christian Jacques) is a hard-to-obtain, significant visualization of the dread associated with the "black death" pandemics; through impressionistic, black and white pictorials, it stands long in the mind. In part, the film was influenced by *Die Pest in Florenz* (1918; director, Fritz Lang), which was based on Edgar Allan Poe's "The Masque of the Red Death." One should mention a Swedish film in a similar vein, *Trollsyn* (1994; director, Ola Solum). A typhoid epidemic and the delay in the diagnosis of typhoid by the titular character was the main theme of *Dr. Bull* (1933; director, John Ford). In 1931's *Arrowsmith* (director, John Ford), a highly awarded film based on the Sinclair Lewis novel of the same name, the character played by Ronald Colman endlessly experiments on means to treat the plague. The "bacteriophages" of Lewis' novel are turned on-screen to magic serum, which

the hero tries to use in a controlled trial in a Caribbean colony. The importance of controlled trials is underlined, and the idea of using viruses to deliver antibacterial treatment is still intriguing. Another film based on a celebrated novel was 1939's *The Citadel* (director, King Vidor), which focuses on an idealistic doctor fighting tuberculosis in a mining town.

Two made-for-television documentaries are of significant scientific and educational importance. *Plague Fighters* (1996; director, Ric Bienstock) is a documentary about the efforts to contain an epidemic of Ebola virus infection in Kikwit, Zaire, that killed 244 patients. *Smallpox 2002: The Silent Weapon* (2002) is an excellent semidocumentary that mixes a story about a smallpox outbreak with interviews with experts. It occasionally uses real scientists to produce a chillingly scientifically accurate "what if" scenario.

BIOTERRORISM IN FILMS

Cinema is always in need of villains, and the premise of a terrorist attack involving biological weapons has always been of interest. In *12 Monkeys* (1995; director, Terry Gilliam), a group of terrorists with environmental concerns called "the Army of Twelve Monkeys" is believed to have spread an unknown virus in 1996, ensuing in 5 billion deaths, and the remaining 1% of the population is forced to live underground. In *The Omega Man* (1971; director, Richard Fleischer), Charlton Heston plays the only survivor from a biological world war, because he had received an experimental vaccine. A deadly virus is in the possession of terrorists in *Operation Delta Force* (1997; director, Sam Firstenberg), and terrorists seize control of an Israeli biomedical laboratory in *Deadly Outbreak* (1995; director, Rick Avery). The latter 2 films ignore scientific accuracy and focus instead on poorly executed action. Worse, though, is *D.R.E.A.M. Team* (1999; director, Dean Hamilton), in which anthrax-wielding terrorists oppose a number of sensual female agents! Action, but not

scientific accuracy, is better served in *Mission Impossible II* (2000; director, Brian De Palma), a massive international success, which sees Tom Cruise save the world from a genetically created disease called "Chimera." (Interestingly, the antidote is called "Bellerophon," indicating an ignorance of Greek mythology as well as clinical microbiology; it was Bellerophon who killed Chimera. Of interest for hepatitis specialists, Bellerophon's horse was Pegasus.) In *Code Name Trixie* (1973; director, George Romero), the agent in a biological weapon is accidentally released in the water supply of a small town. The virus (named "Trixie") affects people in different ways. Either they act violently, or they are catatonic. Soldiers in white protective suits arrive, and the military doctors offer vaccines to the troops and a few civilians.

Of historical importance is *Hei Tai Yang 731* (1988; director, Tun Fei), which focuses on Japanese biological warfare experiments performed in a Chinese prisoner of war camp during the Second World War.

Most significant, however, is *WW3* (also called *Winds of Terror*; 2001; director, Robert Mandel), in which bioterrorists use a deadly virus to eradicate humanity. There is no world war, despite the title. There is a brief message at the end of the film underlining that events like those depicted are simply impossible. The film was aired on television a few months before the anthrax outbreak of 2001.

ACCIDENTS CAN HAPPEN

The release of biological agents can be not only a result of bioterrorism; it can also be the result of a laboratory accident. A military-engineered virus eradicates all human life except for some scientists residing in Antarctica in *Virus* (1980; director, Kingi Fukasaku), which is an excellent depiction of the possible aftermath of a bioterrorist attack. In *The Satan Bug* (1965; director, John Sturges), a leak of the titular agent from a laboratory leads to eradication of all life on the planet. In

The Missing Are Deadly (1975; director, Don McDougall), rats carry a deadly agent outside of the laboratory, ensuing in 100 million deaths in the subsequent 3 weeks. *The Stand* (1994; director, Mick Garris), which is based on a Stephen King novel, presents an apocalyptic view of a laboratory's accidental release of a deadly agent. A more recent film, *Resident Evil* (2002; director, Paul Anderson), unfolds entirely in a biological laboratory in which an accident has to be contained. Unfortunately, the film's main concern is action and not scientific accuracy.

KILLER VIRUSES

A virus that can eradicate humanity is a film subject waiting for a cinematic and scientific masterpiece. In the misleadingly titled *Plague* (1978; director, Ed Hunt), the deadly virus is called M-3: the Gemini strain. In *Fatal Error* (1999; director, Armand Mastroianni), the unidentified virus, which eradicates life in Seattle before a beautiful Centers for Disease Control and Prevention (CDC) expert takes control, turns out to be... a computer virus that evolved in organic species! Another beautiful CDC expert faces the threat of an epidemic of viral fever imported from Mexico in *Jericho Fever* (1993; director, Sandor Stern). In *Pandora's Clock* (1996; director, Eric Laneuville), a "doomsday" virus has to be contained on a plane to save humanity. *Burning Zone* is a 1996 television series reminiscent of the more successful *The X Files*; it focuses on the efforts of a government scientific team to control spread of a man-made virus, an epidemic of cholera in Detroit (imported via South Pacific pearls), and outbreaks of hemorrhagic fever, among other things. In the recent *28 Days Later* (2003; director, Danny Boyle), another killer virus eradicates the population of the United Kingdom, and some of the survivors became zombielike monsters.

The most significant, scientifically accurate, and prototypic of all films of this genre is *The Andromeda Strain* (1971; di-

rector, Robert Wise). Based on a novel by Michael Crichton, who was trained as a doctor, it accurately details the appearance of a deadly agent, its impact, and the efforts at containing it, and, finally, the work-up on its identification and clarification on why certain persons are immune to it. The virus is of alien origin, having come to earth with the fall of a satellite, and it kills humans by clotting their blood. In one interesting scene, gas bombs are fired at birds that feed on the bodies of victims, to avoid spread of the virus.

THE HOT ZONE

In 1994, two rival films focusing on outbreaks of infectious diseases were to be produced by Hollywood. The first, *Crisis in a Hot Zone*, which was set to star Jodie Foster and was based on a memoir about a real-life near-outbreak of Ebola, never made it to the screen. The second, *Outbreak* (1995; director, Wolfgang Petersen), remains the most important film about an outbreak of infectious disease. The film focuses on an outbreak of an imported Motaba virus in the United States. The virus is named after the river in The Congo across whose banks the first epidemic had evolved 20 years earlier and is considered deadlier than Ebola, killing within 24 h after exposure and liquefying internal organs in the process. (Obviously, the screenwriters were influenced by the history of Ebola and Mokola viruses. Of interest, when we are shown an electronic microscopic picture of the virus, what we really see is a strain of Ebola virus.) The bombing of an entire village (!) controlled the first epidemic in Africa. The issue of the viral origin of the disease is briefly referenced when the local witch doctor blames "killing the trees" for its emergence. Years later, a monkey imports the disease to the United States, and the virus is let loose. The first carrier kisses his girlfriend, and so on. In the most accurate depiction of the science of infectious diseases on cinema, the camera follows particles released by sneezing by one of the

carriers in the air of a crowded movie theater. Moreover, a scientist is infected in a laboratory when a test tube breaks during centrifugation (the depiction of level 4 biosafety precautions is also accurate). We learn that an antidote exists and that the Army Medical Research Institute for Infectious Diseases possesses it. After this point, scientific accuracy is sacrificed, and cinematic laws prevail. Dustin Hoffman plays the head of the Army Unit, the beautiful CDC official in charge is his ex-wife, et cetera. The CDC scientist manages to get infected (but remain beautiful), and Hoffman manages to trace the imported monkey and construct an antibody preparation (in a matter of hours!) to save his beloved, and he also manages to abort efforts to control the outbreak through another bombing! In spite of all these distortions, *Outbreak* remains the most sincere attempt to accurately portray the science of clinical microbiology in cinema.

OTHER OUTBREAKS

Numerous other outbreaks and epidemics are depicted in film. One of the earlier and most interesting examples is *Panic in the Streets* (1950; director, Elia Kazan), which follows the race of scientists against time to trace what killed a man, who subsequently proved to suffer from pneumonic plague, to avoid spread. Similarly themed is *Quiet Killer* (1992; director, Sheldon Larry), whereas *The Killer that Stalked New York* (1950; director, Earl McEvoy) focuses on a smallpox carrier who imports the disease from Cuba. *La Peste* (1992; director, Louis Puenzo), based on the novel of that name by Albert Camus, focuses on the impact that an outbreak of plague has on various inhabitants of a South American town. Both the novel's and the film's main concern is the psychological impact of the disease. In *Last Man on Earth* (1964; director, Sidney Salkow), Vincent Price is the only survivor from a deadly outbreak of plague, because he had developed immunity while working with the bacterium years earlier. *80,000 Suspects* (1963; direc-

tor, Val Guest), which is based on Trevor Elleston's novel *The Pillars of Midnight*, focuses on an outbreak of smallpox in a town in southern England. In *Contagious* (1997; director, Joe Napolitano), cholera-infected shrimp are served for dinner during a flight to United States from Mexico, and drugs contaminated by the carrier/druglord further spread the disease. Fortunately, the character played by former "bionic woman" Lindsay Wagner saves the day. (Wagner later on managed to contain an epidemic on a cruise ship in 1998's *Voyage of Terror* [director, Brian Trenchard-Smith]). Ebola virus is imported to Hong Kong from South Africa and causes an outbreak in the awful 1996 horror film *Yibola bing du* (director, Herman Yau).

Quarantine measures were accurately depicted in an episode of the medically themed television series *Chicago Hope*, to contain spread of a possible deadly infection. A similar attempt at controlling a hospital epidemic of legionnaires disease was depicted in 2 episodes from 1982 of another television series that influenced public perception of medical practice, *St. Elsewhere* (which, in another episode, was also the first to tackle HIV infection). Quarantine of a train is performed in *Cassandra Crossing* (1976, director, George Kosmatos), and *Daybreak* (1993; director, Stephen Tolkin) depicts an epidemic of a plagueslike disease in New York that forces

authorities to build prison camps for quarantine and to mark all possibly exposed persons with a "P." *Isle of the Dead* (1945; director, Mark Robson) takes place in 1912 on a Greek island that serves as quarantine place for plague victims (the film is also one of the first to associate vampires with an infectious disease, a theme that was overexploited later).

SEXUALLY TRANSMITTED DISEASES, HIV INFECTION, AND TUBERCULOSIS

The dangers of sexually transmitted diseases have been rarely depicted in the cinema. 1936's *Sex Madness* (director, Dwain Esper) is a ridiculous ethology against gonorrhea. *Intimate Agony* (1983; director, Paul Wendkos) focuses on the burden of genital herpes. The latter aired around the same time that there were the first announcements of the "new epidemic" of AIDS.

AIDS has been depicted in cinema adequately in all its aspects. In fact, it would take another article to focus on the ways in which its various aspects are presented in film. One should remember, however, *And the Band Played on* (1993; director, Roger Spottiswoode), a somber retelling of the history of the disease, its outbreak, and the first heroic attempts to recognize and control HIV infection, and *Philadel-*

phia (1994; director, Jonathan Demme), which accurately presented, through Tom Hanks's performance, the physical deterioration during the end-stage of the disease.

Tuberculosis, on the other hand, has been ignored by cinema. Of note, it is the cause of death of 2 tragic heroines: Greta Garbo's character in 1936's *Camille* (director, George Cukor) and Nicole Kidman's character in 2001's *Moulin Rouge* (director, Baz Luhrmann), although the latter's deterioration was *too* rapid.

CONCLUSIONS

Most depictions of aspects of infectious diseases in cinema are inaccurate. Even the most sincere efforts tend to be marred by extreme scientific inaccuracies, and the premise of epidemics involving unknown viruses of dubious origin that cause apocalyptic events serves to instill the public with fear, which may turn to panic when similar situations arise. Control of the content of film is neither feasible nor ethical. Therefore, specialists should be alert about the effect that cinema has on morphing public opinion and the concepts involving medicine that are presented, and efforts toward informing the general public should be intensified.