Biosafety and Biological Weapons: *The Andromeda Strain* (1971)

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Summary

The Andromeda Strain is a cinematographic adaptation of the book of the same name by Michael Crichton. It may be considered as the most "microbiological" film of the Seventh Art. Directed by Robert Wise, this techno-thriller describes the efforts of a team of scientists to characterize and contain an extra-terrestrial pathogenic microorganism. Although the film was made more than 40 years ago it tackles issues very much in vogue, such as biological weaponry, measures of isolation and protection, the automation of health procedures, and decision-making in the face of a unexpected situation of emergency.

Keywords: Biosafety laboratory, Quarantine, Cinematographic adaptation, Prophylaxis, Biological weapons.

Technical details

Original title: *The Andromeda Strain.*
Country: United States.
Year: 1971.
Director: Robert Wise.
Music: Gill Melle (as Gill Mellé).
Photography: Richard H. Kline.
Film editor: Stuart Gilmore and John W. Holmes.
Screenwiter: Nelson Gidding, about the novel of the same name by Michael Crichton.
Cast: Arthur Hill, David Wayne, James Olson, Kate Reid, Paula Kelly, George Mitchell, Ramon Bieri Peter Hobbs, Kermit Murdock, Richard O'Brien, Eric Christmas, Mark Jenkins, Peter Helm, Joe Di Reda (as Joe DiReda), Carl Reindel...
Color: color.
Runtime: 131 minutes.
Genre: Sci-Fi, Mystery, Thriller.
Production Companies: Universal Pictures.
Synopsis: A highly virulent extraterrestrial microorganism has arrived to the Earth on board a military satellite. The microorganism causes the death of all the inhabitants of a small town in New Mexico. There are only two survivors: a baby and an elderly man who is an alcoholic. The government urgently convenes a team of scientists in a high-security secret laboratory to try to study and contain the threat before it spreads across the world and eliminates the human species.
Awards: Nominated for Oscars for Best Art Direction-Set Decoration and Best Film Editing (1972).

http://www.imdb.com/title/tt0066769

Trailer 1 Trailer 2

The film

This film tells the story of four days of an important scientific crisis in North America.... is the opening sentence of this techno-thriller. With the background of a disturbing soundtrack, the credits show us a series of secret documents, biological war maps and scientific charts, among them a microorganism's pH sensitivity profile.

The action occurs in parallel in three interlinked settings. One level is what happens in the zone affected by the *Andromeda* microorganism. All the inhabitants of a small town (Piedmont, New Mexico) and the military team sent to retrieve an artificial satellite die without warning. A protocol is immediately set up by the military to isolate the zone and the civil authorities are alerted so that they can take a series of decisions. The other level involves the politicians. These authorities are not exposed to the microorganism, but their decisions are crucial, and one such decision is to convene a group of scientists so that they can study and contain the threat. The team of scientists constitutes the third level. They will receive information from the military who are out in the field; they will process it and send it on to the politicians. The politicians should tell the military how they must neutralize the threat and the circle is thus closed. There are some time jumps to the past or the future that serve to explain some of the decisions made or some of the consequences of such decisions.

The film above all focuses on what happens within the team of scientists, all of whom are renowned specialists in their respective fields. The leader is Dr, Jeremy Stone (Arthur Hill), a Nobel laureate who is a specialist in bacteriology. The other members of the team are Dr. Charles Dutton (David Wayne), a pathologist; Dr. Ruth Leavit (Kate Reid), a microbiologist, and Dr. Mark Hall (James Olson), a surgeon with a good knowledge of blood chemistry. A fifth member is absent due to appendicitis. They are gathered inside a secret installation located in the Nevada desert with the code name *Wildfire*. The station is equipped with five levels of increasing isolation and safety and it was originally designed for the search for extraterrestrial microorganisms and for biological warfare, as we see at the end. The installation is also equipped with state-of-the-art scientific equipment of that times: a central computer, ultramicrotomes, an electron microscope, a mass spectrometer, chromatographs, robots for handling microbial cultures, biological isolation wards, etc. Additionally, all the assays and tests are performed automatically thanks to the central computer. The team even has an electronic library, something very common today but unheard in the seventies. Finally, the station is endowed with a small nuclear device for self-destruction in the event of the escape of some pathogenic microorganism. However, the station is till under construction and has not been fully tested.

Garbed in bioprotection suits, Stone and Hall are sent to retrieve the artificial satellite *Scoop 7* and study the victims in an attempt to assess the type of biological threat they are facing (Figure 1). What first draws their attention is that the people are dead but scavenger birds are not. Once in the town, they discover that some people have committed suicide, showing that they had survived the pathogen. On examining the corpses, the surgeon notes that they did not bleed and that there is no livor mortis on the part of their bodies where it should have been. Thanks to this, he discovers that most of the dead people died from a massive clotting of their blood, which has turned to dust. But they also find survivors: a baby and an alcoholic elderly man. After they have moved the survivors and the satellite back to *Wildfire*, the scientists begin to study them (Figure 2).

To prevent any contamination by microorganisms from outside, the scientists are subjected to a rigorous process of immunization and decontamination for 16 hours; this includes photo-incineration of the first layer of the skin (Figure 3) and the ingestion of a capsule (antibiotics?) to eliminate their intestinal flora.

Currently we know that such procedures do more harm than good. Our intestinal flora is crucial for the maintenance of human health and its elimination could lead resistant pathogenic microorganisms to colonize the intestine

When they are inside *Wildfire*, Stone explains the arrangement of the laboratories and the instrumentation available and the reason for having the nuclear device. He hands Dr. Hall the key that will turn off the detonator of the device, since he is the "odd"man. This is a hypothesis invented by Michael Crichton, according to which a bachelor with no worries would be the most qualified person to make critical decisions[1] It is worth noting that there is some infighting among the scientists, such as when Dr. Leavitt comments that she does not consider Hall to be a scientist but a "fashionable doctor" (*"overpriced M.D.").*

Figure 1: Exploring the area affected by *Andromeda.*

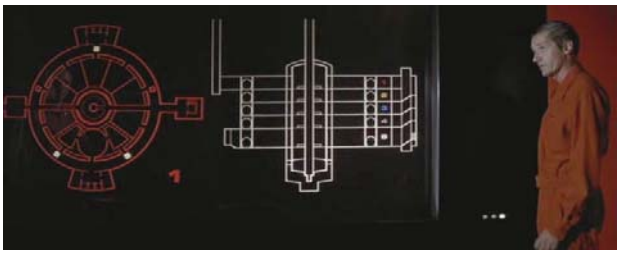

Figure 2: The five underground levels of the secret *Wildfire* laboratory.

Figure 3: Decontamination procedures. Photoincineration of the skin.

The pathogen is studied on two fronts. On one hand the team tries to find out what has spared the baby and the elderly man from its action. Hall and nurse Karen Anson (Paula Kelly) are charged with doing this. On the other hand the team tries to characterize the microorganism biologically. To accomplish this, they perform a series of assays to determine the route of transmission and its size. Using experimental animals and a series of filters they discover that it is airborne and that it is smaller than two microns (Figure 4). Thanks to microscopy techniques they discover a small impact on the satellite; inside is a green substance.

Once the extraterrestrial organism has been analyzed it is given a name: *Andromeda*. The composition of the green substance is analyzed biochemically and microbiologically. *Andromeda* is cultured under different conditions using different culture media: blood agar, chocolate agar, yeast extract, etc. It is composed of carbon, nitrogen, oxygen and hydrogen at proportions similar to living terrestrial beings, but on performing an analysis of amino acids and nucleic acids they find that there aren't any. Slowly they advance in their understanding and eventually they determine that *Andromeda* is highly pH-sensitive. This explains why the baby and the elderly women have survived. The baby has respiratory alkalosis because it cries continually and hyperventilates and the man has acidosis, in this case because he has a bleeding ulcer and for which he has been taking a large amount of aspirin and abusing alcohol, in particular *sterno* which is a mixture of ethanol and methanol. They also discover that *Andromeda* has a huge capacity to mutate and hence adapt (something similar to what happens with flu' virus or HIV). However, the definitive clue is found when they use the electron microscope and observe, incredulous, that *Andromeda* has a compartmentalized hexagonal crystalline structure that is able to grow under a stream of electrons (Figure 5). This gives them the final answer concerning the type of metabolism of *Andromeda*. It is able act like a nuclear reactor, transforming energy into matter. A nuclear explosion would not only fail to destroy the microorganism; it would elicit massive growth and spreading.

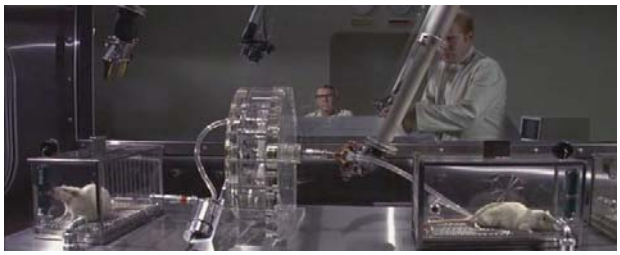

Figure 4: Determining the infective size of *Andrómeda*. Air is passed through a ring of filters with different pore sizes.

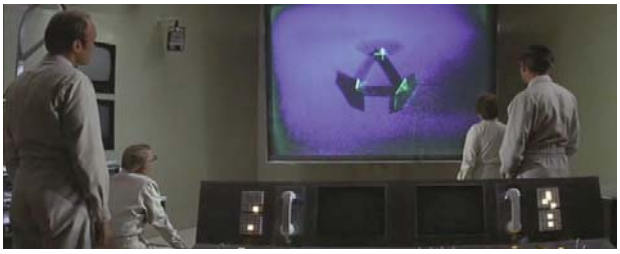

Figure 5: The scientists facing their enemy .*Andromeda* as seen through the electron microscope.

Historical context of the book and of the film

The Andromeda Strain was the first work that M. Crichton signed with his own name. Written in the cold war, it was published in 1969, the year in which Crichton graduated from Medical School and gained a post-doc grant at the Salk Institute. His inspiration for the novel came from a discussion with one of his University lecturers about the possibility that there might be a form of life based on crystals and not on the organic chemistry we are familiar with. The book reached the shelves one month before humans reached the moon. It is a *techno-thriller* in which parts that seem to have been taken from an official dossier and other more novelesque parts are intermingled. Like other works of the time, small human errors or those committed by machines are very important in the plot[2]. The book was a huge success and on the night of the lunar landing Walter Cronkite invited Crichton as a guest to discuss the issue of "space germs" and the quarantine measure that astronauts must undergo when they return to earth. Universal bought the rights of the book for a cinematographic adaptation and about a year later the film was released. Michael Crichton par-

ticipated in the elaboration of the script and even did a cameo (he is the assistant with a beard who appears outside the operating theatre in the scene in which they recruit the surgeon to the team).

The Andromeda Strain was one of the first films to highlight the dangerous potential of biological weaponry. Society was terrified of a nuclear holocaust but Crichton thought that in the future Biology would surpass Nuclear Physics and Chemistry in the role of "Fearsome Science" able to annihilate mankind. Time has not proved him wrong. In the United States, the expression "*Andromeda strain*" is used to refer to outbreaks produced by an infectious agent of unknown origin. Curiously, much of the criticism the film received was more of political than scientific. Some accused him of being an "anti-American lefty"; others a "pro-militarist" because he placed so much emphasis on the American armed forces.

The production had the collaboration of *Cal Tech* and the *Jet Propulsion Laboratory*, such that in all the films is a very realistic recreation of the instrumentation typical of a real working laboratory and its environment. The script writer Nelson Gidding made some changes in respect of the original novel. For example, the male character of Dr. Leavitt became Ruth Leavitt. Initially Wise did not agree because he feared that she would be seen as a "flowery person", similar to Raquel Welch in *Fantastic Voyage* (1966), by Richard Fleischer. Fortunately, Gidding made him see that the person he created would not be like that. He also introduced laser weaponry in the final sequence (in the novel the weapons are automatic dart launchers). But perhaps the most curious addition is the famous error "601", a hint at the recent prowess of the NASA of taking a man to the moon. During the lunar landings, the module computer underwent an error due to memory overload and its identification was "1202". The number 601 is half that and indicated the same error on the computer at *Wildfire* when it was trying to simulate the exponential growth of *Andromeda*[3].

There are two sequences that are interesting for their technical aspects. One is when Dr. Leavitt has an epileptic seizure due to a flash of red light. To prevent that from happening to anybody in the audience the director took particular care that frequency of the flash would be the least one likely to cause such a seizure. The other sequence is when a monkey drops dead after being exposed to *Andromeda*. Wise filmed the scene under the supervision of The American Human Association. In the sequence, it seems that the monkey really does die and to simulate its death the director placed the monkey in a box with air and the box in a room full of CO_2. In the room, out of view of the camera, there was an operator using a breathing apparatus with a bottle of oxygen and an additional mask for the monkey. When a mechanical arm lifted the top off the box, the monkey was immediately exposed to the CO_2, such that he took a few breaths and fainted. Wise continued filming for a couple of seconds and then the operator put the oxygen mask on the animal. It was all done in a single take.

Also interesting is the musical contribution of Gil Melle, one of the few examples in which electronic music was used in a sound track. Its is a mixture of sounds generated electronically, traditional instruments such as the piano and the double bass, and specific sounds such as thudding and bursts of white noise. A special edition of 10,000 copies of a vinyl edition with a hexagonal form was marketed.

The microbiology of *Andromeda*

This film is very interesting from the point of view of teaching microbiology. Several of the procedures used by the scientists to characterize the microorganism are shown. We are also made aware of the human factor in the making of a correct diagnosis. Assay automation is a very important element in current medical practice but the character of Dr Hall refuse to place blind faith in machines. It is his training as a specialist in blood chemistry that allows him to piece together the parts of the puzzle and discover *Andromeda's* weak point.

The procedure to be followed is the one pointed out by Dr. Stone when he says (paraphrasing) *We shall work in three steps. One: detection. We must see whether there is an organism. Two: description: structure and function, and three: control, contention and extermination.*

Michael Crichton was ahead of his times when he endowed *Andromeda* with a series of really interesting biological properties. One of them is the microorganism's capacity to mutate and adapt. When Michael Crichton wrote the book, study of the potential evolution of microorganisms, above all viruses, was still in its infancy. Currently, this concept explains aspects such as the appearance of resistances, the variability of flu' viruses, and the ability of HIV to evade the immune system. From the point of view of environmental microbiology, *Andromeda* is an extremophile and the possibility has been raised that a microorganism, *Andromeda*, could degrade plastics, a material that was considered to be non-biodegradable in those times.

However, the most striking characteristic of *Andromeda* is its structure and metabolism: it is organized as a compartmentalized crystal able to transform

energy into matter without excreting anything. The idea of crystal life has a precedent in the famous essay *"What is life"* by Erwin Schrödinger. Regarding their metabolism, it is true that microorganisms are very versatile in their life forms and the way in which they take up energy, either in the form of light (photoautotrophs) or the use of reduced inorganic compounds (chemolithotrophs). But is it possible for a living being to function as a nuclear reactor? Recently, strains of the yeast *Cryptococcus neoformans* inhabiting the soils of Chernobyl have been described that have a "radiotrophic" metabolism. That is, they transform the energy of the ionizing radiation into chemical energy that they use in their metabolism. *Andromeda* could be a very efficient radioautotroph, although in the film it is defined as something much more powerful and incredible. One thing is to transform radiation energy into chemical energy and quite another to transform it into mass. It does not seem to be physically possible that a living being, or indeed any other device, could transform energy into matter just like á la $E=mc^2$.

Conclusions

Despite the years elapsed since its release, *The Andromeda Strain* continues to be a good *techno-thriller*. From the cinematographic point of view its main defect is that the narrative is somewhat cold and aseptic, which together with its length perhaps makes the film a bit boring in some parts. The scientific characters match the stereotype of cold, cerebral people who try not to let their emotions affect their work. The only exceptions are Dr. Hall and nurse Karen Anson, because for them *Andromeda* is an obstacle in their endeavours to cure the patients in their care. The main virtue of the film is its high degree of authenticity, which makes it perfectly believable.

As seen in other contributions by M. Crichton, science is presented with a Janus face. It is on one hand what has provided mankind with spectacular advances such as the exploration of space or the curing of disease. But it can also cause much misery. The artificial satellite is a Pandora's Box that contains *Andromeda* that is opened by the curious rural physician. Likewise, ignorance can make things worse, as we see in the situation when the scientists counsel the President of the United States to launch an atom bomb to control the infection, without knowing that *Andromeda* will take advantage of the energy released to multiply freely. Crichton describes a scientific crisis that cannot be solved satisfactorily because not everything can be controlled. There is always something unforeseen that could go wrong, such as a member of the team falling sick, a piece of paper blocking a bell, or a flash of light that elicits an epileptic seizure. An example of this type of crisis is petroleum spills. It is better that they should never occur since once they have done so they follow their own course and little can be done. In the case of *The Andromeda Strain*, the resolution of the crisis is a mixture of stupid mistakes and brilliant successes. As we are told by Dr. Dutton, we should not be encouraged to believe that scientists are all-powerful.

Addendum

The Andromeda Strain (2008) by Mikel Salomon is a new cinematographic version of the novel by Michael Crichton made for television as a miniseries. It has important modification with respect to the original script. It was released in Spain through Canal + on 23 July 2008 and is available in DVD format.

http://www.imdb.com/title/tt0424600

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