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RESEARCH ARTICLE

Van Leeuwenhoek – the film: remaking memory in Dutch science cinema 1925–c.1960

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Abstract

This paper examines how the production, content and reception of the film *Antony van Leeuwenhoek* (1924) influenced the historical framing of science. The film features microcinematography by the pioneering Dutch filmmaker Jan Cornelis Mol (1891–1954), and was part of a dynamic process of commemorating seventeenth-century microscopy and bacteriology through an early instance of visual re-creation – a new way of using scientific material heritage, and of enabling audiences to supposedly observe the world of microscopic organisms in just the same way as the Dutch scientist Antoni van Leeuwenhoek (1632–1723) had observed them for himself. Knowledge transfer concerning material culture, around both historical and contemporary instruments, was the determining factor in the microcinematography practices applied in this film. The production and experience of the film also mirrored the seventeenth-century process of experimentation, playing with optics, and visualizing an entirely new and unknown world. Unlike other biographical science films of the 1920s, *Antony van Leeuwenhoek* featured abstract depictions of time and movement that allowed the audience to connect the history of science with microcinematography, contributing to the memory of Van Leeuwenhoek's work as the origins of bacteriology in the process.

> [T]he film … provides us with exquisite and clear living images of microscopic creatures and the hidden processes that occur inside the body of an animal, and it also familiarizes us with a great and learned historical character, one of the many who will occupy a better place in a new national history…[1]

In 1924 the medium of film enabled audiences to see what the Dutch microscopist Antoni van Leeuwenhoek (1632–1723) had famously observed two and a half centuries earlier. It became possible to revisualize and reconstruct these experiences for large audiences through a combination of Van Leeuwenhoek's original seventeenth-century lenses and microcinematography.[2] The director, who used Van Leeuwenhoek's original microscope

[1] J.P. Thijsse, 'De Leeuwenhoek-Film III', *De Amsterdammer* (1925) 2483(10 January), p. 7: '… de film, die ons niet alleen voortreffelijke en duidelijke levende beelden te aanschouwen geeft van microscopisch klein gedierte en verborgen werk in het dierlijk lichaam, maar ons ook in nauwe aanraking brengt met een groot geleerde en goed mensch, een van de velen, die in de Nieuwe Vaderlandsche Geschiedenis een betere plaats zullen krijgen …'

[2] Public microscopy and projected images of microscopic views were common in the eighteenth and nineteenth centuries, but microcinematography and the ultramicroscope enabled the recording of much smaller

in some scenes, managed to create a novel 'historic-micro-cinematographic' genre in science film, thereby opening a new chapter in the history of science – that of visual reconstruction.[3]

Today, the tercentenary of Van Leeuwenhoek's death is being widely celebrated. His personal life, discoveries, observations and achievements are the subject of academic publications and studies.[4] But his legacy is also celebrated in exhibitions, biographies and public media.[5] Histories are being told and retold, old drawings are resurfacing and the memories of science past are being made and remade. A new chapter is thus being added to our collective memory of Van Leeuwenhoek – a chapter in the history of the depiction of Van Leeuwenhoek that is constantly changing and has been (for the past century at least) deeply influenced by popular visual culture. This paper explores how science film as a particularly influential visual medium has shaped and continues to shape culture and memory around Antoni van Leeuwenhoek's work. Of particular importance to this analysis is the method of reconstruction, the role of instruments (both historical and contemporary) and knowledge transfer about microcinematography.

Antoni van Leeuwenhoek is an important figure in the history of Dutch science. In 2004, when television viewers were invited to vote for the 'Greatest Dutchman', Van Leeuwenhoek came fourth, ahead of famous figures such as the painter Vincent van Gogh and the football player Johan Cruyff.[6] Van Leeuwenhoek's name continues to be invoked and remembered frequently.[7] It is used by the Dutch Cancer Institute Antoni van Leeuwenhoek Hospital, for example.[8] In 2009 one of the microscopes made by Van Leeuwenhoek was auctioned at Christies under the lot title 'The foundations of modern biology'.[9] Van Leeuwenhoek's

(moving) microorganisms such as bacteria, which had also been observed by Antoni van Leeuwenhoek with his single-lensed microscope. On the projection of microscopic views see, for example, Peter Heering, 'The enlightened microscope: re-enactment and analysis of projections with eighteenth-century solar microscopes', *BJHS* (2008) 41(3), pp. 345–67; Meegan Kennedy, '"Throes and struggles … witnessed with painful distinctness": the oxy-hydrogen microscope, performing science, and the projection of the moving image', *Victorian Studies* (2019) 62(1), pp. 85–118.

[3] J.C. Mol and W.H. van Seters, 'Antony van Leeuwenhoekfilm' (1925), Archive Rijksmuseum Boerhaave, BOERH s inst m 55: 'historisch-micro-cinematographisch film-werk'.

[4] The process from van Leeuwenhoek's observations, to drawings, to engravings is one of the research aims of the Visualizing the Unknown project (https://visualizingtheunknown.com). The Visualizing the Unknown: Scientific Observation, Representation and Communication in 17th-Century Scholarly and Cultural Networks project (2021–7) is a collaboration between Huygens ING (KNAW), Bibliotheca Hertziana-Max Planck Institute for Art History in Rome and Rijksmuseum Boerhaave in Leiden. The Royal Society of London and Rijksmuseum Amsterdam are partners.

[5] Dirk van Delft, *Onzichtbaar leven: Antoni van Leeuwenhoek en de wondere wereld van de microbiologie*, Amsterdam: Prometheus, 2022; Geertje Dekkers, *Veel, klein en curieus: De wereld van Antoni van Leeuwenhoek (1632–1723)*, Amsterdam: Spectrum, 2023. See also the exhibition Unimaginable: How Van Leeuwenhoek's Microscope Changed the World, 18 April 2023–7 January 2024, Rijksmuseum Boerhaave, Leiden; and https://antonivanleeuwenhoekjaar.nl/ (accessed 7 May 2023).

[6] See 'De Grootste Nederlander', https://en.wikipedia.org/wiki/De_Grootste_Nederlander, *Wikipedia* (accessed 8 January 2020).

[7] In the Netherlands, his name appears in street names, school names, apothecaries, societies and academic chairs, among many others.

[8] This cancer hospital, formerly known as the Antoni van Leeuwenhoekhuis, was established in 1916 and is named after the 'great Dutch founder of microscopic research'. See 'Nederlandsch Kankerinstituut', *Nederlands Tijdschrift voor Geneeskunde* (1915) 59, p. 202: 'den grooten Nederlanschen grondlegger van het microscopisch onderzoek'.

[9] Christies, Sale 5808, Travel, Science & Natural History, London, South Kensington, 8 April 2009: Lot 88, 'A highly important Dutch silver microscope ANTONI VAN LEEUWENHOEK (1632–1723), CIRCA 1690'. Price realized: £313,250. See www.christies.com/LotFinder/lot_details.aspx?intObjectID=5192744 (accessed 10 December 2019).

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role as the 'founding father' of microscopy, microbiology, bacteriology and protozoology has been commemorated both nationally and internationally.[10]

In 1923, the celebrations of 250 years since Van Leeuwenhoek's original observations aroused the interest of the Dutch filmmaker Jan Cornelis Mol (1891–1954). The subject of this paper is Mol's silent film *Antony van Leeuwenhoek*, which re-creates Van Leeuwenhoek's microscopic observations.[11] I will look at how the film played a formative role in the dynamic process of collective memory formation around the history of microscopy and bacteriology between 1925 and 1960. The microcinematographic sequences in the film function as reconstructions of the observations originally made using Van Leeuwenhoek's microscopes, and as visual experiments that replicate Van Leeuwenhoek's seventeenth-century observations. The film, its making and its reception are thus examples of the important matters of skills, materiality and the use of instruments in science cinema. To overcome the technical challenges involved, Mol had to construct his own microcinematographic installation, which led him to develop a new function for microcinematographic imagery as part of a cinematographic reconstruction in the history of science. The juxtaposition of material heritage and modern cinematography enabled the film to function as a dynamic mediator in the formation of cultural memory around microbiology and bacteriology. The use of the double lens of Van Leeuwenhoek's original microscope and Mol's camera made it possible for audiences to witness the graceful movements of Van Leeuwenhoek's 'little animals' for themselves and, as it were, to look through the eyes of the master microscope maker.

The history of microcinematography and science cinema have been the focus of historians of science and film historians in recent decades. Hannah Landecker's important work on microcinematography in cell biology was followed by studies on the recording of Brownian motion, and microcinematography in embryology and popular cinema, among others.[12] Studies on science films, popular-scientific moving images and science documentary have also opened up the rich world of knowledge making and knowledge

[10] Clifford Dobell, *Antony van Leeuwenhoek and His 'Little Animals': Being Some Account of the Father of Protozoology and Bacteriology and His Multifarious Discoveries in These Disciplines*, London: Staples Press, 1932. See, for example, J.O. Corliss, 'Three centuries of protozoology: a brief tribute to its founding father, A. van Leeuwenhoek of Delft', *Journal of Protozoology* (1975) 22(1), pp. 3–7; Brian J. Ford, 'Bacteria and cells of human origin on van Leeuwenhoek's sections of 1674', *Transactions of the American Microscopical Society* (1982) 101, pp. 1–9.

[11] For this paper I studied a copy of the film *Antony van Leeuwenhoek* (1924) available in the collections of the Eye Film Institute Netherlands (Amsterdam). Production: Bureau voor Wetenschappelijke Kinematografie; direction, camera: J.C. Mol; adviser: dr. W.H. van Seters. Eye Film Institute shared the film online in 2017 via Youtube: Eye Filmmuseum, *Antony van Leeuwenhoek*, https://youtu.be/sNSWwym57Ho (accessed 8 December 2019). On J.C. Mol see also Bert Hoogenkamp, *De Nederlandse documentairefilm 1920–1940*, Utrecht: Boom, 1988, pp. 97–108. Contemporary authors also used the term *Leeuwenhoekfilm*; see, for example, W.H. van Seters, 'Anthony van Leeuwenhoek (1632–1723), Lecture delivered as an introduction to the representation of the Leeuwenhoekfilm', in *Lectures on Physics and Physiology Delivered in the University of Leyden during the Second Netherlands Week for American Students July 5–10, 1926*, Leiden: Sijthoff, 1926, pp. 48–52.

[12] On microcinematography and early science films see Hannah Landecker, 'Cellular features: microcinematography and film theory', *Critical inquiry* (2005) 31, pp. 903–37; Landecker, 'Microcinematography and the history of science and film', *Isis* (2006) 97, pp. 121–32; Landecker, 'Creeping, drinking, dying: the cinematic portal and the microscopic world of the twentieth-century cell', *Science in Context* (2011) 24, pp. 381–416; Landecker, 'The life of movement: from microcinematography to live-cell imaging', *Journal of Visual Culture* (2012) 11, pp. 378–99; Charlotte Bigg, 'Evident atoms: visuality in Jean Perrin's Brownian motion research', *Studies in History and Philosophy of Science Part A* (2008) 39, pp. 312–22; Oliver Gaycken, '"The swarming of life": moving images, education, and views through the microscope', *Science in Context* (2011) 24, pp. 361–80; Béatrice De Pastre and Thierry Lefebvre, *Filmer la science, comprendre la vie: Le cinéma de Jean Comandon*, Paris: CNC, 2012; Scott Curtis, *The Shape of Spectatorship: Art, Science, and Early Cinema in Germany*, New York: Columbia University Press, 2015; Jesse Olszynko-Gryn, 'Filming fly eggs: time-lapse cinematography as an intermedial practice', *Isis* (2021) 112, pp. 307–14.

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transfer in science cinema.[13] So far, however, microcinematography has scarcely been studied in relation to the cultural memory of science and the reconstruction of scientific observation. Scientific cinema became part and parcel of commemoration practices from the 1920s onwards, but has never been studied as an important medium in that context.[14] As Jennifer Tucker has argued, visualization in science should be studied as the constitutive and rhetorical work of science itself.[15] Similarly, science films, such as Mol's *Antony van Leeuwenhoek*, were constitutive for the public understanding of the history of biology and bacteriology in the twentieth century. Landecker argues that the use of the microcinematographic apparatus worked as a 'technological portal to another world of time'.[16] However, *Antony van Leeuwenhoek* actually serves as a double portal: the first portal, supposedly to the seventeenth century, involves passing through the second portal of the new microscopic realm that was unlocked by microcinematography. In adopting and experimenting with new optical devices, Mol was actually following in the experimental footsteps of Antoni van Leeuwenhoek himself.

This analysis contributes to our understanding of the way in which scientific heritage is appreciated, how memory building takes place around important figures in the history of science, and the early cinematographic experiments in reconstructing and re-enacting historical scientific observations. As an example of a late microcinematographic film, Mol's *Antony van Leeuwenhoek* reveals how technological challenges, personal relationships and the unwritten skills of microscopy and cinematography emerged and became tangible through efforts to reconstruct and re-create the history of science in film. Compared to other early biographical films, such as Jean Epstein's film about Louis Pasteur, Mol approached his subject more experimentally, mirroring Van Leeuwenhoek's own inquisitive approach to lenses and the world that they unlocked. Finally, this paper shows that efforts to reconstruct and replicate episodes in the history of science pre-date the 1960s and 1970s.[17] Mol's *Antony van Leeuwenhoek* reveals an early attempt to replicate history as heritage in cinema within the context of the absolute film movement.

[13] On science and cinema see David A. Kirby, *Lab Coats in Hollywood: Science, Scientists, and Cinema*, Cambridge, MA and London: MIT Press, 2011; Rima Apple and Michael Apple, 'Screening science', *Isis* (1994) 84, pp. 750–4; Graeme Harper and Andrew Moor (eds.), *Signs of Life: Medicine and Cinema*, London: Wallflower Press, 2005; *Science and Cinema*, special issue of *Science in Context* (2011) 24; *Moving Images: Film in Science and Medicine – Science and Medicine in Film*, special issue of *Gesnerus* (2009) 66; Timothy Boon, *Films of Fact: A History of Science in Documentary Films and Television*, London and New York: Wallflower Press, 2008; Oliver Gaycken, *Devices of Curiosity: Early Cinema and Popular Science*, New York: Oxford University Press, 2015; Jean-Baptiste Gouyon, 'Science and film-making', *Public Understanding of Science* (2015) 25, pp. 17–30; Jesse Olszynko-Gryn, 'Film lessons: early cinema for historians of science', *BJHS* (2016) 49, pp. 279–86. See also the Focus section on research film in *Isis* (2021) 2.

[14] On the history of commemorations in science see Pnina G. Abir-Am and Clark A. Elliott (eds.), *Commemorative Practices in Science*, special issue of *Osiris* (1999) 14; Ludmilla Jordanova, 'Presidential address: remembrance of science past', *BJHS* (2000) 33, pp. 387–406; Geoffrey C. Bowker, *Memory Practices in the Sciences*, Cambridge, MA: MIT Press, 2005. On cultural memory see Astrid Erll and Ann Rigney, *Mediation, Remediation, and the Dynamics of Cultural Memory*, Berlin, Boston, MA and New York: Walter de Gruyter, 2009.

[15] Jennifer Tucker, 'The historian, the picture, and the archive', *Isis* (2006) 97, pp. 111–20; Luc Pauwels (ed.), *Visual Cultures of Science: Rethinking Representational Practices in Knowledge Building and Science Communication*, Hanover, NH: Dartmouth College Press, 2006.

[16] Landecker, 'Creeping, drinking, dying', op. cit. (12), p. 383.

[17] The field of experimental history of science (EHS) developed in the early 1990s; see H. Otto Sibum, 'Science and the knowing body: making sense of embodied knowledge in scientific experiment', in Sven Dupré, Anna Harris, Julia Kursell, Patricia Lulof and Maartje Stols-Witlox, *Reconstruction, Replication and Re-enactment in the Humanities and Social Sciences*, Amsterdam: Amsterdam University Press, 2020, pp. 275–93; on the history of replication and re-enactment in archaeology see Jodi Reeves Flores and Roeland Paardekooper, *Experiments Past: Histories of Experimental Archaeology*, Leiden: Sidestone Press, 2014.

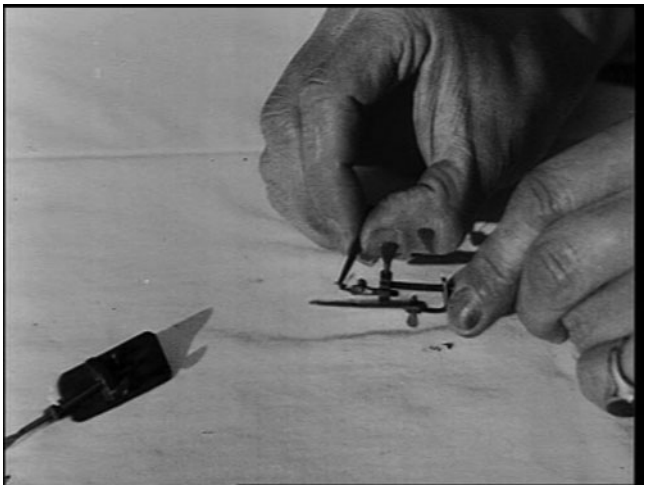

Figure 1. Leeuwenhoek microscope. Still, *Antony van Leeuwenhoek* (1925), Eye Film Collection.

The film

Antony van Leeuwenhoek (1924) is a silent film in five parts. The first part opens with an intertitle dedicating the film to Antoni van Leeuwenhoek, 'the father of bacteriology and protozoology'. Footage of Delft, the birthplace of Van Leeuwenhoek, follows. We are shown the house and the street where he lived, followed by a shot of a portrait of him by Johannes Verkolje, painted around 1680. We then see a pair of hands demonstrating the functioning of an original simple Leeuwenhoek microscope, and later also handling an instrument that may have been Van Leeuwenhoek's original aquatic microscope (Figure 1). The hands are those of biologist Wouter Hendrik van Seters (1891–1976), who had an interest in antique microscopes and worked with Mol on the film.[18] In 1924, the aquatic microscope had just been rediscovered in a repository of the Leiden Physical Laboratory.[19] The next scene shows images of a cross-section of beechwood made using original Van Leeuwenhoek microscope lenses, according to the intertitles shown on the screen. The original drawing of beechwood that was published alongside Leeuwenhoek's letter on the subject is shown next.[20] Some of Van Leeuwenhoek's handwritten letters and collected volumes of letters are also shown. Again, we see hands and arms handling books and unfolding drawings. Part One comes to an end with historical engravings of salts, interspersed with quotes by Van Leeuwenhoek and microcinematographic sequences of the growth of crystals of alum, saltpetre and salmiak (Figure 2). The transition from still engraving to moving footage of alum crystals creates a seamless connection in abstract shapes.

Part Two starts with Van Leeuwenhoek's descriptions of protozoa and bacteria, taken from his original writings and published letters. After footage of some of those letters, the intertitles explain how the following recordings of pepper water were made using the original Van Leeuwenhoek lens (for microcinematography). Illustrations of swarming protozoa are followed by microcinematographic images of these 'little animals' made using a modern microscope. Further recordings of bacteria and the unicellular organisms

[18] On Van Seters see Peter de Clercq, 'Notes on Dutch collectors of antique microscopes', *Journal for the History of Collections* (1995) 7, pp. 251–60.

[19] De Clercq, op. cit. (18), p. 253.

[20] Van Leeuwenhoek did not make the engravings himself, but collaborated with different artists. See Sietske Fransen, 'Antoni van Leeuwenhoek, his images and draughtsmen', *Perspectives on Science* (2019) 27(3), pp. 485–544.

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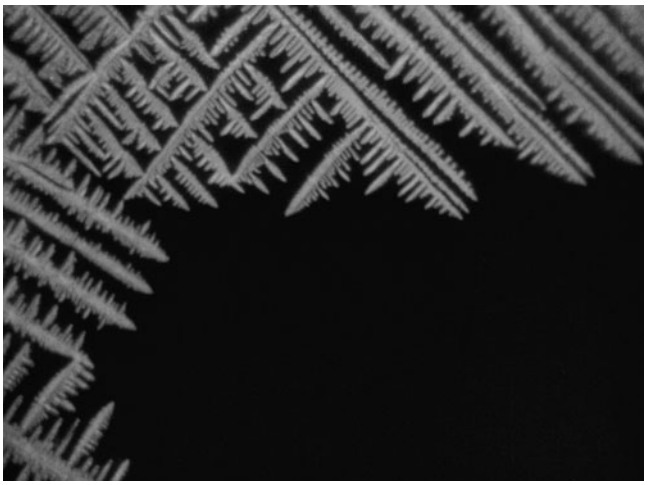

Figure 2. Sal ammoniac (salmiak) crystal. Still, *Antony van Leeuwenhoek*, Eye Film Collection.

Paramecium and Vorticellidae are shown. Parts Three and Four of the film feature similar recordings of *Stylonichia*, *Daphnia*, *Vorticella*, *Hydra*, green algae, vinegar eels and *Euglena*. Lastly, Part Five includes frog and bull sperm cells. Following more footage of the use of Van Leeuwenhoek's aquatic microscope, there are microcinematographic sequences of the circulation of blood with individual blood cells moving through the capillaries. The film's final shots show a medal with Van Leeuwenhoek's portrait and his tombstone in Delft. The closing caption is a quote from Van Leeuwenhoek in an *Album Amicorum*: 'Through labour and diligence one arrives at things which one would have previously considered unfathomable'.[21]

Repeated sequences of engravings, quotes and microcinematography re-create the experiments and microscope observations carried out by Van Leeuwenhoek himself. First, we see an original engraving published in the Van Leeuwenhoek letters, followed by quotes from Van Leeuwenhoek about his observations, some accompanied by engravings that transition into microcinematographic recordings of that particular microorganism or phenomenon. Following a quote about *Stylonychia* swimming with many legs, for instance, we are shown moving images of this single-celled organism, in which we immediately recognize these moving legs and our focus is drawn towards them. In the case of the microcinematographic recordings of *Volvox*, the engravings and quotes mention the bulging part of the round form of this alga when it is viewed through a microscope; this is followed by microcinematographic footage of moving *Volvox* that illustrates precisely that observation (Figure 3). The quotes from Van Leeuwenhoek focus on movements, and the microcinematographic sequences function as a visual demonstration of those movements, such as in the case of the movement of blood cells, which Van Leeuwenhoek describes as 'not an even movement, but being propelled forwards very suddenly'.[22] The microcinematography serves to convince the viewers and to confirm the accuracy of Van Leeuwenhoek's observations. These returning sequences in the film thus function as visual demonstrations of successful experiments.

The film is structured according to biology, not chronology. The five parts are analogous to the evolutionary steps from simple life forms to more complex animal life.

[21] 'Door Arbeyt en Naarstigheyt komt men tot Saaken, die men te vooren onnaspeurlijck agten'.

[22] Original intertitle in film: 'Dese omloopinge en hadde geen egale beweginge, maar die wierd met seer schielijke voortstotinge teweeg gebracht'. Part Four.

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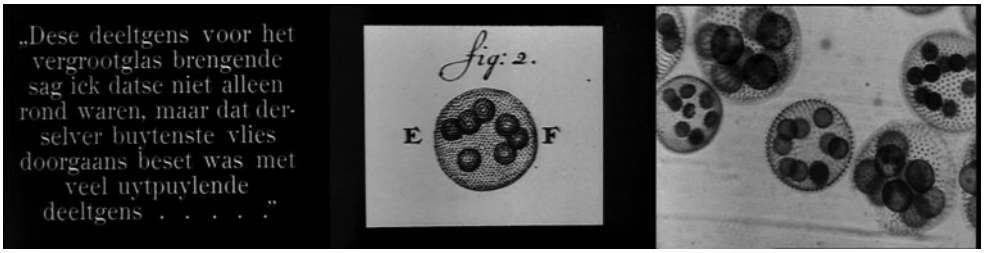

Figure 3. Collage of three stills from *Antony van Leeuwenhoek*, Eye Film Collection.

We progress through the various kingdoms of life, from bacteria, to single-cell life in the form of protozoa, to small multicellular animals like *Rotifer*, to complex multicellular life such as mosquitoes, sperm cells and the circulation of blood in fish and mammals. This is consistent with what Landecker has noted with regard to contemporary biologists and others: that early microcinematographic films 'were experiments in seeing and perceiving life, not just living things, but that which was understood and narrated as the fundament of life'.[23] However, *Antony van Leeuwenhoek* was not made for the purposes of academic research.[24] Nor was it intended for an audience made up only of experts. The film was a tribute to life – as first witnessed and discovered many centuries ago.

Indeed, according to its makers, the film served a dual purpose. The director, Jan Cornelis Mol, and his adviser, Wouter van Seters, aimed, first, to draw attention to the life and work of Antoni van Leeuwenhoek, 'the great Dutchman' and 'pioneer of microscopy'.[25] Second, and more importantly for Mol and Van Seters, they wanted to inspire an interest in the 'miraculous and curious' world under the microscope as Van Leeuwenhoek set eyes on it. The target audience were laypeople, particularly those active in education. The makers reiterated that the film had been composed in such a way as to enable the layperson to enjoy every aspect of the microscopic realm in full. Mol promoted the film as a historical microcinematographic work, and a national film par excellence.[26] The cover of the 1925 brochure features Verkolje's oil painting of Van Leeuwenhoek prominently. The images inside the brochure show Van Leeuwenhoek's original microscope, along with references to its components and workings. The last page shows thirteen stills from the microcinematographic recordings made for the film (Figure 4). One picture shows wood photographed through an original Van Leeuwenhoek microscope lens. The images in the brochure, which include both historical material and microcinematographic material, reflect the dual relevance and function of the film as both historical and biological.

The makers themselves were also well aware of the importance of the effects of time and movement in their film. The focus on the rhythmic movements of the enlarged protozoa stands out, in particular. Van Seters wrote about the impressive 'restless wave

[23] Landecker, 'Cellular features', op. cit. (12), p. 906.

[24] After its initial release before the winter of 1924, Mol continued to improve the film. In September 1925 in an illustrated brochure about the film, Mol and Van Seters explained how they added and replaced certain recordings during the summer. See Mol and Van Seters, op. cit. (3). They considered the October 1925 version 'finished'. I have had access to the 1924 version of the film via the Eye Film Institute collection. However, the film underwent an evolution itself as well, since certain sections were later reused and shown as separate films. I will come back to this in the final part of this paper.

[25] Mol and Van Seters, op. cit. (3).

[26] Circular on the Leeuwenhoekfilm by J.C. Mol (October 1925), Eye Film Museum Library archive, no. 1049-1.

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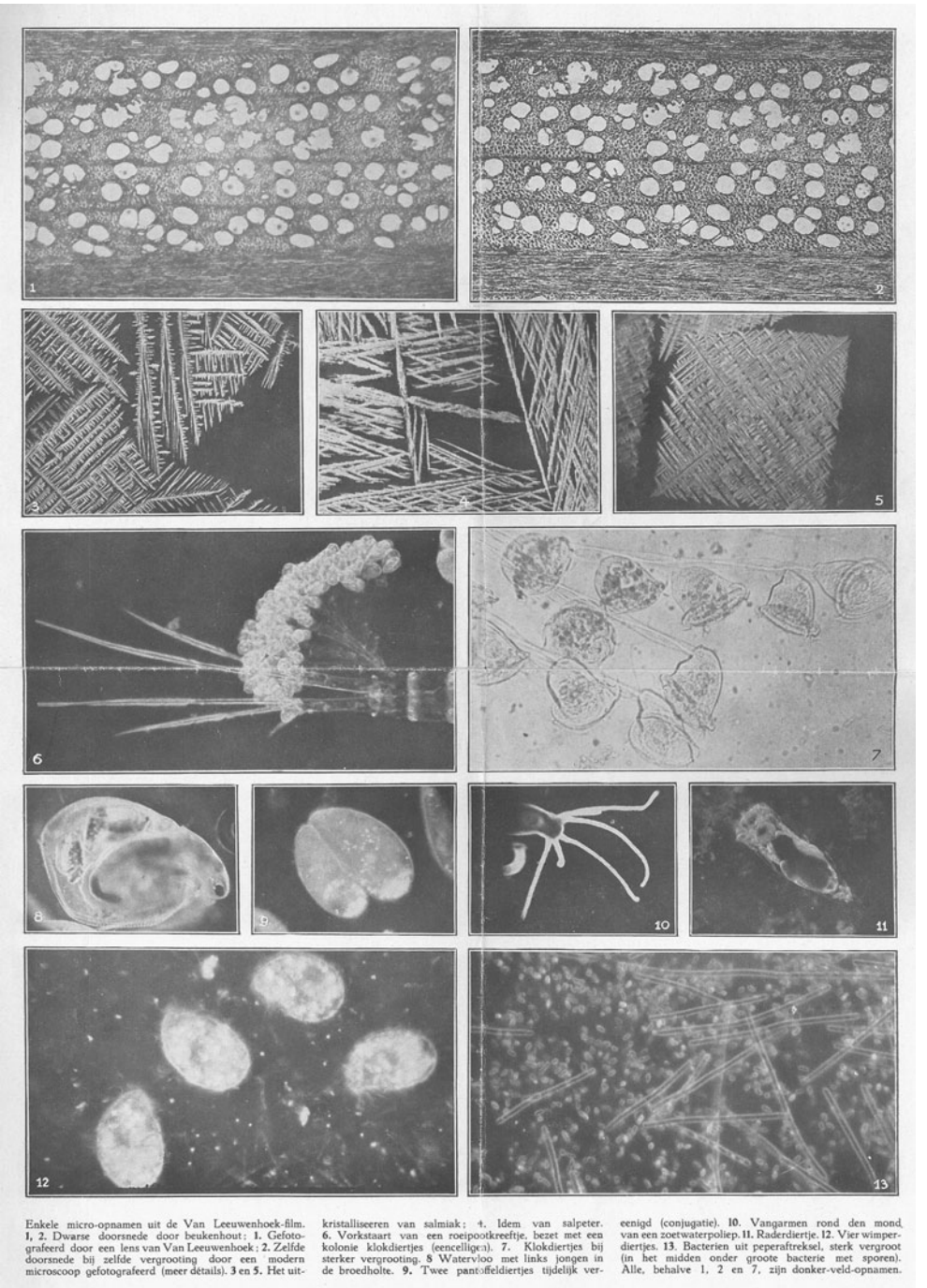

Figure 4. Brochure, *Antony van Leeuwenhoek*, Rijksmuseum Boerhaave.

movements' of protozoa and the mesmerizing 'eternal rotation' of the transparent *Volvox* balls.[27] As Malin Wahlberg has demonstrated convincingly, Mol was fascinated by new

[27] W. H. van Seters, 'De Antony van Leeuwenhoek-Film (1924–1932)', *Natura* (1932) 10, pp. 223–6, 226.

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visual technologies and processes that are invisible to the human eye.[28] In other films, such as *Ontluikende bloemen* (Unfurling Flowers) (1928), Mol experimented with time-lapse footage of flowers growing from bulbs and then dying, using the *Zeitraffer* process. Like several of Mol's later films, Wahlberg argues, *Antony van Leeuwenhoek* illuminates 'the fascination with space–time abstraction and visualized rhythm that unifies the practice of science film and avant-garde cinema of that era'.[29] Mol's 1928 documentary *De tijd in de film* (Time in Film) is a conceptual film which explores cinematic time, including explanations and demonstrations of slowing down, speeding up or even reversing the movement of cyclists in Amsterdam.[30] Mol himself mentioned how entertaining this film was for him, and what a welcome break it was after the 'heavy stuff of my crystal and microcinematographic films'.[31]

But why was making *Antony van Leeuwenhoek* so challenging for Mol, given that microcinematography and science film in other countries was an established genre at that time? In the next section, I will take Wahlberg's argument about Mol's experiments with 'cinematography as a tool for scientific enquiry' one step further. I will describe how, in *Antony van Leeuwenhoek*, Mol used cinema experimentally – not only for the purposes of scientific enquiry, but also as an opportunity to play with the use of equipment and techniques, and with the reconstruction of Van Leeuwenhoek's experimental observations. The medium of film enabled Mol to re-create the seventeenth-century microworld using contemporary techniques. But just like Van Leeuwenhoek himself, Mol had to find his own way through microcinematography and other techniques in order to arrive at 'things which one would have previously considered unfathomable', a quest mirroring the quote by Van Leeuwenhoek in the final scene of *Antony van Leeuwenhoek*.[32]

Complex experiments with life, time and technology

Filming life under a microscope involved complex set-ups. Bacteria and other microorganisms needed to be kept alive, and blood, semen and salts had to be handled. However, by the time audiences in the cinema were enjoying the recordings of sperm cells swimming and giant *Daphnia* plankton on the screen, all that messiness had disappeared. Mol completed a long journey of trial and error before he was able to finish *Antony van Leeuwenhoek*. Like Van Leeuwenhoek himself, Mol and Van Seters had to try out new materials and techniques and discover for themselves the challenges involved in re-creating and filming Van Leeuwenhoek's experiments. These material, technical and bodily dimensions were crucial in Mol's approach to cinema. More importantly, what was possible or impossible in optical, technical, bodily and material terms was instrumental in the re-creation of historical observations in the film.

From a young age, Mol had been an enthusiastic amateur photographer with an interest in optical techniques.[33] In 1921, he became the editor of the Dutch photography magazine *Focus*, where he was fascinated by photographic techniques. His first article on film was published in that magazine in 1923, in which he discussed the Ernemann apparatus

[28] Malin Wahlberg, 'Wonders of cinematic abstraction: J.C. Mol and the aesthetic experience of science film', *Screen* (2006) 47, pp. 273–89, 274.

[29] Wahlberg, op. cit. (28), p. 274, referring to visual rhythm in Mol's early films, such as *Malariafilm* and *Antony van Leeuwenhoek*.

[30] Wahlberg, op. cit. (28), p. 284.

[31] L.J. Jordaan, 'Bioscopy: J.C. Mol', *De Groene Amsterdammer* (1930) 2754, p. 13.

[32] See quote in footnote 21.

[33] Bert Hogenkamp, 'MOL, Jan Cornelis (1891–1954)', in *Biografisch Woordenboek van Nederland* 5, The Hague, 2002, at http://resources.huygens.knaw.nl/bwn1880-2000/lemmata/bwn5/mol (accessed 28 December 2022).

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for *tijdloupe*, or *Zeitlupe*.[34] Like physicist Hans Lehmann in 1917, Mol noted that the apparatus used to capture slow-motion and time-lapse footage was actually capable of extending humankind's power to see the world, just as the microscope had 'unlocked the world of the infinitely small'.[35] Soon enough, Mol would be trying this technique himself, after founding the Bureau for Scientific Cinematography (Bureau voor Wetenschappelijke Kinematografie) in 1924.

The making of *Antony van Leeuwenhoek* shows the importance of materials, skills and technique. For Mol there were numerous challenges to overcome. He would often describe how it had taken him a whole year to make the film, recounting all the difficulties that he had faced. According to Mol, his fascination for film was triggered in 1921 by a microcinematographic demonstration by Professor Heinrich Friedrich Wilhelm Siedentopf, chief of optics at Zeiss in Jena in Germany, who had developed the ultramicroscope with Richard Zsigmondy.[36] During a demonstration in a cinema in the Dutch city of Delft, Siedentopf screened recordings that he had made through microscope lenses, showing the movements of single cells, polyps and microorganisms.[37] It was possible to see the functioning and development of various biological processes in detail and to replay these in slow motion, or even backwards.[38] Siedentopf himself also referenced Van Leeuwenhoek's discoveries in microscopy, arguing that Van Leeuwenhoek had laid the scientific groundwork for the development of microscopes capable of magnifying by up to four thousand times and for making cinematographic recordings. Such footage enabled a glimpse into the secret world of microscopic life on the move. As one newspaper review stated, 'Dead substances became alive'.[39] After the demonstration, Mol asked Siedentopf about the techniques used in the film, but Siedentopf did not want to share his secrets.[40] Mol then turned to Jean Comandon, a French biomedical researcher and pioneer of popular and scientific microcinematography, but again Mol failed to glean any useful information.[41] During a visit to the Netherlands in 1922, Comandon demonstrated his recordings in several major Dutch cities, but Mol was unable to get any information out of him about his techniques.[42] He therefore decided to investigate for himself, relying 'entirely on my own experiments'.[43]

But given that microcinematography and science films in France and Germany were being produced on a large commercial scale from the 1910s, why was it so hard for

[34] J.C. Mol, 'Een filmpraatje', *Focus* (1923) 10, pp. 115–18. The Dutch word *loupe* also refers to the historical meaning of magnifying glasses and early microscopes of the seventeenth century. See also Hans Lehmann, 'Slow motion (1917)', in Anton Kaes, Nicholas Baer and Michael Cowan (eds.), *The Promise of Cinema: German Film Theory 1907–1933*, Oakland: University of California Press, 2016, pp. 89–92.

[35] Mol, op. cit. (34), p. 115: 'het microscoop heeft de wereld van het oneindig kleine voor ons ontsloten'.

[36] David Cahan, 'The Zeiss Werke and the ultramicroscope: the creation of a scientific instrument in context', in Jed Z. Buchwald (ed.), *Scientific Credibility and Technical Standards in 19th and Early 20th Century Germany and Britain*, Dordrecht: Kluwer Academic Publishers, 1996, pp. 67–116.

[37] 'Filmmikroskopie', *Het Vaderland*, 11 October 1921, p. 2. See also 'Microscopische film van Prof. Dr. H. Siedentopf', *Het Vaderland*, 19 April 1922, p. 3.

[38] See also Henry Siedentopf, *Kleiner dan klein: Populaire inleiding tot de voordracht met Microscoop-films van Dr. Henry Siedentopf, hoogleeraar aan de Universiteit van Jena, leider van de afd. microscopie van de Zeissfabrieken te Jena*, Breda: Ned. Natuurhistorische Vereeniging, 1922, p. 5.

[39] 'De film in dienst der wetenschap', *De courant*, 12 October 1921, p. 6: 'Doode substanties werden levend'.

[40] Bert Hogenkamp and Paul Kusters, *JC Mol: Een filmografisch en bibliografisch overzicht van zijn Nederlandse werk*, Hilversum: Nederlands Audiovisueel Archief, 2000, p. vi.

[41] See Multifilm archive, company prospectus, Eye Film Museum Library archive, no. 1049-1. On Comandon see Gaycken, op. cit. (13), Chapter 3; De Pastre and Lefebvre, op. cit. (12).

[42] Leiden, Groningen, Rotterdam, The Hague, Amsterdam, Utrecht and Delft. See 'Nieuwe demonstraties van dr. Comandon van microscopische en sub-microscopische gebeurtenissen', *Nieuwe Rotterdamsche Courant*, 22 February 1922, p. 3.

[43] Company prospectus, op. cit. (41).

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Mol to do this in 1924? Three factors are important here. First, Mol was an amateur when it came to microcinematography. Media historian Bert Hogenkamp has referred to Mol as a 'mentor of scientific, amateur and avant-garde film in the Netherlands'.[44] Hogenkamp argues that science cinema had barely got off the ground at all in the Netherlands when Mol set up his company in 1924, so he had to be a pioneer out of necessity. Mol published in photography magazines aimed at amateurs because he assumed that amateur film would 'elevate' the film industry and theatre film in particular.[45] Furthermore, Mol claimed that 'very little literature' existed on microcinematography. It could be argued that he would have had access to some relevant literature despite the fact that he was working outside the university context, but it is doubtful whether he would have been able to access, understand and gather all the necessary information without a network that extended abroad.[46]

However – and this is the second important factor – even though Mol may have read Comandon's description of his microcinematographic installation, that would not necessarily have enabled him to replicate Comandon's set-up. Quite apart from the difficulty of creating the right conditions using the right apparatus, he would have required very particular skills and knowledge in order to operate that apparatus. For example, in 1909 Comandon had referred to his equipment in this way: 'The cinematographic equipment used was that of Pathé, which we modified for this purpose'.[47] This adapted film equipment from Pathé, along with the manpower provided by Pathé, would not have been accessible to Mol. Most likely, Pathé and Comandon would have been unwilling to share the precise technical details for commercial reasons.[48] Indeed, Pathé had already been granted a patent on the installation in 1911.[49] This included technical improvements to prevent the overheating of the specimen and to stabilize the recording. Such focus on intellectual property may have forced Mol to develop his own (local) technological solution for microcinematography. Similar commercial considerations may have prevented Siedentopf, who was working for Zeiss, from sharing details about his installation with Mol.[50]

A third important factor was Mol's lack of technical skills and knowledge. According to the Dutch–French Alliance in 1925, Siedentopf had visited Comandon in 1911 'to get acquainted with the installation, and to learn how to make recordings'.[51] A Dutch

[44] Bert Hogenkamp, 'De witte jas of "oneindige variaties op hetzelfde thema"', *GBG Nieuws* (1995) 32, pp. 5–12.

[45] J.C. Mol, 'Filmknipsels: Een serie artikelen voor den kino-amateur door J.C. Mol, I Algemeene beschouwingen', *De Camera* (1925) 17(8), pp. 108–9.

[46] Comandon published on his microcinematographic installation in 1909. See M.J. Comandon, 'Cinèmatographie, à l'ultra-microscope de microbes vivants et des particules mobiles', *Comptes rendus hebdomadaires des séances de l'Académie des sciences*, 26 October 1909, pp. 938–41; and 'Dr. Jean Comandon hier ten stede', *Nieuwe Rotterdamsche Courant*, 3 March 1922, p. 1.

[47] Comandon, op. cit. (46), p. 939: 'L'appareil cinématographique est celui de la maison Pathé que nous avons modifié pour ce but'.

[48] Pathé did not mention the installation used by Comandon in their catalogue. See De Pastre and Lefebvre, op. cit. (12), p. 52.

[49] Brevet d'invention no. 419.305, Compagnie générale de phongraphes, cinématographes et appareils de precision, 'Perfectionnements aux dispositifs de prises de vues microcinématographiques', applied on 22 October 1909, published on 4 January 1911.

[50] Geopolitical developments during the First World War may also have played a role here. Siedentopf himself was active on the eastern front, and Zeiss was providing optical and other instruments for military use. See Stuart M. Feffer, 'Microscopes to munitions: Ernst Abbe, Carl Zeiss, and the transformation of technical optics, 1850–1914', dissertation, ProQuest Dissertations Publishing, 1994; and 'Dr. H. Siedentopf im Unterstand an der russische Front mit Zeiss Zielfernrohr' (1916), Historische Fotografien, Zeiss Archive, BI 16559.

[51] 'Dr. Jean Comandon', *Vaderland*, 12 April 1925, p. 1: 'kennis te mogen komen maken met de op-stelling, en het opnemen te mogen leeren'. See also Charlotte Bigg, 'A visual history of Jean Perrin's Brownian motion curves', in Lorraine Daston and Elizabeth Lunbeck (eds.), *Histories of Scientific Observation*, Chicago: The University of Chicago Press, 2011, pp. 156–79, n. 46.

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Figure 5. J.C. Mol in his laboratory. Collection Eye Filmmuseum.

newspaper reported that Siedentopf had even brought Comandon's instruments back with him to Jena to start producing his own microcinematography.[52] This exchange between Paris and Jena was crucial in the transfer of knowledge regarding microcinematography. Mol, however, clearly lacked this experience, materials and know-how.

Mol, who loved to experiment, eventually managed to build a working installation for his first films, but this came at a financial price. In his company prospectus, he recorded the costs of his microcinematographic installation, and in later annual accounts he also charged a large amount for this equipment.[53] It took time and trial and error to perfect his set-up and for Mol to learn how to handle his subjects (Figure 5). Mol described the problems that he encountered when filming through a microscope lens, such as how the organisms would move away from the bright light, or would stop moving, or would even be killed immediately by the light.[54] A further difficulty posed by filming such highly magnified images was the fast, rhythmic movements of the organisms, up to a rate of sixteen per second, which made recording almost impossible.[55] Technically, Comandon had already overcome this problem by using a special disc that rotated in synchrony with the cinematograph, and by cooling the light bundle in a glass bell filled with cold water.[56] But Mol came up with his own tricks. To film a particularly fast-moving organism he added gelatine to the water to thicken the liquid. Physically slowing down the animal thus enabled him to record their movements on film.

[52] 'De Leeuwenhoek-film', *Vaderland*, 14 April 1925, p. 5.
[53] Company prospectus, op. cit. (41).
[54] Hogenkamp and Kusters, op. cit. (40), p. vi.
[55] Hogenkamp and Kusters, op. cit. (40), p. vi.
[56] See De Pastre and Lefebvre, op. cit. (12), p. 53.

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Composition, abstraction and editing were central to Mol's experimentation. His sequences of crystals growing would later be recognized as an example of *cinéma pur*. The sequences were shown as a tryptic (*Uit het rijk der Kristallen*, 1928) in Studio 28 in Paris, and were celebrated in the Netherlands as an example of absolute filming. Dutch modernist writer and critic Menno ter Braak mentioned Mol's work in his monograph *De absolute film* (1931) and provided images of microcinematographic stills of crystals.[57] Mol's work exemplified an understanding of film as an autonomous art form, a non-commercial expression similar to poetry or music. Mol also became a celebrated member of the Dutch Filmliga, an association of avant-garde filmmakers who rejected American kitsch and commercial cinema.[58] The Haarlem-based department of Filmliga scheduled *Antony van Leeuwenhoek* for their fourth meeting in 1928.[59] Filmliga members praised Mol's films for their 'earnest taste for exploration', detached from any sensationalist drive: 'As the microscope extracts nature out of its daily coherence, by making it live as a field of discovery in the mind; so time is shown in the film as subservient to man'.[60] As a filmmaker Mol would be able to orchestrate the natural elements, not as a mere reporter 'reproducing' nature in his films, but as a composer who cinematographically mediates nature through microcinematography.[61]

More specifically, Mol's microcinematography and filmmaking were an experiment in abstracting techniques. As Wahlberg argued, Mol's science films can be understood as 'cinematic abstractions' of natural processes that 'stress the moving image as a plastic form'.[62] Mol was inspired by filmmaker Jean Painlevé's surrealist films of marine life.[63] Yet, contrary to Painlevé, Mol did not included any anthropomorphic comments as intertitles, which, according to Bert Hogenkamp, contributed to the level of abstraction in Mol's cinematographic films.[64] Similarly, contemporary Dutch critics argued that the microcinematographic sequences provided audiences with a completely unknown experience by showing the existence of microlife in gigantic proportions. Re-creating the experiences of Van Leeuwenhoek's first observations of microscopic life, Mol's editing moved between immersion in the details that are revealed by the microscope and the handling of the historical instruments used to reveal those details.[65] Abstraction worked to unite the observer with the alien realm of the microscopic world as first witnessed by Van Leeuwenhoek – a realm that Mol re-created, composed and celebrated.

Through the lens of Van Leeuwenhoek: celebration and re-creation

Even before the emergence of cinema or large historical science exhibitions, both visual and material culture were central to the commemoration of Van Leeuwenhoek. As science historian Klaas van Berkel has shown, the Dutch cultural nationalism of the nineteenth

[57] Menno ter Braak, *De absolute film*, Rotterdam: W.L. en J. Brusse's Uitgeversmaatschappij N.V., 1931, pp. 45–6.

[58] Joris Ivens, Henrik Scholte, Menno ter Braak, Charley Toorop, L.J. Jordaan, Cees Laseur, Hans van Meerten and Ed Pelster, 'Filmliga manifesto (The Netherlands, 1927)', in Scott MacKenzie (ed.), *Film Manifestos and Global Cinema Cultures*, Berkeley: University of California Press, 2014, pp. 525–6.

[59] 'Nederlandsche Filmliga: Officiele meededelingen', *Filmliga* (1928) 6, p. 14.

[60] 'Tiende Voorstelling Programma', *Filmliga* (1928) 9, pp. 221–2, 221: 'Zoo licht de microscoop de natuur uit haar dagelijkschen samenhang, door haar als het ontdekkingsgebied van den geest te laten leven; zoo wordt de tijd in de film als den mensch onderdanig gedemonstreerd'.

[61] See Menno ter Braak's discussion on Mol's work in Menno ter Braak, 'Onze Tiende Matinee', *Filmliga* (1928) 11, pp. 2–3.

[62] Wahlberg, op. cit. (28), p. 283.

[63] Wahlberg, op. cit. (28), p. 284.

[64] Hogenkamp, op. cit. (44), p. 8.

[65] On Van Leeuwenhoek as master of detail see Tiemen Cocquyt, 'Positioning Van Leeuwenhoek's microscopes in 17th-century microscopic practice', *FEMS Microbiology Letters* (2022) 369(1), pp. 1–7.

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century included the re-evaluation, worship and celebration of natural scientists.[66] In 1875, a group of Dutch scientists organized the bicentennial celebration of Antoni van Leeuwenhoek's discoveries. Van Leeuwenhoek represented the 'pure disinterested science', inspiring a positive outlook on the future.[67] Dubbed the 'father of micrography' in 1868, the work of Van Leeuwenhoek attracted ever more attention during the 1870s.[68] P.J. Haaxman, a Dutch apothecary and Van Leeuwenhoek devotee, published a full-length biography in 1871.[69] Subsequently, in 1872, a German professor in Breslau called for a celebration of the discovery of infusoria, referencing a previous commemoration of Leibniz, and the Dutch Veterinary Association (Nederlandsche Dierkundige Vereeniging) organized a celebration of the discovery of infusoria in 1874.[70] Many other Dutch biological and medical societies, including two in the Dutch East Indies, became involved in the preparations for the commemoration day on 8 September 1875. One of the activities involved the striking of an Antoni van Leeuwenhoek Medal.[71] This medal displayed a portrait of Van Leeuwenhoek on the obverse, and a laurel wreath with Van Leeuwenhoek's microscope and space for the name of the winner to be engraved on the reverse.[72]

Images and objects played an important role in these commemorations, and were used to mark events and involve audiences in witnessing the past in the most direct possible way.[73] Portraits of Van Leeuwenhoek were everywhere, it seemed.[74] The exhibition that accompanied the 1875 commemoration included twenty-two portraits and busts. The most prominent was the 1687 oil painting by the Delft painter Johannes Verkolje.[75] Van Leeuwenhoek is shown seated next to a desk, on which there is a globe and the scientist's certificate of membership of the Royal Society, among other things. Verkolje's image was copied many times in the eighteenth, nineteenth and early twentieth centuries – on porcelain and medals, in sketches and in cinema. This proliferation of images heralded Van Leeuwenhoek's emergence as an icon of science. By 1900, Dutch natural scientists were taking pride in national scientific heroes – such as Van Leeuwenhoek – and their legacies.[76]

In the Netherlands, interest in the history of science gained momentum from the 1910s onwards. The Belgian–Dutch Society for the History of Science and Universities was

[66] Klaas van Berkel, *Citaten uit het boek der natuur*, Amsterdam: Bakker, 1998.

[67] Pieter Harting, *Gedenkboek van het den 8sten september 1875 gevierde 200-jarig herinneringsfeest der ontdekking van de mikroskopische wezens door Antony van Leeuwenhoek*, 's Gravenhage and Rotterdam: Nijhoff, Van Hengel & Eeltjes, 1876, p. 9: 'zuivere onbaatzuchtige wetenschap'.

[68] Emile Blanchard, 'Les premiers observateurs au microscope: Les travaux de Leeuwenhoek', *Revue des deux mondes* (1868) 38, pp. 379–416, 398.

[69] P.J. Haaxman, 'Het leven van een groot natuuronderzoeker: Antony van Leeuwenhoek', *Nederlands Tijdschrift voor Geneeskunde* (1871) 15, pp. 1–86.

[70] Ferdinand Cohn, *Untersuchungen ueber Bacteriën*, Kern: Breslau, 1872. Reference in Harting, op. cit. (67), p. 14.

[71] Harting, op. cit. (67), 24; Van Berkel, op. cit. (66), p. 227. The medal was established by the Royal Netherlands Academy of Arts and Sciences (KNAW); see also Koninklijke Nederlandse Akademie van Wetenschappen, 'Laureaten Van Leeuwenhoekmedaille', www.knaw.nl/nl/prijzen/laureaten/leeuwenhoekmedaille (accessed 1 December 2020).

[72] Unengraved copy of the Leeuwenhoek medal, (1875) Rijksmuseum Boerhaave, Leiden, inv nr. V23447.

[73] For example, a plaque of Van Leeuwenhoek by sculptor Jan Christoffel Schultsz was placed in 1909 at Oude Delft in Delft. See also Annelies Haase and Leonie ten Duis, *Oude en nieuwe beelden in Delft*, The Hague: Dekade, 1996.

[74] Van Leeuwenhoek's iconography deserves more research, but the extensive presence of portraits and depictions of Van Leeuwenhoek contrasts starkly with the complete lack of portraits of the seventeenth-century microscopist Jan Swammerdam, for example. Compare also Patricia Fara, 'Images of Newton', *Endeavour* (2000) 24(2), pp. 51–2; Fara, *Newton: The Making of Genius*, London, Basingstoke and Oxford: Macmillan, 2002.

[75] Painting on permanent display at Rijksmuseum Boerhaave, Leiden, inv no. P07252 (on loan from Rijksmuseum Amsterdam). On the history of the painting see P.J. Haaxman, 'Het leven van een groot natuuronderzoeker, Antony van Leeuwenhoek, geschetst uit zijne brieven en andere bescheiden', *Nederlands Tijdschrift voor Geneeskunde* (1871) 15, pp. 1–86.

[76] Van Berkel, op. cit. (66), p. 239.

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founded in 1913.[77] The awareness of material scientific heritage also increased. This culminated in 1928 in the foundation of the Stichting het Nederlands Historisch Wetenschappelijk Museum – a national museum devoted to the history of science located in Leiden (the current Rijksmuseum Boerhaave). The museum opened to the public in 1931, and one of its goals was to pay 'homage … to the memory of the important men who upheld Dutch scientific honour in previous centuries'.[78] Visitors to the museum could enjoy microscopes, instruments and portraits of scientists. From the outset, its collection included microscopes and specimens prepared by famous Dutch scholars and physicians, including two original Van Leeuwenhoek microscopes.[79]

The use of historical microscopes in Mol's *Antony van Leeuwenhoek* can be seen as an early attempt at reconstruction. The phenomena of reproduction and reconstruction were not new in the history of microscopy.[80] Microscope collectors were keen on owning both originals and replicas.[81] Wouter van Seters owned three replica Van Leeuwenhoek microscopes himself, and many replicas had been around since the 1870s.[82] Producing replicas can be considered an early instance of 'RRR' methods (reconstruction, re-enactment, replication, reproduction and re-working).[83] Similarly, Mol's microcinematography offered new possibilities for extending reproduction and replication techniques by using the original Van Leeuwenhoek lenses. Mol and Van Seters were keen to stress that they had used the original lenses in their film, placing the footage recorded through those lenses side by side with footage made using a modern microscope. The film itself also includes references to this comparison in a scene in which a Van Leeuwenhoek microscope and a Zeiss microscope are shown side by side, referred to as 'David and Goliath' in a review (Figure 6).[84]

Contemporary reviews of *Antony van Leeuwenhoek* also frequently emphasized the importance of the use of the original lenses in allowing people to witness anew the observations originally made by Van Leeuwenhoek. The Dutch biologist and popular-science author Jac P. Thijsse compared the movements described by Van Leeuwenhoek and those shown in the film.[85] With regard to the 'exciting' microscopical blood circulation sequence, he noted, 'These clever authors show us this once again, photographed through one of Van Leeuwenhoek's own lenses, so that we can appreciate even better that Van Leeuwenhoek was delighted by that spectacle'.[86] In another review, Thijsse wrote, 'In

[77] Bento Schulte, *Vijftig jaren beoefening van de geschiedenis der geneeskunde, wiskunde en natuurwetenschappen in Nederland 1913–1963*, Leiden: Genootschap voor Geschiedenis der Geneeskunde, Wiskunde en Natuurwetenschappen, 1963.

[78] Willem Otterspeer, 'Begin en context van het Museum Boerhaave', in *75 jaar Museum Boerhaave* – Mededeling 316, Leiden: Museum Boerhaave, 2006, pp. 5–13, 7.

[79] Microscopes inv. no. V7017 and inv. no. V7018 entered the collection of Rijksmuseum Boerhaave in 1929.

[80] See, for example, James Hyslop, 'John Mayall and reproductions of early microscopes', Explore Whipple Collections, Whipple Museum of the History of Science, University of Cambridge, 2008, at www.whipplemuseum.cam.ac.uk/explore-whipple-collections/microscopes/dutch-pioneer-antoni-van-leeuwenhoek/mayall-reproductions (accessed 27 December 2021).

[81] De Clercq, op. cit. (18).

[82] J. van Zuylen, 'On the microscopes of Antoni van Leeuwenhoek', *Janus* (1981) 1–3, pp. 159–98. Replicas by John Mayall are in the collections of the History of Science Museum Oxford and the Whipple Museum of the History of Science in Cambridge.

[83] Sven Dupré, Anna Harris, Julia Kursell, Patricia Lulof and Maartje Stols-Witlox, *Reconstruction, Replication and Re-enactment in the Humanities and Social Sciences*, Amsterdam: Amsterdam University Press, 2020.

[84] Jac. P. Thijse, 'De Leeuwenhoek-Film', *De Amsterdammer* (1925) 2481 (27 December), p. 7.

[85] Jac. P. Thijsse, 'De Leeuwenhoek-Film II', *De Amsterdammer* (1925) 2482 (3 January), p. 7; Jac. P. Thijsse, 'De Leeuwenhoek-Film III', *De Amsterdammer* (1925) 2483 (10 January), p. 7.

[86] Thijsse, 'De Leeuwenhoek-Film II', op. cit. (85): 'De handige auteurs laten ons dat weer eens zien, gefotografeerd door een van Leeuwenhoek's lenzen zelve, zoodat wij nog beter kunnen begrijpen, dat Leeuwenhoek verrukt was van dat schouwspel'.

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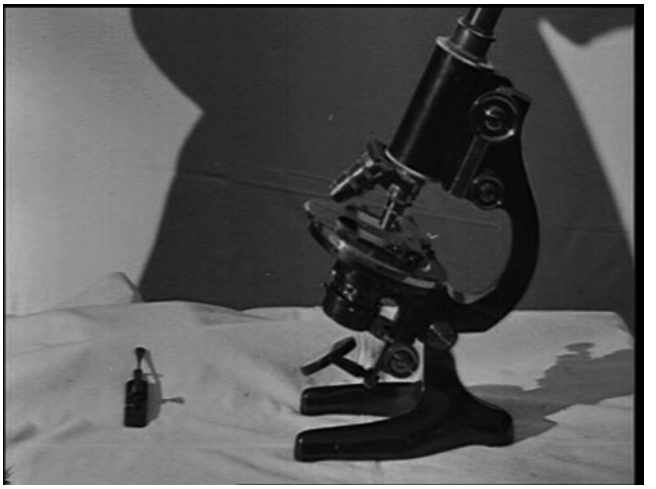

Figure 6. Van Leeuwenhoek microscope (left) and a modern microscope. *Antony van Leeuwenhoek*, still, Eye Film Collection.

this way we are given, as it were, Leeuwenhoek's very own view of things'.[87] The use of original heritage in the film thus invited audiences to relive Van Leeuwenhoek's discoveries for themselves.

This was all the more important during moments of commemoration. Mol's *Antony van Leeuwenhoek* must be contextualized in a culture of celebrating the national history of science. According to one reviewer, the film not only showed the 'excellent and clear moving images of microscopically small creatures' but also 'familiarizes us with a great and learned historical character, one of the many who will get a better place in our New National History than they have had to be satisfied with up until now'.[88] The frequent screenings of the film in the Dutch East Indies are particularly revealing, since the film played a prominent and formative role in scientific identity politics there. One screening on the island of Sumatra in 1927 was organized by the Algemeen Nederlandsch Verbond, an association that promoted the Dutch language around the world, and in Dutch colonies in particular.[89] At another screening in The Hague in 1929, Mol mentioned how the Netherlands should be as proud of Antoni van Leeuwenhoek as it was of other famous national figures, such as the celebrated admirals of the Golden Age, Michiel de Ruyter and Piet Hein.[90] When the British Physiological Society paid a visit to the Netherlands in 1925, its members not only were shown famous sites such as fields of tulips and the laboratory of the Dutch physiologist Willem Einthoven, but they also attended a screening of *Antony van Leeuwenhoek*.[91]

As Mol and Van Seters intended, the film found fertile ground during the tercentennial celebrations of Leeuwenhoek's birth in 1932. The film was screened as part of these celebrations in October 1932.[92] Later commemorative events organized by the Dutch Society for Microbiology and the Dutch Natural History Society also screened the film as part of

[87] Jac. P. Thijse, 'De Leeuwenhoek Film', *De Levende Natuur* (1925) 29, pp. 306–8, 306: 'zoo krijgen wij dan als het ware Leeuwenhoeks kijk op de dingen zelve'.

[88] Thijse, 'De Leeuwenhoek-Film III', op. cit. (85).

[89] 'Algemeen Nederlandsch Verbond', *De Sumatra Post*, 12 February 1927, p. 10.

[90] 'De Leeuwenhoeck-Film', *Het Vaderland*, 12 April 1929, p. 1.

[91] 'British Physiological Society', *Het Vaderland*, 1 April 1925, p. 4.

[92] 'Programma voor maandag 17 October', *Nieuwsblad van het Noorden*, 15 October 1932, p. 11. See also Abraham Schierbeek, 'Leven en werken van Antony van Leeuwenhoek: Rede uitgesproken bij de herdenking te Delft op 24 oktober 1932, op uitnoodiging van het Nationaal Leeuwenhoek Comité, ingesteld door de K.A.v.W', *Nederlandsch tijdschrift voor geneeskunde* (1932) 76, pp. 5149–63.

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their commemoration programmes.[93] Van Leeuwenhoek's legacy was also remembered with programmes that consisted of combining speeches and a screening of Mol's *Antony van Leeuwenhoek*.[94]

But *Antony van Leeuwenhoek* was also part of a wider revival in interest in the historical foundations of bacteriology and microbiology. International bestsellers published at that time included bacteriologist Paul de Kruif's *Microbe Hunters* (1927).[95] Protozoologist Clifford Dobell published his biography *Antony van Leeuwenhoek and His 'Little Animals'* (1932) a few years later.[96] Films on education and microbiology included Mol's other 1924 film *Malaria*, and a Dutch film on infant care made in 1926, which provided information on how to prevent babies from catching infectious diseases.[97] Mol even had plans to make a film about microscopist Johannes Swammerdam (1637–80), a natural historian and contemporary of Van Leeuwenhoek.[98]

As Pnina Abir-Am notes, commemorations in science are not purely nationalist, by definition.[99] In 1922, Pasteur's birth was celebrated in France and Robert Koch's discovery of the tubercle bacillus was commemorated in Germany. Jean Epstein's 1922 film about the life and work of Louis Pasteur was made in a similar context to Mol's film *Antony van Leeuwenhoek*, and it is instructive to compare *Antony van Leeuwenhoek* to Epstein's film about Pasteur.[100] Both films are a tribute to the discoveries of a famous figure in microbiology. Both films begin with the places where those famous figures were born, and both can be considered reconstructions or re-enactments. Epstein's film re-creates episodes and (imaginary) scenes from the life of Pasteur, while Mol's work is a reconstruction of Van Leeuwenhoek's observations and experiments. But there are clear differences between the two films too. In *Antony van Leeuwenhoek*, microcinematography is the primary focus, and this is linked with the use of the original microscopes. Epstein's film contains no microcinematography, and features only one microphotograph. Mol's aversion to commercialism and narrative is also evident from the lack of a linear narrative in *Antony van Leeuwenhoek*, while Epstein's film features a strong chronological narrative about Pasteur's life and achievements. Epstein uses actors to re-enact famous scenes in Pasteur's life and research, and human emotions play a central role. Mol, by contrast, used no actors and stayed true to the Filmliga approach – resisting any urge to add narrative or compromise to commercialism. *Antony van Leeuwenhoek* was not a movie but an artistic experiment that used the medium of film. The viewer becomes part of that

[93] Newspaper clippings on Van Leeuwenhoek from the 'Kroon Archief', Rijksmuseum Boerhaave: 'Nederlandsche Vereeniging voor Microbiologie: Van Leeuwenhoek-herdenking', 12 November 1932; 'Nederlandsche natuurhistorische vereeniging, afdeeling Rotterdam: Herdenking Antoni van Leeuwenhoek', 8 November 1932.

[94] 'Antony van Leeuwenhoek: Herdenking te Arnhem', *Algemeen Handelsblad*, 26 October 1932, p. 13; 'Antony van Leeuwenhoek: Herdenking te Maastricht', *Algemeen Handelsblad*, 11 December 1932, p. 14.

[95] Paul de Kruif, *Microbe Hunters*, New York: Harcourt, Brace and Company, 1926. The seven reprints of the Dutch edition of *Microbe Hunters* between 1927 and 1950 demonstrate the popularity of the book in the Netherlands. Many physicians and scientists have been inspired by this work. See William C. Summers, 'Microbe Hunters revisited', *International Microbiology* (1998) 1, pp. 65–8.

[96] Reference to *Antony van Leeuwenhoek* in Dobell, op. cit. (10), p. 285 n. 2, 424. Dobell also named Leeuwenhoek the father of bacteriology during the bicentenary of van Leeuwenhoek's death in 1923. See Clifford Dobell, *A Protozoological Bicentenary: Anthony van Leeuwenhoek (1632–1723) and Louis Joblot (1645–1723)*, Cambridge: Cambridge University Press, 1923.

[97] Bond tot bescherming van zuigelingen, 'Zuigelingenverzorging en zuigelingenbescherming', 1926. See also Alison Levine, 'Projections of rural life: the agricultural film initiative in France 1919–1939', *Cinema Journal* (2004) 43, pp. 76–95.

[98] Company prospectus, op. cit. (41).

[99] Abir-Am and Elliott, op. cit. (14), p. 3.

[100] 'Pasteur-film te Rotterdam', *Nederlandsch tijdschrift voor geneeskunde* (1924) 68, p. 1701. See also M.A.J.J. Vandevelde and Institut supérier des fermentations, *Hommage a la mémoire de Louis Pasteur (1822–1895): Un commémoration du 100e anniversaire de la naissance de l'illustre fondateur de la microbiologie*, Gand: Ad Hoste, 1922.

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experiment, whereas in Epstein's film about Pasteur the viewer remains on the sidelines as a spectator to the scenes being re-enacted or reimagined.

There are more similarities between *Antony van Leeuwenhoek* and the popular microcinematographic films made by Henry Siedentopf in the 1920s. The themes that Siedentopf touches on, according to one description of his screenings, are very similar to those of *Antony van Leeuwenhoek*.[101] Even the order of the microcinematographic scenes is similar. It is no surprise, then, that Mol's company prospectus in 1925 contained many letters of recommendation that compared Mol's work with the films of Comandon and Siedentopf.[102] Mol clearly wanted his film to be firmly in the tradition of science films. On the other hand, the film's focus on Van Leeuwenhoek as a character from Dutch history comes closer to the celebration of national science portrayed in Epstein's film on Louis Pasteur. One reviewer referred to Van Leeuwenhoek himself as embodying the national Dutch identity: 'sober and phlegmatic'.[103]

Conclusions

> What would otherwise have been reserved for the traveller in distant lands, the participant in difficult expeditions, the experienced researcher working in a laboratory – can now enrich the intellect of the many.[104]

Watching *Antony van Leeuwenhoek* was not merely a passive experience: the film created a community of witnesses of past science and national cohesion.[105] As such, the film functioned as part of the identity of a nation.[106] As Landecker argues, the cinematographic techniques used in science also allowed 'people other than scientists to participate visually in the sights of scientific work and the mode of experimental looking'.[107] In *Antony van Leeuwenhoek* this meant that laypeople could actually step into the shoes of Van Leeuwenhoek and witness the past anew. Between 1925 and 1935, many people did precisely that; Van Seters wrote in 1932 that the film was screened at least 250 times 'between the river Ems and the river Scheldt' over an eight-year period, with an average of three hundred people attending each screening.[108] Wherever possible, a presentation by an expert would also be given. Between 1924 and 1926, Mol gave at least eighty presentations to accompany his film.[109] Other commentators included Van Seters, Schierbeek and Jacob van Rees, a professor of histology. Mol funded *Antony van Leeuwenhoek* himself and sought a return on his investment by travelling around the country and presenting cinematographic fragments taken from the film.[110]

[101] Siedentopf, op. cit. (38).

[102] Compare Landecker, 'Microcinematography and the history of science and film', op. cit. (12), p. 128, who notes about Comandon 'mimicking the action of the microscopist flipping between lenses' and 'sequential scenes' of the 'narrative structure of the experiment'.

[103] B.B., 'De Anthony van Leeuwenhoek-film', *Dieren van huis en hof* (1925) 19, pp. 111–12: 'nuchtere flegma'.

[104] Mol, Prospectus IKA, in Multifilm archive, Eye Film Museum library archive, part B, op. cit. (41): 'Wat anders beperkt bleef tot den reiziger in verre landen, den deelnemer aan moeilijke expeditie's, den volhardenden onderzoeker in zijn laboratorium, dat kan door middel van het filmbeeld het geestelijk eigendom worden van velen'.

[105] See also Benedict Anderson, *Imagined Communities: Reflections on the Origin and Spread of Nationalism*, London: Verso, 1983; Peter Burke, *Eyewitnessing: The Uses of Images as Historical Evidence*, London: Reaktion, 2001.

[106] Pim den Boer, 'Geschiedenis, herinnering en "lieux de mémoire"', in Rob van der Laarse (ed.), *Bezeten van vroeger: Erfgoed, identiteit en musealisering*, Amsterdam: Het Spinhuis, 2005, pp. 40–58, 55.

[107] Landecker, 'Microcinematography and the history of science and film', op. cit. (12), p. 123.

[108] Van Seters, 'Antony van Leeuwenhoek-film', p. 225.

[109] H.G. Cannegieter, 'Karakterschets J.C. Mol', *Morks-Magazijn* (1928) 30, pp. 1–12.

[110] 'Cinematografisch pionieren: Kristallen in kleuren op filmstrook,' *De Telegraaf*, 11 July 1953, p. 9.

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The screenings were held in various locations – from the meeting halls of local societies and centres for adult education or evening classes (*volksuniversiteiten*) to city cinemas, and from conferences to secondary-school theatres.[111] They were not confined to the large cities in the west of the country, and audiences in the north, south and east were also able to enjoy the film.[112] They included photography enthusiasts, biologists, amateur natural historians, university students, medical professors, the members of an aquarium club and secondary-school students. In some cases, the film was reserved for viewers of sixteen years and over.[113] It remained popular for many years. Cinema listings and newspapers were referring to the film as 'well known' by 1928 and 'famous' by 1932, and the scientific press gave the film a positive reception.[114] After the commemorations in 1932, the film went on to be shown abroad in the UK, France and the USA.[115] During a Leeuwenhoek commemoration in Ann Arbor, the Society of American Bacteriologists also organized a successful viewing.[116]

By 1932, the film *Antony van Leeuwenhoek* had penetrated the collective memory with Van Leeuwenhoek as the father of protozoology and bacteriology. Van Seters, who was a high-school teacher, recalled in 1932 how images from the film had lodged in his pupils' memories:

> It is also remarkable that the memory of the images does not fade as quickly as people often imagine. When we were studying single-celled organisms, my pupils would often remark: 'We saw that in the van Leeuwenhoek film' (which they had sometimes seen four years earlier).[117]

Van Seters expressed his satisfaction that the film had done its job, in educational terms.[118] *Antony van Leeuwenhoek* thus served as a 'medial process' through which memories about Van Leeuwenhoek's observations became collective memories. It was the medium of film that enabled these memories to 'come into the public arena and become collective'.[119] Stills from the film also circulated in books published during the commemorations of 1932.[120]

The influence of *Antony van Leeuwenhoek* persisted after the Second World War. Screenings of the original film continued to take place until 1950.[121] But in 1951 Mol

[111] 'Antony van Leeuwenhoek', *Het Vaderland*, 11 April 1925, p. 3; 'Leeuwenhoekfilm', *Het Vaderland*, 20 November 1925, p. 2; 'Zesde internationaal congres voor de geschiedenis van de geneeskunde', *Nieuwe Rotterdamsche Courant*, 20 July 1927, p. 2; 'Een van Leeuwenhoek-film', *Rotterdamsch Nieuwsblad*, 21 October 1927, p. 2; 'Microscopische film Antony van Leeuwenhoek', *Het Vaderland*, 9 April 1929, p. 4.

[112] 'Friso bioscoop', *Leeuwarder nieuwsblad*, 16 March 1926, p. 3.

[113] 'Microscopische film Antony van Leeuwenhoek', op. cit. (111); 'Ons huis Rozenstraat', *Algemeen Handelsblad*, 10 January 1928, p. 7.

[114] 'Geneeskunst en film', *Nieuwe Rotterdamsche Courant*, 23 April 1928, p. 15; 'Centraal theater', *Het Vaderland*, 18 February 1932, p. 8; L. Kaiser, 'Antony van Leeuwenhoek-film', *Nederlandsch tijdschrift voor Geneeskunde* (1924) 68, p. 306.

[115] 'Honderd films in vijftien jaar: De eerste wetenschappelijke films van J.C. Mol', *Algemeen Handelsblad*, 11 January 1939, p. 9.

[116] 'A. van Leeuwenhoekfilm, vertooning in Amerika', *De Tijd*, 28 January 1933, p. 10.

[117] Van Seters, op. cit. (27), p. 226: 'Merkwaardig is ook, dat de indruk der filmbeelden niet zoo snel vervluchtigt, als men wel eens wil onderstellen. Dikwijls had ik gelegenheid uit den mond van leerlingen bij de behandelingen van eencelligen te hooren: "dat hebben wij vroeger (soms vier jaar geleden) op de Van Leeuwenhoek-film gezien"'.

[118] Van Seters, op. cit. (27), p. 226.

[119] Erll and Rigney, op. cit. (14), p. 2.

[120] Henk van Laar, 'Antony van Leeuwenhoek: 24 oktober 1632–26 augustus 1723', *De Meidoorn* (1932) 10, pp. 145–60.

[121] 'Brusselsche studenten bezoeken Utrecht', *Algemeen Handelsblad*, 9 February 1938, p. 4.

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began a reworking of the film entitled *Van Leeuwenhoek tot electronenmicroscoop* (From Leeuwenhoek to the Electron Microscope) (1951), which incorporated scenes from the original film. The new film included some sequences taken from *Antony van Leeuwenhoek*, including scenes featuring the use of original Van Leeuwenhoek microscopes and recordings of protozoa.[122] The effect of the viewer as microscopist was enhanced by the addition of audio, with original letters written by Van Leeuwenhoek being read aloud to accompany footage of moving microscopic creatures.[123] The other footage from the original film includes the sequences showing pepper water, *Volvox*, Vorticellidae, bacteria, salt crystals, spermatozoa and blood circulating in small fish. The new film was first screened at the fifth conference of the International Scientific Film Association in The Hague, and in 1952 it was featured in the Holland Festival, a performing arts festival.[124] After Mol's death in 1953, sequences from *Antony van Leeuwenhoek* were also used in a film about Mol himself in 1961.[125] Around that time, other educational science films appeared that included recordings made through original historical microscopes, such as Peter Whitehead's *The Perception of Life* in 1964.[126] By that time, the microcinematographic sequences made by Mol and Van Seters had become separated from the figure of Van Leeuwenhoek. These sequences concerned microscopic life and movement, as in abstract paintings, as novelist and narrator Cees Nooteboom noted in the 1961 film about Mol: 'Everything moves, even that which is still. Life itself is one movement'.[127]

Antony van Leeuwenhoek contributed to refashioning Van Leeuwenhoek's heritage. From his work as the foundation of microscopy and observations of infusoria in the nineteenth century, the film helped to reframe Leeuwenhoek's work in the public eye as the very origins of bacteriology. In the last decennia of the nineteenth century, authors of handbooks in bacteriology started mentioning Van Leeuwenhoek as the first person to ever observe bacteria with his microscopes.[128] Within thirty years, the perception of Van Leeuwenhoek and his work changed from his being a naturalist who discovered infusoria to being the founding father of bacteriology. The film was instrumental in this process, allowing a broad audience to virtually witness the (supposed) historical starting point of bacteriology on-screen, tracing the swarming bacteria in pepper water filmed through Leeuwenhoek's original lenses. Van Leeuwenhoek's public legacy as a father of bacteriology originates from this period, with the film as visual proof helping to remake Leeuwenhoek into the 'first of the microbe hunters'.[129] *Antony van Leeuwenhoek* formulated a memory as the oldest origins of bacteriology, framed for a broad audience in the context of the fight against infectious diseases.

[122] Composite documentary about the discovery of the microscope by J.C. Mol (Multifilm) from 1925, supplemented with *Terra Incognita* from Verity Films (for Philips Eindhoven), the Netherlands. Thirty minutes, titles and voice-over in English. The Eye Film Collection, KOP1142866.

[123] 'Film over Leeuwenhoek in Holland festival', *Het Parool*, 20 June 1952, p. 5. The reviewer in the newspaper wrote that the film provided the layman with the experience of reliving the discoveries of Van Leeuwenhoek centuries later.

[124] 'Film over Leeuwenhoek in Holland Festival', op. cit. (123).

[125] 'JC Mol, Filmer', 1961, AVRO, voice-over by Cees Nooteboom, The Netherlands Institute for Sound & Vision collection.

[126] James Leo Cahill, 'Hors d'oeuvre: Science, the short film, and the perception of life', *Framework* (2011) 52, pp. 66–82.

[127] 'JC Mol, Filmer', op. cit. (125).

[128] Friedrich Löffler, *Vorlesungen über die geschichtliche Entwickelung der Lehre von den Bacterien: Für Aerzte und Studirende*, part 1, Leipzig: F.C.W. Vogel, 1887, p. 6; Carl Fraenkel, *Text-Book of Bacteriology*, 3rd ed. (tr. J.H. Linsley), New York: William Wood and Company, 1891, p. 1. In 1905 Leeuwenhoek was mentioned under the lemma 'Bacteriology' in a main Dutch encyclopedia: Henri Zondervan (ed.), *Winkler Prins geïllustreerde encyclopaedie*, vol. 2, , 3rd ed., Amsterdam: Elsevier, 1905–1912, p. 521. See also Dobell, op. cit. (10), 1932, pp. 362–87.

[129] De Kruif, op. cit. (95).

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Antony van Leeuwenhoek provides a window into the making and remaking of memory around microscopy and bacteriology in the Netherlands in the interwar period. Cinema became a place for memory building and for visual culture as memory practice.[130] Film functioned as a medium for, but also an actor in, identity politics.[131] Just as text played an important role in 'editing the nation's memory', *Antony van Leeuwenhoek* contributed to visual memory building.[132] As Astrid Erll and others have argued, films can become powerful 'media of cultural memory' which have the potential to 'create and mould images of the past'.[133] In the case of *Antony van Leeuwenhoek*, this potential for creating cultural memory was realized between 1924 and the early 1960s, during which time audiences enjoyed the film (or parts of it that were included in other films), used it in commemorative events and education, and cross-referenced it in other media and writing. Now, almost a hundred years since its appearance, the film will potentially feature in commemorations, exhibitions and television broadcasts once again.

Antony van Leeuwenhoek, and popular-science cinema in general, enable us to explore assumptions and practices around the representation of the history of science, scientists, memory building and the role of heritage and technology. Microcinematography, reconstruction, heritage and the new visual medium for retelling the history of science have the power to contribute to visual memories of science past.

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[130] On collective memory see Maurice Halbwachs and Jeanne Michel Alexandre Halbwachs, *La mémoire collective*, Paris: Presses universitaires de France, 1950.

[131] M. Broersma and J.W. Koopmans (eds.), *Identiteitspolitiek: Media en de Constructie van Gemeenschapsgevoel*, Hilversum: Verloren, 2010.

[132] Compare Dirk van Hulle and Joep Leerssen (eds.), *Editing the Nation's Memory: Textual Scholarship and Nation-Building in Nineteenth-Century Europe*, Amsterdam: Rodopi, 2008.

[133] Astrid Erll, 'Literature, film and the mediality of cultural memory', in Astrid Erll, Nünning Ansgar and Sara B. Young (eds.), *Cultural Memory Studies: An International and Interdisciplinary Handbook*, Berlin and New York: Walter de Gruyter, 2008, pp. 289–98.

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