

Visualizing Science Fiction and relating it to Science Fact

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The proliferation of science fiction in film and visual media brings scientific topics to large audiences, inspiring many people to develop a serious interest in scientific studies. Increasingly, science fiction is being used as a tool in the teaching of science and visual media provide excellent opportunities to foster student engagement and encourage reflection. In this article, we critique science fiction film in terms of 'reel' versus real science, highlighting how it illustrates scientific advances that are important in nanobiotechnology, molecular biology and biochemistry.

"We hope it will not be long before we may have other works of Science-Fiction, as we believe such books likely to fulfil a good purpose, and create an interest, where, unhappily, science alone might fail."

William Wilson

A Little Earnest Book upon a Great Old Subject (1851)
London: Darton and Co., Holborn Hill

Science Fiction was a term first coined by the British poet William Wilson in the mid-19th Century. It has developed into a genre that encompasses written works (novels, magazines and comic books) and visual and aural media (movies, TV serials, radio shows, computer games and graphic art). As might be expected from such a diverse output of material, science fiction has cultivated a devout fan base in a wide variety of languages and cultures. In many ways, it is not surprising that science fiction has emerged and evolved in step with the scientific and technological progress of our modern society. Its frequent extrapolation of current scientific trends can ignite debate about scientific ethics, application and advocacy. In this article, we highlight how science fiction provides the framework to explore the impact and consequences of scientific advances on society, examining whether science fiction films can play a role, positive or negative, in the acceptance of new scientific technologies.

Key words: cinema, dystopian fiction, science fiction, scientism, television

Background context

The science fiction (SF) we recognize today emerged from 'scientific romance' novels written by H.G. Wells, Jules Verne and their contemporaries at the end of the 19th and beginning of the 20th Centuries. The genre was taken on further by American pulp fiction magazines, such as *Amazing Stories*, edited by Hugo Gernsback (Figure 1), which intended to introduce the wonders of modern science to a scientifically naïve public, but they also provided an optimistic view of scientism's role. Positive, progressive visions of a future utopia in a contemporary evolving society were common in American SF. In contrast, the British science romance novels often had a different, darker, dystopian view of the inherent scientific progress, epitomized in Aldous Huxley's *Brave New World*, published in 1932. The SF genre encompasses many themes, including imaginary journeys and, more recently, cloning and nanotechnology. Many of these themes echo the huge recent advances in biotechnological and medical sciences and they have been presented in an SF format on cinema and TV screens throughout the last half century.

Questions often arise about the mutual influence that science has on SF and vice versa. SF is often blamed for distorting science, and hampering the acceptance of new technologies and scientific advances in the eyes of a sceptical public because it blurs the boundaries of reality. But is it fair to suggest that SF provides a negative and inaccurate portrayal of science? Or is it

merely providing a legitimate scrutiny of the scientific desire for progress, by creating opportunities for cultural, philosophical, ethical and moral debate on the benefits of such scientific progress? Such negative connotations for contemporary SF are a major shift from Gernsback's visualizations that SF would create a wonder about science and its benefits.

The enormous extent to which SF has filtered into our culture through visual media should not be underestimated. SF emerged on to screens with the advent of the cinema at the turn of the 20th Century, leading to milestones in the genre such as *The Island of Lost Souls* (1933), which explored the themes of dangerous dark mutations, unregulated science and out of control scientists. The range of SF films is too vast to be covered fully in this article, but it is clear that specific themes become popular at certain times. For example, in the post-World War II period and into the 1950s, many SF films reflected the fears and suspicions that spread during the Cold War. Films such as *The Thing from Another World* (1951) evoked the fear of alien invasion that highlighted the paranoia at the time, but also projected an image of scientists as elitist and out of touch. The 1950s also saw the encroachment of TV into our homes, extending the reach of SF into the public psyche. In the USA, TV anthology series such as *Science Fiction Theatre*, *Tales of Tomorrow* and the *Twilight Zone* provided different stories that touched on SF themes on a weekly basis. The BBC also broadcasted serials such as *The Quatermass Experiment* (1953), with its angst-ridden scientist infected with an alien life form being one of the few SF stories with a scientist as a lead character.

Contemporary biological themes such as nanotechnology, cloning and regenerative medicine have been packaged into an SF format for the large and small screens. Below, we explore how well various scientific advances have been presented and whether the visual media have provided a road map for the future of scientific investigations. We also highlight how SF provides the framework for a speculative exploration of the impact and consequences of scientific advances on society, particularly in consideration of ethical dilemmas.

From Nanobiotechnology to Cloning Humans

Fantastic Voyage (1966), an example of an imaginary journey, first appeared on cinema screens more than 40 years ago (Figure 2) and was followed by an animated TV series, initially shown on the ABC channel in the USA in 1968, also titled *Fantastic Voyage*. A remake of the film as *Inner Space* (1986) was released 20 years



Figure 1. Front cover from issue 1 of *Amazing Stories*. The magazine was launched in America by Hugo Gernsback in 1926, and published by Experimenter Publishing Co. (Image available under Creative Commons Licence.)

later and a new remake of *Fantastic Voyage* directed by Shawn Levy is currently in production. The premise of the original film is that the technology exists to shrink individual molecules in size, allowing a submarine and its crew to be miniaturized and injected into a scientist who is currently in a coma because of a blood clot on the brain. The scientist is the keeper of vital scientific information and the mission of the submarine and its crew is to venture into the body and remove the clot before the miniaturization wears off. One of the crew tries to sabotage the mission and, as the blood clot is removed, the saboteur is killed and devoured by the patient's white blood cells. With time running out before the miniaturization process is reversed, the remaining crew members swim to the eyes and manage to escape the body via a teardrop.

Setting aside the astrophysical unlikelihood of miniaturizing a submarine and its crew, did this film set up plausible suggestions for medical advances to come? Although miniaturizing people and equipment is implausible, the SF story is relevant to the concept of nanotechnology, which emerged into the awareness of the general public during the 1980s, 20 years after the initial outing of *Fantastic Voyage*. Nanobiotechnology has expanded into many different areas and it is

being explored as a treatment for various medical problems, including blood clots. Such targeted drug delivery to damaged or diseased cells is a Holy Grail in personalized medicine. Recent advances include using DNA molecules as cages that release their drug cargo upon interaction with specific cell types (Figure 3) and blood clots being broken down by smart nanoparticles (see www.newscientist.com/blogs/nstv/2012/07/smart-nanoparticles-caught-destroying-a-blood-clot.html). These developments suggest that science may be catching up with the concepts first postulated in the SF films. Although it is difficult to implicate a direct connection between the ideas proposed in *Fantastic Voyage* and targeted drug delivery, it is striking that the initial premise of nanomachinery seemed very far-fetched in the 1960s, but these days it seems within the grasp of contemporary medicine.

A more recent SF film that also alludes to the development of nanobiotechnology is *The Island*

(2005). In an important scene in the film, the central character, Lincoln 6 Echo, is subjected to a brain scan performed by nanobots that travel through his eyes to report on the health of his brain. Although the nanobots are large enough to be seen and so their description as nanotechnology may be questioned, these are again clearly linked to targeted medical procedures.

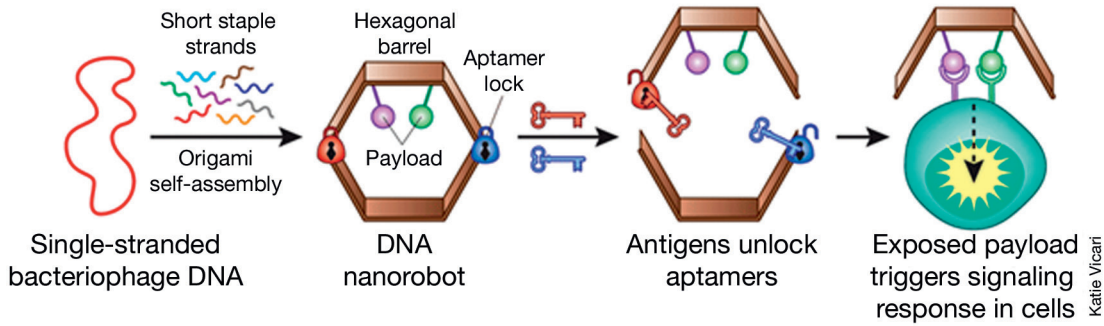
The Island projects other contemporary scientific themes that are popular in SF, with designer humans and cloning at the core of its story. The film is set in 2019 and such a near timeline questions the feasibility for the required scientific developments to be achieved in that timeframe. But, of most interest to the scientific community are the ethical issues that are raised by this SF story. Although the viewer does not learn the specific details until well into the film, we eventually discover that the main characters are clones of people in the outside world. The clones, termed ‘agnates’, are ‘born’ as fully formed adults with imprinted, ‘false’ memories, with the aim to provide babies or organs required by the human ‘sponsors’ who ‘own’ their own agnates.

The political justification for creating agnates’ is that “everyone wants to live forever; it’s the new American dream”. Within the film, cloning for regenerative medicine is deemed to be legal, with “the eugenics laws of 2015” stating that the biological products do not feel pain or other human emotions. During its second half, the film turns into an action-packed thriller, and the only other significant points related to the science are when it becomes clear that the methodology to create the agnates is flawed and some of them retain memories of their sponsors. In the final scenes of the film, it is decided that all agnates should be killed, but Lincoln 6 Echo is able to thwart the plan and free the clones. In addition to highlighting some of the issues associated with the scientific progress of cloning and regenerative medicine, the film also brings up some of the philosophical questions about what defines a human. The film does not attempt to evaluate the rights or wrongs of such scientific progress, but the legal, philosophical and moral difficulties are clear for everyone to see.

Since the middle of the 20th Century, during the era of molecular biology, cloning has preoccupied scientists, the public and SF film-makers. Until recently, there was little expectation that such approaches could be extended to people in a reasonable timeframe. However, improvements in experimental techniques have culminated in the cloning of a range of mammals, including the infamous Dolly the sheep. The massive increase in knowledge of genome sequences since the mid-1990s have also altered people’s perception of what may be achieved. As already described in relation to



Figure 2. Image from *Fantastic Voyage*, 1966. The trailer described that the film would take viewers “off on a fantastic voyage, actually entering inside the human body, exploring an unknown universe...unknown dangers. You are there with them sharing a breakthrough in motion pictures. If you thought it was too late to discover something entirely new on the screen, *Fantastic Voyage* will be a stunning experience, for you are going where no man or camera has ventured before and when you come out you may never look at yourself in the same way again...” © Twentieth Century Fox Film Corporation



Katie Vicari

Figure 3. DNA nanorobots assist delivery of drugs. Nanoscale ‘cages’ have been developed that are made from fragments of DNA that combine to form specific shapes, in a process termed ‘DNA origami’. The DNA assembles around its cargo, which can be a drug. The DNA cage releases its cargo when it is exposed to two antigens that will be present on specific cell types, allowing the drug to be targeted to specific cells. Reprinted by permission from Macmillan Publishers Ltd: Nature Biotechnology **30**, 407–408, © 2012

The Island, recent SF films that explore the applications of cloning technologies also highlight the inherent ethical dilemmas that emerge with these technologies. Science often plays a secondary part to the emotional aspects of the story, as is the case in *GATTACA* (1997; see Cyberbiochemist on p.34 of this issue) which is set in a future where humans are designed with specific characteristics. The film touches on the difficulties that designer people pose for society, but the major parts of the film focuses on a murder and love.

The film *Never Let Me Go* (2010) is an adaptation of the book written by Kazuo Ishiguro. The film portrays a modern alternative dystopian society and it provides a vision of the inherent complex concerns arising from clones used to provide donor organs. The film provides few details about the science that underpins human cloning, but it does raise awareness

of a vision of a society that produces clones, but does not know how to deal with them. As a result, the clones are kept on the fringes of society, viewed as ‘less than human’, but they accept that their role in society is to provide donor organs.

As already highlighted for *The Island*, many films that involve cloning technologies entwine them with traditional thriller stories that entertain and excite the audience. A classic example is *Jurassic Park* (1993), where dinosaurs are cloned using DNA recovered from insects encased in amber. As with the *Fantastic Voyage*, the film focuses upon conspiracies to steal this scientific knowledge as well as the impending threat that dinosaurs pose to humans. This film’s premise includes accurate and feasible scientific information, and proposals to clone extinct animals have been explored in real scientific research. For example,

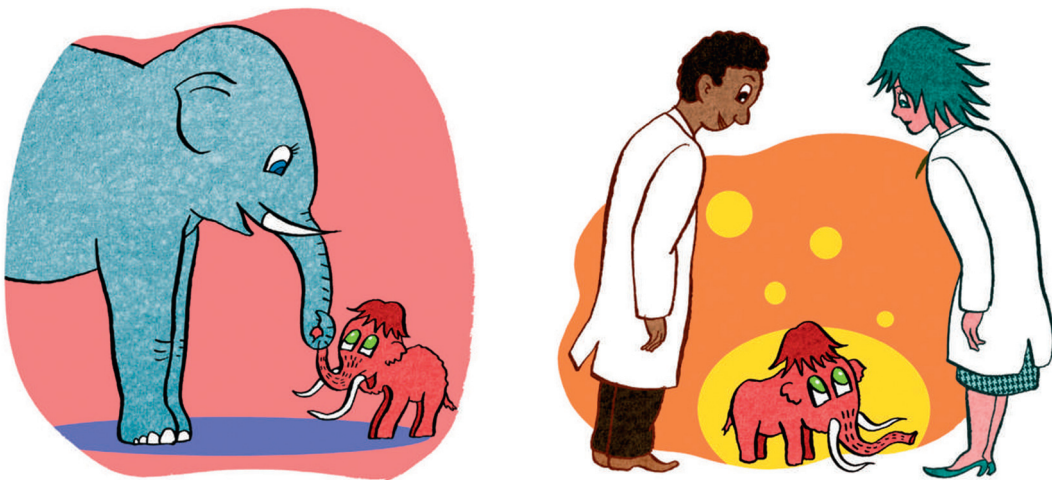


Figure 4. Major developments in cloning technologies and the partial completion of the genome sequence of the woolly mammoth have led to suggestions that it may be feasible to clone this extinct animal. Reprinted by permission from Macmillan Publishers Ltd: Nature **456**, 310–314, © 2008

the recent partial sequencing of the genome of the woolly mammoth has led experienced and respectable scientists to consider what experimental methods need to be developed to enable the resurrection of these extinct animals (Figure 4). It is clear that a more complete genome sequence is required and, because many experimental technologies are still in their infancy, there are huge technological hurdles to be overcome. However, the amazing scientific progress since the making of *Jurassic Park* means that it may be unwise to dismiss the suggestion that this particular SF may never become science fact.

Concluding remarks

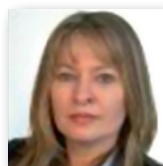
The SF films discussed here are based on scientific themes that range from nanobiotechnology to cloning and regenerative medicine. The science underpinning these themes is very different and is often discussed at basic levels, if at all. Clearly, these films are (usually) made to entertain, and artistic licence can be taken with any aspect of the story, including the science. However, these SF films still provide much value to scientists and science as a whole as they, hopefully, engage with a public who might not normally think seriously about these scientific topics. One aspect of scientific research that is particularly useful to highlight in such SF films is the issue of ethics in science and medicine. There are rarely easy answers to the dilemmas posed in such scientific development and the more responsible films make this point clear. ■

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