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From evil demiurge to caring hero: images of geneticists in the movies

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ABSTRACT

Although images of science and scientists depicted in popular culture have been criticized as an exaggeration and fear mongering, the cinema is an important resource that influences individuals' beliefs about science. Because popular depictions of science play a crucial role in constructing the public's 'scientific imaginary' they constitute an inherent dimension of the social understanding of science and are as important for science communication as the 'real' science. Fictional filmic representations of geneticists portrayed in 145 films reveal that popular culture (re)constructs common images and stereotypes of scientists. While the most prevalent negative stereotypes depicted in films include: the evil demiurge, the egoist without morals, the nerdy geneticist, and the capitalist who betrays the ethos of science, over the last few decades films tend to construct more positive images of geneticists: the objective researcher, the practical expert, the bioethicist, the caring physician and the dedicated idealist. Additionally, although molecular biology depicted in films largely represents a man's world, especially since the 1990s, the figure of the woman geneticist is on the rise. The coexistence of multiple representations of geneticists in films demonstrate that cinematic images of geneticists constitute an important narrative tool that helps moviemakers in reconstructing the social promises and perils related to biotechnology. Thus, films should be understood as a site for the examination of how popular culture fuels hopes and anxieties related to the scientific revolution that permeate culture and how these hopes and fears change over time from horror to hope and from fiction to reality.

KEYWORDS

Genetic imaginary; images of geneticists; movies; popular culture; representations; stereotypes

Introduction

The public image of every scientific discipline, including genetics, depends in large part on individuals who speak about science in public or are associated with it by the audience. Nevertheless, while only a small number of people

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know any geneticist personally the majority derive their impressions of geneticists from other sources, primarily popular culture and the media. Although such images have been indisputably criticized as an exaggeration and fear mongering they constitute an inherent dimension of the social understanding of science and are as important for science communication as the 'real' science (Turney, 1998; Nelkin and Lindee, 1999; Kirby, 2014). Because popular culture is a symbolic resource and a unique 'guide' that helps the audience to make sense of scientific developments cultural depictions of genetics play a crucial role in constructing the public's 'genetic imaginary' (van Dijck, 1998; Merzagora, 2010; Stacey, 2010; Burri, 2018; Bull, 2019).

Although popular culture can play a significant role in increasing the public's awareness of scientific issues and constructing 'science for citizenship' it often undermines the social understanding of science (Schibeci and Lee, 2003). Because movies frequently present unfavourable images of biotechnology, rely on oversimplifications, and reduce the information about the biological aspects of genetic phenomena to a minimum in favour of making the picture more attractive and dramatic, they can lead to erroneous or outdated ideas related to genetics (Muela and Abril, 2014; Domaradzki, 2021; Gibbons et al., 2021). Even though early twenty-first century representations of genetics convey the message that the molecular world is more complex and more indeterminate than previously thought, popular culture is still full of ideas related to genetic essentialism and determinism, leading to the perpetuation of racism, sexism, and pessimism (Kirby, 2003a; Heine et al., 2017; Kampourakis, 2022). Thus, since there is a discrepancy between scientific and popular understandings of genetics (Chapman et al., 2019; Roberts et al., 2019), there is a need to improve the public's genetic and biotechnological literacy (Stern and Kampourakis, 2017).

While many individuals are media-literate and derive their knowledge from formal educational or scientific sources, it is the media, including television, that remains the main source of information on science and technology (Davin, 2003; Quick, 2009; Tian, and Yoo, 2020). Researchers emphasize that exposure to television programs focusing on science may create cognitive barriers and preserve existing cultural stereotypes about science and scientists that are predominantly unfavourable (Jörg, 2003; Glassy, 2006; Funk, 2017; Eurobarometer, 2010; Pew Research Center, 2019). For example, Andrew Tudor (1989) showed that in one quarter of movies the field of science is portrayed as a source of disaster and scientists are often framed as deluded madmen who pose a threat to society. Roslynn Haynes (1994, 2003, 2006) suggests that the two most common trends in portraying scientists is their caricature and vilification, i.e. they are pictured as foolish scientist-inventors or dangerous alchemists. Peter Weingart, Claudia Muhl and Petra Pansegrau (2003) stress that even good scientists are often seduced by the desire for power, fame, or money. Finally, while TV hospital dramas, i.e. *ER*, *Grey's Anatomy*, *House,*

and *Nurse Jackie* often present physicians as heroes acting in the best interests of their patients, they are often framed as egotistical, arrogant, materialistic, sexist, morally corrupt, and uncaring individuals who violate many norms of professionalism (Flores, 2002; Czarny et al., 2010; Ouellette et al., 2021).

While previous research has examined cultural images of scientists in general, few studies have focused on cinematic representations of geneticists. Interestingly, it seems that various deeply-rooted cultural attitudes of hope, suspicion, and ambivalence toward scientists are currently best epitomized by molecular biologists (Turney, 1998). Thus, this article tracks cinematic representations of geneticists over the last sixty years. It argues that because films serve as a cultural forum for discussions on biotechnology, cinematic depictions of geneticists reflect how popular culture (re)constructs social hopes and fears generated by current developments in genetics, how theses promises and perils are conveyed to the public, and how they change over time. Furthermore, it also emphasizes that although representations of genetics and biotechnology in movies are often oversimplified or inaccurate (Muela and Abril, 2014) such images are still very important because they affect the public debate on such biotechnologies as human cloning and stem cell research (O'Riordan, 2008; Eberl, 2010), gene therapy (Kirby, 2000), and synthetic biology (Meyer et al., 2013). Since geneticists constantly find new applications for their research this study stresses the importance of understanding messages about genetics and the role of geneticists that the audience receives from movies. Finally, it also argues that films should be understood as one of the sites of constant renegotiation or struggle over meaning attached to current developments in science, including hopes and anxieties related to the biotechnological revolution (Hall, 1997).

Accordingly, this research aims to describe the dominant images of geneticists portrayed in movies, by asking the following research questions:

- What images of geneticists emerge from popular movies?
- How has the portrayal of geneticists in movies changed over time?

Additionally, although this study was not designed as gender-related research, it also highlights popular depictions of woman geneticists and asks how gender differences in the portrayal of molecular biologists are imagined cinematographically.

Material and methods

This study concerns movies related to genetics released from 1953, when the structure of the double helix was announced, and 2018, inclusively. Our sample was designed according to content-based criteria. While movies were included only if their plot had at least one geneticist, they were excluded if

they focused on the biotechnologies themselves but did not portray geneticists or if the scholars presented did not conduct research connected with genetics. Because this paper was confined to popular fictional films it does not cover documentaries dedicated to rare genetic disorders. Additionally, to provide more coherent results, television series, even those with a medical theme, and animations were also omitted. The second, more pragmatic criterion for movie selection was related to their availability on VHS, DVD, or online movie streaming sites.

The movies chosen for the study were selected via two online movie databases: Internet Movie Database (http://www.imdb.com) and Filmweb (http://www.filmweb.pl). The films were selected with predefined key words: 'biotechnology', 'genetics', 'geneticist', 'molecular biology', 'scientist', and 'research work'. After scrutinizing the available plot descriptions and cast overviews, the aforementioned including and excluding criteria yielded 145 films which were watched and analysed. (The database is available upon request).

I am aware that the selection of movies neither is nor could be true representative sample since the entire number of films portraying geneticists cannot be adequately determined. Another limitation is that the vast majority of analysed movies were either produced in the United States (65.5%) or in cooperation between the United States and European or Asian countries (20%), while only 14.5% were produced outside the US. Moreover, some of the latter films were made in English-speaking countries. Consequently, the study sample under-represents European, Asian, and Hispanic cinema and can potentially be biased. Nevertheless, it is undeniable that the American film industry is a dominating power on the global movie market and its impact on popular culture and global audiences is distinctive (De Zoysa and Newman, 2002). However, while viewers who do not speak English were able to watch most of these films with dubbing or subtitles, most of the non-American movies analysed were available with English subtitles, while others were available both in the mother language and English. Thus, the films selected for this study were chosen to reflect popular culture.

To make sure that the selected movies reached a wider audience I checked both their US and international box office ratings (http://www.boxofficemojo.com), which, at least to some degree, reflects the scale of their reception. Thus, even though some movies included Hollywood blockbusters such as *Avatar* or *Jurassic Park,* others had limited releases, i.e. *Decoding Annie Parker* and *Morgan*, and it seems that they can all be considered as virtual 'witnessing technologies', i.e. they encourage the audience to think that cinematic representations of genetics are plausible and reflect the realities of the natural world (Kirby, 2003b). However, because the moviemakers present only one vision of genetic phenomena and rarely address any uncertainties movies are more concerned with capturing audiences than representing advances in molecular biology accurately (Stern and Kampourakis, 2017; Gibbons et al., 2021).

The quantitative and qualitative content analysis was designed to identify recurring patterns in cinematic images of geneticists and how these images change over time. It started with familiarization with the data, which involved watching all of the pre-selected movies. After becoming immersed in the movies' content, a structured data extraction tool was developed to include the most important features of geneticists depicted in movies. The main categories referred to geneticists' demographic characteristics, including: gender, age, ethnicity, physical appearance, professional position, family status and private life, type of research, place of work, and awareness of ethical, legal, and social issues. While I believe that these categories represent the public's understanding of scientists they were selected because they describe key points in the scientific literature (Tudor, 1989; Haynes, 1994; Jones, 1997; Jörg, 2003; Weingart et al., 2003; Frayling, 2005; Meyer, et al., 2013). In the final stage of analysis, all of the movies were viewed once more and every scene that supported these pre-determined categories was noted on the coding sheet. After comparing notes from all of the movies, recurring images were found and analyzed.

Since the entire analysis was performed by one author there was a higher risk of subjectivity that might have influenced the interpretation of the data. I am also aware of the subjective nature of some categories included in the coding frame, i.e. 'positive'/'negative' and 'attractive'/'unattractive'. Consequently, their comparison may be difficult. While the former categories were based on characteristics derived from previous studies, unattractiveness was defined on the basis of culturally specific markers of beauty (Calogero et al., 2007).

While the identification of the images of geneticists can rely either on the deductive approach, when a researcher is using patterns identified in literature and other studies, or the inductive approach, which aims at identifying new analytic categories that are not limited to existing theories or research, the results of this study were selected by employing a mixed-methods approach. This procedure has enabled me to determine nine main images of geneticists in featured movies. The most common negative stereotypes identified were: (1) the mad or evil demiurge, (2) the egoist without morals, (3) the nerdy geneticist, and (4) the entrepreneur or capitalist who betrays the ethos of science. On the other hand, positive stereotypes included: (1) the objective researcher or inventor, (2) the practical expert, (3) the bioethicist, (4) the caring physician and counsellor, and (5) the dedicated idealist.

Finally, although this study does not claim to describe the phenomenon in its quantitative aspects (see: Weingart et al., 2003), I believe that the selected images provide a unique insight into the cultural stereotypes of geneticists that can easily be recognized by the public. Thus, while this study presents some descriptive statistics, it serves only as an illustration for a qualitative analysis. Moreover, while this research shows how movies reconstruct social images of geneticists I am aware that neither the selection of the films included

in this analysis nor the typology of the images presented exhaust other interpretations.

Images of geneticists depicted in movies

The prototypical geneticist

Although geneticists portrayed in movies represent various types of stereotypes, the prototypical geneticist is white/Caucasian (83.2%), middle aged (54.5%), and male (76.6%). Among other geneticists, younger persons predominate (29.9%) over older ones (15.6%), and Afro-Americans (10.3%) over Asians (5.7%) and Hindus (0.8%). Only 3.3% are physically disabled. 59.8% of cinematic geneticists are leaders, while 40.2% are assistants. Significantly, only 17.8% of the former are women. While 54.1% of the cinematic geneticists are imagined according to the cultural ideas of physical unattractiveness women geneticists are usually young and attractive. The majority of geneticists are totally absorbed with their research and have no personal or family life: 91.4% are single, while only 5.7% are married and 9.4% have children. 61.6% work alone, while 38.4% are members of research teams.

70.8% of genetic research is conducted in laboratories run by scientific institutions, while 20.8% are located far from human settlements. 8.4% of experiments are conducted by scientists in their homes. The majority of research is conducted for state institutions, including the army (18.8%) and the government (16.2%). 26.3% of geneticists conduct experiments for themselves. Interestingly, only 4.6% of cinematic research is run by universities, while 34.4% by private corporations.

This image typically includes a geneticist who is aware of the consequences of their research (51.2%). Simultaneously, 74.2% of cinematic geneticists are ethically insensitive, are eager to go beyond any moral and societal standards, and are often willing to risk the safety of others. 18.9% murder somebody. Although 26.2% try to fix the negative consequences of their actions, 52.1% die and 2.9% get arrested. Finally, the majority of cinematic geneticists are shy, socially withdrawn, unable to maintain meaningful social relationships (especially with women), and have difficulties with organizational skills.

The mad, the corrupted, and the geek: negative images of geneticists in movies

Although the last few decades have witnessed a proliferation of positive images of scientists, who are portrayed as idealistic and highly motivated professionals (Haynes, 2016, 2017; Domaradzki, 2022), still many movies contain ambivalent or negative stereotypes of geneticists (Jörg, 2003; Haynes, 2006). Especially in B movie plots, they are portrayed as individuals who conduct dangerous or

unethical research, losing control over their experiments, or as individuals working for personal gain rather than for the good of humankind: they are motivated by unacceptable scientific curiosity, blinded by the power of knowledge, and neglect the consequences of their research (Weingart et al., 2003; Kirby, 2014).

In particular, horror, science fiction, and dystopian fiction films reproduce the stereotype of **the mad or evil demiurge**, i.e. deluded or obsessed maverick, who conducts genetic experiments in a secret laboratory, where he or she manipulates life processes, prolongs or creates artificial life, or clones humans (Tudor, 1989; Haynes, 1994, 2003). While the demiurge is often a visionary researcher, because he or she violates most cultural norms and taboos on the sanctity of life they are expelled from the scientific community (Dr. Moreau, Dr. Rackham in *Island of the Fishmen*, 1979). Thus, the archetypical demiurge is an arrogant, immoral, and mysterious megalomaniac who tries to transcend the limitations of science, control nature, and recreate life (Franklin 2000; Stern, 2004).

While previous studies show that scientists are also often portrayed as individuals whose experiments threaten humanity and can annihilate all life on a planet, this study shows that moviemakers suggest that it is genetic research that raises fundamental questions about the limits of scientific inquiry, the desirability of the creation of artificial life, and the 'perfection' of humans through technological means. Consequently, because geneticists framed as demiurge conduct their research in secret, outside official institutions (*She Demons*, *The Killer Shrews*, *The Island of Dr. Moreau*, *Island of the Fishmen*, *Attack of the Sabretooth*, *The Nest*, and *The Curse of the Komodo*) they symbolize mystery, fear of the unknown, and lack of social acceptance for genetic research (Kirby, 2003a).

The demiurge is also characterized by his or her delusions of grandeur: he or she is obsessed with the idea of using molecular biology to create an ideal society, enhance humankind, and breed a better version of man. Characters like Dr. Decker (*Konga*, 1961), Dr. Stoner (*Sssssss,* 1973), Professor Nolter (*The Mutations*), Dr. Moreau (*The Island of Dr. Moreau*, 1977), Dr. Meyerling (*The Unborn*, 1991) and Dr. Tiptree (*Carnosaur*, 1993), are not satisfied with the pace of natural selection driving evolution and intend to create a new world and a genetically engineered race of superhumans (Figure 1). Indeed, one of the leading cinematic tropes is the original Frankenstein story of a mad geneticist who uses bioengineering to alter evolution, enhance human nature, and create the 'perfect' man (Jörg, 2003; Weingart et al., 2003; Frayling, 2005).

Cinematic references to the Frankenstein myth bring our attention not so much to genetic monsters but to their creators, who are driven by unacceptable scientific curiosity and the desire for power. It also helps to emphasize that geneticists' ability to create, manipulate, enhance, and commodify life does not

Figure 1. Both Dr. Stoner (*Sssssss*) and Dr. Moreau (*The Island of Dr. Moreau*) are obsessed with controlling heredity and behaviour and creating the 'perfect' man.

justify trespassing all societal and moral boundaries and the risks associated with producing new life forms (Franklin, 2000; Stern, 2004). While such framing helps to destigmatize the negative attitudes of geneticists, it also helps to create an impression that it is not scientists per se that pose a threat to society, but individual, uncontrolled, always scarce, 'pseudoscientists', and that the majority of scientists are noble researchers who serve society (Kirby, 2003a).

Because the demiurge considers himself or herself a god of creation he or she usurps power over nature, evolution, all living organisms, and even life and death (Kirby, 2003a, 2007; Stern, 2004). While Dr. Moreau considers the Beast People as a form of authorship and a raw material that can be bred and loosely manipulated according to the will of their master, Dr. Rackham (*Island of the Fishmen*) declares: 'Here on this island I am an absolute master (…) I am the law', and Dr. Merrick (*The Island*, 2005) declares ecstatically: 'I give life'.

Obsessed with their experiments, the demiurge loses sense of what is ethical and either becomes immoral or ignores the ethical dilemmas stemming from their genetic research in the name of science. They justify every cruel behaviour with humanitarian incentives: fixing defective nature, the betterment of humanity, or the avoidance of deformities. For example, when Dr. Walls (*Godsend*, 2004), who offers to desperate parents to clone the son they have lost, hears Duncan's reservations, he dispels their doubts by making the distinction between the legal and the moral dimensions of the procedure. As he says 'Illegal, yes. Immoral, no. We are talking about using life to create life, that's all'. Thus, while the demiurge rarely feels responsible for their research, they believe that a scientist cannot afford the indulgence of guilt and in order to study nature one must become as remorseless as nature itself. For this reason, just before killing his assistant, Dr. Moreau (1977) confesses: 'To control or understand nature you must become as uncaring, unfeeling, and as implacable as nature'.

Finally, while the demiurge is unable to foresee the catastrophe emerging from their research (Haynes, 1994, 2006; Turney, 1998), frequently it is someone else who warns them against the unintended or unexpected effects of their experiments. In *Jurassic Park* (1993), it is a mathematician and chaos theorist, Dr. Malcolm, who warns the owner of the park: 'Your scientists were so preoccupied with whether or not they could, they didn't stop to think if they should'. In *The Rise of the Planet of the Apes* (2011), a primatologist, Dr. Aranha, cautions Dr. Rodman: 'You're trying to control things that are not meant to be controlled'.

While the demiurge does not know when to stop their experiments, they always rationalize their own research, deny any responsibility, and blame others (whether society, their assistants, or bad luck) for their failures. Even when the demiurge realizes that their genetically altered monsters became a deadly threat, they are convinced that they were doing something great. Thus, the modern Dr. Frankensteins are usually punished with death and become the first victims of their creations.

Another stereotype of geneticists prevalent in movies is the **narcissistic egoist without morals**, portrayed as an unfeeling and egotistical individual who is focused solely on achieving personal goals (Figure 2). For example, in *Blueprint* (2003) Dr. Fischer is driven more by the desire for fame, awards, and recognition than a willingness to help a world-famous pianist, Iris, who suffers from multiple sclerosis. He agrees to clone her because he wants to be remembered as the first scientist to clone a human being. During their negotiations, he is not concerned about the legal and ethical issues surrounding reproductive cloning but demands unlimited access to all medical data and the possibility to publish his research results.

Shown as a middle-aged or older man often wearing big glasses, the narcissistic egoist is framed as a morally insensitive and greedy individual who denies his feelings, is reluctant to help others, and is ready to cheat or misuse them. In the comedy, *Repli-Kate* (2002), self-centred Dr. Jonas decides to present the

Figure 2. Dr. Fischer (*Blueprint*) and Dr. Jonas (*Repli-Kate*) are focused on personal fame and awards and dream about gaining recognition in the scientific community.

results of a human cloning machine developed by his student, Max, at an international conference as his own success and steals all the credit from him and hopes it will help him to gain financial rewards.

Interestingly, the image of the narcissistic egoist is often juxtaposed against the prosocial and ethically sensitive 'real' scientist. In *The Third Twin* (1997), Dr. Jones, working for a private corporation, Genetico, is portrayed as a greedy, insensitive, and money-driven elderly man, while Dr. Ferami is a young and intelligent women scientist working at the university, who is sensitive to ethical and social issues and who believes that science should serve the common good. While Dr. Jones strongly believes that human behaviour is determined by genes which make a person inherently 'good' or 'evil', Dr. Ferami rejects such a deterministic viewpoint of human nature and stresses the significance of environmental factors. In *Errors of the Human Body* (2012), self-centred Dr. Novak who secretly works on 'the discovery of the century' – a genetically modified virus – is shown as a morally insensitive individual, driven solely by the desire for scientific recognition, and is contrasted with Dr. Burton, a brilliant but nostalgic researcher who is striving to discover the human regeneration gene and tries to find peace after the loss of his son, who died of a rare genetic disorder.

By comparing these two opposite types of geneticists, the cinema emphasizes the differences in their motivations and attitudes toward genetic research as well as the source of their financial and ethical attitudes. It also suggests that they represent two different kinds of scientific ethos: individualism and idealism (Weingart et al., 2003). These coexisting representations demonstrate that cinematic images of geneticists help moviemakers reconstruct the social promises and perils related to biotechnology and recreate ambivalence and tensions between popular perceptions of genetics and geneticists (Gibbons et al., 2021) in the media.

The third negative stereotype of geneticists in movies is the **nerdy geneticist**. Similar to computer scientists, mathematicians, and physicists, geneticists are also often framed either as sympathetic but shy, absent-minded, socially withdrawn, and physically unattractive misfits who serve as the butt of jokes, or as neurotic, detached-from-reality, and rigid cerebral individuals who have erratic behaviour, low empathy, and little or no interest in social relations, including spending time with family and friends (Weitekamp, 2017). In both cases, the nerdy geneticist is framed as an eccentric but harmless geek who is passionate about science and completely absorbed by their experiments. Their intelligence and scientific curiosity push them towards making a ground-breaking discovery that will benefit humanity.

Although the nerdy geneticist seems to be a positive character, they are often ascribed a number of negative traits, including unattractive looks, dishevelled hair, oversized glasses with thick lenses, and poor hygiene or posture. They also use jargon or overly sophisticated language that is incomprehensible to

lay people. Consequently, the nerd reflects the media's ambivalent attitude towards genetics: while they are often admired and respected for their intelligence, competencies, and dedication to science, the geek is mocked for their intellect, impracticality, and being out of touch with reality (Jones, 1997; Terzian and Grunzke, 2007).

One such character is Professor Klump in *The Nutty Professor* (1996) and the *Nutty Professor 2: The Klumps* (2000), who is a good-hearted and jolly chemistry professor (Figure 3). Although he is a brilliant scientist admired by his students, due to his excessive obesity, clumsiness, and lack of self-confidence, he is seriously stressed when talking to women. He constantly confuses other university researchers with his awkward behaviours which make him a victim to verbal bullying from the dean of the university. Ed Whittle in *Replicas* (2018), a brilliant, young scientist specializing in reproductive cloning, has all of the stereotypical traits of the nerdy geneticist: intelligence and technical mastery. Additionally, his physical appearance refers to the cultural idea of what constitutes physical unattractiveness and lack of sexual desirability (Calogero et al., 2007).

Although they usually have good intentions the nerdy geneticist is so focused on their research that they are unable to foresee the possible dangers stemming from it. Consequently, due to some unexpected event, an unfortunate accident or one's own clumsiness, the nerd poses a threat to oneself and others. For example, to overcome his depression and gain a women's attention, Professor Klump invents and tests genetically based serums on himself: 'weight loss formula' and 'the youth formula' that transform him into a charismatic, but evil alter ego – 'Buddy Love'. When he tries to remove 'the Buddy Love gene', it results in the slow loss of Klump's intelligence. Nevertheless, in contrast to the demiurge who is personally responsible for a disaster that has occurred, the nerd usually tries to make up for the damage they have caused. Thus, they

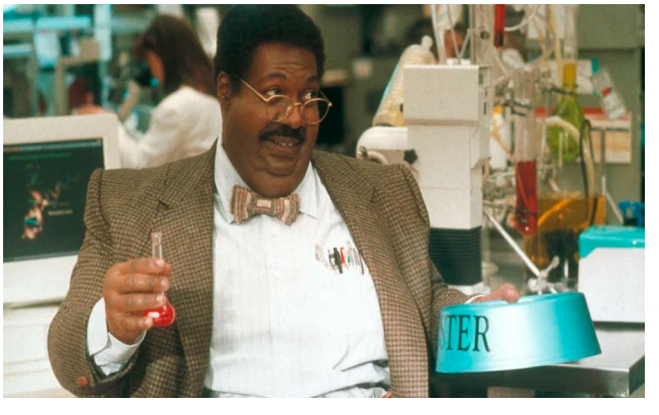

Figure 3. Professor Sherman Klump (*The Nutty Professor*) epitomizes the intelligent, but awkward and absent-minded scientist, who has little control over genetic processes.

represent scientific progress, which has its price and sometimes results in errors and catastrophes (Haynes, 2006; Terzian and Grunzke, 2007).

Interestingly, there are very few women nerds. One notable exception is the brilliant but framed as asexual, emotionally detached, and alienated bio-geneticist, Rosetta Stone, (*Teknolust*, 2002), who exemplifies cultural and gendered stereotypes about women scientists discussed below.

Especially in the 1980s, when the biotechnological industry rapidly flourished, the media emphasized the commercial value of genetics and shows it as a leading branch of the economy. Consequently, a new image of the modern geneticist emerged: the **entrepreneur** or **capitalist** who is a leader or member of a research team working for a private corporation. This type of geneticist is framed as a proficient organizer and entrepreneur whose motivation is to maximize profits. Interestingly, except for some examples, i.e. Dr. Tyrell (*Blade Runner*, 1982), Dr. Merrick (*The Island*, 2005), and Niander *Wallace* (*Blade Runner 2049*, 2017), geneticists are usually depicted not as independent entrepreneurs but as scientists hired by large biocorporations that own and control their own research: Dr. Wu (*Jurassic Park*), Clive Nicoli and Elsa Kast (*Splice*, 2009) and Dr. Rao (*X-Men: The Last Stand*, 2006).

In contrast to the cultural ideal of the academic scientist, the cinematic image of the geneticist as capitalistic is often framed as a self-interested, unscrupulous, and corrupted researcher who betrays the ethos of science and should not be trusted. To achieve their goals, geneticists are ready to act unethically, falsify research results, and misuse research funds (Figure 4). In *The Shaggy Dog* (2006), a team of greedy geneticists led by Dr. Kozak steals a 300-year-old sacred dog from a Tibetan monastery, hoping its DNA will allow him to develop a potion of immortality. Moreover, as Dr. Kozak intends to take control of the pharmaceutical company, he does not hesitate to inject its president with a paralyzing drug in order to euthanize him.

Figure 4. Dr. Kozak (*The Shaggy Dog*) and Dr. Merrick (*The Island*) both represent the businessman-like geneticist who fuels social anxieties related to geneticists' ability to commodify life.

Thus, by showing the link between modern science and the capitalist system, movies create an image that the field of genetics has become an industry-oriented enterprise which increasingly serves as a source of mass production of new life forms (Dinello, 2005; Meyer, et al., 2013; Domaradzki, 2021). A recurrent theme of the geneticist who values research-generated profits more than research itself helps moviemakers to emphasize that scientists' trivial motives of entertainment and profit do not justify the risks associated with recreating and reproducing life (Franklin, 2000; Stern, 2004).

Interestingly, in order to emphasize their negative character traits, geneticists framed as opportunistic capitalists are often contrasted against noble geneticists who conduct their research for the public good and are ethically sound. In *Consumed* (2015), Dr. Liefman working for the agricultural corporation, Clonestra, tries to convince his noble colleague, Dr. Negani, that if they want to receive funding for their research then they have to omit or falsify their undesired research findings. Such framing allows moviemakers to address popular concerns that have been raised in cultural discourse that highlights the risk of an increasing dependence of science on private business which corrupts and controls geneticists. It also helps to sustain the cultural myth of a disinterested, idealistic science that is done with contributing to the common good.

The hero, the expert, and the counsellor: positive images of geneticists in movies

Although the cinema still perpetuates many negative stereotypes of geneticists, in many recent films they have also been framed as heroes and warriors of science (Flores, 2002; Haynes, 2016, 2017; Domaradzki, 2022). One such positive image is that of the **objective researcher** who explains to the audience the basic mechanisms of molecular biology, the nature of a genetic disorder discussed in the movie, and how genetic research is conducted (Figure 5). Such a character is usually portrayed as a highly educated and trained professional working at a university or hospital. To seem more professional, male geneticists are typically dressed in elegant suits with ties and white coats, while women geneticists wear two-piece suits. Additionally, they are often placed in a state-of-the-art laboratory where they are surrounded by sophisticated and highly complicated equipment. Their role as an expert is further emphasized by coloured pictures with microscopic images of DNA, genes or cells, which help to frame geneticists as explorers of science (Stacey, 2010; Bull, 2019).

While the objective researcher is optimistic about genetic discoveries, they avoid univocal and conclusive statements about their research and refrain from making promises about any new treatment. They also temper any exaggerated expectations raised by patients or company executives. For example, in *Lorenzo's Oil* (1992), Professor Nikolais and Dr. Judalon are overly focused on laboratory tests, formal procedures, and methods of scientific

Figure 5. Dr. Stonehill (*Extraordinary Measures*) explains to John Crowley, a father of two girls suffering from Pompe disease, the nature of the genetic disorder and how genetic research is done.

work that make them somehow insensitive to the needs of their patient. In *Extraordinary Measures* (2010) Dr. Stonehill is a hard-working researcher whose revolutionary medical theories and innovative research help him to develop an enzyme treatment for Pompe disease. Although he is convinced about the superiority of his theories, Dr. Stonehill constantly reminds John Crowley that manufacturing new drugs for rare diseases is not a simple process. As he often ignores his teammates and questions the profit motives of company executives, Dr. Stonehill represents the cultural stereotype of university scientists who like to work alone, often late into the evening, and who find it problematic to cooperate with other lab scientists (Jones, 1997; Haynes, 2003). However, although this type of geneticist may seem arrogant, Dr. Stonehill still shows empathy and sympathy for the main character and his sick children.

In movies in which geneticists play minor roles they are often portrayed as **practical experts** who explain the technical aspects of molecular biology in their labs. For example, Professor Bruckner, a renowned geneticist in *The* Boys from *Brazil* (1978), explains in detail the structure of a cell, the nature of DNA, the procedure of 'mononuclear reproduction', and the process through which genetic material is transferred via IVF (Figure 6). An anonymous physician in Paa (2009) explains to Vidlya the nature of progeria affecting her son.

To emphasize their knowledge and skills, geneticists framed as practical experts are often shown in laboratories next to sophisticated equipment or behind computer screens. Again, the main purpose of such an image is to sustain the social perception of geneticists as wise and objective researchers who possess knowledge inaccessible to non-experts and who are able to

Figure 6. Dr. Bruckner (*The* Boys from *Brazil*) calmy explains the procedure of 'mononuclear reproduction' and how genetic material is transferred via IVF while drinking tea.

communicate it to the public. Interestingly, geneticists often discuss genetic methods only if they are socially perceived as problematic, i.e. as unethical or dangerous.

Because in modern societies the authority of experts has both a technical and moral dimension, some movies picture geneticists also as **bioethicists**. Such framing is of special importance since it helps moviemakers to present scientists not only as innovative and skilful researchers but also as individuals with moral qualities who are sensitive to the bioethical dilemmas emerging from the genetic revolution (Czarny et al., 2010). Thus, although the stereotype of the ethically indifferent scientist who is focused solely on the research itself and neglects its social, ethical, and legal dimensions still permeates the cinema, modern movies often present more empathetic portrayals of geneticists as compassionate idealists who are guided by a strong sense of morality and ethics and who are willing to sacrifice oneself for the good of others (Haynes, 2016). Consequently, this image demonstrates that popular culture maintains ambivalence towards perils and promises of genetic research in the biotechnological era.

In *No Ordinary Baby* (2001), Dr. Gordon, a noble and passionate fertility specialist who strongly believes in science, during her meeting with a bioethical committee, discusses the safety of reproductive cloning, as well as the motivation, responsibility, and moral status of the clone as a human being (Figure 7). She rejects the temptation of becoming famous and instead focuses on protecting the privacy of desperate parents and their child. Dr. Augustin in *Avatar* (2009) who believes that the true 'wealth' of Pandora is the interconnectedness among all the Na'vi and other living beings is torn between her work and the intentions of greedy businessmen. Because she has a deep love and respect for the Na'vi she constantly wonders to what extent researchers can interfere with a native culture for the purposes of research (Olivier, 2010).

Figure 7. While Dr. Gordon (*No Ordinary Baby*) and Dr. Augustin (*Avatar*) are trying to use their knowledge and skills to make people's lives easier they are aware of the ethical, legal, and environmental consequences of their genetic research.

Another positive image of the geneticist is portrayed in movies dealing with clinical genetics. Although such movies often focus on the psychosocial problems of patients with rare genetic diseases rather than with genetic therapy, they portray geneticists either as brilliant researchers who struggle to find a cure or as altruistic and empathic physicians caring for their patients (Domaradzki, 2022). This is not surprising, because physicians are often presented more positively than other types of scientists and the medical applications of genetics are perceived as more beneficial and less controversial than other applications (Haynes, 2017). Thus, because clinical genetics represents a brighter side of the genetic revolution, moviemakers often frame the primarily role of genetics as a medical goal: to find a genetic basis of various diseases in order to find a cure for it. This in turn helps to create a favourable image of geneticists as **caring physicians and counsellors**. This type of character is framed as a scientist having noble goals – acting in the public's interest and whose research has a positive effect on society, i.e. they intend to develop new medical therapies (*Extraordinary Measures*, *Decoding Annie Parker*) or try to help parents who want to have a baby (*No Ordinary Baby*).

They usually work in a clinical context and are framed as committed caregivers and advisors to their patients, and this role is further emphasized by their white lab coats. They also fight the bureaucracy that impedes patients' access to available drugs or novel treatment options. They are not alienated or dull individuals, but are rather dedicated and tireless heroes struggling to help their vulnerable patients. This is important, because while putting geneticists in the context of human stories helps to implant a positive image of geneticists among the viewers it also helps them to depict biotechnologies as a 'human-saving technology' or 'possible therapeutic technology' (O'Riordan, 2008).

One such example is Dr. Fleming in *Midnight Sun* (2018) pictured as a caring physician, who cares for a girl suffering from a life-threatening sensitivity to sunlight caused by a rare genetic disorder (Figure 8). Furthermore, Dr. Gordon is shown as a mindful, sensitive, and devoted physician who is ready to put her own career in jeopardy in order to care for the couple for whom she has helped to clone a baby (*No Ordinary Baby*). Her dedication is further emphasized by the strains it causes in the relationship with her young son.

Finally, some geneticists are framed as **dedicated idealists**, i.e. noble, benevolent, selfless, altruistic, and well-intentioned scientists driven by humanitarian motives. While dreaming about making the world a better place, this type of researcher dedicates all of their time, effort, and resources to benefit humankind (Figure 9). Thus, just as idealists embody all of the positive virtues assigned to a scientist by culture: wisdom, scientific curiosity, idealism, commitment, altruism, and public service, dedicated idealists believe that their research will benefit humanity and dedicate themselves to staving off overpopulation or a global food crisis (Dr. Shiragami in *Godzilla vs Biollante*, 1989; Dr. Monroe in *Mega Piranha*, 2010), are trying to find a cure for a deadly virus (Dr. Neville in *I Am Legend*, 2007) or a gene therapy for Alzheimer's disease (Dr. Rodman in *Rise of the Planet of the Apes*).

Although the dedicated idealist is usually a brilliant and hard-working scientist motivated to solve a major scientific problem for the benefit of humanity, they are often depicted as absent-minded or helpless scientists, who are lost in their experiments and do not understand the world around them (Weitekamp, 2017). Moreover, their dedication to science strains their relationship with their partner and makes them prey to self-delusion which prevents them from foreseeing the consequences of their genetic research. Consequently, due to an unforeseen event or accident, they pose a threat to themselves or to others. For example, in Mimic (1997), Dr. Tyler, who tries to find a cure for a deadly epidemic in New York, unintentionally creates a deadly breed of insects that endanger the entire city. In *I Am Legend* (2007), Dr. Krippin, who used the

Figure 8. Dr. Paula Fleming (*Midnight Sun*) is a caring physician preoccupied with her patients.

Figure 9. Using imported Godzilla cells Dr. Shiragami (*Godzilla vs Biollante*) is working with genetically engineered immortal plants that could grow in the arid deserts of Japan.

genetically engineered measles virus to create gene therapy for cancer, fails to predict that it may mutate into a lethal strain of measles with a 90% kill rate.

Alternatively, this type of geneticist is framed as a naive scientist working for a private biocorporation or state agency that puts pressure on them to ignore ethical concerns or prematurely implement biotechnology. In *Errors of the Human Body*, Dr. Burton is so dedicated to his research on the human regeneration gene that he fails to notice that he is being misused by the authorities, who have created a lethal virus. In *Replicas*, Dr. Foster, specializing in synthetic biology and the mapping of the mind's neural pathways, and Dr. Whittle, an expert in reproductive cloning, who attempts to transfer the mind of a dead soldier into an android, do not realize that their employer, the Bionyne Corporation, does not intend to use their research for medical purposes but to create a new military weapon.

Thus, this image helps to sustain social trust in geneticists as noble, prosocial, and sensitive scientists. Since it takes at least some responsibility off the geneticists it helps to spread the message that the real threat comes not from geneticists themselves but from the politicization and commercialization of genetics and biotechnologies in a society (Dinello, 2005; Meyer, et al., 2013; Domaradzki, 2021).

Sexy babes, she-devils, and heroines: images of women geneticists

Not surprisingly, just like other sciences depicted in movies, the field of molecular biology also represents a man's world in which the role of the professional geneticist is reserved mainly for men while women are either absent or occupy minor roles (Elena, 1997; Steinke, 1997; Flicker, 2003). As previously noted, out of 244 identified geneticists, only 23.4% were women scientists. While this lower proportion of women geneticists in movies is surely problematic, it is

rather the qualitative difference of their representation that is the discriminating factor: while in most movies the main professional geneticist is a man, women (if present at all) usually occupy subordinate positions, while only 17.8% of cinematic team leaders are women.

The dominant cinematic image of the women geneticist is that of a man's assistant. Such an inferior position was primarily ascribed to women in the 1960s, 1970s and 1980s when they appeared in movies mainly as daughters, housekeepers and passive assistants, unable to understand and control big science, and as those concerned more with relationships than their work. For example, in *The Killer Shrews*, Ann Craigis, a blonde zoologist who is examining the diet of shrews, is pictured as a submissive and frightened woman who is more interested in captain Thorne Sherman than with her science. In one scene, while chatting with the handsome captain, she is disappointed that he is not paying any attention to her; and in the epilogue, just before kissing him, she confesses that she will never have anything to do with her research anymore and that all she wants is to: 'Live normally, like normal women do' (Figure 10).

In *Konga*, Margaret, assistant and girlfriend of mad botanist, Dr. Decker, is tired of her 'backstreet existence' and of constantly pretending that she is his housekeeper, secretary, and assistant. When the sexist and cold-hearted scientist promises he would do anything for her, Margaret insists on marriage. Both of these films show that, especially in the past, women were often portrayed through stereotypical female roles, i.e. as more emotional, vulnerable, and fragile. Moreover, their role in the movies was to develop suspense rather than show how science is carried out.

Also, in modern movies women geneticists are often depicted as subordinate to or intellectually inferior to their male colleagues. In *Hulk* (2003), Dr. Ross, Bruce Banner's research partner, is presented more as his credulous and naïve former girlfriend than as a competent scientist. It is also Banner who coordinates their research. Thus, women are still portrayed via gender stereotypes, i.e. as man's partner, and are often focused more on seeking a

Figure 10. Ann Craigis (*The Killer Shrews*) and Margaret (*Konga*) are portrayed more as housekeepers preoccupied with relationships than as full-fledged scientists.

relationship than on their professional success. In *Nutty Professor 2: The Klumps* (2000), the brilliant and beautiful Professor Gaines, who has developed a method of isolating genetic material, rejects an offer to head a genetic department and decides to help Professor Klump instead. Moreover, not only does she sacrifice her own career for that of her male colleague, but the film ends with their wedding scene.

Since the 1990s not only has the amount of woman geneticists in films increased significantly, but they are frequently portrayed as highly qualified and independent researchers and team executives who solve problems, i.e.: Dr. Tyler in *Mimic*, Dr. Baker in *Species 2* (1998), Dr. Hayden in *The Gene Generation* (2007), Dr. Kast in *Splice,* and Dr. Cheng in *Morgan* (2016). In *The Third Twin*, Dr. Ferami is an intelligent and attractive psychobiologist who is conducting research on the influence of genetics on personality and criminal tendencies. *Decoding Annie Parker* (2013), tells a true story of Dr. King, a brilliant and passionate geneticist and leader of a research team, who discovered the BRCA1 breast cancer gene, and who struggles with the male-dominated structure of academia (Figure 11). Although modern female characters have outstanding qualifications, often outclass their male colleagues, and are able to function in an environment dominated and ruled by men, most of them are still young, good-looking, and lack recognition from their male counterparts. Many others have male mentors, i.e. Dr. Glaser in *Forbidden World* (1982) and Dr. Green in *The Relic* (1997).

Thus, the cinema still perpetuates stereotypical images of women geneticists and frequently downplays their knowledge and skills, focusing on their feminine qualities instead of their scientific competencies. Consequently, while their male colleagues are usually much older and physically unattractive,

Figure 11. Dr. King (*Decoding Annie Parker*) struggles to uncover the genetic roots of breast cancer and overcome the scepticism from her male counterparts in academia.

women tend to be young and very attractive. It supports Laura Mulvey's (1999) claim that the main advantage of cinematic women scientists is their pleasurable looks. By stressing their physicality and sexuality, the cinema suggests that women scientists often lack the masculine traits and skills portrayed as necessary to conduct scientific research. Finally, movies often portray women geneticists through their feelings and emotions rather than intellectual capabilities. For example, in movies on rare genetic diseases women researchers are pictured more often as caring physicians (i.e. Dr. Fleming in *Midnight Sun*) than brilliant inventors or discoverers of novel therapies, the roles that are often reserved for men (*Lorenzo's Oil* or *Extraordinary Measures*). Even when portrayed as intelligent experts, women are often shown as intellectual and erotic people, and sexuality is their main attribute. For example, although in *Forbidden World*, Dr. Glaser is the one who 'knows more about genetic synthesis than anyone else', she is still portrayed as a blonde and sexually unrestrained assistant.

Ironically, such stereotypes are strengthened through images of genius women scientists, exemplified by the biogeneticist, Rosetta Stone, in *Teknolust*, who are often pictured as unattractive, emotionally detached, and alienated individuals living a lonely life and conducting their research (Figure 12). Such masculinized women suggest that in the scientific world the woman has to choose between being a 'real' scientist or a 'real' woman and that being a single, prominent scientist cannot be regarded as a complete success.

What is also intriguing is that women geneticists rarely work on mad or ethically ambiguous projects. They are usually portrayed instead as more ethically sound and morally responsible for their research. For example, Dr. Forster in *Shadow Fury* (2001) is the only member of her research team who experiences moral remorse and tries to make sinister experiments right. Thus, while men geneticists often epitomize 'mad' or 'evil' science, women play an important role in creating a positive, 'more humane', image of genetics.

Figure 12. Dr. Glaser's (*Forbidden World*) physical attractiveness and sexually desired look contrasts with Rosetta Stone's austere appearance (*Teknolust*).

However, especially in horror films, women are also depicted as overly ambitious, evil, or mad scientists conducting illegal experiments (Figure 13). In *Black Sheep* (2006) Dr. Rush, an arrogant, emotionless, and greedy villainess who conducts experiments aiming to breed the perfect sheep is trying to take over the business of her boss. In *Sharktopus vs. Whalewolf* (2015), Dr. Reinhart, a Mengele-like genius scientist, in order to create a master race, experiments on humans.

All in all, this analysis shows that molecular biology in movies seems to be reserved for males, while women geneticists remain dependent on their male superiors, lack male competencies required in the scientific world, and are depicted via sexualized stereotypes. Moreover, by focusing on their physical appearance, movies create an impression that women are not 'real' scientists, since having a professional career and femininity are perceived as mutually exclusive.

Conclusion

Although the cinema is not the only medium that affects the public's perception of science, this study supports findings from other scholars who have demonstrated that popular culture, including movies, is a place of interpretive struggle where social hopes and fears related to developments in molecular biology are constantly redefined, reinterpreted, and renegotiated (Hall, 1997). It shows that because popular culture is filled with genetic thinking, metaphors, and symbols movies function as a cultural forum for multifaceted negotiations on long-standing social ideas pertaining to genetics and (re)construct society's perception of biotechnology (Turney, 1998; Merzagora, 2010; Stacey, 2010). As van Dijck (1998: 13) observed, the anticipatory effect of imagination is not created solely in science or in fiction, but is produced in culture which structures the public's understanding of science. Thus, this study shows that

Figure 13. Dr. Astrid Rush (*Black Sheep*) and Dr. Elsa Reinhardt (*Sharktopus vs. Whalewolf*) use their scientific gifts for evil purposes, thus showing the darker side of genetic research.

within the movies there are no 'true' representations of geneticists because their images are constantly being reconstructed.

It also shows that while popular culture constitutes a rich source of means which aid moviemakers in framing genetics, one of its most essential narrative tools is individual characters who help to organize the plot, attract the audience, and focus their attention. Moreover, while cinematic images of scientists help to (re)construct social, cultural, and economic hopes and anxieties related to the scientific revolution movies constitute a key site for the genetic imaginary and have cultural resonance: they enable the public to recognize the character of the scientist more easily and influence the social perception of science (Burri, 2018; Bull, 2019).

Although some authors argue that molecular frameworks that permeate popular culture create opportunities for education on current developments in biotechnology (Rose, 2007) this study shows that because movies reconstruct existing stereotypes of geneticists they can reinforce people's misconceptions, corrode critical thinking skills, hinder biotechnological literacy, and affect the public's trust in science (Stern and Kampourakis, 2017; Kampourakis, 2022).

Most importantly, while research suggests that popular culture constructs predominantly negative images of geneticists (Tudor, 1989; Haynes, 1994, 2006; Jörg, 2003; Gibbons et al., 2021), this paper shows that there is no single prevailing image, and both negative and positive depictions of geneticists can be found (Haynes, 2016, 2017; Domaradzki, 2022). While it confirms that the most common cultural stereotypes of geneticists depicted in movies are: the mad scientist, the egoistic scientist, the nerd scientist, the noble or idealistic scientist and the hero scientist (Haynes, 1994, 2003), it also shows that over time additional images have emerged, including the capitalist, the objective researcher, the practical expert, the bioethicist, and the caring physician.

This study also confirms observations made by others that although cinematic depictions of scientists were relatively consistent and coherent until the 1990s, since then they have become more differentiated. As cinematic images of geneticists change over time, they (re)construct the hopes and fears related to developments in molecular biology that permeate culture (Kirby, 2011, 2014). Thus, while in the 1960s, 1970s and 1980s, movies focused on such ethically problematic genetic research as experiments with recombinant DNA, the manipulation of human genetic material and human cloning, the cinema reproduced old myths about Frankenstein, Faust, and Golem. This should come as no surprise, because popular perceptions of genetics at that time were strongly influenced by the Asilomar Conference organized in 1975 on recombinant DNA, which was highly reported by the media and fuelled social anxieties concerning the creation of harmful new organisms and evoked images of Frankenstein's monster and the Andromeda virus (Turney, 1998; van Dijck, 1998). Consequently, earlier movies especially reproduced a typical 'mad scientist' scheme: far from human settlements the genius but somehow evil or crazed

geneticist brings to life a new monster, which becomes out of control, threatening the whole of humanity (*Sssssss*, *The Mutations*, *The Island of Dr. Moreau*).

From the 1970s to the 1990s, when movies emphasized the risks resulting from the politicization and militarization of biotechnology, the cinema depicted geneticists as scientists working for the government and military agencies on weapons production, whether it was the use of recombinant DNA and cloning to produce genetically modified viruses and hybrid animals which served as biological weapons (*Piranha*, 1978; *Bats* 1999), or genetically enhanced 'killer supersoldiers' (*The Clones of Bruce Lee*, 1977; *American Ninja 2: The Confrontation*, 1987). While movies framed geneticists as scientists who are under constant pressure to make breakthroughs, they suggested that it is not the geneticists who should be mistrusted but rather those in power, who use biotechnologies as a tool for ideological, militaristic, and political purposes. Thus, cinematic representations from that time emphasized that the real danger comes not from scientists but from an alliance between: molecular biologists, the government, and the military (Dinello, 2005; Domaradzki, 2021; Wasson and Grieveson, 2018).

Finally, with the advent of the biotechnological industry in the 1990s the cinema started to emphasize that science shifts from a purely academic enterprise to a money-driven and industry-dependent business (Meyer et al., 2013). Consequently, the image of geneticists captivated by market-orientated research emerged (*Jurassic Park*, *Deep Blue Sea*, 1999; *Black Sheep*, *Consumed*) which reconstructed social concerns over the bioindustry's excessive preoccupation over profit maximization and the production and selling of biotechnologies, even at the cost of crossing ethical boundaries.

While in earlier movies there was a strong tendency to vilify scientists, especially in modern movies, geneticists are no longer exclusively feared as they are increasingly being portrayed in a more positive light as normal people and dedicated scholars, idealists, physicians, and hardworking professionals trying to save the world (Haynes, 2016, 2017). This is not surprising, as especially since the 1990s, when the Human Genome Project was initiated, genetics is no longer framed merely as an obscure scientific paradigm but is often pictured instead as a preferred solution to many medical problems (O'Riordan, 2008). Thus, this research shows that great social enthusiasm related to anticipated advances in clinical genetics has helped to create a more positive image of molecular biology. Consequently, the cinema has seen the ascendance of heroic scientists who are framed as pioneers of science or caring physicians who struggle to develop miracle cures (Domaradzki, 2022).

Because recent movies focus on the ways in which biotechnology can make the world a better place the cinema helps to associate geneticists with progress rather than with conflict, and by stressing the medical applications of biotechnology, the cinema has given geneticists a more humane face and has bolstered the faith in science as a disinterested crusade for the common good (Schmidt

et al., 2015). Furthermore, framing geneticists as superheroes who, owing to their knowledge and skills are able to save lives, helps to divert attention from ethical dilemmas related to laboratory work. It also helps to create the image of science that is considered by moviemakers as more interesting to audiences than the one of arduous and boring laboratory research conducted by nerdy scientists.

Although some movies still (re)construct the negative image of the molecular biologist who is overly ambitious and is ready to use any method to achieve their goals (*Errors of the Human Body*, *Rise of the Planet of the Apes*), or violates natural laws and cultural taboos (*The Reconstruction of William Zero*, 2014; *Replicas*), more frequently they are framed as naïve scientists who are unable to perceive problems from a wider perspective or researchers exploited by state agencies or corrupted by private biocorporations.

Finally, this study also shows that while in earlier movies genetics was mainly framed as 'science for men' and women were often depicted either as subordinate, intellectually inferior, or as lacking competencies required in the scientific world, especially since the 1990s the figure of the women geneticist is on the rise (Elena, 1997; Steinke, 1997; Flicker, 2003).

All in all, although it is difficult to generalize, since the landscape for genetics and the cinema has changed significantly since the 1950s, this research confirms that there are some trends over time that are sociologically important. It shows that up to the 1980s, when genetics was predominantly framed as a mysterious and potentially dangerous science, geneticists were mainly described in a negative way. In contrast, from the 1990s, when many applications of genetics became widely available and less controversial, positive images of geneticists have been on the rise, especially over the last two decades. At the same time, this study shows that none of these representations is in themselves 'true' or 'fixed' (Hall, 1997). On the contrary, because cinematic depictions of geneticists are always contextualized, every particular image is constructed at a certain time through text and vison.

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References

Bull, S. (2019) Television and the Genetic Imaginary. in: *Palgrave Studies in Science and Popular Culture*. (London: Palgrave Macmillan).

Burri, R. V. (2018) Envisioning futures: imagining technoscientific worlds in film, *European Journal of Futures Research*, 6, pp. 17. doi:10.1186/s40309-018-0148-6

Calogero, R. M., Boroughs, M. and Thompson, J. K. (2007) The impact of Western beauty ideals on the lives of women and men: A sociocultural perspective, in: V. Swami, and A Furnham (Eds) *The Body Beautiful*, pp. 259–298 (London: Palgrave Macmillan).

Chapman, R., Likhanov, M., Selita, F., Zakharov, I., Smith-Woolley, E. and Kovas, Y. (2019) New literacy challenge for the twenty-first century: genetic knowledge is poor even among well educated, *Journal of Community Genetics*, 10(1), pp. 73–84.

Czarny, M. J., Faden, R. R. and Sugarman, J. (2010) Bioethics and professionalism in popular television medical dramas, *Journal of Medical Ethics*, 36(4), pp. 203–206.

Davin, S. (2003) Healthy viewing: the reception of medical narratives, *Sociology of Health and Illness*, 25(6), pp. 662–679.

De Zoysa, R. and Newman, O. (2002) Globalization, soft power and the challenge of Hollywood, *Contemporary Politics*, 8(3), pp. 185–202.

Dinello, D. (2005) *Technophobia!: Science Fiction Visions of Posthuman Technology* (Austin: University of Texas Press).

Domaradzki, J. (2021) Popular culture and genetics: Genetics and biotechnologies in the movies, *Polish Sociological Review*, 215(3), pp. 281–310.

Domaradzki, J. (2022) Treating rare diseases with the movies: Can popular movies enhance public understanding of rare diseases?, *Orphanet Journal of Rare Diseases*, 17(1), pp. 117.

Eberl, J. (2010) I, clone: How cloning is (mis)portrayed in contemporary cinema, *Film and History*, 40(2), pp. 27–44.

Elena, A. (1997) Skirts in the lab: Madame Curie and the image of the woman scientist in the feature film, *Public Understanding of Science*, 6(3), pp. 269–278.

Eurobarometer. 2010. *Science and Technology*. Available at https://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs_340_en.pdf (accessed 15 September 2021).

Flicker, E. (2003) Between brains and breasts–women scientists in fiction film: On the marginalization and sexualization of scientific competence, *Public Understanding of Science*, 12(3), pp. 307–318.

Flores, G. (2002) Mad scientists, compassionate healers, and greedy egotists: the portrayal of physicians in the movies, *Journal of the National Medical Association*, 94(7), pp. 635–658.

Franklin, S. (2000) Life itself: Global nature and genetic imaginary, in: S. Franklin, C. Lury, and J Stacey (Eds) *Global Nature, Global Culture*, pp. 188–227 (London: Sage).

Frayling, C. (2005) *Mad, Bad and Dangerous? The Scientist and the Cinema* (London: Reaktion Books).

Funk, C. (2017) Mixed messages about public trust in science, *Issues in Science and Technology*, 34(1), pp. 86–88.

Gibbons, E., Stovall, I. and Clayton, J. (2021) Genetics in film and TV, 1912–2020, *Journal of Literature and Science*, 14(1), pp. 1–22.
Glassy, M. C. (2006) *The Biology of Science Fiction Cinema* (Jefferson, N.C.: McFarland & Company).
Hall, S. (1997) *Representation: Cultural Representations and Signifying Practices* (London: Sage).
Haynes, R. D. (1994) *From Faust to From Faust to Strangelove* (Baltimore: The John Hopkins University Press).
Haynes, R. D. (2003) From alchemy to artificial intelligence: Stereotypes of the scientist in Western literature, *Public Understanding of Science*, 12(3), pp. 243–253.
Haynes, R. D. (2006) The alchemist in fiction: The master narrative, HYLE, *International Journal for Philosophy of Chemistry*, 12(1), pp. 5–29.
Haynes, R. D. (2016) Whatever happened to the 'mad, bad' scientist? Overturning the stereotype, *Public Understanding of Science*, 25(1), pp. 31–44.
Haynes, R. D. (2017) *From Madman to Crime Fighter. The Scientist in Western Culture* (Baltimore, MD: Johns Hopkins University Press).
Heine, S. J., Dar-Nimrod, I., Cheung, B. Y. and Proulx, T. (2017) Essentially biased: Why people are fatalistic about genes, in: J.M. Olson (Eds) *Advances in Experimental Social Psychology*, pp. 137–192 (Elsevier Academic Press).
Jones, R. A. (1997) The boffin: A stereotype of scientists in post-war British films (1945–1970), *Public Understanding of Science*, 6(1), pp. 31–48.
Jörg, D. (2003) The good, the bad and the ugly – Dr. Moreau goes to Hollywood, *Public Understanding of Science*, 12(3), pp. 297–305.
Kampourakis, K. (2022) *Understanding Genes* (Cambridge: Cambridge University Press).
Kirby, D. A. (2000) The new eugenics in cinema: genetic determinism and gene therapy in "GATTACA", *Science Fiction Studies*, 27(2), pp. 193–215.
Kirby, D. A. (2003a) The threat of materialism in the age of genetics: DNA at the drive-in, in: G.D. Rhodes (Eds) *Horror at the Drive-in: Essays in Popular Americana*, pp. 241–258 (Jefferson, NC: McFarland).
Kirby, D. A. (2003b) Science advisors, representation, and Hollywood films, *Molecular Intervention*, 3(2), pp. 54–60.
Kirby, D. A. (2007) The devil in our DNA: A brief history of eugenics in science fiction films, *Literature and Medicine*, 26(1), pp. 83–108.
Kirby, D. A. (2011) *Lab Coats in Hollywood: Science, Scientists, and Cinema* (Cambridge, MA: The MIT Press).
Kirby, D. A. (2014) Science and technology in film. Themes and representations, in: M. Bucchi, and B Trench (Eds) *Routledge Handbook of Public Communication of Science and Technology*, pp. 97–112 (New York: Routledge).
Merzagora, M. (2010) Reflecting imaginaries: science and society in the movies, in: A. Smelik (Eds) *The Scientific Imaginary in Visual Culture*, pp. 35–48 (Goettingen: Socrates).
Meyer, A., Cserer, A. and Schmidt, M. (2013) Frankenstein 2.0.: Identifying and characterising synthetic biology engineers in science fiction films, *Life Sciences, Society and Policy*, 2013(9), pp. 9.
Muela, G. F. J. and Abril, A. M. (2014) Genetics and cinema: Personal misconceptions that constitute obstacles to learning, *International Journal of Science Education, Part B: Communication and Public Engagement*, 4(3), pp. 260–280.
Mulvey, L. (1999) Visual pleasure and narrative cinema, in: L. Braudy, and M Cohen (Eds) *Film Theory and Criticism: Introductory Readings*, pp. 833–844 (New York: Oxford University Press).

Nelkin, D. and Lindee, M. S. (1999) *The DNA Mystique. The Gene As a Cultural Icon* (New York: W. H. Freeman and Company).
Ouellette, L., Ritter, H., Shaheen, M., Brown, A., Huynh, V., Fleeger, A., Fleeger, T. and Jones, J. S. (2021) Are television medical dramas bad for our image?, *American Journal of Emergency Medicine*, 41(1), pp. 235–236.
O'Riordan, K. (2008) Human cloning in film: Horror, ambivalence, hope, *Science as Culture*, 17(2), pp. 145–162.
Pew Research Center. 2019. *Key Findings About Americans' Confidence in Science and Their Views on Scientists' Role in Society*. Available at https://www.pewresearch.org/fact-tank/2020/02/12/key-findings-about-americans-confidence-in-science-and-their-views-on-scientists-role-in-society/ (accessed 15 September 2021).
Olivier, B. (2010) AVATAR: ecopolitics, technology, science, art and myth, *South African Journal of Art History*, 25(3), pp. 1–16.
Quick, B. L. (2009) The effects of viewing Grey's anatomy on perceptions of doctors and patient satisfaction, *Journal of Broadcasting and Electronic Media*, 53(1), pp. 38–55.
Roberts, J., Archer, L., DeWitt, J. and Middleton, A. (2019) Popular culture and genetics; friend, foe or something more complex?, *European Journal of Medical Genetics*, 62(5), pp. 368–375.
Rose, C. (2007) Biology in the movies: Using the double-edged sword of popular culture to enhance public understanding of science, *Evolutionary Biology*, 34(1-2), pp. 49–54.
Schibeci, R. and Lee, L. (2003) Portrayals of science and scientists, and 'science for citizenship, *Research in Science and Technological Education*, 21, pp. 177–192.
Schmidt, M., Meyer, A. and Cserer, A. (2015) The Bio:Fiction film festival: Sensing how a debate about synthetic biology might evolve, *Public Understanding of Science*, 24(5), pp. 619–635.
Stacey, J. (2010) *The Cinematic Life of the Gene* (London: Duke University Press).
Steinke, J. (1997) A portrait of a woman as a scientist: Breaking down barriers created by gender role stereotypes, *Public Understanding of Science*, 6(4), pp. 409–428.
Stern, F. and Kampourakis, K. (2017) Teaching for genetics literacy in the post-genomic era, *Studies in Science Education*, 53(2), pp. 193–225.
Stern, M. (2004) Jurassic park and the moveable feast of science, *Science as Culture*, 13(3), pp. 347–372.
Terzian, S. G. and Grunzke, A. L. (2007) Scrambled eggheads: Ambivalent representations of scientists in six Hollywood film comedies from 1961 to 1965, *Public Understanding of Science*, 16(4), pp. 407–419.
Tian, Y. and Yoo, J. H. (2020) Medical drama viewing and medical trust: A moderated mediation approach, *Health Communication*, 35(1), pp. 46–55.
Tudor, A. (1989) *Monsters and Mad Scientists* (Oxford: Basil Blackwell).
Turney, J. (1998) *Frankenstein's Footsteps: Science, Genetics and Popular Culture* (New Haven and London: Yale University Press).
van Dijck, J. (1998) *Imagenation. Popular Images of Genetics* (New Hampshire and London: Palgrave Macmillan).
Wasson, H. and Grieveson, L. (2018) *Cinema's Military Industrial Complex* (Oakland, CA: University of California Press).
Weingart, P., Muhl, C. and Pansegrau, P. (2003) Of power maniacs and unethical geniuses: Science and scientists in fiction film, *Public Understanding of Science*, 12(3), pp. 279–287.
Weitekamp, M. A. (2017) The image of scientists in The Big Bang Theory, *Physics Today*, 70 (1), pp. 40–48.